

CONNECTICUT
AGRICULTURAL EXPERIMENT STATION

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OCTOBER, 1921

Report of the Director
For the Year ending October 31, 1921

BY E. H. JENKINS

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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OCTOBER, 1921

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Report of the Director

FOR THE YEAR ENDING OCTOBER 31ST, 1921.

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

A formal report of your Board to the Governor of the State is made annually. This, however, is not distributed with the bulletins and is therefore not generally seen by the public.

It seems wise, therefore, to give some brief summary of this Station's work in a form which can be read by all who are interested.

While much of the Station's work is fundamental and essential to the teaching of the Agricultural College and of the Extension Service, it is done without advertising and does not attract public notice, so that the needs of the Station and the importance of its work are quite generally overlooked. In addition to doing this agricultural research work this Station has become during the forty-six years of its life an agency of public service, primarily agricultural, but serving in large measure all the citizens of the State.

BIOCHEMICAL DEPARTMENT.

Dr. T. B. Osborne in charge.

Two projects are being studied in this department.

One of them, in charge of Dr. Osborne, is a study of the chemistry of the different proteins.

Another problem, closely related, in which Dr. Osborne and Dr. L. B. Mendel of Yale University are collaborating, is a study of the relative values of these proteins in nutrition. This has necessarily involved a study of all other factors of nutrition. Thus it has led to the discovery of the fat-soluble vitamine (coincidentally with its discovery by another investigator) and to further knowledge of the rôle of the other ingredients of the diet as well as to the perfection of artificial rations which have opened a wider field for study of fundamental problems. The first project was undertaken about thirty years ago by Dr. Osborne, long before the Adams fund was provided by Congress. The published results of these two researches have contributed largely to a new conception of the nature and composition of the proteins and their different values in nutrition, and have finally demonstrated the falsity of the assumption that the proteins of food are about alike in nutritive value, having shown that some are incapable of supporting the growth and even the life of animals, and that the others differ very considerably in their effectiveness.

The work of the present year may be briefly noticed as follows:

A method has been devised by which a ration for experimental animals can be prepared in which fat is at most a minimal contamination. On such rations young rats quadrupled their weight in the usual time and appeared as well nourished as rats which had liberal amounts of fat in their diets. Unless, therefore, a minute amount of fat plays as important a part in assimilation as do the vitamins, it is reasonable to assume that pure fats are not an essential part of the mammalian diet.

The same kind of experiment was then carried on with carbohydrates. A ration was prepared in which the amount of carbohydrates was at most exceedingly small. In some of these trials the rats grew from early age to adult size at a rate rarely exceeded on normal rations. A chemical analysis of the entire bodies of some of them showed that they contained practically as much glycogen as is found in rats fed on diets in which carbohydrates are abundant, indicating that the rat can manufacture the necessary supply of tissue carbohydrates from non-carbohydrate material, and can also supply its energy from other sources than carbohydrates.

Next an experiment was tried of excluding *both* carbohydrates and fat from the diet, which then contained more than 90 percent of protein, 5 percent of inorganic salts along with small daily doses of vitamins in dried alfalfa and brewery yeast, thus forcing the animal to meet its energy requirement from protein alone. In these trials, which are still in progress, the rats have grown at more than normal rate to about 225 grams, but subsequent growth has been much slower so that the final outcome is uncertain.

Trials with variable quantities of vitamin B, in rations which were otherwise identical, show a quantitative relation between the amount of vitamins fed and the gain in weight.

The record of 1,000 rats which have been under experiment here show that ophthalmia has appeared only in rats deprived of the fat-soluble vitamin, but never in those weakened by any other disease or defect of diet, and never has it "spread," though the ophthalmic rats have been close to those which did not have the disease. This strongly indicates that xerophthalmia is purely a food-deficiency disease and is not infectious.

In view of the question frequently asked whether dried milk is deficient in vitamins, it is worth while noting that in this laboratory rats have grown from early age to full adult size, for more than a year, on dried milk powder, corn starch and lard.

Dr. Osborne has undertaken the study of the proteins of green or growing plants; a study of extreme difficulty, but in which the experience of many years in the study of reserve proteins of seeds is of great value. This is a very important field of study which

apparently has received no attention because of its great difficulties.

The work above described is of fundamental importance. Its results may not be immediately applied to feeding practice, but it provides the basis on which most rational experimental work on feeding problems can be securely placed.

The co-operative exhibits for the meeting of the American Medical Association and of the National Child Welfare Association have been noticed in the report of the Chemical Department.

The results of the work of the biochemical laboratory are published in scientific journals. Following is a list of those which have appeared during the present year:

- Skimmed Milk as a Supplement to Corn in Feeding. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLIV, 1-4.
- Growth on Diets Poor in True Fats. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLV, 145-152.
- A Critique of Experiments with Diets Free from Fat-Soluble Vitamine. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1921) XLV, 277-288.
- The Effect of Alkali on the Efficiency of the Water-Soluble Vitamine B. Thomas B. Osborne and Charles S. Leavenworth. Jour. Biol. Chem. (1921) XLV, 423-426.
- Does Growth Require Preformed Carbohydrate in the Diet? Thomas B. Osborne and Lafayette B. Mendel. Proc. Soc. Exper. Biol. and Med. (1921) XVIII, 136-137.
- Growth on Diets Containing More than Ninety Per Cent of Protein. Thomas B. Osborne and Lafayette B. Mendel. Proc. Soc. Exper. Biol. and Med. (1921) XVIII, 167-168.
- Ophthalmia and Diet. Thomas B. Osborne and Lafayette B. Mendel. Jour. Am. Med. Assn. (1921) LXXVI, 905-908.
- La oftalmia y el regimen. Thomas B. Osborne and Lafayette B. Mendel. Jour. Am. Med. Assn. Edicion Espanol. (1921) V, 503-506.
- Anaphylaxis Reactions with Purified Proteins from Milk. H. Gideon Wells and Thomas B. Osborne. Jour. Infect. Dis. (1921), XXIX, 200-216.

THE BOTANICAL DEPARTMENT.

Dr. G. P. Clinton in charge.

This department, in co-operation with the Entomological Department and with Mr. B. A. Porter of the U. S. Bureau of Entomology, has conducted rather elaborate experiments on the comparative efficiency of dusting *versus* spraying apples and peaches to combat insect and fungous pests. Mr. Stoddard was the co-operating member from this department. This is a continuance of similar tests made last year on apples.

For this work the apple orchards of Messrs. W. F. Platt and F. N. Platt at Milford were used and the Station's orchard at Mt. Carmel. The experiments with peaches were carried on at Mr. M. L. Coleman's orchard at Cheshire and the Station's orchard at Mt. Carmel. The number of trees involved was 1,017, and the fruit individually examined and scored amounted to about 334 barrels of apples and 1,715 baskets of peaches.

The work on the improvement of sweet-corn seed, now in its second year, has been done by Mr. Stoddard at the farms of Mr. C. R. Treat of Orange, and the E. B. Clark Seed Co. of Milford, with gratifying results and will be continued for another year at least.

Data have been gathered on the condition and yield of the individual trees in the fertilizer tests at the Barnes experimental peach orchard, now in the tenth bearing year.

Studies of the white-pine blister-rust have been continued and the results partially prepared for publication by Dr. Clinton and Dr. McCormick. These include work on some other rusts.

A tobacco disease survey has been carried on, chiefly by Dr. Clinton, the results to be published as soon as other work will permit.

A study of the wild-fire of tobacco has taken most of the time of Dr. Clinton, Dr. McCormick and Mr. Graham during the past summer. It is hoped to prepare the results shortly for publication.

Dr. McCormick has made life-history studies of the *Thielavia basicola* (root rot of tobacco) and has brought to light the ascospores of this fungus in artificial cultures.

Cultures of miscellaneous fungi, especially of *Pythium*, have been obtained and are being studied by Dr. Clinton and Dr. McCormick.

Eight hundred and sixty-two samples of agricultural seeds have been tested for various growers, besides about 2,000 ears of sweet corn for the seed-corn selection work of the Station, and also the ears of twenty-five barrels of sweet corn for the E. B. Clark Seed Co., for selection of their seed stock planting.

Three hundred and eighty-two specimens have been added to the herbarium, which now numbers nearly 48,500 specimens.

THE CHEMICAL DEPARTMENT.

Dr. E. M. Bailey in charge.

The time of this department is largely occupied with the chemical examination of fertilizers, feeding stuffs, human foods and drugs, as required by statute and with analyses required by experimental field work at this Station and at Storrs. Six hundred and three samples of commercial and other fodder materials, more than one thousand samples of commercial and other fertilizers, and about twenty-two hundred samples of foods, drugs and miscellaneous materials have been examined and the results have been published or are being prepared for publication. Ten hundred and sixty-nine pieces of Babcock glassware have been tested and certified for creameries and individuals in this state. Of the number tested, about one percent were found inaccurate and so marked.

In collaboration with the Biochemical Department an educational exhibit was prepared and exhibited at the annual meeting of the American Medical Association held in Boston. It consisted of stuffed experimental animals, photographs and charts showing the results of various lines of investigations. A descriptive leaflet was also distributed. A similar exhibit was prepared for the meeting of the American Child Hygiene Association in New Haven.

The chemist in charge has continued to collaborate with the Council of the American Medical Association in matters pertaining to diabetic and other special foods; and, as Associate Referee on the cryoscopy of milk for the Association of Agricultural Chemists, has prepared a report of data obtained in this and other laboratories upon the freezing point range of authentic milk from normal and abnormal cows for the purpose of establishing a basis for the judgment of market milk with reference to the detection of added water.

Mr. Andrew, as Referee on Tea for the same Association, has prepared a report of studies on the determination of caffeine, which includes a new method for this determination devised in this laboratory; and he has further collaborated in the study of methods for the analysis of drugs.

Mr. Shepard has continued to participate in the co-operative analytical program of the American Oil Chemists' Society, which involves analyses of check cottonseed meals and fertilizers every month, with the aim of securing greater uniformity of procedure in the examination of these products.

Expert testimony in court has been furnished to the Dairy and Food Commissioner when required.

The department has issued Bulletin 223 on Fertilizers, Bulletin 227 on Food Products and Drugs, and Bulletin 229 on Feeding Stuffs.

Mr. R. N. Copeland, Ph.B., filled a temporary appointment as chemist from March 1st to September 1st, 1921. Mr. Harry J. Fisher, A.B., was appointed as a chemist on October 17th, 1921.

ENTOMOLOGICAL DEPARTMENT.

Dr. W. E. Britton in charge.

The control operations against the gypsy moth in the eastern portion of the state have been continued vigorously under the supervision of Mr. John T. Ashworth, in co-operation with the Federal Bureau of Entomology. The federal men have scouted the margin of the infested area, while the state men have worked in the more thickly infested territory. The federal scouts found three new towns infested (Stafford, Somers and Suffield), all bordering upon Massachusetts. While this pest has done great

damage in the neighboring states of Massachusetts and Rhode Island, any serious damage in this state has been prevented. The imported nursery stock inspected consisted of twenty-one shipments, containing 126 cases. Ten shipments, or 47.6 per cent, were found to contain insects or other animals or plant diseases, some of which are known to be pests, and the infested material was destroyed.

The ninety-four nurseries in the State have all been inspected, one of them twice, but a few of them have not yet cleaned up their nurseries so as to receive certificates. In addition, sixty-five orchards and gardens have been examined with reference to insect pests.

The elaborate experiments on the comparative efficiency of dusting *versus* spraying on apples and peaches, in which this department co-operated with the Botanical Department and Mr. B. A. Porter of the Bureau of Entomology, has already been noted above.

Mr. Walden has studied the life history of the raspberry fruit worm, *Byturus unicolor*, and will continue his observations next year and also test measures of control.

Mr. Walden has made further collections of leafhoppers which, together with the material collected in 1920, form an exceedingly valuable series from Connecticut.

Mr. Zappe has carried out a number of minor projects, mostly along control lines. Some of these are as follows:—spraying to control the arbor-vitae leaf miner; wire-worm experiments on tobacco; controlling the rhododendron lace bug; relation between flea-beetles and tobacco wild-fire; paradichlorobenzene as a remedy for the peach borer. Mr. Zappe has made important collections of beetles and has spent much time rearranging the Coleoptera in the Station collection to conform with the new Check List.

Dr. Garman has given considerable attention to a study of the European red mite, *Paratetranychus pilosus*, and is experimenting with various materials to destroy the eggs. He has studied the violet midge, *Contarinia violicola*, which caused much damage in the large greenhouses of the W. W. Thomson Company of West Hartford. Dr. Garman has made studies of the grass-feeding spittle-bug, and his paper has been published as Bulletin 230 of this Station. He will continue to study the other species of this group of insects (family *Cercopidae*), as their life histories are not at all well known.

Dr. Garman has nearly finished a paper on the Odonata or dragon-flies of Connecticut, to be published by the State Geological and Natural History Survey, and will prepare a paper on the mites of Connecticut, to be published also by the Survey.

Dr. Garman has made important collections of Odonata from the different sections of the state, and has made many drawings to be used to illustrate the Hemiptera of Connecticut.

Mr. Sealy has supervised the maintenance of the mosquito ditching work during the season. There has been very little new work. The appropriation was increased \$2,000 by the General Assembly.

The insect collection now contains more than 5,500 named species. The number of specimens is as follows:—

Systematic collection	20,800 specimens
Duplicates	30,000 specimens
Undetermined	5,000 specimens
Total	55,800 specimens

The department library now contains about 1,000 bound volumes and 3,000 separate pamphlets. There are 2,300 photographic negatives, 720 lantern slides, and 1,400 microscopic mounts of insects.

The entomologist has aided in a number of the projects, has investigated an injury to tobacco plants by the seed corn maggot, has attended to the correspondence and issued the necessary certificates, and has spent much time editing and revising the manuscript of the Hemiptera of Connecticut soon to be published by the Geological and Natural History Survey. His Check-List of the Insects of Connecticut was published early in the year.

Some time has also been devoted to the work of the Tree-Protection Examining Board.

PUBLICATIONS OF ENTOMOLOGICAL DEPARTMENT 1921.

By W. E. Britton:

Twentieth Report State Entomologist of Connecticut (Bulletin 226); 84 pages, 13 figures, 12 plates; 10,500 copies distributed in April 1921.

Spray Now to Kill the European Red Mite; Bulletin of Immediate Information No. 13 (mimeographed), 3 pages; 600 copies distributed March 10, 1921.

Check List of the Insects of Connecticut; Bulletin 31, State Geological and Natural History Survey; 397 pages; distributed in spring by State Librarian at Hartford.

The European Corn Borer; Report Connecticut Board of Agriculture for 1919-1920, page 92; 4 pages; 1921.

Report of Committee on Injurious Insects; Proceedings 30th Annual Meeting Connecticut Pomological Society; page 36.

Report of Committee on Insects and Diseases, Insects; Report Connecticut Vegetable Growers' Association, page 21; 1921.

First Report of the Tree-Protection Examining Board; Bulletin 231; 12 pages; 11,500 copies distributed in November 1921; 1000 copies in the form of a separate to be used by the Board.

The House Fly as a Carrier of Disease Germs and How Controlled; 12 pages, 2 figures; published as an unnumbered bulletin of the State Department of Health (Revised Edition).

- By W. E. Britton and G. P. Clinton:
Spray Calendar (Bulletin 224), 44 pages, 95 figures: 11,500 copies distributed in March 1921.
- By W. E. Britton and L. O. Howard:
William Hampton Patton, Entomological News, Vol. XXXII, page 33 February 1921, 8 pages, 1 plate.
- By B. H. Walden:
Progress of Anti-Mosquito Work in Connecticut, Proceedings 7th Annual Meeting New Jersey Mosquito Extermination Association, page 92, 1920.
- By M. P. Zappe:
Aphis Control, Report Connecticut Board of Agriculture for 1919-20, page 96, 1921.
- By Philip Garman:
A Study of the Bulb Mite (Bulletin 225) 20 pages, 3 figures, 3 plates; 10,500 copies distributed in March 1921.
The Grass-Feeding Frog-Hopper or Spittle-Bug (Bulletin 230) 12 pages, 3 figures, 2 plates: 10,500 copies distributed in November 1921.
The Relation of Certain Greenhouse Pests to a Geranium Leaf Spot (Bulletin 239, Maryland Agr. Exp. Station), 30 pages, 7 figures, October 1920.
The European Red Mite, *Paratetranychus pilosus*, Can. & Fanz., in Journal of Economic Entomology, Vol. 14, page 355, 1921.
- By Philip Garman and F. L. Stevens:
The Genus *Septoria* Presented in Tabulation with Discussion, Trans. Ill. State Acad. Science, Vol. XIII, page 176, 44 pages, 1920.

FORESTRY DEPARTMENT.

W. O. Filley in charge.

Since 1901 the Station Forester has, as State Forester, purchased and administered land for state forests and since 1905 has, as State Forest Fire Warden, organized and supervised the local fire warden service. Hereafter the State Forester will be appointed by the State Park and Forest Commission with an office in Hartford. The first incumbent of the new position is Austin F. Hawes, who served as forester of this Experiment Station from 1904 until 1909.

The new arrangement relieves the Experiment Station of responsibility for the state forests and the fire warden service, both of which require an increasing amount of administrative routine. This change will give the Station Forester more time for experimental work. He is by statute made an ex-officio member of the State Park and Forest Commission, and will continue to co-operate with the State Forester in his work.

Forest Planting.—The nursery work at Mt. Carmel was confined to lifting and shipping over 50,000 transplants set out as

two-year seedlings in 1919, and transplanting a few thousand two-year seedlings from seed beds on the Station grounds. The fifty thousand transplants were shipped to the Portland, Simsbury and Eastford State Forests.

An arrangement was made with a commercial nursery to fill small orders for forest planting stock at prices based on the total amount of orders placed by the Experiment Station. In this way wholesale rates were secured for thirty land owners whose orders totalled 122,500 red and white pine transplants. Ten thousand trees for use on state forests and parks were purchased in the same way. The total shipments for forest planting by the Experiment Station and by the commercial nursery on Experiment Station orders, amounted to 175,000 trees.

The plantations at Rainbow have required but little attention. Mr. F. M. Snow continues to act as caretaker. He has harrowed the fire lines and attended to sales of wood as well as guarded against fires and trespassers.

White Pine Survey.—The white pine survey undertaken in 1919 was completed in the winter of 1921 in co-operation with the Bureau of Plant Industry.

The fifty-four towns covered by the survey give the following results:

County -	Forest Area Acres	Hardwood and Pine Areas Acres	Pure Pine Stands Acres	Pine Reproduction Acres	Standing Pine Timber Acres
Litchfield, (15 towns)	220,050	56,450	6,700	6,725	52,970,000
Hartford, (16 towns)	117,150	3,625	5,600	5,850	33,940,000
Tolland, (8 towns)	109,100	15,700	2,600	1,550	21,325,000
Windham, (11 towns)	147,950	56,550	3,725	1,725	22,770,000
New London, (2 towns)	31,950	9,550	450	275	4,950,000
	<u>626,200</u>	<u>141,875</u>	<u>19,075</u>	<u>16,125</u>	<u>135,955,000</u>

Throughout the rest of the State there are a few scattering stands of pine which would doubtless bring the total to 140,000-000 Ft. B.M. There is also a sufficient acreage planted to pine in the other towns to make the total area of young growth at least 20,000 acres. The value of standing pine is approximately \$1,120,000 and the present value of young pine growth is not less than \$500,000.

White Pine Blister Rust.—Control work has been carried on under the supervision of Mr. Hicock.

(1). The Branford area was carefully scouted for pine infections but, as in previous years, none were found.

(2). Inspection of plantations. Twelve plantations and one nursery in which pine infections had previously been found and eradication work done were again inspected. Infected pines were found in seven of these but the infections were so localized as to indicate that the disease is being effectually controlled there.

(3). The eradication of wild Ribes (currants and gooseberries) from infected areas in Norfolk, Canaan and Colebrook between May 1st and September 15th, covered about 8,000 acres, one half of which had been previously worked in 1916-1917, and 1919. In the area worked for the first time considerable pine infection was found, but mostly concentrated near small infection centers. In the areas reworked few Ribes were found, and almost no pine infections of a date subsequent to the eradication. About 39,000 Ribes bushes were pulled and destroyed during the summer.

(4). The Pomfret area, of which a survey was made in 1919, was carefully scouted again and five infected pines found. Only one of these was outside the original infected area. The disease seems to be under control here, although the area must be watched for several seasons.

(5). Cornwall. As new pine infections had been located in Cornwall last winter, that town was thoroughly scouted during the summer and infected pines were found very widely distributed. They were mostly 1918 and 1919 infections which had not yet fruited. The situation is so serious that it seems necessary to begin eradication work in this town next season, and it will be necessary to ask land owners to bear a share of the cost, as the state appropriation alone will not be sufficient for all the work to be done next year.

(6). Further scouting. After September 15th, scouting was done in Canaan, North Canaan, Salisbury, and the towns along the Rhode Island line. In these latter no suspicious infections were discovered, but the towns northwest of Cornwall show almost as bad conditions as were found in that town.

It seems evident that the blister rust had become established in Cornwall, Canaan, North Canaan and Salisbury before control work was effective in Norfolk. Until this year, however, most of these infections could not be detected and only a small percentage has as yet fruited. The northern half of Litchfield County will require radical measures in the near future if the spread of the disease is to be checked. It may be necessary to establish a quarantine and prohibit the growing of currant and gooseberry bushes in that region. Financial co-operation with the towns, or with the land owners, must also supplement the state appropriation, which is entirely inadequate to relieve the situation promptly and effectively.

State Forests.—The State Forests were under the charge of the Station Forester for eight months of the year. Only two purchases of land were made during that time. The addition of

154 acres at Eastford and twenty acres at Portland made the total area of State Forests 4,441 acres as turned over to the new State Forester. Additional purchases have been completed since July 1st from the appropriation of \$10,000 granted by the Legislature of 1921. Sales of wood, ties, poles, etc., amounted to \$2,375.

In the spring, plantings were made as follows:

Portland	12,000 red pine	500 arborvitae	
Simsbury	17,000 red pine	4,000 arborvitae	
Eastford	15,000 red pine	4,000 Douglas fir	4,000 white spruce

The total number of trees planted on state forests was 56,500.

In the fall of 1920 Mr. Moss and Mr. Hicock started the field work for a topographic and type map of the Eastford State Forest, but were unable to complete it that season. Mr. Moss therefore continued the work during the summer and fall of 1921, as a co-operative project with the State Forester. Since this survey was initiated and carried out by the Experiment Station, it will probably be published as a Station bulletin, as was the working plan for the Portland State Forest made in 1913.

State Forest Fire Warden.—The calendar year 1920 showed the smallest total number of forest fires in any year since records have been kept. Only 408 fires were reported, of which 208 were in the month of April, and 112 in May, leaving only eighty-eight for the balance of the year. The area burned over was 11,348 acres, and the estimated damage was \$40,000, both these totals also establishing new low records. Although due credit should be given to the fire wardens for increased vigilance and efficiency, it is probably true that the decrease in the number of fires is largely due to weather conditions. During the first six months of 1921, 530 fires were reported with an area burned of 17,465 acres, and an estimated damage of \$70,000. This increase over the previous year is readily accounted for by a comparatively light snow fall during the winter, especially in March, so that the ground was bare over most of the state by the first of April. The precipitation was below normal in most parts of the State for every month except April.

Tree Protection Examining Board.—The work of this Board, of which Mr. Filley is Secretary, has already been reported in Bulletin 231.

PLANT BREEDING DEPARTMENT.

Dr. Jones in charge.

Ten years' work in careful selection from a cross between Sumatra and Broadleaf tobacco has resulted in fixing a type called Connecticut Round Tip, which combines the higher number and better shape of leaves of the Sumatra with the larger size of the Broadleaf.

This is briefly described in Bulletin 228.

While its actual value and the best method of growing and fermenting this type is not yet fully established, it is meeting with favor among growers. About 200 acres have been grown this year, and a larger acreage next year seems assured.

The method of corn-breeding based on selection in self-fertilized lines is now in its third year. Following our initiative, sixteen Stations in this country, two in Canada, and one each in Spain and Italy are taking up this method and applying it to the improvement of corn.

The number of generations of self-fertilization necessary to attain complete uniformity and stability in a naturally cross-pollinated plant, such as corn, is being studied, using material which has been inbred for sixteen years.

The breeding work on tobacco will be greatly facilitated by the establishment of the tobacco station which is noticed elsewhere. It includes:

(1). The study of inheritance of yield, quality, shape and number of leaves after crossing established varieties. Particular attention is now being given to several selections of a cross of Broadleaf and Cuban varieties.

(2). A strain test to determine whether inherited differences have arisen in established varieties of tobacco which are normally self-fertilized, and if so the most desirable will be propagated and tested.

(3). Selection of plants on the basis of resistance to root-rot disease to determine whether such differences permanently exist, and if so, whether sufficient resistance exists as to be commercially practicable and what is its relation to yield and quality.

In co-operation with the Storrs Station this department has made a careful corn survey of the State and after collecting the varieties which appeared most productive and otherwise desirable, comparative field tests have been made with them during six years at Storrs and Mt. Carmel. The results have been tabulated and sent to those specially interested with a map of the state showing the sections in which different varieties may be expected to give the most satisfactory yields and also giving the names of growers from whom the seed may be obtained.

In addition to the bulletin cited above there has been published:
Genetic Studies on the Protein Content of Maize. E. M. East and D. F. Jones. *Genetics*, 5: 543-610, Nov. 1920.

THE TOBACCO EXPERIMENT STATION.

The last General Assembly appropriated to the Board of Control of the Connecticut Agricultural Station \$10,000 for the biennial period for research and experiment on the causes and

prevention of diseases and injuries to the Connecticut tobacco crop which occur in the field or in the preparation for market and for improving the crop by selection and breeding and by co-operative experiments with growers.

The Board is authorized to accept gifts or loans of land or equipment, or gifts of money to be used exclusively for the purposes named above, such gifts of land to be accepted in the name of the state.

The Station is required to make an annual report to the Governor to be printed with the Station report and is authorized to issue bulletins of information of value to tobacco growers.

The Act was approved May 5, 1921.

Anticipating this action, Messrs. F. W. Morgan, J. E. Ransom and J. B. Stewart of Windsor, because of their interest in the project, generously bought a tract of $13\frac{1}{2}$ acres of excellent tobacco land with three tobacco barns in Windsor and offered it to the Station at its cost to them, refusing a better offer from another source. The Station obtained funds from private sources to buy this land as no state appropriation could be used for the purpose.

This secures for the work what is absolutely necessary for its success, perpetual control of the land and the crops.

It was imperative to start work at once, or to lose a year's use of the land; but on May 5th, the earliest date on which we could undertake it, there were no seed beds, no tools, no fertilizers ready, and no one engaged to manage the field work.

In spite of these embarrassments it was determined to make a beginning, however unfavorable the outlook. Mr. Louis Evans, who had much experience in growing tobacco, was engaged to handle the field work. About seven acres of turf land were broken up, fertilized and fitted for the crop. Dr. Jones had a small supply of six tobacco selections from crosses of two types which were to be tested in the field for further selection and fermented for judgment of their quality. By gift and purchase plants were secured for setting about three and one-half acres of Round Tip tobacco, and a portion of the field was set off for study of tobacco diseases under Dr. Clinton's supervision, infected plants being supplied from beds made by him at the Station in New Haven and by donation from growers.

The plants were set during the first week in June.

About \$800 had to be spent in repairing and fitting the barns, and over \$500 for tools and miscellaneous supplies. In common with the experience of many other growers, the crop suffered from wild-fire, which gave opportunity for valuable study of this bacterial disease.

The crop cured successfully. The Round Tip is to be sold in the bundle and the selections are now being fermented under Dr. Chapman's supervision.

Immediately after the passage of this Act, leading growers and

packers in Connecticut and Massachusetts, appreciating the suggestion of the Legislative Committee on Appropriations that, if the state made an appropriation, the growers and packers should also co-operate with the state in financing, and realizing that the funds appropriated by the state were insufficient to adequately equip and maintain the tobacco experiment station to the extent deemed necessary, organized and incorporated the Connecticut Valley Tobacco Improvement Association, the objects of which are to "carry on any kind of work calculated to improve the quality of, or to protect from disease, New England tobacco, and to co-operate in this work with any individuals or organizations interested in such tobacco work."

This Association secured the services of Dr. George H. Chapman, of the Massachusetts Agricultural Experiment Station, to act in the capacity of Research Director, and also equipped an office and laboratory with sufficient endowment for maintenance and experiment at Windsor, in which pathological and chemical work necessary to the solution of the various problems can be carried on.

It was evident to both the Station and to the managers of this Association that the common aim of both could best be secured by the closest co-operation between them. The Station had suitable land for experimental work which, so far as can be seen, is secure for the long-continued work which is absolutely necessary, but the funds appropriated by the State are not sufficient to support the work which should be done. After full discussion, therefore, the following arrangement was concluded between the two organizations:

"It is the intention of the Board of Control of the Connecticut Agricultural Experiment Station to devote exclusively the land and buildings in Windsor held by it under the Lockwood Trust, to experiments on the growing of tobacco and on processes for its preparation for manufacture, so long as there are sufficient funds provided by the state or by a co-operating company for the suitable conduct of such work.

To this work the Station will devote the use of its land and the buildings already there and whatever money the state has appropriated or may appropriate for study of the tobacco crop.

The Station wishes the fullest co-operation possible with all agencies in the same kind of work.

In particular it desires close relations with the Connecticut Valley Tobacco Improvement Association as at present organized and administered; it being understood that while this Association is supported entirely by the contributions of its members, yet its work and findings are in the interest of all growers and handlers of tobacco in the New England district, and will be freely communicated to them in suitable ways.

To that end the following agreement has been made:

(1). Plans for the different kinds of experimental work to be carried out at the Tobacco Station may be proposed both by the Director of the Station and the Research Director of the said Association, and shall be adopted by mutual agreement and consent.

(2). The Research Director of the Association shall have general direction of the work in the field and of the curing, fermenting and further handling of the leaf and of its sale and it is understood that all income from sales shall be devoted to the furtherance of the experimental work.

(3). The Plant Breeder of the Station shall have the management of work in breeding and selection.

(4). Both the Research Director of the Association and the staff of the station shall be fully informed of the progress and results of the work done under the supervision of either.

(5). There shall be opportunity for work by the Station botanist on tobacco diseases on land especially set apart by mutual agreement for that purpose.

(6). If desired, a building or buildings for the purpose of experiment may be built on the land at the expense of either party. If it should be necessary for the Station at any time to dispose of the property, the Connecticut Valley Tobacco Improvement Association shall have opportunity to buy the property at its fair valuation as determined by competent judges selected by buyer and seller; but from the purchase price shall be deducted the value of any buildings erected by the said Association at their value as determined at the time of sale and by the said method of valuation.

(7). It is the present understanding of the Station that the fund appropriated by the state may be spent in any way for the furtherance of the work, either in salaries, labor, or supplies, and probably in building, though the opinion of the Attorney General on the last item is desirable.

(8). It seems desirable, if not necessary, that all publications should appear as co-operative between the Tobacco Improvement Association and the Station. For example—

Cause and Prevention of Canker in Tobacco, by G. H. Chapman, Research Expert. The Connecticut Valley Tobacco Improvement Association and the Connecticut Agricultural Experiment Station Co-operating.
Round Tip Tobacco, by D. F. Jones, Plant Breeder of the Conn. Agric. Expt. Sta. The Conn. Agric. Sta. and the Conn. Valley Tobacco Improvement Assn. Co-operating.

(9). For the publication of bulletins on the progress of results of the work the Station will provide, subject to limitations of space imposed by State authority.

(10). The Station laboratories and apparatus will be used in the work to the extent consistent with the other demands on it.

(11). Any further arrangements regarding the detail of the work shall be exclusively settled by the Research Director of the Connecticut Valley Tobacco Improvement Association, the Director of the Station, and Mr. J. W. Alsop, representing both agencies.

(12). In order that the Research Director may receive publications of other Stations and to facilitate the use of the franking privilege, he is made a member of the Station staff as "In charge of the Tobacco Station."

FARMERS' WEEK.

Beginning on January 24th, 1921, conferences of the various agricultural societies were held in Hartford, and an Exhibit was staged in the State Armory.

The Station occupied a floor space of about 64 by 18 ft., and made an educational exhibit of the work done in the six separate departments of its work. The success of the Exhibit was due to the very cordial co-operation of every one in the Station employ, for all of whom unusual work became necessary.

THE FIELD DAY.

On August 31st the annual Station Field Day was held at Mt. Carmel. As this year marks the three hundredth anniversary of the first planting of corn in New England by white men it was fitting that the breeding, selection and growing of corn should have been the subject of the talks after lunch. Between 250 and 300 were present.

PHYSICAL EQUIPMENT.

The equipment of the Station includes a working library of about 6,500 volumes and about 500 volumes not owned by the Station but deposited here as a loan, an herbarium of 48,500 specimens, an insect collection of 55,800 specimens, 1,500 lantern slides, 3,700 negatives, and 3,745 microscope slides.

The valuation of the Station land and buildings is.....	\$295,275
The valuation of the contents of the buildings.....	97,360

\$392,635

Respectfully submitted,

E. H. JENKINS,

Director.