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AGRICULTURAL ECONOMICS

Alabama's Farm Fire Insurance. (B. F. Alvord.) — Farmers' mutual fire insurance companies of the entire United States reported about 12.3 billion dollars insurance in force in 1940. This amount was equal to 68 per cent of the census value of farm buildings, implements and machinery, livestock, poultry, and bees of that year. In Alabama farmers' mutual fire insurance companies reported 1.5 million dollars of insurance in force or only 7 tenths of 1 per cent of the census value of the kinds of Alabama farm property named above.

Mailed reports from 598 Alabama farmers indicate general interest in fire insurance. Their greatest interest is in insuring dwellings; their second greatest interest is in insuring barns; and third, in insuring automobiles. Few showed interest in insuring either farm tools or farm livestock. Interest in insurance increased steadily as the value of the property increased.

Over half of the property loss reported from fire involved dwellings. Nearly one-fourth involved barns and about one-ninth involved other buildings. These 598 farmers together reported a total fire loss of $182,507 over a number of years. The average per farm was about $300, but the average per loss was over $1,100. About 11 per cent of the individual losses reported amounted to $3,000 or more. In the last full year covered by the 598 reports, 1943, the ratio of reported losses of dwellings and contents to reported value of dwellings was 71 cents per $100. The ratio of reported losses of barns and contents to reported value of barns was 76 cents per $100.

Cost of Producing, Processing, and Distributing Grade-A Milk on 29 Alabama Farms, 1945. (J. Homer Blackstone.) — An analysis of records for the year 1945 on the cost of producing, processing, and distributing grade-A milk for retail on 29 Alabama farms indicates the following:

BIRMINGHAM MARKET. Eight retail dairies were studied in this area. Their average cost of producing, processing, and distributing milk was 18.6 cents per quart. These dairies delivered approximately 47 per cent of their milk to homes and 53 per cent to stores and eating places.

MOBILE MARKET. Eight retail dairies were studied in the Mobile market. Their average cost of producing, processing, and distributing milk was 17.8 cents per quart. These dairies made no home deliveries but sold all their milk to stores, restaurants, and cafes.

MONTGOMERY MARKET. The average cost of producing, processing, and distributing milk of four retail dairies studied in this area was 13.5 cents per quart. These dairies made no home deliveries but sold all of their milk to stores and cafes.

OTHER MARKETS. Nine retail dairies selling on eight different small markets located throughout the state are in this group. Their average cost of producing, processing, and distributing milk was 16.5 cents per quart. These dairies delivered their milk to homes, stores, and eating places.

ALL RETAIL DAIRIES. Averages for the entire group of 29 retail dairies indicate that: (1) Total sales of farm products on the average retail farm amounted to $33,728. Of these sales, milk accounted for $27,903 and all other farm products accounted for $5,825; (2) cash farm expenses averaged $30,787 per farm; (3) farm cash available (sales less expenses) averaged $2,941 per farm; and (4) return for operator's labor on the retail dairies averaged $658 per farm.

Cost of Producing Wholesale Grade-A Milk on 90 Alabama Farms, 1945. (J. Homer Blackstone.) — An analysis of records for the year 1945 on cost of producing grade-A milk for wholesale on 90 Alabama farms, comprising a total of 5,321 cows and located in the major fluid milk sheds of Alabama, indicates that:

(1) Production per cow on these farms averaged 4,700 pounds in 1945.

(2) Net cost per hundredweight of milk showed wide variations for different sections of the state. Averages, by type-of-farming areas,[1] for the farms studied were: Sand Mountain, $3.79; Tennessee Valley, $4.03; Limestone Valley, $5.60; Black Belt, $4.98; Upper Coastal Plain-A, $5.22; Upper Coastal Plain-B, $5.92; Piedmont, $5.42; and Gulf Coast, $6.23.

(3) The cost of producing milk in each area varied by quarters. The highest cost occurred in the winter months and the lowest cost in the summer months. In some areas, this variation was small, while in others, the Black Belt in particular, the change in cost from lowest to highest quarter was more than double.

(4) As size of herd increased from an average of 13 to 104 cows, the cost of producing a hundredweight of milk increased from $4.81 to $5.35, or 54 cents.

(5) As production per cow increased from 3,099 pounds to 6,837 pounds, total costs per hundredweight of milk decreased from $5.86 to $4.92, or 94 cents. Of the decreased cost per hundredweight, 21 cents was for feed, 17 cents was for labor, and 56 cents was saved from all other costs.

(6) A weighted average of all 90 farms shows that 56 per cent of the total gross cost per hundredweight of milk was for feed and pasture, 20 per cent for labor, and 24 per cent for all other costs.

(7) Average sales per farm amounted to $16,664. Milk sales amounted to $11,479, with all other sales amounting to $5,185.

(8) Cash farm expenses averaged $15,058 per farm.

(9) Farm cash available (sales less expenses) averaged $1,606 per farm.

(10) Returns for operator's labor were *minus* $499 on the average farm.

(11) An analysis of wholesale farms by size of herd indicates that the most profitable size group consisted of 10 farms having an average of 23 cows and an average return for operator's labor of $656; and that the least profitable size group consisted of 30 farms having an average of 104 cows and an average return for operator's labor of *minus* $1,130.

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[1] Included in this study were 4 records from farmers located in the Sand Mountain area, 10 in the Tennessee Valley, 16 in the Limestone Valley, 28 in the Black Belt, 8 in the Upper Coastal Plain-A (Pickens and Tuscaloosa counties), 8 in the Upper Coastal Plain-B (Russell and Lee counties), 8 in the Piedmont, and 8 in the Gulf Coast area.

AGRICULTURAL ENGINEERING

Relationship of Physical Properties of Soil to Elements of Tillage Implement Design and Physical Effects of Tillage in Relation to Plant Growth: TRACK DESIGN STUDIES FOR MILITARY VEHICLES (F. A. Kummer and Army Ordnance project personnel.) — The cooperative project with the War Department (Army Ordnance) was concluded August 16, 1946. The work was initiated during the war at the request of the War Department in connection with problems related to the mobility of trucks and other track-laying vehicles under difficult soil conditions.

The soil physical equipment available for fundamental studies related to implement design was used for tests in connection with tank track design. Laboratory scale models and full size vehicle tests were made to establish relationships between soil behavior and vehicle performance.

The following conclusions and results were submitted in a final report to the Chief of Ordnance, War Department, by the project personnel:

(1) A thorough knowledge of the dynamic properties of soils is needed in order that designs of tracks, tires, and suspensions of military vehicles may be based on sound engineering principles.

(2) The results obtained show that vehicle traction is primarily a function of soil shear resistance.

(3) An optimum relationship exists between soil shear resistance, vehicle weight, lug width, and lug spacing for a given soil condition. This relationship varies with different soils and soil conditions.

(4) Maximum traction depends upon the complete utilization of the soil reactions produced by a moving vehicle.

The consideration of soil physical properties to vehicle design should result in improved traction for a given soil condition, thereby increasing the ability of military vehicles to cross difficult terrain. Soil reconnaissance techniques, taking into consideration soil physical properties, could offer invaluable data for strategic planning.

FARM TRACTOR TIRE STUDIES. (F. A. Kummer and C. A. Rollo.) — The results obtained from the cooperative studies on vehicle track design are applicable in many respects to the design of farm tractors and implements. The same basic in-

formation applies also to the development and design of rubber tires and tire treads for agricultural purposes. A project of this type was initiated March 15, 1946 in cooperation with the Auburn Research Foundation and the U. S. Rubber Company.

A considerable amount of basic information on the subject of farm tractor tire design and performance has been obtained and was reported in the form of a master's thesis in Agricultural Engineering at the conclusion of the one-year investigation, March 15, 1947.

PHYSICAL EFFECTS OF TILLAGE IN RELATION TO PLANT GROWTH. (F. A. Kummer and R. Q. Parks.) — An attempt was made to evaluate soil productivity changes in Alabama cropping systems on the basis of soil physical changes. Determinations made were considered indicative of overall changes in soil tilth and the studies were made on the extremes in cropping systems available. For the purpose of differentiating the effects of agronomic treatments, soil pore volume measurements were made to determine the changes in total, capillary, and non-capillary pore space.

Marked changes in soil porosity were found on all plots and were associated with growth of small grain, legume cover crops, and tillage operations. Increases in soil pore volumes resulted only from tillage operations. These effects were temporary and no increases in stability of structure associated with these cropping systems were found.

AGRONOMY AND SOILS

Effects of Lime on Potash Requirements of Alabama Crops: (1) EFFECTS OF LIME ON POTASH REQUIREMENT OF COTTON. (Howard T. Rogers.) — An analysis of 15 years' results of a lime test on Hartsells fine sandy loam (Sand Mountain) shows striking evidence that lime has increased the need for potash by cotton in a 2-year corn and cotton rotation. Laboratory studies have failed to show any pronounced effect of the lime on exchangeable potash in the soil. In an experiment on Norfolk sand at Auburn, lime (3,000 pounds per acre of ground marble) increased seedling disease and reduced the efficiency of potassium fertilizer on cotton.

(2) EFFECTS OF LIME ON THE RELEASE OF DIFFICULTLY SOLUBLE SOIL POTASSIUM AND ON THE EFFICIENCY OF APPLIED FERTILIZER POTASSIUM. (Howard T. Rogers and E. T. York.) — In field

and laboratory studies of the effects of varying rates of lime on the potash requirement of cotton, it was found that the net effect of liming depended upon the supply of non-exchangeable – but slowly available – potassium in the soil and the capacity of the soil to absorb bases (exchange capacity). Liming a Norfolk *sand,* which had a low exchange capacity (1.1 M.E./100 gm. soil) and a low reserve of soil potassium (27 lb./acre exchangeable K_2O) reduced the supply of exchangeable potassium 50 per cent 7 weeks after application of fertilizer. The net effect of lime on a Norfolk sandy loam (exchange capacity of 1.9 M.E. and 77 lb./acre exchangeable K_2O) was the reverse of the effect on the sand. Exchangeable potassium was approximately doubled by liming the latter soil where no potash was added and was increased to a lesser degree where fertilized.

This two-way effect of lime was demonstrated by incubation studies on a variety of soils in the laboratory where it was shown that lime favored the release of non-exchangeable soil potassium, but also increased fixation of added fertilizer potassium. The net effect of lime on the supply of readily soluble potassium in a soil would be affected by the soil's supply of reserve potassium available for release and also by the soil's capacity to absorb and hold in an exchangeable form the released and the added potassium.

These findings emphasize the need for a carefully controlled liming program on the light-textured soils of the Coastal Plain and the grey soils of northern Alabama.

Lime and Boron Investigations. (1) IMPORTANCE OF FINENESS OF GROUND LIMESTONE. (Howard T. Rogers.) – Three years' results of field tests in which relative efficiencies of limestone of varying degrees of fineness were determined with crimson clover and Sudan grass show that: (1) The coarsest grade of limestone tested (4- to 10-mesh) produced less than one-half as much clover as the 100- to 200-mesh material on a Norfolk loamy sand with initial pH of 5.2; (2) the 10- to 20-mesh stone produced only 61 per cent as much clover as the finer fraction when both were applied at the rate of 1,500 pounds per acre; and (3) limestone should be ground to contain a high percentage of material finer than 20-mesh in size. Ground limestone finer than 60-mesh in size, however, was only slightly more effective than the 20- to 60-mesh fraction on this strongly acid soil.

(2) BORON REQUIREMENTS OF ALFALFA. (Howard T. Rogers.) — Although a single application of borax has proved highly beneficial in increasing alfalfa hay yields, tests over a 3-year period on Norfolk loamy sand (Auburn), Madison clay loam (North Auburn), and Hartsells fine sandy loam (Sand Mountain) show no evidence that heavy annual top-dressings with this material are needed where 20 pounds per acre are applied at time of planting. In some cases, however, alfalfa plants have shown boron deficiency symptoms before any appreciable reduction in hay yields occurred. For this reason, the most practical way to supply the boron needs of this crop may be the applications of small amounts of borax annually or every other year with other fertilizers.

The hot-water soluble boron content of these soils and boron content of the alfalfa crowns indicate that an extremely small amount of boron is required for alfalfa, even though this plant has responded to borax more frequently than any other legume tested.

Effects of Grazing Management on Beef Gains from White Clover-Dallis Grass Pastures in Central Alabama. (E. L. Mayton, Howard T. Rogers, and J. C. Grimes.) — Based on a 4-year study of different rates of stocking and times of grazing a white clover-Dallis grass pasture on the Main Station, Auburn, it was concluded:

(1) A moderate rate of stocking (about 2 acres per brood cow and calf) and continuous grazing from April 1 to October 1 appeared to be the best system. Most of the time this pasture carried some reserve vegetation, which was needed during dry periods, and produced as much beef as any other scheme of grazing.

(2) Continuous heavy grazing (about 1 acre per cow and calf) did not kill white clover that was properly fertilized.

(3) There was no evidence that removing the stock from white clover pastures during May to allow the clover to mature a heavy seed crop was of any value.

(4) Rotational grazing in which the pasture was grazed heavily for two weeks, then rested a month, was not a good system under the conditions of this study.

(5) Beef yields produced on these bottom land pastures in Central Alabama (274 pounds per acre per year) compared favorably with the beef yields from lime-land pastures in the

Black Belt section of the State (307 pounds per acre per year).

Studies in Relation to Alfalfa Fertilization on Some Alabama Soils. (J. H. Naftel and Clarence M. Wilson.) — A rather detailed study in connection with alfalfa fertility experiments on several Alabama soil types was conducted during 1946.

On two of six soil types studied, severe boron deficiency symptoms were present in alfalfa that had not received an application of borax. In all cases where severe deficiency symptoms were present, the boron content of the alfalfa averaged less than 20 p.p.m. boron for the four cuttings made during the 1946 growing season. When boron deficiency symptoms were not evident, the boron content of the alfalfa was greater than 20 p.p.m. In practically all cases, the water-soluble boron content of soil from boron-deficient areas was less than 0.35 p.p.m. boron.

Soil samples were taken at different depths from plots receiving borax and from plots receiving no borax. These samples were analyzed for water-soluble boron. These analyses showed that boron moves downward in the soil profile at a fairly rapid rate.

Boron-deficient alfalfa showed a Ca/B ratio above or in the vicinity of 600:1. As long as this ratio was not greater than 500:1, no deficiency symptoms were evident in the alfalfa.

Factors Affecting the Leaching of Potassium in Soils. (R. W. Pearson.) — Samples of Hartsells fine sandy loam and of Norfolk sandy loam were taken from the "rates of potash" plots at the Sand Mountain and Wiregrass substations. These samples were taken at four depths: (a) 0 to 8, (b) 8 to 16, (c) 16 to 24, and (d) 24 to 32 inches. All except one of the plots sampled had received 600 pounds of 6-8-4 annually for 10 years and then biennially for 6 years. The nitrogen in the formula was derived from different sources for the various plots, including urea, ammonium sulfate, and sodium nitrate, both limed and unlimed. One plot had received four times the annual K application applied once in 4 years. Exchangeable potassium determinations were made. Summarized results are as follows:

(1) Accumulation of exchangeable K in the 24- to 32-inch layer indicated leaching below even this depth.

(2) Less leaching of K occurred with sodium nitrate than with either ammonium sulfate or urea as the source of nitrogen.

(3) There was no difference in the effect of ammonium sulfate and urea on leaching of K when the equivalent acidity of these materials was neutralized.

(4) Ammonium sulfate, when not neutralized, caused large amounts of K to leach below the 8-inch layer. Forty-seven and 34 per cent of the K applied over the 16-year period had leached below the 8-inch zone in the Norfolk and Hartsells soils, respectively.

(5) The addition of lime in amounts required to neutralize the acidity of ammonium sulfate reduced the amounts of K leached. Fifty-three pounds per acre less of K_2O was leached in the Norfolk and 50 pounds less in the Hartsells due to lime.

(6) The application of K in large amounts at infrequent intervals was shown to be an extremely inefficient procedure for light textured soils. More than twice as much K had leached into the 8- to 32-inch zone in both soils studied when potash was added once in 4 years as compared to annual applications.

Cotton Breeding and Improvement Investigations. (H. B. Tisdale and J. B. Dick.) — A new wilt-resistant strain of the Deltapine variety of cotton has been developed through straight line selecting and testing on wilt infested soil since 1936. This new strain is designated as Deltapine 1096. It is highly wilt-resistant, producing satisfactory yields with good fiber quality, 1 to 1-1/16 inches in length. The seed of this strain of Deltapine is being increased and work on the improvement of yield and other important agronomic characters is being continued. A new hybrid strain designated as Auburn Hybrid 10168 has been developed from a cross of Clevewilt and Miller 610 made in 1938. This strain produces high yields with good fiber properties, but it shows only medium resistance to wilt. The seed of this strain was increased considerably in 1946 and improvement work is being continued with several strains from it that show more resistance to wilt.

Variety Testing. (H. B. Tisdale and J. B. Dick.) — The average results of cotton variety tests conducted on the Main Station, Substations, and Experiment Fields for the past 3 years, 1944-46, show that Empire, Stoneville 2-B, White Gold, Deltapine 14, and Coker 100 Wilt are the most productive varieties of satisfactory staple length and other qualities for any section of Alabama not infested with cotton wilt. Coker 100 Wilt, Stonewilt, Coker

4 in 1, and Delta Dixie are the most productive wilt-resistant varieties of satisfactory staple length and other qualities for sections of the state infested with cotton wilt.

Time of Planting Winter Legumes. (T. H. Rogers.) — This test was planted at the Main Station on fallow land at each date of planting. All plots were fertilized at the rate of one ton of lime, 300 pounds of 18 per cent superphosphate, and 100 pounds of 60 per cent muriate of potash per acre. The first planting was made on July 15 in 1944 and 1945. All legumes failed at this early date except crimson clover and alfalfa. These two crops made only fair growth when planted on July 15. This early planting was omitted for the 1946 crop. Crab grass and other summer weeds crowded out the legumes when they were planted on July 15. Sometime between July 15 and August 15, crab grass and other grasses apparently stop germinating. There was little or no summer grass in any of the plots planted on or after August 15.

Monantha vetch, crimson clover, and Austrian winter peas produced more than any of the other legumes when planted on August 15. In general, September 15 and October 1 were the best dates for planting any of the legumes. The data are presented in Table 1.

TABLE 1.— AVERAGE YIELDS PER ACRE OF WINTER COVER CROPS FROM DIFFERENT PLANTING DATES, MAIN STATION, 1944-46

Crop	Date planted and yield per acre				
	August 15	Sept. 15	Oct. 1	Oct. 15	Nov. 1[1]
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Hairy vetch	6,213	9,198	9,052	7,411	8,288
Monantha vetch	14,690	10,715	9,919	11,652	9,672
Common vetch	8,338[2]	10,649	10,222	7,012	6,388
Austrian winter peas	10,117	8,063[2]	5,517	7,239	4,290
Blue lupine	7,704	32,783	25,900	19,435	14,706
Crimson clover	11,080	18,329	12,423	6,966	5,715[4]
Alfalfa	4,675	6,158	3,128	1,552	1,405[4]

[1] 2-year average — 1944 and 1946.
[2] Poor stand in 1945.
[3] Failed in 1945.
[4] Failed in 1944.

Breeding Legumes for Forage and Soil Improvement. (E. F. Schultz, Jr.) — A summary of winter legume yields since 1930 from 11 locations in the state shows that, for production of green manure, hairy and smooth vetch *Vicia villosa* (L.) are the most widely adapted varieties, and that they have usually made satisfactory growth ranging from 5,600 to 12,400 pounds

per acre. Austrian winter peas have produced about the same amount of growth as hairy vetch. In the southern portion of the state, blue lupine has produced more green matter than any other winter legume. North of the Black Belt, blue lupine is frequently killed by cold weather. In the Tennessee and Coosa valleys and on Sand Mountain, crimson clover has made more growth than hairy vetch. Caley peas *Lathyrus hirsutus* (L.), also known as Singletary peas or wild winter peas, have made excellent growth in the Black Belt, but have not made satisfactory yields in other regions of the state. LaFayette Monantha vetch *Vicia monantha* (L. Desf.) and Auburn woolypod vetch *Vicia dasycarpa* (Ten.) have made larger and earlier yields than other vetches, though they are not quite as winter hardy as hairy vetch.

Factors Affecting the Nature and Behavior of Native and Added Phosphates in Soils: (1) THE LOSS OF PHOSPHORUS BY EROSION. (L. E. Ensminger.) — A study was started at the Wiregrass Substation in 1930 to measure the influence of acidity on the availability of phosphates. Two tiers of 17 plots each, in duplicate, were used for the study. One tier was limed to pH 6.5 and the other tier was unlimed. Sodium nitrate was used as the source of nitrogen on half of the plots of each tier and ammonium sulfate as the source of nitrogen on the other half of the plots of each tier. Soil samples were collected before the experiment was started and again in October, 1945. Total phosphorus was determined on these samples. Phosphorus that could not be accounted for by analysis of the surface 16 inches of soil and crop removal was assumed to be lost by erosion. The unlimed tier lost an average of 70 per cent of the added phosphorus by erosion, and there was no difference between the plots receiving sodium nitrate and those receiving ammonium sulfate. However, in case of the limed tier, the sodium nitrate plots lost an average of 32 per cent of the added phosphorus and the ammonium sulfate plots lost an average of 75 per cent of the added phosphorus by erosion.

Data from the Sand Mountain Substation also show considerable loss of phosphorus by erosion. The sources-of-phosphorus test with legumes (corn, cotton, and winter legume rotation) and the sources-of-phosphorus test without legumes (corn and cotton rotation) were sampled in January, 1946. These experiments were started in 1930. An analysis of the samples for total

phosphorus showed that the legume plots lost an average of 38 per cent of the added phosphorus, while the non-legume plots lost an average of 61 per cent. This might be expected, since the legume plots received more phosphorus on the average than the non-legume plots. However, a comparison of plots that had received about the same amount of phosphorus showed a higher percentage of loss from the non-legume plots. Evidently winter legumes in the rotation have decreased the loss of phosphorus by erosion.

(2) A Chemical Study of the Potato-Producing Soils of Baldwin County with Particular Reference to Residual Phosphorus. (L. E. Ensminger.) — Soil samples were collected April, 1945 from 44 potato fields of Baldwin County. Total phosphorus, dilute acid-soluble phosphorus, and pH were determined on these samples. In comparison with the virgin soils of the area, there has been a considerable accumulation of phosphorus in these soils due to the large amount of phosphate used in fertilizing each potato crop. Based on the number of years the land has been in potatoes (farmers' estimate), there has been an accumulation in the surface soil of 116 pounds of P_2O_5 per acre per year. Dilute acid-soluble phosphorus shows a close correlation with total phosphorus. The pH values range from slightly above 5.0 to as low as 4.5.

(3) Response of Cotton to Various Sources of Phosphorus in Relation to Soil Reaction (pH). (L. E. Ensminger.) — A number of cooperative experiments were conducted from 1934 to 1938 to test the value of superphosphate, triple superphosphate, di-calcium phosphate, and tri-calcium phosphate as sources of phosphorus for cotton. Soil samples were collected from the unphosphated soil in a number of cases and the reaction of these soils was determined. The soils with a pH of less than 5.5 gave a significantly higher yield response to the various phosphates than the soils with a pH of 5.5 to 6.5. Dilute acid-soluble phosphorus was significantly higher in the soils of pH 5.5 to 6.5 than in the soils of pH less than 5.5. These relationships indicate that a decrease in soil acidity causes soil phosphorus to be more available. Tri-calcium phosphate was only about 86 per cent as efficient as superphosphate. It is interesting to note that over the pH range covered by these samples that tri-calcium phosphate was relatively as efficient at the higher pH values as at the lower pH values.

Factors Influencing Seed Production of Legumes. (D. G. Sturkie and E. F. Schultz, Jr.) — Laying by peanuts with additional soil about the base of the plant increased the incidence of southern blight *Sclerotium rolfsii* (Sacc.) and decreased the yield of Spanish peanuts 42 per cent and of runner peanuts 21 per cent.

Effect of Sources of Nitrogen on Soil Reaction, Organic Matter, and Exchangeable Ions. (W. V. Chandler.) — In 1929 a study was begun on several Substations and Fields to compare the efficiency of different sources of nitrogen. Samples of soil were taken in January and February, 1946, for chemical study.

The data revealed that 2.2 pounds of basic slag per pound of ammonium sulfate was adequate to maintain a nonacid-forming fertilizer. On the other hand, 1.2 pounds of limestone per pound of ammonium sulfate was not adequate under field conditions, although the application of lime increased the calcium in the surface layers. The acidity produced by prolonged use of ammonium sulfate had penetrated to a depth of 21 inches.

There was a decrease in the amount of exchangeable magnesium in all soils after 16 years of cotton-and-corn rotation, irrespective of the lime amendments. The amount of exchangeable calcium was not materially affected except where basic slag was applied as a source of phosphorus, in which case there was an increase; where sulfate of ammonia was used without lime there was a decrease.

There was an increase or greater spread in the carbon-nitrogen ratio after 16 years of cropping. Also there was a decrease in the total nitrogen and organic carbon content. The nitrogen content decreased from about 0.08 to 0.03 per cent in soil samples from Tennessee Valley, Monroeville, Sand Mountain, and Wiregrass. In contrast, the organic carbon decreased from about 0.95 per cent to 0.45 per cent in the following order: Monroeville, Tennessee Valley, Wiregrass, and Sand Mountain. These variations gave C:N ratios as follows: Tennessee Valley 12:2, Sand Mountain 16:6, Monroeville 28:3, and Wiregrass 29:2.

Effect of Legumes and Fertilizer Treatment on the Yield and Total Nitrogen Content of Soils. (W. V. Chandler.) — In 1929 and 1930 experiments were begun at eight locations in Alabama to study the effects of legumes and fertilizer treatments on the yields of cotton and corn in a 2-year rotation. Soil samples were collected for laboratory study from these experiments in January

and February, 1946. A study of the total nitrogen content of some of these samples were made.

Three treatments were studied for total nitrogen content. These plots were in a 2-year rotation of cotton and corn with the following treatments: winter legumes and no fertilizer, no legume but commercial fertilizer, and winter legume with commercial fertilizer. The commercial fertilizer consisted of 100 pounds of nitrate of soda, 600 pounds of superphosphate, and 75 pounds of muriate of potash, all of which was applied to the cotton.

The total nitrogen content of the soils from the three treatments increased in the following order: "no legume but fertilizer," "legumes but no fertilizer," "and legumes and fertilizer." The corn yields were in the same order of variation: 17.9 bushels, 27.4 bushels, and 36.7 bushels per acre. The cotton yields showed a different trend. The legume-but-no-fertilizer plots made the lowest yields, an average of 752 pounds of seed cotton per acre; the no-legume-but-fertilizer plots yielded 1,098 pounds, and the plots receiving both legumes and fertilizer yielded 1,431 pounds.

A definite correlation was obtained between the total nitrogen content of the soil and the yield of corn, which varied within three groups: i.e. (a) Tennessee Valley and Alexandria, (b) Monroeville and Prattville, and (c) Aliceville, Sand Mountain, Wiregrass, and Brewton. No such correlation is evident for the cotton yields.

Residual Value of Stable Manure, Vetch, and Nitrate of Soda. (W. V. Chandler.) — An experiment was begun in 1925 to compare the values of 5 tons manure, 325 pounds of nitrate of soda, and a crop of vetch as sources of nitrogen. This experiment was continued until 1942 when a residual study was begun. Samples of soil were collected in 1942 and in 1946 for laboratory studies.

Analysis of samples collected the 2 years were made for total nitrogen and organic carbon. The total nitrogen content decreased in the order, by plots: manure, vetch, commercial nitrogen, and no-nitrogen. The decrease in total nitrogen from 1942 to 1946 was equal to approximately 200, 75, and 50 pounds per acre in the manure, vetch, and commercial nitrogen plots, respectively.

In 1942 organic carbon content of the soils was as follows: manure plot, about 15,800 pounds per acre; nitate of soda plot, 12,000 pounds; vetch plot, 10,750 pounds; no-nitrogen plot, 8,500

pounds. The same relationship was evident in 1946. There was a rather uniform reduction of about 2,000 pounds of carbon per acre in all treatments between 1942 and 1946. A slight reduction occurred in the C:N ratio from 1942 to 1946, but there was no appreciable difference between treatments.

ANIMAL AND POULTRY HUSBANDRY

Nutritive Value of Sweetpotatoes. (W. D. Salmon.) — Laboratory experiments with rats showed that tankage and meat scrap were unsatisfactory protein supplements in sweetpotato rations. Fish meal and caesin were much superior.

Ground corn or wheat with no protein supplement except 4 per cent of alfalfa leaf meal produced more rapid growth in rats than dried sweetpotatoes supplemented with 4 per cent of alfalfa leaf meal and 10 per cent of tankage, meat and bone meal or fish meal.

Hogs receiving a ration containing 20 per cent of casein, 72 of sweetpotato meal, 4 of alfalfa leaf meal, 2.5 of dried yeast, 0.5 of salt, and 1 of bone meal made an average daily gain of 1.90 pounds and consumed 406 pounds of feed for each 100 pounds of gain. Hogs receiving a similar ration containing 20 per cent of fish meal instead of caesin gained 1.50 pounds per day and required 481 pounds of feed for 100 pounds of gain. When the protein supplement was meat and bone meal, the average daily gain was only 0.37 pounds and 1,290 pounds of feed were required for 100 pounds of gain.

Toxicity of DDT to Farm Animals. (J. C. Grimes and A. H. Quinn.) — In one test corn was fed to steers and hogs after it had been treated in the crib with DDT as follows:

1 part of DDT to 10,000 parts of corn
1 part of DDT to 20,000 parts of corn
1 part of DDT to 50,000 parts of corn

In a second test, conducted in cooperation with the USDA Bureau of Entomology, one lot of hay that contained 48 p.p.m. of DDT and a second lot that contained 184 p.p.m. were fed to fattening steers and to dairy cows.

After a feeding period of 100 to 120 days, the steers and hogs were slaughtered and tests for DDT were made on the heart, liver, spleen, kidneys, and from the fat and the lean tissues of the carcass. Milk samples were taken from the dairy cows at regular intervals and tested for DDT content.

The results of the two tests were as follows:

1. The animals showed no visible signs of toxicity.
2. Weight gains of both the hogs and cattle tended to decline as the DDT content of the ration increased.
3. Relatively large amounts of DDT were found to be stored in the internal organs of the slaughtered animals and smaller amounts in the lean tissues.
4. An analysis of milk samples from the dairy cows indicated that DDT was being passed in the milk.
5. Milk from cows receiving hay that had been treated with DDT was lethal when consumed by flies.
6. DDT was present in the fatty tissues and internal organs of slaughtered calves that suckled cows fed DDT-treated hay.

Lathyrism in Relation to the Use of Lathyrus Hirsutus for Livestock. (D. M. Turney, W. D. Salmon, and D. H. Copeland.) — The addition of 10 or 25 per cent of Caley Pea *Lathyrus hirsutus* seed to an adequate diet impaired reproduction in rats even when the diet was supplemented with milk. With 25 per cent of the diet, the impairment was evident in the first generation and became progressively worse with each succeeding generation until the third when there was essentially complete failure of reproduction. With 10 per cent of the seed in the diet, reproduction was normal in the first generation, was markedly impaired in the second generation, and failed in the fourth generation. The addition of manganese sulfate and of alpha tocopherol supplements had no significant effect on reproduction.

Pigs receiving a full ration of corn and grazed on Caley peas as the sole protein supplement made rapid and economical gains. They showed only slight symptoms of stiffness. Pigs grazed on Austrian winter peas under similar conditions were affected much more severely. One pig on Austrian winter pea pasture became so stiff that it was unable to get up.

Pigs receiving 25 or 50 per cent of Caley pea seed in the ration developed severe bone deformities. These deformities developed to the point where the pigs could not walk.

The seed of hairy vetch, Austrian Winter peas, or blue lupine, when included in adequate diets at a 50 per cent level, did not produce any symptoms of toxic effects on rats. When these seed were used as the sole source of protein, however, the rats were unable to grow, because of the poor quality of the protein. In addition to the poor protein quality, the bitter taste of the blue

lupine seed decreased the food consumption and thus further limited the gains.

Crotalaria seed and leaves were extremely toxic, and rats died of acute poisoning when fed as little as 1 per cent of these materials in the diet.

Variation in the Vitamin Content of Milk and Butter. (W. D. Salmon and Cornelia Flanagan.) — Milk and butter from local herds, where Experiment Station recommendations for winter grazing are being followed to some extent, showed much less seasonal variation in vitamin A and carotene content than was formerly observed in the area. There was a close relationship between the amount and quality of the pasture, both winter and summer, and the vitamin A value of the milk and butter. There was considerable variation from herd to herd. Milk from the best herd had 497 μg. of vitamin A and 887 μg. of carotene per quart in April, whereas the poorest herd had only 205 μg. of vitamin A and 624 μg. of carotene per quart. Again in November, one herd had only 204 μg. of carotene per quart of milk, whereas the three best herds had 468 μg. of vitamin A and 702 μg. of carotene per quart of milk.

Butter produced by three local herds had an average value for the year of 17,200 I.U. per pound in comparison with an average value of 12,300 I.U. per pound for five brands of creamery butter purchased on the Auburn retail market each month during the year.

The carotene content of some common forage plants and pasture grasses was as follows in μg. per 100 gm. dry matter: Johnson grass 126, well-fertilized Bermuda grass 114, unfertilized Bermuda grass 29, Sudan grass 76, bur clover 55, alfalfa 54, soybean plant 52, kudzu plant 51, lespedeza sericea 42.

Storage Levels of DDT. (W. C. Sherman.) — Various tissues and organs from beef cattle that had been fed DDT-treated hay and corn and from hogs that had been fed DDT-treated corn were analyzed for content of DDT. The results are summarized in Tables 2 and 3.

The DDT content of tissues from beef cattle was proportional to the amount of DDT in the feed, it being considerably higher in animals fed hay containing 184 p.p.m. DDT in the hay than in animals that received 48 p.p.m. and 40 p.p.m. DDT in hay and corn, respectively. The DDT content of tissues from beef

cattle was appreciably higher than that of corresponding tissues from hogs. The rate of disappearance of stored DDT from beef cattle after the feeding of DDT was discontinued was very slow. There still was appreciable amounts of DDT in the carcasses after the animals had been on pasture for as long as 210 days.

TABLE 2.— DDT STORAGE IN STEERS FED DDT-TREATED CORN AND HAY

Treatment	Weights of animals		DDT content, ppm fresh basis			
	Initial Wt.	Final Wt.	Leaf Fat	Loin Fat	Tender-loin	Round
	Lb.	*Lb.*				
DDT corn 105 days	400	580	65	51	2.0	0.7
DDT corn 204 days	580	880	65	46	1.6	0.9
DDT hay (48 ppm) 147 days	540	740		70	2.9	1.2
DDT hay (48 ppm) 108 days, then pasture 210 days	460	720	33	31	1.9	
DDT hay (184 ppm) 95 days	560	610	139	152	2.8	1.4
DDT hay (184 ppm) 105 days, then pasture 39 days	480	570		79	1.6	0.5
DDT hay (184 ppm) 108 days, then pasture 210 days	460	620	11	11	0.7	0.5
Calf, DDT hay (184 ppm) to cow, 143 days	90	260		825	10.0	6.2

TABLE 3.— DDT AND FAT CONTENT OF TISSUES, FRESH BASIS

Tissue	Hog[1]		Steer[2]	
	DDT	Fat	DDT	Fat
	p.p.m.	*Per cent*	*p.p.m.*	*Per cent*
Leaf fat	13.3		65.0	
Loin fat	12.7		46.0	
Tenderloin	1.0	5.9	1.4	3.0
Round (ham)	0.2	3.4	0.8	2.0
Liver	0.4	5.5	0.1	3.4
Kidney	2.6	13.2	0.1	2.4
Heart	0.6	4.8	0.8	2.5
Spleen	0.7	10.2	0.4	1.6
Bacon	9.9			
Ham fat	12.7			

[1] Hog received DDT corn 223 days
[2] Steer received DDT corn 204 days.

Management of Farm Poultry Flocks. (D. F. King and G. J. Cottier.) — On farms where improved housing, feeding, and breeding of hens and improved methods of raising chicks were used, the hens produced during the year an average of 126.91 eggs as compared to 41.49 eggs per hen per year where these practices were not followed. The effect of the improvement

practices on egg production can be ranked in order of their importance as follows: feeding and breeding of hens, methods of raising chicks, and housing of hens. Other factors affecting the yearly egg production are date of hatching, age of birds in flock, consumption of corn, and amount of range allowed the chickens.

BOTANY AND PLANT PATHOLOGY

Studies on the Control of Cercospora Leaf Spot of Peanuts. (Coyt Wilson and J. P. Wilson.) — Results of experiments conducted at the Wiregrass Substation in 1945 and 1946 showed that the yields of Spanish peanuts could be increased and that the digging date could be delayed by controlling Cercospora leaf spot. The materials used included dusting sulfur; sulfur-copper, containing 90 parts dusting sulfur and 10 parts copper oxychloride sulfate; talc-copper, containing 90 parts talc and 10 parts copper oxychloride sulfate; Kolocop, a proprietary dust containing 6 per cent metallic copper and 60 per cent sulfur; and Bordeaux spray, 6-2-100. The dusts were applied three or four times at 10-day to 2-week intervals beginning about June 20.

The results show that the harvesting season is lengthened by controlling leaf spot and the increase in yield from dusting or spraying is greater at the later digging date. In 1945 sulfur-copper mixtures were more effective than dusting sulfur alone or talc-copper. However, in 1946 these mixtures were no better than dusting sulfur alone. The copper mixtures control leaf spot and shedding better than sulfur alone, but in hot, dry weather the copper appears to stunt the plants to some extent.

The Cause and Control of Concealed Damage in Peanuts. (Coyt Wilson.) — Studies of the cause and control of concealed damage of runner peanuts were continued in 1945 and 1946. The work included studies on the relationship between moisture content and development of damage, the relationship between amount of damage and percentage of free fatty acids in the expressed oil, isolations from damaged seeds, and studies on the resistance of Dixie Runner to concealed damage.

The greatest amount of damage developed in those peanuts that were held at moisture levels of 20 to 35 per cent for a week or more. Development of damage was slower at moisture levels above or below this range.

The percentage of free fatty acids in the expressed oil increases as the percentage of concealed damage in the sample increases. The relationship is practically a straight line. The oil from peanuts containing no damage contained 0.283 to 0.335 per cent free fatty acids. In the oil from peanut meal made entirely from seed with concealed damage, the percentage of free fatty acids ranged from 13.554 to 17.129.

The predominant fungus associated with concealed damage in southeastern Alabama is *Diplodia theobromae* (Pat.) Nowell. More than 2,500 seeds from 28 different samples have been plated. A total of 2,142 cultures of fungi and bacteria was obtained, of which 87.2 per cent were *D. theobromae*. In the early phases of concealed damage, *D. theobromae* was the only fungus that could be isolated. In the advanced stages, secondary invaders including *Sclerotium bataticola, Sclerotium rolfsii,* and various species of *Fusarium, Rhizoctonia, Penicillium,* and *Aspergillus* were isolated.

Preliminary tests indicate that Dixie Runner is far more resistant to concealed damage than the runners commonly grown in Alabama. Less than 2 per cent concealed damage was found in Dixie Runners cured under adverse conditions; the commonly grown Alabama runners cured under similar conditions contained as much as 14 per cent damage.

Cotton Seed Treatment Studies. (Coyt Wilson.) — The effect of seed treatment with Merc-O-Dust or 2% Ceresan on the emergence of cotton seedlings was studied in 1945. At each planting date Merc-O-Dust was better than no treatment and 2% Ceresan was better than Merc-O-Dust.

Seed Treatments for Peanuts. (Coyt Wilson.) — Response of machine-shelled seed of Spanish and runner peanuts to a number of different seed disinfectants was studied in 1945 and in 1946. The seed were shelled on a peanut sheller developed by the USDA Farm Tillage Laboratory, Auburn, Alabama. Shelling and treating was done on the day before the seed were planted. All materials tested gave significant increases in stands. DuBay 1452-F, 2% Ceresan, Arasan, Phygon, Dow 9, and Spergon were the best treatments. Emergence from untreated seeds was 50 to 60 per cent, and that from treated seeds generally was above 80 per cent.

Experiments conducted over the 2-year period, 1945-46, proved

that peanut seed shelled and treated 9 weeks ahead of planting produced stands as good as those shelled and treated one day before planting.

Studies on the Control of Late Blight of Irish Potato. (Coyt Wilson, Otto Brown, and Frank E. Garrett.) — Results of experiments involving replicated treatments of different sprays and dusts on Irish potatoes at the Gulf Coast Substation in 1945 and 1946 showed that Dithane D-14 controls both early and late blight without retarding the growth of the potatoes. In 1945 plots sprayed with Dithane yielded approximately 20 per cent more potatoes than those plots receiving no fungicide. A number of neutral copper sprays increased the yields by 16 to 18 per cent, while Bordeaux spray, 8-6-100, increased the yield by only 6 per cent. In 1946 there was no late blight, *Phytophthora infestans,* in the plots, and all of the copper sprays and dusts reduced the yield of potatoes by approximately 10 per cent.

Several proprietary copper dusts have been tested. All appear to be about equally effective under the conditions that prevailed during these tests. All of the copper dusts cause some retardation of growth, and, in the absence of late blight, they reduce the yield slightly. When late blight is a limiting factor, as in 1945, dusting with a copper dust is a profitable operation.

Control of "Cherokee" Rose *Rosa brackeata* (L.) (J. R. Jackson.) — *Rosa brackeata,* known locally as "Cherokee" rose, is a serious pest on lime land pastures in the Black Belt of Alabama. Roses have been cleared from heavily infested areas by tractor plows at a cost of $5.75 per acre and by a bulldozer at a cost of $2.65. These costs included bunching and burning of brush.

After clearing, the use of clean-cultivated crops for 4 years has destroyed all roses on heavily infested areas. The number and vigor of roses have been sufficiently reduced to warrant returning the land to pasture after three crops of oats rotated with Johnson grass hay production in summer, provided fertilizer practices were adequate to produce a vigorous growth of Johnson grass.

Effect of Pasture Improvement on Weed Populations. (J. R. Jackson.) — Weed population studies of experimental pasture plots at the Black Belt Substation show that the improvement of pastures by the use of fertilizers reduces the number of weeds. The average weed infestation per acre on plots receiving no

fertilizer was 285,000 in the fall and 122,000 in the spring, whereas the average weed infestation on plots receiving a complete fertilizer was 40,000 in the fall and 15,000 in the spring.

Chemical Control of Nutgrass. (J. R. Jackson.) — Uramon has destroyed nutgrass *Cyperus rotundus* (L.) in Norfolk sandy soil containing an average of 100 live tubers per square foot. Two pounds of Uramon per square yard killed 97 per cent of the tubers; 3 pounds destroyed all of them when the Uramon was mixed thoroughly throughout the soil to the depth of penetration of tubers. The soil was kept moist and mulched through June, July, and August.

HORTICULTURE and FORESTRY

Green-Seeded Bush Lima Bean Tests. (C. L. Isbell.) — With the introduction of varieties of green-seeded Bush Lima beans a few years ago, experiments were started to determine their adaptability to Alabama conditions.

Supergreen and the small, green-seeded varieties, Congreen and Clark's Bush, were compared with the standard white, small-seeded Bush Lima Henderson.

Results from these experiments show that Supergreen is not adapted to Auburn conditions. The small-seeded varieties yielded 20 to 90 times as much as Supergreen. The small, green-seeded varieties were 2 to 7 days later than Henderson in reaching edible size. There was not much difference in the yields of the small-seeded varieties. The yield of each of the small-seeded varieties was about 4,000 pounds of green beans in the hull.

In shelling, freezing, and cooking tests the green-seeded varieties gave a greener and more attractive appearance.

Improved Varieties of Table Cowpeas Developed. (C. L. Isbell.) — Experiments have been underway for several years to develop improved varieties of table cowpeas by means of cross-pollination and selection. These experiments have resulted in the development of five new varieties, each being superior in one or more characteristics to existing varieties. Time required between planting and harvesting ranges from very early to late mid-season. All varieties yielded well, producing white peas with either brown or black eyes.

Pokeweed Does Well Under Garden Culture. (C. L. Isbell.) — Many farm families harvest volunteer pokeweed plants and use

the leaves and young shoots as greens. A considerable quantity of this plant is sold on some curb markets of the state. A practical experiment was conducted during 1940, 1941, and 1942 to determine its possibilities as a cultivated plant.

Results of these experiments show that with reasonable care pokeweed lends itself well to garden conditions from crowns produced from volunteer plants or from crowns produced from seedlings grown under garden conditions.

Asparagus Does Well Under Garden Conditions. (C. L. Isbell.) — Whether good asparagus can be grown as far South as Auburn, Alabama, has been questioned. One hundred crowns of the Mary Washington variety, planted 18 inches apart in a single row under garden conditions, produced an average annual yield of 96 pounds during a 5-year period ending in 1946. Since crowns tend to produce more after they are several years old, results of this experiment indicate that asparagus can be successfully grown under garden conditions as far south as Central Alabama.

Orchard Erosion Control. (J. C. Moore.) — The problem of soil erosion and maintenance of soil fertility in cultivated orchards is important in the Southeast and one difficult to solve.

Since 1938 studies have been conducted to determine methods of controlling erosion and maintaining the soil by the use of permanent ground covers combined with the Nichol's-type terrace.

Treatments found most promising thus far are:

1. Bur clover plus rescue grass as a winter annual; these ground covers seed early, and fall to the ground forming a mulch through the summer months; they come back as volunteer crops in the fall.

2. Lespedeza sericea, cut and left on the ground; this method is recommended for slopes with more than a 5 per cent grade.

Storage Quality of Sweetpotatoes as Affected by Different Rates of Application of Nitrogen Applied as Side Dressing. (L. M. Ware and W. A. Johnson.) — Results of experiments at numerous locations in Alabama have shown that the yield of potatoes on most soils of average fertility may be increased considerably by side applications of nitrogen. It is generally believed, however, that side applications of nitrogen result in a potato of low-keeping quality.

To determine the effect of side applications of nitrogen on the keeping quality of sweetpotatoes, storage tests were conducted

during the 1944-1945 seasons on 20 lots of potatoes; the amount of nitrogen they received at planting time and as side applications varied from 16 to 112 pounds per acre. Side applications were applied as vines began to run. The Triumph and Porto Rico varieties were both included in the test.

The data show that no ill effects on the keeping quality of either variety resulted from side applications of nitrogen.

Since all potatoes were handled in a way similar to that of grading for shipment, it likewise might be stated that there was little evidence that side applications of nitrogen would affect shipping quality.

Effects of Manures, Minor Elements and of Divided Applications of Nitrogen and of Nitrogen, Phosphorus, and Potash on the Yield of Vegetable Crops. (W. A. Johnson and L. M. Ware.) — Studies have been conducted for 3 years to determine why vegetable crops on light textured soils fail even though supplied adequate amounts of commercial fertilizers. Treatments included manures, lime, minor elements, divided applications of nitrogen, and divided applications of nitrogen, phosphorus, and potassium.

Yields were increased from 2 to 40 times as a result of manure applications with identical fertilizer treatments, even though liberal applications of fertilizers were used with all treatments.

Yields were increased by dividing nitrogen and by dividing nitrogen, phosphorus, and potash into several applications. The effects were much more pronounced in the spring than in the fall. Likewise, effects were more pronounced on plots receiving no animal manure than on those to which animal manures were applied.

The yield of spring carrots may be used to illustrate this general trend. Yields were increased 8 times by the use of manures where all fertilizer elements were applied at planting time and about three times where the elements were applied at three periods. On the plots not receiving manures, the yields of carrots were increased 4 times by dividing the nitrogen application, and 6 times by dividing all three of the principal fertilizer elements.

Influence of Side Applications of Nitrogen and Rates of Nitrogen on Sweetpotato Yields. (W. A. Johnson and L. M. Ware.) — An experiment for studying the effects of side applications

and different rates of nitrogen on sweetpotato production was started in 1943 in field plots on Norfolk soil. There were three rates of side applications of nitrogen with each of three different rates of applications of a complete fertilizer.

In all cases increases in the amount of nitrogen used as a side application resulted in larger yields. With the Porto Rico sweetpotato, the greatest yield increases occurred in the No. 1 grade. As the rate of complete fertilizer was increased from 400 to 1,200 pounds per acre, however, the increase in yields due to extra nitrogen was less.

Relation Between Vine Production and Sweetpotato Yields. (L. M. Ware and W. A. Johnson.) — To determine the relationship between vine growth and sweetpotato yields, the weights of both were determined in a number of experiments on several different soils. In some experiments the effects of irrigation and organic matter on root and vine yields also were measured.

In practically all cases where there was an increase in the yield of vines, there was an increase in root yield. On the Chesterfield, Norfolk, Decatur, and Hartsells soils, records on both the Triumph and Porto Rico varieties showed an increase in yield of roots and vines with each higher rate of nitrogen, except for some of the highest rates which probably supplied more nitrogen than was needed for the crop.

The application of either vetch or manure gave an increase in yield of both vines and roots. Twelve tons of manure resulted in an increase in vine yield of over 6 tons per acre. In each case where the sweetpotatoes showed an increase in yield of vines, there was a corresponding increase in yield of roots.

Each increment of fertilizer applied with and without irrigation, dry lespedeza, or the combination of irrigation and dry lespedeza, resulted in an increase in yield of both roots and vines of both varieties used.

Respiration Losses of Sweetpotatoes During Storage. (L. M. Ware and W. A. Johnson.) — Studies were conducted for 2 years to determine losses in weight of sweetpotatoes due primarily to respiration. The experiment was designed to prevent losses from mice and to separate losses due to decay from those due to respiration.

The most rapid losses were at the beginning and end of the storage period. Losses were low during the winter months. High

losses early in the storage period were associated with high temperature during the curing period; low losses during the winter period were associated with low temperature; and high losses during the spring and summer periods were associated with rising temperatures. Sprouting of the tubers accelerated the respiration during late storage periods.

For each 100 pounds of potatoes harvested, only 77.22 pounds remained by June. The usual storage period for sweetpotatoes ends about March. Respiration losses had amounted to 13.88 per cent by March 3. Approximately 86 per cent of the total loss in storage was due to respiration.

Influence of Lime and of Different Rates of Nitrogen, Phosphorus, and Potash on Growth Cracks in the Sweetpotato. (L. M. Ware and W. A. Johnson.) — To determine the effect of lime and of different rates of application of nitrogen, phosphorus, and potassium on the cracking of sweetpotatoes, records of cracking were obtained from a number of experiments conducted in 1944 and 1945 on five soils.

Potassium applied at high rates on both Decatur and Hartsells soils resulted in some increase in cracking in 1944 but very little in 1945.

Where lime was applied there was an increase in cracking both years on the Decatur soil and in 1945 on the Hartsells soil.

In 1944, cracking on both Decatur and Hartsells soils increased on the high nitrogen plots; however, there was practically no evidence that rates of nitrogen affected cracking in 1945.

The highest rate of cracking in most cases was associated with either a low rate or the 0 rate of phosphorus. As the amount of phosphorus applied was increased, the amount of cracking in the sweetpotato remained about the same or showed a decrease in percentage.

There was no difference in the amount of cracking on the limed and unlimed plots on the Norfolk, Eutaw, and Cecil soils.

Tomato Breeding. (F. E. Johnstone, Jr., and C. L. Isbell.) — Of 41 homozygous lines of tomatoes developed at Auburn, 13 proved to be highly resistant to *Fusarium* wilt in artificial inoculation tests in the greenhouse and in field trials. Several of these are promising as home garden types. However, for commercial use they will have to be crossed to obtain a suitable large-fruited, resistant variety. Of the non-resistant lines, several were equal

to or better than standard varieties at Auburn, Oneonta, and Atmore from the standpoint of several important characteristics.

English Pea Breeding. (C. L. Isbell and F. E. Johnstone, Jr.) — Thirty-four homozygous lines of English peas have been selected from crosses made in 1940-41. By observation, they appear to be equal to or superior in most respects to standard varieties now being grown in Alabama. Seed of these will be increased for comparative yield tests at Auburn and in other sections of the state. Of the lines selected from all crosses, approximately a third of them were from the cross of Thomas Laxton and Willets Wonder.

Behavior of Different Pine Species Underplanted in Hardwood Stands. (L. M. Ware and Rudolph Stahelin.) — On thousands of acres of forest land, pines have been removed and the hardwoods, present as an understory, have been left to take possession. In 1933 an experiment was started on the Main Station to see if pines planted under the hardwoods would survive and grow and if a release cutting would be necessary. Slash, loblolly, shortleaf, and longleaf pines were included in the test. One-year seedlings were planted in a regular 6 by 8-foot spacing. The area had been in longleaf pines. A dense stand of hickories, oaks, and sweetgums about 4 to 8 feet in height covered the area quite uniformly. On one portion of the area the pines were released 4 years after planting. On another portion the pines were not released.

A release cutting increased the survival and the growth of each species of pines. The growth of slash pine was 3 times and that of shortleaf was about six times. Loblolly was benefited much less by releasing than the other two species. It was the best of the species where no release was given. The slash and loblolly were about equally good when underplanted and released. The shortleaf was not as well adapted to underplanting, irrespective of release or no release. The longleaf gave too low a survival to permit study.

The cordage of wood in pine trees was about twice as much in an adjacent old field plantation without hardwood competition as in the underplanted stand. However, the slash and loblolly pines were so well established on the hardwood area that pines as a major component of the stand was assured.

Characteristics of Natural Loblolly Stands Under Different Degrees of Thinning. (Rudolph Stahelin and L. M. Ware). — To study some of the differences in stand and tree characteristics of inadequately stocked, well stocked, and densely stocked stands, experiments were begun in 1927 on three natural areas that were well stocked at that time with loblolly reproduction of about 3 years of age. On one plot the trees were thinned to stand 16 by 16 feet apart; on a second plot trees were thinned to stand 6 by 6 feet apart; and on a third plot the natural stand of about 3,000 trees per acre was left. The quality of the site was high.

Thinnings were made in 1945 when the stand was 20 years old. The inadequately stocked stand had a total volume of 19 cords; the well stocked stand, 47 cords; and the dense stand, 55 cords per acre. The gross value of all marketable wood on the three stands cut and delivered would have been $126, $331.50, and $381.80 per acre. The actual thinnings removed in 1945 had values of $6.82, $106.20, and $144 per acre, respectively.

The thinning done when the trees were 3 years old affected not only the total yield of wood at the age of 20 years, but also the structure of the stand. In 1945 there were 242, 431, and 670 trees per acre 4 inches and above (d.b.h.) on the inadequately, well, and densely stocked areas, respectively. The numbers of trees 10 inches (d.b.h.) and above were 65, 141, and 50 on the three areas in the order mentioned above.

Thinning to a 6 by 6-foot spacing resulted in the greatest number of trees approaching sawlog size at 20 years. The unthinned check plot now contains almost as many trees 10 inches and over as the plot that was thinned to a 16 by 16-foot spacing. Because of the numerous large limbs, the quality of the trees on the inadequately stocked plot is much inferior to that of the trees on the other two plots. This experiment shows that too drastic a thinning of young stands defeats its own purpose and causes an incomplete utilization of the land by eliminating the trees that would furnish pulpwood and poles. The lighter thinning to a 6 by 6-foot spacing resulted in a well stocked stand. It offers the best solution for hastening the production of trees of sawlog size and also gives an adequate growing stock, which supplies minor products in addition to sawlogs.

Incidence of Cronartium Rusts on Slash Pine Plantations Receiving Cultural Treatments. (William R. Boggess and Rudolph Stahelin.) — Cronartium rusts *C. fusiforme* (Hedge & Hunt) and

C. cerebrum (Hedge & Long) cause serious damage in young stands of southern yellow pine. These rusts occur on the stems or branches of pine trees. They cause malformation such as galls, burls, cankers and witches' broom. Trunk infections frequently result in death of the infected trees.

Observations on the incidence of Cronartium rusts were made on slash pine plantations established at Auburn in 1938. These plantations were a part of an experiment designed to test the effect of cultivation, fertilization, and intercropping on the growth of planted slash pine. In the experiment, eight ¼-acre plots were planted with slash pine at a spacing of 8 by 8 feet.

Three treatments were used:

1. No cultural treatment (check).
2. Trees cultivated and fertilized; each tree received an application of 0.3 lb. of complete fertilizer (1-5-4) and a side dressing of 0.1 lb. of nitrate of soda (after growth had started).
3. Trees cultivated and fertilized as described; cotton grown between the rows with an additional application of 325 lb. 6-8-4 fertilizer per acre.

The percentage of Cronartium-infected trees is twice as great on the treated as on the untreated plots. The percentage of trees with Cronartium is the same for both cultural treatments.

The average diameter (4½ feet above the ground, outside bark) of the cultivated-fertilized and intercropped trees is greater than those receiving no cultural treatment; this diameter difference is statistically significant at the 5 per cent level.

There is 1½ times more wood per acre on the treated than on the untreated plots; however, the volume of Cronartium-infected trees is 4 times greater on the plots receiving cultural treatments. This leaves about the same volume of healthy trees for all treatments. The diseased trees, however, have practically full value when marketed for pulpwood.

Carpenter Dimension Mill as an Aid in Utilization of Small Hardwoods. (William R. Boggess and Robert H. Clark.) — The utilization of small hardwoods is a problem common to owners of timberland in the South. These small hardwoods are usually considered worthless from a commercial standpoint. They occupy space in stands that could be used by faster growing pine or better quality hardwoods.

A test sawing was made on the newly developed Carpenter Dimension Mill to test its adaptability for sawing small hard-

woods. This mill is a modified edger that saws small logs into square-edged dimension stock.

A total of 558 red oak and white oak logs were used in the study; they were 8 feet long and ranged from 5.5 to 10 inches in diameter at the small end. Half of the logs were graded and sawed into 2 inch boards and sold as flooring stock. The ungraded half was sawed into 2 inch boards and sold on a mill-run basis to a box manufacturer.

The logs scaled 4,611 board feet by the Doyle Rule. They produced 6,811 board feet of lumber, giving a mill over-run of 47.7 per cent.

In the flooring study, only the two best log grades could be used. Most of the flooring produced was in the lower grades. An average price of $40 per thousand was received for the flooring stock, f.o.b. flooring mill.

A price of $35 per thousand at the mill was received for the lumber marketed as box boards. Only 21 board feet were lost as cull.

Logging and milling costs were $19.40 per thousand board feet on a lumber scale basis. Hauling costs will vary with the distance from the forest to the mill. A sufficient margin, however, is left to cover hauling costs and leave a reasonable profit for the operation.

ZOOLOGY-ENTOMOLOGY

Control of Insects Attacking Stored Corn. (F. S. Arant and L. L. English.) — Experiments were conducted to determine the effectiveness of powdered insecticides against the rice weevil, *Sitophilus oryza* (L.) and other insects in shelled corn stored in quart fruit jars fitted with 30-mesh screen wire covers. DDT and benzene hexachloride were highly effective over a 3-month period. At 10 p.p.m., DDT gave excellent control, and was slightly more effective than Rothane (dichloro diphenyl dichloro-ethane) at 40 p.p.m. A Ryania (Ryanex)-DDT mixture was no more effective than DDT alone. The effectiveness of DDT was reduced greatly by hydrated lime and by magnesia dust (MgO) and to a lesser extent by pulverized iron ore and ferric oxide in the order named. A Dilroc-DDT mixture was as effective over a 3-month period as DDT alone. Dilroc is a finely pulverized limestone, which might reduce the toxicity of DDT to mammals.

Results of experiments with different samples of benzine hexachloride were not as consistent as those with DDT. Based on total $C_6H_6Cl_6$ content, benzene hexachloride appeared slightly less effective than DDT, particularly at the lower dosages. Based on the gamma isomer, it was much more effective than DDT. In one experiment, corn treated with sufficient benzene hexachloride to contain 1 to 2 parts gamma isomer p.p.m. of corn was protected from weevils over a 3-month period as well as corn treated with DDT at the rate of 10 p.p.m. At the end of one month in another experiment, two mixtures containing gamma isomer at the rate of 2 p.p.m. were as effective as DDT at the rate of 10 p.p.m. A third sample in very poor physical condition attained the same level of efficiency at a gamma isomer content of 4 p.p.m. in corn.

Benzene hexachloride in the form of a residual coating on the bottom and sides of a jar was 100 per cent effective against weevils infesting corn stored in the jar. A similar residue of DDT resulted in 86 per cent mortality. As a fumigant, benzene hexachloride was moderately effective at the end of one month.

Alcimide, an inert powder recommended by the English, resulted in 78 per cent mortality at the end of one month when used at the rate of 0.2 per cent.

In preliminary experiments, DDT-*Dilroc* dust mixed with unshucked corn in cribs did not give satisfactory control of the rice weevil at the rate of 20 parts pure DDT per million parts of corn. Better control was effected at rates of 50 and 100 p.p.m. but even at the higher concentration only fair control was achieved.

Spraying Cattle With DDT. (F. S. Arant and A. H. Quinn.) — Beef cattle, sprayed four times at intervals of 2 to 5 weeks with DDT at concentrations of 0.25, 1.0, and 2.5 per cent, were effectively protected against the horn fly, *Siphona irritans* (L.) from July 10 to October 8. Applications that averaged 1.6 pints of 0.25 per cent spray per cow were required to give what appeared to the eye to be the same degree of wetting as was effected by an average of 1.1 pints of 2.5 per cent material. Each unsprayed animal in the check lot had many hundreds of flies throughout the season, whereas sprayed cattle averaged less than 10.

Unsprayed animals, running with larger groups of sprayed cattle, received considerable protection against horn flies. Sprayed

cattle running with unsprayed ones became reinfested sooner and had more flies than cattle sprayed and segregated. The DDT sprays were only moderately effective against the stable fly, *Stomoxys calcitrans* (L.).

Velvetbean Caterpillar and Other Peanut Insects. (F. S. Arant.) — Experiments in the control of the velvetbean caterpillar, *Anticarsia gemmatilis* (Hbn.) were conducted at the Wiregrass Substation during a major outbreak of the pest on peanuts. Single applications of cryolite, 3 per cent DDT, 1 per cent DDT, and 5 per cent gamma isomer of benzene hexachloride dust at the rate of 30 to 35 pounds per acre on small replicated plots gave protection against insect damage from August 20 until harvest, September 19. Some control was obtained on checks adjacent to the dusted plots.

All dusted plots produced substantially more peanuts than the checks and the dusted plants lost fewer peanuts in the ground at harvest than undusted ones. Four replicated plots dusted with 1 per cent DDT averaged 1,519 pounds of dry peanuts per acre on the vines at harvest, as compared with 946 pounds on the 4 checks. An average of 175 pounds was lost in the ground on the DDT plots and 298 on the checks.

Peanuts receiving 3 per cent DDT at the heavy rate of 30 to 35 pounds per acre averaged 271 pounds of dry peanuts per acre less than peanuts dusted with 1 per cent DDT at the same rate. In another experiment, where dusts were applied at the same rate, plots receiving 3 per cent DDT averaged 1,114 pounds of dry peanuts per acre, as compared with 1,324 pounds from cryolite-treated plots, 1,323 pounds from plots receiving 5 per cent gamma benzene hexachloride, and 901 pounds from check plots.

The yield of peanuts was reduced where the plants were ragged by worms but not defoliated, though the reduction, with one exception, was less than where complete defoliation occurred.

Peanuts dusted once at the rate of 20 pounds per acre with 1 per cent gamma benzene hexachloride produced an average of 1,468 pounds of dry peanuts per acre, as compared with 1,164 on the checks, which were ragged but not completely defoliated.

Profitable gains resulted from dusting peanuts after they were defoliated by worms. Per acre yields of dry peanuts at the second digging were as follows: check, 699 pounds; cryolite plots, 1,232

pounds; 1 per cent DDT plots, 1,222 pounds; and 1 per cent gamma BHC plots, 1,032 pounds.

DDT (1 per cent) and benzene hexachloride (1 per cent gamma) were highly effective against velvetbean caterpillar on alfalfa at the Main Station. The average numbers of worms per five sweeps of an insect net one week after applying dusts at the rate of about 12 pounds per acre were as follows: DDT plot, 2.0 worms; check, 87.0; benzene hexachloride, 1.5; check 77.5; "1068", 27.5 worms; check, 53.5. Damage equivalent to an extra cutting occurred on the checks, whereas no damage occurred where DDT and benzene hexachloride were used.

DDT dusts and sprays were effective against the leafhoppers, *Empoasca fabae* (Harr.) on peanuts. Sabadilla and sulphur were also fairly effective in the order named. Rotenone and nicotine were low in efficiency. DDT as a spray was highly effective against thrips, *Frankliniella fusca* (Hinds), and, as a dust it was moderately effective. There was no increase in yield under the conditions of these experiments.

Toxicity of DDT to Farm Animals. (F. S. Arant and L. L. English.) — In an experiment conducted in cooperation with the Department of Animal Husbandry, unshucked corn was treated with DDT — 20 p.p.m., 50 p.p.m., and 100 p.p.m. — stored in cribs and fed to steers and pigs. All animals appeared healthy but gained slightly less weight than check animals. Factors other than the DDT were possible, even probably, responsible for the lower gains of the animals receiving DDT. Unchecked corn removed from the crib contained only 9, 15, and 28 parts DDT per million parts of corn, according to analysis made by the State Toxicology Laboratory. The higher amounts were from the cribs receiving the higher rates of DDT. Shelled corn contained less than 1 p.p.m.

Tissues of slaughtered animals were analyzed for DDT by Dr. W. C. Sherman. Two steers fed unshucked corn treated in storage with DDT, 50 p.p.m., contained approximately the same amount of DDT, although one received the corn for 204 days and the other only 105 days. Loin fat of the steers contained 46 to 51 p.p.m. The DDT content of the lean meat was 2 p.p.m. or less. Ten to 13 p.p.m. were found in the fat of a pig fed unshucked corn from the same crib. Very small quantities of DDT occurred in the lean meat. The internal organs of both steers and pig contained very small amounts of DDT.

Fertilizer Experiments with Camellias. (L. L. English.) — Camellias were grown in pots of soil with the pH adjusted to several levels by supplementing the soil with sulphur and lime. Pots receiving nitrogen, but with a pH of 4.0, made less growth than similar pots having a pH range of 4.4 to 7.0. No practical difference in growth was obtained with 3, 6, and 9 per cent nitrogen where the pH range was from 4.4 to 6.5. Growth was a little slower at pH 7.0. Survival was definitely lower in the series of pots with a pH of 4.0.

Tests with DDT and Ryanex on the Corn Earworm. (L. L. English.) — A 5 per cent DDT dust applied from one to five times to plots of sweet corn increased the number of undamaged ears only about 10 per cent. A 50 per cent Ryanex dust gave about the same results.

Farm Ponds. (H. S. Swingle, E. E. Prather, J. M. Lawrence, J. W. Webb, and J. R. Snow.) — It was found possible to produce two crops of goldfish minnows per year in a pond. The first crop was removed in July; the pond was immediately restocked with brood fish and the second crop removed in December. Brood goldfish were found to spawn as late as August 24.

Fathead minnows *Pimephales promelas* (Rafinesque) were produced in ponds at rates in excess of 100,000 per acre, but only approximately one-third of this number was large enough for use as bait by October. In other ponds these minnows were able to reproduce in the presence of bass, crappie, bluegills, and darters.

Carp *Cyprinus carpio* (Linnaeus) reproduced in ponds stocked at the rate of 40 adults per acre, but failed to reproduce when stocked at the rate of 500 adults per acre. At the latter rate of stocking, a total of 435.0 pounds of carp was produced per acre.

In a fertilized pond largemouth buffalo *Megastomatobus cyprinella* (Valenciennes) failed to spawn when stocked at the rate of 40 adults per acre.

A combination of buffalo and bass, with a few carp, gave a total production of 846 pounds of fish per acre in a fertilized pond.

In a 3-year experiment, a shellcracker *Lepomis microlophus* (G.)-bass combination failed to maintain good fishing. The shellcrackers became less and less numerous during the course of the experiment.

The removal of large numbers of bass from ponds by seining upset the balance between the bluegills and bass and ruined the pond from the standpoint of fishing. After the bass were removed, the bluegills became so overcrowded that none was able to grow to an edible size.

Late winter and early spring fertilization of a pond was found to stimulate spawning of bream and greatly increase the catch.

The addition of organic materials supplying carbon dioxide to the water increased fish production in ponds fertilized with inorganic fertilizers.

Several forms of 2,4-D used as sprays showed considerable promise in the control of various pond weeds, including needlerush, spikerush, arrowhead, and water grass.

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No. 92 Christmas Tree Production. JOSEPH C. MOORE. 1945.

No. 93 Chamber for Fumigating Plants with Methyl Bromide. L. L. ENGLISH and G. F. TURNIPSEED. 1946.

Experiment Station Leaflets

No. 21 Growing and Fattening Hogs in Alabama. W. E. SEWELL. 1945.

No. 22 Raising Crickets for Bait. H. S. SWINGLE. 1946.

Experiment Station Progress Report Series

No. 12 Sweetpotatoes for Livestock Feed. L. M. WARE. 1945.

No. 13 Blue Lupine Culture in Southern Alabama. E. F. SCHULTZ and D. G. STURKIE. 1945.

No. 14 Artificial Manure Production. D. G. STURKIE. 1945.

No. 15 Feeding Laying Hens. D. F. KING. 1945.

No. 16 Cannibalism Among Chickens. D. F. KING. 1945.

No. 17 Caley Pea Production and Uses in Alabama. K. G. BAKER. 1945.

No. 18 Movable Brooder House. D. F. KING. 1945.

No. 19 Recommendations on Boll Weevil Control in Alabama, J. M. ROBINSON and F. S. ARANT. 1945.

No. 20 Method of Storing Cured Pork to Prevent Infestation by Skippers. W. E. SEWELL. 1945.

No. 21 A System for Process Milk Production in the Black Belt. K. G. BAKER. 1945.

No. 22 Studies on the Control of Late Blight of Irish Potatoes. OTTO BROWN, FRANK E. GARRETT, and COYT WILSON. 1945.

No. 23 Alamalt — Its Properties and Uses. MILDRED S. VAN DE MARK. 1945.

No. 24 Seed Treatments for Peanuts. COYT WILSON, H. R. ALBRECHT, and I. F. REED. 1946.

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No. 26 Control of the Peanut Worm. L. L. ENGLISH. 1946.

No. 27 Summary of Results from Operation of a Cotton-Hog Farm Management Unit, Monroeville Experiment Field, 1942-45. J. W. RICHARDSON. 1946.

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December 31, 1946

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J. R. Snow, B.S. ..... *Graduate Assistant in Fish Culture*

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W. B. Kelley ..... *Assistant Superintendent*

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Otto Brown, M.S. ..... *Superintendent*
H. F. Yates, B.S. ..... *Assistant Superintendent*

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E. L. Mayton, M.S. ..... *Superintendent*
J. W. McClendon, B.S. ..... *Assistant Superintendent*

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B. W. Appleton, B.S. ..... *Assistant Superintendent*

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J. P. Wilson, B.S. ..... *Superintendent*
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R. H. CLARK, M.S.—*Associate Forester*
E. L. MAYTON, M.S.—*Superintendent, Piedmont Substation*
E. E. PRATHER, M.S.—*Assistant Fish Culturist*

1945 Resignations

JAMES E. BRYAN, JR., B.S.—*Assistant Forester*
J. F. DUGGAR, M.S.—*Prof. Spec. Investigations* (deceased)
K. B. MCCLINTICK, M.F.—*Associate Forester*
W. E. SEWELL, Ph.D.—*Animal Husbandman*
A. G. WILLIAMS, JR., M.S.—*Assistant in Poultry Husbandry*

1946 Appointments

W. E. ALSTON, B.S.—*Animal Husbandman*
B. W. APPLETON, B.S.—*Assistant Superintendent Sand Mountain Substation*
J. H. BLACKSTONE, M.S.—*Assistant Agricultural Economist*
J. L. BUTT, B.S.—*Graduate Assistant*
H. E. CHRISTEN, M.F.—*Associate Forester*
B. L. COLLIER, B.S.—*Graduate Assistant*
A. E. CULLISON, M.S.—*Animal Husbandman*
WILBUR DEVALL, M.S.—*Associate Forester*
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J. G. GOODMAN, M.S.—*Associate Poultry Husbandman*
W. B. KELLEY—*Assistant Superintendent Black Belt Substation*
J. M. LAWRENCE, M.S.—*Assistant Fish Culturist*
F. S. MCCAIN, B.S.—*Graduate Assistant*
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E. T. YORK, JR., B.S.—*Graduate Assistant*

1946 Resignations

R. H. ALLEN, B.S.—*Research Assistant*
O. A. ATKINS, M.S.—*Assistant Horticulturist (Coop. USDA)*
H. R. BENFORD, M.S.—*Assistant Agronomist*
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A. W. COOPER, M.S.—*Associate Agricultural Engineer*

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