FIFTY-SECOND ANNUAL REPORT

January 1 to December 31, 1941

OF THE

Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

AUBURN

M. J. FUNCHESS, *Director*
AUBURN, ALABAMA

Alabama Polytechnic Institute

TRUSTEES

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*J. W. Tidmore, Ph.D., Assistant Director
W. H. Weidenbach, B.S., Executive Secretary
Kirtley Brown, A.B., Agricultural Editor
Mary E. Martin, Librarian
Sara Willeford, B.S., Agricultural Librarian

Agricultural Economics

B. F. Alvord, M.S. ..... Head, Agricultural Economics
J. N. Mahan, M.S. ..... Associate Agricultural Economist
W. K. McPherson, M.S. ..... Associate Agricultural Economist
B. T. Lanham, Jr., M.S. ..... Assistant Agricultural Economist
W. F. Lagrone, B.S. ..... Junior Economist (Coop. USDA)
J. H. Blackstone, M.S. ..... Assistant Agricultural Economist
J. W. Lester, B.S. ..... Graduate Assistant

Agricultural Engineering

J. H. Neal, Ph.D. ..... Head, Agricultural Engineering
R. M. Merrill, B.S. ..... Senior Agricultural Engineer (Coop. USDA)
**E. G. Diseker, M.S. ..... Associate Agricultural Engineer
E. D. Gordon, M.S. ..... Associate Agricultural Engineer (Coop. USDA)
F. A. Kummer, M.S. ..... Associate Agricultural Engineer
I. F. Reed, M.S. ..... Associate Agricultural Engineer (Coop. USDA)
D. A. Parsons, B.A. ..... Project Supervisor (Coop. USDA)
J. O. Laws, B.S. ..... Assistant Soil Conservationist (Coop. USDA)
Norval Stoltenberg, B.S. ..... Junior Soil Technologist (Coop. USDA)
A. W. Cooper, M.S. ..... Assistant Agricultural Engineer
C. H. Bailey, M.S. ..... Assistant in Agricultural Engineering
C. C. Morgan, Jr., B.S. ..... Assistant in Agricultural Engineering

Agronomy and Soils

*J. W. Tidmore, Ph.D. ..... Head, Agronomy and Soils
N. J. Volk, Ph.D. ..... Acting Head, Agronomy and Soils
J. B. Dick, B.S. ..... Associate Agronomist, (Coop. USDA)
E. L. Mayton, M.S. ..... Associate Agronomist
J. A. Naftel, Ph.D. ..... Associate Soil Chemist
R. W. Pearson, Ph.D. ..... Associate Soil Chemist
Anna L. Sommer, Ph.D. ..... Associate Soil Chemist
D. G. Sturkie, Ph.D. ..... Associate Agronomist
H. B. Tisdale, M.S. ..... Associate Plant Breeder
G. W. Volk, Ph.D. ..... Associate Soil Chemist
J. T. Williamson, B.S. ..... Associate Agronomist
H. W. Reuszer, Ph.D. ..... Agent (Coop. USDA)
H. R. Albrecht, Ph.D. ..... Assistant Agronomist
R. J. Jones, Ph.D. ..... Assistant Soil Chemist
E. C. Richardson, M.S. ..... Assistant Agronomist (Coop. USDA)
J. W. Richardson, B.S. (Brewton) ..... Assistant Agronomist
F. E. Bertram, B.S. (Prattville) ..... Assistant in Agronomy
C. L. Breedlove, ... Assistant in Agronomy
***J. W. McClendon, B.S. ..... Assistant in Agronomy
E. H. Stewart, M.S. ..... Assistant in Agronomy
R. W. Taylor, M.S. ..... Assistant in Agronomy
**J. I. Wear, M.S. ..... Assistant in Agronomy

*Deceased.
**On leave for Military Service.
***Transferred to Black Belt Substation.

P. B. Gibson, B.S. — Graduate Assistant
M. E. Holt, M.S. — Graduate Assistant
D. T. Meadows, B.S. — Graduate Assistant
J. C. Rice, B.S. — Graduate Assistant
C. M. Wilson, B.S. — Graduate Assistant

Animal and Poultry Husbandry

J. C. Grimes, M.S. — Head, Animal and Poultry Husbandry
W. D. Salmon, M.A. — Animal Nutritionist
W. E. Sewell, M.S. — Animal Husbandman
G. J. Cottier, M.A. — Associate Poultry Husbandman
R. W. Engel, Ph.D. — Associate Animal Nutritionist
D. F. King, M.S. — Associate Poultry Husbandman
C. J. Koehn, Ph.D. — Associate Animal Nutritionist
W. C. Sherman, Ph.D. — Associate Animal Nutritionist
P. D. Sturkie, Ph.D. — Associate Poultry Husbandman
**M. J. Burns, B.S. — Graduate Assistant

Botany and Plant Pathology

J. L. Seal, Ph.D. — Head, Botany and Plant Pathology
E. V. Smith, Ph.D. — Associate Botanist and Plant Pathologist
J. R. Jackson, Ph.D. — Assistant Botanist and Plant Pathologist
T. R. Wright, M.S. (Fairhope) — Assistant Botanist and Plant Pathologist (Coop. State Dept. Agri., and Ala. Ext. Service)

Horticulture and Forestry

L. M. Ware, M.S. — Head, Horticulture and Forestry
C. L. Isbell, Ph.D. — Horticulturist
E. W. McElwee, M.S. — Associate Horticulturist
P. A. Swarthout, B.S. — Associate Forester (Coop. USDA)
O. A. Atkins, M.S. — Assistant Horticulturist (Coop. USDA)
W. R. Boggess, M.F. — Assistant Forester
**F. E. Johnstone, Jr., Ph.D. — Assistant Vegetable Breeder
E. R. Toole, Ph.D. — Junior Forest Pathologist (BPI) (Coop. USDA)
**J. E. Bryan, Jr., B.S. — Assistant in Forestry
Hubert Harris, B.S. — Assistant in Horticulture
H. A. Nation, M.S. — Assistant in Horticulture
W. A. Johnson, B.S. — Laboratory Technician

Special Investigations

J. F. Duggar, M.S. — Research Professor of Special Investigations

Veterinary Medicine

L. E. Starr, Ph.D. — Animal Pathologist

Zoology-Entomology

J. M. Robinson, M.A. — Head, Zoology-Entomology
L. L. English, Ph.D. (Spring Hill) — Entomologist
H. S. Swingle, M.S. — Fish Culturist
F. S. Arant, Ph.D. — Associate Entomologist
R. O. Christenson, Ph.D. — Associate Zoologist
A. M. Pearson, Ph.D. — Associate Biologist (Coop. USDI and State Dept. of Con.)
J. M. Lawrence, B.S. — Assistant in Fish Culture
E. E. Prather, B.S. — Assistant in Fish Culture
H. H. Earle, Jr., B.S. — Graduate Assistant

Substations

Black Belt — Marion Junction, Dallas County, Alabama
K. G. Baker, B.S. — Superintendent
T. B. Chisolm, B.A. — Assistant to Superintendent
J. W. McClendon, B.S. — Assistant Superintendent

Gulf Coast — Fairhope, Baldwin County, Alabama
Otto Brown, M.S. — Superintendent
Harold Yates, B.S. — Assistant Superintendent

Sand Mountain — Crossville, DeKalb County, Alabama
R. C. Christopher, B.S. — Superintendent
H. A. Ponder, B.S. — Assistant Superintendent
S. E. Gissendanner, B.S. — Assistant Superintendent

Tennessee Valley — Belle Mina, Limestone County, Alabama
Fred Stewart, B.S. — Superintendent
J. K. Boseck, B.S. — Assistant Superintendent

Wiregrass — Headland, Henry County, Alabama
J. P. Wilson, B.S. — Superintendent
C. A. Brogden, B.S. — Assistant Superintendent
R. P. Goggans, B.S. — Assistant

**On leave for Military Service.

CHANGES IN STATION STAFF DURING 1941

Appointments

C. L. Breedlove — Assistant in Agronomy
H. H. Earle, Jr., B.S. — Graduate Assistant
S. E. Gissendanner, B.S. — Assistant Superintendent, Sand Mountain Substation
R. P. Goggans, B.S. — Assistant, Wiregrass Substation
J. M. Lawrence, B.S. — Assistant in Fish Culture
C. C. Morgan, Jr., B.S. — Assistant in Agricultural Engineering
W. K. McPherson, M.S. — Associate Agricultural Economist
H. A. Nation, M.S. — Assistant in Horticulture
R. W. Pearson, Ph.D. — Associate Soil Chemist
E. E. Prather, B.S. — Assistant in Fish Culture
E. C. Richardson, M.S. — Assistant Agronomist (Coop. USDA) (1940)
E. H. Stewart, M.S. — Assistant in Agronomy
Norval Stoltenberg, B.S. — Junior Soil Technologist (Coop. USDA)

Resignations

C. H. Bailey, M.S. — Assistant in Agricultural Engineering
J. H. Blackstone, M.S. — Assistant Agricultural Economist
T. B. Chisolm, B.A. — Assistant to Superintendent, Black Belt Substation
M. E. Holt, M.S. — Graduate Assistant
D. T. Meadows, B.S. — Graduate Assistant
H. A. Ponder, B.S. — Assistant Superintendent, Sand Mountain Substation
L. E. Starr, Ph.D. — Animal Pathologist
R. W. Taylor, M.S. — Assistant in Agronomy

NEW PUBLICATIONS

Experiment Station Publications

(Bulletins, Circulars, Leaflets, and Mimeographed Reports)

Salter, L. C., and Morgan, E. L. — **Farmer Cooperation in Northern Alabama.** Bul. 249: 1-52. (1941).

Alvord, Ben F., Crosby, M. A., and Schiffman, E. G. — **Factors Influencing Alabama Agriculture, Its Characteristics and Farming Areas.** Bul. 250: 1-76. (1941).

McPherson, W. K. — **Organization and Use of Alabama Locker Plants in 1941.** Special Circular: 1-19 (1941).

King, D. F. — **Homemade Lamp Brooder.** Leaflet 19: 1-4. (1941).

Arant, F. S. — **Rotenone Insecticides and Their Use on the Farm.** (July 1941).

Boggess, W. R., Swarthout, Paul A., and Toole, E. Richard — **Preliminary Results of the Little-leaf Disease of Southern Pines in Alabama.** (September 1941).

Lanham, Ben T., and Lagrone, William F. — **Farm Family Labor Available and Used, by Size of Farms in Marion County Alabama.** (Farm Management Report No. 2 for Marion County, March 1941).

Lanham, Ben T., Lagrone, William F. — **The Status of Sharecroppers in Marion County, Alabama.** (Farm Management Report No. 3 for Marion County, April 1941).

Ware, L. M. — **An Irish Potato Program for Alabama.** (January 1941).

Articles in Scientific Journals

Arant, F. S. — **Rate of Application of Derris-Talc Dusts for Pickleworm Control.** *Jour. Econ. Ent. 34 (4): 520-521, (1941).*

Atkins, O. A. — **The Partridge Pea** *(Chamaecrista fasculata),* **a Promising Plant for Soil Conservation.** *Amer. Soc. Agron. Jour. 33: 471-472. (1941).*

Christenson, Reed O., and Butler, R. L., Jr. — **Seasonal Occurrence of Some Economically Important Parasites of the Chicken.** *Jour. Ala. Acad. Sci. 13: 31-33, graphs 1-2. (1941).*

Engel, R. W. — **Hemoglobin Values of Lee County Draftees.** *1st Ala. Nutr. Conf. Rpt. (1941).*

Engel, R. W. — **Effect of Calcium Pantothenate and Other B-Vitamins on Liver Fat.** *Jour. Biol. Chem., 140, xxxvii (1941).*

Engel, R. W., and Salmon, W. D. — **Improved Diets for Nutritional and Pathologic Studies of Choline Deficiency in Young Rats.** *Jour. Nutr., 22: 109-22. (1941).*

Grimes, J. C. — **A Study of the Transmission of Factors Associated with Economy of Gains in Swine.** *Assoc. South. Agr. Workers Proc. 40: 106-107. (1941).*

Grimes, J. C. — **Feeding Value of Sweetpotatoes.** *Assoc. South. Agr. Workers Proc. 40: 163-164. (1941).*

Jones, Randall J. — **Nitrogen Losses from Legumes on Three Major Soil Types in Alabama as Revealed by Lysimeter Studies.** *Assoc. South. Agr. Workers Proc. 40: 105-106. (1941).*

Koehn, C. J. — **Milk and Butter as Sources of Vitamin A.** *1st. Ala. Nutr. Conf. Rpt. (1941).*

Salmon, W. D. — **Nutrition in Defense.** *1st. Ala. Nutr. Conf. Rpt. (1941).*

Salmon, W. D. — **Relation of Pantothenic Acid, Pyridoxine, and Linoleic Acid to the Cure of Rat Acrodynia.** *Jour. Biol. Chem. 140, cix-cx. (1941).*

Sherman, W. C. — **The Effect of Certain Fats and Unsaturated Fatty Acids Upon the Utilization of Carotene.** *Jour. Nutr. 22: 153-165. (1941).*

Sherman, W. C. — **Activity of Alpha-Tocopherol in Preventing Antagonism Between Linoleic and Linolenic Esters and Carotene.** *Soc. Expt. Biol. and Med. Proc. 47: 199-200. (1941).*

Smith, E. V., and Swingle, H. S. — **The Use of Fertilizer**

for Controlling the Pond Weed *(Najas guadalupensis). Trans. 6th N. Amer. Wildlife Conf. 245-251. (1941).*

Sturkie, Paul D. — **Hypermobile Joints in all Descendants for Two Generations.** *Jour. Hered. 32: 232-234. (July 1941).*

Swingle, H. S., and Smith, E. V. — **Managing Ponds for Fish Production.** *Prog. Fish Cult. 53: 8-13. (1941).*

Swingle, H. S., and Smith, E. V. — **The Management of Ponds for the Production of Game and Pan Fish.** *A Symposium on Hydrobiology, 218-226, Univ. of Wis. Press (1941).*

Volk, N. J. — **The Determination of Small Amounts of Exchangeable Potassium in Soils, Employing the Sodium Cobaltinitrite Procedure.** *Amer. Soc. Agron. Jour. 33: 684. (1941).*

Ware, L. M. — **The Effects of Fertilizers, Organic Material, and Irrigation on the Yield of Certain Truck Crops.** *Amer. Soc. Hort. Sci. 39: 363-366. (1941).*

Articles in Popular Journals

Grimes, J. C. — **Breeding and Selecting for Economy of Gains.** *The Duroc News (June 1941).*

Grimes, J. C. — **Feeding Value of Sweetpotatoes.** *The Cattleman (April 1941).*

Grimes, J. C. — **Extra Cash in Southern Meals.** *Progressive Farmer (December 1941).*

Lanham, Ben T. — **How Much Does it Cost to Feed and Maintain Work Stock?** *Alabama Extension Animal Husbandry. (August 1941).*

McPherson, W. K. — **1940 Census of Number of Cattle and Hogs on Farms are not Comparable with the 1935 Census Figures.** *Alabama Extension Animal Husbandry. (July 1941).*

McPherson, W. K. — **Changes in Number of Livestock on Alabama Farms.** *Alabama Extension Animal Husbandry. (August 1941).*

McPherson, W. K. — **Livestock-Feedstuffs Ratios in Alabama.** *Alabama Extension Animal Husbandry. (October 1941).*

Volk, N. J. — **Available Potassium in Alabama Soils.** *Better Crops With Plant Food (June 1941).*

Ware, L. M. — **The Function of Research in Alabama Forestry.** *Alabama Conservation (January 1941).*

Ware, L. M. — **A Simple Method Developed for Drying Sweetpotatoes.** *Forum (December 1941).*

Ware, L. M. — **Sweetpotatoes Dried on Farm Solves Old Problem.** *Progressive Farmer (December 1941).*

AGRICULTURAL ECONOMICS

Credit Advances to Sharecroppers in the Upper and Lower Coastal Plain Farming Areas of Alabama. (Ben T. Lanham, Jr., and William F. Lagrone). — In Marion County, which is considered typical of the Upper Coastal Plain farming area, about half of the credit advanced to sharecroppers in 1938 was in the form of cash only; the remaining half was about equally divided between that furnished as provisions only and that furnished as a combination of cash and provisions. Sharecroppers in this area received an average credit advance of $73 per family. This amounted to $15.53 per acre of cash crops.

Table 1. — Credit Advances per Sharecropper Family in the Upper and Lower Coastal Plain Farming Areas of Alabama in 1938 and 1939

Item	Unit	Upper Coastal Plain[1]	Lower Coastal Plain[2]	
		Old-way cropper	Old-way cropper	New-way cropper
Farms surveyed	Number	24	35	14
Type of advances made:				
Cash only	Per cent	54	91	64
Provisions only	Per cent	25	0	0
Cash and provisions	Per cent	21	9	36
Credit advanced per family[3]	Dollars	73	104	114
Acres of cash crops per family[4]	Acres	4.7	21.4	25.8
Credit advanced per acre of cash crops	Dollars	15.53	4.86	4.42

[1]Based on farmers' estimates as of 1938 in Marion County, a county representative of much of the Upper Coastal Plain farming area of Alabama.

[2]Based on farmers' estimates as of 1939 in Henry County, a county representative of much of the Lower Coastal Plain farming area of Alabama.

[3]These amounts do not include the cost of the cropper's share of fertilizer, ginning, peanut picking, etc.

[4]In Marion County this acreage is cotton only. In Henry County this acreage is the aggregate average acreage of cotton and dug peanuts.

In the Lower Coastal Plain farming area, there are two distinct types of sharecroppers. "Old-way" croppers are comparable to the sharecroppers found in the Upper Coastal Plain farming area. "New-way" croppers are those who own their work stock, but pay no fertilizer costs. Both groups in this area receive larger advances per family than sharecroppers in the Upper Coastal Plain farming area, according to a Henry County study. Credit advances, however, amount to less than $5 per acre of cash crops. Two-thirds of all credit advances

to "new-way" croppers and 90 per cent of those to "old-way" croppers are in the form of cash. The remaining credit advances in both cases are furnished as part cash and part provisions.

Agricultural Engineering

Dynamics of Soil Erosion and Principles of Control; Contour Furrows for Water Conservation on Pasture Land. (A. W. Cooper and E. L. Mayton). — Two years' results show that it does not pay to contour furrow a hillside pasture of the type used in this experiment. The pasture has a sandy loam soil with slope from 4 to 7 per cent. Although the check plots had from two to three times as much runoff as the contoured plots, it was of little significance, because the runoff from the check plots was small as compared to the total precipitation. The small amount of water saved by contour furrowing did not increase the herbage yields, because it was not saved at a time when there was a need for the additional water.

Dynamics of Soil Erosion and Principles of Control; Effect of Different Crop Covers on Infiltration, Runoff, and Soil Losses when Subjected to Artificial Rain. (C. C. Morgan, Jr., and J. H. Neal). — The initial moisture content of the soil had a greater effect on the rate of infiltration during the early part of the test than any other factor. Where the initial soil moisture content was relatively high, the infiltration rate was low, and runoff began almost immediately after the beginning of the rain. The slope of the plot apparently had no effect upon the rate and the total amount of infiltration.

It was found that the slope had little or no effect on the total runoff. The runoff increased with a corresponding increase in rainfall intensity. For rains of less than one hour duration, vegetation and contour furrows greatly reduced the amount of runoff. However, when rains continued longer than one hour, neither vegetation nor contour furrows had any appreciable effect on runoff.

Both slope and vegetative cover greatly affected the soil losses, which also varied with the rainfall intensity, increasing with a geometric ratio.

The results from these tests show that the soil losses from all rains and the water losses from rains of less than 1 hour duration can be greatly reduced by keeping the soil covered with a closely growing vegetation as winter legumes, or by making depression storage space as contour furrows and ridges.

Development of Sweetpotato Shredding Equipment. (F. A. Kummer). — The production of sweetpotatoes for stock feed has recently gained considerable importance and widespread interest among southern farmers. The feasibility of natural drying of shredded sweetpotatoes on low-cost drying surfaces has been proved by this Station.

One of the primary requirements for development of a satisfactory feed-processing program is simple equipment. Certain basic features are essential, such as low-cost construction, adequate shredding capacity, and mobility to eliminate long hauls. With these requirements in mind, a portable shredding machine was constructed that has given satisfactory results.

The machine has a shredding capacity of approximately 300 bushels of sweetpotatoes per hour. A 5-hp. electric motor and also a tractor power take-off have been used successfully to drive this machine. In some cases it may even be practical to transmit the driving power from the rear wheel of an automobile or truck. With a capacity of 300 bushels per hour, the material shredded in one hour would require one-half acre of drying surface, and it would produce approximately 3 tons of dried feed.

AGRONOMY AND SOILS

Cotton Variety Tests. (H. B. Tisdale and J. B. Dick). — The average results of cotton variety tests conducted on the Main Station, Substations, and Experimental Fields for 3 years, 1939-41, show that Stoneville 2B and 5A, White Gold, Coker 100, Washington, Deltapine 12, and Carolina Big Boll, which produce staple of about 1 inch, are satisfactory varieties for sections of Alabama not infested with the cotton wilt disease. Clevewilt 7, Cook 144, Coker's 4-in-1, Dixie Triumph, and the wilt-resistant Clevelands, which produce staple around 1 inch, are satisfactory for the wilt-infested sections of Alabama.

Cotton Breeding. (H. B. Tisdale and J. B. Dick). — A new strain of Cook 144, designated as Cook 144-7 (Auburn), has been developed that is superior to the old strain in yield, length of staple, and resistance to wilt. Such other qualities as boll size, earliness, and type of plant are similar to the old strain.

Colorimetric Determination of Magnesium in Soils and Plants. (Randall J. Jones). — A quantitative separation of magnesium can be made by the use of 8-hydroxyquinoline as the precipitating reagent. The precipitate is dissolved in 0.1N HCl and a stable green color is developed by the addition of ferric acetate. The color intensity is proportional to the concentration of magnesium, and, by means of a photoelectric cell, readings can be made on solutions containing 0.25 to 10 p.p.m. of magnesium.

Small amounts of iron, aluminum, and manganese, often present in the acid extracts of soils and plant ash, can be quantitatively separated from magnesium and calcium by adding 8-hydroxyquinoline to the solution, which is maintained at pH of 6 to 7. Calcium is then precipitated with ammonium oxalate, and the magnesium present in the filtrate is separated by adding an excess of ammonium hydroxide and heating the solution to boiling point.

The determination can be most rapidly made by using 25-ml. centrifuge tubes for separating and washing the precipitate of magnesium.

Value of *Crotalaria spectabilis* as a Green Manure Crop on Sandy Soils. (Randall J. Jones). — The beneficial effects of turning under summer legumes as green manure crops have been limited by the leaching of nitrates during the winter months. Lysimeter studies for the last 5 years have revealed that less nitrogen was lost by leaching from *Crotalaria spectabilis* than from soybeans or cowpeas when these legumes were turned under on Norfolk sandy loam. Sufficient quantities of each legume, equivalent to 75 pounds of nitrogen per acre, were plowed under annually in each case. Sudan grass was grown on the soil during the summer.

When the legumes were turned under in the fall, the annual amount of nitrate-nitrogen leached was 42 pounds from crotalaria, 50 pounds from cowpeas, and 52 pounds from soy-

beans. This loss of nitrogen was reduced about 50 per cent by waiting until spring to turn under the legumes. The yield of Sudan grass from spring-turned crotalaria was about 75 per cent greater than that from fall-turned crotalaria.

Crotalaria has the added advantage over most other summer legumes of producing enormous yields of both vegetative material and seed.

Exchangeable Calcium and Magnesium Content of Soils from Different Soil Provinces in Alabama. (J. A. Naftel). — Many of the Coastal Plain soils contained less than 100 p.p.m. of calcium and less than 25 p.p.m. of magnesium unless they had received lime. Susquehanna clay, however, contained 1,580 p.p.m. of calcium and 210 p.p.m. of magnesium, which was the highest base content found in the soils of this province. Hartsells soils of the Appalachian region were low in calcium and magnesium except where limed. It is believed that many of these soils have reached critical low levels in both calcium and magnesium for normal growth of crops.

Soils of the Black Belt contained extremely high amounts of exchangeable calcium and magnesium even at low pH values. The latter was particularly true for Vaiden and Eutaw series. Plant response was obtained from liming these soils, but this was due mainly to the correction of acidity.

Effect of Calcium:Magnesium Ratio of Lime on the Yield and Composition of Soybeans. (J. A. Naftel). — On sandy soils a slight increase in yield of soybeans was obtained from lime, but little difference was obtained from varying the ratio of calcium to magnesium, except where the lime was made up of 100 per cent magnesium. In the latter lime treatments, growth was severely injured, and on some soils failure of crops occurred. The content of calcium in the plants was progressively decreased on all soils by increasing the magnesium content of the lime. Conversely, the magnesium content of plants increased as this element was increased in the liming material applied. These observations are significant in relation to animal nutrition, since magnesium is of minor importance in feeds.

Certain Factors That Influence Seed Production in Vetch. (H. R. Albrecht). — Seed production in the vetches has al-

ways been highly uncertain in Alabama, principally because of environmental factors. Weather factors reducing yields include prolonged fall droughts, high humidity in the blooming season, heavy rains during harvest, and winter killing, which especially is severe on some vetch varieties. Yields are reduced also by damage caused by grasshoppers, corn-ear worms, army worms, aphids, and tarnished plant bugs.

Varietal adaptation or selection has been most effective in combating destructive influences. Early-maturing varieties are in general the best seed producers. Monantha vetch on the average has exceeded all others up to 1942. Early selections of woolypod and common vetch also made good seed yields.

White Clover Disease Studies. (H. R. Albrecht). — Observations made in the white clover breeding plots and in pastures located in most sections of the State indicate strongly that diseases are responsible for considerable white clover failures in Alabama. Thus far, 10 organisms have been recognized as causing destruction to white clover. They are:

Polythrincium trifolii
Colletotrichum trifoliorum
Stagonospora meliloti
Botrytus sp.
Sclerotinia trifolii
Sclerotium rolfsii
Cercospora sp.
Fusarium sp.
Bacillus lathyrii
Heterodera radicicola

Diseases, except possibly *Cercospora sp.* which generally occurs in late summer, do not usually become severe on overgrazed or sparsely-vegetated pastures. They cause most injury to pastures of heavy growth. Disease prevalence in this way may be a consequence of good pasture management.

Supplements for Use with Ammonium Phosphates and Urea. (J. W. Tidmore and N. J. Volk). — Eleven-year average results at Auburn show that, when a fertilizer is made up of ammonium phosphate, urea, and muriate of potash, it is necessary to add supplementary materials if the maximum returns are to be obtained from the mixture. Apparently the most effective supplement is gypsum. About 50 pounds per acre is sufficient; this amount increased the yield of seed cotton 400 pounds per acre on Norfolk sandy loam on the Main Station farm. Lime was not as efficient a supplement

as gypsum, but it increased the yield by about 250 pounds. Lime added to the gypsum did not increase the yield. In no case did the supplements added to ammonium phosphate, muriate, and urea equal the production obtained from the use of regular superphosphate, muriate, and urea or sodium nitrate.

Partial Replacement of Potassium with Sodium in the Production of Cotton. (N. J. Volk). — During the 3-year period, 1939-1941, numerous greenhouse and field tests were conducted to determine the effect of sodium on the yield of cotton. Sodium was found to be especially beneficial to cotton when potash was deficient, and it was slightly beneficial when potash was abundant. The most pronounced effect of sodium was the reduction in severity of defoliation on potash-starved plants and the increase in number of bolls set and matured. In no case, however, was sodium able to substitute for potassium in amounts of more than 15 to 25 per cent of the potash required.

Extra Potash for Cotton in "Rust"-Susceptible Areas. (J. W. Tidmore and N. J. Volk). — Data obtained from 146 cooperative field tests conducted in South Alabama reveal that about 45 per cent of the land in that region needs more than 24 pounds of potash per acre in order to prevent cotton rust from reducing the yield of seed cotton. About 20 per cent of the area needs more than 36 pounds of potash per acre. There is no indication that cotton following winter legumes needs more potash than when following corn; in fact, just the opposite appears to be true. This conclusion is in agreement with data published by this Station, which show that winter legumes actually conserve soil potash for succeeding crops by absorbing it and preventing it from leaching.

Animal and Poultry Husbandry

Study of the Transmission of Factors Associated with Economy of Gains in Swine. (J. C. Grimes). — In this project eight lines of breeding, known as the superior strain, are being selected for efficient gains. A check group, known as the inferior strain, is selected for inefficient gains. Both strains had a common ancestry. The results are summarized as follows:

The superior strain of hogs required 20 days less time to reach 225 pounds in weight and 24 pounds less feed for each 100 pounds gain than the inferior-strain hogs.

The pigs that ate the most feed daily made the most rapid and the most economical gains.

In general, "medium chuffy" type pigs made faster and cheaper gains than the "rangy" type.

There was apparently no very close relationship between the number of pigs in a litter and the birth weight of the pigs, or in their rate and economy of gains.

Small pigs at birth required more time to reach 225 pounds than pigs which were large at birth. The small pigs did not require any more feed per unit of gain, however, than the large pigs.

Male pigs tended to be slightly heavier at birth, to gain faster, and require less feed per unit of gain than female pigs.

Environmental factors are important in influencing the rate and economy of gains in pigs. Both rate and economy of gains fluctuated considerably from year to year, even under the same feed and management conditions. Clean soil was found to be very important in obtaining rapid and cheap gains.

Regardless of environmental effects, pigs from certain blood lines have consistently gained faster and cheaper than pigs from other blood lines.

Value of Shelter for Wintering Breeding Cows. (J. C. Grimes). — During the winter of 1940-41, brood cows that had access to a shed, open on the south side, lost 38 pounds each, while a similar group of cows wintered in an open lot lost 123 pounds each. The same kind and amount of feed was supplied both groups of cows. The ration consisted of sorghum silage and a limited amount of peanut hay and cottonseed meal. These results indicate that cows require more feed for body maintenance when wintered in the open than when shelter is provided.

Results of Grazing Pigs on Kudzu With and Without a Grain Supplement. (J. C. Grimes). — During an 84-day period in the summer of 1941, pigs were grazed on a kudzu pasture with and without a grain supplement. The initial weight of pigs averaged approximately 100 pounds. The pigs

that grazed kudzu with no supplementary feed gained an average of 23 pounds each; those that grazed kudzu and that were given a daily grain allowance (corn, 9 parts; tankage, 1 part) equal to 1 per cent of their live weight, gained an average of 84 pounds each; while those that grazed kudzu and were fed a full feed of corn and tankage gained an average of 124 pounds each. These results indicate:

That kudzu pasture alone may be used to carry shoats through the summer while peanuts, corn, or other fattening crops are maturing.

That if a surplus is available, corn can be fed to hogs at a profit while grazing kudzu. The hogs that were full fed corn while on kudzu paid $1.40 per bushel for the corn they ate, whereas those fed a limited ration of corn paid $2.12 per bushel of corn.

Sweetpotato Meal as a Substitute for Corn in Rations for Beef Cattle, Mules, and Hogs. (J. C. Grimes). — In an experiment conducted during the winter of 1940-1941, sweetpotato meal proved to be 91 per cent as efficient as corn meal on the basis of feed required per unit of gain, when fed with cottonseed meal and peanut hay in the ration for fattening steers. In 126 days the potato-meal-fed steers gained 212 pounds, while in the same length of time the corn-fed steers gained 232 pounds. There was no significant difference in the dressing percentage, carcass grade, or palatability of the meat from the two groups of steers.

In feeding potato meal to work mules as a substitute for corn, it was found that most mules did not relish the potato meal and that best results were obtained when not more than 50 per cent of the grain in the ration was replaced by this meal.

Fifty-pound pigs did not make satisfactory gains when fed a ration of sweetpotato meal and tankage. The unsatisfactory gains seemed to be due to a limited intake of food and to the laxative effect of the ration. Pigs receiving potato meal consumed only about one half as much feed as the check group getting corn. Better results were obtained when larger pigs were used or when only 50 per cent of the corn ration was replaced with potato meal. Because of the low protein content of potato meal, more protein supplement is required with this feed than with corn.

Toxicity of Cottonseed Meal for Swine. (W. E. Sewell). — Chemical analyses showed that 16 cottonseed meals produced in Alabama varied in content of free gossypol from 0.0550 to 0.1657 per cent, and in bound gossypol from 0.6274 to 1.0412 per cent. Biological tests proved that ill effects produced by the meals when fed to rats, chicks, and pigs were due primarily to the free gossypol contained in the meal. The meal containing the least amount of free gossypol was toxic to hogs when fed in sufficient amounts to supply all the protein needed to balance corn.

In laboratory tests, free gossypol was practically eliminated from cottonseed meats and cottonseed meal by various heat treatments. The efficacy of the heat treatment was found to depend upon moisture content; dry heat was relatively ineffective, whereas, heat in the presence of sufficient moisture rapidly eliminated the free gossypol, as well as the toxicity of the meal. The percentage of moisture for the most efficient destruction of free gossypol was determined.

A practical farm method for detoxifying cottonseed meal was developed. A highly toxic meal treated by this method gave satisfactory results when used as 30 per cent of a ration for chicks, or 25 per cent of a ration for hogs. Hogs fed this ration from weaning to market weight made as rapid and economical gains as a check lot receiving a similar ration containing peanut meal instead of cottonseed meal. In contrast, six out of eight hogs died when fed the untreated cottonseed meal at the same level in the ration.

It is believed that the procedure developed in this study may be adapted to oil mill practice for the production of nontoxic cottonseed meal for chickens and hogs.

Carotene Content of Vegetables Preserved by Drying (C. J. Koehn). — The Department of Horticulture and Forestry is developing a method of preserving vegetables for human consumption by sun-drying. The dried product may be stored and used in the winter when vegetables are scarce. Since the average human diet is low in vitamin A during the winter, this study was undertaken to determine the amount of carotene (pro-vitamin A) contained in these dried vegetables. Carotene determinations were made before and after drying to ascertain the destruction taking place during the

drying process. Mustard, turnip greens, and spinach retained from 52 to 84 per cent of their carotene, while Porto Rico sweetpotatoes and carrots retained 90 and 92 per cent, respectively. Pole beans and lima beans, which have little carotene, retained only 22 per cent.

After 6 weeks storage the dried vegetables had lost an additional 6 to 30 per cent of their carotene.

The effect of canning on the carotene content of these same vegetables was determined. It was found that no loss of carotene occurred when compared with cooked vegetables.

Influence of Alpha-Tocopherol and Unsaturated Fatty Acids upon the Utilization of Vitamin A. (W. C. Sherman). — The antagonism between linoleic or linolenic acid esters, and carotene was prevented by feeding the unsaponifiable fraction of soybean oil to vitamin A-deficient rats, but this was not prevented by feeding choline, ethanolamine, lecithin, cephalin, hydroquinone, or catechol. The feeding of alpha-tocopherol protected against this antagonism.

Tests *in vitro* showed that carotene was rapidly destroyed by methyl linolate in the absence of suitable antioxidants. There was no direct destruction of carotene by the methyl linolate in the feeding tests, however, since the yeast and casein of the basal diet were found to possess stabilizing properties. Hydroquinone and catechol also stabilized carotene with methyl linolate *in vitro,* although they were entirely inactive when fed.

The destruction of carotene by unsaturated fatty acids apparently occurs mainly in the intestines, since feeding the carotene and methyl linolate on alternate days removed the antagonism. Furthermore, methyl linolate fed during the depletion period did not affect the time required to produce vitamin A deficiency.

To be protective, alpha-tocopherol had to be fed with the carotene and methyl linolate. Protection was not obtained by feeding the alpha-tocopherol during the depletion period, or by continued feeding of alpha-tocopherol on one day and carotene with methyl linolate on the following day.

Direct proof of intestinal destruction of carotene by methyl linolate and protection by alpha-tocopherol was obtained from analysis of the gastro-intestinal contents of rats after they

had received various combinations of carotene, methyl linolate, and alpha-tocopherol.

Erythematous Dermatitis Produced in Rats by Deficiency of Riboflavin or Pantothenic Acid. (W. D. Salmon). — Rats receiving a fat-free diet supplemented with adequate amounts of thiamin and pyridoxine developed a severe erythematous dermatitis of the feet if either riboflavin or pantothenic acid was fed at a low level (2 to 5 μg. of riboflavin or 5 to 10 μg. of calcium pantothenate per rat daily). The gross appearance of the lesions was similar to that of pyridoxine-deficiency lesions. The lesions were prevented by corn oil, as well as by higher levels of riboflavin and pantothenic acid.

Relation of B Vitamins to Growth of Rats. (W. D. Salmon). — Studies of the rate of growth of rats receiving purified diets supplemented with crystalline vitamins are being made in this laboratory for two purposes: (1) to determine whether vitamin B factors other than thiamin, riboflavin, pyridoxine, and pantothenic acid play an important role in the growth of rats; and (2) to establish a basis for biological assay of the B vitamins.

Rats receiving a purified high-sugar diet supplemented with carotene, calciferol, alpha-tocopherol, corn oil, thiamin, riboflavin, calcium pantothenate, and choline grew to average weights of over 200 gm. for females and over 300 gm. for males at 20 weeks of age. No symptoms of nutritional deficiency were apparent at any time in this period.

The growth rate was not increased by inositol or para-amino-benzoic acid. It was increased by peanuts, alfalfa leaves, liver extract, brewer's yeast, or whole liver substance. It was also increased by substituting lard for part of the sucrose in the basal diet. It does not appear, however, that the increased growth rates are sufficient to interfere with bioassays of foods when crystalline vitamins are used as essential supplements to assay diets.

The Value of Kudzu and Other Forms of Summer Green Feeds for Poultry. (G. J. Cottier and D. F. King). — Kudzu was compared with Bermuda grass, pearl millet, Kobe lespedeza, and alyce clover as a grazing crop for laying hens. The earliest grazing was obtained in the kudzu and Bermuda grass

lots, and the largest amount of green feed was produced in the kudzu and millet lots. Egg production was similar in all lots, with the highest production being obtained from hens grazing millet. The lowest mortality was obtained when hens grazed lespedeza, and the largest egg size resulted when kudzu was grazed. Alyce clover made very poor growth and was unsatisfactory as a grazing crop for chickens.

Management of Farm Poultry Flocks. (D. F. King and G. J. Cottier). — The object of this project is to study under farm conditions the importance of improved housing, feeding, and breeding of hens, and improved methods of raising chicks.

On farms where no improvement practices were followed (the control group), the hens produced an average of 60.97 eggs as compared to 126.96 eggs per hen obtained where all improved practices were used. Where a combination of improved feeding and improved breeding was used, the increase in egg production over the control group was approximately double the increase obtained by using a combination of improved housing and improved methods of raising chicks. This indicates that improved feeding and improved breeding are of primary importance in increasing egg production of farm hens, whereas improved housing and improved methods of raising chicks are of secondary importance.

The amount of corn produced is a limiting factor on many of the farms where improved feeding is being practiced. On farms where the corn consumption per hen was 37.23 pounds per year, the hen produced an average of 57.91 more eggs than where the corn consumption was only 10.75 pounds per year. Good hatchability under farm conditions was obtained even when cottonseed meal was fed. Fifty per cent of the farm chickens were hatched during the months of April and May. There was a direct relation between the date of hatching and egg production. Data indicate that date of hatching is slightly less important than breeding in affecting egg production. Where pullets constituted 50 per cent or more of the flock, egg production was 40.77 eggs greater per bird than where less than 50 per cent of the flock was made up of pullets.

Horticulture and Forestry

Preservation of Pecan Kernels by Drying and Sealing. (Hubert Harris). — The following conclusions are drawn from tests run at Auburn on drying and storing pecan kernels:

Kernels with moisture content of 3.5 to 4.5 per cent, placed in unsealed containers and held during the winter in common storage, will become rancid by April or May; molds are likely to develop on them by mid-summer if the moisture percentage is about 4.5. Storing in sealed containers will entirely prevent molding, and it will delay rancidity for a period of 1 to 6 weeks, depending upon the moisture content of the kernels.

Kernels dried to 0.25 to 0.50 per cent moisture develop an excellent "toasted" flavor and texture. This flavor is maintained for at least 2 years by holding the kernels in sealed containers at ordinary temperatures.

Best results are obtained by drying the kernels in an oven at a temperature of 200° to 225° F. Higher temperatures are likely to cause scorching and irregular drying. Regular stirring during the process is essential. The drying period will range from 25 to 50 minutes, depending on oven temperature, original moisture content of the kernels, and the quantity of kernels dried at one time.

The "hot seal" and "vacuum seal," as used in these tests, are equally satisfactory in maintaining flavor during the first 12 months. By the end of 2 years, however, the vacuum pack develops a slightly "flat" flavor. The vacuum pack preserves the natural bright color much better than the other method.

If freshly shelled pecan kernels from dry nuts are held for 30 minutes in partially sealed fruit jars placed in 2 inches of boiling water, their moisture content will be lowered only about 0.25 per cent. If kernels thus treated are sealed, they will keep in very good condition from fall until the following August; however, they will become too rancid for use by December.

Selecting and Testing Promising Seedling Pecans and Other Fruits and Nuts of Alabama. (Hubert Harris). — This Station in past years has given much attention to locating and testing promising "chance seedlings" of the various fruits and nuts of the State, the principal object being to obtain varieties

that are better adapted to home use; commercial possibilities are also considered.

Special emphasis is being placed on the pecan. This is mainly because of the small number of good standard varieties and the ever-increasing importance of the scab problem, which is making it impossible to produce Schleys and other susceptible varieties in many sections of the State. Fifty-one selections of pecans have been made since 1936. A few of these have been discarded because of slight susceptibility to scab; many others have failed to measure up to high standards of quality. A few of the later selections have not been under observation long enough for a careful analysis to be made of their merits. Seedlings are kept under observation for 3 or 4 years before being propagated. Of the 51 selections, 21 have been propagated and set in a test planting on the Main Station. A few of them have also been distributed to agricultural high schools for general observation in different sections of the State.

Storage and Drying of Vegetables. (C. L. Isbell). — Experiments have shown that galvanized iron roofs in bright sunlight may be used as a place for drying many vegetables.

On hot summer days the temperature on galvanized iron roofing when exposed to full sun reaches around 110° F. by 8 A. M. and rises rapidly to 125 to 137° F., where it remains until about the middle of the afternoon. On relatively cool fall and winter days, the temperature on galvanized iron roofs in the sun is considerably above 100° F., for a large part of the day. Such days are good vegetable-drying weather, especially if there is considerable wind.

Experiments underway with the drying of vegetables on galvanized iron roofs justify the following:

Green cowpeas, lima beans, and soybeans may be shelled, scalded, dried, and stored for 2 or more years. These products are practically as attractive and palatable as fresh products and are not likely to be injured in storage by insects.

Rape, mustard, and turnip greens may be dried and stored for a considerable time. The quality of these is acceptable, though not as good as the fresh products.

Roots of carrots, rutabagas, and turnips, and stems of kohlrabi may be sliced or shredded, dried, and stored. The dried

carrots are usable. The rutabagas, turnips, and kohlrabi are quite good.

Sweetpotatoes when dried are not as attractive and palatable as the fresh product; the product, however, is usable in many ways and is not perishable like the fresh product. Drying appears to be a practicable way to save fresh sweetpotatoes that have been frozen.

Irish potatoes may be sliced, scalded, dried, and stored for use later. If dried without scalding, the product is dark.

Ordinary garden sage and some of the mints may be dried in the shade, ground or powdered, and stored for future use.

Pimento peppers may be dried, stored, and used as a substitute for canned pimentos; scalding in oil or roasting until blistered facilitates peeling and drying.

Various dried greens, as well as dried Irish potatoes and sweetpotatoes, may be ground in inexpensive hand mills and conveniently stored in concentrated form.

Volume Affected by the Little-leaf Disease of Pines in Two Selected Areas in Alabama. (W. R. Boggess). — Alabama farmers and log timber owners in the Piedmont and Upper Coastal Plain are sustaining considerable loss in their pine-growing stock from the little-leaf disease. In an effort to determine the seriousness of the disease, from the standpoint of volume affected, the Station initiated and supervised a survey in 1941 made in cooperation with the Soil Conservation Service, United States Forest Service, State Division of Forestry, and State Department of Agriculture.

This survey, completed during May, consisted of sampling two areas within the State that represented two apparent extremes in severity of the little-leaf disease. One sampling unit of 153,600 acres consisted of a strip 8 miles wide and 30 miles long along U. S. Highway 241 between Waverly and Sylacauga. A similar strip 15 miles long, consisting of 102,400 acres, was located along U. S. Highway 78 between Carbon Hill and Guin. A sample of approximately 1/10 of 1 per cent was taken by locating ¼-acre plots at 16-chain intervals along lines established 2 miles apart within each sampling unit.

The survey indicated that, of a total area of 50,950 acres in pine in the Waverly-Sylacauga area, approximately 50 per cent, or 25,475 acres, showed evidence of the little-leaf

disease. In the Carbon Hill-Guin area, pine types occupied 23,800 acres, and the little-leaf disease was present on 33 per cent or 7,854 acres.

Establishments of Pines Under a Stand of Inferior Hardwoods. (J. E. Bryan, Jr., and L. M. Ware). — One of the major forestry problems of Alabama is that of converting back to pine thousands of acres of forest land which once supported pine stands but which now support stands of inferior hardwoods. This condition has resulted from unwise cutting practices and uncontrolled burning.

In January 1933 plantings of slash, longleaf, loblolly, and shortleaf pines were made at this Station in a rather thick stand of hardwood saplings dominated by hickory and inferior oaks, averaging about 6 feet in height. Plantings were made in a series of plots, each slightly less than ¼ acre in size and containing 192 plants. The hardwoods were cleared from some of the plots at the time of planting, while in others they were left. All pines were spaced 6 by 8 feet. To serve as checks, similar plantings were made in an adjoining open field.

During January 1937 some of the plots were cleaned of all competing hardwoods. At this time, because of the prolific sprouting of the hardwoods, it was impossible to determine the plots that had been cleaned prior to planting.

Height measurements were made in February and December, 1941. At the time of the last measurement, slash, loblolly, and shortleaf had obtained dominance over the hardwood in the plots released in 1937. In the plots not released, no pine had reached a dominant position with respect to the hardwood; however, their present position in the crown canopy seems to indicate that loblolly, slash, and shortleaf have good chances of eventually overtaking the hardwoods without release.

Of 192 longleaf seedlings planted under each treatment, 4 had started height growth in the wooded plots without release, and 8 in the released plots. In the open field 73 had begun height growth.

From results to date the following conclusions may be drawn:

The growth of slash, loblolly, longleaf, or shortleaf pine is greatly retarded by hardwood competition.

Unless provision is made for elimination of sprouts, clearing of hardwood prior to planting is of little value from the standpoint of growth of the pine.

All four species of pine respond to release 4 years after the time of establishment. Slash shows the greatest response of the four.

Longleaf probably cannot be established successfully under competing hardwoods.

Loblolly shows the best possibilities of overcoming hardwood competition without release.

Intercropped Slash Pine. (J. E. Bryan, Jr., and L. M. Ware). — During the last few years, much publicity has been given to the possibilities of growing slash pine as a regular field crop in the same field with cotton or corn. Such practice seemed to offer economic possibilities of offsetting the cost of establishing the stand by returns from the crop, and at the same time to offer greatly increased growth of the trees by making available part of the fertilizer used on the field crop.

To test these possibilities, an experiment was designed and established in 1934 at this Station. The following results were obtained:

Intercropping with corn or cotton, and cultivating and fertilizing without an intercrop from the first growing season cause significant increase in the growth of slash pine.

There is no significant difference in the growth of pines cultivated and fertilized with or without crops; neither does the growth of the pines cropped with cotton differ significantly from the growth of those cropped with corn.

The cost of cultivating and fertilizing without an intercrop is prohibitive, unless future measurements prove that the treated pines reach merchantable size and are of equal quality at a much earlier date than do untreated pines.

Intercropping with cotton or corn, if practiced with care and on land suited to the production of these crops, is practical the first year. Under limited conditions cotton may be grown a second year with success.

The Influence of Additional Illumination on the Flowering of the Gardenia *(Gardenia veitchi)*. (E. W. McElwee). — The

gardenia is used primarily as a corsage flower, and for this reason it is greatly in demand during holiday seasons and during winter months. Since the gardenia normally blooms during the late winter and spring months in the greenhouse, any treatment that will advance the blooming date will increase the value of this crop.

An experiment was started in 1939 to study the influence of various additional illumination treatments on the flowering of the gardenia, particularly for producing flowers for Christmas.

Preliminary results show that additional illumination treatments did not materially affect the quality or quantity of blooms produced during the season and that no treatment was consistently better. However, they did show that earlier blooming may be induced.

Additional illumination treatments advanced the blooming dates of older plants more than those of younger plants. Beginning November 1 additional illumination treatment advanced the blooming date of 2-year plants from February 14 to January 6, or 39 days, producing effective bloom during January and February, with the period of maximum production just prior to St. Valentine's Day. The September 15 and October 1 treatments in 1940 produced effective bloom for Christmas, but the period of maximum production came after Christmas, in early January. In 1941 the October 1 treatment was the best for producing effective blooming during December. The maximum period of production came just prior to and during the Christmas season.

These preliminary results indicate that gardenias should be given additional illumination, starting about September 15, to induce blooming during December and the Christmas season. Treatment should start about November 1 when it is desirable to have the plants in bloom during January and February.

Rescue Grass, a Promising Hillculture Groundcover. (O. A. Atkins). — Rescue grass, a native of South America, appears promising for use as a ground cover and as a pasture plant. It is also used for hay. Rescue grass matures earlier than Italian rye grass and reseeds heavily. Yields of 10,000 pounds per acre, green weight, have been obtained at Auburn with

light fertilization. It is very satisfactory in a grass-legume ground cover. The seed are light (16 pounds per bushel). Rescue grass is planted in September, October, or November at rates of 20 to 30 pounds of seed per acre on prepared land. It does especially well in combination with Kobe and common lespedeza and lespedeza sericea.

Devil's Shoestring, Its Possibilities as a Hillculture Crop. (O. A. Atkins). — In 1939 a series of experimental plots were set up at this Station to determine the possibilities of Devil's Shoestring as an erosion-control crop and poor-land plant, and to determine its possibilities as a commercial source of rotenone in the United States. In the fall of 1940 and 1941, following 2 and 3 years' growth, respectively, one-half of the plants were harvested each year, and the fresh and dry weights of the roots were determined. Devil's Shoestring gave little response in plant growth to applications of nitrogen, phosphorus, potash, or lime, even though the plants were grown on a poor, eroded hillside. Plants in check plots made satisfactory growth without fertilization of any kind. The apparent ability of Devil's Shoestring to grow satisfactorily without fertilization is a very strong point in favor of the plant as a possible hillculture crop. Yields of roots (dry weight basis) of 1,620 and 3,318 pounds per acre were obtained in 1941, and of 1,080 and 2,220 pounds in 1940, when calculated on the basis of 6,000 plants per acre. Roots harvested in 1940 averaged about 1.76 per cent rotenone on a dry weight basis.

Kudzu as a Plant Barrier in Building Terraces. (O. A. Atkins). — In 1939 an area of approximately 10 acres of poor, hilly land was selected at Auburn, and terrace contour lines were established on this area. Instead of using any of the usual terracing equipment, two contour beds for kudzu were prepared parallel to and just below the established contours. Standard practices for planting and growing the kudzu were used. Each fall and spring since the experiment was started the area immediately above the contour band of kudzu has been plowed just as in plowing out a Nichols' terrace channel, throwing the dirt against the kudzu on the lower side and up the slope above the established contour in an effort to develop

a channel that would bring the run-off water around the contour.

Results of this experiment indicate that with moderate slopes a channel can be developed above the contour band of vegetation which will serve as a channel-type terrace, and that this channel can be developed by using the more or less standard methods for maintaining a Nichols'-type terrace. Contrary to expectations, very few serious breaks occurred while the channel was being formed. The terraces have very satisfactory cross sections, and the capacity of the channel is sufficient to carry all of the runoff water even after severe rains. The depth of the channel that has developed varies between 10 and 15 inches.

ZOOLOGY-ENTOMOLOGY

Sprays and Dusts for the Control of Camellia and Azalea Pests. (L. L. English). — The effectiveness of oil sprays for the control of tea scale *(Fiorinia theae* Green) was increased by using derris as a supplement. A proprietary dust containing dinitro-o-cyclohexyl phenol as the active ingredient was effective in controlling the red mite *(Paratetranychus ilicis* McG.) during the winter months without injury to the plants. In warm weather the plants were injured. An oil spray supplemented with nicotine sulphate was more effective in controlling thrips *(Heliothrips haemorrhoidalis* Bouche) on azaleas than a tartar emetic-sugar spray and pyrethrum dust mixtures.

Fumigation of Camellias and Azaleas with Methyl Bromide. (L. L. English). — Sufficient data have been accumulated to establish a mathematical relationship between the dosage, exposure, and temperature requirements for perfect kills of scale insects in chamber fumigation.

The number of varieties of azaleas from which cuttings can be fumigated with a schedule sufficient to control red mites, thrips, and lacebug was extended to 74. Seventy-seven varieties of azaleas were found to take schedules effective against coccids. No method was developed for successfully fumigating either the cuttings or plants of Coral Bell and Salmon Beauty varieties. Further experiments indicated that camellia cuttings of most varieties can be fumigated with schedules that are effective against coccids and red mites.

Apparently all varieties of camellias can be fumigated with effective schedules of methyl bromide, if the plants are in pots, flats, balled and burlaped, or if the roots are properly protected with moist soil.

Rate of Fertilizing Cotton With and Without Poisoning for Boll Weevil Control. (J. M. Robinson and E. L. Mayton). — Four different rates of a 4.8-9.6-4.8 fertilizer made from nitrate of soda, superphosphate, and muriate of potash were compared for cotton on Norfolk sandy loam at Auburn over the 18-year period, 1924-1941. Treatments were duplicated on two sections. Cotton on one section was dusted for the control of boll weevil when the average infestation had reached 10 per cent; the cotton on the corresponding section was not dusted.

The per acre rates of fertilizer application were in 500-pound increments up to 2,000 pounds inclusive. Every third plot was left unfertilized as a check. The boll weevil infestation was high enough to require poisoning with calcium arsenate beginning July 3, 1941. Ten applications of poison were required to protect the cotton. The gains from poisoning were 178, 302, 438, and 534 pounds of seed cotton per acre for first, second, third, and fourth increments of 500 pounds of fertilizer per acre, respectively.

Boll weevil infestation was heavy enough during 9 of the 18 years to necessitate poisoning. Poisoning for boll weevil control in this experiment accounted for an average increase of 46 pounds of seed cotton per acre on the three unfertilized plots. The average increases in yield for the different fertilizer applications on the poisoned sections were 215, 263, 394, and 380 pounds of seed cotton per acre for the first, second, third, and fourth increments of 500 pounds, respectively (Table 2).

Studies on the Occurrence, Epidemiology and Inter-Host Relationships of Nematode Parasites of the Chicken *(Gallus gallus)* **in Alabama.** (Reed O. Christenson). — During 1941, 165 chickens from the Experiment Station flock were autopsied. An average of 96.78 parasitic worms was found per bird. One hundred fifty-eight of the 165 chickens had one or more parasitic worms, giving an infection rate of 95.8 per cent. The average number of worms per infected bird was

Table 2. — Yields of Seed Cotton per Acre from Rate-of-Fertilizer Plots When Dusting Was Necessary 9 of the 18 Years for the Control of Boll Weevil, 1924-41

Fertilizer per acre (Lb.)	Plot	Pounds of seed cotton per acre										
		1924	1926	1927	1928	1929	1932	1935	1940	1941	Average	
		North	South	North	South	South	North	South	North	South	Yield	Increase
0	Dusted	186	176	360	72	82	190	244	52	12	153	49
	Undusted	84	164	130	84	86	72	264	36	20	104	
500	Dusted	678	688	844	460	628	756	1,282	1,078	758	797	215
	Undusted	456	484	282	256	582	544	1,082	970	580	582	
1,000	Dusted	1,050	1,294	1,212	1,064	1,138	1,268	1,680	1,306	1,436	1,272	263
	Undusted	756	912	474	570	1,004	1,140	1,756	1,334	1,134	1,009	
0	Dusted	94	168	276	38	62	102	256	40	70	130	52
	Undusted	102	138	52	58	28	78	124	50	10	71	
1,500	Dusted	1,352	1,680	1,468	1,050	1,230	1,774	2,172	—*	1,634	1,545	394
	Undusted	1,148	1,260	606	710	1,078	1,348	1,864	—*	1,196	1,151	
2,000	Dusted	1,402	1,898	1,496	1,308	1,238	1,786	2,436	—*	1,656	1,653	380
	Undusted	1,304	1,414	566	1,166	1,068	1,388	2,156	—*	1,120	1,273	
0	Dusted	24	52	260	8	120	76	300	14	108	107	37
	Undusted	136	132	44	62	12	96	60	86	4	70	

*Stand badly damaged by nitrate of soda at side dressing time.

101. Four species of economically important nematodes were prevalent, namely: *Cheilospirura hamulosa, Capillaria columbae, Heterakis gallinae,* and *Ascaridia galli.* Aside from the *Ascaridia galli,* the incidence of the other parasites was similar to that reported for 1940; in the case of this species, however, the average incidence rose from 3.1 worms per bird in 1940 to 7.82 in 1941. The average number of worms per infected bird rose from 3.34 to 13.87. The seasonal occurrence was similar to that previously reported, the incidence rising sharply after the summer rainy period, which occurred about one month earlier than usual.

Surface soil temperatures reached magnitudes during the summer that would instantly kill the eggs of *Heterakis gallinae* and *Ascaridia galli.* The highest temperature recorded on the various soil plots was 140° F., occurring in Decatur clay between rainfall periods in June. Soil temperatures passed the critical temperature of 128° F. on a number of days during the summer. The hottest month in 1940 (May), from the standpoint of soil temperatures, was also the driest, but it had a lower average atmospheric temperature than any one of the 3 following months. During normal years when the summer rainfall period occurs in July, it is expected that June will have the highest average soil temperature. The maximum soil temperatures on clear days occurred between 12 M. and 1:00 P. M. Surface soil temperatures varied with the soil types under observation; Decatur clay was the hottest, Sumter clay second, Norfolk sand third, Cecil clay fourth, and Hartsells sandy loam fifth. A coating of sod over the soil surface reduced the surface temperature materially during hot periods, and it prevented radiation of absorbed heat during cold periods.

Farm Ponds. (H. S. Swingle, E. V. Smith, J. M. Lawrence, and E. E. Prather). — In feeding experiments, largemouth black bass *(Huro salmoides)* were found to vary tremendously in the efficiency with which they utilized forage fish. The most efficient individuals have been selected for breeding and their progeny will be selected in an attempt to develop a strain of bass that will make greater gains in weight per unit of food.

Small largemouth black bass (1.5 to 2.5 ounces) were able to utilize bullfrog tadpoles *(Rana sp.)* as food, making 1 pound

of gain per each 6 pounds of tadpoles consumed. Bass, larger than 0.5 pound, failed to grow when fed exclusively upon a tadpole diet.

Mussels were produced in an unfertilized pond at the rate of 52 pounds per acre, and in a fertilized pond at the rate of 910 pounds per acre.

Yellow bullheads *(Ameiurus natalis)* were produced at rates of 169 pounds per acre in an unfertilized pond and 234 pounds per acre in a fertilized pond.

Spring and summer applications of cottonseed meal-superphosphate (3-1) and of soybean meal-superphosphate (6-1) caused the growth of such large amounts of filamentous algae in ponds that fishing or seining was impossible.

Fishing records were kept on a 12-acre fertilized pond stocked with blue-gills, shellcrackers, crappie, yellow bullheads, and largemouth black bass. During the 1941 season a total of 2,140 pounds of fish, or 178 pounds per acre, was removed by hook and line fishing from this pond. In a nearby unfertilized 30-acre lake, fished by the same group of sportsmen, the catch has been less than 6 pounds of fish per acre yearly for the last 2 or 3 years.

Najas guadalupensis, Potamogeton angustifolius, and *P. pusillus* were controlled in ponds by winter and spring applications of commercial fertilizer. This method of weed control resulted in greatly increased growth of the fish and in better fishing.

The Relative Efficiency of Rotenone-Containing Insecticides in the Control of Vegetable Insects. (F. S. Arant). — During a period of frequent rainfall, a 1 per cent rotenone mixture of derris, talc, and flour did not give satisfactory control of the pickleworm *(Diaphania nitidalis* Stoll) when applied to cantaloupes at 10- and 15-day intervals; when applied at 5-day intervals, the mixture gave 61 per cent control. This was 22 to 33 per cent lower than the control in previous years during more favorable weather conditions. Pickleworm infestation was extremely heavy in late cantaloupes grown adjacent to plots of earlier melons. Derris and cubé dusts containing 1 per cent rotenone did not reduce the infestation materially until the dosage was increased to 20 pounds per acre per application. Twelve dustings at the

average rate of 17.5 pounds per acre **did not** give economic control, although worm-free melons were matured at the rate of 750 to 2,080 per acre on the dusted plots, as compared with none on the check plots. Derris was more effective than cubé. Cuprocide incorporated into one of the dust mixtures resulted in healthier plants and higher yields than those obtained on plots not dusted with Cuprocide. Ten applications of 1 per cent rotenone dust applied at 5-day intervals at the rate of 12.5 pounds per acre gave satisfactory control of the pickleworm in cucumbers during a period of favorable weather. Derris gave 93 per cent control and cubé 79 per cent.

Investigations made in cooperation with the Soil Conservation Service and the United States Bureau of Plant Industry showed that toxic strain of Devil's Shoestring *(Tephrosia virginiana)* retained their rotenone content and grew well over a period of 3 years in Alabama. The rotenone-deguelin value of roots harvested in the fall of 1940, as determined by an adaptation of the Goodhue method, varied from 1.6 to 5.7 per cent, with an average value of 3.0 per cent. Variations in rotenone-deguelin content were greater between some plants on a plot than between plots growing the same strain. Analyses made in Washington, D. C., showed the rotenone content of samples of roots from different plots to vary from 1.21 to 2.74 per cent, with an average of 1.76 per cent. Fertilizer treatments did not appear to affect the rotenone or rotenoids content of the roots.

Locally grown samples of powdered Tephrosia roots were effective against the Mexican bean beetle *(Epilachna varivestis* Muls.) and the Harlequin bug *(Murgantia histrionica* Hahn). Samples with high rotenone-deguelin values were usually more effective than samples with lower values.

A commercial sample of derris was more effective than cubé against the Colorado potato beetle (*Leptinotarsus decemlineata* Say), cabbage worms (mixed infestation), Harlequin bug *(Murgantia histrionica* Hahn), Mexican bean beetle *(Epilachna varivestis* Muls.), and the milk-weed leaf beetle (*Chrysochus auritus* Fab.). The two materials appeared equally effective against nymphs of the squash bug *(Anasa tristis* Deg.). The guaranteed rotenone content of the derris and cubé was the same, but the rotenone-deguelin value of the derris was 1.3 times greater than that of the cubé.