

Bulletin 347

March, 1933

# REPORT OF THE DIRECTOR

For the Year Ending

October 31, 1932



Connecticut  
Agricultural Experiment Station  
New Haven

# CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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## REPORT OF THE DIRECTOR

For the Year Ending October 31, 1932.

*To the Board of Control of the Connecticut Agricultural Station:*

In accordance with custom, I submit herewith my report for the Station year ending October 31, 1932. There is included a brief account of the more important accomplishments during this period, a list of all active projects and other matters for purposes of record.

### **The Station as a Public Service Institution**

In periods of low prices, such as now prevail, farmers as well as other producers must keep down production costs if they are to make a living. Unlike a shop, a farm cannot well be closed up and put in a stand-by condition—the cows continue to give milk and the trees to bear fruit. It becomes, therefore, a question of finding methods that reduce costs, that give the best results most economically.

Herein lies the value of the Agricultural Experiment Station, the function of which is to increase our knowledge of the soil and of plant and animal behavior. A new variety of sweet corn that produces a larger, more uniform crop costs no more per acre to produce than the older, less productive varieties; the control of damage by the Mexican bean beetle means possible profit rather than certain loss if the crop is destroyed; the fertilizer for an acre of tobacco is one of the largest items of cost, so that if cheaper materials can be used, a significant saving will result.

These examples and many others show the special value of research when prices are low. This new knowledge is not obtained overnight, but through years of painstaking study, the pattern growing slowly on the loom, thread by thread, until the whole is revealed.

The Agricultural Experiment Station was created to bring this service to agriculture and to make possible an uninterrupted flow of food into the cities. It maintains laboratories and experimental farms where scientists are constantly turning up new facts for whomever may have the wisdom to use them. As our economic life becomes more complex, as competition becomes keener, new and more efficient methods must be found—the advance of science cannot be allowed to lag behind the need.

But the Experiment Station is more than a mere research institution. It does not hide its light under a bushel. As an agency of the State, its services are free to all citizens. Each day it supplies information on a variety of subjects to both country and city residents. Included in this service are such matters as the inspection of fertilizers, feeds, foods, drugs, insecticides, and fungicides; the examination of seeds for germination and purity; the inspection and certification of nurseries; the control of plant pests such as the gypsy moth, European corn borer, Japanese beetle, and white pine blister rust; the elimination of mosquitoes; the identification of plant diseases and insect pests.

When one considers that the total cost to the State of the Station's work is less than 14 cents per capita annually, it seems astonishingly small. This is equivalent to the usual price of a quart of milk. It is patently impossible to measure the value of either research or service in dollars and cents. Sometimes an isolated case may be cited, like the discovery that our tobacco soils have a large reserve of phosphorus. As a result the phosphorus content of the fertilizer used has been reduced, resulting in a saving of about \$3.00 to the acre, or conservatively, \$50,000 a year to the tobacco growers of the State.

### **Finances**

The general conditions make it imperative that public expenditures be made economically and wisely. By careful planning, the last fiscal year was ended with a substantial balance, which will be even larger this year. No essential work or service has been abandoned, nor any of the permanent staff dropped.

For the biennium 1933-1935, the estimates submitted to the General Assembly are 16 per cent less than the amount last appropriated. Even with this substantial reduction, it is believed that we can carry on satisfactorily.

### **The Jenkins Laboratory**

The new Jenkins Laboratory was dedicated October 11 with a program planned also as a tribute to the late Dr. Edward H. Jenkins, Director Emeritus, for whom the building was named. He died November 6, 1931.

The program of the dedication, and the addresses delivered, are given in full in *Bulletin* 345.

Four departments, Botany, Entomology, Plant Breeding, and Forestry are housed in the new laboratory. They are now provided with adequate space for the first time in many years.

**Progress of the Station's Work****Analytical Chemistry**

Special attention has been given to the subject of spray residues on fruits and vegetables, extending the work done last year. The stricter tolerance of 0.01 grain of arsenic ( $\text{As}_2\text{O}_3$ ), to a pound as adopted and announced by the United States Department of Agriculture early this year, has been used in our recent examinations. Samples of vegetables have included celery, lettuce, cabbage and string beans; the examination of fruits has been confined to apples. In general, the amounts of arsenic found have not exceeded the tolerance. In a few instances apples have shown excesses. Our own experience, and that in other States, indicates that treatment with dilute acid will effectually remove arsenic spray residue at the time of harvest and we have suggested this procedure.

The work of the year has been largely occupied with inspections and analyses required by the statutes concerning Fertilizer and Feeding Stuffs control. This involved analysis of 903 samples of fertilizer and 1016 samples of feeding stuffs. The new regulation requiring that statements of guaranty for mixed fertilizers should be expressed in terms of nitrogen, available phosphoric acid ( $\text{P}_2\text{O}_5$ ), and water-soluble potash ( $\text{K}_2\text{O}$ ), and that percentages be stated in whole numbers, has become effective without confusion or difficulty.

In addition to food control work done for the Dairy and Food Commissioner on carbonated beverages, fats and oil, ice cream, meat products, milk products and miscellaneous foods, considerable attention has been given to the examination of eggs in collaboration with the Commissioner of Agriculture in an effort to harmonize the administration of the egg grading statute and the older statute relating to cold storage eggs.

A considerable amount of time has been given to the investigation of cases of poisoning of farm animals. This is done in cooperation with the Commissioner on Domestic Animals or with the State Police and sometimes directly for individual owners. It is often difficult or impossible to determine the probable cause of death in these cases, particularly if the deaths have been due to poisonous plants, as the evidence in several instances strongly indicated.

The chemist in charge has assisted the Dairy and Food Commissioner and the Director of this Station in preparing a revision of the Rules and Regulations for carrying out the provisions of the Food and Drug law of the State. He has continued to serve as a member of the Food Standards Committee of the United States Department of Agriculture; and of the Council on Pharmacy and Chemistry and the Committee on Foods of the American Medical Association.

**Biochemistry**

The chemical investigations of the tobacco plant have been continued as a major project. The chemical changes that occur dur-

ing curing are complex but once understood, they throw light on many problems of plant physiology. An exhaustive study of these changes has been completed and prepared for publication. A new method for the determination of nitrates in plant tissues was developed in the course of this investigation. The study of the organic acids of the tobacco plant also has been continued and a report is being written.

Bulletin 339, published during the year, reports the series of studies on the chemistry of the tobacco seed, mentioned last year. The chief protein is of the globulin type that can be prepared readily by the usual methods. No nicotine seems to be present in the seed, but it is produced very soon after sprouting. Tobacco seed was fed to rats, mice and pigeons with satisfactory results, but chickens do not seem to thrive.

In the field of protein chemistry a new method for cystine has been developed; also the basic amino acids of egg albumen have been restudied and a review of the more recent contributions to the theory of protein structure has been prepared.

#### Botany

What seems to be the oldest living chestnut tree in the state was found in Lebanon. It is more than 2 feet in diameter at the base. A considerable portion has been killed by the chestnut blight, but several living branches still remain. An effort will be made to keep the tree alive.

The Station Botanist has grown several hundred native chestnut seedlings that will be sent to interested residents who wish to cooperate by planting these and reporting their condition from time to time. The object is to learn whether the disease organism has lost its virulence, in which case we might expect to bring healthy trees to maturity.

Stewart's disease on sweet corn appeared in the State for the first time and brought 40 calls from growers. The peculiar weather conditions probably aggravated the trouble, which is caused by a bacterium carried on seed.

Late blight on tomatoes, so far very rare in Connecticut, caused heavy damage on a few farms. As in the case of Stewart's disease, this was increased by the weather conditions.

Over 400 samples of seed were tested for germination and purity, 300 of which were official samples collected by the Commissioner of Agriculture. The detailed report was published as Bulletin 14 of the State Department of Agriculture.

The spraying experiments on fruits, especially apples, were continued as usual. Corroborating previous results, a spray of lime, lead arsenate and fish oil controlled sooty blotch as well as did the sulfur sprays. Also, it proved effective as a summer spray for apple scab.

A detailed study of the morphology and microchemistry of the tobacco seed was made in collaboration with the Biochemical Department. It involved paraffin sections of the dormant seed as well as of the young seedlings. The presence and location of protein, fat, and starch were determined by microchemical methods. The report was published at Part IV of Bulletin 339.

The field experiments on the control of vegetable diseases are now in their third year and have yielded some interesting results. Calcium cyanamid has controlled clubroot of cabbage and cauliflower as effectively as lime. Spraying potatoes with 8-8-50 Bordeaux mixture gave much larger yields than 4-4-50 or copper lime dust.

The new quarters in the Jenkins Laboratory have made possible proper arrangement of the herbarium, a most valuable and useful part of the department's equipment.

#### Entomology

The Oriental Fruit Moth continued as a major project. Mass production of the *Trichogramma* made possible the liberation of 22 million of this parasite in 150 peach orchards. Of the *Macrocentrus* more than 30,000 adults were reared, considerable progress having been made on methods of artificial production.

After the parasites are released, there remain many problems in the orchard. For example, what effect do sprays and dusts have on parasitism? Indications are that heavy applications of sulfur retard the development of the parasites. On the whole, the parasite work has been very successful and a marked reduction in fruit moth injury is reported.

Another unwelcome immigrant is the Mexican bean beetle, to which much time has been devoted. Two lines of attack have been followed—cultural practices and the use of insecticides. String beans were planted every 10 days from May 2 to July 21. Plantings before May 15 and between June 1 and 11 produced a fair crop without the use of insecticides. All other plantings required two sprays. However, in all cases, spraying increased the yield. Various spacing was also tried, from 2 to 8 inches in the row. The 6 and 8 inch spacing produced the highest yield of marketable beans, largely because the wider spacing makes possible a better application of sprays.

The red pine has been extensively planted throughout the northeastern states, but is now threatened by the European pine shoot moth, which has recently spread quite rapidly. The life cycle of the insect has been determined and much information regarding its habits has been obtained. The relation of the insect to red pine has been investigated, particularly the relation of the environment to the pest's injuriousness. Control measures have been carried out on certain areas, particularly by means of removing infested tips, and the results obtained from one season's work will be determined

this winter. Several plantation owners have attempted to control the insect on their own property and the effect of these measures is being investigated.

The examination of red pine plantations in the northeastern and northwestern parts of the state continues, the object being to obtain more information regarding the distribution of the insect and the intensity of the infestations.

Several native insects which parasitize the shoot moth have been reared from material collected in the field, and their relative abundance will be determined. The Federal Bureau of Entomology has sent colonies of the following European parasites, all of which have been liberated in infested plantations near New Haven: *Copidosoma geniculatum* Dal., *Cremastus interruptor* Grav., and *Orgilus obscurator* Nees.

Laboratory experiments with insecticides indicate that a combination of an ovicide and a larvicide may prove very efficient in controlling the insect on ornamental trees.

No satisfactory control is known for the flea beetle, which causes serious injury to potatoes. Therefore, a new series of experiments has been started, which includes both the life history and control. This pest apparently has only one complete generation in Connecticut. The adults emerged from early in July until September. From 38 to 80 days were required for complete development from egg to adult. A large percentage of the beetles matured in a period of 46 to 50 days.

Lead arsenate diluted 1½ pounds to 50 gallons of water with one pint of fish oil was superior to 4-4-50 Bordeaux mixture in increasing the yield. Calcium arsenate and barium fluosilicate with fish oil were not satisfactory. These tests were made on overwintering adults on Irish Cobbler potatoes. In the laboratory barium fluosilicate was very toxic to the beetles, and lead arsenate and calcium arsenate much less toxic. Bordeaux mixture killed no beetles, but was an excellent repellent.

Other new research projects deal with clothes moths, mosquitoes, the white apple leaf hopper, and certain forest insects.

Control and service duties occupy a considerable number of the staff. The number of nurseries in Connecticut has now reached 350, all of which must be inspected. In the fight against the gypsy moth, 41 towns were covered in whole or in part. Several large outbreaks were discovered and suppressed. One thousand six hundred and twenty-nine miles of roadway and 7,706 acres of woodland were scouted, 14,479 egg masses creosoted, and 75,335 pounds of lead arsenate applied as spray.

Under the anti-mosquito statute, the Station is charged with the duties of maintaining the ditches, dikes and other works. Eleven thousand five hundred and sixty acres in 18 shore towns are now under supervision.



The quarantine for the European corn borer has been removed, the Station's efforts now being concentrated on the enforcement of the "clean-up" statute. In April 22 inspectors covered the entire state and found 3,750 cases where the stalks were not properly disposed of. With seven exceptions, these persons willingly cooperated by destroying the stalks.

The Japanese beetle is now well distributed over the state, and the control program consists of giving information to citizens who wish to treat lawns, and in the placing of traps in heavily infested areas. All nurserymen or florists who ship outside the quarantined area need certification, and inspection is a large part of this program.

#### Forestry

The experimental forest plantations at Rainbow had reached the stage where improvement cuttings were badly needed on many of the 70 plots. A detailed study of these was made in 1932, and a program of experimental cuttings prepared. In response to a local demand for firewood resulting from the general economic conditions, more than 30 families were given permission to cut in accordance with this program, and by Christmas of 1932 more than 125 cords of wood had been removed from the plantations without cost to the Station, except for supervision. Not only will a great improvement in the silvicultural condition of the plantations result, but a winter's supply of wood will be provided for many needy families. After the completion of these cuttings, growth measurements will be made and data secured for a progress report, which should be ready for publication by the fall of 1933.

The relation of soil characters to the growth of trees is an almost unexplored field. The extensive series of plots laid out on the Cockaponset and Meshomasic State Forests in 1926 and 1927 to determine the relation between distribution of forest trees and soil type, were re-read. This involved the remeasurement of about 20,000 stems. It appears that in the younger forests certain species such as blue beech, red cedar, and gray birch are dying out rapidly. In the older forests there is little change in species; some individual trees have died, but other enduring shade species, such as hard and red maple, are coming in. About 85 smaller plots were re-read for the changes in the forest floor vegetation. New plots have been laid out to determine further the relation between soils and forest trees.

Sixteen milacre plots were laid out in the mixed hardwood forests of central Connecticut to determine the amount, kind and composition of the litter, which falls to the ground each year. The composition of the forest surrounding each plot is known. The technique of recovering the litter is a difficult one and must be further perfected.

During the growing season, the progress of height growth was measured on several species of conifers and hardwoods to determine the relation of such growth periods to climatic conditions.

With the disappearance of the chestnut, Connecticut lost its market for posts and poles, it being assumed that other native woods are unsuitable. However, the possibility of treating these cheaply with creosote seemed promising and in 1928, 40 posts each of white pine, pitch pine, gray birch, red maple, and popple were subjected to several types of treatment and set in the ground at the Tobacco Substation, Windsor.

Each year some of each kind were removed and examined. With the exception of pitch pine, all untreated posts were badly decayed in four years. A two coat brush treatment increased the life somewhat; those given open tank treatment showed no sign of rot in three years. These experiments are being continued on a larger scale, this being possible through the cooperation of the State Highway Department.

Since the Station began work in forestry in 1902, the distribution of forest planting stock has been one of its important services. Last year 990,000 trees were furnished at cost to owners of land within the state. This number is 30 per cent less than the previous year, for reasons that are obvious.

The blister rust eradication work included four phases: Eradication of currants and gooseberries growing near white pine, nursery sanitation, field studies, and the furnishing of information to pine owners. The destruction of 135,672 gooseberry and currant bushes gave protection to 1,293 acres of pine land. A considerable number of nurseries were surveyed and Ribes-free zones established around them.

#### Genetics (Plant Breeding)

Spanish Gold sweet corn, first sent out for trial in 1929 was sold by 14 seedsmen in 1932 and seems to have made a place for itself as an extra early variety of yellow sweet corn. In many trials during the past season it was the first to produce marketable ears.

During the past season preliminary tests have been made under farm conditions of a new hybrid sweet corn called Gold Cross. This corn of the Whipple type has the uniformity and productiveness characteristic of crossed corn and has been developed especially for market gardeners as an early mid-season variety having good sized ears and bright, attractive kernel color.

The comparative production of dry matter in ensilage corn of different time of maturity is being studied. The varieties are those of the latest maturity obtainable. Up to the present time the largest growing and latest varieties have produced the most total dry matter. Varietal hybrids between southern types of corn and locally adapted

varieties are also being tested for dry matter production in the expectation that some of these will combine something of the large growth of the southern types with the dry matter content of the earlier native sorts.

Corn has now been inbred by self-fertilization for 27 generations: One line separated in the first 17 generations into two separate lines and self-fertilized for 9 more generations, has shown significant differences in height of plant and in size and shape of ear, which indicates either that complete uniformity and fixity of type has not been obtained after 17 generations of self-fertilization, or that mutation has taken place.

The dioecious corn produced from the combination of two aberrant plants has continued to produce only pistillate and staminate individuals through three generations. The further study of this original production of separate-sexed plants has involved the introduction of other factors in the chromosome that contains the sex-differentiating factors, in an attempt to produce sex-linked characters that will closely parallel the condition in other plants and in animals.

Some 400 selections of seedling strawberries have been made from a large number of crosses between inbred strains of Howard, Chesapeake, Glen Mary, and other varieties. These will be grown and tested in larger quantity with the aim of finding among them a more attractive berry with the Howard type of foliage and with the same productiveness. Another object is to find out the advantages, if any, of inbreeding before crossing strawberries.

Beets are naturally self-sterile. A method has been developed to produce inbred beet seed by enclosing in a bag branches from two plants of the same family. Two generations of seed have been produced in this way. Some method of controlling pollination is necessary to secure the desired uniformity in shape and color of roots. The results with carrots show that two generations of self-pollination have produced lines differing markedly in shape and color of the roots.

Continued self-pollination, accompanied by selection of the most desirable types, in yellow summer squash has resulted in a reduction in vegetative growth but, at the same time, an increase in the number of squashes. Uniformity of shape and color are more easily controlled in inbred lines and some promising strains of straightneck squash have been isolated.

Different strains of New York lettuce in duplicate plantings produced from 48 to 99 per cent of marketable heads. This shows the need of strain testing to determine the seed best adapted to eastern conditions. Single plant selections when tested in progeny rows have also shown marked differences in ability to head, demonstrating the possibility of producing commercial types of head lettuce better adapted to local conditions.

In the vegetable strain trials at Windsor, in addition to lettuce, new beets, carrots, tomatoes, squash, peppers, and egg plant, have demonstrated certain advantages for Connecticut conditions.

#### Soils

Greenhouse and laboratory studies of a series of typical market garden fields have shown that the residual effect of previous heavy fertilization has practically eliminated phosphorous as a limiting factor. Potash fertilization may be neglected for one or two crops without serious results, but a third crop suffers severely when potash is omitted from the treatment. Nitrogenous fertilization must be liberal for every crop, since little available residual nitrogen has accumulated in these soils, even when heavily manured.

Rate of application experiments for the three important fertilizer nutrients on a composite of several important Connecticut soils has revealed significant differences in relative growth responses at different levels of fertilization for tobacco, oats and carrots, under greenhouse conditions.

Microchemical tests for soluble potassium and manganese have been developed, in addition to those previously announced for acidity nitrates, and available phosphorus.

The fertilizer experiments with vegetable crops have been continued on the Windsor field, with results in general agreement with those of previous years. Available nitrogen supply and organic matter appear to be the most significant variable factors.

The lysimeter studies at Windsor have been continued with no material change since last year. Successive years show decreasing amounts of calcium and increasing potassium concentrations in the drainage waters from both the surface soil and 20-inch depths. No lime has been applied. The readily exchangeable calcium supply of these soils is apparently being depleted by the heavy nitrate leachings. Cover crop experiments in the new tanks started in 1931 indicate a considerable conservation of nitrogen as compared with tanks fallowed between tobacco crops.

#### Tobacco Substation

Most of the potash fertilizer experiments, which were carried on for a number of years, have been summarized and published. Tests with cottonhull ashes, included more recently, are continued. Up to the present this source of potash has not produced quite as good results as other sources tested.

Tests with single sources of nitrogen have been made for a number of years and are still continued. In 1932 experiments on combined organic sources, as well as tests of quantity of nitrogen, have been included.

The need of liming materials for tobacco may be determined by the reaction of the soil. Soil testing is done on application at the Tobacco Substation.

Tests with stable manure on shade tobacco were carried on at F. S. Holcomb's farm in West Granby. The results from manure are less favorable than those from commercial fertilizers alone.

Curing of shade tobacco under controlled conditions of temperature and humidity was continued in 1932, in an attempt to find means of improving the colors of the later pickings. It appears that a temperature of 90 degrees F. will produce better colors than 85 degrees, on leaves of the third picking. The humidity was held at 70 to 75 per cent.

Experiments on the control of curing under shed conditions were begun last summer. Preliminary runs showed that a temperature of 90 degrees F. during the firing period was satisfactory, and could be maintained with very little fluctuation. Firing was continued until a marked drop in relative humidity indicated that the greater part of the water had been removed from the leaves. The use of artificial humidification in the shed was also studied.

Studies on the rate of nitrification of nitrogenous fertilizer materials were started on the single source of nitrogen plots. Nitrification during the first six weeks of the growing period was at a low level, due to the dryness of the soil, and growth was correspondingly small. Adequate rains during the latter part of July stimulated nitrate production, and the growth during this period was very rapid. Heavy rains in early August caused a rapid removal of nitrates at about the time of harvest.

After three years of experimenting with barium fluosilicate as an insecticide for controlling the potato flea beetle on tobacco, it has been found that this material applied at a rate of 4 to 5 pounds to the acre, once every 10 days, will hold the insect in check and leave little or no residue. In order to distribute such a light dosage evenly, the material may be diluted with tobacco dust.

The tobacco bud worm (*Chloridea viriscens* Fab.) of the south appeared in many places in Connecticut during the summer of 1932, causing some injury. This is its first appearance in a good many years.

Intensive studies on wireworms are being continued with special regard to the activity of the insects throughout the season in order that some means of control may be worked out.

### The Station Library

During the year there were added to the Station library approximately the following number of accessions of permanent value.

U. S. Department of Agriculture bulletins and reports.....	930
State Agricultural Experiment Station publications.....	1759
Scientific and agricultural journals (domestic and foreign)....	3431
Single books purchased.....	62
Total .....	6182

Most of the United States Department of Agriculture and State Agricultural Experiment Station publications are received in pamphlet form. These and also the scientific and agricultural journals which are of sufficient value to be purchased, are later combined into cloth-bound volumes.

Journals purchased now number 88. About 25 domestic farm journals and 28 foreign agricultural journals are being received in exchange for our bulletins. The total number of cloth and paper bound volumes of all sizes is 17,200.

### **Station Meetings and Exhibits**

In view of the dedication exercises of the new Jenkins Laboratory, the inclusive annual Field Day on the Mount Carmel farm was omitted. Instead, smaller meetings were held for the benefit of groups interested in particular experiments.

On June 11 strawberry growers were invited to the Mount Carmel farm to see the Station's tests of 53 new strawberry varieties and to view our breeding studies, which comprised 8,000 seedling crosses.

Vegetable growers met June 18 and August 20 on the Windsor experimental field. Here they saw our three-year-old study of vegetable fertilization and our expanded work in vegetable breeding and variety tests.

The Station cooperated with the New Haven County Farm Bureau in a demonstration of night orchard spraying on the Mount Carmel farm July 7. Fruit growers appeared to be much interested in the light, which was a powerful acetylene lamp with special type of reflector that threw a wide beam.

Vegetable pest control and vegetable breeding experiments on the Mount Carmel farm were exhibited August 13 in a field meeting, in which the New Haven County Farm Bureau cooperated.

The ninth annual Conference of Entomologists Working in Connecticut was held at the Station October 28. Papers were read by both amateur and professional entomologists from Connecticut and outside the state, and the new quarters of the Entomology Department in Jenkins Laboratory were inspected.

The Department of Plant Breeding exhibited at the Sixth International Congress of Genetics held at Cornell University in August, ears of corn illustrating studies in the breeding of maize. The exhibit included samples of the oldest inbred corn in existence, dated 1905; samples of Burr Leaming and Canada Leaming crossed corn, and the parents of both; dioecious corn; ears showing abnormal sugary segregation; and the following crossed sweet corn: Gold Cross, Green Cross, Redgreen, and Yellow Cross.

**Changes in Staff**

No changes in the Station staff occurred during the year.

**Projects for 1932-33***Analytical Chemistry*

1. Inspection of fertilizers.
2. Inspection of feeding stuffs.
3. Inspection of foods and drugs.
4. Calibration of Babcock glassware and thermometers.
5. Analyses of insecticides and fungicides.
7. Analyses of special and miscellaneous foods.
8. Collaborative studies on analytical methods.

*Biochemistry*

1. Cell chemistry.
  - a. A detailed examination of the nitrogenous constituents of plant cells, in particular those of leaf tissues. The further development of methods for the determination of the different forms of nitrogen in extracts of such tissues.
  - b. An investigation of the nitrogenous constituents of the tobacco plant with special reference to the changes that occur during curing.
  - c. An investigation of the composition of tobacco seed.
2. Protein chemistry.
  - a. The methods for the determination of the basic amino acids yielded by proteins with the object of increasing their accuracy and convenience.
  - b. The methods for the separation of other amino acids yielded by proteins.
  - c. The properties of certain of the amino acids and their derivatives.
  - d. Methods for the preparation of pure proteins on a large scale with the object of obtaining material for chemical and nutritional study.
3. Nutrition investigations.
  - a. The relation of diet to the rate of growth with special attention to certain factors that appear to determine rapid growth.
  - b. The investigation of the relation of certain constituents of the diet to the growth of skeletal tissue.
  - c. The relation of rate of growth to well-being as shown by the investigation of certain organs and tissues.
  - d. The relation of the rate at which growth has occurred to the basal metabolism of the rat.

*Botany*

2. The nature and cause of mosaic disease of plants.
5. Plant disease survey of Connecticut.
8. Spraying and dusting experiments on apples and peaches. (See also Entomology No. 3.)
15. A study of the virulence of the chestnut blight.
16. Tobacco diseases, especially black and brown rootrot.
20. Diseases of shade trees.
23. Rogueing as a control for raspberry mosaic. (With U. S. Dept. Agr.)
24. Studies of the morphology of the willow scab fungus.
27. An investigation of an elm disease in Connecticut.

28. Studies on the identification of apple varieties by seed characters.
29. The absorption of nitrogen through the leaves of the plant.
30. Control of diseases of vegetable crops.

*Control and Service*

12. Seed testing.
25. Spray service (with the Extension Service).

*Entomology*

3. Spraying and dusting experiments on apples and peaches. (See also Botany, No. 8.)
9. Insect survey of Connecticut.
17. Studies in the control of the Oriental fruit moth.
21. Control of the spinach leaf miner.
28. Investigations on oil sprays.
29. Control of the Mexican bean beetle in Connecticut.
30. A study of insects that attack the tobacco plant. (See also Tobacco Substation, No. 20.)
31. Studies on the biology and control of the European pine shoot moth. (See also Forestry, No. 13.)
32. The biology and control of the potato flea beetle.
33. Mosquito control.
34. Clothes moths.
35. The biology and control of the white apple leafhopper.

*Control and Service*

10. Inspection of orchards and nurseries.
11. Control of gipsy moth. (In cooperation with U. S. Dept. Agr.)
12. Elimination of mosquito nuisance.
13. Inspection of apiaries.
19. Control of the European corn borer. (In cooperation with U. S. Dept. Agr.)
24. Control of the Asiatic beetle.
25. Control of the Japanese beetle. (In cooperation with U. S. Dept. Agr.)
27. Rearing and distributing parasites of the Oriental fruit moth.

*Forestry*

1. Experimental plantations on a sandy tract at Rainbow.
  - a. Comparison of many species of conifers and hardwoods, in pure stands and in combinations.
  - b. Methods of management for those species that have survived.
  - c. Studies on growth and habits of the several species.
2. Effect of thinning in white pine at Shaker Station.
3. Effect of thinning in hardwoods at Quassipaug Lake.
6. Studies of forest plantations throughout the state.
  - a. Comparative growth of various species.
  - b. Reasons for success or failure.
  - c. Soil and other site factors necessary for success of each species.
10. An investigation of the distribution and growth of forest trees as influenced by soil conditions and other site factors.
11. Coniferous seed bed study to determine:
  - a. The value of fertilizers in seed beds.
  - b. The value of different amounts of seed.
  - c. The value of dusts and sprays in preventing dampening off.
12. A study of preservative treatments of native woods used for posts.
13. Studies on the biology and control of the European pine shoot moth. (See also Entomology, No. 31.)



*Control and Service*

5. Distribution of forest planting stock. (Under Clarke-McNary Act.)
7. Control of white pine blister rust. (With U. S. Dept. Agr.)

*Genetics (Plant Breeding)*

1. A genetic study of hereditary characters in corn involving their linkage relations and variability.
2. The effects of inbreeding and crossing upon corn.
3. Methods for the improvement of naturally cross-fertilized plants by selection in self-fertilized lines, with particular attention to field corn for grain and ensilage; alfalfa; some of the more important vegetable crops, such as sweet corn for market gardening and canning, beets, carrots, cucumbers, melons, squash, and some fruits, such as bush fruits and strawberries.
4. Methods for the improvement of naturally self-fertilized plants, with particular attention to tobacco and vegetable crops such as lettuce, lima beans and tomatoes.
5. A study of variation and the effects of selection in strains of cross-fertilized and self-fertilized vegetables.

*Soils*

1. A descriptive inventory of Connecticut soil types in relation to their use for crops, pasture and forest.
2. The physical and chemical characteristics of important soil types in relation to the nutritive response of tobacco and other crops when these soils are variously treated in the greenhouse.
3. Nutrient requirements of vegetable crops on important soil types used for market gardening in the state.
4. A study of the physical, chemical and biological conditions of several soil types in natural mixed hardwoods and in planted coniferous forests.
5. Lysimeter studies of the drainage losses and other changes that occur in several soils under heavy fertilization as practiced for tobacco and vegetables.

*Tobacco Substation*

1. Fertilizer experiments—various sources and rates of nitrogen, phosphoric acid and potash.
2. Field tests with farm manure.
4. Tobacco nutrition studies—the role of nitrogen, sulfur, chlorine, potassium, calcium, manganese, boron and magnesium.
5. Improvement of Havana seed tobacco. (With U. S. Dept. Agr.)
6. Improvement of Broadleaf tobacco.
7. Improvement of Cuban shade tobacco.
8. The effect of various winter cover crops used on tobacco land.
11. Soil reaction in relation to tobacco.
13. Preservative treatment of shade tent poles. (See Forestry, No. 12.)
17. The role of humidity and temperature in curing tobacco.
20. A study of insects that attack the tobacco plant. (See also Entomology, No. 30.)
23. Studies on the rates of growth of tobacco.

## Publications

### *Bulletins of the Station*

- REPORT ON COMMERCIAL FERTILIZERS FOR 1931. E. M. Bailey. No. 331.  
 THE MEXICAN BEAN BEETLE IN CONNECTICUT. Roger B. Friend and Neely Turner. No. 332.  
 MICROCHEMICAL SOIL TESTS. M. F. Morgan. No. 333.  
 POTASH REQUIREMENTS OF THE TOBACCO CROP. P. J. Anderson, T. R. Swanback, and O. E. Street. No. 334.  
 REPORT OF TOBACCO SUBSTATION AT WINDSOR FOR 1931. P. J. Anderson, T. R. Swanback, and O. E. Street. No. 335.  
 REPORT ON INSPECTION OF COMMERCIAL FEEDING STUFFS FOR 1931. E. M. Bailey. No. 336.  
 REPORT OF THE DIRECTOR, 1931. W. L. Slate. No. 337.  
 THIRTY-FIRST REPORT OF THE CONNECTICUT STATE ENTOMOLOGIST. W. E. Britton, Ph.D. No. 338.  
 CHEMICAL INVESTIGATIONS OF THE TOBACCO PLANT, III. TOBACCO SEED. Hubert Bradford Vickery, Lafayette B. Mendel, Alfred J. Wakeman, Charles S. Leavenworth, and Florence A. McCormick. No. 339.  
 THE FOOD VALUE OF MILK, A REVISION OF BULLETIN 215, 1919. No. 340.  
 REPORT ON FOOD AND DRUG PRODUCTS. E. M. Bailey. No. 341.  
 PROFILE CHARACTERISTICS OF NEW ENGLAND FOREST SOILS. Herbert A. Lunt. No. 342.

### *Circulars of the Station*

- Requirements for Tree Workers in Connecticut. No. 81.  
 Testing Vegetables for Connecticut, Results for 1931. Donald F. Jones and Lawrence C. Curtis. No. 82.  
 Lawn Seeding and Care. No. 83.  
 The Elm Leaf Beetle Outbreak. W. E. Britton. No. 84.  
 Quarantine Restrictions Affecting Shipments of Connecticut Plants 1932. W. E. Britton. No. 85.  
 Regulations Concerning Transportation of Nursery Stock in the United States and Canada. Compiled by W. E. Britton, State Entomologist. No. 86.

### *Journal Papers*

- VICKERY, HUBERT BRADFORD. Biographical memoir of Thomas Burr Osborne, 1859-1929. Nat. Acad. Sci., Biographical Memoirs, 14, Eighth Memoir, 261-304. 1931.  
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- VICKERY, HUBERT BRADFORD, PUCHER, GEORGE W., and WAKEMAN, ALFRED J. The determination of nitrate nitrogen in plant tissues. Proc. Amer. Soc. Biol. Chem., Jour. Biol. Chem., **97**: lxxxix-xc. 1932.
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- FRIEND, R. B. The control of the cabbage maggot, *Phorbia brassicae* Bouché, on radishes. Jour. Econ. Ent., **25**: 709. 1932.
- FRIEND, R. B. Die Forstinsekten Mitteleuropas, by K. Escherich (Review). Jour. Econ. Ent., **25**: 420. 1932.
- FRIEND, R. B. Die Tierische Schädlinge des Ackerbanes, by Sophie Rostrup and Mathias Thomsen (Review). Jour. Econ. Ent., **25**: 149. 1932.
- GARMAN, PHILIP. How should the grower expect to control apple leaf-hopper. Proc. 41st Ann. Meeting Conn. Pomol. Soc.: 38. 1932.
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All of which is respectfully submitted,

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