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Connecticut Agricultural Experiment Station
New Haven, Connecticut

REPORT OF THE DIRECTOR

FOR THE

YEAR ENDING OCTOBER 31

1928

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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As of

October 31, 1928

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Press of The Wilson H. Lee Co., New Haven, Conn.

Report of the Director

For the Year Ending October 31, 1928

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

In accordance with the usual custom, I have the honor to submit herewith a statement regarding the work of the Station for the past twelve months, together with other information of a pertinent nature. Our Station, the first to be established in this country, has now completed fifty-three years of service to Connecticut agriculture. With this in mind, the following note on its history and record may be appropriate.

The agricultural experiment station had its origin in Europe, the first having been established at Mockern, Germany, in 1851. By 1873 there were sixty-three such stations in continental Europe supported by agricultural societies or by the states in which they were located. The first privately endowed station was established at Rothamsted, England.

In 1853, Samuel W. Johnson, a young graduate of Yale University went to Germany to study chemistry, particularly its application to agriculture. While there he visited several of the experiment stations and studied under some of the famous agricultural chemists of that day. Returning to Yale as an instructor in chemistry, he was appointed Chemist to the State Agricultural Society. During the next twenty years he never ceased to urge in his lectures and in the press, the need of agricultural stations in this country, and as a result of his labors, the Legislature of 1875 secured to Connecticut the honor of establishing the first agricultural experiment station in America. Connecticut having pioneered in the movement, several other states followed, until in 1887 Congress passed the Hatch Act, providing for a station in each state.

The duties of the Station as defined in the statute are three-fold: the analysis of fertilizers, feeds, drugs, foods and other products for the protection of the people of the State; the conduct of "scientific investigation and experiments" in agriculture and related sciences; the dissemination of the results.

As an example of the first, the fertilizer inspection of 1928 disclosed the sale of a brand of fish meal to which had been added sulfate of ammonia, thus causing a low grade fish to show the same amount of total nitrogen as does the high grade product. These facts were made known immediately and the purchasers have been reimbursed by the dealers who unwittingly sold the goods.

Other direct services include the inspection of nurseries and orchards, the control of insect pests and plant diseases, the dis-

tribution of forest planting stock, the testing of seeds, advice on the management of land and the like.

Under the head of "experiments" might be listed a long series of investigations covering the fifty-three years of the Station's existence. Notable among them are those dealing with corn breeding, the white pine blister rust, the chestnut bark disease, tobacco wild fire, tobacco root rot, the nature of the vegetable proteins, the discovery of the vitamines and studies on the food value of milk. For this last it is fair to say that most of our recent knowledge of the food value of milk and the resulting increase in its consumption are traceable to the contributions of the Station.

The dissemination of results is accomplished through bulletins, lectures, the work of the Extension Service, correspondence and many personal visits to farms and orchards. The Station is not only a research institution—it is and always has been a service agency for the people of the State. The following quotation from the Report for 1902 truly describes the policy that the Station has always tried to follow: "It is the wish of the Board of Control to make the Station as useful as its resources will admit. Every Connecticut citizen who is concerned in agriculture, whether farmer or resident of a city, has the right to apply to the Station for any assistance that comes within its province to render, and the Station will respond as far as lies in its power."

REVIEW OF THE YEAR

The Station has been unusually fortunate in the number of outstanding scientists who have been members of its staff since its establishment. Among those deserving highest honor is Dr. Thomas B. Osborne, who at his own request has been relieved of active charge of the Biochemical Laboratory and given the title of Consulting Biochemist. Coming to the Station in 1886, Dr. Osborne soon began his life work, the study of the Nature of the Vegetable Proteins, for which his name is known and honored throughout the scientific world. In collaboration with Dr. Lafayette B. Mendel of Yale University, he has pioneered in the newer phases of nutrition, thus adding to the reputation of the Station for fundamental contributions to agriculture and science. It is a source of satisfaction to all interested in the Station to know that Dr. Osborne is to maintain his active interest in the work he established and carried on so well and that we will continue to have the benefit of his advice and counsel.

The annual reports of the Station now number fifty-two and constitute a record of unusual value. Included in each report is an index but a cumulative index has never been prepared except for two subjects, Entomology and Food and Drugs. Dr. Jenkins volunteered to undertake this task and a complete index of all

matters of permanent value is now ready for the printer. With this will be included several special sections such as Analyses of Unusual Fertilizer Materials, A Complete List of Members of the Staff, and the like. Not only the Station but all those having occasion to consult agricultural literature will be indebted to Dr. Jenkins.

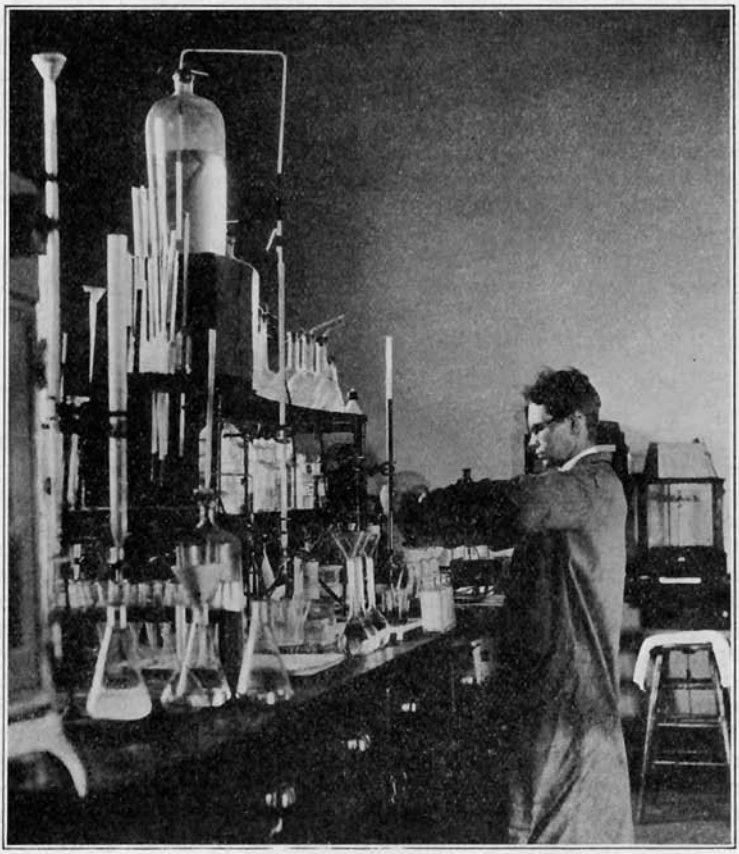

FIGURE 2. Analyzing Foods and Drugs—Analytical Laboratory.

CONTROL AND SERVICE WORK

INSPECTION OF FERTILIZERS, FEEDS, FOODS, DRUGS, ETC.

In accordance with the statutes relating thereto, the Analytical Laboratory has analyzed 900 samples of *Fertilizers and Fertilizer materials*. Of these, 536 were drawn officially by the Station Agent and the balance were received from farmers. The Report

on Fertilizers will appear in December, 1928, as Bulletin 296 of the Annual Report of the Station.

The *Feed Inspection* has involved the analysis of 800 samples, the report on which will be printed early in 1929. Over 800 brands of feeding stuffs are now registered for sale in Connecticut.

The examination of *Foods and Drugs* occupies a considerable portion of the time of the laboratory. During the past year 1,288 samples were analyzed, including such a wide variety of foods as pickles, sweet chocolate, breads and ice cream; and of drugs, powdered pepsin, Fowler's solution and many proprietary preparations. Special studies were made of cod liver oils (for vitamine A) and of "denicotinized" tobaccos, the latter especially attracting wide attention among physicians and laymen.

Of *Babcock Glassware*, 2,540 separate pieces have been calibrated and 134 dairy thermometers standardized, in accordance with the statutes.

In addition to the above regular duties, a large amount of detailed analytical work has been done in collaboration with the Tobacco Substation at Windsor, the Storrs Experiment Station and the Association of Official Agricultural Chemists.

CONTROL OF INSECT PESTS

The constantly increasing number of insect pests, the establishment and enforcement of quarantines, together with the necessary inspections and scouting, require more attention each successive year.

The State quarantine on account of the *Asiatic Beetle* has been maintained and enforced, and 426 certificates have been issued covering 2,951 cubic yards of soil and for 4,394 plants to be moved out of the restricted area. About 1,194 plants have been inspected by one of the staff, who has also examined 55 lawns by request and shown the owners how to apply the lead arsenate treatment. No carbon disulphide emulsion was applied in 1928.

The *Japanese Beetle* has been the subject of much attention. In 1927, the beetles were discovered in rather large numbers in Bridgeport, and on December 1, 1927, the quarantine was extended to cover two rows of shore towns from the New York line to the Housatonic River, in conformity with the Federal quarantine. From June 15 to October 1, all principal highways leading out of the quarantined area were patrolled during the day time, and a 24-hour patrol service was maintained at the eastern end of the Washington Bridge on the Boston-New York Post Road, to prevent the movement of farm products out of the quarantined area except in conformity with the regulations. An inspection stand was established in Bridgeport to facilitate the inspection of truck loads of produce to be shipped out of the area.

During the summer of 1928, Federal men scouted for the beetles in nearly all cities and larger towns of Connecticut outside the quarantined area, resulting in the discovery of infestations in New Haven, New London and Hartford. Only a few beetles were found at each of the first two places but the Hartford infestation was larger and the number of beetles probably ran into the hundreds. At Springfield, Mass., not far from the Connecticut line an infestation was found containing nearly 5,000 beetles. As yet there has been no Federal action regarding quarantines but it is probable that the present quarantine will be extended to include New Haven and adjacent towns, and that the other colonies will be treated as "outside" infestations. This work is conducted in

FIGURE 3. Burning Corn Stalks and Stubble in Stonington—European Corn Borer Control.

co-operation with the Federal Plant Quarantine and Control Administration.

The *European Corn Borer* has spread markedly during the season. Clean-up measures around the 1927 infestations were conducted partly in the fall and completed the following spring by State and Federal forces working in co-operation. In 1928, 21 new towns were found to be infested. These with the five already under quarantine make 27 towns in which the Corn Borer was found in 1928. A continuation of the clean-up methods practiced in the past seems to be out of the question on account of the expense and legislation compelling the owners or tenants to dispose of their corn stalks is now being considered.

There has been no important spread of the *Gipsy Moth* in Connecticut during the season. No stripping has occurred within the

State but larger areas than ever before were defoliated in Massachusetts, New Hampshire and Maine.

The annual *Inspection of Nurseries* has been conducted with greater care and thoroughness than ever before on account of the new pests to be looked for. The Station has also inspected the fruit and rose stocks imported from foreign countries into Connecticut nurseries for propagation.

The work of *Mosquito Elimination* has been continued as usual. Considerable new ditching work has been done during the year with funds raised by town appropriations and private contributions. The ditching in Hamden, East Haven and Old Saybrook

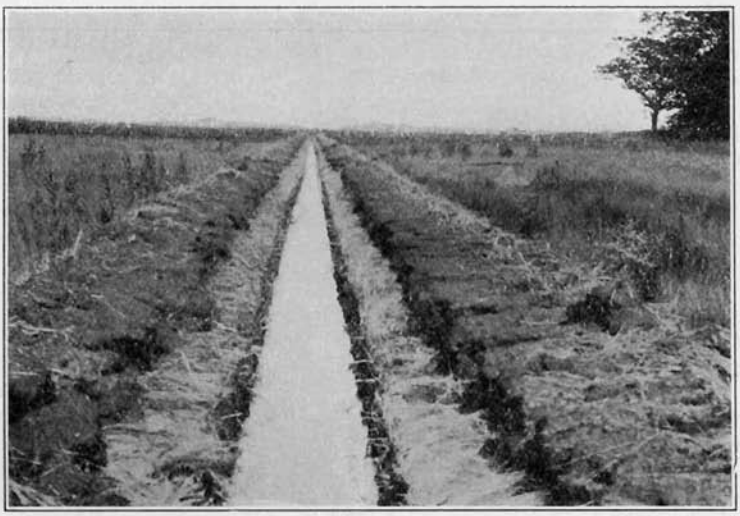

FIGURE 4. A New Double-width Ditch at Hammonasset Park—Mosquito Elimination.

is not completed, but funds will be provided. The City of New Haven has installed a new tide gate at the Little River bridge on Middletown Avenue, which will make possible the ditching of a considerable area in North Haven.. All of this work means a greater cost for maintenance, for according to the law the State is morally, if not legally responsible for maintenance after the areas have been properly ditched and the work approved and accepted. The appropriation for this work must be increased if the Station is to carry out the provisions of the statute.

WHITE PINE BLISTER RUST

During the past season 123,385 wild Ribes and 1,151 cultivated Ribes were destroyed on 75,102 acres. The work was conducted in 26 towns. Approximately one and a half percent of the acreage

covered this year was a re-eradication of areas worked in previous years. 245,045 acres of non-pine land in the general pine region were eliminated from control.

The nursery sanitation project undertaken in 1927 was extended to include 3,962 acres surrounding commercial nurseries and 1,480 acres of water company plantings. These figures are included in the 75,102 acres reported above.

SUMMARY OF WHITE PINE BLISTER RUST CONTROL—1925 to 1928

Year.	Initial Erad. A.	Re-Erad. Acres.	Tot. A. Erad.	Wild Ribes	Cult. Ribes.	Estimated Pine A. Protected.	Nursery Sanitation Acres.
1925	6,688	40	6,728	258,515	684		0
1926	21,687	570	22,256	182,826	330	7,400	0
1927	12,068	8,836	20,904	159,121	2,235	10,400	1,000
1928	68,539	1,122	69,661	123,383	1,151	34,800	3,962

All eradication in 1927 and 1928 represents co-operative effort on the part of towns, individuals, pine owners, and the state. There is a noticeable reduction in the number of wild Ribes destroyed each year which indicates that initial eradication is effective in the areas of heaviest Ribes concentration. Blister Rust has been arrested on protected areas, but some re-eradication will be necessary each year if previously eradicated areas are to be kept in a sanitary condition.

SEED TESTING

This year a special study was made of the quality of Flower Seed offered on the Connecticut market and the inspection of Vegetable Seed was continued. The following table shows the extent of this work:

Kinds.	Number of samples.	Number of varieties.	Number of strains.
Vegetables	190	25	71
Flowers	62	26	14
Field Crops	33	14	18
Trees	20	8	5

SPRAY SERVICE

In continuation of the plan developed some years ago, the Station collaborated with the Extension Service and the Pomological Society in a Spray Service for orchardists. Two members of the Staff visited orchards regularly during the spring and summer, thus keeping in close touch with the appearance and development of insect pests and fungus diseases. The data collected, together with the weather predictions, provided the basis of advice on spraying and dusting.

DISTRIBUTION OF PLANTING STOCK

One and a quarter million trees were distributed during the past year for forest planting purposes, 333,000 of these going to farmers under the Clark-McNary Act. This is almost twice the number distributed in 1927.

PROGRESS OF INVESTIGATIONS

Here follow brief notes on those projects of greatest interest or on which definite results have been obtained during the year. No attempt is made to discuss all of the investigations under way, a list of which will be found on page 134.

BIOCHEMISTRY

Chemistry of the Proteins. As a part of the study of the methods for the separation of the basic amino-acids of proteins, highly purified crystalline samples of several of these substances have been prepared and photomicrographs published. A crystalline preparation of lysine had not been obtained previously.

Convenient methods for the preparation of both arginine and histidine on a large scale have also been developed. Analyses of the basic amino-acids of two proteins, edestin and oxyhemoglobin have been made and a full review of current speculations upon the constitution of proteins has been published in Physiological Reviews. Papers describing the other phases of the work have been published in the Journal of Biological Chemistry.

Nitrogenous Constituents of Plants. Progress has been made in the investigation of the simpler nitrogenous constituents of fresh green tobacco leaf although no papers have as yet been published. This work is being actively continued.

Experiments in Nutrition. Extensive data have been collected on the effect of diets deficient in various respects upon growth and the composition of the bones. A method has been developed for modifying the determining factors, one at a time. Thus the influence of the fat-soluble vitamine, the proportions of the inorganic nutrients and the potential reaction of the diet is being investigated.

In connection with extended earlier observations on the influence of green leaves on nutrition the potency of watercress with respect to some of its constituent vitamines has been investigated. This substance is found to be comparatively rich in vitamine A. The content of vitamine "B" in liver and preparations thereof is also being studied anew.

BOTANY

Mosaic. The rogueing experiment for the control of mosaic in Cuthbert Raspberries, in co-operation with the U. S. Bureau of Plant Industry has been continued. Because of unusual spread

in 1927, many plants were removed. Plot I, consisting of plants received from Massachusetts, still shows the greatest amount of mosaic, although the disease is now general in all of the five plots.

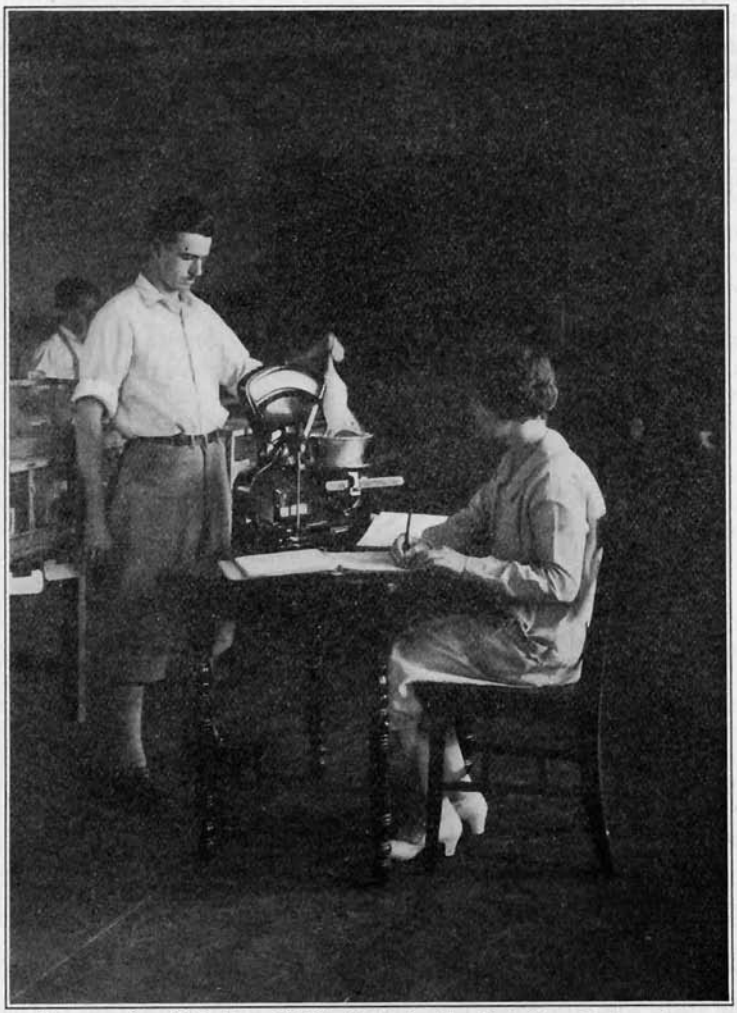

FIGURE 5. Weighing White Rats in the Nutrition Laboratory.

The practicability of this method of control has not yet been demonstrated by this experiment.

Infection of tobacco plants with "white-pickle" mosaic of cucumber produced some leaf mottling, but failed to produce plate

crystals in these mottled leaves and also seemed to disappear in the new growth. Last year somewhat similar results occurred with infection of cucurbits with "white-pickle" that seemed more or less temporary.

Plant Disease Survey. Because of the very wet summer the year has been unusually favorable for the development of plant diseases. As a result we have secured a greater number of diseases new to

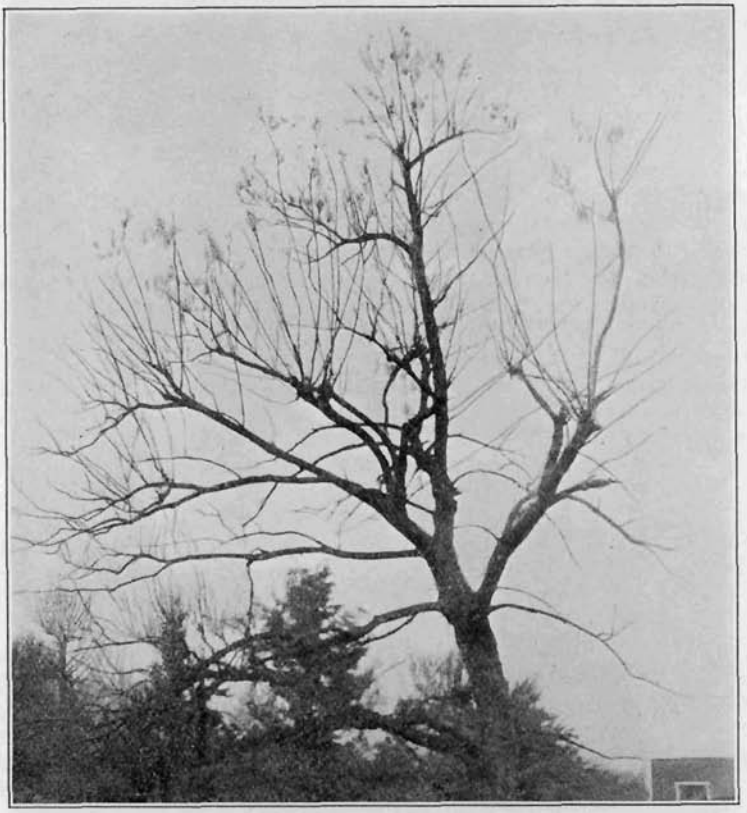

FIGURE 6. A Tree Practically Defoliated by Willow Scab.

the state than for sometime. Among the more important of these are bacterial leaf diseases of corn and horse radish, a Fusicladium disease of poplar similar to the new willow disease of last year, several Helminthosporium diseases of grains and grasses, a fungous leaf-scorch of maple, the Macrosporium blight of carrots, a Phytophthora rot of tomato fruit, and a number of new hosts for the Sclerotium stem-rot of herbaceous perennials. Besides these,

potato blight made its earliest recorded appearance in the state and caused some damage to the vines and rot of the tubers. The Fusicladium scab continued its destruction of willows, being even worse than last year.

Chestnut Blight. Last spring about 1,300 one-year-old chestnut seedlings were planted in two new places, Southport and Redding Ridge. This makes four locations in the State on which over 2,500 seedlings have been set out in recent years to see whether they would survive the blight. So far considerably more than half of the seedlings have died from unfavorable environment but none from blight. It seems to be difficult to carry the seedlings through the first season, especially when set out in the sun. This year's plantings, however, have apparently done better than usual due to the wet summer. A quantity of this year's nuts has been secured from the South for starting more seedlings. Records have also been made of two marked plots of native seedlings and sprouts in the woods to determine the progress of the blight from year to year.

Tree Diseases. The most important and extensive work in this field has been the new willow scab or blightfungus, *Fusicladium saliciperdum.* Considerable time has been spent in determining the distribution of this fungus, especially in this state and Canada, in noting its damage and the species of willows attacked. Cultures of the fungus were obtained and successful inoculations made in producing the disease similar to that in nature. Successful spraying experiments have also been carried on for its control.

ENTOMOLOGY

Asiatic Beetle. The investigations on the life history, habits and methods of control of the Asiatic beetle, *Anomala orientalis,* are completed and the data has been assembled, analyzed and prepared for publication. During 1928 much attention has been given to control by applications of lead arsenate, both mixed with the top layer of soil before seeding, and washed into the turf where re-seeding was unnecessary.

Plum Curculio. The six year study of the control of this insect in Connecticut apple orchards has been completed and the data is now nearly ready for publication. It was found that four applications of lead arsenate, preferably the pink, calyx, 7-day and 2-weeks sprays will give fair control.

Oriental Peach Moth. No satisfactory method of artificial control has yet been discovered. During the year, the ichneumonid parasite *Glypta rufiscutellaris,* was reared for the first time in considerable numbers in Connecticut from the Oriental fruit moth, and it was more abundant than the other ichneumonid parasite, *Macrocentrus ancylivora,* which has heretofore been the principal parasite of the Oriental fruit moth in the state. The egg parasite, *Trichogramma minuta,* was also present in 1928. Nearly 2,500

larvae of the Oriental fruit moth have been collected and reared for the experimental work of 1929. Over 600 of these were obtained from a bushel of quinces grown in Cheshire.

FORESTRY

Treatment to Prolong the Life of Timber. In co-operation with the Tobacco Substation at Windsor, the Forestry Department has undertaken to demonstrate the value of preservative treatment for tobacco shade-tent poles and the relative value of various native woods so treated, compared with chestnut. Posts of all the species common in Connecticut were peeled and seasoned last fall. In the spring they were treated with creosote and set in rows

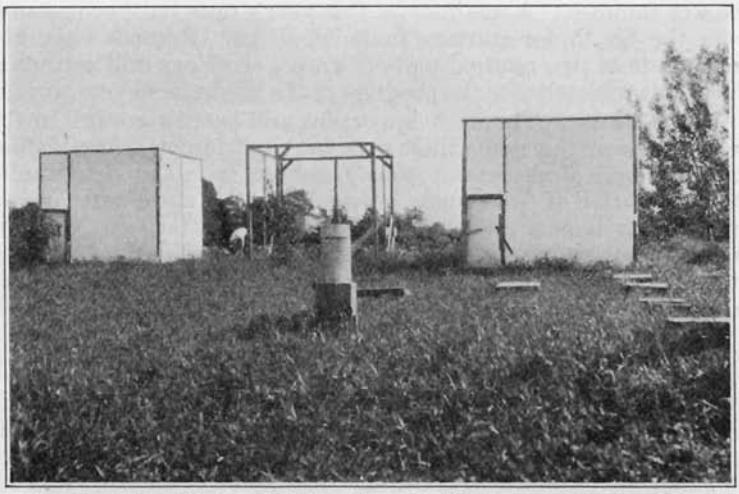

FIGURE 7. Tree Cages at Mt. Carmel Farm Used in Studying the Oriental Peach Moth.

on the Tobacco Station farm. Untreated check posts were included. Naturally no data will be available for some years.

In the meantime there is a demand for information on methods of treating posts. Tobacco Station Bulletin No. 9 was therefore prepared and distributed last fall. It is a short, illustrated paper describing the methods of treatment adapted to farm use and the results that may be expected therefrom.

The Rainbow Plantations. Begun in 1902, these plantings have reached an age where they are yielding much valuable information. In addition to the comparisons between the several species, pruning and thinning experiments are now possible. Also these plots are furnishing an excellent opportunity for studying the effects of pure and mixed stands on the soil conditions which determine rate of growth.

A minor project undertaken during the year in co-operation with the Botany Department, was one to determine the effect of calcium chloride washed from roadways on ornamental Norway spruce trees planted close by. The first results indicate that a solution of more than five percent strength is necessary to seriously damage the trees.

The Relation of Soil Type to Forest Composition and Rate of Growth. The work on this project was continued during the 1928 field season with a study of growth of pine plantations as related to soil type. It was originally planned to carry on the work with both red and white pine, but because of damage done by the weevil to white pine, investigation of this species was temporarily

FIGURE 8. White Pine Plantation after "Cordwood" Thinning.

abandoned and efforts were confined to red pine. Two hundred stations in red pine plantations were established as temporary plots. The data included:

a. The height of ten or more dominant trees.
b. Detailed notes on soil type and other soil factors.

From the tree measurements a "site index curve" for red pine has been prepared and tables derived therefrom. By the use of these tables any plantation or portion thereof may be given an "index number" which denotes the site quality or growing capacity of the land. At an age of fifteen years, the range in height (site index) varied from nine to twenty-two feet. The correlation between soil type and site quality is now being determined.

Using the data taken during the past season it is planned to select some twenty permanent plots where a careful study of soil

conditions will be begun in red pine plantations to ascertain what soil factors are important in determining the growth of this species, and the effect of the forest planting upon the soil.

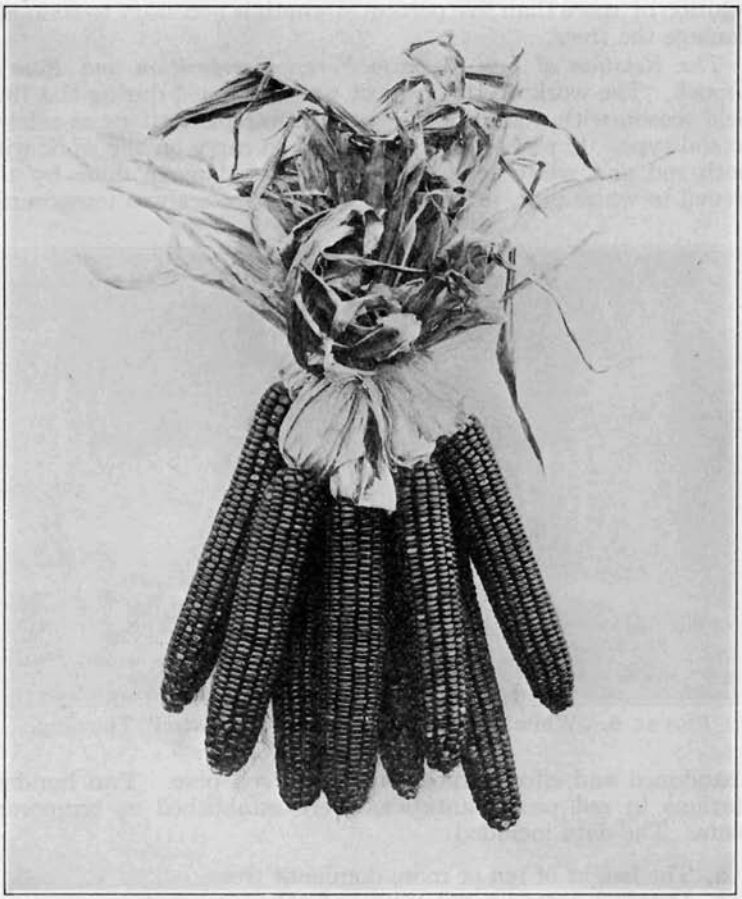

FIGURE 9. Canada Leaming. A new type of Crossed Corn. As early as Canada Flint and as productive as Leaming.

PLANT BREEDING

Corn Breeding. A new type of "crossed" field corn has been distributed for trial. This is a first generation combination of inbred strains of Leaming dent and Canada Yellow Flint and is called Canada Leaming. It unites the high yielding power and stalk growth of the dent type with the early maturity and good grain quality of the flint. This corn is being tested in Southern New

England as a husking corn and in Northern New England for silage purposes.

About 150 crosses of inbred strains of Whipples Early Yellow sweet corn have been grown in a preliminary trial and some combinations have shown outstanding productiveness and uniformity in size and shape of ear and in time of ripening and at the same time have been as early or earlier in maturity than the original variety.

A new variety of sweet corn, not a first generation cross, has been produced by combining a number of inbred strains of Golden Bantam and Crosby. This new variety, which reproduces itself each year, is called Golden Crosby and in preliminary tests has met with favor from some of the Connecticut seedsmen who are growing it for canning purposes.

Abnormal segregation of the sugary factor in certain families of corn has given widely deviating ratios, in most cases a large excess of recessive seeds and in other cases a marked deficiency. The ratios show larger variations from normal than have been found previously and indicate a new mode of inheritance that is not clearly understood.

Vegetable Breeding. Crosby Egyptian beets have been completely self-sterile, no seed having been produced from bagged flowers nor from isolated plants. Breeding methods with this plant will necessarily be limited to open pollinated selections and to sib-matings. The effect of environmental conditions on the color of garden beets is being studied also.

Selections have been made in the second generation of a cross between a late and unproductive straightneck type of summer squash with an early crookneck in an attempt to fix an early straightneck type of good quality.

A new variety of spinach is now in the third generation of selection from a cross of Virginia Savoy, Viroflay and King of Denmark. It combines in a large measure size, earliness and long keeping qualities from its parental types.

A large number of selections from the cross of Alacrity and Earliana tomatoes have been grown in the attempt to produce a strain of the Earliana season, but with better shape and quality of fruit. Some of the selections which are now in the third generation are promising.

A remarkably productive and early-ripening pepper has been developed from a cross of Sweet Spanish by Harris Earliest. Several selections are being put through a careful test and will soon be available for preliminary trial by market gardeners.

SOIL INVESTIGATIONS

The Soils of Connecticut. Detailed investigations of the supply and availability of plant nutrients in the important soil types of the State have been continued. During the 1928 season two crops

of tobacco and one crop of oats have been grown in the greenhouse on twenty-four soils. Tobacco has proven to be an ideal crop to reveal differences in the availability of the several plant nutrients contained in the soil. The most striking results may be summarized as follows:

Twenty-two of the twenty-four soils showed marked deficiency of potash and twenty exhibited more or less pronounced lack of available phosphorus. Results of greenhouse tests can be correlated very closely with the rapid method for the determination of

FIGURE 10. A Field Party Studying Connecticut Soils.

available phosphorus now used in the soils laboratory. None of the soils were able to supply sufficient nitrogen for normal growth of tobacco, although some contained as high as 10,000 pounds of total nitrogen per acre.

Tobacco showed abnormal growth on two very acid soils (3.9-4.0 pH). On these particular soils, this reaction was correlated with abnormally high concentrations of soluble manganese and aluminum. All the other soils, even with pH values as low as 4.6, showed little or no response to lime for the tobacco crop.

Forest Soils. A study of the characteristics of various types of soil under forested conditions is in progress, with a view to determining the soil factors which have a definite relation to silvicultural practice in Connecticut. Most forest soils that have never been farmed have been found to be considerably more acid than ordinary agricultural soils. Several extremely acid (as low as 3.2 pH) forest soils have been encountered. This phase of the program will be more actively followed than heretofore.

Co-operation with the Storrs Station. During the summer of 1928 one hundred and twenty-five farms distributed over the eastern highland of the State have been surveyed as to soil type in co-operation with the Agricultural Economics Department of the Storrs Experiment Station, which is studying the "Economic Significance of Soil Type." Soil maps of each farm were prepared, and samples of soil from over a thousand fields were tested for acidity. Soil samples from sixteen of these farms have been collected and are to be studied intensively in the greenhouse and laboratory.

Lawn Management. Lawn fertilization experiments have been conducted for the past three years. For average lawn turf on soils similar to that at the Station, top dressing with a readily available nitrogeneous fertilizer like sulfate of ammonia has proven to be the most important requirement. Moderate applications of phosphoric acid and potash help to keep up the fertility of the soil, but without a fertilizer containing available nitrogen, they are of little or no benefit.

Seeding trials with various lawn grasses, particularly the bent grasses, are being conducted. Stolon plantings of several strains of creeping bent have been successful, but are not proving thoroughly satisfactory to maintain under average lawn conditions. Seedings of several strains of bent grass produced commercially have demonstrated that native grown seed of creeping bent, velvet bent and Rhode Island bent are well adapted to local conditions where excellent drainage is provided. Fully as good turf has been produced by seeding creeping bent as by planting the stolons.

Connecticut River Flood Plain Studies. At the request of the Attorney General's office the Soils Department has undertaken a special study of the soils of the Connecticut River Flood Plain and the effects of periodic flooding on their productivity. A detailed soil and land cover survey has been completed of over 20,000 acres adjacent to the Connecticut River north of Middletown and laboratory and greenhouse studies are being made of the characteristics of these soils and of the sediments deposited upon them by floods.

TOBACCO SUBSTATION

Relation of Fertilizer Ingredients to the Burn of Tobacco. Sulfate of ammonia has seriously lowered the fire holding capacity of the leaf. Dry ground fish in large quantities has had the same effect

but to a less degree. Urea, tankage and nitrate of soda have had no pronounced effect in either direction. Muriate of potash has been extremely injurious to burn. Double sulfate of potash-magnesia slightly reduced the fire holding capacity when compared with sulfate of potash. Both carbonatate and nitrate of potash gave a better burn than sulfate. Lime produced a very white ash but lowered the fire holding capacity.

The Effect of Various Fertilizers on the Chemical Composition of Tobacco. Different carriers of nitrogen have not changed the total amount of nitrogen absorbed by the plant. The lower leaves of the plant have higher percentages of total ash, potassium, calcium, and nitrate nitrogen than the upper leaves.

The upper leaves have higher percentages of phosphorus, ammonia nitrogen, nicotine and chlorine than the lower leaves.

Plants treated with sulfate of ammonia show increased percentages of manganese, sulfur and aluminum.

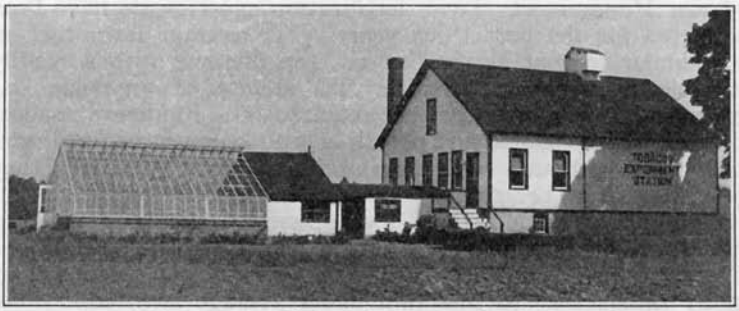

FIGURE 11. Laboratory and Greenhouse at the Tobacco Substation at Windsor.

The potash content of the plant is reduced appreciably by ommitting potash from the fertilizer even though the soil naturally contains a large supply of potash.

Effect of Some Nitrogenous Fertilizers on Soil Reaction. Sulfate of ammonia has had the strongest influence in making soil more acid. Dry ground fish and tankage have had an acidifying tendency but to a less degree. Urea made the soil more acid after the initial alkaline effect had disappeared. Nitrate of soda reduced soil acidity, but nitrate of potash had no pronounced effect.

Urea as a Source of Nitrogen. Results with this fertilizer have been very satisfactory when it was used in moderate amounts. Two other synthetic nitrogen compounds, nitrate of potash and nitrate of lime also have given good results.

Increasing the Organic Matter in the Soil. Manure as a supplement to commercial fertilizer has given somewhat increased yields and better quality on a very sandy soil. A similar effect has been

produced by the use of a commercial "humus" product or by covering the sandy plots with muck soil.

Cover Crops for Tobacco Soils. During wet years on a sandy soil the yield and quality have been increased by the use of certain winter cover crops. Oats, barley and rye have been most effective. Wheat, alfalfa and red top have had a slightly beneficial effect while timothy has been detrimental.

Field Days and Exhibits

The Mt. Carmel Farm Field Day was held on July 18, the New Haven County Farm Bureau joining with the Station in the same

Figure 12. Station Exhibit at the State Fair, 1928.

manner as in 1926. The general topic was Plant Pests. Professor W. H. Whetzel of Cornell University and Professor W. C. O'Kane of New Hampshire University were the speakers.

The Field Day at the Tobacco Substation was unique in that some two hundred tobacco farmers from Pennsylvania spent the afternoon inspecting the plots.

A general Station exhibit was made at the State Fair in Hartford and also a special tobacco exhibit.

Library

During the year there were added to the Station Library 900 accessions of permanent value. Journals purchased now number 50, in addition to which some 30 farm papers and journals are received as exchanges. For a few of the old farm papers we have complete files. The total number of bound volumes is now 16,800.

Physical Equipment

Additions to the Station's scientific equipment include a rotary microtome, an apochromatic objective, an electric warming table for slides, a Berkefeld filter, an electric incubator, a steam pressure sterilzer, a moisture equavalent centrifuge, two analytical balances, a wide field binocular microscope, two experimental tobacco curing chambers with temperature and humidity controls and an electirc computing machine.

An addition to the barn at the Mt. Carmel Farm provides much needed space for the Botany and Entomology departments.

Changes in Staff

Appointments;

Herbert A. Lunt, M.S., Research Assistant in Forest Soils, August, 1928.

George W. Pucher, Ph.D., Research Assistant in Biochemistry, September, 1928.

Mrs. Gladys Brooke, B.A., Secretary in Entomology Department, September, 1928.

Harold B. Bender, B.S., Graduate Assistant in Botany, October, 1928.

Resignations;

H. J. Lutz, M. F., Assistant Forester, June, 1928.

George Zundel, Ph.D., Graduate Assistant in Botany, July,1928.

Grace A. Foote, B. A., Secretary in Entomology Department, August, 1928.

ACTIVE PROJECTS.

ANALYTICAL CHEMISTRY.

Dr. E. M. Baily in charge.

1. Inspection of Fertilizers.
2. Inspection of Feeding Stuffs.
3. Inspection of Foods and Drugs.
4. Calibration of Babcock Glassware.
5. Inspection of Insecticides and Fungicides.
7. Analysis of Diabetic Foods.

BIOCHEMISTRY.

Dr. T. B. Osborne, Consulting Biochemist.

Dr. H. B. Vickery, Biochemist in charge.

(In Collaboration with Dr. L. B. Mendel, Yale University.)

1. Cell Chemistry.
   a. A detailed investigation of the nitrogenous constituents of plant cells including not only the protein components but also the hitherto scantily considered non-protein substances. The methods developed and successfully applied to the green leaf in the case of alfalfa are now being extended to the *tobacco leaf.*
   b. The investigation of the nature of the simpler nitrogenous constituents of yeast.

2. Protein Chemistry.
   a. The methods for the determination of the basic amino acids of proteins are under investigation with the object of effecting improvements.
   b. 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 especial attention to certain factors which appear to determine rapid growth.
   b. The investigation of the relation of diet to opthalmia.
   c. Experiments on the relation of diet to fertility in cooperation with Dr. Mason of Vanderbilt University.

BOTANY.

Dr. G. P. Clinton in charge.

2. The Nature and Cause of Mosaic Disease of Plants.
3. The Ustilaginales of North America.
4. The Rusts of Connecticut.
5. Plant Disease Survey of Connecticut.
6. Thielavia basicola; a Study of the Perfect Stage.
7. A Study of Pythiums.
8. Spraying and Dusting Experiments on Apples and Peaches. (With Entomology.)
12. Seed Testing.
13. Peach "Yellows."
15. Chestnut Blight—virulence studies.
18. Tobacco Diseases—especially Black and Brown Root Rot. (Experiments at Tobacco Substation.)
20. Tree Diseases.
23. Rogueing as a Control for Raspberry Mosaic. (With U. S. D. A.)

ENTOMOLOGY.

Dr. W. E. Britton in charge.

3. Spraying and Dusting Experiments on Apples and Peaches. (With Botany.)
6. Control of Foul Brood of Bees.
7. A Study of the Asiatic Beetle, *Anomala orientalis.*
9. Insect Survey of Connecticut.
16. Experiments with the Cabbage Maggot.
17. Life History and Methods of Controlling the Oriental Peach Moth, *Laspeyresia molesta.*
18. Life History of Imported Currant Worm.
20. Life History, Habits and Control of the Imported Birch Leaf-Miner, *Fenusa pumila.*
21. Life History and Control of the Spinach Leaf-Miner.
26. Experiments on the Control of Squash Vine Borer.

Control Projects.

10. Inspection of Orchards and Nurseries.
11. Control of Gipsy Moth.
12. Elimination of the Mosquito Nuisance in Salt Marshes.
13. Inspection of Apiaries.
19. Control of the European Corn Borer.
24. Control of the Asiatic Beetle.
25. Control of the Japanese Beetle.

FORESTRY.

Mr. W. O. Filley in charge.

1. Experimental Plantations on a Sandy Tract at Rainbow.
   a. Comparison of a wide variety of conifers and hardwoods.
   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)—Three Grades of Thinning.
3. Effect of Thinning in Hardwoods (At Quassipaug Lake).
5. Distribution of Forest Planting Stock. (Under Clark-McNary Act.)
8. Studies of Forest Plantations (State-wide).
   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 damping off.

Control Project

7. Control of White Pine Blister Rust. (With U. S. D. A.)

GENETICS (PLANT BREEDING)

Dr. D. F. Jones in charge.

1. A Genetic Study of Hereditary Characters in Corn Involving Their Linkage Relations and Variability, with particular attention to characters directly influencing yield.
2. The Effect of Inbreeding and Crossing upon Corn in Relation to Vigor, Rate of Growth, Productiveness and Variability.
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, and to some of the more important Vegetable Crops such as sweet corn for market gardening and canning, beets, cabbage, carrots, cucumbers, melons, onions, radish, rutabagas, 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.

SOILS

Mr. M. F. Morgan in charge.

1. What Soil Characters are Factors in Determining the Agronomic Value or Utilization of Land?
2. Experiments in Lawn Fertilization.

TOBACCO SUB-STATION AT WINDSOR

Dr. P. J. Anderson in charge.

1. Fertilizer Experiments:
   Various Sources and Rates of Nitrogen, Phosphoric Acid and Potash.
2. Experiments with Farm Manure.
3. Experiments with Manure Substitutes.
4. Tobacco Nutrition Studies: the Rôle of Nitrogen, Sulfur, Chlorine, Potassium, Calcium, Manganese, Boron, Magnesium.
5. Improvement of Havana Seed Tobacco.
6. Improvement of Broadleaf Tobacco.
7. Improvement of Cuban Shade Tobacco.
8. The Effect of Various Winter Cover Crops used on Tobacco Land.
9. Brown Root Rot of Tobacco (with U. S. D. A.).
10. Studies on Black Root Rot of Tobacco.
11. Soil Reaction in Relation to Tobacco.
13. Preservative Treatment of Shade Tent Poles.
14. Tests of Wires for Shade Tents.
15. The Effects of Topping and Suckering at Different Heights and Dates.
16. The Effect of Stage of Picking Shade Tobacco.
17. The Rôle of Humidity and Temperature in Curing Tobacco.
19. Tobacco Diseases—Miscellaneous.
20. Tobacco Insects—Miscellaneous.
21. A Study of the Root Development of the Tobacco Plant.

PUBLICATIONS

BULLETINS

No. 290. Fertilizer Report for 1927.
No. 291. Report of the Director for 1927.
No. 292. Some Insect Pests of Nursery Stock in Connecticut.
No. 293. The Quality of Vegetable Seed bought by Market Gardeners in Connecticut in 1927.
No. 294. Report of the State Entomologist for 1927.
No. 295. Report on Foods and Drugs for 1927.

TOBACCO SERIES

No. 9. Prolonging the Life of Tobacco Shade Tent Poles.
No. 10. Report of Tobacco Station at Windsor for 1927.

CIRCULARS OF IMMEDIATE INFORMATION.

No. 61. Regulations Concerning the Transportation of Nursery Stock in the United States and Canada.

JOURNAL PAPERS.

Mendel, Lafayette B. and Cannon, Helen C. The relation of the rate of growth to diet. II. Jour. Biol. Chemistry, v. 75, (1927), No. 3, p. 779.

Vickery, Hubert Bradford and Leavenworth, Charles S. On the separation of Histidine and Arginine III. The preparation of Arginine. Jour. Biol. Chem., v. 75, (1927), p. 115-122. October, 1927.

Vickery, Hubert Bradford and Leavenworth, Charles S. A note on the crystallization of free Lysine. Jour. of Biol. Chemistry, v. 76, (1928), No. 3, p. 437.

Vickery, Hubert Bradford and Leavenworth, Charles S. A note on the crystallization of free Arginine and Histidine. Jour. of Biol. Chemistry, v. 76, (1928), No. 3, p. 701.
Vickery, Hubert Bradford and Leavenworth, Charles S. Modifications of the method for the determination of the Basic Amino Acids of Proteins. The bases of Edestin. Jour. Biol. Chemistry, v. 76, (1928), No. 3, p. 707.
Vickery, Hubert Bradford and Leavenworth, Charles S. On the separation of Histidine and Arginine IV. The preparation of Histidine. Jour. Biol. Chemistry, v. 76, (1928), No. 3, p. 627.
Britton, W. E. Insects attacking vegetable crops in 1927. Report Conn. Vegetable Growers' Assoc. 1927. (1928), p. 66-70.
Britton, W. E. Report of Committee on Injurious Insects. Conn. Pomol. Soc. Proc., v. 37, (1927), p. 16-19.
Britton, W. E. Oil sprays and oil injury. Jour. Economic Entomology, v. 21, p. 418-421. April, 1928.
Britton, W. E. The Elm Leaf Beetle. Tree Talk, v. 8, No. 4, p. 32. March, 1928.
Britton, W. E. Some Insect Pests of Cultivated Plants. Garden Guide (Revision A. T. de La Mare Co.), (1928), p. 293-308.
Britton, W. E. and Botsford, R. C. Anti-mosquito activities in Connecticut in 1927. Proceedings, Fifteenth Annual Meeting New Jersey Mosquito Extermination Assoc. (In press).
Garman, Philip. The European red mite, peach moth and plum curculio. Conn. Pomol. Soc. Proc., v. 37, (1927), p. 28-34.
Garman, Philip. Dusting menaces fruit growers. Gleanings in Bee Culture, v. 61, p. 293-329. May, 1928.
Zappe, M. P. Fighting the apple maggot and the control of aphids. Connecticut Pomol. Soc. Proc., v. 37, (1927), p. 24-27.
Jones, D. F. Like father like son-in-law. Scientific Monthly, v. 26, (1928), p. 557-560.

WHAT THE STATION CAN DO

Each mail brings to the station requests for information and service, the range of subjects being almost without limit. Every effort is made to comply with these requests, even though they are outside the fields under investigation. This is one of the purposes for which the library is maintained. However, some of the letters request help that requires an intimate knowledge of live stock management and the like and again we are asked to make laboratory determinations for which we do not have the equipment or staff. Therefore it is helpful to publish from time to time a list of the subjects on which we can furnish information and the kinds of samples we can accept.

The Station can furnish information on:

Fertilizers and fertilization.
Soils and their management.
The chemical composition of Foods, Drugs, Insecticides and Fungicides.
The composition of Diabetic Foods.
Insect Pests of plants and their control.
Fungus and other Diseases of plants and their control.
Sprays and spraying.
Fruits and fruit management.
Weeds and their control.

Forestry—all phases.
Care of Shade Trees.
Plant breeding—especially field corn, sweet corn, fruits and vegetables.
Lawns, establishment and care.
Bees.
Mosquito Elimination.
Tobacco culture.

Samples and specimens that can be analyzed, tested or identified:

Fertilizers.
Feeding stuffs.
Foods and Drugs.
Milk—except for bacterial count.
Seeds.
Weeds and other plants.
Insects.
Diseased and injured plants.
Soils.

The Station cannot furnish information on:

Live stock feeding and management, including Poultry.
Animal diseases.
Household management.
Clothing.
Farm management.
Marketing and cooperation.

REQUESTS FOR INFORMATION ON THESE SUBJECTS SHOULD BE SENT TO THE CONNECTICUT AGRICULTURAL COLLEGE AT STORRS.

The Station cannot make analyses and examinations of:

Drinking water—apply to the State Board of Health, Hartford.
Milk for bacterial content—apply to the Dairy Commissioner, Hartford.
Sick or dead poultry should be sent to Poultry Department, Storrs Experiment Station, Storrs, Conn.

All of which is respectfully submitted,

WILLIAM L. SLATE,

Director.