FORTY-THIRD ANNUAL REPORT

Fiscal Year Ending June 30, 1932

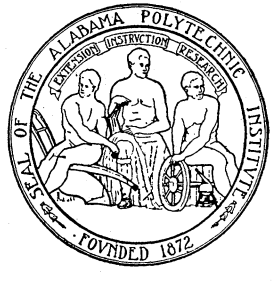
OF THE

Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

AUBURN



M. J. FUNCHESS, *Director*

AUBURN, ALABAMA

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COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

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P. O. Davis, B. S., Agricultural Editor
Mary E. Martin, Librarian
Sara Willeford, Agricultural Librarian

Agricultural Economics:

*J. D. Pope, M. S.	Agricultural Economist
B. F. Alvord, M. S.	Associate Agricultural Economist
C. G. Garman, M. S.	Associate Agricultural Economist
E. H. Mereness, Ph. D.	Associate Agricultural Economist
C. M. Clark, M. S.	Assistant in Agricultural Economics
Dee R. Eoff, B. S.	Assistant in Agricultural Economics
Edith M. Slights	Statistical Assistant

Agricultural Engineering:

M. L. Nichols, M. S.	Agricultural Engineer
J. W. Randolph, M. S.	Agricultural Engineer (Coop. U. S. D. A.)
H. C. Mauer, B. S.	Junior Agricultural Engineer (Coop. U. S. D. A.)
A. Carnes, M. S.	Assistant Agricultural Engineer
N. W. Wilson, B. S.	Assistant Agricultural Engineer
E. G. Diseker, B. S.	Assistant in Agricultural Engineering
H. D. Sexton, B. S.	Graduate Assistant

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J. W. Tidmore, Ph. D.	Soil Chemist
Anna L. Sommer, Ph. D.	Associate Soil Chemist
**F. L. Davis, M. A.	Assistant Soil Chemist
G. D. Scarseth, B. S.	Assistant Soil Chemist
J. A. Naftel, M. S.	Assistant Soil Chemist
H. B. Tisdale, M. S.	Associate Plant Breeder
J. T. Williamson, B. S.	Associate Agronomist
R. Y. Bailey, B. S.	Assistant Agronomist
D. G. Sturkie, Ph. D.	Assistant Agronomist
G. H. Jester, B. S.	Assistant in Agronomy
F. E. Bertram, B. S.	Assistant in Agronomy
E. L. Mayton, B. S.	Assistant in Agronomy
J. W. Richardson, B. S.	Assistant in Agronomy
J. R. Taylor, B. S.	Assistant in Agronomy

Animal Husbandry, Dairying, and Poultry:

J. C. Grimes, M. S.	Head Animal Husbandry, Dairying, and Poultry
W. D. Salmon, M. A.	Research Professor Animal Nutrition
G. A. Schrader, Ph. D.	Associate Research Professor Animal Nutrition

* On leave.
**Assigned by the State Department of Agriculture and Industry.

C. O. Prickett, B. S. — Associate Research Professor Animal Nutrition
G. A. Trollope, B. S. — Poultry Husbandman
D. F. King, M. S. — Assistant Poultry Husbandman
W. E. Sewell, M. A. — Assistant Animal Husbandman
G. J. Cottier, M. A. — Assistant in Animal Husbandry
C. T. Bailey, B. S. — Superintendent Poultry Farm
J. G. Goodman, B. S. — Graduate Assistant

Botany and Plant Pathology:

J. L. Seal, Ph. D. — Botanist
*G. L. Fick, M. S. — Assistant Botanist
E. V. Smith, M. S. — Assistant in Botany and Pathology

Entomology:

J. M. Robinson, M. A. — Entomologist
L. L. English, Ph. D. — Associate Entomologist (Spring Hill, Ala.)
H. S. Swingle, M. S. — Associate Entomologist
F. S. Arant, M. S. — Assistant Entomologist

Home Economics:

Edna R. Bishop, M. A. — Associate Home Economist

Horticulture and Forestry:

L. M. Ware, M. S. — Horticulturist
C. L. Isbell, Ph. D. — Horticulturist
O. C. Medlock, M. S. — Assistant Horticulturist
R. W. Taylor, M. S. — Assistant Horticulturist
P. L. Wright, B. S. — Graduate Assistant
E. E. McElwee, B. S. — Graduate Assistant

Special Investigations:

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

Agricultural Substations:

Fred Stewart, B. S. — Superintendent Tennessee Valley Substation, Belle Mina, Ala.
C. F. King — Assistant to Superintendent Tennessee Valley Substation, Belle Mina, Ala.
R. C. Christopher, B. S. — Superintendent Sand Mountain Substation, Crossville, Ala.
J. M. Henderson, B. S. — Assistant to Superintendent, Sand Mountain Substation, Crossville, Ala.
J. P. Wilson, B. S. — Superintendent Wiregrass Substation, Headland, Ala.
K. G. Baker, B. S. — Superintendent Black Belt Substation, Marion Junction, Ala.
C. L. McIntyre, B. S. — Assistant to Superintendent Black Belt Substation, Marion Junction, Ala.
Otto Brown, M. S. — Superintendent Gulf Coast Substation, Fairhope, Ala.
H. F. Yates, B. S. — Assistant to Superintendent Gulf Coast Substation, Fairhope, Ala.

CHANGES IN STATION STAFF DURING 1931-32:

Appointments:

E. H. Mereness, Ph. D. — Associate Agricultural Economist
J. A. Naftel, M. S. — Assistant Soil Chemist
J. G. Goodman, B. S. — Graduate Assistant in Animal Husbandry
E. V. Smith, M. S. — Assistant in Botany and Pathology
Dee R. Eoff, B. S. — Assistant in Agricultural Economics
H. C. Mauer, B. S. — Junior Agricultural Engineer (Coop. U. S. D. A.)
E. E. McElwee, B. S. — Graduate Assistant in Horticulture and Forestry

Resignations:

P. A. Taylor, B. S. — Assistant in Agricultural Economics
W. A. Gardner, Ph. D. — Botanist
W. C. Kelley, B. S. — Assistant in Entomology

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* On leave.

NEW PUBLICATIONS

Bailey, R. Y., and Seal, J. L.—**Small Grain Crops in Alabama.** *Alabama Experiment Station Circular 60.* Results are given on planting, fertilization, varieties, harvesting, uses, and diseases of oats, wheat, and rye. Oats planted in the fall made approximately twice as much as those planted in the spring. Red Rustproof and Fulghum varieties made the largest yields of oats in variety tests. Of six varieties of wheat included in variety tests, the Alabama Bluestem variety made the largest average yield.

Baver, L. D., and Scarseth, G. D.—**Subtropical Weathering in Alabama as Evidenced in the Susquehanna Fine Sandy Loam Profile.** *Soil Research,* 1931, 2:288-307. A study of the physical and chemical properties and composition of the soil and colloidal material of a Susquehanna fine sandy loam profile shows that the lateritic type of weathering has been predominant in its development. Analytical data on the composition of colloids from other soils collected from various localities in the state are also given. On the basis of this study the northern limit of lateritic weathering in Alabama is placed at the 61°F. mean annual temperature isotherm. Most of the soils in the state are under the influence of lateritic weathering.

Diseker, E. G.—**Inexpensive Machinery for Filling the Trench Silo.** *Alabama Agricultural Experiment Station Circular 61.* A small feed cutter having sufficient capacity for filling a trench silo and requiring only a small amount of power was tested during the fall season of 1931. This is a comparatively small machine without a blower. If a tractor is not available, a small gas engine is sufficient for its operation. This machine operated with a 4-horse-power gas engine will cut silage at the rate of 40 tons per ten hours.

Pope, J. D., and Clark, Carl M.—**The Relation of Quality of Cotton to Prices Paid to Farmers in Alabama.** *Alabama Experiment Station Bulletin 235.* A study of the official classification and prices paid to farmers for approximately 15,000 bales of cotton sampled in Alabama during the marketing seasons 1926-27, 1927-28, and 1928-29 indicated that there was a tendency for cotton buyers to pay farmers more for the better grades than for the poorer grades. On the other hand, very little distinction was made between 13/16-inch, ⅞-inch, and 15/16-inch staple lengths in the purchase of individual bales of cotton from farmers.

AGRICULTURAL ECONOMICS

A Study of Farm Organization on the Heavy Clay Soils of the Black Belt of Alabama. (C. M. Clark).—The average labor income of all farm operators interviewed in three selected areas in Montgomery, Greene, and Perry Counties was $55, $81, and $204, respectively. Most of these farms, as is typical of most of the Black Belt, received a major portion of their income from cotton.

Fifty-four per cent of all land owners in the three areas rented out their farms, operating no land themselves. The average returns on investment by these owners were 2.1 per cent in Montgomery, 3.1 per cent in Greene, and 4.9 per cent in Perry. In Perry and Greene those owner non-operators made higher returns on investment who had a higher percentage of the farm in crops, and a larger proportion of crop land in cotton. Owner non-operators in Montgomery who had a larger proportion of the farm in crops, but a smaller percentage of the crop land in cotton, made the higher percentage returns on investment. The average returns on investment of owner non-operator farms were as follows: Eutaw clay 4.9 per cent, Houston clay 4.0 per cent, and Sumter clay 2.1 per cent. Land owners whose tenants made the higher average labor incomes received the larger returns on investment.

In Montgomery those cotton farm operators who had the higher acreages in cotton made the smaller labor incomes. On the other hand, in Perry and Greene, those cotton farm operators who had the largest acreages of cotton received the largest labor incomes. In the two latter areas cotton farmers who had more than the average number of acres of cotton and less than the average number of head of productive livestock received larger incomes for labor than those who were below average in those factors. In Montgomery, more productive livestock and less acres in cotton than the average were associated with higher than average labor incomes. In all areas increases in labor income were found to be closely associated with increases in yield of lint cotton per acre.

An Economic Study of Changes in Farm Organization and Practices made by Cotton Farmers in Marshall and DeKalb Counties in Response to a Changing Price Level. (Ben F. Alvord).—Data as to certain changes in farm prices, in farm organization, in farm practices, in yields, and in labor incomes are available on from 84 to 106 farms for each of the comparison periods, 1927 to 1928, 1928 to 1929, 1929 to 1930, and 1930 to 1931. The most noticeable changes in farm organization and practices following price changes were in crop acreages, and in rates of fertilizer application to cotton and corn.

In each successive year following a decline in the price of cotton increasing numbers of farmers reported reductions in cotton acreage and increases in corn acreage. Responses to price changes were not similar on all farms. Even in 1931, when farmers generally reduced their cotton acreage in response to sharply depressed prices, 25.5 per cent of the group increased their cotton acreage by 2 or more acres, 12.3 per cent increased it by 6 or more acres, and 8.5 per cent increased it by 10 or more acres. These increases, though small, are relatively important since the average number of acres of cotton per farm in 1931 was only 19.6. Increases in corn acreage occurred simultaneously with decreases in cotton acreage, but were hardly as numerous or as large. Decreases in both pounds of fertilizer applied and in expenditure for fertilizer per acre on both cotton and corn usually occurred following a decline in the price of cotton; a few instances were noted each year of farmers who increased the amounts of fertilizer applied. In 1931, however, only 2 per cent of the farmers, as compared with 80 per cent in 1928, increased their expenditure for fertilizer by $1 or more per acre over that of the preceding year.

AGRICULTURAL ENGINEERING

Experiments with Machinery for Planting and Harvesting Oats. (E. G. Diseker).—Land was prepared and oats were planted by the use of the following combinations of equipment: (1) A 12-inch moldboard horse-drawn plow, and a Farmall tractor with a 6-foot tandem disc and grain drill, (2) an end-gate seeder, 12-inch horse-drawn plow and a Farmall tractor with a 6-foot tandem disc, (3) a 6-foot tandem disc, a 6-foot grain drill and a Farmall tractor. Combinations (1) and (2) were used on prairie soil; combination (3) was used on sandy soil. The fuel and labor costs per acre for preparation and planting were as follows: combination (1) $1.97, combination (2) $1.93, and combination (3) $0.26. The yields of oats on prairie soil planted by combinations (1) and (2) were found to be the same.

Continued experiments show that the windrow harvester, when used with the pick-up attachment on the combine, was better adapted to harvesting oats under Alabama conditions than was the combine alone. This method allowed the oats and weeds to become uniformly dry, thus eleminating troubles with wet grain. On steep land it was found to be advisable to have an adjustable hillside combine for harvesting oats. In a test on land having a 15 per cent grade, leveling the machine increased the amount threshed from 20 bushels to 33 bushels per acre.

Weed Control Studies. (E. G. Diseker).—Tests with the rotary hoe from 1929 to 1931, inclusive, showed this to be a profit-

able implement for the cultivation of young cotton, corn, and soybeans when the soil was in proper condition for its use. The labor required for cultivation was greatly reduced by the use of this implement. In several instances the rotary hoe aided in getting a stand of cotton on crusted soil.

Continued experiments with a one-horse spring-tooth weeder showed it to be a satisfactory implement for the cultivation of young corn, cotton, and peanuts that were infested with common weeds and crab grass, when the vegetation did not exceed 2 inches in height. It did not destroy Bermuda, Johnson, and nut grass.

To successfully plow up nut grass with a cultivator, it was necessary to use sweeps over three inches wide and have them overlapping several inches, to prevent them from sliding around the grass. Sweeps were found to be more effective than shovels or spring teeth. A riding cultivator was found to be more efficient for nut grass than a walking cultivator, because it was more easily controlled and a more uniform depth of penetration was obtained.

Continued experiments with corn and cotton showed the check-row method to be practical on sandy and Black Belt soils having moderate grades (up to 10 per cent). A thorough and uniform seed bed should be prepared before attempting to check corn and cotton with the present two-row planters. Fifty per cent of the chopping and hoeing was eliminated by checking. The yields of check and drilled planted cotton were similar.

Methods of Curing Hay. (E. G. Diseker).—During the period of 1928 to 1932, inclusive, legumes were cured in swath and windrows. Cowpeas and soybeans cured in the windrow produced a better quality of hay than when cured in the swath, because a greater amount of leaves and green color was retained in the hay. Results showed it was not necessary to turn the windrows more than twice, unless rains occurred while curing. Cowpea hay was safely baled into light bales when it contained 10 per cent moisture.

Continued tests with the Louisville hay drier and the Voshamp drier showed that green alfalfa and Johnson grass, containing 70 to 78 per cent moisture, could be reduced to 8 to 20 per cent moisture in the dried hay, at a fuel and labor cost of $2.88 to $5.00 per ton of dried material.

Hillside Planting and Cultivating Equipment. (E. G. Diseker).—A two-row flexible planter was built and used for planting cotton on land having as much as a 40 per cent slope and numerous terraces. A uniform stand of cotton was obtained over irregular beds and terraces.

Small cotton on land having a grade of 25 per cent was cultivated with a one-row riding cultivator with standard wheels.

Cotton 6 to 8 inches high was cultivated on a 38 per cent grade when 1¼"x1¼" angle iron rims were used on standard wheels.

The walking cultivator was found to be more difficult to handle on the steep grades than the riding pivot-axle cultivator.

Soil Erosion Studies. (M. L. Nichols and Hugh Sexton).—A comparison of the soil from the experimental plots with the original soil revealed the fact that the losses during the two years tions, i. e., the fractions having the greater effect on productivity. of the experiment were mainly in the colloid, clay, and silt frac- The greatest loss was in the silt fraction, which varied from 7 per cent on the plots having 10 per cent grade to 9 per cent on the plots having 20 per cent grade. The loss in colloid varied from 1 per cent on the 10 per cent grade to 4 per cent on the 20 per cent grade.

Mechanical analyses were also made of the material washed from the plots by different amounts and rates of rainfall, when the soil was in different physical conditions. The analyses showed that in all cases the losses were in the finer separates. The losses on the 0 and 5 per cent grades were practically all colloid, clay, and silt. When the soil was compacted a one-inch rain washed 439 pounds colloid, 171 pounds of silt, and 26 pounds of clay per acre from the 5 per cent grade plots. These losses increased on plots having greater grades. On the 20 per cent grade these losses were 2,224 pounds of colloid, 8,240 pounds of silt, and 277 pounds of clay per acre. After the soil was plowed 5 inches deep the losses from a similar rain were very much greater. On the 5 per cent grade the losses were: 853 pounds of colloid, 333 pounds of silt, and 52 pounds of clay per acre. On the 20 per cent grade these losses were: 5,929 pounds of colloid, 1,731 pounds of silt, and 409 pounds of clay per acre.

The rate of rainfall is one of the most important factors affecting the amount of erosion. An inch of rain was applied to all plots. In 8½ minutes the loss of the soil on the level plots alone was 623 pounds per acre. When the same amount of rain was applied in 16½ minutes the loss on the level plot was 336 pounds per acre. This difference, however, was much greater on the steeper slopes. In both cases the moisture content and other soil conditions were aproximately the same.

The degree of saturation at the beginning of precipitation materially affects erosion. For example, one and one-half inches of rain were applied in 25 minutes to the plots having 5 per cent slope when the surface soil contained 10.78 per cent of moisture. The soil eroded per acre was 72 pounds. On the same plot when the soil was saturated, the loss for a similar rain was 3,555 pounds per acre.

Plowing land materially increases erosion when the land becomes saturated. Surface cultivation materially increases erosion when the rate of rainfall is high and decreases it when the

rate is low. All data to date show that contour rows reduce erosion very materially.

It was reported last year that a heavy growth of vetch practically eliminated erosion on slopes up to 10 per cent during one inch of rain applied in 8½ minutes. The same experiment was repeated this year using Austrian peas as the protective crop. Comparative data for all grades were not obtained due to the fact that a large number of the peas, on the level and 5 per cent grade plots, were killed by water standing between the cotton beds during the cold weather. Where good stands were obtained both crops were very effective in preventing erosion. The amount of protection depended upon the slope, the amount of green material present, and the growth habits of the plant. The data indicate that pound for pound (green weight) hairy vetch will decrease erosion more than will Austrian peas.

AGRONOMY AND SOILS

Methods of Land Preparation for Cotton. (R. Y. Bailey).—Different methods of preparing land for cotton were studied on Norfolk sandy loam during the seven-year period, 1925-1931, inclusive. The methods of preparation used and the yields of cotton obtained are presented in Table 1.

During the seven-year period three plots which were broken deeply made an average of 1,028 pounds of seed cotton per acre annually, three plots which were broken shallowly made an average annual yield of 924 pounds, and seven unbroken plots made an average of 895 pounds.

Soybean Variety Tests. (H. B. Tisdale).—Table 2 gives the results of soybean variety tests conducted at Auburn over the period 1926-1931, inclusive. The results show that the Chiquita is a promising new variety for Central Alabama. It produced the highest average yield of seed and a relatively high average yield of hay per acre.

Permanent Pasture Studies on Upland Soils (E. L. Mayton).—These studies conducted over the period 1925-1932, in which different fertilizer treatments were applied to different mixtures of pasture plants may be summarized as follows:

(1) Hop clover in the early spring and the three grasses (Dallis, Bermuda, and carpet) and lespedeza in the summer are the only plants which have shown promise under the conditions of this experiment.

(2) Dallis grass has withstood summer drouths better than any other plants used.

(3) Hop clover and lespedeza have shown a marked response to phosphorus; the grasses have shown a marked response to nitrogen.

TABLE 1.—Average Yield of Cotton in an Experiment Comparing Different Methods of Land Preparation, 1925-1931

Plot	Method of preparation	Fertilizer applied	Seven-year average yields of seed cotton in pounds per acre
1	Check-land not broken	In a shallow furrow and bedded on	914
2	Broken deeply	In a shallow furrow and bedded on	1,031
3	Broken deeply	In a deep furrow and bedded on	1,032
4	Broken deeply	With seed on a bed made by laying off rows with a middle buster	1,020
5	Check	Check	828
6	Broken shallowly	In a shallow furrow and bedded on	888
7	Broken shallowly	In a deep furrow and bedded on	934
8	Broken shallowly	With seed on a bed made by laying off rows with a middle buster	951
9	Check	Check	890
10	Not broken	In a shallow furrow and bedded on	892
11	Not broken	In a deep furrow and bedded on	919
12	Not broken	With seed on a bed made by throwing two furrows to the old row with a turn plow	951
13	Check	Check	931

(4) The yields from limed plots have been generally larger than yields from unlimed plots. Since a better balanced sod of the desirable pasture plants was obtained by liming, this indicates a more sufficient utilization of the fertilizer materials applied.

(5) Fertilizer treatments have proved of questionable value under the conditions of this experiment where the moisture supply is limited. All fertilizer treatments, however, have increased the percentage of desirable pasture plants.

TABLE 2.—Average Yields of Hay and Seed and Relative Earliness of Soybeans in Variety Tests at Auburn, 1926-1931

Variety	Yields per acre		Number days from planting to hay cutting
	Hay	Seed	
	Lbs.	Bus.	
Otootan	2,587	5.2	125
Biloxi	2,514	6.2	128
Chiquita	2,480	10.5	109
Tarheel Black	2,401	9.7	114
Mammoth Yellow	2,334	7.9	110
Laredo	1,977	8.0	112
Arlington	1,822	8.5	98
Southern Prolific	1,696	7.9	105
Dixie	1,524	10.1	89
Virginia	1,431	7.1	87

(6) A thicker and better balanced sod with fewer weeds throughout the growing season has been obtained on plots which received a complete fertilizer plus lime.

The Time of Cutting Sudan and Johnson Grass for Hay. (D. G. Sturkie).—The results of this study, which was started in 1929, show that the value of the hay has been about equal when cut at the three following stages: booting, blooming, and late milk. The largest yield was produced by cutting in the late milk stage. Earlier cutting reduced the yield of Johnson grass approximately one-third and that of Sudan one-half. In the case of Johnson grass it was evident that the stage at which cut and the frequency of cutting should be such as to permit a large root reserve to be formed for the maximum yields of hay.

Fertilizer Studies with Italian Rye Grass. (D. G. Sturkie).—The results of fertilizer studies with a thick sod of Italian Rye grass on a fertile Norfolk sandy loam soil may be summarized as follows:

(1) Nitrogen was the only element added which markedly benefited the grass. Applications of phosphorus, potassium, or calcium produced no visible effect.

(2) Mineral nitrogen, from a mixture of equal parts of nitrate of soda and sulfate of ammonia, produced as satisfactory a sod as did organic nitrogen from cottonseed meal.

(3) Applications of mineral nitrogen made several times during the winter produced a better sod than the same amount of nitrogen applied in one application at planting time. This was true for all rates of application used in this study. The treatments used were 500, 1,000, and 2,000 pounds of material per acre.

(4) Top-dressing the sod at a rate of 500 pounds or more per acre with a mineral source of nitrogen resulted in severe burning of the grass.

Plant Introduction Studies. (D. G. Sturkie).—A test was started in 1929 to determine the adaptability of certain plants which might be useful for forage, lawn, or soil-improving purposes in this section. The following is a list of plants that have been tested but did not appear to be valuable or that could not withstand the climatic conditions at Auburn.

Grasses

Andropogon bifoveloatus No. 04147
Andropogon caricosus No. 04720
Andropogon intermedium No. 04143
Andropogon ischaenum F.P.I. 76028
Andropogon pertusus S.P.I. 49510
Andropogon purpureosericeus S.P.I. No. 49509
Andropogon scaberrimus No. 03490
Andropogon trichopus S.P.I. 51334
Andropogon annulatus
Arundinella anomala S.P.I. 57276
Avena plonoculmis S.P.I. 59364
Avena ludoviciana S.P.I. 64094
Axonopus compressus No. 03087
Axonopus compressus No. 05556
Axonopus compressus F.C. No. 13581
Axonopus compressus F.C. No. 13582
Axonopus compressus S.P.I. 67803
Axonopus purpuresis No. 03489
Brachiaria brizantha F.P.I. 77474
Brachiaria distachya F.P.I. 75960
Chaetochloa geniculata S.P.I. 67545
Chloris beyrichiana F.P.I. 75775
Chloris ciliata F.P.I. 74514
Chloris petraea S.P.I. 47105
Chloris polydactyla F.P.I. 74548
Chloris sp. No. 05045
Cynodon dactylon F.P.I. 76420
Cynodon dactylon (St. Lucia-var. St. Lucia)
Cymbopogon sp. S.P.I. 60474
Cymbopogon afronardus F.P.I. 75313
Digitaria abyssinica S.P.I. 51432
Digitaria didactyla
Danthonia pilosa F.P.O. 76012
Digitaria sp. F.P.I. 75314
Eragrostis fascicularia S.P.I. 54404
Ehrharta calycina F.P.I. 75200
Eleusine floccifolia F.P.I. 75319
Eremochloa ophiuroides F.P.I. 70786
Harpachne schimperi F.P.I. 75329
Heleochloa schoenoides S.P.I. 61429
Hyparrhenia hirta S.P.I. 58756
Hyparrhenia hirta S.P.I. 66008
Hyparrhenia sp. F.P.I. 76426
Ixophorus unisetur F.P.I. 71388
Leptochloa obtusiflora F.P.I. No. 75907
Melica cupani S.P.I. 64953
Melica gmelini S.P.I. 64775
Opizia stolonifera F.P.I. 77026
Opizia stolonifera F.P.I. 77027
Panicum bergi No. 62045
Panicum flavidum No. 05466
Panicum maximum No. 04337
Panicum sp. S.P.I. 51158
Panicum sp. S.P.I. 52179
Paspalum conjugatim F.P.I. 76432
Paspalum dilatatum F.C. 13585
Paspalum dilatatum
Paspalum scrobiculatim F.P.I. 76434
Paspalum sp. S.P.I. 76436
Pennisetum ciliare S.P.I. 48178
Pennisetum complanatim S.P.I. 49763
Pennisetum latifolium S.P.I. 49003
Pennisetum setosum F.P.I. 76437
Pennisetum unisetum S.P.I. 60569
Pennisetum sp. F.P.I. 75921
Pentzia incana S.P.I. 67880
Saccharum officinarum S.P.I. 29109
Sporobolus sp. S.P.I. 58779
Spodiopogon sp. S.P.I. 59638
Sporobolus sp. S.P.I. 67609
Sporobolus sp. S.P.I. 60456
Sporobolus sp. F.P.I. 75379
Star grass
Triodia brasiliensis S.P.I. 62059
Tripsacum latifolium No. 03097
Tripsacum laxum No. 04530
Trichloris pluriflora F.P.I. 75779
Tricholaena rosea F.P.I. 7644

Miscellaneous Forage Crops

Alysicarpus rugosa 33444
Arachis nambyquaceae 62099
Bradburya plumeri
Bradburya plumeri 68019
Bradburya pubescens 77979
Calopogonium mucunoides

(Continued on next page.)

Miscellaneous Forage Crops (continued)

Crotalaria sp. 70939	Crotalaria usuramoensis 45617
Crotalaria sp. 60305	Dolichos hosei
Crotalaria sp. 65331	Guar
Crotalaria sp. 73005	Hastings Poultry Pea
Crotalaria sp. 60306	Indigofera suffruticosa 46248
Crotalaria sp. 61646	Meibomia sp. 73016
Crotalaria sp. 60472	Meibomia gyroides
Crotalaria sp. 04277	Red Bean No. 1
Crotalaria sp. 60304	Red Bean No. 72912
Crotalaria emarginate	Shuteria vestita
Crotalaria juncea 57223	Teramus labialis
Crotalaria polyspema 51836	Pyrethrum

Phosphate Studies in Solution Cultures. (Anna L. Sommer).—The minimum concentration of the phosphate ion necessary for maximum growth differs for different kinds of plants. A study of root systems of wheat, buckwheat, peas, corn, tomatoes, and cotton indicated that, with the exception of tomatoes, this minimum concentration was inversely related to the amount of surface exposed to the solution for absorption. The number of root hairs is apparently the most important consideration. Wheat and buckwheat, which showed a tremendous number of root hairs, made good growth where the phosphate ion concentration was maintained at 0.1 p.p.m., while cotton and corn on which no root hairs were observed made a very poor growth. The roots of tomato plants grown in this series had sufficient root hairs to lead one to expect them to make fair growth at low phosphate concentrations. This very poor top-growth may be attributed to physiological peculiarities of the tomato since it belongs to the group of plants whose leaves and stems become purple when phosphorus in the nutrient medium is deficient. Some of the tomato plants which were shaded during the latter part of the experiment lost the purplish color and began to make more rapid growth.

Cotton, which has a very limited root surface, could not maintain normal growth when phosphorus was removed from the nutrient medium even though it had been present in large excess for the first 64 days of growth. Growth practically stopped soon after the plants were removed to phosphorus-free solutions.

The Occurrence of an Oxidizing Agent in Solutions in Which the Ammonium Ion was used as the Source of Nitrogen. (Anna L. Sommer).—In a study comparing ammonium and nitrate ions as the source of nitrogen in the presence of deficient and adequate phosphate supplies, a rapid fading of the blue color of the reduced molybdenum compound was observed when colorimetric determinations for phosphate were made on solutions containing the ammonium ion. The substance causing the fading did not appear until after the plants had been growing in the solution. Evaporation of the solution to about 1/20 of the orig-

inal volume caused it to become yellow. Further study showed that the yellow compound and the oxidizing agent were not the same. The yellow compound was readily and the oxidizing agent only slightly soluble in alcohol. Evaporation of the solution to dryness and subsequent heating at a temperature only a little above 100° C. destroyed the oxidizing agent. The oxidizing agent was not destroyed when the solution was evaporated to dryness at reduced pressure, nor when boiled at atmospheric pressure in the presence of an excess of calcium carbonate. It was destroyed when boiled in the presence of fairly concentrated acid.

This substance was produced in solutions by both wheat and peas, the only plants thus far studied. It remained in the solution in which peas were growing but disappeared after a time in cultures of wheat.

Properties and Fertilizer Response of Certain Soil Types. (F. L. Davis).—Greenhouse and laboratory studies of 11 Greenville fine sandy loams, 8 Greenville sandy loams, and 4 fine sandy loams of types having a similar profile found in the Coastal Plain region have been made. Similar chemical and greenhouse studies of 4 Decatur clay loams and 18 Decatur clays found in the Limestone Valleys are being made. A summary of the data obtained earlier on this project by W. W. Pate on 14 Norfolk fine sandy loams and 8 other samples of types having similar profiles is reported herein for the purpose of comparison.

The results of the greenhouse studies showed a greater need for phosphate than for any other element. Plant response to phosphate fertilization was the greatest on the Norfolk soils. A decided residual effect of applications of phosphate was obtained on all soils. This effect was the greatest on the Norfolk and smallest on the Decatur soils. The beneficial effect from residual phosphate was least on those soils which had the greatest colloidal content. This diminishing residual effect of phosphate fertilization was due to fixation of the phosphate by the colloidal fraction of the soils. A greater plant response from residual phosphate applications was obtained on the limed than on the unlimed cultures of all the soils. This response was greatest on the Norfolk soils. This effect is explained as being due to the reversion of the phosphate, in the presence of lime, to tri-calcium phosphate, a form easily rendered soluble again, whereas, in the absence of lime it is converted to the comparatively unavailable iron and aluminum phosphates.

All soils showed an increased plant growth from liming, it being the greatest on the Decatur and smallest on the Greenville soils. This response was inversely related to the pH values of the soils.

Only the Norfolk soils showed a response to potash fertilization of the first crop, and this response was slight. Both the Nor-

folk and the Greenville soils showed large response to potash fertilization on the second consecutive crop. This indicates that there is an amount of available potash in both soils sufficient to produce but one normal crop without additional potash applications under greenhouse conditions.

A summary of the growths of plants obtained in the greenhouse is given in Table 3. The results of the laboratory studies show that the readily available phosphate content of the Norfolk and Greenville soils increases from south to north. Within these series the more southerly located the soil the greater is its need for phosphate fertilization. On the average the Decatur soils contain more total P_2O_5 but less available phosphate than the Greenville soils. This difference is explained by the larger colloidal content of the Decatur soils.

The amount of lime required to bring the soils of the Greenville series to a pH of 6.50 was found to be more closely related to their organic matter content than to their content of mineral colloids.

The SiO_2-sesquioxide ratio of the Norfolk and Greenville soils increases from south to north. The subsoils of the Norfolk and Greenville soils have larger SiO_2-sesquioxide ratios than their respective surface soils. Both of these facts are in agreement with the accepted theories of the effect of climate upon soil profile development.

As compared with the Norfolk soils the Greenville soils contain larger quantities of exchangeable calcium. This indicates an influence of calcareous materials in the formation of the Greenville soils.

The readily available phosphate content of the soils as determined in the laboratory was found to be closely correlated with the crop growth on the soils. The values of the index of correlation expressing this relationship for the Norfolk and Greenville soils were $+0.812$ and $+0.785$, respectively.

Plant growth of Austrian winter peas was found to be more closely correlated to the degree of calcium saturation of the soils than to their pH value. This indicates that within the pH limits of these soils the need of this crop for lime is a nutritional rather than an acidity problem.

A summary of the data obtained by the more important laboratory determinations on these soils is given in Table 3.

Fixation of Phosphates by Soil Colloids. (G. D. Scarseth).—In a study of the nature and extent of phosphate fixation an experiment was conducted with four types of soil colloids which varied in SiO_2-sesquioxide ratios from 1.57 to 3.81. Each type of colloid received $Ca(OH)_2$ in amounts equivalent to 0, 33.3, 66.6, 100, and 200 per cent of the base saturation capacity. Phosphates were added to each colloid system when equilibrium between the calcium and the colloids was established. The forms

TABLE 3.—Average Yields Obtained in the Greenhouse in Grams Dry Weight

Soils	First crop (a) Austrian winter peas						
	N	N P	N K	N P K	P K	N P K L	P K L
Norfolks	5.30	8.26	5.55	8.76	6.94	9.69	9.15
Decaturs	4.83	6.69	4.88	6.82	5.81	8.24	7.13
(b) Sorghum							
Greenvilles	26.83	36.52	26.52	37.53	.....	38.33	.....

Soils	Second successive crop (a) Sorghum						
	N	N P	N K	N P K	N K Residual P	N P K Residual L	N K Residual P and L
Norfolks	11.44	20.78	12.74	28.58	20.27	34.11	26.42
Decaturs	11.02	37.64	11.11	38.29	21.23	41.02	25.80
Greenvilles	18.15	21.56	25.78	41.14	28.05	42.67	33.98

Soils	Third successive crop (a) Sorghum						
	N	N P	N K	N P K	N K Residual P	N P K Residual L	N K Residual P and L
Norfolks	6.78	13.17	9.59	27.17	14.46	31.68	16.73
Decaturs	14.17	40.18	15.98	47.80	23.93	50.74	30.23
(b) Austrian winter peas							
Greenvilles	2.62	3.92	3.54	5.81	4.39	6.00	4.60

of phosphates added were: ortho-phosphoric acid, mono-calcium phosphate, di-calcium phosphate, tri-calcium phosphate, rock phosphate, and tri-sodium phosphate. The extent and nature of the PO_4 fixation were determined by a modification of Truog's method by the use of buffered N/500 and N/10 H_2SO_4 solutions.

The results of this study show that the availability of the native phosphorus in the colloids varied directly with the SiO_2-sesquioxide ratio, i. e., the native phorphorus in soils with red colloids was less available than that in soils with gray colloids. The native phosphorus in any of the soil colloids studied was more available in the colloids with an excess of calcium hydroxide at equilibrium with the soil acids than in the colloids unsaturated with calcium.

The data show that the phosphate fixation capacity of the colloid is inversely proportional to the SiO_2-sesquioxide ratio. In general, the more acid the colloid the greater was the recovery of added phosphates. Supersaturating the colloid with calcium decreases the percentage recovery of added phosphates.

Ortho-phosphoric acid, di-calcium phosphate, and tri-sodium phosphate were about equal in availability and more available than the other forms of phosphates in the gray colloids, but di-calcium and tri-sodium phosphate are less fixed than ortho-phosphoric acid in the red colloids. Mono-calcium phosphate was fixed to a slight degree more than the di-calcium phosphate in all the colloids. Tri-calcium phosphate was about 10 per cent less available than the mono-calcium phosphate in the gray colloid and about equal to it in the red colloid. Rock phosphate was about 20 per cent less available than mono-calcium phosphate in the gray colloid and slightly more available than the mono-calcium phosphate in the red colloid.

Fixation of Phosphates by an Acid, Heavy Clay Soil. (G. D. Scarseth).—The fixation of six different forms of phosphates was compared at various rates and periods of application before planting sorghum in a greenhouse pot experiment on a very acid, heavy clay soil (Vaiden clay). Calcium carbonate was also applied at different periods with each of the phosphates at a rate necessary to bring the reaction of the soil to pH 6.5. It was found that on the unlimed soil di-calcium phosphate was slightly more available than the mono-calcium phosphate. Tri-calcium phosphate was a little more than 50 per cent as available as the mono-calcium phosphate. Superphosphate was 17 per cent and mono-ammonium phosphate was about 10 per cent more efficient than mono-calcium phosphate. Ferric phosphate was quite ineffective in supplying available PO_4 to the plants.

The fixation of all the phosphates increased with time. Nearly all the very soluble phosphate was fixed at the end of a 365-day period. The rate of fixation was greatest for the most soluble forms of calcium phosphate. Tri-calcium phosphate, although less available, was more slowly fixed than di-calcium phosphate, and di-calcium phosphate was more slowly fixed than mono-calcium phosphate. The rate of fixation for the tri-sodium phosphate compared closely with that of the di-calcium phosphate.

Except with the tri-calcium phosphate, calcium carbonate caused a very great depression in the availability of the various phosphates applied in low rates (300 lbs. superphosphate per acre). This depression diminished slightly as the length of time the lime had been in the soil increased. With the high phosphate rates (1800 lbs. superphosphate per acre) there was a general depression but of less magnitude than with the low rates and this depression decreased rapidly as the length of time the calcium carbonate had been in the soil increased. The calcium carbonate depressed the available phosphate in the tri-calcium phosphate where the calcium carbonate was applied at planting, but this depression decreased greatly as the length of time between liming and phosphate addition increased.

ANIMAL HUSBANDRY

A Protein Supplement to White Corn for Fattening Hogs in the Dry Lot. (J. C. Grimes, W. E. Sewell, and G. J. Cottier).—Two trials, one extending from January 1 to April 9, 1931, and the other from June 4 to September 10, 1932, have been made to determine the value of certain protein supplements.

The first trial included four lots of ten hogs each. All lots received a basal ration of white corn and a mineral mixture composed of equal parts of charcoal, lime, and salt. The supplement used in each lot was as follows:

Lot I—60 per cent protein digester tankage.
Lot II—40 per cent protein tankage.
Lot III—40 per cent protein commercial mixture.
Lot IV—"Alabama Trinity" composed of 2 parts of 60 per cent tankage, 1 part of cottonseed meal, and 1 part of kudzu meal.

The second trial was a repetition of the first trial with a fifth lot added. Lot V received a ration of white corn, minerals, and a supplement made up of equal parts of tankage (60 per cent protein) and cottonseed meal (40 per cent protein). There were only eight hogs in each lot in the second trial. All rations in both trials were self-fed, free choice.

The average results for the two trials are summarized in Table 4.

TABLE 4.—Results from Different Protein Supplements

Lot number	I	II	III	IV	V
Average number of pigs per lot	9	9	9	9	8
Average initial wt. per pig, lbs.	48.2	48.3	48.2	48.3	47.0
Average daily gain per pig, lbs.	1.54	0.75	1.35	1.51	1.41
Average feed required per 100 lbs. gain	356.8	478.6	379.0	363.0	352.1

A Closed-System Respiration Apparatus for Young Rats and Other Small Animals. (G. A. Schrader).—A desirable approach to the study of the relation of vitamin B to carbohydrate metabolism involves the determination of the gaseous exchange of the rat, as measured by the respiratory quotient, together with the chemical procedure previously discussed. An apparatus of the closed-system type which is suitable for short respiration periods with small rats has been developed.

Constant oxygen content and atmospheric pressure are maintained by means of a 50 ml. burette attached to a leveling

tube and by a sensitive capillary manometer inserted in the animal chamber. The animal chamber consists of a 1500-1700 mls. wide-mouth bottle which can be tightly sealed. The carbon-dioxide is determined by absorption in standard barium hydroxide, contained in a small efficient absorption bottle, and the excess alkali titrated with standard hydrochloric acid.

Accurate and reproducible results are obtained with this apparatus for metabolism periods of 20-30 minutes, in which there is an oxygen consumption of 25-50 mls. and a proportionate carbon-dioxide production. The R. Q. of the starved normal young rat was consistently found to be between 0.68 and 0.74.

The Relation of Vitamin B to Hemoglobin Content of Blood. (W. D. Salmon and J. G. Goodman).—Other investigators have reported that anhydremia is associated with a deficiency of vitamin B. Samples of blood taken from rats and pigeons showing marked symptoms of vitamin B deficiency frequently tends to be dark and viscous. It is sometimes impossible to get satisfactory samples of peripheral blood from such animals. Hemoglobin determinations were made on more than 200 samples of blood from rats on various diets with the idea that under the conditions of these experiments hemoglobin can be used as an index of blood concentration.

Rats showing characteristic vitamin B deficiency usually had an abnormally high hemoglobin content; in some cases this was as high as 25 gms. per 100 cc. However, control rats receiving adequate vitamin B but having their food-intake limited to that of the deficient animals likewise had an abnormally high hemoglobin content. The results indicated that the anhydremia associated with a lack of vitamin B was a result of the accompanying inanition rather than of any specific effect of vitamin B.

Effect of Heating Casein on Gains of Rats. (W. D. Salmon).—Casein heated to 130° C. for 48 hours was used as the sole source of protein in the diet, vitamins B and G being supplied by a protein-free extract of yeast. Rats on this diet failed to make any growth and eventually declined and died. When the diet was supplemented with 0.50 gm. per rat daily of an extracted residue of yeast a subnormal rate of growth followed.

On the same diets containing casein which had been thoroughly extracted with acidulated H_2O but not heated, rats made gains of 25 to 35 gms. per week when the sole source of vitamins B and G was a protein-free extract of yeast. These results are not in accord with the conclusions of Hunt that there is an unextractable factor of the vitamin B complex in yeast, which is necessary for the growth of rats.

Mineral Supplements in the Dairy Ration. (W. H. Eaton).—The studies on bone meal and marble dust as mineral supple-

ments in the dairy ration have been continued. There have been no apparent beneficial effects from the use of these mineral supplements.

Studies Relating to the Preparation of Chocolate Ice Cream. (A. D. Burke).—Experimental studies on thirty-one samples of cocoa and chocolate liquor indicated that: (1) Chocolate ice cream was generally improved in flavor when cocoa was added at the rate of 2.25 to 2.75 per cent instead of the generally accepted rate of approximately 3 per cent; reducing the quantity of cocoa to 2.25 to 2.75 per cent sometimes lightened the color of chocolate ice cream to the extent that the addition of artificial color was desirable; (2) an excellent and highly desirable flavor was produced in ice cream when the cocoa or chocolate syrup is so standardized in sugar content that the finished ice cream contained 15 per cent sugar; (3) cocoa or chocolate syrups should be homogenized prior to use in ice cream except when they are added with the ingredients in the pasteurizer and processed along with the mix.

Simplified Rations for Chickens During the Brooding, Growing, and Laying Periods. (G. A. Trollope, D. F. King, C. T. Bailey).—Eight lots of 350 chicks each were fed various rations composed chiefly of feed products grown on Alabama farms supplemented by a simple mineral mixture. The study involved the use of the same rations continuously throughout a period of 16 months, including the brooding and growing stages and a laying period of 11 months. The control lot received a well-balanced, 10-ingredient ration which has given satisfactory results over a period of years. A ration of 85 pounds of yellow corn meal, 15 pounds of ground oats, and 11 pounds of mineral mixture, with skim milk, self-fed, proved more efficient than the control ration. A similar ration in which wheat shorts replaced ground oats was found to be almost as efficient. White corn meal was inferior to yellow corn meal in simplified rations under confinement conditions. The replacement of skim milk with meat scrap, as a source of protein, was unsatisfactory during the brooding period. In general, the simplified rations gave satisfactory growth, were more economical, and resulted in higher egg production and greater egg weight.

Efficient Rations for Laying Hens. (G. A. Trollope and D. F. King).—White corn meal and yellow corn meal were equally efficient for egg production when used with a basal ration of liquid skim milk, minerals, and green feed, under free range management. Yellow corn meal gave higher hatchability of eggs than white corn meal. Hens fed liquid skim milk as the chief source of protein produced more and larger eggs than those fed meat scrap, fish meal, or cottonseed meal as main protein sources.

Ground Soybean Hay for Laying Hens. (D. F. King and G. A. Trollope).—The object of this study was to determine the possibility of substituting ground soybean hay for alfalfa leaf meal in laying rations.

Four lots, each containing 50 S. C. W. Leghorn pullets, were tested for a period of nine months. The results obtained show no significant difference in egg production, rate of mortality, or in hatchability, and weight of eggs laid by birds receiving alfalfa leaf meal and birds receiving soybean hay meal when used to supplement rations containing either yellow or white corn meal.

BOTANY

Studies of Nut Grass. (G. L. Fick, E. V. Smith and R. Y. Bailey).—The nut grass plant consists of a system of aerial shoots, underground tubers, "basal bulbs," and rhizomes. Experiments indicated that this system functioned as a unit, that any part of the system might draw on the remainder for food and water, and that the aerial shoot with the tuber or "basal bulb" to which it was directly attached did not function as an individual. Two years' results showed that the deeply formed tubers were no more efficacious in sending shoots above ground than were shallower-formed tubers when planted at the same depth.

Experiments now in progress, in which the aerial shoots are being clipped daily and at 2-, 4-, and 7-day intervals, show that the reserve carbohydrates of the underground system are rapidly depleted. Tubers from all treatments sprouted, however, after two months of clipping.

ENTOMOLOGY

Control of the Turnip Webworm *(Hellula undalis Fabr.).* (J. M. Robinson).—The toxicity of barium fluosilicate, sodium fluosilicate, extra light sodium fluosilicate, calcium arsenate, lead arsenate, and cryolite, was tested on the turnip webworm. These tests indicated that sodium fluosilicate and calcium arsenate, when diluted fifty per cent with hydrated lime, were sufficiently effective to control the larva of the turnip webworm when applied at weekly intervals. The foliage of the turnips was not affected by calcium arsenate and sodium fluosilicate when applied in the aforementioned dilutions.

Control of the Cowpea Curculio *(Chalcodermus aeneus Boh.).* (F. S. Arant).—Variety tests to determine the susceptibility of different varieties of cowpeas to the attack of the cowpea curculio were conducted. The order in which the thirteen varie-

ties were arrayed with regard to percentage of peas punctured by the cowpea curculio was as follows: California Black Eye, 45.8; Virginia Black Eye, 45.3; Dixie Queen Brown Eye, 41.8; Cowpea, 36; Extra Early Black Eye, 34.2; White Crowder, 33.3; Lady Pea, 32.5; Six Week Pea, 31.8; Cream Crowder, 31; Speckle Crowder, 25.9; Black Crowder, 21; Taylor, 14; Conch, 12.9.

Extra light sodium fluosilicate mixed in equal proportions with hydrated lime and applied in a series of five dustings at weekly intervals to twelve varieties of cowpeas materially reduced the infestation. The percentage of punctured peas for all dusted varieties was 10.9 as compared to 19.5 for all undusted varieties.

The Life History and Control of the Pecan Weevil *(Curculio caryae Horn).* (H. S. Swingle).—One generation of the pecan weevil has been reared in the insectary. The life cycle required two years for completion.

In Central Alabama adult weevils began emerging from the soil on the last day of July. Emergence reached its peak by August 28. The number of weevils present in groves declined rapidly after that date and all had died before September 30.

The infestation of weevils was less than half as large as in the previous year, as shown by jarring records. Nuts matured later than usual and the adult weevils began to die off before egg laying could begin. This resulted in much less damage than usual to Schleys and a good crop was matured. Success nuts matured so late that the weevils did no damage, whereas, in 1930, 12 per cent of the nuts at harvest were infested.

Eggs were laid during the period August 24 to September 20. Larvae emerged from the nuts from September 9, 1931, until March, 1932. Maximum emergence occurred between October 8 and 20.

The destruction of nuts with closely clinging husks at harvest was found to destroy large numbers of larvae, but this practice cannot be relied upon alone to give effective control as the majority of the larvae have left the nuts by harvest time during most years.

Jarring, where the trees have low-hanging branches, will reduce the damage from the pecan weevil. This should be done at least once a week, beginning about the first week in August and continuing until the second week in September. The weevils should be destroyed by dropping into kerosene. Lead arsenate-lime dust did not reduce injury by the pecan weevil.

The Control of Citrus Insects with Oil Emulsions. (L. L. English).—*Life History Work.*—About 60 days were required for the completion of the life cycle of purple scale, *Lepidosaphes beckil* Newm. Although hatching of eggs was more or less continuous

throughout the year, the crawlers appeared in three main broods. The length of life cycle of long scale, *L. gloverii* Pack., was essentially the same as purple scale. The eggs of the latter did not hatch throughout the winter and the crawlers did not occur in broods as distinctly as those of purple scale. The life cycle of camphor scale, *Pseudaonidia duplex* Ckll., averaged about 10 days longer than purple scale. Camphor scale was dormant during the winter and the crawlers appeared in rather distinct broods. Red spider, *Tetranychus citri* McGregor, is mainly a pest of winter and early spring. The adults of white fly, *Dialeurodes citri* Ash., appeared in three rather distinct maximums. There were "fly free" periods in May and July.

INSECT CONTROL.—In field trials satisfactory control of purple scale and camphor scale was obtained with two applications of proprietary oils when the applications were timed to catch the maximum number of crawlers. The results with camphor scale were particularly good on account of its more distinct broods. Bordeaux reduced the effectiveness of oil emulsions against purple scale when the two sprays were combined. The reduction in kill of the white fly larvae was less than that of the purple scale. The effectiveness of oils against purple scale increased gradually with viscosity for oils ranging from 64 to 146 seconds Saybolt. Between viscosities of 64 and 54, there seemed to be a critical value, below which the oils were very ineffective. Crude rubber dispersed in oils to increase their viscosity failed to materially increase their effectiveness.

OIL RESIDUE.—Oils ranging in viscosity from 54 to 146 seconds required from 15 to 100 days for complete disappearance from satsuma foliage. There was no essential difference in the rate of disappearance of white and straw oils. The amount of oil on the foliage of satsumas any time after spraying can be expressed by the equation:

$y = ae^{-bx} \pm C$, where
$y =$ the amount of oil,
$x =$ the number of days after spraying,
and a, b, and C, are constants depending on the concentration of the spray, the viscosity of the oil, etc.

HOME ECONOMICS

A Study of the Calcium and Phosphorus Content of Various Vegetable Foods Grown in Alabama. (Edna R. Bishop).—Analyses of leafy vegetables grown either in the greenhouse or in the field showed a wide variation of calcium and phosphorus

content with different soils and different fertilizer treatments. The variation in these two elements was usually in opposite direction; the calcium-phosphorus ratio varied as much as 12-fold in the case of cabbage.

HORTICULTURE

Fertilizer Experiments with Strawberries. (R. W. Taylor).—A summary of flower and fruit production on Norfolk fine sandy loam receiving different fertilizer applications in 1930 followed by a uniform application of a mixture of nitrate of soda and sulfate of ammonia to supply nitrogen at the rate of 30 pounds per acre in 1931 before fruiting is shown in Table 5.

TABLE 5.—Influence of Fertilizer Treatment on Production of Flowers and Fruits of the Strawberry

Fertilizer treatment 1930 Pounds per acre			Average number of flowers and fruits in 1931					
			Main crop		Late crop		Total	
N	P_2O_5	K_2O	Flowers**	Fruits	Flowers**	Fruits	Flowers**	Fruits
0	0	0	235	211	91	76	326	287
0	256	0	271	255	80	92	351	347
80	256	0	395	306	76	87	471	393
80	256	100	357	318	122	142	479	460

* Average of 6 plots of 12 selected plants each.
** Open flowers counted at weekly intervals.

Variety Tests with Vegetables. (C. L. Isbell).—

BEANS.—In a comparison of the bush snap beans, including the Black Valentine, Red Valentine, Excelsior Refuge, Stringless Greenpod, and Tennessee Greenpod, the latter matured earliest and produced the highest yield when planted in the spring, but it did not yield well when planted in summer. The Valentine varieties were the highest yielders based on averages of all plantings made during the growing seasons. The Ideal Market was the earliest of the pole varieties of snap beans tested. When all plantings were considered and averaged, it was the highest yielder, followed by Kentucky Wonder, McCaslan, Cornfield, and Southern Prolific in the order named. During very dry seasons, as that of the summer of 1931, the Cornfield and a nematode-resistant strain, selected at Auburn, greatly outyielded other varieties.

CABBAGE.—The All-Head Early, All-Season, Louisiana Copenhagen, Succession, and Louisiana Wakefield grown as spring cabbage have given in three years average head yields of 5,668, 3,030, 13,050, 5,833, and 8,984 pounds per acre, respectively. These

differences were relatively much greater than the differences in the gross yields of the different varieties per acre. The late-maturing varieties did not reach normal development, due to unfavorable weather conditions. Of the varieties named, the Copenhagen is the most promising for the production of heads from spring set plants.

GARDEN PEAS.—A planting of garden peas made February 8, 1932, offered an unusual opportunity of comparing the relative hardiness of different varieties during the prolonged cold period of March 5 to 15, which reached minimum temperature of 17° F. The percentages of the plants killed by this temperature were as follows: Alaska 83, Ameer 73, Prosperity 72, Thomas Laxton 44, Laxtonia 25, Little Marvel 25, Improved Telephone 4, Champion of England 1, Dwarf Telephone 0, and Bliss Everbearing 0 per cent.

Nitrate Levels of the Soil as Influenced by Different Ratios of Nitrates and Organic Materials. (E. W. McElwee).—This experiment was planned to study the effects of certain organic materials on the nitrate levels of the soil, with the object of applying the results to the problem of increasing cold resistance of satsuma trees by discouraging late activity of the trees in fall and winter, through the lowering of the nitrate content of the soil. In the experiment pots were used supplemented by outside bins. This study consisted largely of determining at intervals the nitrate content of the soil after the addition of different ratios of nitrates and certain organic materials.

On the basis of a check treatment receiving no organic materials or nitrates but having a natural nitrate content of 35 p.p.m., the greatest nitrate depression for each material added was as follows: for 1 ton of grass, 17 p.p.m.; for 2 tons of grass, 32 p.p.m.; for 1 ton of legumes, 10 p.p.m.; and for 2 tons of legumes, 20 p.p.m. When the nitrate content of the soil was increased to 200 p.p.m., by the application of nitrate of soda, the greatest depression was: for 2 tons of grass, 57 p.p.m.; for 2 tons of legumes, 29 p.p.m.; and for 200 pounds of sugar, 30 p.p.m. All weights of organic material were on a dry basis.

The duration of the nitrate depression period under greenhouse conditions increased as the rate of application of organic material increased, and decreased as the nitrogen content of the added organic material increased. The length of time the nitrate content remained near the lowest point was as follows: for 1 ton of legume, 7 days; for 2 tons of legumes, 13 days; for 1 ton of grass, 14 days; for 2 tons of grass, 21 days; and for 2 tons of grass plus 200 pounds of sugar, 20 days. The rate and amount of nitrate accumulation following the nitrate depression increased as the nitrogen content of the material increased. The soil in all cases receiving sugar only had not reached the nitrate

content of the soil of the respective check treatment at the end of 67 days. The soil receiving grass or legumes reached the nitrate content of the soil of the check treatment as follows: legumes, 7 to 19 days; and grass 44 to 53 days.

The nitrate accumulation, above that of the check, following the nitrate depression by organic materials was at the end of 67 days as follows: for 1 ton of grass, 12 p.p.m.; for 2 tons of grass, 15 p.p.m.; for 1 ton of legumes, 20 p.p.m.; and for 2 tons of legumes, 75 p.p.m.

Influence of Different Fertilizer Treatments and Seasonal Conditions on the Characteristics, Composition and Properties of the Strawberry Fruit. (L. M. Ware).—This year's work adds strength to the conclusion of last year that different fertilizer treatments do not so greatly alter the eating, shipping, or storage qualities of berries as to materially affect their market value.

The work this year shows, as did the work of last year, that certain materials have a marked and distinct effect on certain specific characteristics and properties of the fruit. Of the individual elements studied, the effect of potassium is most distinct. Berries receiving potassium always have a significantly higher electrical conductivity, indicating a higher content of ionizable salts, always require much more base to neutralize a given amount of juice, yet generally have a lower acidity—a higher pH—than berries receiving no potash. Potassium on the contrary has no significant influence on the size, the sugar content, the firmness, the soluble solids, the total solids, or the shipping quality of berries. In fact it appears to affect very little those qualities or characteristics which determine the market value of a fruit.

Rainfall, as it affects soil moisture, causes differences in berries at different periods that are greater than the differences from different treatment at any one period. As soil moisture becomes more and more limited irrespective of fertilizer treatment very definite changes occur in the general characteristics, composition, and properties of the berries. In the field the berries lose their bright red color and pleasing contrast between seed and skin. They become smaller, the yield drops, and the percentage of No. 1 berries is reduced. Laboratory studies show a marked increase in soluble solids, sugar content, total solids, titratible acidity and firmness, and a distinct drop in acidity, a reduction in the amount of moisture lost during shipment, a drop in electrical resistance, and a drop in the shipping index number indicating better shipping quality. Rain of sufficient amount to affect the supply of available soil moisture causes a prompt and distinct reversal of the above trends.

SPECIAL INVESTIGATIONS

Number of Root Nodules on Spanish Peanuts as Affected by Fertilization. (J. F. Duggar).—In the exceptionally dry summer of 1931 superphosphate, basic slag, hydrated lime, and muriate of potash, each applied separately, tended to reduce the average number of nodules per plant throughout its life, even when the fertilizer was not in immediate contact with the non-inoculated, unhulled seed.

When the fertilizers were separately applied in closest possible contact with the unhulled and untreated seed, the average number of nodules per plant was notably reduced by each chemical. This reduction was greatest during the early life of the seedlings. Such unfavorable effect of common fertilizer ingredients diminished as the plant grew older; it had almost disappeared by harvest time, even in this dry summer, in the cases of separate applications of basic slag and hydrated lime.

Correlation between Yield of Spanish Peanuts and Nodule Numbers or Numbers of Main Branches. (J. F. Duggar).—Correlation was found to be high (correlation coefficient = + .641 ± .083) between weight of dry nuts per plant and the average number of nodules of all sizes as found on Spanish peanut plants 49 days before harvest.

In general the yield of nuts was more nearly parallel to the number of nodules per plant as found 38 to 49 days before harvest than to the number of nodules present on the day of digging peanuts. Such correlations tended to run highest on unfertilized and otherwise untreated plots and were affected by the use of different fertilizers and seed treatments.

A growth factor that was closely and positively correlated with yield of dry nuts per plant was the average number of stems per plant; the correlations coefficient was + .764 ± .018 when calculated for a group of 284 plants constituting a composite sample from all plots, subjected to various seed treatments and fertilization. It thus appears that in a season of deficient rainfall relative yields on areas receiving varied treatments could have been closely foretold by determining several weeks in advance the average number of main or primary branches on the Spanish peanut plants.

Nodule Numbers on Lespedeza as Affected by Inoculation of Korean and by Fertilization. (J. F. Duggar).—Plants of Korean lespedeza *(L. stipulacea)* developed in 1931 only a very meager supply of root nodules. The numbers of root tubercles were increased more than fourfold when Korean lespedeza seed were inoculated with a culture made from the tubercles of the same species.

On the other hand, Kobe, Tennessee 76, and Common lespedeza were found to be abundantly supplied with nodules on the fields of the Experiment Station at Auburn and on adjacent farms.

When fertilizer was so applied as to involve closest possible contact with the seed of Common, Tennessee 76, and Kobe lespedeza, the several chemicals variously affected nodule numbers. Basic slag exerted no uniform effect; hydrated lime was of doubtful advantage; superphosphate was depressive throughout the early stages of the seedling's life but highly stimulative to nodule formation in the latter stages; sulphur at the rate of 100 pounds per acre was favorable to nodule formation on plants of Tennessee 76 and Common lespedeza.

In relative yields of hay, Kobe stood first and Tennessee 76 second, both yielding much more than Common lespedeza or inoculated Korean. Basic slag and superphosphate appreciably increased the hay yields of Common and Tennessee 76 lespedeza.