FORTY-FOURTH ANNUAL REPORT

Fiscal Year Ending June 30, 1933

OF THE

# Agricultural Experiment Station

OF THE

# Alabama Polytechnic Institute

AUBURN

M. J. FUNCHESS, *Director*

AUBURN, ALABAMA

## Contents

# ALABAMA POLYTECHNIC INSTITUTE

## COLLEGE OF AGRICULTURE

## AGRICULTURAL EXPERIMENT STATION



### EXPERIMENT STATION STAFF

John Jenkins Wilmore, B. M. E., M. E., 1888
Bolling Hall Crenshaw, M. S., 1891
Luther Noble Duncan, M. S., 1905
Administrative Committee 1932
M. J. Funchess, M. S., Director of Experiment Station
W. H. Weidenbach, B. S., Executive Secretary
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
E. H. Mereness, Ph. D. — Associate Agricultural Economist
*C. M. Clark, M. S. — Assistant Agricultural Economist
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.)
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
H. C. Mauer, B. S. — Graduate Assistant

**Agronomy and Soils:**

M. J. Funchess, M. S. — Agronomist
J. W. Tidmore, Ph. D. — Soil Chemist
Anna L. Sommer, Ph. D. — Associate Soil Chemist
**F. L. Davis, M. S. — Assistant Soil Chemist
*G. D. Scarseth, B. S. — Assistant Soil Chemist
J. A. Naftel, Ph. D. — Assistant Soil Chemist
R. E. Yoder, Ph. D. — 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 — Assistant in Agronomy
E. C. Richardson, B. S. — Graduate Assistant

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

**Animal Husbandry and Poultry:**

| | |
|---|---|
| J. C. Grimes, M. S. | Head, Animal Industry Group |
| W. D. Salmon, M. A. | Research Professor Animal Nutrition |
| G. A. Schrader, Ph. D. | Associate Research Professor Animal Nutrition |
| C. O. Prichett, 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 |
| J. G. Goodman, B. S. | Graduate Assistant |

**Botany and Plant Pathology:**

| | |
|---|---|
| J. L. Seal, Ph. D. | Botanist |
| G. L. Fick, M. S. | Associate Botanist |
| E. V. Smith, M. S. | Assistant in Botany and Plant 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. | Head Horticulturist |
| C. L. Isbell, Ph. D. | Horticulturist |
| O. C. Medlock, M. S. | Assistant Horticulturist |
| R. W. Taylor, M. S. | Assistant Horticulturist |
| E. E. McElwee | 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. |
| 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 1932-33:

**Appointments:**

| | |
|---|---|
| R. E. Yoder, Ph. D. | Assistant Soil Chemist |
| E. C. Richardson, B. S. | Graduate Assistant in Agronomy |

**Resignations:**

| | |
|---|---|
| C. G. Garman, M. S. | Associate Agricultural Economist |
| C. T. Bailey, B. S. | Superintendent Poultry Farm |
| C. F. King | Assistant to Superintendent Tennessee Valley Substation, Belle Mina, Ala. |

## NEW PUBLICATIONS

Davis, F. L., and Scarseth, G. D.—**Some Correlations Between Crop Yields and the Readily Available Phosphorus in Soils as Determined by Troug's Method.** *Jour. Amer. Soc. Agron., 24, 909-920.* The amounts of readily available phosphorus by Troug's method and by a slight modification of the method in a number of Alabama soils and the crop yields on these soils in the greenhouse are reported. Statistical correlations and graphical analyses of the relationships between the values obtained for readily available phosphorus and the yields of crops in the greenhouse are also given.

Davis, F. L.—**A Correlative Study of the Relationships of the Hydrogen-ion Concentration and the Degree of Calcium Saturation of Soils to the Growth of Austrian Winter Peas on Certain Soils.** *Jour. Amer. Soc. Agron., 24, No. 12 Supplement, 38.* A statistical study was made of the correlated relationship between the yield of Austrian winter peas in pot cultures in the greenhouse and (1) the H-ion concentration and (2) the degree of calcium saturation of groups of Norfolk, Greenville, and Decatur soils.

Diseker, E. G.—**An Inexpensive Machine for Filling the Trench Silo.** *Alabama Agricultural Experiment Station Circular 61.* The circular reports the use of a small power feed cutter, without a blower, which has sufficient capacity for filling a trench silo. A 4-horsepower gas engine was found to be sufficient for its operation.

Garman, C. G.—**Factors Related to Income and Costs of Production on Farms in Marshall and DeKalb Counties, Alabama, 1927-1929.** *Alabama Agricultural Experiment Station Bulletin 236.* Averages based on the study of 108 farms, of which 29 were classified as farms having commercial poultry flocks, were used in this study. Farms having commercial poultry flocks had more stable incomes than other farms. Increased acres of cotton were related to increased labor income but the advantage in income diminished as the price of cotton declined. High yields per acre or per head were closely associated with low cost per unit and high labor return.

"Farms which were above average in the three factors, acres of cotton, yield of lint cotton per acre, and acres of cotton per mule had an average labor income of $870, whereas those which were below average in all three of these factors had an average labor income of $45."

Farmers using two-horse cultivators had higher labor incomes than farmers using one-horse cultivating equipment.

Grimes, J. C., Sewell, W. E., and Cottier, G. J.—**The Use of Ice in Curing Pork on the Farm.** *Alabama Agricultural Experiment Station Circular 62.* A method is reported for curing pork on the farm during moderately warm weather by using an iced brine solution.

Sturkie, D. G.—**Control of Weeds in Lawns with Calcium Cyanamid.** *Jour. Amer. Soc. Agron., 25, 82-84.* This paper reports the effect of treating a Bermuda grass lawn with various amounts of calcium cyanamid; also the effects of treatment on a number of different weeds and on sods of other species of grasses.

Taylor, R. W.—**Influence of Nitrogenous Fertilizers Applied at Different Dates on the Numbers of Flower Clusters and Fruits of the Strawberry.** *Proc. Amer. Soc. Hort. Sci. 29, 313-17, 1932.* Nitrogenous fertilizers applied in the fall or at various dates in the winter before the fruiting season increased the number of flower clusters, flowers, and fruits. The greatest increase over the check occurred where the fall fertilizer application was supplemented by a winter application. Leaf growth and soil nitrates indicated that applications of nitrogenous fertilizers made in the fall or very early in the fruiting year did not supply sufficient nitrogen over a sufficiently long period for best results.

Tidmore, J. W., and Williamson, J. T.—**Experiments with Commercial Nitrogenous Fertilizers.** *Alabama Agricultural Experiment Station Bulletin 238.* Results are given concerning the relative value of different sources of nitrogen, factors that determine the relative value of different nitrogenous fertilizers, and methods of correcting the acidity developed in soils from the use of physiologically acid fertilizers.

## AGRICULTURAL ECONOMICS

*Relationship between the Type of Soil and Success of Farm Mortgage Loans in Southeast Alabama.* (E. H. Mereness).—A study of 4,800 farm mortgages, covering about 60 per cent of the land area of Coffee, Geneva, and Henry Counties, indicated a close relationship between type of soil and degree of success of loans as measured by losses per $1,000 loaned. In Table 1 farms showing about the same degree of success on certain of the better types were grouped for convenience. The losses ranged from an average of $24 per $1,000 loaned for the group including Greenville, Ruston, Orangeburg, and Norfolk sandy loam soils to $243 for the group of farms which were located mostly on Kalmia fine sand. Norfolk sand and Susquehanna fine sandy loam were intermediate in rank. Wide variations in success of loans, however, occurred within most soil types which showed that factors other than soil type affected the success of loans.

## AGRICULTURAL ENGINEERING

**Field Curing and Baling Cowpea Hay.** (E. G. Diseker).—Over a five-year period, curing cowpea hay in windrows has consistently proved to be a more satisfactory method of producing a high-quality hay than curing in the swath. Hay cured in windrows retained more of the leaves and had a greener color than when cured in the swath.

Turning the windrow should take place when the hay in about half the upper portion of the windrow will rattle when disturbed. With proper curing weather, one turning of the windrow (usually three or four days after cutting, depending upon the growth of hay) is sufficient. The hay should be examined in the middle of the afternoon, and, if sufficiently cured, turned the following morning after the dew has thoroughly dried from the upper part of the hay. This will prevent shattering of the leaves and also place the windrow on dry soil with the damp side up.

Hay containing 18 per cent moisture from portions of single and double windrows was safely baled into a 78.5-pound bale after 8 days of curing.

**Studies of Soil Crust Formation.** (A. Carnes).—An approximate expression of the law governing cementation in the soil, based on the composition of the soil, was found. It was also found that the cementation in a given soil varied with the replaceable bases and approximately followed the law $R = \frac{a}{2}(e^{\frac{x}{a}} + e^{-\frac{x}{a}})$, where $R$ is the modulus of rupture, $a$ the $R$ value when $x$ is zero, $e$ the base of natural logarithms, and $x$ the percentage saturation with calcium. $R$ was also found to be proportional to the moisture.

In a preliminary study of flocculation, it was found that the amount of material less than .05 mm. in diameter remaining in suspension after stirring seemed to follow the law $S = at^b$, where $S$ is the percentage of material in suspension less than .05 mm., $t$ the time in minutes of hand stirring, $a$ is a constant depending on the amount of flocculation at the start, and $b$ is a constant depending on the stability of the floccules.

**Soil Dynamics.** (M. L. Nichols.).—A study of the resistance of soil to compressive forces showed that the relationship of the thickness *(T)* of a given layer of soil to a compressive force

TABLE 1.—The Relation of Types of Soils to Losses Incurred on Farm Mortgage Loans from 1917 - 1931 in Coffee, Geneva, and Henry Counties, Alabama.

| Type of soil | Coffee County | | Geneva County | | Henry County | | Total three counties | |
|---|---|---|---|---|---|---|---|---|
| | Number of loans | Losses per $1,000 loaned | Number of loans | Losses per $1,000 loaned | Number of loans | Losses per $1,000 loaned | Number of loans | Losses per $1,000 loaned |
| Greenville, Ruston, Orangeburg, or Norfolk sandy loam | 320 | $ 19.39 | 683 | $ 33.92 | 335 | $14.33 | 1,338 | $ 24.46 |
| Norfolk sand | 220 | 151.89 | 46 | 145.60 | 190 | 53.99 | 456 | 103.63 |
| Susquehanna fine sandy loam | 141 | 136.19 | | | | | 141 | 136.19 |
| Kalmia fine sand, and Kalmia fine sand mixed with other soil types | 39 | 248.61 | 50 | 237.00 | | | 89 | 242.98 |
| All loans* | 1,243 | 73.66 | 1,128 | 57.88 | 677 | 39.63 | 3,048 | 59.15 |

*Loans made to finance the resale of foreclosed farms were not included.

*(P)* could be calculated by the empirical formula, $TP^k = a$, where $k$ and $a$ are specific soil constants depending upon the moisture contents and plasticity constants. While this formula was found to be sufficiently accurate for practical calculations, its obvious implications for extreme values of either $T$ or $P$ indicated the need of further investigations which are at present under way. The variations of the constants for each soil with moisture content approximately corresponded to Versley's classification.

It was found that the rate of penetration of a plunger, where the reaction was free to arch over a considerable area, was proportional to pressure and that this proportion was a function of the apparent specific gravity. The compression and arch action studies were continued to determine the relationship of these factors to the rolling resistance of a wheel. The exact nature of the soil reactions and of wheel slippage was determined by special laboratory apparatus. It was found that the generally accepted theory did not explain the true nature of slippage on soils since slippage consisted of a compressive action in front of the wheel resulting in actual forward movement with no rotation of the wheel on its axle.

Studies of the curvature of the moldboard of the common plow were continued and a method of measuring surface pressures was determined. The English type plow was found to be a portion of a conic surface which was formed by the rotation of curve having formulas of the type $y = a\, e^{bx}$.

## AGRONOMY AND SOILS

**Potash Top-Dressing Experiments With Cotton.** (R. Y. Bailey).—Potash top-dressing experiments were conducted on Norfolk sandy loam during the five-year period, 1928-1932, inclusive, to determine whether an application of potash used as a top-dressing on cotton, which was fertilized with 50 pounds of muriate of potash per acre before planting, would increase the yield, the size of bolls, the percentage of lint, or the oil content of the seed.

The fertilizer treatments, the average yields, weight of bolls, percentage of lint, and percentage of fat in the seed obtained in these experiments are shown in Table 2.

**Time of Turning Vetch for Corn and Cotton.** (E. L. Mayton). —Vetch on different plots was turned for corn about March 25, April 5, and April 15, during the eight-year period 1925-1932. Corn was planted on these plots approximately ten days after each turning date. Adjacent to each vetch plot two other plots were planted to corn on the same date and fertilized with nitrate of soda at the rate of 100 and 200, 200 and 300, and

**TABLE 2.—Yield of Cotton, Weight of Bolls, Percentage of Lint, and Percentage of Fat in Seed Obtained in Potash Top-Dressing Experiments on Norfolk Sandy Loam.**

| Potash fertilizer pounds muriate per acre[1] | | 5-year averages—1928-1932 | | | |
|---|---|---|---|---|---|
| Before planting | Top-dressing | Pounds seed cotton per acre | Weight of 100 bolls | Percentage of lint | Percentage of fat in seed |
| | | | Lbs. | | |
| None | None | 506 | 1.06 | 38.3 | 22.83 |
| 50 | None | 782 | 1.16 | 38.5 | 24.33 |
| 50 | 200 | 794 | 1.18 | 38.2 | 25.54 |

[1]All plots received 400 pounds of superphosphate and 200 pounds of sodium nitrate per acre.

200 and 400 pounds per acre for the April 5, April 15, and April 25 planting dates, respectively. Every fourth plot in the experiment was untreated and served as a check plot. All check plots were planted on the first planting date. Corn was spaced 18 and 36 inches apart in five-foot drills on different sections of the plots.

The eight-year average yields of all treated plots were larger on the section spaced 18 inches apart, whereas on the untreated check plots the 36-inch spacing produced the larger yields. The average yields following vetch were 22.9, 27.6, and 29.6 bushels per acre on the plots turned March 25, April 5, and April 15, respectively. The yields from vetch plots in each case were larger than the yields from the nitrate of soda plots, which were planted on the same date.

In a similar experiment vetch was turned for cotton about March 25, April 5, and April 15, and cotton was planted approximately ten days after each turning date over the same eight-year period. One plot adjacent to the vetch plots planted April 5 and April 25 was planted on the same date and fertilized with nitrate of soda at the rate of 300 pounds per acre; the phosphate and potash fertilization was the same on each plot.

The eight-year average yields of plots planted on April 5, 15, and 25 were: vetch 1,159, nitrate of soda 1,192; vetch 1,111; and vetch 1,014, nitrate of soda 1,044 pounds of seed cotton per acre, respectively. These data indicate that early planting of cotton was more important than the larger growth of vetch obtained on the plots planted on the last two dates. Therefore vetch should be turned for cotton as soon as there is a sufficient growth to supply a reasonable amount of nitrogen.

**A Comparison of Stable Manure, Nitrate of Soda and Vetch as Sources of Nitrogen for Cotton and Corn in a Two-Year Rotation.** (E. L. Mayton).—This experiment was started in the fall of 1924 and has been continued over the eight-year period, 1925-1932. The cropping system was a two-year rotation of cotton and corn. Manure was applied at the rate of 5 tons per acre each spring; nitrate of soda at the rate of 325 pounds per acre; and the vetch was turned about April 1. The phosphate and potash fertilization was essentially the same on each plot. Monantha vetch was killed by cold in 1928; in 1929 rabbits destroyed the vetch and Austrian peas on the corn plots; and in 1932 rabbits destroyed Austrian peas on both the corn and cotton plots. Consequently, only six crops of winter legumes have been turned for cotton and five crops for corn, over the eight-year period, as compared with the regular applications of manure and nitrate of soda each year.

The eight-year average yields of seed cotton, pounds per acre, were as follows: manure 1,581; nitrate of soda 1,287; and vetch 1,348. The corn yields over the same period were: manure 37.2; nitrate of soda 35.2; and vetch 31.4 bushels per acre.

**Austrian Winter Peas.** (H. B. Tisdale).—Table 3 shows the average seed yields of Austrian winter pea strains selected in 1928 from a field of Austrian winter peas grown from commercial seed. The selected strains of peas showed less resistance to cold than the commercial strain, which may be partly attributed to the more advanced growth of the selected strains. The low yield in 1933 was caused by a freeze in February.

**TABLE 3.—Average Yield in Bushels of Seed per Acre of Selected Strains of Austrian Winter Peas.**

| Strain No. | 1931 | 1932 | 1933 | Average 3 years 1931-1933 |
|---|---|---|---|---|
| 7 | 15.00 | 6.21 | .35 | 7.19 |
| 48 | 11.67 | 7.58 | .44 | 6.56 |
| 6 | 14.33 | 3.58 | .13 | 6.01 |
| 9 | 13.67 | 2.92 | .13 | 5.57 |
| 29 | 10.00 | 2.55 | .44 | 4.33 |
| 22 | 7.67 | 3.50 | .70 | 3.96 |
| 30 | 7.00 | 1.78 | .98 | 3.25 |
| Commercial | 5.39 | 1.56 | 1.88 | 2.79 |

**Oat Breeding.** (H. B. Tisdale).—Table 4 shows the results of a test for three years of oat strains selected in 1929 for cold- and disease-resistance. In these tests the Red Rustproof strains have proved to be superior to the other strains tested. The Fulghum Strain 6A may be considered a new variety of Fulghum oats, which is characterized by being about one week later and having larger and more vigorous-growing plants than the regular Fulghum variety. The Small Winter and Norton are cold-resistant and good-yielding strains, but are too susceptible to the rust disease for Central and South Alabama.

**TABLE 4.—Average Yield, Bushels per Acre, of Selected Oat Strains.**

| Strain or Variety | 1931 | 1932 | 1933 | Average 3 years |
|---|---|---|---|---|
| Red Rustproof 43A | 55.8 | 73.4 | 46.7 | 58.6 |
| Red Rustproof 2A | 49.3 | 79.4 | 45.7 | 58.1 |
| Red Rustproof 3A | 53.1 | 75.3 | 41.0 | 56.5 |
| Red Rustproof 48A | 53.6 | 72.9 | 41.7 | 56.1 |
| Red Rustproof 69A | 44.7 | 73.7 | 42.4 | 53.6 |
| Fulghum 6A Check | 54.6 | 45.0 | 40.3 | 46.6 |
| Norton 30-34 | 54.6 | 31.3 | 33.7 | 39.9 |
| Norton 30-38 | 53.1 | 30.5 | 31.9 | 38.5 |
| Norton 3 | 49.0 | 28.9 | 33.0 | 37.0 |
| Small Winter 57A | 43.2 | 31.1 | 32.3 | 35.5 |
| Small Winter 14A | 45.4 | 27.0 | 30.9 | 34.4 |
| Fulghum 35A | 38.0 | 40.5 | 24.3 | 34.3 |
| Fulghum 29 C.B. | 38.4 | 37.3 | 26.0 | 33.9 |
| Small Winter 69A | 46.0 | 24.6 | 31.2 | 33.9 |
| Fulghum 26A | 41.3 | 33.5 | 25.7 | 33.5 |
| Fulghum 38A | 37.4 | 36.5 | 26.4 | 33.4 |
| Small Winter 51A | 51.1 | 20.3 | 26.3 | 32.6 |

**Histological Studies of the Fiber and Seed of Cotton.** (D. G. Sturkie).—This study was started in 1929 to determine the origin of the fiber and its development in length, width, and thickness. The successive stages in the development of the seed were also studied.

In 1929, flowers as they appeared were marked with dated tags. After a forty- to fifty-day period several bolls of each daily stage were harvested and preserved in formalin acetic alcohol.

In 1931 and 1932 material in successive stages of development were secured from bolls produced by flowers of the same blooming date and preserved in formalin acetic alcohol. Plots were irrigated to prevent undue water stress, but were not irrigated often enough to cause abnormal plant growth. Flowers were tagged on July 31 and August 15. Fertilization was similar and adequate on all plots. A large number of bolls were collected at three-day intervals starting from date of blooming and continuing through maturity.

Fiber origin studies were made with flower buds, young fertilized and young unfertilized ovules. Material was embedded, sectioned, stained, and mounted by standard methods. A variation of the standard was used in sectioning fibers. This consisted in stretching the fibers across cardboard frames and embedding in the usual way. Development of fiber thickness was then determined by measurements of cross sections.

Progressive development of fiber length was determined by combing out the fibers in warm water and measuring their length. The length of lint on sides and ends of six seed was measured. Measurements of the length of very young fibers were made with the aid of a microscope. The major and minor axes of all the seed of the boll were measured while still in warm water. Due to the small number of measurements made the results are relative and not absolute.

During 1931 and 1932 bolls produced by flowers of the same blooming date were collected daily, dried and weighed. The seed were then delinted, dried and weighed to determine development in weight.

The results may be summarized as follows:

FIBER ORIGIN.—Cotton fibers originated from the outermost cells of the epidermis of the seed. Most fibers are formed on the day of blooming irrespective of pollination or fertilization. Very few fibers are formed after the third day.

FIBER ELONGATION.—In fertilized ovules, rapid elongation of fiber proceeds until the twenty-first day, elongation being completed by the twenty-fourth day. The period of most rapid growth is between fifteen and twenty-one days of age. During this period the fiber is lengthening at the rate of approximately 1/25 to 2/25 of an inch per day. In unfertilized ovules, fiber elongation ceases after the third day.

FIBER WIDTH.—The fiber attains its maximum width by the sixth day after blossoming.

FIBER THICKENING.—Fiber thickening does not begin until the fiber has attained its entire length. Thickening of the fiber wall usually begins on the nineteenth day. Thickening is relatively slow until the twenty-seventh day, but after this it is rapid and is generally completed by the thirty-ninth day.

SIZE OF SEED.—Seed growth, as regards length and width, is practically completed in twenty-one days.

WEIGHT OF SEED.—The weight of seed increases very slowly for the first ten days and more rapidly until approximately forty-five days of age.

PERCENTAGE OF LINT.—For the first twenty-one days the percentage of lint is variable; during this period the weight of the fiber is proportional to its length but after maximum length is reached the increasing weight of the fiber is due to the thickening process. From the twenty-second to the fortieth day the weight of a seed and the weight of lint from that seed increases at the same rate. After forty days the lint ceases to gain in weight while the seed continues until about the forty-fifth day. This causes a decrease in the percentage of lint after the fortieth day.

**Studies with Calcium Cyanamid in the Control of Weeds in Lawns.** (D. G. Sturkie).—These studies were made during the winters of 1931-1932, and 1932-1933. The results may be briefly summarized as follows:

(1) Granular and powdered cyanamid were equally effective in control of weeds when used at the rate of 1,500 pounds per acre.

(2) The best time of application was in February or March.

(3) The material should be applied at the rate of at least 1,000 pounds per acre for best control. Rates less than this did not kill all of the weeds.

(4) Applications as large as 3,000 pounds per acre were not injurious to dormant Bermuda grass. This was the heaviest application used in the study.

(5) Applications of over 250 pounds per acre were very injurious to Italian rye grass on Bermuda grass sod.

(6) An application of 1,500 pounds of cyanamid per acre killed the following plants:

Chickweed (common) (Stellaria media (L) Cyrill.)
Chickweed (mouse-ear) (Cerastium viscosum L.)
Cranesbill (Geranium carolinianum L.)
Lesser Wart Cress (Coronopus didymus (L) Sm.)
Cudweed (Gnaphalium purpureum L.)
Bur clover (Medicago arabica Huds.)
Carolina clover (Trifolium sp.)
Hop clover (Trifolium procumbens L.)
White clover (Trifolium repens L.)
Black medic (Medicago lupulina L.)
Dandelion (Taraxacum officinale Weber.)
Dwarf dandelion (Krigia virginica (L.) Willd.)
Hen-bit (Lamium amplexicaule L.)
Lespedeza (Lespedeza striata (Thunb.) H. & A.)
Peppergrass (Lepidium virginicum L.)
White Plantain (Plantago virginica L.)
Ragweed (Ambrosia artemisiifolia L.)
Sheep sorrell (Rumex acetosella L.)
Wood sorrel (Oxalis stricta L.)

(7) An application of 1,500 pounds of cyanamid per acre did not kill the following plants:

Wild garlic (Allium vineale L.)
English Plantain (Plantago lanceolata L.)
Purple Bent Grass (Argostic hyemalis (Walt) B. S. P.)

**A Study of Winter Lawn Grasses and Their Effect on Bermuda Grass.** (D. G. Sturkie).—During the winter of 1932 a test was conducted to determine the best winter lawn grasses on Bermuda sod and on non-sod land. Half of each area was closely mowed (½-inch stubble) and half was mowed high (2-inch stubble). The following grasses were tested: Italian rye, English rye, Pacey's rye, crested dog's-tail, meadow foxtail, tall meadow oat, redtop, wood meadow, sweet vernal, orchard, rescue, Kentucky blue, Canada blue, bulbous blue, rough stalk meadow, Cocoo's bent, South German bent, creeping bent, seaside bent, Colonial bent, Rhode Island bent, sheep fescue, fine-leaved sheep fescue, Chewings' New Zealand fescue, various-leaved fescue, Chewing's fescue, hard fescue, meadow fescue, and true creeping red fescue.

For lawn purposes the best grasses were Italian rye, Pacey's rye, English rye, rough stalk meadow, true creeping red fescue, Chewings' New Zealand fescue, Chewings' fescue, seaside bent, South German bent, and Kentucky blue.

The Bermuda was badly injured by Italian rye, Pacey's rye, English rye, sweet vernal, Chewings' fescue, and meadow fescue. It was only slightly injured by awnless brome, Kentucky blue, Canada blue, and rough stalk meadow grasses. The injury from the other grasses was intermediate between the two extremes mentioned. The injury was more severe in all cases where the grass was cut with a high stubble. It required about 30 days for the Bermuda grass to recover from the injury caused by the winter grasses.

**The Determination of the Lime Requirement of Soils by Casorption Studies.** (J. A. Naftel and R. E. Yoder).—A study was made of the lime requirement of five typical soils of Alabama and one from the Mississippi Delta. Bradfield's concept of base saturation, a soil in equilibrium with an excess of $CaCO_3$ and the $CO_2$ partial pressure of the air, was applied throughout the investigation. It was found that the amount of Ca sorbed was very definite under these equilibrium conditions. Furthermore, the saturation point was easily obtained experimentally and occurred through a definite pH range. The saturation points were obtained from glass electrode measurements of pH and by specific conductivity curves. The milli-equivalents of Ca sorbed per 100 gms. of soil, at the air-calcium-soil equilibrium, is termed the "casorption" value. Briefly, it is a measure of the Ca unsaturation of the soil. Descriptive data of these soils are included in Table 5 and Figure 1.

Greenhouse experiments were set up to determine the optimum degree of Ca saturation for crop growth on the different soils. Pots of each of the soil types were limed to 0, 25, 50, 75, and 100 per cent of their casorption values both with $CaCO_3$ or with $CaCO_3 . MgCO_3$. Growth curves were plotted after the crops were harvested, and from these the lime requirement was obtained for the different soils and crops. The growth curves for soybeans of all the soils passed through a maxi-

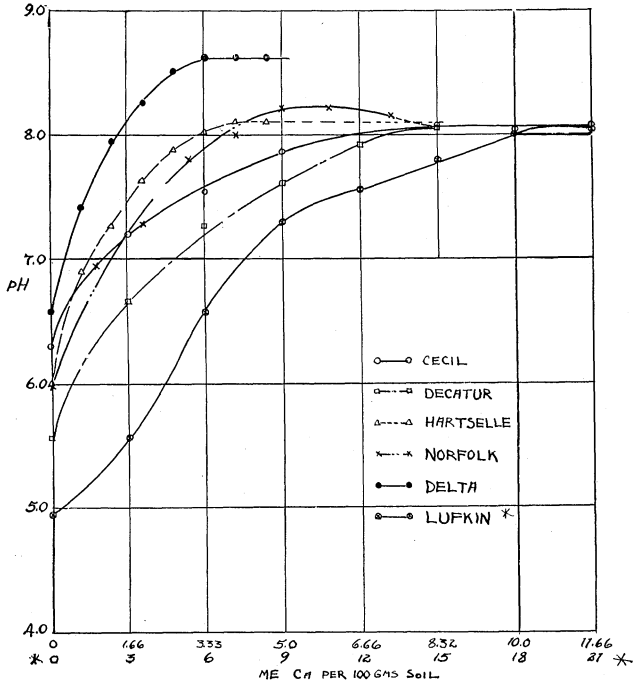


FIGURE 1.—Air-$CaCO_3$-Soil Equilibria in Soils.

mum, and hence this method proved satisfactory. As would be expected, the greatest lime response was obtained on the Lufkin which had the lowest Ca saturation. The other five soils were relatively highly saturated with Ca. There was no evidence of lime injury in these soils even with the 100 per cent casorption value addition.

**TABLE 5.—Base Exchange Status of Different Soil Types.**

| Soil type | pH value | Base exchange capacity in milligram equivalents per 100 gms. of soil | Exchange calcium | | Exchange magnesium | |
|---|---|---|---|---|---|---|
| | | | Milli-equivalents per 100 grams of soil | Percentage of exchange capacity | Milli-equivalents per 100 grams of soil | Percentage of exchange capacity |
| Cecil clay | 6.32 | 10.00 | 4.54 | 45.4 | 0.94 | 9.4 |
| Decatur clay loam | 5.75 | 8.75 | 3.39 | 38.8 | 1.24 | 14.2 |
| Hartselle sandy loam | 6.10 | 3.20 | 1.65 | 51.6 | 0.39 | 12.2 |
| Norfolk sandy loam | 6.10 | 3.25 | 1.26 | 39.8 | 0.54 | 16.6 |
| Delta very fine sandy loam | 6.60 | 10.20 | 7.18 | 70.3 | 2.11 | 20.7 |
| Lufkin | 4.75 | 34.15 | 15.12 | 44.3 | 8.39 | 24.4 |

Casorption studies are adaptable to the soils of the humid region regardless of their state of base saturation. The results of this study show that casorption values together with growth curves from crops are fundamentally satisfactory for the determination of the lime requirement of a soil.

**The Use of Quinhydrone with the Glass Electrode in Determining the Redox Capacity of Soils.** (J. A. Naftel).—A study was made of the reducing or oxidizing properties, "Redox Capacity", of six typical soils of the Cotton Belt. The pH values of the soil suspensions were determined with the glass electrode and then the suspensions were saturated with quinhydrone (QH) in known amount. The pH value was determined at various intervals of time both with the glass and QH electrodes. In certain soils, Nos. 1 and 2 in Table 6, a large drift in pH value was obtained. Electrometric titrations of the suspensions, after adding QH, showed that considerable hydroquinone had been oxidized by some constituent in the soil, Soils 1, 2, and 3 in Table 7. There was little reduction of the added quinone. The calculated redox capacities, in Table 7, were extremely high in Soils 1, 2, and 6, and very low in the other three soils. Analyses showed that Mn was the active oxidizing constituent in the soils possessing high redox capacities. The results of this study indicate that QH, a compound of equimolecular oxidizing and reducing properties, together with the glass electrode, offers interesting possibilities as an indicator for the redox capacity of a soil.

**TABLE 6.—The Quinhydrone Electrode Error in Typical Soils of Alabama.**

| No. | Soil series | pH values of soil suspensions | | | | |
|---|---|---|---|---|---|---|
| | | QH added | | | Errors | |
| | | O | Excess | | QH | QH elect |
| | | G | G | QH | | |
| 1 | Cecil | 5.60 | 7.46 | 7.68 | 1.86 | 0.22 |
| 2 | Decatur | 4.87 | 7.30 | 7.40 | 2.43 | 0.10 |
| 3 | Hartselle | 5.15 | 5.20 | 5.58 | 0.05 | 0.38 |
| 4 | Norfolk | 5.08 | 5.38 | 5.58 | 0.30 | 0.20 |
| 5 | Delta | 6.00 | 6.71 | 7.00 | 0.71 | 0.29 |
| 6 | Lufkin | 4.34 | 4.75 | 4.85 | 0.41 | 0.15 |

Note:
G = pH by glass electrode.
QH = pH by QH electrode.
QH error = difference in glass electrode pH values before and after QH added.
QH electrode error = difference in glass electrode pH value and QH pH value after adding QH.

**Relation of Root System to Minimum $PO_4$ Concentration Necessary for Good Growth.** (A. L. Sommer).—A study of the extent of root system as compared with the minimum $PO_4$ concentration necessary for good growth indicated that, at least

**Table 7.—The Influence of Mn on the Redox Capacity of Soils as Measured with Quinhydrone.**
(Initial Q/HQ = 0.977)

| Soil | M.E. per 100 gms. soil | | | | | | QH | | M.E. Mn per 100 gms. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | HQ | | | Q | | | | | | | |
| | Added | Found | Oxidized | Added | Found | Reduced | Q/HQ | Redox[1] capacity | EX[2] | QH EX[2] | Reduced by QH |
| 1 | 6.925 | 1.625 | 5.300 | 6.725 | 5.600 | 1.125 | 3.440 | 246.3 | 0.0 | 6.10 | 6.100 |
| 2 | 6.925 | 1.675 | 5.250 | 6.725 | 5.450 | 1.275 | 3.250 | 227.3 | 0.408 | 6.90 | 6.492 |
| 3 | 6.925 | 6.700 | 0.225 | 6.725 | 6.200 | 0.525 | 0.926 | 5.1 | Trace | 0.19 | .190 |
| 4 | 6.925 | 6.700 | 0.225 | 6.725 | 6.170 | 0.555 | 0.922 | 5.5 | Trace | 0.12 | .120 |
| 5 | 6.925 | 6.800 | 0.125 | 6.725 | 5.140 | 1.585 | 0.755 | 22.2 | Trace | 0.40 | .400 |
| 6 | 6.925 | 1.675 | 5.250 | 6.725 | 9.300 | 2.575 | 5.550 | 557.3 | 1.225 | 4.28 | 3.055 |

[1]Obtained as follows: (Q/HQ - 0.977) (100)
[2]Exchangeable.

for a number of plants, the greater the root surface the smaller is the $PO_4$ concentration necessary for normal growth. Further evidence was obtained in a comparison of the phosphorus content of the expressed juice of the lower stems and of the young leaves of cotton (small root surface, high $PO_4$ requirement) and of buckwheat (relatively large root surface, low $PO_4$ requirement). Both kinds of plants were grown in each of several 1,000-liter containers and the $PO_4$ concentrations maintained were 0.8 p.p.m., 3.2 p.p.m., and 12.8 p.p.m. Plants at all concentrations made good growth but the cotton plants at the higher concentrations were much larger than those at a concentration of 0.8 p.p.m. The expressed juice from the stems of buckwheat contained much more phosphorus than that from cotton. There was much less difference (sometimes a reversal in the relationship) between the phosphate contents of the young leaves of the two kinds of plants. This indicates that there is little or no difference in the amount of phosphorus needed to produce a unit of dry matter of the two plants and that the rate of growth is limited at low $PO_4$ concentrations by the rate of supply of this ion. The analytical data are given in Table 8.

**TABLE 8.—Phosphorus Content of Expressed Juice of Stems and of Young Leaves of Cotton and Buckwheat.**

| P.P.M. $PO_4$ in solutions | Percentage phosphorus | | | | | |
|---|---|---|---|---|---|---|
| | Expressed juice of stems | | Young leaves (dry weight) | | | |
| | | | Soluble phosphorus | | Total phosphorus | |
| | Cotton | Buckwheat | Cotton | Buckwheat | Cotton | Buckwheat |
| | 0.0090[1] | 0.0195 | 0.35 | 0.53 | 0.55 | 0.76 |
| 0.8 | 0.0090[2] | 0.030 | 0.52 | 0.86 | 0.76 | 1.10 |
| | 0.0095[1] | 0.034 | 0.46 | 0.65 | 0.68 | 0.86 |
| 3.2 | 0.020[2] | 0.040 | 0.84 | 0.67 | 1.18 | 0.88 |
| | 0.012[1] | 0.036 | 0.68 | 0.67 | 1.00 | 0.90 |
| 12.8 | 0.028[2] | 0.057 | 0.80 | 0.58 | 0.90 | 0.88 |

[1]First crop of buckwheat and first harvest of cotton (38 days).
[2]Second crop of buckwheat and second harvest of cotton (57 days).

## ANIMAL HUSBANDRY AND POULTRY

**A Protein Supplement to White Corn for Fattening Hogs in the Dry Lot.** (J. C. Grimes, W. E. Sewell, and G. J. Cottier).—This study has been continued but some variation was made in the kind of rations used. This was thought to be desirable because in the previous tests serious trouble developed from what was thought to be a deficiency disease but what has at times in the past been called "cottonseed meal poisoning." The trouble first developed in a lot that was receiving a supplement of tankage and cottonseed meal and later to a degree in all the other lots.

In order to make a further study of this trouble eight lots of ten hogs each were fed on white corn and various amounts of cottonseed meal from July 6 to September 28, 1932. The rations used in the different lots were as follows:

Lot I.—White corn and a mixture of equal parts of tankage and cottonseed meal, self-fed, free choice.

Lot II.—Same as Lot I except soybean hay was added.

Lot III.—White corn, cottonseed meal, self-fed, free choice.

Lot IV.—White corn three parts, and cottonseed meal one part, mixed and self-fed.

Lot V.—Same as Lot I except for the previous treatment of the pigs (sows and pigs on oat pasture during the suckling period).

Lot VI.—Same as Lot IV except that hogs had access to green soybean pasture.

Lot VII.—Same as Lot I except hogs had access to green soybean pasture.

Lot VIII.—Same as Lot III except hogs had access to green soybean pasture.

The pigs used in all lots except Lot V were raised under dry-lot conditions, and all lots were under dry-lot conditions while on experiment except as noted above. A mineral mixture of charcoal, lime, and salt was supplied in all lots.

None of the hogs showed a deficiency trouble similar to that noted in the previous tests. It is possible that the season of the year influenced the results. The pigs used in this test were farrowed in the spring and fattened during the summer. They were in the sunshine more than the pigs used in the previous test which were farrowed in the fall.

No "cottonseed meal poisoning" was noted despite the fact that in one of the lots 27 per cent of the total ration consisted of cottonseed meal. Several of the hogs in Lots III and IV where there was a heavy consumption of cottonseed meal, however, had shaggy coats of hair and made very slow gains.

A brief summary of the results is given in Table 9.

**I. The Ability of the Vitamin B-deficient Rat to Utilize d-Glucose.** (G. A. Schrader).—In continuance of the experiment a more complete study of the beriberi rat has been made. In addition to the usual chemical analyses for glycogen, the respiratory metabolism, in approximately 30-minute periods, was determined for 4 hours following the administration of a glycogen precursor. These determinations were performed on rats which received no vitamin B and showed no symptoms (Group II) and on rats which received adequate vitamin B

**TABLE 9.—Summary of Results in Feeding White Corn with Various Protein Supplements to Hogs During an 84-Day Period.**

| Lot Number | I | II | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|---|
| Av. initial weight per animal, pounds | 59.35 | 59.05 | 59.30 | 59.30 | 59.40 | 59.40 | 59.10 | 58.80 |
| Av. daily gain, pounds | 1.53 | 1.57 | 1.08 | 0.99 | 1.56 | 1.37 | 1.60 | 1.22 |
| Av. amount cottonseed meal consumed, pounds (per cent of ration) | 12.39 | 11.95 | 27.66 | 25.00 | 12.41 | 25.00 | 11.32 | 20.05 |
| Feed required to make 100 pounds gain: | | | | | | | | |
| Corn | 317.47 | 305.30 | 302.98 | 387.82 | 307.31 | 290.24 | 272.56 | 283.90 |
| Supplement | 104.68 | 102.35 | 117.97 | 129.27 | 101.29 | 96.75 | 80.36 | 79.61 |
| Soybean hay | —— | 17.05 | —— | —— | —— | —— | —— | —— |
| Mineral | .94 | 1.21 | 1.54 | 1.56 | .99 | 1.13 | .89 | 1.17 |
| Av. feed cost per 100 pounds gain, dollars | 3.61 | 3.60 | 3.12 | 3.18 | 4.59 | 3.32 | 4.01 | 2.74 |

Price of feed: Corn at 40¢ per bushel.
Tankage at $35 per ton.
Cottonseed meal at $16 per ton.
Minerals at $15 per ton.

(Group III), as well as on the beriberi animals (Group I). All 3 groups of rats received the same diet and their daily food intake was kept as nearly equal as possible. In each group some of the rats were used under basal conditions and others after the administration of 125 mgs. of d-glucose.

It appears that the beriberi rat can utilize d-glucose, both for immediate heat production and for glycogen formation. The heat production of all 3 groups was raised to nearly the same degree, 17, 9, and 15 per cent for Groups I, II, and III, respectively. There also was a rise in the R.Q.'s of all 3 groups. Of the 125 mgs. of glucose administered Group I converted 53, Group II, 72, and Group III, 54 per cent into glycogen. When expressed in terms of total carbohydrate accounted for, i.e., the sum of the administered glucose converted into glycogen and that used for heat production, the percentages were 97, 121, and 89 for Groups I, II, and III, respectively.

**II. Efficacy of Fats in Decreasing the Vitamin B Requirement.** (W. D. Salmon and J. G. Goodman).—When the diet of rats contained 40 per cent of the test fat, the average time required for the development of beriberi on various fats was as follows: butter fat 34 days, hydrogenated cottonseed oil 37 days, Wesson oil 41 days, Crisco 41 days, hydrogenated cocoanut-peanut oil mixture 41 days, pecan oil 46 days. As pecan oil had a significant vitamin B-sparing effect it seemed desirable to determine if the fat in the pecan kernel would affect the accuracy of the usual test for the vitamin B content of food material. Pecan kernel and pecan kernel residue from which the fat had been extracted were tested for their vitamin B content. On the fat-free basis the kernel and the residue were equally efficient in protecting pigeons against the onset of beriberi. Since the pecan kernel contained 67 per cent of fat and the daily protective dose for pigeons was 2.6 gm. it does not seem probable that the fat content of the common food materials will affect the accuracy of the test for their vitamin B content if the pigeon method is used.

**Simplified Rations for Chicks.** (G. A. Trollope, D. F. King, C. T. Bailey).—Eight lots of 100 chicks each were fed various rations composed chiefly of feed products grown on Alabama farms; these rations were supplemented by a simple mineral mixture. This report covers a two-month brooding period, a three-month growing period, and a laying period of six months. The phase of the study which pertains to the laying period is still in progress. The control lot received a well-balanced, ten-ingredient ration which has given satisfactory results over a period of years. A ration of yellow corn meal, wheat shorts, mineral mixture, and skim milk (ad libitum) proved more efficient than the control ration. A similar ration in which no wheat shorts was used proved almost as efficient. The yellow corn meal in simplified rations was superior to white corn meal, even when the birds had access to seasonal green feeds. In general, the simplified rations gave satisfactory growth, were more economical, and resulted in higher egg production than the ration used in the control lot.

**Studies of Force-Molting and Time of Employing the Practice When All-Night Lighting Is Used.** (G. A. Trollope, D. F. King, and C. T. Bailey).—The objectives of this study were to determine the effect of force-molting hens in connection with the use of all-night lights and to determine the proper season to force-molt. Three hundred S. C. W. Leghorns were used in the experiment. Although the work is still in progress the results to date indicate that the season of maximum molt in hens was unaffected by force-molting at different times. The date of force-molting materially affected the duration of the molt. The later the hens were molted the shorter was the duration of the molt. Egg production was increased by force-molting during September.

**Efficient Rations for Laying Hens (Phase C, Peanut Studies).** (G. A. Trollope, D. F. King, and C. T. Bailey).—The objective of this project was to study the supplementary value of whole peanuts, ground peanuts (with and without shells), and peanut meal in rations for laying hens. Ten lots of 40 S. C. White Leghorn pullets each were used.

The basal ration consisted of yellow corn meal, bone meal and salt, with whole white corn for the scratch ration. The control lot received a mash ration of 66 pounds yellow corn meal, 34 pounds dried skim milk, 7 pounds bone meal, and 1 pound salt. Sufficient milk was fed in Lots 5, 7, and 9 to provide equivalent amounts of protein from milk and from peanut sources. The protein supplements used in the rations and summary of results are given in Table 10.

Whole peanuts fed with the basal ration or with whole corn, ad libitum, gave very low egg production and poor body weight. When fed as the sole protein supplement, peanut meal gave higher egg production than any of the other peanut products. Ground peanuts (with shells) in combination with skim milk gave a satisfactory egg production when fed with the basal ration used in this experiment. The efficiency of the peanut products for egg production was materially improved when skim milk was substituted to supply 50 per cent of the protein supplement. The highest rate of egg production was obtained where skim milk was used as the sole protein supplement. Rations that were high in fiber or fat, or both, gave low egg

**TABLE 10.—Egg Production, Weight of Birds, Egg Weight, and Hatchability of Eggs as Influenced by the Protein Supplement Fed.**

| Lot No. | Protein supplement | Average monthly egg production | | Average body weight of birds | Average egg weight | Hatchability |
|---|---|---|---|---|---|---|
| | | number | per cent | pounds | ounces | per cent |
| 1 | Dried skim milk | 17.3 | 57.1 | 3.93 | 1.97 | 81.48 |
| 2 | None | 6.8 | 22.6 | 3.35 | 1.79 | 41.22 |
| 3 | Whole peanuts, ad lib. | 9.1 | 30.0 | 3.29 | 1.88 | 74.47 |
| 4 | Ground peanuts (with shells) | 8.4 | 27.6 | 3.37 | 1.87 | 48.97 |
| 5 | Ground peanuts (with shells) plus skim milk | 16.3 | 53.9 | 3.69 | 1.96 | 65.59 |
| 6 | Ground peanuts (without shells) | 11.2 | 36.9 | 3.39 | 1.87 | 41.67 |
| 7 | Ground peanuts (without shells) plus skim milk | 14.8 | 49.0 | 3.56 | 1.95 | 85.65 |
| 8 | Peanut meal | 12.9 | 42.8 | 3.45 | 1.91 | 74.49 |
| 9 | Peanut meal plus skim milk | 14.1 | 46.8 | 3.63 | 1.94 | 84.26 |
| 10 | Whole peanuts, whole corn, both ad lib. | 4.0 | 12.7 | 3.05 | 1.78 | 78.00 |

production. A direct correlation existed between rate of egg production, egg size, and body weight of birds. The greatest egg weight was obtained on rations supplemented with skim milk.

## BOTANY AND PLANT PATHOLOGY

**Studies of Nut Grass.** (G. L. Fick, E. V. Smith and R. Y. Bailey).—During the growing season of 1932, well established systems of nut grass in the greenhouse and in the field were clipped at regular intervals, varying from one day to one week. The effects of the clipping treatments were followed by making carbohydrate analyses and sprouting tests with the tubers.

The tubers from all clipped areas in greenhouse and field showed a rapid and marked decline in carbohydrate content. By September the starch (the chief storage carbohydrate) in tubers from clipped field plots was reduced to about 2 per cent as compared to 19 per cent in tubers from the control plots. The sprouting capacity of tubers was not so promptly affected; towards the end of the growing season, however, a marked decrease was evident. Results of this experiment indicated that clipping once a week was just as effective as clipping daily. Clipping of the field plots was continued in 1933 and prior to July 1 very few sprouts had appeared on any of the clipped plots.

Sprouting tests were conducted with tubers collected from the field at frequent intervals during the winter. The results obtained indicate that nut grass tubers do not have a well-defined winter rest period but will sprout promptly whenever environmental conditions are favorable.

In order to study the development of the nut grass system, one tuber was planted in each of 100 four-gallon pots containing Norfolk sandy loam. Three pots containing systems of the same age were emptied at 3-day intervals and the progress of the development carefully recorded; material was also taken at significant stages of development and prepared for future histological study. The general trend of development was as follows: The first sprouts to appear developed at the tips of rhizomes which came from buds at or near the apex of the tuber. Three days after the sprouts appeared an enlargement, the basal bulb, was evident at the juncture of each sprout and rhizome. The basal bulbs increased rapidly in diameter and by the ninth day had formed one or more rhizomes. On the eighteenth day new aerial shoots and horizontally growing rhizomes from median and basal buds of the original tuber were first observed. On this date also the first new tubers were found, located on rhizomes which originated from the basal bulb. From the eighteenth to the sixty-ninth day (July 1, 1933) rhizome, tuber, and sprout formation progressed rapidly, resulting in an extensive and complex system of nut grass.

Beginning April 10, 1933, an area of Norfolk sandy loam on the Station farm was plowed with a two-horse turn plow as often as nut grass sprouts appeared. Prior to July 1, 1933, this area had been plowed seven times. Although the number and vigor of nut grass sprouts seem to have been reduced by plowing, some sprouts are still appearing on the area.

**Control of Wild Onion,** *Allium vineale* L. (E. V. Smith).—This work was initiated in October, 1932, with a two-fold object in view: (1) to study the seasonal distribution and activity of bulbs and seeds of the wild onion, and (2) to apply the results of the above study to an investigation of the control of wild onion with creosote-kerosene or other sprays.

Beginning on October 17, 1932, examinations were made at intervals of one week, and the number of bulbs at each stage of activity determined. Approximately 1,200 bulbs were dug each week.

The bulbs began sprouting some time before the project was begun and on October 17 only about 15 per cent of the bulbs were dormant; approximately 40 per cent had sprouted but the sprouts were not above ground, and the other 45 per cent had produced sprouts which were above ground. The bulbs continued to sprout so that on December 26 only about

1.5 per cent of the bulbs were dormant, approximately 1.5 per cent of them had sprouted but the sprouts were not yet above ground, while the remaining 97 per cent had produced sprouts that were above ground.

Bulbs dug on December 19, 1932, were studied in cross section; some of the larger bulbs showed primordia of new secondary bulbs.

Plots, 5 by 10 feet, were established on onion-infested Bermuda grass sod and sprayed on December 20 with a 10-90 creosote-kerosene mixture at rates of 217.8, 435.6, and 653.4 gallons per acre. These plots will be kept under observation.

**The Mycosphaerella Disease of Winter Peas, and Diseases of Winter Peas and Vetches Caused by Ascochyta species.** (J. L. Seal).—*Mycosphaerella pinodes* (Beck. and Blox.) Stone, according to isolation studies, is more generally responsible for diseases of peas and vetches than the two *Ascochyta* species. The latter, however, are frequently encountered in field plantings of winter legumes. Much of the field damage during the past season was associated with failure of inoculation. Peas and vetch, when not properly inoculated, are materially weakened and suffer from the above diseases much more than normal plants. The diseases were far more abundant and spread more rapidly in plantings after the hosts were weakened by late winter freezes. These fungi fruit abundantly on weakened host tissues.

From laboratory studies it has been found that the *Ascochytas* are carried from season to season in and on the seed more commonly than *Mycosphaerella*. All of these organisms may live from year to year in the imperfect stage on old plant parts. However, *Mycosphaerella* may be found producing asci on dead plant tissues during the late spring and summer months. This perfect stage is not essential for the organism to live from season to season in the South, but it does add an additional means of perpetuating the organism.

These organisms gradually die when the host seeds are stored for a number of years. In tests made over a four-year period, however, it was found that, even though the seeds are gradually freed of the organisms, they are so reduced in germinating power it is unwise to plant more than one-year old seeds. By the fourth year the seeds will have completely lost their germinating power.

Crop rotation, planting disease-free seed, and seed treatment to destroy surface-borne organisms offer the most promising means of control.

## ENTOMOLOGY

**Life History and Control of Citrus Insects.** (L. L. English).—LIFE HISTORY WORK.—Seven generations of purple scale, *Lepidosaphes beckii* Newm., were obtained in two years. Three were obtained each summer and one during the winter. The shortest life cycle required 52 days and the longest 148 days. Chaff scale, *Parlatoria pergandii* Comst., has three generations per season, requiring from 57 to 96 days for the completion of the life cycle. Records on the seasonal abundance of rust mite, *Eriophyes oleivorus* (Ash), show it to be a pest of summer and early fall. It is particularly injurious in the late summer.

INSECT CONTROL.—A season program of one application of lime sulphur and two applications of oil gave almost perfect control of rust mite. The treated blocks ran from 0.5 per cent to 1.7 per cent russets, whereas the check block ran 45.6 per cent russets. Lime sulphur at a concentration of 1-50 gave a high kill of purple scale two weeks or less in age. The effectiveness of this spray against older scales is more uncertain and more dependent on weather conditions. A quasi-relationship has been established between the viscosity of spray oils and their effectiveness against purple scale. Within the limits of 64 to 96 seconds Saybolt the median lethal dosage of oil is a straight line function of the viscosity.

**Boll Weevil Control with Calcium Arsenate.** (J. M. Robinson and F. S. Arant).—The work on boll weevil control was limited in 1932 to dusting cotton at Auburn on Norfolk sandy loam soil receiving different rates of fertilizer. The infestation began near the north end of the dusted tier of plots and spread gradually southward to the undusted tier. The percentage of punctured squares was higher on the dusted than on the undusted plots at all times from June 18 to August 2, in spite of the fact that three applications of calcium arsenate were made during this period; the infestation was especially high on plots receiving 1,000, 1,500, and 2,000 pounds of fertilizer per acre. Ten applications of calcium arsenate were made during the fruiting season of the cotton. Four of the dustings, August 8 to 19 inclusive, were affected by rain within 24 hours. The yields of cotton on the various plots were slightly above the six-year average yields. Definite gains in favor of dusting occurred on all fertilized plots. The increased yields of dusted over undusted cotton were 213, 128, 426, and 400 pounds of seed cotton per acre, respectively, for the plots receiving 500, 1,000, 1,500, and 2,000 pounds of fertilizer per acre.

**Turnip Webworm Control.** (J. M. Robinson).—The results of toxicity tests of various insecticides on the larva of this pest under cage conditions indicated that barium fluosilicate, sodium fluosilicate, calcium arsenate, and lead arsenate were the most effective. For quickness of kill they ranked as follows: sodium fluosilicate, calcium arsenate, barium fluosilicate, and lead arsenate. These materials were also tested under field conditions and the same relative toxicity resulted.

The average amount of dust used per acre for sodium fluosilicate was 26 pounds and for calcium arsenate was 9 pounds. From the cage tests and the field tests, it is evident that sodium fluosilicate and calcium arsenate are the most effective materials to use in controlling the turnip webworm larva. When due consideration is given to the amount of dust per acre, the relative cost per pound, the availability of the material over the State, and the further fact that calcium arsenate was approximately as effective as sodium fluosilicate in the cage tests, it is evident that calcium arsenate is the most satisfactory insecticide to control the turnip webworm.

**Life History and Control of the Cowpea Curculio,** *Chalcodermus aeneus*, Boh. (F. S. Arant).—Studies were made in 1932 on certain phases of the life history to supplement studies previously made. The oviposition period of the cowpea curculio began the middle of June and was continuous to the first of October; this was a period corresponding roughly to the fruiting period of the peas. The maximum number of eggs deposited by a single female was 281; the average was 111.1. The maximum number deposited by a female in one day was 10 and the average 2.6. The average number of days in the incubation period was 3.5.

The immature stages of the cowpea curculio were found to be parasitized by a tachinid fly, *Myiophasia globosa,* Tns. Only 2.5 per cent of the curculio observed in 1932, however, were infested.

Not one of the 1,265 beetles placed in the hibernation cages during October 1932 survived the winter. There was a 5-per cent survival in 1931-32.

The third year of tests to determine the susceptibility of varieties was completed. The percentage of punctured peas among the various varieties was as follows: California Black Eye, 61.0 per cent; Six Weeks Pea, 48.4; Virginia Black Eye, 46.7; Dixie Queen Brown Eye, 42.7; Cowpea, 41.9; Conch, 36.0; White Crowder, 34.4; Taylor, 33; Cream Crowder, 30.3; Speckled Crowder, 29.2; Lady Pea, 28.6; Extra Early Black Eye, 28.1; Victor, 20.7. The average percentage of punctured peas for the three-year period was as follows: California Black Eye, 52.8 per cent; White Crowder, 43.9; Cowpea, 42.6; Dixie Queen Brown Eye, 42.4; Virginia Black Eye, 39.7; Extra Early Black Eye, 35.7; Lady Pea, 35.5; Six Weeks Pea, 34.1; Cream Crowder, 31.3; Speckled Crowder, 30.9; Conch, 26.0; Taylor, 25.9; Victor, 20.7.

Dusting tests for the control of the cowpea curculio were continued. Sodium fluosilicate alone or in combination with colloidal silica or gypsum materially reduced the infestation and produced no injury to the cowpea foliage. Lead arsenate and barium fluosilicate burned the foliage of cowpeas rather severely; the cowpea curculio infestation was too low on the peas dusted with these materials to determine their effectiveness.

**Biology and Control of the Southern Corn Rootworm,** *Diabrotica 12-punctata,* Fabr. (F. S. Arant).—The sixth year of tests to determine when to turn legumes and when to plant corn to avoid injury from the Southern corn rootworm was completed in 1933. Legumes were turned March 16, April 4, and April 19, and five plantings of corn were made at weekly intervals, beginning the day following each turning. Considerable injury occurred to the early corn following legumes. Little or no injury occurred to any corn planted May 3 or thereafter. These results are in accord with those of previous years.

**Fungous and Bacterial Diseases of the Pecan Weevil.** (H. S. Swingle and J. L. Seal).—The two parasitic fungi, *Metarrhizium anisopliae* and *Sporotrichium bassiana,* have been successfully reared in large quantities upon corn meal media. Three applications of spores were made to the soil around pecan trees and, while the diseases have apparently become established, satisfactory control of the pecan weevil larvae has not been obtained.

**Life History and Control of the Pecan Weevil,** *C. caryae.* (H. S. Swingle).—The infestation of pecan weevils in 1932 was heavy at Lanett and moderate at Camp Hill, Alabama. The use of jarring as a control measure combined with the work of natural parasites has reduced the infestation at the latter place.

Pupation took place in the fall, from September 9 to October 11. The length of the pupal period was approximately six weeks. A portion of the weevils require two and some three years for the completion of their life cycle.

Jarring was the most successful measure tried for control of the pecan weevil. At Lanett, Alabama, 18,000 weevils were taken from one grove by this method, and over 70 per cent of the nuts were free of worms at harvest.

## HOME ECONOMICS

**A Study of the Calcium and Phosphorus Content of Various Vegetable Foods Grown in Alabama.** (Edna R. Bishop).—The Ca and P content of a given vegetable varies widely, and usually in opposite directions; the Ca/P ratio, therefore, varies markedly. Increased rates of fertilizer with phosphate produce a regular increase in phosphorus content but only a small change in calcium. The plant materials analyzed were grown in a greenhouse.

## HORTICULTURE AND FORESTRY

**The Influence of Fertilizer Treatment on Certain Characteristics of the Irish Potato.** (L. M. Ware).—Laboratory studies during the past year show in a very consistent way that as the rate of application of a complete fertilizer is increased there is a decrease in the percentage of reducing sugars, total sugars, total solids and starch in the tubers and a reduction in the electrical resistance of the juices. Field and storage studies show correspondingly a definite increase in yield and plant vigor and a progressive decrease in the shrinkage of tubers in storage with each added amount of fertilizer. Little or no consistent differences in tubers could be attributed to a given element or to a given source of material.

**Species Composition of Burned and Unburned Forest Plots.** (L. M. Ware).—Data taken this year from one acre plots established in 1926 on a cut-over pine area show a very significant difference in the number of trees of different species on the burned and unburned areas. On the area which has been burned each year since 1926 there were 31 pine, 49 sweet gum, 268 sassafras, and 84 oak. On the area which has been burned at five-year intervals—1927 and 1932—there were 79 pine, 76 sweet gum, 24 sassafras, and 9 oak. On the area which had not been burned, there were 670 pine, 231 sweet gum, 29 sassafras, and 43 oak. Four well spaced pine trees were left on each area for reseeding purposes.

**Causes of Crop Failures on New Ground.** (L. M. Ware and J. K. Boseck).—In the southern counties of Alabama, and especially in the counties bordering the Gulf, crop failures have so often followed the effort to grow crops on new ground that there has developed a general opinion among farmers, and especially among truck growers, that new ground is not suited to the growing of many crops the first year after clearing.

After two years of experimental work in South Alabama, the principal causes of failure have been determined and the fact established that probably any of the truck or field crops generally grown in this section of the state can be grown successfully on new ground the first year after clearing. The almost complete absence of available phosphorus and the very high nitrogen requirement the first year, are the two factors which control crop production in the southern counties of this state on fresh new ground.

Records on six truck crops and as many field crops indicate that where no phosphorus is applied to new ground practically no yield is made. Complete failure with some crops follows where no phosphorus is added. Records on six truck crops also show that a much higher rate of application of nitrogen must be given to crops grown the first year after clearing on new ground than in later years. Laboratory studies have indicated that this is due to a locking up of the added nitrogen by bacterial activity encouraged by the abundant supply of readily available organic material. Nitrogen must therefore be supplied in quantities sufficient to meet the requirements of the individual crop in addition to the nitrogen locked by bacterial activity. It appears now that new ground soils may be made quite productive if it is recognized that available phosphorus is almost absent from fresh land and that more nitrogen must be applied to crops the first year than in later years.

**A Promising Variety of Plum.** (O. C. Medlock).—Observations since 1926 on the performance of the Methley plum indicate that the vigor and productivity of the tree and the quality of fruit are such that growers in Alabama should give this variety a trial. The fruit ripens about June 1 and is good for both dessert and culinary purposes.

## SPECIAL INVESTIGATIONS

**Nodule Numbers and Yields of Spanish Peanut Plants as Affected by Inoculation.** (J. F. Duggar).—Artificial inoculation of unhulled seed peanuts with peanut pure cultures invariably resulted in large increases in average number of both total and large nodules per plant of the Spanish peanut variety grown at Auburn on Norfolk soils. The increase in total nodules in 1930, 1931, and 1932 average 305 per cent on the unfertilized plots planted with unhulled seed, and 142 per cent on those planted with shelled Spanish peanuts.

Yields of dry nuts in four experiments were increased above those of the non-inoculated plants by 27 per cent on the unfertilized plots and by 33 per cent on those that received phosphate.

**Effects of Commercial Fertilizers on Nodule Numbers on Spanish Peanut Plants.** (J. F. Duggar).—Nodule numbers were usually increased above those on the unfertilized plots by applications in 1930, 1931, and 1932 of basic slag phosphate, superphosphate, muriate of potash, or hydrated lime in customary amounts and not in contact with the unhulled Spanish peanut seed. This is in contrast with a depression in nodule numbers, especially on the young plants, where superphosphate and muriate of potash were placed in immediate contact with the unhulled seed.

**Differences in the Formation of Root Nodules on Spanish and Runner Peanut Plants.** (J. F. Duggar).—In each of two years Runner peanut plants not artificially inoculated bore large numbers of root nodules in contrast with scant nodule formation on adjacent uninoculated Spanish peanut plants.