CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

BULLETIN 243 NOVEMBER, 1922

Report of the Director

FOR THE YEAR ENDING OCTOBER 31, 1922

By E. H. JENKINS

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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October, 1922.

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Report of the Director

FOR THE YEAR ENDING OCTOBER 31ST, 1922.

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

Following are the facts concerning the work done by the Station staff during the year which may not be so conveniently gathered from the detailed papers included in the Station bulletins and reports. The Station work is divided between seven departments as follows:

BOTANICAL DEPARTMENT.

Dr. G. P. Clinton in charge.

The work of this department is chiefly a study of plant pathology: that is of the diseases which injure plants and of the proposed remedies.

One of the chief studies of the year has been a comparison of sprays *vs.* dusts on fruit and vegetables, carried on by Mr. Stoddard in co-operation with the entomological department. This is further described under the entomological department.

Sweet corn seed selection, now in its third year, is an attempt by careful tests to secure perfect germination and freedom from disease in the stock seed of Connecticut growers, and by this means to get commercial crops of seed which will have superior quality. The results thus far are encouraging, and in connection with the work of the plant breeding department on sweet corn promise to be of great value to seed growers.

The study of the wildfire disease of tobacco has made it possible to very greatly control the ravages of this bacterial trouble, if not to entirely suppress it.

Dr. Clinton is also preparing a general description and discussion of all tobacco diseases. He continues a plant disease survey of the state, with special reports to the United States Department of Agriculture.

Dr. Clinton also determines the species of smuts referred to him from all parts of the country, and in connection with Dr. Stevens of Illinois, he has prepared an article on the smuts of Hawaii.

Further work on the white pine blister rust by Drs. Clinton and McCormick is about ready for publication.

Various studies of miscellaneous fungi, the Thielavia root rot of tobacco, species of Pythium, heteroecious rusts, etc., and of mosaic diseases, are in progress.

The study of peach yellows in connection with orchard fertilization is continued.

The incidental office and laboratory work has included the writing of over 600 letters, identifying 225 specimens of fungi, weeds, seeds and varieties of fruit, testing the germination of 742 samples of seed for various persons, besides a very large number of corn samples in connection with the selection work.

Three hundred and thirteen named specimens have been added to the herbarium and several hundred more of this year's collection wait for study and determination.

Twelve lectures and addresses on botanical subjects have been delivered.

A public meeting was held in New Milford in conjunction with the Farm Bureau Agents of Litchfield and Fairfield Counties to give information regarding the control of the wildfire disease of tobacco, which has appeared for the first time in the Housatonic Valley.

The publications of the department have been:

Dr. Clinton. New Facts Regarding Diseases of Vegetables and Their Control. Connecticut Vegetable Growers' Association, 1921, 7-20.

Drs. Clinton and McCormick. Wildfire of Tobacco in Connecticut. Bulletin 239, 58 pp.

Mr. Stoddard. Report on Fungous Troubles of Fruit, Season of 1921. Connecticut Pomological Society, 24, 74-77.

Mr. Stoddard has also collaborated in publications listed under the entomological department.

BIOCHEMICAL DEPARTMENT.

Dr. T. B. Osborne in charge.

The study of protein chemistry is in charge of Dr. Osborne. In the study of problems of nutrition he is favored by the collaboration of Dr. Lafayette B. Mendel of Yale University. The work of this department is in part supported by a grant from the Carnegie Institution of Washington. This is at present concerned with:

1. A study of the constitution of the proteins and also of the chemical makeup of green forage plants, by methods recently devised in this laboratory.

2. Study of some fundamental facts of nutrition (by methods devised here), with special reference to the nutritive function and relative nutritive value of the chemical factors involved.

3. In collaboration with Dr. Park and his associates in the Medical School of Yale University, the influence of diet as a factor

in the development of rickets and other organic changes is being studied.

4. The studies of the relation of vitamines to nutrition are being continued.

5. An elaborate study of the chemical constituents of the living alfalfa plant has developed much of interest and value regarding the chemistry of the living plant, but the results are not yet ready for popular discussion.

By using the method here devised of feeding animals, it has been made clear that some of the traditions concerning the needed relative proportions of protein and other nutrients must be in part modified or abandoned.

Thus rats have been grown here to adult size without more than traces of carbohydrates in their food, others without more than traces of fat in their food, and, most surprising of all, rats have been often grown nearly to maturity on rations containing 90 per cent of protein, but without more than traces of carbohydrates or fat, and on such a ration the energy requirement was well met by protein, for the rats ate no more of this diet than they would eat of a mixed diet having the same calorific value.

7. It has been noticed here, as elsewhere, that animals fed on rations consisting of purified nutrients, including vitamines and mineral salts, rations which are wholly adequate to enable animals to grow to full maturity and to maintain themselves in apparently normal condition, may be incapable of reproduction.

Examinations of such animals made in collaboration with workers in Professor Harrison's laboratories of Yale University show extreme abnormalities in the reproductive systems of both sexes. It is noted that small additions of egg yolk, and probably of some other naturally occurring foods, avert this sterility. An extensive study of these abnormalities has been undertaken.

8. Work in collaboration with Professor H. G. Wells of the University of Chicago has proved, by means of the anaphylaxis reaction, that the four proteins of cow's milk are chemically distinct, and that one of them, the lacto-globulin, is chemically indistinguishable from the serum globulin of beef blood.

The recent experiments in this department indicate that the amount of the water-soluble B. vitamine requirement bears a fairly definite relation to the mass of active tissue of the animal, that is, the larger and heavier the animal the larger the amount of vitamine required.

The study of the proteins, begun by Dr. Osborne about thirty years ago, has been most fruitful in establishing the nature and structure of these very complicated bodies and their relative value in nutrition: facts which have profoundly modified current theories regarding their rôle in nutrition. The results of the work

of this department are published in technical journals. Following is a list of the papers published during the present year:

Feeding Experiments with Mixtures of Foodstuffs in Unusual Proportions. Thomas B. Osborne and Lafayette B. Mendel. Proc. Nat. Acad. Sc. (1921) VII, 157-162.

The Proteins of the Alfalfa Plant. Thomas B. Osborne, Alfred J. Wakeman and Charles S. Leavenworth. Jour. Biol. Chem. (1921) XLIX, 63-91.

Vitamin A in Oranges. Thomas B. Osborne and Lafayette B. Mendel. Proc. Soc. Exper. Biol. and Med. (1922) XIX, 187-188.

Quelques caracteristiques d' ordre chimique de l'alimentation. Thomas B. Osborne and Lafayette B. Mendel. Bull. Soc. Sc. d'Hyg. Alimentaire (1922) X, 5-11.

Nutritive Factors in Plant Tissues. V. Further Observations on the Occurrence of Vitamin-B. Thomas B. Osborne and Lafayette B. Mendel. Jour. Am. Med. Assn. (1922) LXXVIII, 1121-1122.

Mas observaciones sobre la distribucion de la vitamina B en algunos alimentos vegetales. Thomas B. Osborne and Lafayette B. Mendel. Jour. Am. Med. Assn. Edicion Espanol (1922) VII, 656-657.

Milk as a Source of Water-Soluble Vitamin, III. Thomas Burr Osborne and Lafayette Benedict Mendel. Biochem. Jour. (1922) XVI, 363-367.

The Water-Soluble Constituents of the Alfalfa Plant. Thomas B. Osborne, Alfred J. Wakeman and Charles S. Leavenworth. Jour. Biol. Chem. (1922) LIII, 411-429.

CHEMICAL DEPARTMENT.

Dr. E. M. Bailey in charge.

This department is charged by statute with much control work, which has been required of this Station because it could be better and more economically done here than elsewhere.

Thus some 900 fertilizers have been analyzed and the results reported to the manufacturers and buyers of them. They have also been tabulated with appropriate discussion and are now being printed for distribution.

The same has been done with 535 samples of commercial feed and fodder materials.

Over 2400 samples of foods and drugs have been examined, many of them for the Dairy and Food Commissioner, and expert evidence has been furnished in prosecutions for adulteration or misbranding.

Over 1900 pieces of glassware used by milk dealers for the Babcock test have been examined and certified when correct.

The foregoing work is required by special statutes. The research and other work of the department may be summarized as follows:

The discovery of the vitamines and of their importance in nutrition has been quickly noted by manufacturers and the facts com-

mercialized. A considerable number of so-called vitamine preparations are made and sold, with large advertising claims for them. A chemical and biochemical study of these proprietary vitamine preparations (many of which do not at all meet their advertising claims) has been made and a report on them is ready for publication.

Analyses have been made of the insecticides and fungicides in the Connecticut market.

Further work includes: Studies of methods for the examination of teas; for the determination of crude fiber and for the determination of nicotine in tobacco products, and further studies on the cryoscopy of milk.

Co-operative work with other organizations has included:

Analytical work with the American Oil Chemical Society to secure greater uniformity in the analyses of cotton seed meal and other fertilizers.

The published studies of diabetic preparations made by this department are in great demand by physicians and patients in all parts of the country, and Dr. Bailey collaborates with the Council of Pharmacy and Chemistry of the American Medical Association on matters relating to diabetic and other special foods.

He is also a member of the Joint Committee of Definitions and Standards, which includes three members each from the Bureau of Chemistry of the United States Department of Agriculture, the Association of Food and Drug Commissioners and the Association of Official Agricultural Chemists. The definitions and standards of food and drug products established by the committee are generally accepted as decisive as to the name and quality of such products.

The department has issued the following bulletins and reports:

Bulletin 233. The Fertilizer Report for 1921. 90 pp.
Bulletin 236. Report on Food Products and Drugs for 1921, 73 pp.
Bulletin 238. Report on Feeding Stuffs, 1921, 34 pp.
Cryscopy of Milk. Report of Associate Referee. J. Assoc. Offic. Agr. Chemists 1922, 5, 494. Report of Referee on Tea, J. Assoc. Offic. Agr. Chemists 1922, 6, 107.

ENTOMOLOGICAL DEPARTMENT.

Dr. W. E. Britton in charge.

Dr. Britton is the state as well as the Station Entomologist, and the following paragraphs cover his work in both capacities.

An extensive wind-spread invasion of the gipsy moth was brought to light by the scouting work of last winter, done in co-operation with the Federal authorities, who have charge of most of such work on the borders of areas known to be infested. All of Tolland and Hartford Counties are scatteringly infested, also

the northern and eastern borders of Litchfield County, two northern towns in New Haven County, two northern towns in Middlesex and all of New London County except four towns.

Windham County has been infested for several years and is now more thickly infested than any other part of the state.

Following the Federal quarantine, a state quarantine, No. 4, has been published, with a map, in Bulletin of Immediate Information No. 18.

This new infestation makes the area to be treated three times as large as before and makes the present appropriation entirely inadequate to do the work required. Between 20 and 25 state men have been employed in this work throughout the year.

In discharge of other work required by special statutes, 106 official nursery inspections have been made, and all stock infested with dangerous pests destroyed before certificates were given permitting the shipment of stock.

Thirty shipments, 159 cases, of imported nursery stock were inspected and 56.6 per cent of them found infested with insects or fungi, which had to be destroyed before release.

Apiary inspection involved examination of 797 apiaries containing 8,007 colonies. Thirty-three apiaries and 68 colonies had European foul brood, 11 apiaries and 22 colonies had American foul brood.

Mr. Sealy has had charge of the maintenance of drainage for mosquito elimination, besides making several preliminary surveys and giving advice as to the best means of getting rid of the mosquito nuisance.

Aside from the foregoing work, which is required by statute, the following comparisons of sprays *vs.* dusts have been the joint work of Mr. Stoddard of the botanical and Mr. Zappe of the entomological department:

On apples: Sulphur dust *vs.* liquid L. & S., in two orchards; Saunders dust and sulphur dust *vs.* liquid L. & S., and liquid L. & S. *vs.* 3-6-50 Bordeaux, each in one orchard; Saunders dust *vs.* sulphur dust and liquid L. & S. in one orchard.

On peaches: Sulphur dust *vs.* atomic sulphur, and Henry's Summo spray, in one orchard; Atomic sulphur *vs.* sulphur dust in another orchard.

The entomological department has also made the following comparisons:

On cherries: Liquid L. & S. 1 to 40 *vs.* 2-6-50 Bordeaux, both with Kayso spreader.

On potatoes, 4-4-50 Bordeaux *vs.* Saunders dust, in two places.

On onions, 4-4-50 Bordeaux with and without Kayso spreader.

All the tests included check plots, and comparison was made between three and four applications. They involved individual examination and scoring of about 384 barrels of apples and 600

baskets of peaches. The results are being prepared for publication.

Besides these, tests of various dormant sprays to kill the San José scale have been made, and dusting experiments on potatoes, turnips and cabbages have been conducted. Field tests have also been made to control the cabbage maggot, and of paradichlorobenzene to kill the peach borer.

Special studies have been made of the raspberry fruit worm, *Byturus unicolor*, the spruce mite, a pest of spruce trees in ornamental plantings, and of the European red mite, *Paratetranychus pilosus*, a pest of apple orchards. Various sprays for its control have been tested.

The life history of another species of spittle-bug or frog-hopper, found on alders, has been established.

Further observations have been made on the life history, spread and injury done by the apple and thorn skeletonizer, *Hemerophila pariana*, first found in Connecticut at Greenwich in 1920, and now distributed throughout the state. Nearly all unsprayed apple trees in Fairfield and New Haven Counties and the southern part of Hartford County were brown in late summer from its attacks.

A paper by Dr. Garman on the Dragonflies of Connecticut is nearly finished and will be published by the State Geological and Natural History Survey.

Dr. Britton and fifteen other specialists have prepared a monograph on the Hemiptera of Connecticut, containing 1100 typewritten pages, 20 plates and 169 text figures, which is now in the printer's hands, to be issued as a bulletin of the State Natural History Survey.

The office routine has included the writing of 2,350 letters, 656 circulars and postals, 54 reports to the Federal Horticultural Board, and 15 lectures and addresses at farmers' gatherings.

There have been moderate additions to the library and insect collections.

The publications of the department have been:

By W. E. Britton:

Twenty-first Report, State Entomologist of Connecticut (Bull. 234), 94 pp., 6 figs., 16 plates.

Control of Ant Invasions, Bull. of Immediate Information No. 17, 6 pp.

The Gipsy Moth Quarantine, Bull. of Immediate Information, No. 18, 4 pp.

Report of Committee on Injurious Insects. Proceedings 31st Annual Meeting, Conn. Pomol. Soc., 1922, p. 71.

New Facts Regarding Insects attacking Vegetables and their Remedies. Proceedings 9th Annual Meeting Conn. Veg. Growers Ass'n, 1922, p. 44.

Tobacco Plants Injured by Seed Corn Maggot. Jour. Economic Entomology, Vol. 15, 1922, p. 275.

Preparedness for Insect Control. Market Growers Journal, June 15, 1921, p. 12.

Notes in New Haven County Farm Bureau News on Potato Spraying and Skeletonizers on Apple and Birch Trees.

By W. E. Britton, M. P. Zappe and E. M. Stoddard:

Experiments in Dusting *versus* Spraying on Apples and Peaches in Connecticut in 1921. (Bull. 235, 20 pp., 5 figs., 6 plates.)

Results on Apples and Peaches in Connecticut. Bull. 2, Crop Protection Digest, Feb. 1922, p. 7.

By W. E. Britton and S. T. Sealy:

Mosquito Work in Connecticut in 1920. Eighth Rept. N. J. Mosquito Extermination Ass'n, p. 64, 1922.

By Philip Garman:

The Grass Feeding Frog-Hopper or Spittle Bug, Guide to Nature, Vol. XIV, 1922, p. 165 (2 pp., 3 illustrations).

By M. P. Zappe and E. M. Stoddard:

Results of Dusting *vs.* Spraying on Apples and Peaches in Connecticut. Proceedings 31st Annual Meeting Conn. Pomol. Soc. 1922, p. 77.

FORESTRY DEPARTMENT.

Mr. W. O. Filley in charge.

The transfer of the records of the state forester, including the fire warden service, to the newly appointed state forester has involved considerable labor, but will leave more time for experimental forestry work.

The call for forest planting stock has been very large this year, but the supply consisted simply of five-year red pine transplants and two-year white pine seedlings. A commercial nursery held this stock for delivery at wholesale rates on orders placed through this department. By this arrangement forest planters made a considerable saving. The supply was less than the demand. About 211,000 trees were thus secured and planted by fifty applicants. Three thousand black walnut seedlings were obtained from Ohio and distributed at cost.

The experimental plantings at Rainbow have made good growth, but two small fires ruined a plantation of six acres. Descriptive signs have been put up to make it possible for visitors without a guide to learn some of the important lessons of the experiment.

The work of controlling the white pine blister rust has been carried on in Litchfield County by Mr. Hicock, who spent four months in camp with eradication crews. The disease was found to be spreading in Cornwall, Salisbury, North Canaan and Canaan.

As the state appropriation is inadequate, help has been sought from the towns and private owners. Through the Litchfield

County Farm Bureau a meeting was held in Cornwall. A committee was appointed to raise $2,000 by subscription, the state to spend an equal amount. Eradication work was carried on from May 16 to September 16. Over 5,000 acres were covered and nearly 100,000 wild currant and gooseberry bushes were removed.

A number of land owners in Salisbury met the expense of eradication work, the wages of a foreman and director being paid by the state. A local crew of five covered nearly 2,000 acres, removing about 37,000 wild currant and gooseberry plants. At a meeting in August, it was decided to endeavor to raise $3,500, for two years' work, if the state will contribute an equal amount.

By a co-operative agreement between the Bureau of Plant Industry, the State Relations Service, the Extension Service of the Agricultural College, and this Station, an effort is being made to show the public the seriousness of this rust, how to recognize it, and how to protect their property against it. The Bureau of Plant Industry will appoint and maintain educational agents in counties or groups of counties who will work under the supervision of this Station. One agent was assigned to Litchfield County in May; a second to Tolland, Hartford and Windham Counties in August, and a third to the remaining counties in October.

The sample forest plots at Woodbury, established in 1912, have been remeasured, the small wood lot at Mt. Carmel is being changed from a culled stand of hardwoods to a stand of mixed conifers, and a further survey is being made of the larger wood-using industries of the state.

The forester, together with the entomologist and botanist, act as a Tree Protection Examining Board to test the qualifications of those who do commercial work in the treatment of ornamental and orchard trees and to give certificates to those who are qualified.

The routine work of the office has involved the writing of 984 letters, 439 form letters, and the sending of 2,936 mail and express packages. Fourteen addresses have been given on forestry subjects, and examinations of forest land have been made for seventeen owners, to whom advice was given.

PLANT BREEDING DEPARTMENT.

Dr. D. F. Jones in charge.

After years of strict inbreeding of different strains of corn, the method of combining these strains by crossing, to secure increased vigor and yield, is being made of practical use in what is called the double-crossed Burr-Leaming.

This is the result of crossing four inbred strains in pairs and again crossing the two resulting hybrids.

It is not a fixed variety, and will not continue to give high yields if the seed from the hybrid plants is used for planting. The only seed recommended is the first generation of crossed seed.

The double-crossed Burr-Leaming, as a silage corn, has proved superior in yield to many other varieties in numerous trials in Fairfield, New Haven, Middlesex and Hartford Counties, and is being tested for silage in Massachusetts, Vermont and New York. In southern Connecticut, it is also a high yielding husking corn.

It requires a season of from 120 to 130 days to ripen sufficiently for putting in the shock. It is a large growing variety, requiring generous fertility and not too close planting.

At the trial field at Mt. Carmel this variety has outyielded every other in three years out of four. Only in 1920, when all yields were very low, did a single variety yield two bushels per acre more than this.

The average yields of the four best varieties and of the Burr-Leaming were, in bushels per acre:

	1918	1919	1920	1921
Four best varieties	87	68	45	82
Burr-Leaming hybrid	116	88	55	95

In our experience, this hybrid stands up better than most others, making it easier to cut with machinery, and the leaves on the whole plant stay green until the kernels are glazed.

This hybrid has been developed as a sort of by-product of the studies on inbreeding and cross-breeding undertaken to develop the fundamental principles of inheritance and which have been in progress for some fifteen years.

Work is also under way in improving the types of Evergreen and Golden Bantam sweet corn for canning purposes. The aim is to get even size and shape and especially uniform ripening.

Several methods for utilizing inbred strains are being studied to simplify the process of crossing, and, if possible, to do away with crossing entirely, while getting the best results in vigor, yield of grain and freedom from disease.

Studies on attaining complete homozygosity in naturally cross-fertilized species and studies on linkage of hereditary factors and inheritance of abnormalities with particular reference to sterility are at present only of interest to investigators.

Further studies of the best methods of growing and curing the Round Tip tobacco, which was originated by this department, and of certain new hybrid strains, will be reported with the work of the Tobacco Station after fermentation and testing are completed.

The ten-year test of corn varieties (eight years in co-operation with the Storrs Station) has been completed, and a report on the subject is in preparation.

The publications in scientific journals during the year, from this department, have been:

The Indeterminate Growth Factor in Tobacco and Its Effect upon Development. Genetics, 6:433-444, 1921.

Collins' Remarks on the Vigor of First Generation Hybrids, Amer. Naturalist, 55:457-461, 1921.

Indirect Evidence from Duplex Hybrids Bearing upon the Number and Distribution of Growth Factors in the Chromosomes. Amer. Naturalist, 56:166-173, 1922.

Selective Fertilization as an Indicator of Germinal Differences. Science, 55:59-60, 1922.

The Productiveness of Single and Double First Generation Corn Hybrids. Jour. Amer. Soc. Agronomy, 14: 242-252, 1922.

Dr. Jones has delivered two addresses at the Farmers' Week of the Ohio State University on "Breeding Out the Nubbins" and on "Inbreeding and Hybrid Vigor," and one address on "New Methods of Corn Breeding," at Berlin, Connecticut.

THE TOBACCO EXPERIMENT STATION.

Dr. G. H. Chapman in charge.

During the last winter a plan for the experimental field work was prepared. This included a test of the effect on yield and quality of supplying half the nitrogen and all the nitrogen in mineral forms, also of supplying half the nitrogen in fish or in tankage, the effect of small, moderate and large amounts of phosphoric acid, and tests of the effect of magnesia, sulphur and chlorine.

On a plot nearly ruined by wildfire last year, and where the infected leaves and stalks were plowed under, healthy broadleaf and Havana plants were set to determine whether the organism lived over winter and would attack the next year's crop. No evidence of such effects appeared.

The effect of close and open planting on the growth of Round Tip tobacco and the best time for harvesting were studied on another plot.

Fifteen strains of a Cuban- Broadleaf cross made by Dr. Jones are tested to decide which are worth further selection.

A number of so-called good and poor domestic strains are to be compared under uniform treatment to learn, if possible, the truth or falsity of the statement that our strains of Havana and broadleaf are deteriorating.

Various strains of domestic and imported Cuban seed have been tested under shade to determine the type most suitable for yield and quality.

The United States Department of Agriculture is co-operating in studies of brown-rot of tobacco and in the experiments with magnesia, etc., noted above.

It is hoped that within a few months the fermentation of the experimental crops will be finished and a report on them prepared.

Bulletin No. 1 of this department has been issued. Condensed Recommendations for the Control of Wildfire, 4pp.

PHYSICAL EQUIPMENT.

The Station equipment includes a working library of over 10,000 bound volumes and about 500 volumes not owned by the Station but deposited here as a loan, an herbarium of about 48,800 specimens and an insect collection of about 56,000 specimens.

The valuation of the Station land and buildings is..	$295,275
Of the contents of the buildings	102,645
	$397,920

An exhibition illustrating the various departments of the Station work was made at the Exposition in Hartford, January 23 to 27.

The Station field day was held at Mt. Carmel on September 2.

The routine work of the Station may be briefly summarized as follows:

Fertilizers analyzed	900
Feeds analyzed	535
Foods and drugs analyzed	2,400
Pieces of glass ware tested and certified	1,973
Samples of seeds tested	742
Specimens identified	491
Nursery, orchard, apiary and other inspections	933
Addresses at farmers' meetings	44
Publications in scientific journals	13
Entomological monographs prepared	2
Letters written (more than)	9,000
Post and express packages sent	3,038
Form letters sent (more than)	1,500

Respectfully submitted,

E. H. JENKINS,
Director.