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Thirty-ninth Annual Report

OF

The Connecticut Agricultural Experiment Station

Being the annual report for the year ended October 31

1915

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF.

SEPTEMBER 30, 1915.

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DONALD F. JONES, B.S., *Plant Breeder.*
C. D. HUBBELL, *Assistant.*

Vegetable Growing.
HOWARD F. HUBER, B.S.

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REPORT OF THE BOARD OF CONTROL

OF

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

To His Excellency, Marcus H. Holcomb, Governor of Connecticut:

The Board of Control of The Connecticut Agricultural Experiment Station herewith respectfully submits its report for the year ending October 31, 1915.

During the year there have been but two changes in the staff.

Mr. H. K. Hayes, plant breeder, after five years of efficient service here, left the Station in December, 1914, to take a professorship in the University of Minnesota. He is succeeded by Donald F. Jones, B.S., a graduate of the University of Kansas, formerly connected with the Arizona Agricultural Station and later an instructor in Syracuse University.

Miss F. M. Valentine, for three years stenographer in the entomological department, was obliged by ill health to give up her work in June and died in September of the present year. Miss Grace E. Foote now does the clerical and stenographic work of this department.

LEGISLATION AFFECTING THE STATION.

The General Assembly increased the appropriation for State Forests from $5,000 to $8,000, and for the fire-warden service from $5,000 to $7,000.

Chapter 264 of the Public Acts of 1915 authorizes the director of this Station to make rules and orders concerning the elimination of mosquito breeding areas, to enter premises for examination or elimination of mosquitos, and to take remedial measures, subject to right of appeal of the owners to the courts.

Chapter 267 of the Public Acts of 1915 requires towns to suppress the gipsy and brown-tail moths under the direction of the State Entomologist, who is also entomologist of the Station, one-half the amount expended by towns to be reimbursed by the

State. This bill carried an appropriation of $21,000 to be used by the State Entomologist in this work. The General Assembly also appropriated $4,000 which was made immediately available for summer work. The State Entomologist, subject to the approval of the Board of Control, was authorized to purchase supplies, employ men, and make rules and regulations governing town work.

A Special Act (124) of the General Assembly permits the printing of 525 pages of our annual report instead of 475 as formerly.

Botanical Department.

The laboratory studies of this department have been chiefly on poisonous plants, including mushrooms, on cultures of fungi, and on molds upon unsalted butter. Such studies often have to be carried on for some years before a comprehensive report can be made. This year the botanist's report consisted of a study of chlorosis of plants, with special reference to the "calico" disease of tobacco; a study based on experiments extending over nine years. There have been identified for applicants 268 botanical specimens, and 207 samples of seeds have been tested for purity or vitality or both.

Besides the experimental work at the Mount Carmel farm, such work has been done also at six different places in the State on nine different diseases, a part of it in continuation of work carried on for some years past.

At the Mount Carmel farm the members of the Station staff are continuing experiments on the following subjects: tests of various spray mixtures, selection experiments with melons, a study of peach yellows and crown gall, experiments with reference to selection and storage of seed potatoes, observations on the powdery scab, and studies of the effects of various fertilizers on the prevalence of plant diseases.

Chemical Department.

As required by statute, the inspections of fertilizers, cattle feeds and human foods and drugs have been made as usual, involving more or less extensive examinations of 713 fertilizers and soil amendments, 214 cattle feeds, and 2,114 samples of foods and drugs.

As provided by statute, 890 pieces of Babcock glassware have been tested and certified for the use of creameries in this State.

A considerable number of analyses have been made of vegetable products in coöperation with other departments, and many samples of soil have been tested for acidity.

Members of the staff have appeared in court fifteen times to give expert evidence in connection with the work of the State Dairy and Food Commissioner, and the chemical department has also given valuable help to the city police department and the State Board of Pharmacy in the effort to abate the traffic in narcotic drugs.

The chemical department has coöperated with the Association of Official Agricultural Chemists by making studies of three important analytical methods. In addition the department has finished work on the determination of phenolphthalein in drug mixtures, on the composition and digestibility of infant foods, and on caffein-free coffee.

A valuable index to the reports of this Station on Food Products and Drugs has been prepared by Mr. Street and has been published as Bulletin No. 187 of this Station. He has also prepared a chapter on Meat and Meat Products for a revision of the fourth edition of Allen's Commercial Organic Analysis and has contributed to journals seven other papers relating to various food and drug preparations examined here.

Messrs. Street and Bailey have also published a paper on the Carbohydrates and Enzymes of the Soy Bean.

Mr. Street has served on the Federal Committee of Food Definitions and Standards, the Committee on Revision of Methods of the Association of Official Agricultural Chemists, and as referee on diabetic foods for the Council of the American Medical Association.

Entomological Department.

The nursery stock inspection has required the careful examination of 78 local nurseries and of 1,349 cases or packages of imported nursery stock. Fifty-six of the 264 shipments contained insects or fungi, some of which were dangerous.

Of apiaries 494 have been inspected, containing 4,241 colonies. In 26 per cent of the apiaries European foul brood was found,

in 0.8 per cent American foul brood, and in ten apiaries pickled or sac brood. The cost of inspection was $1.51 per apiary.

The little scouting work for brown-tail moth which could be done showed the presence of the moth in three towns, Wethersfield, Newington and New Britain, where it had not been found before.

A very serious infestation of gipsy moth involving twenty towns in eastern Connecticut has made it necessary to spend the greater part of the available funds in fighting this insect. Necessary apparatus has been bought and Mr. Irving W. Davis has been constantly employed with a staff of scouts in discovering and destroying the pest. We have been most efficiently helped in this work by the coöperation of those in charge of the Federal work. It is believed that the pest has been materially checked, and in all except the four towns in the north-east corner of the State it is well under control.

The gipsy moth has been found in 20 towns, in 308 separate localities. Sixty-two infestations were sprayed and 6,000 trees were banded with Tanglefoot.

Mr. Lowry has continued successfully his experiments on control of the cabbage maggot, and Mr. Walden his experiments in controlling the white pine weevil.

A destructive European sawfly already established here was discovered in the nursery inspection.

A large number of duplicate pinned insect specimens, accurately determined, were given to Professor A. T. Morse for Wellesley College to start a collection in place of the one lost by fire.

Aside from the Station entomological publications, fourteen papers on related subjects by the entomologist, Dr. Britton, have been printed in various journals and reports.

Forestry Department.

The nursery work is being rapidly reduced as the special need for it decreases.

Seed of the white or paper birch has been successfully germinated and the seedlings will later be used in our experimental forest. Somewhat more than 100,000 seedlings have been sold from the Station nurseries, leaving available for use next spring about 70,000 seedlings.

The Rainbow plantation has only needed the clearing of fire lines and removing brush which interfered with planted trees. About 4,200 seedlings were also planted, and experiments in fighting the pine weevil were continued.

The assistant forester has given courses in forestry during the second semester at The Connecticut Agricultural College and made plans for the permanent management of the extensive forest land belonging to the college.

Thirteen examinations of forest land for private owners have been made. As a result of the forester's examination and report to the Elizabeth Porter Putnam Chapter, D. A. R., of the Wolf Den property in Pomfret, lumbering operations were carried on there by a contractor under the forester's supervision. The result was satisfactory to both the contractor and the owners and furnishes an example of conservative lumbering.

State Forests.

In the Portland Forest, attempts to check the spread of the chestnut disease by cutting diseased trees have been far from successful and will not be continued. There have been set in the forest 15,500 seedlings and transplants, and a systematic cutting of weeviled pine tops has been made.

In the Simsbury Forest the $250 received from the railroad company for fire damage has been spent in cleaning the fire lines and replacing the trees destroyed by fire. There were thus used 15,700 seedlings and transplants.

In the Union Forest the only work done was the weevil control.

In the Cornwall Forest a boundary survey has been made, and in the past summer a topographical survey from which working plans will be prepared.

Forest Fires.

In the fall of 1914 forest fires were very frequent, especially after the opening of the hunting season, and again in the spring of 1915. In February the ground was bare and no rain fell for six weeks beginning February 19th. Heavy snow early in April checked fires for a week, but from then on till June they were unusually frequent. The fire record for the six months ending

June 30th is worse than that of any previous twelve months. One thousand, three hundred and twenty-five fires burned over 100,000 acres, with an estimated damage of $247,000.

During the last summer an intensive forest survey of the town of Redding has been made to determine the present conditions and future needs of the badly deteriorated forest stand in that town, which is typical of many towns in the State. The work is an experiment to see whether the result will justify the expense, less than $300, and whether the land owners will be willing to coöperate with each other in doing those things which will lead to economic betterment of the forest area.

Plant Breeding.

The work on tobacco has included a study of the Sumatra-Broadleaf and Cuban-Havana crosses compared with the standard varieties and of the crosses between the Stewart and Normal Cuban strains. The study of inheritance of leaf number is continued with the Halladay selections in coöperation with Dr. East of the Bussey Institution and with the United States Department of Agriculture.

In connection with a corn survey of Connecticut now being made by the two experiment stations in coöperation, twenty-seven varieties of field corn have been tested for productiveness at Storrs, Mount Carmel and Greens Farms.

Seven of the nine first generation hybrid strains of corn tested at Mount Carmel have yielded better than either parent.

Other studies of inheritance in corn are being continued, and also less extensive work with tomatoes, rye and alfalfa.

Soy bean selections have given several distinct types of plants which are being tested for productiveness. Should any show special merit, seed will be grown for distribution.

Twenty-one farmers have grown the Hollybrook variety of soy bean in coöperation with the Station, and in most cases with very satisfactory results.

Protein Research Department.

During the year further quantitative studies of the nutritive deficiencies of zein, the principal protein of corn, have been made, and of the feeding value of rations in which the nutritive defects in the composition of the protein of one feeding stuff were

sought to be made good by supplementing it with another feed containing proteins of different structure.

Rigid experiments are being made to determine more exactly the relative nutritive value of the individual proteins for maintenance and growth.

The study under a variety of conditions of the effect of long-continued suppression of growth on subsequent capacity to grow shows that this capacity to grow to full size is retained for a time at least double that during which full growth is normally made.

Other valuable studies relating to the constitution and economic value of proteins are being made, but are of too technical a nature to make a description of them advisable in this report.

The results of this work done by Dr. Osborne in coöperation with Professor L. B. Mendel of Yale University and with the Carnegie Institution of Washington are published in scientific journals and are not further noticed in this report. During the year nine papers of this sort have been printed in these journals.

Vegetable-growing Department.

A test of different strains of Earliana tomato in continuation of last year's work has been carefully carried out, forming the basis for work in possible improvement in earliness, which will next be undertaken.

Similar tests of different strains of Southport White Globe onion have been begun.

A cross between Stowell's Evergreen and Golden Bantam sweet corn is being developed which has promising features.

A study of the merits of overhead irrigation on the truck farm was valueless because of the unusually abundant rainfall.

The Station has made two educational exhibits; one at the agricultural fair of the New London County Agricultural Society at Norwich and the other at the fair of the Connecticut State Agricultural Society at Berlin. These exhibits involve very considerable expense and seriously interrupt the experimental work of the Station at a time when the results of such work must be gathered, but they have excited so much interest and have brought to the attention of so many the uses which farmers can make of the Station that the effort has seemed to be justified.

The annual field meeting at the Mount Carmel farm was held on August 18th with an attendance of between 450 and 500 people. This meeting we consider most profitable and every effort should be made to have it a leading feature of the summer field meetings. It is not the plan to have formal addresses, but many informal talks and discussions on those parts of the grounds where the special crop or the special point under discussion may be seen and examined. We wish to have all the specialists and leaders in agricultural improvement present and taking part in these informal conferences.

The experiment field at Mount Carmel has been enlarged during the year by the purchase by the Lockwood Trust of 15.4 acres of land adjoining the original purchase. This purchase was necessary in view of the increased need of land for experimental work. While certain field work must be done elsewhere, it will certainly be more satisfactory to have the Station's experimental field work concentrated on its own land unembarrassed by connection with the operation of a private farm.

During the year covered by this report the Station has issued its annual report for 1914 of 462 pages and 32 plates in an edition of 10,000 copies; four bulletins in octavo form aggregating 147 pages with 16 figures in the text, and one bulletin in calendar form (being a spray calendar with 64 cuts); one bulletin of Special Information (4 pages); and one Joint Bulletin of 11 pages prepared by the Storrs Station and Connecticut Station jointly.

The Station correspondence has involved the sending of 11,538 letters and manuscript reports (administration office 5,102; and from the departments: botanical 748, chemical 943, entomological 2,423, forestry 1,968, plant breeding 18, vegetable growing 99, protein research 237).

There have been identified for applicants 555 specimens of insects and plants.

Members of the staff have made 79 public addresses at gatherings of farmers within the State, and 34 papers have been published in scientific journals discussing the results of experiments made at this Station.

All of which is respectfully submitted:

G. A. HOPSON,
Secretary.

NEW HAVEN, CONN., October 31, 1915.

REPORT OF THE TREASURER, 1915

E. H. JENKINS, in account with THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION for the fiscal year ending September 30, 1915.

RECEIPTS.

Balance on hand, October 1, 1914 (Analysis Fees)		$ 937.01
State Appropriation, Agriculture	$17,500.00	
State Appropriation, Food	2,500.00	
State Appropriation, Insect Pest	4,000.00	
State Appropriation, Gypsy Moth	4,000.00	
State Appropriation, Gypsy Moth Deficiency	4,000.00	
United States Appropriation, Hatch	7,500.00	
United States Appropriation, Adams	7,500.00	
Analysis Fees	10,200.00	
Sale of Station Produce	46.88	
Miscellaneous Receipts	578.53	
From Lockwood Trust Income (including sale of tree seedlings and Mt. Carmel Farm Produce)	10,900.72	
	$68,726.13	
State Appropriation, Insect Pest	250.00	
		68,976.13
Total		$69,913.14

DISBURSEMENTS.

E. H. Jenkins, director, salary	$2,800.00
E. H. Jenkins, treasurer, "	400.00
V. E. Cole, salary	930.00
L. M. Brautlecht, "	830.00
J. P. Street, "	2,500.00
T. B. Osborne, "	2,400.00
E. M. Bailey, "	1,800.00
C. B. Morison, "	1,333.34
C. E. Shepard, "	1,000.00
G. L. Davis, "	1,000.00
W. E. Britton, "	2,500.00
G. P. Clinton, "	2,500.00
E. M. Stoddard, "	1,200.00
W. O. Filley, "	2,200.00
A. E. Moss, "	1,600.00
H. K. Hayes, "	450.00
Edna L. Ferry, "	1,320.00
H. F. Huber, "	1,200.00
D. F. Jones, "	1,000.00
H. Lange, "	925.00
V. L. Churchill, "	825.00
Wm. Veitch, "	700.00
E. L. Avery, "	480.00
E. B. Whittlesey, "	720.00

C. D. Hubbell	$ 728.00	
H. Kiley	728.00	
Wm. Pokrob	728.00	
F. Sheldon	728.00	
Geo. Graham	728.00	
Labor	4,225.23	
Publications	1,515.11	
Postage	411.43	
Stationery	454.75	
Telephone and Telegraph	176.73	
Freight and Express	217.82	
Gas, Kerosene and Electricity	790.68	
Coal	1,507.00	
Water	159.05	
Chemicals and Laboratory Supplies	1,160.65	
Agricultural and Horticultural Supplies	193.30	
Miscellaneous Supplies (including gasoline)	1,285.52	
Fertilizers	504.97	
Feeding Stuffs	288.23	
Library and Periodicals	744.61	
Tools, Machinery and Appliances	1,787.79	
Furniture and Fixtures	311.40	
Scientific Apparatus	221.56	
Live Stock	4.50	
Traveling by the Board	248.35	
Traveling by the Staff	1,527.23	
Traveling in connection with Adams Fund Investigations	213.50	
Insurance	525.94	
Insect Pest Appropriation to State Entomologist	4,250.00	
Contingent	208.20	
Lockwood Expenses	400.00	
Gypsy Moth Appropriation to State Entomologist	4,000.00	
Gypsy Moth Deficiency Appropriation to State Entomologist	4,000.00	
New Buildings	85.90	
Betterments	123.35	
Repairs	640.82	
Total Disbursements		$68,436.96
Balance on hand, Sept. 30, 1915 (Analysis Fees)		1,476.18
		$69,913.14

NEW HAVEN, CONN., Oct. 25, 1915.

THIS IS TO CERTIFY that we have examined the acccounts of E. H. Jenkins, Treas. of The Connecticut Agricultural Experiment Station, for the fiscal year ending Sept. 30, 1915, and have found them correct.

WILLIAM P. BAILEY,
JAMES P. TOBIN,
Auditors of Public Accounts.

PART I.

Report on Commercial Fertilizers, 1915,

WITH SUGGESTIONS REGARDING FERTILIZERS IN 1916.

BY E. H. JENKINS, *Director, and* JOHN PHILLIPS STREET,
Chemist in Charge of the Analytical Laboratory.

THE PRESENT SITUATION, DECEMBER, 1915.

The problem of fertilizing the land was never so serious and perplexing as now, because of the effect of the war in Europe on business in America.

Potash in form of potash salts is only to be had in commercial fertilizers, most of which carry little more than one per cent of potash.

A very small supply comes from Japan and there is also a very small production in this country but all of this is, and for a good while will be, absorbed in chemical industries which are suffering for want of more.

No basic phosphate is imported and domestic production is almost negligible in amount.

Owing partly to the limited mining of phosphate rock, but chiefly to the enormous consumption of oil of vitriol in the manufacture of war munitions (estimated to be from 350,000 to 400,000 tons yearly), acid phosphate is very expensive.

Nitrate of soda also at present is costly because of its extensive use in munition making, the scarcity of shipping and the temporary closing of the Panama canal. All other raw materials of fertilizers have advanced considerably in price.

At a recent meeting of the directors of the New England, New York and New Jersey Stations, after discussing the present situation, it was decided to make certain suggestions regarding

fertilizers to the farmers of the states represented, leaving to each director the form in which they should be presented, with due regard to special local conditions.

Considering the great variety of soils in the northeastern states and the diverse systems of farming, it is not to be expected that such suggestions will be universally and perfectly applicable. We believe, however, that they will be generally helpful in a particularly trying situation.

General Suggestions.

At the outset we wish to emphasize what has often been said, that care for the sanitation of the soil must precede the use of commercial fertilizers. This is true every year but it needs special emphasis in the present crisis.

Only on soils well provided with humus or humus-forming materials and lime, free from excess of acidity, well drained and in which the early rains have been stored and are held by early plowing and intelligent tillage,—only on such soils will it pay to use commercial fertilizers this year. Fertilizers are foods (not "stimulants") for healthy soils. They are not medicine for sick land.

1. **Begin now to gather and prepare all the home sources of plant food and humus.** Use in the pens all of the leaves, stalks and trash which the pigs can work over into manure. On shore farms sea weeds and marsh grasses are valuable for this purpose. Make tight the floors in stalls and stables, use enough litter to hold all liquid manure, for nearly all of the potash, as well as the most valuable part of the nitrogen of manure, is in the urine.

If manure is stored, keep it in a compacted pile with nearly vertical sides, under cover if possible, fairly moist and with some arrangement to catch any liquid draining from it, which should be poured back on the pile. New York stable manure, according to our analyses, carries in each ton about 12 lbs. of nitrogen, 12 lbs. of potash and 8.4 lbs. of phosphoric acid, with 500 or more pounds of humus-forming material. Cow manure averages 11.6 lbs. nitrogen, 6.8 lbs. phosphoric acid and 9.2 lbs. potash, with 360 lbs. of humus-forming material. *Save it all.* The more generous the feed the richer the manure.

Save all wood ashes either from household fires, brush heaps, or brick-kilns, for both the potash and the lime in them.

Till the soil as never before. Plow and harrow early. Don't let the spring winds dry out the compacted soil. Lack of soil-water is more to be feared than lack of potash. To release the insoluble potash, as well as the insoluble nitrogen, in the soil and at the same time to hold the soil moisture, nothing is more effectual than tillage.

2. **Sources of plant food.** Commercial mixed fertilizers will be available, the different brands of which will furnish from 1 to 6 per cent of ammonia (equivalent to 0.8 to 4.95 per cent of nitrogen), and from 8 to 10 per cent of phosphoric acid, either with no potash, or with 1 per cent of it.

Nitrogen. For crops growing in cold weather, such as oats, rye, winter wheat, potatoes, and for other crops in the colder regions, a portion of the nitrogen, from one-fourth to one-third or even more, should be in the form of nitrate, if that is possible. Sulphate of ammonia is somewhat less rapid and effective as a source of nitrogen, though on some soils and in some cases it has proved equal to nitrate of soda. Calling the effect of the nitrogen of nitrates 100, that of sulphate of ammonia and cyanamid may be reckoned at somewhere about 80 per cent, of dried blood about 65 per cent, and of stable manure 40-50 per cent.

Cyanamid just at present is the cheapest source of available nitrogen. In mixtures it must not be used with sulphate of ammonia, and more than 150-200 lbs. in a ton of mixture will revert part of the phosphoric acid in acid phosphate. It should be applied a week or ten days before seeding. The dust from it is likely to be irritating to the skin and eyes but is not poisonous to human beings.

The organic nitrogen in fine bone, tankage, and fish is probably about alike in its availability. With it should be classed the nitrogen of cotton seed meal and castor pomace.

The different forms of wool and felt waste are rich in nitrogen but vary considerably in agricultural value and their nitrogen is usually very slowly and incompletely available. When they cost little more than cartage, they may be worked over by pigs or composted with lime and applied to all-season crops.

Phosphoric Acid. Floats, or finely powdered phosphate rock, is not to be recommended for general application or for quick returns. There is no certain evidence that mixing with manure increases the availability of floats. The addition of floats to stable

manure has proved of value in Ohio, but where manure is protected from leaching, the addition of 40 lbs. of acid phosphate to the ton of manure—as it is made—proved more profitable than the addition of a like amount of floats.

The phosphoric acid of bone and tankage is much more available than that of floats, and these forms are well adapted for all-season crops. Acid phosphate is the most quickly available form, but while prices are as high as at the present it may be advisable to use it only on naturally productive land for cash crops. Quickly available phosphoric acid hastens development of the root system and is particularly valuable for crops which must make a rapid and early growth.

Potash cannot at present be bought in potash salts. Mixed fertilizers are on sale containing one per cent of potash. "Canada hard wood ashes" have generally been of very poor quality in recent years. When wood ashes contain four per cent or more of *water-soluble* potash, they are an excellent source of both lime and potash for all crops except potatoes. For other sources of potash see note on tobacco below.

The use by farmers of ground feldspar as a source of fertilizer-potash is utterly futile. Buy no mineral potash fertilizer except on the basis of the amount of *water-soluble* potash. Buy no preparations recommended as "potash liberators." Nothing is better for that purpose than that which is mentioned below.

3. **Soils.** Light soils in general contain less potash than heavy soils. Commercial fertilizers next year will probably pay only on land in good productive condition. It will not pay to try to build up poor soils with them. For cash crops use the best land. The commercial value of the crop is also the measure of the economy of using commercial fertilizers. With crops involving high labor cost and high commercial value,—tobacco and onions, for example,—the fertilizer cost is less important. Some mowings, which in a normal season would be left in hay, should go into cash crops.

4. **Fertilizers adapted to different crops.** The following suggestions apply chiefly to the coming season as "war measures." They are not to be taken either as definite prescriptions or as necessarily applying to normal farm and market conditions.

Whether fertilizers can be more economically bought in raw materials or in mixed commercial fertilizers this year can only

be determined by the farmer himself or by associations of buyers, after getting quotations for both kinds *on the same basis of guaranty and payment.*

Top Dressing for Grass. A commercial fertilizer with a high percentage of nitrogen may be used, or 100-200 lbs. of nitrate of soda or of cyanamid, or of a mixture of the two, or a like amount of ammonium sulphate (but cyanamid must not be mixed with ammonium sulphate). It should be applied soon after growth begins in the spring. At present prices the use of acid phosphate for top dressing is hardly to be advised, but stable manure is of course valuable when it can be spared for this purpose.

For Clover and Alfalfa. Wood ashes are excellent if they can be got. Lime-kiln ashes perhaps are the next best thing in the present scarcity or high price of acid phosphate and basic phosphate.

For Corn. Here is where the large part of the farm manure usually and reasonably goes. Ten tons of farm manure carry about 120 lbs. of nitrogen, 84 lbs. of phosphoric acid and 120 lbs. of potash, with more than 2 tons of humus-forming matter. With this may be used 300-500 lbs. of a "3-10 formula" (3% of ammonia, or 2.47% of nitrogen, and 10% of phosphoric acid). In this state nitrate in the formula is not necessary.

For Potatoes. The fertilization of potato land offers peculiar difficulties. It is a cash crop and in normal times should pay well for a heavy dressing with fertilizers. It is also a crop which on most lands needs for maximum production an abundant supply of potash, so that it is likely potato land will feel most the dearth of water-soluble potash fertilizers.

The methods of growing the crop which conform to the best farm practice have been given in Joint Circular No. 1, to be had on request.

We cannot advise the use of ashes on potato land because of the danger of increasing scab. A commercial potato manure carrying 4 per cent or more of nitrogen, a third of which is in mineral form (nitrate of soda or sulphate of ammonia), and 8 to 10 per cent of phosphoric acid may be recommended, to be used at the rate of 1,000 to 2,000 pounds per acre.

Stable manure composted now with wetted tobacco stems, if used on land not seriously infected with scab, might be worth while, especially for light lands deficient in humus.

Tobacco is the largest cash crop grown in this state, having an estimated farm value of about seven million dollars.

A heavy outlay for tobacco fertilizers is therefore wiser than a similar outlay for many other crops.

There is no better basis for a tobacco fertilizer than horse manure, or, if that is not available, mixed stable manure supplemented either with a special tobacco fertilizer, of which a considerable number of brands are offered, or with unmixed fertilizer materials.

On lands which previously had generous dressings of potash salts tobacco has been raised very successfully for two or more years in succession without any additions of potash.

A possible source of potash however is hard-wood ashes. They must be bought on a guaranty of *water-soluble* potash, with suitable rebate in case the guaranty is not fully met.

Some carloads of ashes of good quality have been sold recently in the state. A ton of ashes with 4 per cent of potash contains 80 pounds of potash. We have used more than three tons of wood ashes yearly for four years in succession with good results both in quality and quantity of leaf.

Several carloads of tobacco stems recently examined have averaged 2.15 per cent of nitrogen, 0.50 per cent of phosphoric acid and 6.34 per cent of potash, the latter ranging from 4.5 to 8.5 per cent.

Tobacco stalks from 1,800 pounds of cured leaf contain about 30 pounds of nitrogen, 6 of phosphoric acid and 48 of potash, or about one-third of the amounts in the whole crop.

If there is objection to plowing in all the stalks taken from an acre and if they cannot be used on corn land, they may as a last resort be burned, and the ashes, which contain most of the potash and phosphates, may be used on tobacco land.

Cotton seed meal will probably be the chief reliance for quickly available nitrogen, in spite of the high price. We believe one-third of the nitrogen may be supplied in dry fish scrap if that is available. A part of the nitrogen and the phosphoric acid may also be applied in *fine* bone or tankage.

For Root Crops, excepting Potatoes, and Vegetables in General. Eight tons or more of manure well worked into the soil and 500 pounds of a 3-8 or 3-10 formula. The amount of manure used will of course differ greatly according to the supply and the use or probable profit to be made of the crops.

If no manure is available, dress the land with 1,000-2,000 lbs. of a 5-8 or 5-10 formula.

Raspberries and Other Small Fruits may receive about the same dressing as vegetables in general, but in smaller amount.

For Spring Seeding. If the land was well fertilized in 1914 no application may be needed; otherwise 300-500 lbs. of a 6-8, 5-8, or 5-10 formula may be used.

For Orchards which are just being set out or for orchards which have been well fertilized in past years no fertilizer need be used, particularly if they are well tilled and have a cover crop, though in orchards on the lighter sandy soils when growth has been slow an application of 100 to 150 pounds of nitrate of soda in spring may pay, even at present prices.

5. Potash liberators. Nitrate of soda to some extent prevents a "luxury consumption" of potash; i. e., it makes potash "go further" in feeding the crop. It also helps to release potash where it is combined in the easily decomposed silicates of the soil. These are incidental gains to be considered only when nitrate is bought as a source of quick-acting nitrogen. Nitrate could not profitably be used solely for the purpose of liberating or conserving potash. Common salt has somewhat the same effect. "Salting meadows" is an old farm practice and the use of 150 to 300 lbs. of salt on meadows, as well as on land under tillage, may be quite helpful though experiments with it have not always given favorable results. Ground limestone and agricultural lime have probably some effect in making soil-potash available, especially that which is contained in vegetable matter. Their action in releasing potash from silicates has not been established by definite evidence.

Gypsum or land plaster may best be used by mixing it with the manure as it is made. Gypsum acts favorably on the fermentation of manure and the fixation of ammonia, as well as on the insoluble potash of the soil. About 40 per cent of acid phosphate consists of plaster and where acid phosphate is used, further application of plaster is unnecessary.

6. Regarding the use of lime. Field experiments and farm experiments both indicate that ground magnesian limestone is generally as beneficial to land as the pure calcitic limestone.

It is not proved that slaked lime materially hastens the destruction of humus in the soil more than does ground limestone. If

the productiveness of a soil is increased by liming, the humus in it may even increase.

The addition of humus-formers (manure or green crops) and of lime should go together. Finely ground limestone is much more quickly active in the soil than are coarser grades. The larger part of it should pass holes 1/60 inch in diameter.

7. **Regarding the purchase of fertilizers.** Get quotations and terms from several manufacturers or dealers.

Buy for cash if at all possible.

Buy with others in mixed car lots where that can be done.

Insist on a guaranty, with a rebate at current retail prices for any deficiency in composition.

It is proposed by some mixers of fertilizers to sell farmers chemicals unmixed and to make a separate charge for mixing and bagging them, giving no guaranty of the composition of the mixture. The object of this procedure apparently is, in part at least, to circumvent the fertilizer law, which requires that fertilizers sold or offered for sale shall be guaranteed and registered at the station and that the manufacturers shall pay an analysis fee. Under the method above described, the manufacturer claims that he does not sell *the mixture* but only the ingredients of it, on which fees have been paid. To carry the raw materials for manufacturing fertilizers and to maintain mixing machinery and a mixing plant and at the same time to claim that one is not a maker of mixed fertilizers has the appearance of "skating on thin ice." The buyer cannot do better than to buy chemicals of guaranteed composition and mix them himself, or to buy mixtures guaranteed by those who have the reputation and composition of these mixtures to maintain.

IN CONCLUSION.

What shall we do without potash? The answer is easy. We shall do more *with* it than ever before.

By better use of litter and care of manure we shall save the potash which has heretofore run to waste in liquid manure, carrying with it the most valuable part of the nitrogen.

By saving all wood ashes from household fires and brush heaps and when possible the screened ashes from brick-kilns, which burn more than 30,000 cords of wood in this state every year, we shall further increase our supply of fertilizer potash.

We shall make available more of the potash in the soil by more thorough and persistent tillage, by dressing with manure and by the judicious use of lime and vegetable matter.

We shall not try to promote permanent fertility by using feldspar, nor shall we listen to the seller of remarkable "potash liberators."

It is the writer's belief that the extremely high prices of nitrogen and phosphoric acid this year are a more serious menace to general farming in Connecticut than the absence of potash.

REPORT ON COMMERCIAL FERTILIZERS.

In the following pages are given the results of the 1915 inspection of commercial fertilizers, as well as the analyses of a number of miscellaneous waste and by-products.

TRADE VALUES OF FERTILIZING ELEMENTS FOR 1915 AND DISCUSSION OF "VALUATION."

The average trade values (or retail costs per pound) of the forms of nitrogen, phosphoric acid and potash ordinarily occurring on the market in raw materials and chemicals, as found in New England, New York and New Jersey markets during 1914, and adopted as a basis for comparison at a conference of representatives of the New England, New York and New Jersey Stations in March, 1915, are as follows:

	Cents per pound.
Nitrogen in nitrates	15
" in ammonia salts	15.5
" organic, in fine dry fish, blood and meat	22
" " in cotton seed meal and castor pomace	20
" " in fine* bone and tankage	21
" " in mixed fertilizers	19
" " in coarse* bone and tankage	17
Phosphoric acid, water-soluble	4
" " citrate-soluble†	3.5

* In this report "fine" as applied to bone and tankage signifies smaller than 1/50 inch; "coarse" larger than 1/50 inch.

† Dissolved from 2 grams of the fertilizer, previously extracted with pure water, by 100 cc. of neutral solution of ammonium citrate, sp.gr. 1.09, in thirty minutes at 65° C., with agitation once in five minutes. Such dissolved phosphoric acid is commonly called "reverted" or "backgone" phosphoric acid.

	Cents per pound.
Phosphoric acid in fine* bone and tankage	4
" " in coarse* bone and tankage and ashes	3.5
" " in cotton seed meal and castor pomace	3.5
" " insoluble in water or citrate solution in mixed fertilizers	2
Potash in high grade sulphate and mixtures free from muriates	9.5
" in cotton seed meal and castor pomace	9.5
" in muriate	8.5

The foregoing, as nearly as can be estimated, are the average prices at which, during the six months preceding March last, the respective ingredients were retailed for cash in our large markets, in those raw materials which are the regular sources of supply. The prices for potash are based on a very few quotations in a widely fluctuating market and have but little significance. Probably, however, most of the potash used in mixed fertilizers this year was bought before any very sharp rise in its price took place. The nitrate market, also, has seen wide fluctuations. These facts and the general confusion wrought by the war in Europe make the statement of average values more difficult and less satisfactory than usual.

In the discussion which follows, the actual cost to the buyer of nitrogen, phosphoric acid, or potash is calculated in those fertilizers which contain but one fertilizer ingredient, like nitrate of soda and acid phosphate.

It is also calculated with rather close approximation in such raw materials as have more than one fertilizer ingredient, such as cotton seed meal and tankage. The price asked for manufactured fertilizers, which are mixtures of various chemicals and other fertilizing materials, must of course cover the manufacturing costs as well as cost of raw materials. Manufacturing expenses vary greatly with the manufacturing facilities, method of marketing and advertising, etc.

It is not possible to determine fully by examination or analysis just what raw materials have been used in the manufacture of mixed fertilizers; whether for instance dried blood, a very expensive ammoniate, or tankage, costing less per unit.

Under these circumstances it is not possible to give a valuation; meaning by the word a statement of the actual worth or of the fair market price of a given manufactured fertilizer. Nothing of this kind has ever of recent years been attempted by this station. What has been attempted has been to give a statement of the average cash cost at freight centers and in raw materials of good quality of the same amounts of nitrogen, phosphoric acid and potash as are found in one ton of each mixed fertilizer. This attempt takes no account in any case of what the raw materials may have cost the manufacturer—but only of what the buyer might have to pay for equally good materials.

* See note on p. 9.

It includes no manufacturing or selling expenses, which often make up from ten to twenty per cent or more of the cost of the finished product. It therefore does not indicate what should be the fair selling price of the article, but always is below that figure.

It shows only the average retail price of an equivalent in raw materials of the plant food in the goods.

It is a help in comparing fertilizers which differ in composition and in price and affords a basis for approximately determining the economy of home mixing or of applying the raw materials separately to the land, as compared with the purchase of ready-made mixtures.

The term "valuation" as applied to the calculation just described has been frequently misinterpreted in spite of the full explanation of the term given yearly in our reports. It has been regarded by some as a valuation of the finished fertilizer rather than a valuation of the fertilizer elements in it.

In the tables of analyses of mixed fertilizers is a column with the heading, "Average retail cost of like amounts of nitrogen, phosphoric acid and potash in raw materials." This means that to get these three ingredients in raw materials of good quality and in the amount contained in one ton of the mixed fertilizer, the buyer would usually have to pay for them the amount named *in cash, at freight stations.*

Farmers must learn, however, to make the same kind of calculation and comparison based, not as here on average figures, but on the prices actually prevailing at the time and place where calculation is made and with their individual facilities for purchase. Such a calculation will be more accurate and therefore more helpful to him than the calculations here made from average figures.

Analyses of Fertilizers, 1915.

During 1915 forty-eight individuals and firms have entered for sale in this state three hundred and fifty-six brands of fertilizers, classified as follows:

Nitrogenous superphosphates	280
Bone manures and "phosphate and potash"	27
Fish, tankage, castor pomace, and chemicals	49
Total	356

During the spring months V. L. Churchill, the sampling agent, visited one hundred towns and villages of the state and gathered 545 samples of commercial fertilizers.

These represented all the brands registered with the exception of the following:

American Agricultural Chemical Co.'s Special Complete Tobacco Manure, Valley Special Complete Fertilizer, East India Economizer Phosphate, Quinnipiac Special Potato Manure, Williams and Clark's Good Crop Phosphate, Williams and Clark's Matchless Fertilizer, Williams and Clark's Reliable Fertilizer, Williams and Clark's Special Chesterfield Manure; *Bowker's* Blood, Bone and Potash Revised; *Coe-Mortimer's* Famous Prize Brand Grain and Grass Fertilizer; *German Kali Works'* Kainit; **James's* Ground Bone; *Lister's* *Special Tobacco Fertilizer, *Revised H. G. Special for Spring Crops, *U. S. Superphosphate; *Lowell Fertilizer Co.'s* Acid Phosphate; *Mapes'* Cereal Brand; *National* Special Complete Fertilizer; and *Wilcox's* H. G. Tankage. Of these it was therefore impossible to make analyses, except where the manufacturer had deposited a sample of the brand within the present year, or where individual purchasers sent samples of these brands. In such cases the Station assumes responsibility only for the correctness of the analysis and not for the sampling.

Classification of Fertilizers Analyzed.

1. *Containing nitrogen as the chief active ingredient:*	
Nitrate of soda	14
Dried blood	7
Cyanamid	1
Cotton seed meal	182
Castor pomace	8

*A sample sent by the manufacturer was analyzed.

2. *Containing phosphoric acid as the chief active ingredient:*	
Ground phosphate rock	1
Basic slag phosphate	1
Basic lime phosphate	2
Precipitated bone	7
"Barium-Phosphate"	1
Acid phosphate	26
3. *Containing potash as the chief active ingredient:*	
Cotton hull ashes	2
Sulphate of potash	1
Muriate of potash	3
Carbonate of potash	1
4. *Raw materials chiefly valuable for nitrogen and phosphoric acid:*	
Fish manures	11
Tankage	17
Bone manures	28
5. *Mixed fertilizers:*	
Factory-mixed fertilizers	308
Home-mixed fertilizers	4
6. *Miscellaneous fertilizers and waste products:*	
Wood and other ashes	25
Limestone and shell lime	35
Miscellaneous	43
Total	728

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA OR SODIUM NITRATE.

As offered in the Connecticut market this year, nitrate of soda has contained an average of 15.59 per cent of nitrogen, equivalent to 94.5 per cent of pure sodium nitrate.

The following fourteen samples have been analyzed:

5683. Sold by Bowker Fertilizer Co., New York. Sampled and sent by John Gotta, Portland.

5714. Sold by Nitrate Agencies Co., New York. Stock of Pring Bros., Wallingford.

5707. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

5745. Sold by Bowker Fertilizer Co., New York. Stock of S. B. Wakeman, Westport.

5701. Sold by American Agricultural Chemical Co., New York. Stock of C. Buckingham, Southport.

5700. Sold by American Agricultural Chemical Co., New York. Stock of D. L. Clark & Son, Milford.

5716. Sold by Sanderson Fert. and Chem. Co., New Haven. Stock of Morse & Landon, Guilford.

5734. Sold by Armour Fertilizer Works, Chrome, N. J. Stock of Brower & Malone, Norwalk.

5911. Sold by L. T. Frisbie Co., New Haven. Stock bought by W. A. Simpson, Wallingford, through Patron's Exchange.

5915. Sold by Wilcox Fertilizer Co., Mystic. Sampled at factory.

5820. Sold by Coe-Mortimer Co., New York. Stock bought by C. R. Burr, Manchester.

5712. Sold by Nitrate Agencies Co., New York. Stock bought by A. D. Clark, Orange.

5676. Sold by L. T. Frisbie Co., New Haven. Stock bought by Highwood Vegetable Growers' Asso., Highwood.

5709. Sold by Coe-Mortimer Co., New York. Stock bought by J. A. Martin, Wallingford.

ANALYSES OF NITRATE OF SODA.

Station No.	5683	5714	5707	5745	5701	5700	5716
Per cent of							
Nitrogen guaranteed	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Nitrogen found	15.68	15.56	15.58	15.46	15.81	15.74	15.66
Cost per ton	$45.00	47.00	48.00	48.70	50.00	50.00	50.00
Nitrogen costs cents per pound	14.3	15.1	15.4	15.8	15.8	15.9	16.0

Station No.	5734	5911	5915	5820	5712	5676	5709
Per cent of							
Nitrogen guaranteed	14.81	15.00	15.00	15.00	15.00	15.00	15.00
Nitrogen found	15.44	15.40	15.48	15.56	15.56	15.66	15.71
Cost per ton	$50.00	....	....	....	....	....	....
Nitrogen costs cents per pound	16.2	....	....	....	....	....	....

The cost of nitrogen in form of nitrate of soda in small lots at retail has ranged from 14.3 to 16.2 cents per pound, on the average 15.6 cents. In mixed car lots, for cash, it has been bought for 13.5 cents per pound. Its cost is subject to sudden changes.

DRIED BLOOD OR BLOOD MEAL.

The following seven samples have been analyzed:

5744. Sold by American Agricultural Chemical Co., New York. Stock bought by S. B. Wakeman, Westport.

5704. Sold by American Agricultural Chemical Co., New York. Stock of D. L. Clark & Son, Milford.

6207. Sold by L. T. Frisbie Co., New Haven. Stock bought by this Station.

5864. Sold by Sanderson Fert. and Chem. Co., New Haven. Stock bought by Station.

5679. Sold by L. T. Frisbie Co., New Haven. Stock bought by Highwood Vegetable Growers' Asso., Highwood.

6068. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

6237. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

ANALYSES OF DRIED BLOOD.

Station No.	5744	5704	6207	5864	5679	6068	6237
Per cent of							
Nitrogen guaranteed	9.87	9.87	13.00	....	13.00	13.00	9.87
Nitrogen found	10.98	11.00	10.36	11.37	12.52	13.68	9.60
Cost per ton	$50.70	52.00	....	....	....	....	45.00
Nitrogen costs cents per pound	23.1	23.6	....	....	....	....	23.4

Samples **6207, 5679,** and **6237** failed to satisfy their nitrogen guaranty.

The average cost of nitrogen in form of dried blood at retail was 23.4 cents per pound in the three samples for which prices were available.

CYANAMID.

5668. Sold by A. W. Higgins, Westfield, Mass. Sent by E. N. Austin, Suffield. Guaranteed 17.50 per cent nitrogen; contained 16.12 per cent; cost $62.00 per ton. The nitrogen in the sample cost 19.2 cents per lb. The nitrogen in this material is about as quickly available as that of nitrate of soda. Its mechanical condition and the irritating dust which comes from it when handled make it inconvenient to use unmixed. It is used to some extent in mixed fertilizers, but has a tendency to make the water-soluble phosphates insoluble in water.

COTTON SEED MEAL.

The Station has examined 182 samples of cotton seed meal this year. Most, if not all, of these samples represented car lots bought for use as fertilizer. They also represented a cash outlay of at least $145,000. The Station has reported each analysis to the dealer and also to the buyers, so far as their names were known to it. Every buyer of fertilizer meal should know the number of the car in which it is delivered, and if the analysis of that car lot is below the guaranty should claim and receive a rebate. The dealer receives this rebate from the manufacturer or jobber, and the purchaser should demand his portion of such rebate. Of the 182 analyses 143 are not reported because they fully met the guaranty and the space which they would require is needed for more important matter.

In the following table are given the analyses of 38 samples which were below their guaranty.

The average percentage of nitrogen in all the samples was 6.96, somewhat higher than last year.

Thirty-eight samples failed to meet their nitrogen guaranty, the deficiency ranging from 0.10 to 0.68 per cent, with an average of 0.25 per cent.

Cotton seed meal contains on the average 3.15 per cent of phosphoric acid and 1.9 per cent of potash. Allowing $4.42 per ton for this phosphoric acid and potash in each case, and using the same schedule of values as was used last year, the average cost per pound of nitrogen in all the samples for which prices were supplied was 19.9 cents; in the samples reaching their guaranty the average cost was 19.1 cents, while in those which were deficient the average cost was 20.6 cents. If the schedule of valuations of the present year is used in this calculation, the above average costs of nitrogen would be reduced by about one cent.

ANALYSES OF COTTON SEED MEALS WHICH DID NOT MEET THEIR GUARANTY.

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
	F. W. Brode & Co.					
6285	.....	E. N. Austin	6.39	6.58	$31.00	20.8
6015	61349	Olds & Whipple	6.46	6.91	33.00	22.1
	Humphreys Godwin Co.					
5212	110801	Olds & Whipple	8.07	8.43	37.00	20.2
5239	91467 x 3298	Spencer Bros.	6.35	6.50	28.50	18.9
5240	90289 x 2070	"	6.35	6.50	28.50	18.9
5587	92512 x 38132	"	6.07	6.50	29.50	20.6
5589	52063 x 12312	"	6.34	6.50	29.50	19.8
5591	74109	Olds & Whipple	7.96	8.35	36.00	19.8
5592	93525	"	7.79	8.35	36.00	20.2
5648	49669 x 12046	Spencer Bros.	6.12	6.50	29.50	20.5
5848	43301	"	5.82	6.50	28.50	20.7
5849	40645	"	6.32	6.50	29.50	19.8
5979	71861	Griffin-Neuberger Tobacco Co.	7.70	7.81	36.47	23.7
5980	64894	"	7.64	7.81	36.19	20.8
	International Agr. Corp.					
5944	78134	Meech & Stoddard	6.20	6.50		
	Meech & Stoddard.					
5807	.....	W. H. Griswold	6.26	6.50	33.00	22.8
6009	37376	Conn. Tobacco Corp.	6.38	6.50	31.90	21.5
6025	76899 x 1036	Spencer Bros.	6.27	6.50	32.75	22.6
6026	74026 x 8656	"	6.32	6.50	32.75	22.4

ANALYSES OF COTTON SEED MEALS WHICH DID NOT MEET THEIR GUARANTY.—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
	Olds & Whipple.					
5673		L. B. Haas & Co.	7.51	7.69	$33.66	19.5
5674		" "	7.52	7.69	33.66	19.4
6057	90807	Griffin-Neuberger Tobacco Co.	7.50	7.81	37.05	21.7
	Pelham Oil & Fert. Co.					
6085	77776	Conn. Tobacco Corp.	6.23	6.50		
	Planters' Cotton Oil Co.					
5945	815	Conn. Tobacco Corp.	6.22	6.50	31.90	22.1
6075	88997	" " "	6.22	6.50	31.90	21.9
6076	87334	" " "	6.30	6.50		
6083	94101	" " "	6.32	6.50		
6088	75195	" " "	6.30	6.50		
6093	82128	" " "	6.34	6.50		
	W. Newton Smith.					
6204	1679	Conn. Tobacco Corp.	6.31	6.50	31.90	21.8
	Union Brok. & Comm. Co.					
5210	70283	Olds & Whipple	6.92	7.03	28.50	17.4
5244	11823	" "	7.27	7.40	31.00	18.3
5353	135212	" "	7.28	7.40	31.00	18.2
5718	19058	" "	6.89	7.17	34.00	21.5
5719	32545	" "	7.01	7.17	34.00	21.1
5720	72817	" "	6.75	7.07	33.50	21.5
5721	111224	" "	6.98	7.17	34.00	21.2
5722	51021	" "	6.97	7.07	33.50	20.9

CASTOR POMACE.

This is a residue from the manufacture of castor oil and is used chiefly as a tobacco fertilizer. Experience indicates that it is a little slower in its action than cotton seed meal and that it gives a somewhat heavier quality to the tobacco leaf. Stock will eat it greedily if they have the chance, but it is extremely poisonous.

The following eight samples have been analyzed:

6073. Sold by American Agricultural Chemical Co., New York. Stock of C. L. King, Burnside.

6074. Sold by American Agricultural Chemical Co., New York. Stock of E. N. Austin, Suffield.

5904. Sold by American Agricultural Chemical Co., New York. Stock of G. A. Williams, Silver Lane.

5907. Sold by Apothecaries Hall Co., Waterbury. Stock of W. J. Reeves, Windsorville.

5908. Sold by Baker Castor Oil Co., New York. Stock of Spencer Bros., Suffield.

5594. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of A. S. Brainard, Thompsonville. Sampled and sent by F. W. Button, Thompsonville.

5686. Sold by Bowker Fertilizer Co., New York. Sampled and sent by John Gotta, Portland.

5803. Sold by Olds and Whipple, Hartford. Sampled at factory.

ANALYSES OF CASTOR POMACE.

Station No.	6073	6074	5904	5907	5908	5594	5686	5803
Per cent of								
Nitrogen guaranteed	4.53	4.53	4.53	4.52	4.50	4.94	4.53	5.00
Nitrogen found	5.32	5.00	5.13	5.20	4.52	4.98	4.66	5.60
Cost per ton	$27.00	26.00	26.00	25.00	26.00	25.00	24.00	25.00
Nitrogen costs cents per pound	**22.4**	**22.8**	**22.3**	**21.0**	**24.9**	**21.9**	**22.4**	**19.5**

In sample **5908** one per cent each of phosphoric acid and potash was also guaranteed; the sample contained 1.75 and 1.09 per cent, respectively.

Castor pomace contains on the average 1.95 per cent of phosphoric acid and 0.95 per cent of potash.

Allowing $3.16 per ton for the phosphoric acid and potash present, the average cost per pound of nitrogen in castor pomace this year was 22.7 cents.

The cost of nitrogen per pound is calculated by deducting from the ton price $3.16, which is the valuation of the phosphoric acid and potash by the schedule of values given on page 9, and dividing the remainder by the number of pounds of nitrogen found in the ton. This cost of nitrogen has ranged from 19.5 to 24.9 per pound and has averaged 22.2 cents.

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

GROUND PHOSPHATE ROCK.

5865. Bought for the Station. It contained 29.99 per cent of phosphoric acid.

Such observations as have been made on Connecticut soils lead us to believe that on land deficient in available phosphates equal money values of acid phosphate or basic phosphate may be expected to yield much larger returns in the first two or three years after application than will ground phosphate rock, and that an ultimate profit from the use of the latter material is quite uncertain on most of our soils.

BASIC SLAG, BASIC PHOSPHATE OR THOMAS PHOSPHATE POWDER.

The material is a finely ground slag, produced by a special process of removing phosphorus from iron. It should contain from 17 to 19 per cent of phosphoric acid and may also carry from 35 to 50 per cent of lime and 13 per cent of iron.

Very little of the phosphoric acid is soluble in water, but by a conventional method of extraction (Wagner's) the larger part of the phosphoric acid in slag of good quality is soluble in the citric acid used. Pot and field experiments and practical experience alike have shown that the phosphoric acid of basic slag is quite readily available to crops, and it has come into rather extensive use, particularly by orchardists. Basic slag of good grade should contain 15 per cent or more of "available" phosphoric acid.

Hitherto all of the basic slag has been imported, but shipments have been almost cut off on account of the war. The Tennessee

Coal, Iron and Railroad Co., of Birmingham, Ala., are, however, producing it and sent to the Station a sample of their product, **6384**, which contains 18.55 per cent of phosphoric acid, of which 15.35 per cent is "available" by the Wagner method.

As a substitute for basic phosphate, a product called "basic lime phosphate" has been put on the market. The two samples analyzed here are as follows:

6227. Sold by the American Agricultural Chemical Co., New York. Stock of C. R. Main, Norwich. Price $16 per ton. Guaranteed 13 per cent "available" phosphoric acid. It contained 14.67 per cent total and 11.71 per cent "available" phosphoric acid. The "available" phosphoric acid therefore cost 6.8 cents per pound.

6245. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Sampled at factory. Guaranteed 13 per cent of "available" phosphoric acid. It contained 14.64 per cent total and 12.79 per cent "available" phosphoric acid and sold for $15.25 per ton. "Available" phosphoric acid cost 5.9 cents per pound in this sample.

PRECIPITATED BONE PHOSPHATE.

This is a manufacturing by-product and consists of fine precipitated phosphate of lime, neutral in reaction, and contains no nitrogen.

It is very readily soluble in ammonium citrate and is quickly available to crops. It is at present chiefly used as a tobacco fertilizer. We are advised that most of it is imported, sold on foreign analysis only, and "available" is determined by the Wagner method. In our opinion the use of this method for the analysis of such a material is not justified. The Wagner method can be reasonably used only with basic slag, which contains large quantities of iron and some free lime, which interfere with the use of the conventional ammonium citrate method. There is no reason for using the Wagner method with precipitated bone other than the desire to make it appear more "available" than it would seem to be if the method commonly applied to phosphatic materials were employed.

The first six samples analyzed were all bought through Olds & Whipple, Hartford. They were as follows:

5817 and **5818**, car Nos. 193855 and 91776, respectively. Sampled and sent by the Connecticut Tobacco Corporation, Tariffville.

6004, car No. 46133. Sampled and sent by the Connecticut Tobacco Corporation, Tariffville.

6095 and **6096**, car Nos. 94379 and 7556, respectively. Sampled and sent by the Connecticut Tobacco Corporation, Tariffville.

6241. Sampled from stock of Olds & Whipple at factory.

All the above samples were guaranteed 37 per cent of "available" phosphoric acid.

6369. Sent by North-Eastern Forestry Co., Cheshire. Although sold as "precipitated bone," it was probably a raw phosphate of little, if any, agricultural value.

ANALYSES OF PRECIPITATED BONE.

Station No.	5817	5818	6004	6095	6096	6241	6369
Per cent of							
Water-soluble phosphoric acid	1.54	1.37	1.29	1.30	1.31	1.42	0.14
Citrate-soluble phosphoric acid	38.61	38.88	37.44	39.33	38.26	37.75	4.40
Citrate-insoluble phosphoric acid	1.87	1.91	1.83	1.91	2.09	2.03	33.72
Total phosphoric acid	42.02	42.16	40.56	42.54	41.66	41.20	38.26
"Available" phosphoric acid	40.15	40.25	38.73	40.63	39.57	39.17	4.54
Cost per ton	$50.00	50.00	....	....	....	....	....
Total phosphoric acid costs cents per pound	5.9	5.9	5.3	....	....	....	....
Available phosphoric acid costs cents per pound	6.2	6.2	....	....	....	....	....

"BARIUM-PHOSPHATE."

4672. Sent by the manufacturer, Witherbee, Sherman & Co., Port Henry, N. Y. Guaranteed 14 per cent phosphoric acid. It contained 17.87 per cent. It is not a barium phosphate but essentially a calcium phosphate mixed with barium sulphide.

The presence of such an abnormal constituent as barium sulphide in material sold as a fertilizer made it desirable to test its effects on vegetation. Mr. Huber, in charge of the vegetable work, therefore, planted rape in 8 inch pots filled with a sandy soil, to which 4 per cent by weight of leaf mold was added and nitrogen at the rate of 75 pounds per acre, in form of nitrate of soda, with 100 pounds of potash per acre, in form of muriate.

To the soil of some of the pots phosphoric acid, at the rates of 50, 100 and 200 pounds per acre, was added and in the forms of Tennessee phosphate, "barium-phosphate" and acid phosphate.

The quantity of dry matter in the crops from pots which had acid phosphate was slightly larger than that from pots which received the other phosphates, and, what was the chief thing sought to determine by the experiment, the barium sulphide in an amount of "barium-phosphate" carrying 200 pounds of phosphoric acid per acre produced no visible bad effect on the plants or the yield of dry matter.

To test the possible effect on the germination of seedlings, wheat, tomato, bean and corn seeds were planted in 5 inch pots filled with garden soil, two pots receiving each of the following number of pounds per acre of *barium sulphide* in form of "barium-phosphate," 49, 98, 196, 329 and 784.

There was no difference in the number of germinating seeds, or in time of germination, between the pots which had no barium sulphide and those which had it in any of the above amounts. In these experiments therefore no injurious effect has appeared which could be attributed to the large amount of barium sulphide present.

. DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

This material is made by treating mineral phosphates or phosphate rock with oil of vitriol (sulphuric acid), which converts the larger part of the phosphoric acid into forms soluble in water and at the same time changes into sulphate a large part of the lime which was previously combined with phosphoric acid.

The guaranty usually gives the percentage of "available" phosphoric acid. This is only a trade name for the sum of the water-soluble and citrate-soluble* phosphoric acid. Its amount gives no certain indication of the actual availability of this phosphoric acid to crops. In acid phosphate, however well made from domestic rock, it is fair to assume that the larger part of the "available" is also agriculturally available.

The following twenty-six samples were analyzed:

5682. Sold by the Bowker Fertilizer Co., New York. Sampled and sent by John Gotta, Portland.

* See page 9.

The following six samples were sold by the Virginia-Carolina Chemical Co., Richmond, Va., to the Connecticut Tobacco Corporation which drew and sent the samples.

6005, car 80051; **6008**, car 13341; **5812**, car 31008; **5811**, car 198980; **5809**, car 110118; **5810**, car 2032.

5735. Sold by Sanderson Fert. and Chem. Co., New Haven. Stock of C. R. Treat, Orange.

5746. Sold by Nitrate Agencies Co., New York. Stock of E. B. Palmer, Bridgeport.

6065. Sold by Sanderson Fert. and Chem. Co., New Haven. Sampled at factory.

5736. Sold by Nitrate Agencies Co., New York. Stock of C. R. Treat, Orange.

5675. Sold by L. T. Frisbie Co., New Haven. Stock of Highwood Vegetable Growers' Asso., Highwood.

5910. Sold by L. T. Frisbie Co., New Haven. Stock of W. A. Simpson, Wallingford.

6069. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

6228. Sold by American Agricultural Chemical Co., New York. Stock of L. B. Woodin, North Haven.

5705. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

5743. Sold by American Agricultural Chemical Co., New York. Stock of S. B. Wakeman, Westport.

6232. Sold by Apothecaries Hall Co., Waterbury. Stock of D. C. Peck, Plainville.

5715. Sold by Sanderson Fert. and Chem. Co., New Haven. Stock of Morse & Landon, Guilford.

6234. Sold by Bowker Fertilizer Co., New York. Stock of Goodsell Bros., Bristol.

5702. Sold by American Agricultural Chemical Co., New York. Stock of D. L. Clark & Son, Milford.

The following four samples were from stock sold by Virginia-Carolina Chemical Co., Richmond, Va., and drawn and sent by Connecticut Tobacco Corporation, Tariffville:

6100, car 112441; **6101**, car 33085; **6102**, car 38726; **6103**, car 51737.

5914. Sold by Wilcox Fertilizer Co., Mystic. Sampled at factory.

ANALYSES OF ACID PHOSPHATE.

Station No.	Water-soluble phosphoric acid.	Citrate-soluble phosphoric acid.	Citrate-insoluble phosphoric acid.	Total phosphoric acid.	"Available" phosphoric acid found.	"Available" phosphoric acid guaranteed.	Cost per ton.	"Available" phosphoric acid costs cents per pound.
5682	12.95	2.89	0.79	16.63	15.84	16.00	$10.75*	3.39
6005	15.90	3.06	0.65	19.61	18.96	.....	13.00	3.43
6008	15.52	3.35	0.75	19.62	18.87	.....	13.00	3.44
5812	14.83	3.85	0.77	19.45	18.68	.....	13.00	3.48
5811	14.45	3.97	0.77	19.19	18.42	.....	13.00	3.53
5809	14.21	4.01	0.84	19.06	18.22	.....	13.00	3.57
5810	14.35	3.77	0.88	19.00	18.12	.....	13.00	3.59
5735	14.35	1.80	0.61	16.76	16.15	14.00	12.25	3.79
5746	13.25	3.22	0.42	16.89	16.47	16.00	12.50	3.79
6065	12.82	3.13	0.81	16.76	15.95	14.00	12.25	3.84
5736	13.25	1.81	2.15	17.21	15.06	16.00	12.00	3.98
5675	14.21	1.98	0.38	16.57	16.19	16.00	13.00	4.00
5910	14.25	2.10	0.33	16.68	16.35	16.00	13.00	4.00
6069	10.80	4.26	0.29	15.35	15.06	14.00	12.00	4.00
6228	12.51	3.19	0.61	16.31	15.70	16.00	13.00	4.14
5705	13.10	1.74	0.17	15.01	14.84	14.00	13.00	4.38
5743	13.44	2.92	0.59	16.95	16.36	16.00	14.45	4.42
6232	13.92	2.77	1.19	17.88	16.69	16.00	15.00	4.49
5715	11.71	3.70	0.56	15.97	15.41	14.00	14.00	4.54
6234	10.61	3.52	0.84	14.97	14.13	14.00	14.00	4.95
5702	11.31	3.28	0.52	15.11	14.59	14.00	14.75	5.05
6100	15.46	3.83	0.64	19.93	19.29	.....	.....	....
6101	15.46	3.82	0.70	19.98	19.28	.....	.....	....
6102	15.50	3.56	0.69	19.75	19.06	.....	.....	....
6103	15.26	3.73	0.69	19.68	18.99	.....	.....	....
5914	13.98	2.68	0.12	16.78	16.66	14.00	.....	....

As the table indicates, there are three quite distinct grades of acid phosphate on the market, containing 14, 16 and 18 per cent of "available" phosphoric acid respectively. The "available" in the 14 per cent grade cost on the average 4.37 cents per pound, in the 16 per cent 4.03 cents, and in the 18 per cent 3.50 cents, which again illustrates the relative cheapness of the higher grade fertilizing materials.

Two samples did not contain the full amount of "available" phosphoric acid guaranteed.

* Mixed car lot.

The average cost of available phosphoric acid in the form of acid phosphate was 3.99 cents per pound. The average cost in the first seven samples in the table was 3.49 cents per pound; these samples were bought in car lots, illustrating the saving effected by this mode of purchase.

III. RAW MATERIALS OF HIGH GRADE CONTAINING POTASH.

Owing to the great war in Europe but very little potash has been shipped to this country during the past year, and the small stock available has been offered at almost prohibitive prices. The prices attached to the samples examined by us have but little significance.

CARBONATE OF POTASH.

5728. Sold by American Agricultural Chemical Co., New York. Sent by Broad Brook Lumber and Coal Co., Broad Brook. It contained 49.09 per cent of potash. The sample represented old stock not in good condition, and for this reason was sold by the manufacturer on the unit basis.

HIGH GRADE SULPHATE OF POTASH.

5733. Sold by Nitrate Agencies Co., New York. Stock of E. B. Palmer, Bridgeport. Price $3.25 per 100 lbs. Guaranteed 47 per cent of potash. It contained 49.36 per cent which cost 6.5 cents per pound.

MURIATE OF POTASH.

5731. Sold by H. J. Baker & Bro., New York. Sampled and sent by S. D. Woodruff and Sons, Orange. It contained 61.56 per cent of potash, equivalent to 97.5 per cent actual muriate.

5711. Sold by Nitrate Agencies Co., New York. Stock of A. D. Clark, Orange. Guaranteed 48 per cent of potash. It contained 49.42 per cent.

5710. Stock of Pring Bros., Wallingford. Price $60 per ton. Guaranteed 48 per cent of potash. .It contained 49.24 per cent. The potash cost 6.1 cents per pound.

COTTON HULL ASHES.

5221. Sold by M. Frankfort, New York City. Sampled and sent by L. B. Haas and Co., Hartford. Guaranteed 11 per cent available phosphoric acid and 15.50 per cent potash. Cost $32.00 per ton.

5204. Sold by Olds and Whipple, Hartford. Sampled and sent by C. F. Segee, East Hartford.

Station No.	5221	5204
Per cent of		
Potash	16.01	20.96
"Available" phosphoric acid	12.87	.....
Total phosphoric acid	13.75	.....

Valuing the three forms of phosphoric acid at the schedule rates in sample **5221,** potash cost 7.0 cents per pound.

IV. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN AND PHOSPHORIC ACID.

FISH MANURES.

Of this well-known and excellent fertilizer eleven samples have been examined. Sample **6236** failed to meet either its nitrogen or phosphoric acid guaranty. Sample **6314** contained very much more bone than usual, and accordingly the nitrogen is lower and the phosphoric acid much higher than in normal dried fish. The sample undoubtedly represents a fish manure made, not from the whole fish, from which the oil has been extracted, but from fish offal, heads, bones, etc. The other ten samples were unusually high grade and contained on the average 9.17 per cent of nitrogen and 8.01 per cent of phosphoric acid.

The cost per ton has ranged from $38 to $52. Allowing four cents per pound for the phosphoric acid, the cost of nitrogen in the samples of fish ranged from 17.8 to 26.4 cents per pound, with an average of 22 cents.

(*Table of analyses on pages 28 and 29.*)

SLAUGHTER HOUSE TANKAGE.

After boiling or steaming various slaughter house wastes, fat rises to the surface and is removed; the soup is run off and the settlings remaining in the tanks (tankage) are dried, ground and sold as fertilizer. Tankage has a wide range of composition, depending largely on the relative amounts of bone and of meat scraps which are "rendered" as above, but in general nitrogen gives more than half the value to the material. Like bone, the

immediate agricultural value of tankage depends not only on the chemical composition but also on the fineness.

Of the seventeen samples analyzed this year one fails to meet the nitrogen guaranty and four are deficient in phosphoric acid. One of the latter, **5909**, guaranteed to contain 9.15 per cent of phosphoric acid, contains but 2.07 per cent.

5912, Lister's Celebrated Ground Bone and Tankage, although selling at only a slightly lower price than standard tankage, con-

ANALYSES OF

Station No.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station:	
5905	American Agr. Chem. Co.	F. S. Bidwell & Co., Windsor Locks
5906	American Agr. Chem. Co.	G. S. Phelps, Thompsonville
5706	Apothecaries Hall Co.	Factory
6235	Bowker Fertilizer Co.	S. Veits, West Suffield
6236	E. D. Chittenden Co.	Wm. Norton, Broad Brook
5819	*Niantic Menhaden Oil & Guano Co.	T. J. Coleman, Warehouse Point
5804	Olds & Whipple	Factory
5913	Wilcox Fertilizer Co.	E. H. Woodward, Enfield
	Sampled by Purchaser:	
5666	American Agr. Chem. Co.	E. N. Austin, Suffield
5667	G. F. Taylor Commission Co.	E. N. Austin, Suffield
6314	Bought from F. H. Thrall, Windsor	J. A. Du Bon, Poquonock

* Old stock.

tains less phosphoric acid and only about one-half the amount of nitrogen.

Nine of these tankages contain over 50 per cent of material too coarse to pass a $\frac{1}{10}$-inch circular hole. This coarser material it is fair to suppose is less quickly available to crops.

It would seem to be profitable both for the manufacturer and the farmer to grind dry tankage finer than is commonly done.

The average cost of the brands whose selling price was known, was $32.28 per ton and the valuation $30.05. Allowing four cents per pound for the phosphoric acid, the nitrogen in seven

samples, excluding **5912**, ranged in cost from 13.6 to 23.3 cents per pound, averaging 19.3 cents.

(*Table of analyses on pages 32 and 33.*)

BONE MANURES.

Of the twenty-seven samples bearing a guaranty, three did not meet their guaranteed nitrogen and one was deficient in phosphoric acid. In three cases, **6229**, **5988** and **5995**, the deficiency

FISH MANURES.

Nitrogen.				Phosphoric acid.			Total Phosphoric Acid.			
As Ammonia.	As Organic.	Total found.	Total guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Cost per ton.	Average retail cost of like amounts of nitrogen and phosphoric acid in other raw materials.
0.37	8.87	9.24	8.23	0.72	5.18	1.07	6.97	6.0	$49.00	$45.76
0.39	8.77	9.16	8.23	0.72	5.60	1.16	7.48	6.0	48.00	45.78
0.25	9.53	9.78	8.20	...	...	...	9.52	5.5	46.00	50.33
0.10	8.08	8.18	8.23	0.86	5.86	0.57	7.29	6.0	49.00	41.69
0.24	7.78	8.02	8.20	0.42	3.20	0.92	4.54	6.0	....	38.60
1.58	7.30	8.88	8.25	1.22	4.31	0.83	6.36	...	....	42.11
0.18	9.60	9.78	7.40	0.43	5.99	1.64	8.06	5.5	48.00	49.25
0.21	9.24	9.45	8.24	0.87	6.32	0.87	8.06	6.0	52.00	47.76
...	...	8.82	8.23	...	...	...	12.00	...	45.00	48.41
...	...	10.41	9.46	...	...	...	9.81	...	45.00	53.65
...	...	6.04	...	0.69	11.60	7.92	20.21	...	38.00	42.73

of one ingredient was not made up in money value by an excess of the other. A duplicate sample of **5995**, however, **6242**, taken from factory stock, fully met its guaranty in both respects.

5986 is a low grade bone product, selling for almost the same price as high grade bone meal, but containing very much less nitrogen and phosphoric acid. Omitting this sample, the average cost per ton in the twenty samples, the prices of which are given, was $33.97, and the average valuation $30.19.

Allowing four cents per pound for the phosphoric acid, as in the case of tankage, the average cost of nitrogen in the twenty

ANALYSES OF

Station No.	Manufacturer and Brand.	Dealer or Purchaser.
	Sampled by Station:	
5986	American Agr. Chem. Co., Bone Meal	Silliman Hardware Co.
5985	American Agr. Chem. Co., Fine Ground Bone	C. Buckingham
6229	American Agr. Chem. Co., High Grade Ground Bone	E. O. Chapman
5987	Armour Fertilizer Works, Bone Meal	Brower & Malone
6233	Berkshire Fertilizer Co., Ground Bone	Factory
5988	Valentine Bohl, Self-Recommending Fertilizer	Apothecaries Hall Co.
5989	Bowker Fertilizer Co., Fresh Ground Bone	W. B. Rice
5635	Coe-Mortimer Co., Fine Ground Bone	J. A. Martin
5678	L. T. Frisbie Co., Fine Bone Meal	Highwood Veg. Growers' Asso.
5990	L. T. Frisbie Co., Fine Bone Meal	W. A. Simpson
5991	International Agr. Corp., Buffalo Bone Meal	Apothecaries Hall Co.
6239	Lister's Agr. Chem. Works, Bone Meal	F. C. Benjamin
5992	Lowell Fertilizer Co., Ground Bone	M. E. Cooke
5993	Olds & Whipple, Bone Meal	Factory
5994	Rogers & Hubbard Co., Pure Raw Knuckle Bone Flour	Factory
5995	Rogers & Hubbard Co., Strictly Pure Fine Bone	R. H. Hall
6242	Rogers & Hubbard Co., Strictly Pure Fine Bone	Factory
6063	Rogers Mfg. Co., Fine Ground Bone	F. S. Platt Co.
6062	Rogers Mfg. Co., Pure Knuckle Bone Flour	Factory
6243	F. S. Royster Guano Co., Fine Ground Bone Meal	C. B. Sikes, Jr.
6061	Sanderson Fert. & Chem. Co., Fine Ground Bone	Morse & Landon
5996	C. M. Shay Fertilizer Co., Pure Ground Bone	G. M. Williams Co.
6246	M. L. Shoemaker & Co., Swift-Sure Bone Meal	F. A. Forbes
5997	Van Iderstine Co., Pure Ground Bone	E. B. Clark Seed Co.
5998	Wilcox Fertilizer Co., Pure Ground Bone	Factory
	Sampled by Purchaser:	
5617	L. T. Frisbie Co., Bone Meal	F. W. Browning
6064	E. L. James, Ground Bone	Factory
5974	Not known	C. M. Geer

samples of bone was 22.6 cents per pound, somewhat higher than in tankage. The range in cost of the nitrogen, however, was very wide, from 14.2 to 34.8 cents per pound, and the average cost is without particular significance. In certain brands of bone

BONE MANURES.

Chemical Analysis.				Mechanical Analysis.			
Nitrogen.		Phosphoric Acid.					
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen and phosphoric acid in other raw materials.
1.95	1.65	16.38	13.75	62	38	$31.00	$20.08
2.16	2.47	28.66	22.88	57	43	30.00	30.05
2.98	3.29	21.21	20.59	58	42	33.00	27.59
2.64	2.47	23.28	22.00	62	38	37.00	28.03
2.91	2.50	23.41	20.00	61	39	32.00	29.15
3.94	3.82	22.13	23.03	55	45	32.00	31.86
2.68	2.47	24.43	22.88	58	42	27.75	28.88
2.83	2.47	25.79	22.89	56	44	....	30.38
2.75	2.47	26.87	23.00	58	42	....	31.00
2.90	2.47	26.23	23.00	70	30	....	32.20
2.51	2.50	23.16	22.00	49	51	30.00	27.39
2.74	2.67	25.46	22.88	55	45	35.00	29.77
2.92	2.46	26.74	23.00	59	41	30.00	31.62
2.49	2.50	25.46	22.00	65	35	34.00	29.26
3.99	3.82	24.95	24.70	58	42	42.00	34.33
3.56	3.70	22.39	22.00	40	60	41.00	29.81
3.85	3.70	23.62	22.00	34	66	35.00	31.48
3.50	3.50	26.74	25.00	90	10	40.00	35.54
3.90	3.80	26.61	25.00	52	48	36.00	34.89
2.49	2.47	23.21	22.90	70	30	35.00	27.73
2.98	2.47	25.71	20.00	50	50	31.00	30.60
2.32	2.06	28.14	25.00	66	34	35.00	30.67
5.86	4.53	22.06	20.00	61	39	38.00	39.59
2.14	2.00	27.89	27.00	44	56	30.00	28.77
2.75	2.48	22.39	22.00	72	28	32.50	28.21
2.93	3.00	27.10	22.90	62	38	30.00	32.07
4.02	3.00	20.09	20.00	1	99	37.00	27.76
3.59	...	22.77	....	30	70	35.00	29.69

bought in car lots the nitrogen, on a similar basis, this year cost only 10.5 cents per pound. The advantage of purchasing this, and all other fertilizers, in large lots for cash is too obvious to require further comment.

ANALYSES OF

Station No.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station:	
5703	American Agr. Chem. Co.	D. L. Clark & Son, Milford .....
6230	American Agr. Chem. Co.	H. S. Davis, New Haven .....
5708	Apothecaries Hall Co.	Factory .....
6070	Coe-Mortimer Co.	J. W. Crowell, Burnside .....
6067	L. T. Frisbie Co.	Factory .....
5677	L. T. Frisbie Co.	Highwood Veg. Growers' Asso., Highwood
5909	L. T. Frisbie Co.	W. A. Simpson, Wallingford .....
5912	Lister's Agr. Chem. Works ...	S. J. Orr, West Suffield .....
5713	Nitrate Agencies Co.	A. D. Clark, Orange .....
6244	Sanderson Fert. & Chem. Co.	A. Ure, Highwood .....
5717	S. D. Woodruff & Sons	Factory .....
	Sampled by Purchaser:	
5729	Bowker Fertilizer Co.	C. Greenbacker, Meriden .....
5730	Bowker Fertilizer Co.	C. Greenbacker, Meriden .....
5684	Bowker Fertilizer Co.	John Gotta, Portland .....
5772	Apothecaries Hall Co.	J. M. Taylor, Kensington .....
5616	.....	Barnes & Co., Wallingford .....
5665	.....	E. N. Austin, Suffield .....

PRICES OF NITROGEN, PHOSPHORIC ACID AND POTASH IN RAW MATERIALS.

1914 AND 1915 COMPARED.

No. of Analyses 1915.		Costs in cents per pound. Average. Spring of 1915.	Average. Spring of 1914.
	Nitrogen in		
8	Nitrate of soda (14.3–16.2)	15.6	18.2
3	Blood	23.4	....
1	Cyanamid	19.2	....
182	Cotton seed meal	*19.9	*21.4
8	Castor pomace (19.5–24.9)	22.7	22.3
	Available phosphoric acid in		
2	"Lime phosphate"	6.3	....
..	Basic phosphate	....	5.44
7	Precipitated bone	6.2	*5.8
26	Acid phosphate	3.99	4.7

* Car lots.

TANKAGE.

Chemical Analysis. Nitrogen. As Ammonia.	As Water-Soluble Organic.	As Active-Insoluble Organic.	As Inactive-Insoluble Organic.	Total Found.	Total Guaranteed.	Phosphoric Acid. Found.	Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Coarser than 1-50 inch.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen and phosphoric acid in other raw materials.
0.47	1.25	2.30	1.07	5.09	4.94	15.31	13.73	56	44	$35.00	$31.15
0.12	0.79	3.82	2.08	6.81	7.41	11.58	9.15	53	47	40.94	34.77
0.21	1.75	2.29	1.12	5.37	4.94	15.22	15.00	46	54	32.00	31.58
0.19	1.73	2.05	1.53	5.50	4.94	13.34	13.73	46	54	32.00	30.67
0.22	2.00	1.55	1.10	4.87	4.94	14.46	15.00	42	58	....	28.92
0.17	...	7.32†	...	7.49	7.41	11.22	9.15	42	58	....	36.31
0.07	1.52	4.58	1.31	7.48	7.41	2.07	9.15	44	56	....	29.60
0.07	0.59	1.36	0.80	2.82	2.67	10.93	12.00	52	48	28.00	18.97
0.20	2.75	1.73	1.30	5.98	5.76	6.60	6.38	55	45	....	27.95
0.12	3.01	3.25	1.03	7.41	7.41	13.01	9.00	54	46	....	38.21
0.22	4.29	2.38	1.33	8.22	...	5.50	....	35	65	....	34.30
0.23	1.57	1.84	1.32	4.96	4.94	14.05	13.73	41	59	....	28.92
0.23	2.02	2.20	1.34	5.79	4.94	14.47	13.73	55	45	....	33.17
...	...	...	...	5.00	4.94	15.56	13.73	39	61	....	30.07
0.10	1.23	2.94	1.16	5.43	4.94	10.34	15.00	53	47	30.00	28.56
...	...	...	...	7.51	...	5.12	....	..	..	....	....
...	...	...	...	7.48	...	*9.65	....	35	65	28.00	34.62

* Contained also 0.39% potash. † Total organic.

No. of Analyses 1915.		Costs in cents per pound. Average. Spring of 1915.	Average. Spring of 1914.
	Water-soluble potash in		
1	High grade sulphate	6.5	4.8–5.5
1	Muriate	6.1	4.4
1	Cotton hull ashes	7.0	7.6–9.0
10	Fish Manures, per ton, $38.00–52.00.	Cost of nitrogen†	22.0	24.5
17	Tankages, " " 28.00–40.94.	" " " †	19.3	19.8
27	Bones, " " 27.75–42.00.	" " " †	22.6	25.8

While the figures here given in most cases are averages from a rather small number of analyses, they agree with the results of an

† Allowing 4 cents per pound for phosphoric acid.

inspection of market quotations in showing that nitrogen and phosphoric acid (in acid phosphate) cost less early in 1915 than at the same time in the previous year, but potash was very hard to get and the prices of it soared and were very soon out of sight.

V. MIXED FERTILIZERS.

MIXTURES OF PHOSPHATES WITH POTASH SALTS.

6072. American Agr. Chem. Co.'s Special XXX Phosphate and Potash. Stock of Gault Bros., Westport.

6154. American Agr. Chem. Co.'s Bradley's Alkaline Phosphate and Potash. Stock of J. H. Paddock, Wallingford.

6071. American Agr. Chem. Co.'s Wheeler's Grass and Oats. Stock of M. E. Crawford, New Canaan.

5924. Lister's Grain and Grass Fertilizer. Stock of S. J. Orr, West Suffield.

Station No.	6072	6154	6071	5924
Per cent of				
Water-soluble phosphoric acid	9.94	7.39	7.30	7.39
Citrate-soluble phosphoric acid	3.99	2.76	4.14	2.60
Citrate-insoluble phosphoric acid	1.10	0.57	1.42	0.69
Total phosphoric acid found	15.03	10.72	12.86	10.68
" " " guaranteed	15.00	11.00	12.00	11.00
"Available" phosphoric acid found	13.93	10.15	11.44	9.99
" " " guaranteed	14.00	10.00	11.00	10.00
Potash as muriate, total	2.00	2.04	2.02	1.85
" guaranteed	2.00	2.00	2.00	2.00
Cost per ton	$26.00	.....	23.00	21.00

These are mixtures of acid phosphate and muriate of potash. 1,500 pounds of 16 per cent acid phosphate and 100 pounds of muriate of potash, at prices for which these materials were freely bought last spring, would cost $14.25 and would contain more fertilizing material than a ton of any of these mixtures which cost from $21 to $26 per ton.

MIXED TOBACCO FERTILIZERS CONTAINING CHIEFLY PHOSPHORIC ACID AND POTASH.

The nine samples analyzed are of one brand, Mapes Tobacco Ash Constituents, made by The Mapes Formula and Peruvian Guano Co., New York City. Eight of them were sampled and sent by the Connecticut Tobacco Corporation. The car numbers

in the order of the samples as given in the table were 193102, 35429, 91696, 34096, 7629, 510776, 112227 and 13346. No. **5928** was drawn in Hazardville by the station agent.

Station No.	5814	5815	5816	6006	6007	6097	6098	6099	5928
Per cent of									
Nitrogen found	0.60	0.63	0.60	0.52	0.54	0.60	0.50	0.62	0.90
" guaranteed	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Water-soluble phosphoric acid	0.12	0.10	0.05	0.22	0.11	0.04	0.04	0.06	0.05
Citrate-soluble phosphoric acid	2.44	3.06	2.82	2.72	2.94	2.69	2.46	2.52	1.97
Citrate-insoluble phosphoric acid	3.12	3.21	2.99	2.88	2.57	3.47	2.17	3.75	3.28
Total phosphoric acid found	5.68	6.37	5.86	5.82	5.62	6.20	4.67	6.33	5.30
Total phosphoric acid guaranteed	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70
Potash as muriate	0.97	1.00	1.08	1.00	1.00	1.00	1.48	0.96	2.87
" " sulphate	8.60	8.91	10.16	3.87	6.90	10.49	9.26	10.29	4.43
" " carbonate	5.07	5.88	3.80	10.09	7.88	5.14	5.58	3.72	6.11
Total water-soluble potash found	14.64	15.79	15.04	14.96	15.78	16.63	16.32	14.97	13.41
Total potash guaranteed	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Cost per ton	$35.00	35.00	35.00	35.00	35.00	....	....	....	40.00

The percentage amounts of the different forms of potash given above do not necessarily show the amount in which muriate, carbonate or sulphate of potash was used in the manufacture. The station determines chlorine and sulphuric acid in the fertilizer, calculates as muriate the potash required to combine with all the chlorine present, then the amount required for the sulphuric acid present, and only reckons as carbonate the potash not required in these calculations.

If now carbonate of potash was used in making the fertilizer, but acid phosphate or plaster (both of which contain much combined sulphuric acid) also formed part of the mixture, a considerable part of the potash would be calculated as sulphate. In the same way, if common salt was contained in any of the ingredients of the mixture, part of the potash would be calculated as muriate.

The reason for this procedure is the following: The amount of potash in form of carbonate in a commercial fertilizer cannot be directly and certainly determined. The reason for buying the

more expensive carbonate is chiefly to avoid muriates or sulphates, but if muriates or sulphates are introduced in other ingredients of the mixture the advantage of using carbonate is largely nullified, and while its cost to the manufacturer is higher than that of muriate or sulphate its value to the user may be no greater.

In the above brand, making the usual allowance for the nitrogen and phosphoric acid present, the average cost of potash was about 9.5 cents per pound.

In car lots this fertilizer supplied total potash at prices ranging from 8.7 to 10.1 cents per pound.

NITROGENOUS SUPERPHOSPHATES.

In the following tables, pages 44 to 65, are given the analyses of 270 samples of fertilizers drawn by the station agent, and representing 261 different brands. At the end of the table will be found the analyses of 21 samples sent by purchasers or manufacturers.

Analyses Requiring Special Notice.

6161. *Armour's* 4-8-3 fertilizer failed to meet the potash guaranty by 0.53 per cent. An unsuccessful attempt was made to find other lots of this brand from which a second sample could be drawn.

5967. *Berkshire Ammoniated Bone Phosphate* showed a deficiency of 1.12 per cent potash and an excess of 1.26 per cent nitrogen. Evidently there was an error in the mixing, as a second sample, **6270,** satisfied the guaranty in all respects.

5918. *Bowker's High Nitrogen Mixture* showed a deficiency of 0.86 per cent nitrogen. A second sample, **6279,** showed a deficiency of 1.67 per cent nitrogen, as well as a shortage of 0.55 per cent potash. The manufacturer has advised us that the purchasers of this brand have been given credit slips covering the deficiencies noted.

5971. *Bowker's Lawn and Garden Dressing Revised* failed to meet its guaranty by 0.68 per cent nitrogen and 0.18 per cent potash. A second sample, **6261,** was entirely satisfactory in both respects.

5836. *Buffalo Top Dresser* showed a deficiency of 0.68 per cent nitrogen. A second sample, **6222,** satisfied the guaranties.

5930. *National Special Complete Root and Grain* failed to meet its guaranty by 0.44 per cent nitrogen and 0.44 per cent potash. A second sample, **6224,** was but little better, showing deficiencies of 0.32 per cent nitrogen and 0.41 per cent potash.

6191. *Rogers and Hubbard's War Special Formula Complete Phosphate* was 0.69 per cent deficient in available phosphoric acid. A second sample, **6275,** was 1.24 per cent deficient in available phosphoric acid, with a shortage of 0.21 per cent potash as well.

5769. *Royster's Tomahawk Compound* was 0.16 per cent deficient in nitrogen. A second sample, **6225,** was satisfactory in this respect. The manufacturer states that the second sample was made by the same formula as the first and the goods all came from the same stock.

6143. *Virginia-Carolina Co.'s High Grade Corn and Vegetable Compound* with 4 per cent potash. One sample was drawn from a small lot in Milford. It was not possible to get a second sample from other stock. Our analysis showed this sample to contain 3.49 per cent of potash. A portion of this sample was sent on request to the Company's chemist who found 3.84 per cent of potash.

Regarding Guaranties.

Of the 270 brands sampled by the station, 55, or 20 per cent, failed in some particular to meet the minimum guaranteed composition. This was, however, a decided improvement over the inspection of 1914, when 115, or 39 per cent, were deficient in one or more of the fertilizing elements. This year 44 brands were deficient as regards a single ingredient, 10 in respect to two, and one was deficient in nitrogen, phosphoric acid and potash.

A deficiency is not counted unless it exceeds 0.1 per cent nitrogen, 0.3 per cent phosphoric acid or 0.15 per cent of potash.

The following summary shows the firms whose brands failed to meet their guaranties in the ingredients indicated:

	Number of Brands analyzed.	Possible Deficiencies.	No. of Brands deficient in: Nitrogen.	"Available."	Potash.	Nitrogen and Potash.	Nitrogen and "Available."	"Available" and Potash.	Nitrogen, "Available" and Potash.
Amer. Agr. Chem. Co. ...	52	156	1	2	4	1	..	..	..
Apothecaries Hall Co. ...	4	12	..	..	..	..	1	..	..
Armour	11	33	2	..	1	..	..	..	..
Atlantic Packing Co.	5	15	..	..	1	..	..	..	..
Berkshire	9	27	..	..	1	..	..	..	..
Bowker	20	60	2	1	..	2	..	..	..
Chittenden	4	12	..	..	..	..	1	..	..
Coe-Mortimer	9	27	1	..	..	..	..	..	..
Conn. Valley Orchard Co.	1	3	..	..	1	..	..	..	..
Essex	6	18	..	..	1	..	..	..	..
International Agr. Corp..	9	27	2	..	..	1	..	..	..
Lister	7	21	1	..	..	..	..	..	..
Lowell	10	30	..	..	2	..	..	..	..
Manchester	2	6	1	..	..	..	..	..	..
Mapes	14	44	..	1	2	..	..	..	..
National	12	36	3	..	..	2	..	..	..
New England	5	15	1	..	..	..	..	..	..
Parmenter & Polsey	3	9	..	..	1	..	..	..	..
Rogers & Hubbard	10	30	..	2	1	..	..	1	..
Rogers Mfg. Co.	7	21	..	2	..	..	..	..	..
Royster	8	24	2	..	..	..	..	..	..
Sanderson	10	30	..	..	1	1	..	..	..
Shoemaker	3	9	3	..	..	..	..	..	..
Virginia-Carolina Chem. Co.	8	24	..	..	1	..	..	..	..
Whitman & Pratt	2	6	..	..	..	..	..	..	1
Other manufacturers	39	117	..	..	..	..	..	..	..
Totals	270	809	19	8	17	7	2	1	1

In 32 of the 55 deficient samples the deficiency in one ingredient was fully made up, so far as money value given is concerned, by an over-run in another ingredient. The 23 brands named below, however, did not satisfy even this requirement. The shortages run from 31 cents to $3.20 per ton.

No.	Brand.	Relation to Guaranty. Available Nitrogen.	Phos. Acid.	Potash.
6155	Bradley's Extra Complete Manure	—0.09	—0.50	+0.20
5827	" Special H. G. Fertilizer	—0.20	+0.52	—0.13
6107	Great Eastern Revised Garden Special ...	—0.16	+0.84	—0.52
6160	Armour's 5-8-3	—0.47	+0.64	+0.15
*6161	" 4-8-3	—0.01	+0.65	—0.53

* See note page 36.

No.	Brand.	Relation to Guaranty. Available Nitrogen.	Phos. Acid.	Potash.
6041	Bowker's Corn Phosphate	—0.17	+0.12	+0.12
*5918	" High Nitrogen Mixture	—0.86	+0.64	—0.03
6279	" " " "	—1.67	+0.83	—0.55
*5971	" Lawn and Garden Dressing Rev.	—0.68	+1.17	—0.18
6943	Chittenden's Connecticut Tobacco Grower	—0.15	—0.45	+0.10
*5836	Buffalo Top Dresser	—0.68	+0.82	—0.06
6170	" 5-8-4	—0.29	+1.72	—0.31
6118	Lister's Revised Complete Tobacco	—0.52	+1.46	+0.35
5784	Lowell Potato Manure	—0.04	+1.27	—0.71
*5930	National Spec. Comp. Root and Grain Fert.	—0.44	+0.56	—0.44
6224	" " " " " " "	—0.32	+0.65	—0.41
6174	" " " Grass Fertilizer	—0.24	+0.36	+0.11
6175	" " H. G. Top Dressing	—0.96	+0.57	+0.03
*6191	Rogers & Hubbard's Complete Phosphate	—0.06	—0.69	+0.09
6275	" " " "	—0.03	—1.24	—0.21
*5769	Royster's Tomahawk Compound	—0.16	+0.43	—0.10
6133	Sanderson's Special with Potash Revised	—0.23	—0.10	—0.19
6263	Whitman & Pratt's Potato Manure	—0.24	—0.45	—0.19

THE SOLUBILITY OF THE ORGANIC NITROGEN IN NITROGENOUS SUPERPHOSPHATES.

The solubility and ready decomposition of nitrogenous matters is believed to stand in close relation to their availability to crops. Two methods have been adopted by the Association of Official Agricultural Chemists for determining nitrogen solubility, the alkaline and neutral potassium permanganate methods. These have been described in former reports. Although this station believes the "neutral" method more clearly and certainly differentiates between high grade and inferior forms of organic nitrogen, yet for the sake of uniformity with the practice of the other New England stations, it has used the "alkaline" method in its inspections.

It has been repeatedly demonstrated that the "alkaline" method fails to do justice to the nitrogen of mixtures containing cotton seed meal or castor pomace, and as a considerable number of the mixed fertilizers sold in Connecticut contain one or both of these valuable fertilizing materials, all brands in which inferior forms of organic nitrogen were indicated by the "alkaline" method have also been tested by the "neutral" method, which does justice to both cotton seed meal and castor pomace.

* See note pages 36 and 37.
† Total phosphoric acid.

As an illustration of comparative tests by the two methods, the following results are presented on four tobacco fertilizers containing cotton seed meal as the chief organic constituent. An organic nitrogen solubility of over 85 by the "neutral" method indicates high grade material, while a solubility of 50 or under by the "alkaline" is generally deemed to indicate inferiority.

ACTIVE-INSOLUBLE ORGANIC NITROGEN.

Neutral method. %	Alkaline method. %
90.2	48.0
92.2	48.2
92.7	42.7
92.0	44.2

The percentage of active-insoluble organic nitrogen shown by the "alkaline" method in 28 brands containing cotton seed meal ranged from 42.2 to 76.1, with an average of 56.2, showing the inapplicability of the method to this kind of fertilizer.

All of the brands of complete fertilizers were tested this year by the "alkaline" method, except a few in which the amount of organic nitrogen was insignificant. All brands showing 50 per cent or less of active-insoluble organic nitrogen by this method were likewise tested by the "neutral" method and only those brands showing less than 85 per cent solubility by this method are included in the following table of suspicious samples.

The manufacturers of some of these brands have reported the formulas by which the goods were mixed and the low nitrogen solubility was explained by the presence of tobacco stems or of sheep manure. Both of these materials are good "conditioners" and have considerable value as fertilizers. But the nitrogen in them is certainly not so readily available to crops as that of the raw materials having a higher per cent of nitrogen, such as blood, tankage, cotton seed meal, etc.

In certain brands the nitrogen found exceeded that guaranteed by a percentage greater than the amount of inactive-insoluble organic nitrogen found. These are not included in the table, as no injustice is worked upon the purchaser, so long as this inert nitrogen is not valued at the price of high grade materials.

The following table gives the results of the tests of 24 brands, in which the percentage of active-insoluble organic nitrogen ranged from 36.4 to 50.5 by the "alkaline" method, and from 50.0 to 84.6 by the "neutral" method.

BRANDS IN WHICH INFERIOR ORGANIC NITROGEN IS INDICATED BY PERMANGANATE METHODS.

Station No.	Brand.	Organic Nitrogen.							
		Total.	Alkaline Method.				Neutral Method.		
			Water-soluble.	Active-insoluble.	Inactive-insoluble.	Per cent Active-insoluble.	Active-insoluble.	Inactive-insoluble.	Per cent Active-insoluble.
5879	East India Special Church's Fish and Potash	1.54	0.56	0.49	0.49	50.0	0.79	0.19	80.1
6106	Great Eastern Revised Northern Corn Special	1.48	0.48	0.44	0.56	44.0	0.73	0.27	73.0
6107	Great Eastern Revised Garden Special	1.53	0.37	0.58	0.58	50.0	0.94	0.22	81.0
6109	Wheeler's Corn Fertilizer	1.07	0.24	0.37	0.46	44.6	0.58	0.25	69.9
5884	Apothecaries Hall Co.'s Victor Corn Phosphate	1.33	0.55	0.36	0.42	46.2	0.57	0.21	72.6
6161	Armour's 4-8-3	2.16	0.60	0.72	0.84	46.2	1.32	0.24	84.6
5967	Berkshire Ammoniated Bone Phosphate	0.74	0.36	0.14	0.24	36.8	0.19	0.19	50.0
5778	Brown's Special Formula	2.56	0.63	0.77	1.16	40.0	1.59	0.34	81.6
6044	Chittenden's Fish and Potash Special Formula	2.21	1.11	0.44	0.66	40.0	0.90	0.20	81.8
5753	Clark's Special Mixture for General Use	0.88	0.30	0.26	0.32	44.8	0.47	0.11	78.3
5781	Essex XXX Fish and Potash	1.28	0.58	0.31	0.39	44.3	0.57	0.13	78.4
6052	Frisbie's Connecticut Special	1.16	0.58	0.26	0.32	44.8	0.48	0.10	82.5
5758	Lowell Potato Phosphate	1.47	0.46	0.51	0.50	50.5	0.79	0.22	80.8
5784	Lowell Potato Manure	0.79	0.34	0.20	0.25	44.4	0.37	0.08	75.2
5785	Lowell Superior Fertilizer	1.22	0.46	0.38	0.38	50.0	0.65	0.11	82.6
6125	Manchester's 1915 Formula	1.00	0.45	0.20	0.35	36.4	0.41	0.14	74.5
5765	New England Superphosphate	1.31	0.54	0.38	0.39	49.4	0.63	0.14	81.8
6137	Sanderson's Corn Superphosphate	1.81	0.71	0.44	0.66	40.0	0.90	0.20	81.8
5770	Sanderson's Potato Manure Revised	1.04	0.27	0.38	0.39	49.4	0.58	0.19	73.7
5844	Sanderson's Atlantic Coast Bone, Fish and Potash Revised	1.78	0.61	0.50	0.67	42.7	0.95	0.22	80.5
6143	Virginia-Carolina H. G. Corn and Vegetable Compound	0.98	0.42	0.27	0.29	48.2	0.44	0.12	78.6
6144	Virginia-Carolina National Corn, Grain and Grass Top Dresser	0.72	0.17	0.26	0.29	47.3	0.45	0.10	81.8
6146	Wilcox Potato Fertilizer	0.75	0.16	0.26	0.33	44.1	0.41	0.18	69.5
6147	Wilcox Corn Special	1.12	0.32	0.37	0.43	46.3	0.62	0.18	77.5

BRAND NAMES.

The scarcity of potash due to the great war has had a marked effect on the composition of the mixed fertilizers offered in our markets. Only one manufacturer has maintained the high percentages of potash of former years. The average amount of potash guaranteed in the nitrogenous superphosphates has been reduced to 3.25 per cent, as compared with 5.94 per cent guaranteed in 1914. Furthermore, while in 1914 more than 4.5 per cent of potash was guaranteed in 207 brands, this year only 11 brands guarantee more than that amount.

Certain manufacturers in the past have laid much stress upon the adaptation of their formulas to the growth of particular crops. These formulas, with the exception noted above, have been quite radically changed this year, and yet the corresponding brands are recommended for the same crops as in previous years, although their potash content has been reduced from 10 to 4 per cent. The thought naturally suggests itself whether the purchaser of complete fertilizers in the past has been buying potash which his soil did not need. If the same brand with its reduced amount of potash, other conditions being the same, will give as good crops as when the amount of potash was much larger, the purchaser may well stop to question his past procedure. The user of commercial fertilizers should realize that what he needs is not a "Potato Manure" or a "Corn Fertilizer," but so many pounds of nitrogen, phosphoric acid, or potash. His soil may need one, two, or all three of these fertilizing elements, as the case may be, but applying phosphoric acid to a soil already rich in available phosphates, or potash to a soil already containing an abundance of available potash, is, or may be, uneconomical and wasteful.

To pay no attention to special or fanciful brand names would be a step in the direction towards the intelligent purchase of mixed fertilizers. The manufacturer in considering the composition of his brands does not call them "Potato Manure," "Corn Fertilizer," or "Grass Dressing," but "3-8-3" "1-8-2," or "5-8-4." He thinks only in terms of nitrogen (ammonia), phosphoric acid and potash, and for the purchaser to do otherwise is only to befuddle his brain as to the real purpose for which he is buying fertility, namely, supply of given amounts of plant food to his soil and crop.

THE COST OF FERTILIZERS.

Notwithstanding the decreased percentages of potash supplied in the mixed fertilizers this year, the average cost per ton is considerably higher, $36.79, as compared with $34.24, the average of recent years. We have already shown that the average potash content in mixed fertilizers has decreased from 5.94 per cent to 3.25 per cent. It is granted that the cost of potash salts has greatly increased since September, 1914, but it is doubtful if this increase in price seriously affected the cost to the manufacturer of much of the potash used in the goods sold in this state in the spring of 1915. The shortage of potash has been met chiefly by reducing the quantity rather than by paying higher prices and maintaining the percentage composition. If the manufacturers had maintained the same amount of potash in their formulas as in former years, there might be some excuse for slightly higher prices for their nitrogenous superphosphates. However, with an average reduction in potash of 2.69 per cent, the reduction in certain brands amounting to as much as 6 per cent, and with practically all nitrogenous and phosphatic raw materials cheaper than in 1914, we find the average price of the mixed fertilizers put up $2.55 per ton. It is difficult to see any justification for this increased price.

The purchaser should give the closest attention to the price he pays for his fertilizers. A study of the tables will show what variable amounts of nitrogen, phosphoric acid and potash he could obtain for the same price: for instance, the following guaranteed amounts of nitrogen, available phosphoric acid and potash, respectively, were sold this year for the prices stated:

For	$28	1–9–2	or	3–9–4
"	29	1–8.5–1.5	or	2–9–3
"	30	1–9.5–2.5	or	2.25–8.5–5.5
"	32	1.25–9–2	or	3.75–6.5–3
"	33	2–8–2	or	5–4.25–3.25
"	34	2–8–3	or	4–8.5–6
"	35	2–8–3	or	4.5–5.25–3
"	36	2.5–10–3.5	or	5–5.5–3.5
"	38	1.5–8.25–3.25	or	5–7–3
"	39	2.5–9.25–3	or	4.25–9.5–4.5
"	40	1.75–4–3.5	or	4.5–5–9.5
"	45	2.25–10.5–4	or	4.5–7.5–6.5
"	50	4.25–8.25–2.75	or	8.5–7.5–3

Nitrogenous Superphosphates

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent: **The American Agricultural Chemical Co., New York City.**			
6156	Church's Fish & Potash "D"	Ellington	$27.50	$17.02
5823	Odorless Grass and Lawn Top Dressing	Norwalk	36.00	20.42
5874	Special Complete Manure for Top Dressing	Stamford	42.50	26.93
5951	Special H. G. Fertilizer	Norwich	37.50	24.05
5822	Special Sure Growth Phosphate	Southport	34.50	21.66
	Bradley Branch:			
5952	Corn Phosphate	Putnam	31.00	16.57
5953	Eclipse Phosphate	Norwich	27.50	14.32
6155	Extra Complete Manure	Middletown	42.00	25.69
5824	Half Century Fertilizer	Milford	32.50	19.26
5825	Patent Superphosphate	Norwalk	30.50	17.43
5954	Potato Fertilizer	So. Woodstock	33.50	19.14
5826	Special Complete Manure for Potatoes and Vegetables	Stamford	38.00	25.59
5955	Special Complete Manure for Top Dressing Grass and Grain	Norwich	42.50	27.22
5827	Special H. G. Fertilizer	Milford	36.50	22.82
5828	Special New Rival Fertilizer	Plantsville	30.00	16.37
6032	Special Niagara Phosphate	Putnam	29.00	12.64
6218	Special Potato Manure	Groton	35.00	20.53
5875	Special Retriever Manure	Glastonbury	35.00	20.53
5956	Special Tobacco Manure	Glastonbury	36.50	25.68
6104	Special Tobacco Manure with Carb. Potash	Glastonbury	39.50	25.22
6105	XL Superphosphate of Lime	Stafford Springs	33.00	19.68
	East India Branch:			
5957	A. A. Ammoniated Superphosphate	Branford	34.00	20.45
5876	Revised Tobacco Special	Burnside	35.50	25.84
5829	Revised Victor Special	Southport	36.50	25.38
6157	Special Cabbage and Potato Manure	New Haven	42.00	29.83
5879	§Special Church's Fish and Potash	Thompsonville	32.00	18.16
5880	Special Improved Compound	Southport	27.50	16.78
5877	Special Potato Manure	Burnside	37.00	26.66
5878	Special Vegetable, Vine and Potato	Southport	34.50	23.77
6249	Unexcelled Fertilizer	Newtown	....	20.28
	Great Eastern Branch:			
6158	Potato Manure	Danbury	31.00	19.44
6107	§Revised Garden Special	Granby	36.00	23.74
6253	Revised General	Litchfield	29.00	15.66
6106	§Revised Northern Corn Special	Granby	30.00	17.64

* For further explanation see page 10.
§ See remarks on nitrogen solubility pages 39 to 41.

Analyzed in 1915.

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.23	0.78	0.28	0.31	0.31	1.91	1.65	4.75	3.94	1.10	9.79	9.0	8.69	8.0	2.05	2.0	6156
1.79	0.82	0.28	0.74	0.28	3.91	3.91	3.12	2.06	0.45	5.63	6.0	5.18	5.0	2.03	2.0	5823
3.34	1.01	0.12	0.33	0.22	5.02	4.94	4.70	2.94	0.61	8.25	8.0	7.64	7.0	3.04	3.0	5874
1.16	0.88	0.35	0.43	0.28	3.10	2.88	4.17	4.08	1.09	9.34	9.0	8.25	8.0	4.22	4.0	5951
0.52	0.10	0.30	1.21	0.50	2.63	2.47	6.24	2.36	0.55	9.15	9.0	8.60	8.0	[1]2.83	3.0	5822
0.57	0.52	0.29	0.36	0.32	2.06	2.06	4.37	4.16	1.32	9.85	9.0	8.53	8.0	1.54	1.5	5952
0.12	0.28	0.18	0.37	0.19	1.14	1.03	4.08	4.11	1.60	9.79	9.0	8.19	8.0	2.06	2.0	5953
0.40	1.30	0.28	0.65	0.57	3.20	3.29	5.52	3.98	1.02	10.52	11.0	9.50	10.0	4.20	4.0	6155
0.08	0.56	0.66	0.44	0.34	2.08	2.06	6.14	2.38	0.82	9.34	9.0	8.52	8.0	2.88	3.0	5824
0.19	0.42	0.52	0.68	0.40	2.21	2.06	3.98	3.88	1.93	9.79	9.0	7.86	8.0	1.65	1.5	5825
0.73	0.54	0.20	0.47	0.22	2.16	2.06	4.90	3.70	0.61	9.21	9.0	8.60	8.0	3.03	3.0	5954
0.04	1.58	0.62	0.67	0.47	3.38	3.29	5.14	3.25	0.82	9.21	9.0	8.39	8.0	4.21	4.0	5826
3.10	1.14	0.25	0.44	0.18	5.11	4.94	4.46	3.30	0.68	8.44	8.0	7.76	7.0	2.90	3.0	5955
0.04	1.21	0.52	0.51	0.40	2.68	2.88	6.48	2.04	0.82	9.34	9.0	8.52	8.0	3.87	4.0	5827
....	0.20	0.88	0.19	0.19	1.46	1.23	5.04	4.68	1.41	11.13	10.0	9.72	9.0	1.82	2.0	5828
0.13	0.23	0.17	0.29	0.20	1.02	0.82	3.98	4.33	1.16	9.47	9.0	8.31	8.0	1.39	1.0	6032
0.94	0.88	0.17	0.38	0.25	2.62	2.47	4.94	3.61	0.72	9.27	9.0	8.55	8.0	3.04	3.0	6218
0.13	0.62	0.49	0.75	0.62	2.61	2.47	6.24	1.78	0.68	8.70	9.0	8.02	8.0	2.73	3.0	5875
0.32	0.78	0.19	1.90	1.39	4.58	4.53	0.62	3.11	0.17	3.90	4.0	3.73	3.0	[2]3.37	3.0	5956
0.88	0.12	0.91	1.32	1.31	4.54	4.53	0.53	3.42	0.14	4.09	4.0	3.95	3.0	[3]3.14	3.0	6104
0.82	0.17	0.46	0.56	0.53	2.54	2.47	4.37	4.66	1.65	10.68	10.0	9.03	9.0	1.99	2.0	6105
0.22	0.98	0.37	0.59	0.46	2.62	2.47	6.62	2.85	0.96	10.43	10.0	9.47	9.0	2.16	2.0	5957
0.91	0.08	0.34	2.02	1.24	4.59	4.53	0.91	2.92	0.26	4.09	4.0	3.83	3.0	[4]3.36	3.0	5876
0.09	1.92	0.66	0.62	0.25	3.54	3.29	5.90	2.48	0.64	9.02	9.0	8.38	8.0	3.90	4.0	5829
0.16	2.85	0.34	0.57	0.43	4.35	4.11	7.58	2.87	0.90	11.35	11.0	10.45	10.0	4.11	4.0	6157
0.25	0.40	0.56	0.49	0.49	2.19	2.06	4.90	3.67	1.54	10.11	9.0	8.57	8.0	1.89	1.5	5879
....	0.19	0.52	0.36	0.34	1.41	1.23	7.58	1.96	0.78	10.32	10.0	9.54	9.0	2.24	2.0	5880
0.10	1.52	0.46	0.82	0.51	3.41	3.29	6.53	3.07	1.27	10.87	11.0	9.60	10.0	4.10	4.0	5877
0.10	0.98	0.46	0.75	0.61	2.90	2.88	5.47	2.94	0.93	9.34	9.0	8.41	8.0	3.94	4.0	5878
0.12	0.32	0.85	0.55	0.46	2.30	2.06	5.44	2.64	1.16	9.24	9.0	8.08	8.0	3.06	3.0	6249
0.12	0.80	0.45	0.41	0.34	2.12	2.06	3.94	4.17	1.80	9.91	9.0	8.11	8.0	3.09	3.0	6158
0.07	1.53	0.37	0.58	0.58	3.13	3.29	6.24	2.60	0.63	9.47	9.0	8.84	8.0	3.48	4.0	6107
0.18	0.48	0.37	0.28	0.24	1.55	0.82	4.46	3.98	1.28	9.72	9.0	8.44	8.0	1.99	2.0	6253
0.08	0.63	0.48	0.44	0.56	2.19	2.06	3.89	4.69	2.10	10.68	9.0	8.58	8.0	1.53	1.5	6106

[1] 0.44% as muriate, 2.39% as sulphate.
[2] 0.36% as muriate, 3.01% as sulphate.
[3] 0.40% as muriate, 0.60% as sulphate, 2.14% as carbonate.
[4] 0.40% as muriate, 2.96% as sulphate.

NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent:			
	The American Agricultural Chemical Co., New York City. (*Continued.*)			
	Packers' Union Branch:			
5958	Special Animal Corn Fertilizer	Waterford	$33.00	$18.09
5830	Special Potato Manure	New Canaan	35.00	19.49
	Quinnipiac Branch:			
5832	Corn Manure	Southport	29.00	17.46
5959	Phosphate	New London	38.00	18.86
5831	Potato Phosphate	Westport	34.00	20.38
6159	Special Fish and Potash Mixture	Gildersleeve	....	24.33
5833	Special Market Garden Manure	Southport	36.50	25.85
6108	Special Wrapper Leaf Brand Tobacco Manure	Warehouse Point	40.00	26.37
	Wheeler Branch:			
6109	§Corn Fertilizer	Granby	29.00	16.11
6110	Cuban Tobacco Grower	Granby	37.00	26.14
6111	Potato Manure	Granby	....	19.25
	Williams and Clark Branch:			
5962	Americus Ammoniated Bone Superphosphate	Norwich	34.50	19.98
5881	Americus Corn Phosphate	Milford	32.00	17.32
5834	Americus H. G. Special for Potatoes and Root Crops	Waterbury	40.00	25.71
5882	Americus Potato Manure	South Manchester	34.00	19.51
5960	Meadow Queen Fertilizer	Milford	35.00	20.68
5883	Special Clark's Root Manure	Wallingford	....	14.53
5961	Special Seed Leaf Tobacco Manure	South Manchester	37.00	25.76
	Apothecaries Hall Co., Waterbury, Conn.			
5884	§Victor Corn Phosphate	Windsorville	34.00	22.49
6033	Victor Potato and Vegetable Special	Waterbury	35.00	23.55
5963	Victor Tobacco Special	Windsorville	38.00	26.34
6034	Victor Top Dresser for Grass and Grain	Waterbury	54.00	40.10
	Armour Fertilizer Works, Baltimore, Md.			
5747	All Soluble	Norwalk	39.00	24.08
5964	Ammoniated Bone with Potash	Bridgeport	32.00	17.70
5886	Bidwell's 3-8-4	Windsor Locks	34.00	25.03
6035	Brewer's Special	East Hartford	37.00	27.45
5887	Fish and Potash	Norwalk	33.00	17.36
6162	Grain Grower	South Manchester	35.00	15.93
5885	3-8-3	Bridgeport	34.00	20.98
6160	5-8-3	Thompsonville	40.00	25.26
6161	†§4-8-3	Thompsonville	37.00	22.76
6112	5-8-4	Bridgeport	38.00	28.11
5748	5½-4-3	Rockville	38.00	25.72

* For further explanation see page 10.
† See note page 36.
§ See remarks on nitrogen solubility pages 39 to 41.

ANALYZED IN 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.62	0.23	0.23	0.41	0.28	1.77	1.65	6.68	4.18	1.29	12.15	11.0	10.86	10.0	1.90	2.0	5958
0.10	0.72	0.45	0.44	0.41	2.12	2.06	4.03	4.09	1.79	9.91	9.0	8.12	8.0	3.07	3.0	5830
0.14	0.39	0.58	0.64	0.44	2.19	2.06	3.60	4.48	1.83	9.91	9.0	8.08	8.0	1.63	1.5	5832
0.87	0.62	0.23	0.52	0.25	2.49	2.47	5.04	4.17	0.70	9.91	10.0	9.21	9.0	1.94	2.0	5959
0.09	0.92	0.50	0.46	0.33	2.30	2.06	3.98	4.32	1.87	10.17	9.0	8.30	8.0	3.18	3.0	5831
0.05	1.15	0.51	0.72	0.62	3.05	2.88	4.89	3.43	0.87	9.19	9.0	8.32	8.0	4.07	4.0	6159
0.11	1.11	0.63	0.89	0.63	3.37	3.29	5.08	3.13	0.95	9.16	9.0	8.21	8.0	4.28	4.0	5833
1.00	0.09	0.35	1.79	1.46	4.69	4.53	1.01	3.06	0.13	4.20	4.0	4.07	3.0	[5]3.42	3.0	6108
0.14	0.54	0.24	0.37	0.46	1.75	1.65	4.22	3.86	1.96	10.04	9.0	8.08	8.0	1.82	2.0	6109
0.91	0.09	0.04	2.09	1.67	4.80	4.53	1.30	2.29	0.70	4.29	4.0	3.59	3.0	[6]3.08	3.0	6110
0.06	0.90	0.27	0.42	0.41	2.06	2.06	5.76	2.65	1.25	9.66	9.0	8.41	8.0	3.02	3.0	6111
1.06	0.89	0.12	0.44	0.26	2.77	2.47	5.28	3.75	0.90	9.93	10.0	9.03	9.0	2.18	2.0	5962
0.16	0.36	0.56	0.62	0.46	2.16	2.06	3.36	4.41	2.06	9.83	9.0	7.77	8.0	1.70	1.5	5881
....	1.51	0.99	0.51	0.43	3.44	3.29	4.01	4.35	1.64	10.00	9.0	8.36	8.0	3.99	4.0	5834
....	0.36	0.71	0.56	0.49	2.12	2.06	5.52	2.66	1.16	9.34	9.0	8.18	8.0	2.92	3.0	5882
....	0.92	1.12	0.48	0.17	2.69	2.47	6.34	2.82	1.01	10.17	10.0	9.16	9.0	2.15	2.0	5960
....	0.10	0.23	0.37	0.30	1.00	0.82	7.42	1.68	0.88	9.98	10.0	9.10	9.0	1.96	2.0	5883
0.22	0.80	0.18	2.27	1.27	4.74	4.53	0.62	3.09	0.19	3.90	4.0	3.71	3.0	[7]3.06	3.0	5961
0.19	1.25	0.55	0.36	0.42	2.77	2.47	5.41	3.24	0.73	9.38	9.0	8.65	8.0	3.59	3.0	5884
0.25	1.49	0.43	0.30	0.42	2.89	2.47	5.52	2.76	0.74	9.02	9.0	8.28	8.0	4.22	4.0	6033
0.22	2.54	0.31	0.68	0.64	4.39	4.12	2.97	1.11	0.38	4.46	5.0	4.08	4.0	[8]4.45	4.0	5963
6.24	1.24	0.30	0.28		8.06	8.20	3.50	2.64	0.51	6.65	8.0	6.14	7.0	[9]6.07	4.0	6034
....	0.66	0.84	0.76	0.62	2.88	2.88	3.36	4.37	1.42	9.15	8.5	7.73	8.0	4.28	4.0	5747
0.36	0.32	0.54	0.66	0.59	2.47	2.47	4.20	2.23	0.84	7.27	6.5	6.43	6.0	2.10	2.0	5964
0.88	0.09	0.37	0.70	0.50	2.54	2.47	5.93	3.43	2.06	11.42	8.5	9.36	8.0	[10]4.35	4.0	5886
0.61	0.09	0.37	2.11	1.30	4.48	4.53	3.12	2.36	1.04	6.52	4.5	5.48	4.0	[11]3.41	3.0	6035
....	0.42	0.54	0.74	0.57	2.27	2.06	3.93	2.44	1.09	7.46	6.5	6.37	6.0	2.20	2.0	5887
0.11	0.66	0.28	0.36	0.31	1.72	1.65	5.90	2.33	0.32	8.55	8.5	8.23	8.0	2.04	2.0	6162
0.33	0.42	0.58	0.68	0.49	2.50	2.47	5.88	2.45	1.01	9.34	8.5	8.33	8.0	3.07	3.0	5885
0.92	0.26	0.53	1.21	0.72	3.64	4.11	6.05	2.59	0.83	9.47	8.5	8.64	8.0	3.15	3.0	6160
0.91	0.21	0.60	0.72	0.84	3.28	3.29	6.19	2.46	0.75	9.40	8.5	8.65	8.0	2.47	3.0	6161
0.89	0.30	0.53	1.30	0.95	3.97	4.11	5.52	2.72	0.91	9.15	8.5	8.24	8.0	4.29	4.0	6112
0.92	0.08	0.02	1.72	1.86	4.60	4.52	2.04	2.19	0.75	4.98	4.5	4.23	4.0	[12]2.98	3.0	5748

[5] 0.48% as muriate, 2.94% as sulphate.
[6] 0.40% as muriate, 2.68% as sulphate.
[7] 0.36% as muriate, 2.70% as sulphate.
[8] 0.68% as muriate, 3.77% as sulphate.
[9] 5.22% as muriate, 0.85% as sulphate.
[10] 0.39% as muriate, 3.96% as sulphate.
[11] 0.32% as muriate, 3.09% as sulphate.
[12] 0.45% as muriate, 2.53% as sulphate.

NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent:			
	Atlantic Packing Co., New Haven, Conn.			
5965	Atlantic Corn and Grain Fertilizer	New London	$30.00	$18.95
5966	Atlantic Potato Phosphate	Moodus	35.00	20.26
6036	Atlantic Special Vegetable	New Haven	....	27.97
6164	Atlantic Tobacco Special (C. S. Meal)	Windsor	....	26.90
6163	Atlantic Top Dresser	Moodus	44.00	27.48
	Berkshire Fertilizer Co., Bridgeport, Conn.			
5967	†§Ammoniated Bone Phosphate	Chester	26.00	14.98
6270	†Ammoniated Bone Phosphate	Waterbury	29.00	15.40
5968	Complete Fertilizer	Chester	34.00	21.49
5888	Economical Grass Fertilizer	Suffield	49.00	36.10
6038	Fish and Potash	Chester	32.00	20.59
6037	Grass Special	Waterbury	43.00	25.90
5777	Long Island Special	Plainville	37.00	24.57
5835	Potato and Vegetable Phosphate	Waterbury	33.00	17.52
5969	Tobacco Special	Suffield	39.00	29.21
	F. E. Boardman, Middletown, Conn.			
5970	Complete Fertilizer for Potatoes and General Crops	Middletown	....	26.10
6220	Tobacco Fertilizer	Middletown	....	26.05
	Bowker Fertilizer Co., New York City.			
5751	All Round Fertilizer	Westport	33.50	24.44
6166	Ammoniated Food for Flowers	Hartford	‡	18.69
6039	Brighton Phosphate	New Haven	27.00	11.93
6041	Corn Phosphate	Jewett City	29.00	15.24
5749	Farm and Garden Phosphate	New Haven	32.00	16.57
5918	†High Nitrogen Mixture	Wallingford	55.00	35.64
6279	†High Nitrogen Mixture	Broad Brook	51.70	32.73
5891	Hill and Drill Phosphate	Hazardville	36.00	20.50
5971	†Lawn and Garden Dressing Revised	New Haven	50.00	24.38
6261	Lawn and Garden Dressing Revised	South Manchester	48.00	26.81
5750	Potato and Vegetable Fertilizer	Yalesville	38.00	24.52
6040	Potato and Vegetable Phosphate	Colchester	32.00	15.93
5889	Special Complete Alkaline Tobacco Grower (Carbonate)	West Suffield	36.50	28.64
6219	Special Complete Alkaline Tobacco Grower (Carbonate)	West Suffield	36.50	26.42

* For further explanation see page 10.
† See note page 36.
§ See remarks on nitrogen solubility pages 39 to 41.
‡ Price 25 cents for small package.

ANALYZED IN 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.20	0.70	0.44	0.26	0.24	1.84	1.64	7.08	2.09	0.63	9.80	9.0	9.17	8.0	3.10	3.0	5965
0.28	0.96	0.53	0.42	0.28	2.47	2.46	6.48	2.09	0.78	9.35	9.0	8.57	8.0	2.84	3.0	5966
0.56	1.32	0.81	0.46	0.34	3.49	3.28	5.52	4.67	0.75	10.94	9.0	10.19	8.0	4.76	4.0	6036
1.12	....	0.13	2.18	0.85	4.28	4.10	5.28	1.91	0.33	7.52	8.0	7.19	6.0	[13]3.12	3.0	6164
0.99	1.01	0.68	0.98	0.44	4.10	4.10	6.24	2.00	0.52	8.76	10.0	8.24	8.0	4.00	4.0	6163
1.29	0.05	0.36	0.14	0.24	2.08	0.82	4.13	4.49	0.50	9.12	9.0	8.62	8.0	0.88	2.0	5967
0.30	0.01	0.33	0.41	0.39	1.44	0.82	3.74	4.18	0.52	8.44	9.0	7.92	8.0	2.22	2.0	6270
0.82	0.26	0.43	0.68	0.62	2.81	2.50	2.20	6.44	0.52	9.16	9.0	8.64	8.0	3.04	3.0	5968
8.35	0.02	0.14	0.05		8.56	8.00	0.97	6.45	0.32	7.74	8.0	7.42	4.0	2.85	2.0	5888
....	0.28	0.30	1.25	0.89	2.72	2.50	2.29	3.20	0.91	6.40	6.0	5.49	4.0	3.54	3.0	6038
3.98	0.28	0.22	0.38	0.30	5.16	5.00	3.84	1.55	0.37	5.76	5.0	5.39	4.0	3.15	2.0	6037
0.35	1.04	0.51	0.85	0.67	3.42	3.30	1.60	4.80	0.52	6.92	8.0	6.40	6.0	4.55	4.0	5777
0.23	0.04	0.57	0.66	0.60	2.10	1.70	2.09	6.03	0.69	8.81	9.0	8.12	8.0	2.12	2.0	5835
1.25	0.12	0.68	1.77	1.63	5.45	4.50	0.31	4.57	0.20	5.08	4.0	4.88	3.0	[14]3.26	3.0	5969
1.06	0.86	0.92	0.45	0.38	3.67	3.03	1.17	6.70	1.48	9.35	...	7.87	7.0	[15]3.98	4.0	5970
1.10	0.96	0.39	0.70	0.68	3.83	3.30	2.98	4.73	0.29	8.00	...	7.71	7.0	[16]3.86	3.0	6220
0.10	1.66	0.43	0.40	0.37	2.96	2.47	5.16	3.09	1.41	9.66	9.0	8.25	8.0	4.46	3.0	5751
2.27	0.01	0.10	0.10		2.48	2.47	0.42	6.56	0.95	7.93	7.0	6.98	6.0	[17]3.31	2.0	6166
0.24	0.21	0.17	0.20	0.16	0.98	0.82	3.50	4.83	0.88	9.21	9.0	8.33	8.0	1.19	1.0	6039
0.37	0.35	0.25	0.32	0.19	1.48	1.65	4.42	3.70	1.09	9.21	9.0	8.12	8.0	2.12	2.0	6041
0.64	0.62	0.06	0.27	0.23	1.82	1.65	3.69	4.65	0.91	9.25	9.0	8.34	8.0	2.37	2.0	5749
3.09	2.81	0.31	0.72	0.44	7.37	8.23	4.18	2.46	0.65	7.29	7.0	6.64	6.0	3.97	4.0	5918
2.21	2.53		1.82		6.56	8.23	4.03	2.80	0.72	7.55	7.0	6.83	6.0	3.45	4.0	6279
....	1.24	0.70	0.39	0.36	2.69	2.47	6.93	2.50	0.79	10.22	10.0	9.43	9.0	2.08	2.0	5891
2.73	0.67	0.23	0.40	0.23	4.26	4.94	2.03	6.14	0.32	8.49	8.0	8.17	7.0	2.82	3.0	5971
3.27	1.18		0.78		5.23	4.94	3.98	2.56	0.82	7.36	8.0	6.54	7.0	2.99	3.0	6261
....	1.55	0.70	0.43	0.37	3.05	2.88	5.41	3.21	1.61	10.23	9.0	8.62	8.0	3.99	4.0	5750
0.42	0.27	0.27	0.40	0.21	1.57	1.65	4.66	3.96	1.10	9.72	9.0	8.62	8.0	2.09	2.0	6040
1.30	0.05	0.47	1.71	1.39	4.92	4.11	1.23	4.27	1.09	6.59	5.0	5.50	4.0	[18]3.50	3.0	5889
1.00	0.08	0.21	1.44	1.44	4.17	4.11	0.53	5.11	1.27	6.91	5.0	5.64	4.0	[19]3.73	3.0	6219

[13] 0.36% as muriate, 2.76% as sulphate.
[14] 0.68% as muriate, 2.58% as sulphate.
[15] 0.80% as muriate, 3.18% as sulphate.
[16] 0.36% as muriate, 3.50% as sulphate.
[17] 2.55% as muriate, 0.76% as sulphate.
[18] 0.28% as muriate, 3.22% as sulphate.
[19] 0.84% as muriate, 2.67% as sulphate, 0.22% as carbonate.

Nitrogenous Superphosphates

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent:			
	Bowker Fertilizer Co., New York City. *(Continued.)*			
5890	Special Complete Alkaline Tobacco Grower (Sulphate)	Enfield	$39.00	$26.42
6165	Square Brand Fertilizer	South Britain	30.00	18.49
5973	Sure Crop Phosphate	New London	30.00	15.64
5780	Stockbridge Cereal Manure	Meriden	35.00	25.84
5972	Stockbridge Early Crop Manure	Meriden	38.00	26.65
5779	Stockbridge General Crop Manure	Waterbury	40.00	25.81
	F. O. Brown, Leonard's Bridge, Conn.			
5778	§Special Formula	Meriden	....	27.30
6113	Special Oats and Top Dressing	Manchester	38.00	31.06
	E. D. Chittenden Co., Bridgeport, Conn.			
5752	Complete Tobacco and Onion Grower	Westport	33.00	26.69
6043	Connecticut Tobacco Grower	Broad Brook	45.00	25.42
6044	§Fish and Potash Special Formula	Broad Brook	....	19.12
6042	Tobacco Special	Broad Brook	33.00	27.25
	The Everett B. Clark Seed Co., Milford, Conn.			
5753	§Special Mixture for General Use	Milford	....	25.98
6114	Special Top Dressing Fertilizer	Milford	....	26.47
	The Coe-Mortimer Co., New York City.			
5872	Blood, Bone and Potash Revised	Manchester	....	29.15
5873	Blue Brand Excelsior Guano	Highwood	37.00	27.19
6046	Columbian Corn and Potato Fertilizer Special	Plainfield	32.00	15.07
6115	Double Strength Top Dressing Manure Special	Stafford Springs	52.00	38.56
5754	H. G. Ammoniated Superphosphate Revised	Torrington	34.00	20.37
5871	Ideal Tobacco Fertilizer Special	Manchester	....	25.55
6045	New Englander Special Revised	Torrington	29.00	15.49
6047	Prolific Crop Producer	Abington	35.00	20.44
6167	XXV Ammoniated Phosphate	Washington	26.00	13.78
	Connecticut Valley Orchard Co., Berlin, Conn.			
6048	High Grade Special	Berlin	28.00	19.66
	T. H. Eldridge, Norwich, Conn.			
6049	H. G. Fish and Potash	Norwich	32.00	20.24
6050	Special Superphosphate	Norwich	28.00	16.34

* For further explanation see page 10.
§ See remarks on nitrogen solubility pages 39 to 41.

Analyzed in 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.98	0.04	0.18	1.86	1.29	4.35	4.11	1.78	3.54	0.78	6.10	5.0	5.32	4.0	[20]3.46	3.0	5890
0.03	0.85	0.36	0.38	0.34	1.96	2.06	5.09	3.15	0.91	9.15	9.0	8.24	8.0	2.95	3.0	6165
0.11	0.13	0.20	0.31	0.29	1.04	0.82	7.33	2.10	0.84	10.27	10.0	9.43	9.0	2.47	2.0	5973
....	1.68	0.61	0.52	0.45	3.26	3.29	7.74	2.19	0.75	10.68	11.0	9.93	10.0	3.89	4.0	5780
3.33	1.30	0.15	0.20	0.13	5.11	4.94	4.31	2.77	0.72	7.80	8.0	7.08	7.0	3.07	3.0	5972
....	2.20	0.51	0.38	0.35	3.44	3.29	6.50	1.91	0.83	9.24	9.0	8.41	8.0	4.36	4.0	5779
0.89	0.15	0.63	0.77	1.16	3.60	3.33	4.18	3.26	1.20	8.64	8.0	7.44	...	4.90	4.0	5778
2.64	1.24	0.51	0.38	0.64	5.41	5.50	4.85	2.53	0.40	7.78	8.0	7.38	...	4.52	4.0	6113
....	1.18	1.38	0.58	0.58	3.72	3.30	6.50	2.20	0.42	9.12	9.0	8.70	8.0	[21]3.48	3.0	5752
0.21	3.24	0.25	0.47	0.63	4.80	4.95	2.16	1.39	0.40	3.95	5.0	3.55	4.0	[22]4.10	4.0	6043
....	0.62	1.11	0.44	0.66	2.83	2.47	3.61	2.52	0.60	6.73	6.0	6.13	6.0	2.30	2.0	6044
0.14	2.06	0.72	1.16	0.92	5.00	4.50	2.16	2.18	0.52	4.86	4.0	4.34	3.0	[23]3.39	3.0	6042
0.09	2.36	0.30	0.26	0.32	3.33	3.29	6.43	2.98	0.70	10.11	9.0	9.41	8.0	[24]4.16	4.0	5753
3.40	1.24	0.15	0.22	0.29	5.30	4.93	4.85	1.76	0.55	7.16	7.0	6.61	6.0	[25]2.59	2.0	6114
0.20	2.84	0.23	0.65	0.27	4.19	4.11	8.50	1.99	0.51	11.00	11.0	10.49	10.0	4.11	4.0	5872
0.10	1.72	0.44	0.82	0.42	3.50	3.29	7.68	2.86	0.59	11.13	11.0	10.54	10.0	4.00	4.0	5873
0.47	0.35	0.19	0.18	0.16	1.35	1.23	5.52	3.32	0.86	9.70	10.0	8.84	9.0	2.04	2.0	6046
2.11	3.08	0.34	1.65	0.77	7.95	8.23	2.88	4.21	0.27	7.36	7.0	7.09	6.0	4.02	4.0	6115
0.15	0.75	0.64	0.36	0.34	2.24	2.06	4.80	3.72	1.29	9.81	9.0	8.52	8.0	3.26	3.0	5754
0.19	0.78	0.25	1.82	1.48	4.52	4.53	0.77	3.00	0.20	3.97	4.0	3.77	3.0	[26]3.32	3.0	5871
0.25	0.25	0.35	0.24	0.21	1.30	0.82	4.46	4.30	1.50	10.26	10.0	8.76	9.0	2.20	2.0	6045
0.74	0.76	0.25	0.59	0.42	2.76	2.47	3.94	5.28	1.45	10.67	10.0	9.22	9.0	2.14	2.0	6047
0.14	0.10	0.20	0.31	0.30	1.05	0.82	6.30	1.85	0.52	8.67	9.0	8.15	8.0	2.01	2.0	6167
....	0.23	0.79	0.60	0.60	2.22	2.06	5.31	2.91	0.84	9.06	9.0	8.22	8.0	2.80	3.0	6048
0.13	0.21	0.56	1.02	0.63	2.55	2.40	4.43	2.03	0.22	6.68	6.0	6.46	5.0	3.38	3.0	6049
0.98	0.02	0.06	0.31		1.37	1.23	5.74	3.75	0.86	10.35	10.0	9.49	8.0	2.24	2.0	6050

[20] 0.36% as muriate, 3.10% as sulphate.
[21] 0.68% as muriate, 2.80% as sulphate.
[22] 0.16% as muriate, 3.94% as sulphate.
[23] 0.54% as muriate, 2.85% as sulphate.
[24] 1.79% as muriate, 2.37% as sulphate.
[25] 1.75% as muriate, 0.84% as sulphate.
[26] 0.21% as muriate, 3.11% as sulphate.

Nitrogenous Superphosphates

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent:			
	Essex Fertilizer Co., Boston, Mass.			
6116	Complete Manure for Corn, Grain and Grass	Hazardville	$41.00	$27.39
6051	Complete Manure for Potatoes, Roots and Vegetables	Plainville	37.00	26.65
6168	Market Garden and Potato Manure	Hazardville	34.00	22.88
5919	New Tobacco Fertilizer	West Suffield	....	26.10
6221	Special Corn Fertilizer	Cromwell	....	20.88
5781	§XXX Fish and Potash	Plainville	40.50	19.72
	L. T. Frisbie Co., New Haven, Conn.			
5755	Complete Manure, Garden, Fruit and Vine	Highwood	....	22.51
5920	Corn and Grain Fertilizer	New Haven	29.00	18.92
6052	§Connecticut Special	Norwich	....	22.30
6053	Market Garden and Top Dresser	Hartford	39.00	28.73
6054	Tobacco Special (C. S. M.)	New Haven	38.00	26.83
5756	Vegetable Grower	Highwood	....	25.92
	International Agricultural Corporation, Buffalo, N. Y.			
6169	Buffalo High Grade Manure	Milford	....	24.07
5782	Buffalo New England Special	Ansonia	31.00	19.31
5922	Buffalo Tobacco Producer	Glastonbury	....	27.00
5836	†Buffalo Top Dresser	West Cheshire	44.00	26.09
6222	†Buffalo Top Dresser	New Hartford	43.00	29.60
5783	Buffalo Vegetable and Potato	West Cheshire	34.00	19.66
5921	Buffalo 1-8-2	New Britain	28.00	13.77
5757	Buffalo 3-8-4	Ansonia	35.00	23.85
6170	Buffalo 5-8-4	West Hartford	....	27.54
	Lister's Agricultural Chemical Works, Newark, N. J.			
6121	Ammoniated Dissolved Superphosphate	North Branford	....	17.87
6119	Revised Corn and Potato Fertilizer	North Branford	....	17.19
6120	Revised Potato Manure	Burnside	38.00	26.51
5923	Revised Complete Tobacco Manure (Carbonate)	Burnside	39.00	25.39
6118	Revised Complete Tobacco Manure (Sulphate)	Rockville	40.00	22.89
6117	Standard Pure Superphosphate of Lime	Rockville	35.00	22.21
6122	Success Fertilizer	Moodus	....	16.55
	Lowell Fertilizer Co., Boston, Mass.			
5759	Animal Brand	New Canaan	35.00	21.01
5760	Bone Fertilizer	Rockville	30.00	18.35
5926	Corn and Vegetable	Warehouse Point	40.00	24.61
6124	Empress Brand	New Haven	26.00	14.25
5925	Market Garden Manure	South Manchester	39.00	27.49

* For further explanation see page 10.
† See note page 36.
§ See remarks on nitrogen solubility pages 39 to 41.

Analyzed in 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.78	1.70	0.44	0.48	0.48	3.88	3.28	4.44	5.26	1.25	10.95	9.0	9.70	8.0	3.96	4.0	6116
0.60	1.40	0.54	0.52	0.34	3.40	3.28	5.36	3.99	0.65	10.00	9.0	9.35	8.0	4.62	4.0	6051
0.07	1.26	0.53	0.35	0.32	2.53	2.00	4.82	4.45	0.68	9.95	9.0	9.27	8.0	4.09	4.0	6168
1.01	0.11	1.18	0.98	0.84	4.12	4.10	3.36	3.81	1.15	8.32	7.0	7.17	6.0	[27]2.99	3.0	5919
0.10	0.90	0.72	0.29	0.21	2.22	2.00	5.28	2.58	1.10	8.96	9.0	7.86	8.0	3.93	3.0	6221
....	0.79	0.58	0.31	0.39	2.07	2.00	5.71	3.94	0.81	10.46	9.0	9.65	8.0	2.80	3.0	5781
0.46	0.79	0.55	0.37	0.30	2.47	2.46	6.31	2.94	0.69	9.94	9.0	9.25	8.0	3.91	4.0	5755
0.06	0.77	0.34	0.36	0.31	1.84	1.64	5.47	3.85	0.59	9.91	9.0	9.32	8.0	3.05	3.0	5920
0.50	0.80	0.58	0.26	0.32	2.46	2.46	6.03	3.45	0.31	9.79	9.0	9.48	8.0	3.85	3.0	6052
0.84	2.00	0.49	0.45	0.39	4.17	4.10	5.61	3.94	0.51	10.06	9.0	9.55	8.0	4.42	4.0	6053
0.92	0.08	0.84	1.31	1.07	4.22	4.10	3.41	3.37	0.74	7.52	7.0	6.78	6.0	[28]3.32	3.0	6054
0.49	1.48	0.51	0.52	0.29	3.29	3.28	5.40	3.98	0.79	10.17	9.0	9.38	8.0	4.36	4.0	5756
0.14	1.75	0.25	0.64	0.42	3.20	3.30	6.03	3.59	0.70	10.32	9.0	9.62	8.0	[29]3.00	3.0	6169
....	0.22	0.25	0.77	0.56	1.80	1.60	6.55	4.11	1.33	11.99	10.0	10.66	9.0	[30]2.26	2.0	5782
0.25	1.85	0.01	1.29	1.00	4.40	4.50	3.26	3.60	0.88	7.74	6.0	6.86	5.0	[31]3.35	3.0	5922
2.42	0.50	0.10	1.39	0.71	5.12	5.80	3.65	3.17	1.19	8.01	7.0	6.82	6.0	1.94	2.0	5836
2.93	1.42	0.27	0.77	0.44	5.83	5.80	4.99	3.57	1.29	9.85	7.0	8.56	6.0	[32]2.16	2.0	6222
1.30	0.52	0.01	0.39	0.29	2.51	2.40	4.47	3.69	1.10	9.26	9.0	8.16	8.0	2.90	3.0	5783
0.08	0.04	0.02	0.42	0.29	0.85	0.80	5.66	3.77	0.68	10.11	9.0	9.43	8.0	1.88	2.0	5921
....	0.28	0.26	1.11	0.65	2.30	2.50	6.29	3.82	1.34	11.45	9.0	10.11	8.0	4.15	4.0	5757
0.14	2.18	0.14	0.93	0.42	3.81	4.10	7.15	2.57	0.59	10.31	9.0	9.72	8.0	[33]3.69	4.0	6170
....	0.33	0.68	0.63	0.56	2.20	2.06	5.35	3.27	1.54	10.16	9.0	8.62	8.0	1.50	1.5	6121
....	0.78	0.45	0.33	0.32	1.88	1.65	5.14	3.40	1.52	10.06	9.0	8.54	8.0	2.05	2.0	6119
0.14	1.90	0.38	0.49	0.42	3.33	3.29	7.80	2.19	1.14	11.13	11.0	9.99	10.0	4.16	4.0	6120
1.33	0.06	0.18	1.59	1.08	4.24	4.11	0.24	5.08	2.16	7.48	5.0	5.32	4.0	[34]3.10	3.0	5923
1.72	0.10	0.36	0.79	0.62	3.59	4.11	2.18	3.28	1.09	6.55	5.0	5.46	4.0	[35]3.35	3.0	6118
....	0.24	0.90	0.90	0.73	2.77	2.47	5.28	3.92	2.43	11.63	10.0	9.20	9.0	2.31	2.0	6117
....	0.06	0.78	0.28	0.27	1.39	1.23	6.03	3.10	1.23	10.36	10.0	9.13	9.0	2.25	2.0	6122
0.44	0.81	0.60	0.45	0.28	2.58	2.46	6.34	2.15	0.78	9.27	9.0	8.49	8.0	3.08	3.0	5759
....	0.53	0.56	0.31	0.24	1.64	1.64	5.81	3.36	0.42	9.59	9.0	9.17	8.0	3.13	3.0	5760
1.06	0.66	0.76	0.54	0.26	3.28	3.29	6.53	1.41	0.63	8.57	9.0	7.94	8.0	4.11	4.0	5926
0.13	0.42	0.35	0.21	0.19	1.30	1.25	5.76	2.33	0.24	8.33	8.0	8.09	7.0	1.98	2.0	6124
0.73	2.06	0.38	0.64	0.30	4.11	4.10	6.67	1.58	0.51	8.76	9.0	8.25	8.0	4.26	4.0	5925

[27] 0.88% as muriate, 2.11% as sulphate.
[28] 0.56% as muriate, 2.76% as sulphate.
[29] 0.32% as muriate, 2.68% as sulphate.
[30] 1.57% as muriate, 0.69% as sulphate.
[31] 0.36% as muriate, 2.99% as sulphate.
[32] 1.63% as muriate, 0.53% as sulphate.
[33] 0.32% as muriate, 3.37% as sulphate.
[34] 0.64% as muriate, 0.85% as sulphate, 1.61% as carbonate.
[35] 0.80% as muriate, 2.55% as sulphate.

NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent: **Lowell Fertilizer Co., Boston, Mass.** *(Continued.)*			
5758	§Potato Phosphate	Wallingford	$34.00	$23.14
5784	§Potato Manure	New Britain	38.00	17.57
6223	Special Grass Mixture, Top Dressing and Lawns	South Manchester	39.00	28.77
6123	Special Tobacco from Vegetable and Animal Matter	Warehouse Point	38.00	25.90
5785	§Superior Fertilizer	Rockville	39.00	26.82
	E. Manchester & Sons, Winsted, Conn.			
6125	§1915 Formula	Ellington	30.00	24.10
6126	1915 Special	Litchfield	38.00	31.28
	The Mapes Formula & Peruvian Guano Co., New York City.			
5786	Average Soil Complete Manure	Southington	40.00	31.42
5761	Complete Manure, "A" Brand	Meriden	43.00	22.86
5762	Corn Manure	Ellington	41.00	28.70
6066	Dissolved Bone	Stonington	....	22.44
5838	Economical Potato Manure	Southington	40.00	36.57
6127	Fruit and Vine Manure	Meriden	51.00	31.79
5837	Potato Manure	Ellington	45.00	32.38
5839	Seeding Down Manure	Forestville	47.00	39.21
6171	Special for Tobacco, Two in One	Ellington	48.00	36.62
6172	Tobacco Manure, Wrapper Brand	Ellington	54.00	36.63
5927	Tobacco Starter Improved	Suffield	40.00	23.35
5763	Top Dresser Improved, Full Strength	Ellington	57.00	45.70
5787	Top Dresser Improved, Half Strength	Meriden	40.00	24.40
6173	Vegetable Manure, Complete for Light Soils	Hartford	51.00	33.98
	National Fertilizer Co., New York City.			
6179	Ammoniated Bone Phosphate	Guilford	....	16.67
5764	Fish and Potash Special	Hazardville	34.50	24.50
5930	†Special Complete Root and Grain Fertilizer	Silver Lane	38.00	22.72
6224	†Special Complete Root and Grain Fertilizer	Hazardville	36.00	23.16
6176	Special Eureka Potato Fertilizer	South Manchester	39.00	23.12
6174	Special Complete Grass Fertilizer	South Manchester	44.00	27.33
6175	Special H. G. Top Dressing	South Manchester	58.00	36.31
5788	Special Potato Phosphate	Greenwich	34.00	19.80
6177	Tobacco Special with Carbonate Potash, Revised	Hazardville	39.00	27.75
6178	Tobacco Special Revised	Hazardville	37.50	26.21

* For further explanation see page 10.
† See note page 37.
§ See remarks on nitrogen solubility pages 39 to 41.

ANALYZED IN 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.33	0.65	0.46	0.51	0.50	2.45	2.46	5.78	4.22	1.22	11.22	9.0	10.00	8.0	3.81	4.0	5758
0.13	0.68	0.34	0.20	0.25	1.60	1.64	5.63	2.64	0.33	8.60	8.0	8.27	7.0	3.29	4.0	5784
0.92	2.02	0.41	0.42	0.35	4.12	4.10	5.73	3.48	0.58	9.79	9.0	9.21	8.0	4.72	4.0	6223
1.23	0.05	0.45	1.19	1.11	4.03	4.10	4.51	1.53	0.61	6.65	7.0	6.04	6.0	[36]3.56	3.0	6123
0.75	1.70	0.46	0.38	0.38	3.67	3.69	4.95	4.16	0.91	10.02	9.0	9.11	8.0	4.37	4.0	5785
0.53	0.81	0.45	0.20	0.35	2.34	2.47	5.83	2.54	0.61	8.98	...	8.37	8.0	5.60	3.0	6125
0.84	2.06	0.43	0.54	0.42	4.29	4.10	6.85	5.02	1.37	13.24	...	11.87	10.0	4.44	4.0	6126
2.13	1.34	0.15	0.40	0.53	4.55	4.12	0.30	7.17	0.97	8.44	8.0	7.47	7.0	[37]5.92	5.0	5786
1.27	0.92	0.17	0.20	0.35	2.91	2.47	0.82	9.16	2.79	12.77	12.0	9.98	10.0	3.10	2.5	5761
1.45	0.60	0.24	0.34	0.28	2.91	2.47	0.10	8.53	2.69	11.32	10.0	8.63	8.0	[38]6.40	6.0	5762
....	0.10		2.31		2.41	2.06	5.52	11.56	2.11	19.19	...	17.08	12.0	....	...	6066
2.13	1.71	0.23	0.40	0.16	4.63	3.29	0.13	4.91	1.04	6.08	6.0	5.04	4.0	[39]9.52	8.0	5838
1.09	0.04	0.17	0.25	0.38	1.93	1.65	0.68	6.06	1.13	7.87	7.0	6.74	5.0	[40]10.68	10.0	6127
3.11	0.26	0.34	0.46	0.33	4.50	3.71	0.25	7.21	1.97	9.43	8.0	7.46	8.0	[41]6.40	6.0	5837
2.18	0.07	0.01	0.23	0.13	2.62	2.47	0.06	14.14	5.62	19.82	18.0	14.20	...	11.09	10.0	5839
2.32	0.12	1.49	1.05	0.96	5.94	5.35	0.12	6.24	1.02	7.38	7.0	6.36	...	[42]6.00	6.0	6171
1.58	0.04	2.10	1.64	1.00	6.45	6.18	0.09	4.66	1.19	5.94	4.5	4.75	...	[43]12.16	10.5	6172
2.34	0.05	0.02	0.83	0.78	4.02	4.12	0.05	7.63	1.34	9.02	8.0	7.68	6.0	[44]2.20	1.0	5927
5.71	4.73	0.16	0.17	0.13	10.90	9.88	0.24	6.18	0.59	7.01	8.0	6.42	5.0	[45]4.05	4.0	5763
3.28	1.76	0.21	0.30		5.55	4.94	0.37	3.36	0.95	4.68	4.0	3.73	2.5	[46]2.22	2.0	5787
2.24	1.58	0.33	0.66	0.60	5.41	4.94	0.12	7.06	2.41	9.59	8.0	7.18	6.0	[47]5.52	6.0	6173
0.12	0.58	0.35	0.33	0.32	1.70	1.65	4.94	3.37	1.16	9.47	9.0	8.31	8.0	2.32	2.0	6179
0.32	1.28	0.25	0.66	0.45	2.96	2.88	5.38	3.08	1.33	9.79	9.0	8.46	8.0	4.36	4.0	5764
0.12	1.52	0.41	0.41	0.39	2.85	3.29	4.49	4.07	1.39	9.95	9.0	8.56	8.0	3.56	4.0	5930
0.11	1.69	0.45	0.40	0.32	2.97	3.29	4.76	3.89	1.28	9.93	9.0	8.65	8.0	3.59	4.0	6224
0.07	1.23	0.41	0.51	0.48	2.70	2.88	5.83	2.84	0.69	9.36	9.0	8.67	8.0	4.03	4.0	6176
1.19	0.85	0.96	0.44	0.43	3.87	4.11	3.71	5.65	0.63	9.99	10.0	9.36	9.0	4.11	4.0	6174
1.86	2.77	1.54	0.66	0.44	7.27	8.23	3.91	2.66	0.67	7.24	7.0	6.57	6.0	4.03	4.0	6175
0.16	0.74	0.42	0.45	0.41	2.18	2.06	4.66	3.73	1.78	10.17	9.0	8.39	8.0	3.01	3.0	5788
0.06	0.06	1.26	1.70	1.56	4.64	4.53	0.37	3.94	1.34	5.65	4.0	4.31	3.0	[48]3.56	3.0	6177
0.34	0.82	0.41	1.51	1.50	4.58	4.53	1.01	3.07	1.36	5.44	4.0	4.08	3.0	[49]3.27	3.0	6178

[36] 0.40% as muriate, 3.16% as sulphate.
[37] 0.60% as muriate, 5.32% as sulphate.
[38] 0.36% as muriate, 6.04% as sulphate.
[39] 0.84% as muriate, 8.68% as sulphate.
[40] 0.80% as muriate, 9.88% as sulphate.
[41] 1.24% as muriate, 5.16% as sulphate.
[42] 1.48% as muriate, 4.52% as sulphate.
[43] 3.89% as muriate, 1.58% as sulphate, 6.69% as carbonate.
[44] 0.60% as muriate, 1.60% as sulphate.
[45] 1.53% as muriate, 2.52% as sulphate.
[46] 0.48% as muriate, 1.74% as sulphate.
[47] 0.84% as muriate, 4.68% as sulphate.
[48] 0.32% as muriate, 2.54% as sulphate, 0.70% as carbonate.
[49] 0.32% as muriate, 2.95% as sulphate.

Nitrogenous Superphosphates

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent:			
	National Fertilizer Co., New York City. *(Continued.)*			
5636	Tobacco Special Revised	Thompsonville	$37.00	$28.03
5840	XXX Fish and Potash Special	Greenwich	39.00	21.18
	New England Fertilizer Co., Boston, Mass.			
5841	Corn and Grain Fertilizer	Rockville	28.00	14.09
6180	High Grade Potato Fertilizer	Meriden	....	22.06
5929	Improved Tobacco Grower	West Suffield	38.00	26.09
6181	Potato Fertilizer	Meriden	....	19.05
5765	§Superphosphate	Rockville	34.00	21.65
	Nitrate Agencies' Co., New York City.			
6130	High Grade Peruvian Guano	Clinton	70.00	52.95
	Olds & Whipple, Hartford, Conn.			
6183	Complete Grass Fertilizer, Top Dressing	Hartford	32.50	23.90
6186	Complete Corn and Potato Fertilizer	Warehouse Point	....	25.74
5931	Complete Tobacco Fertilizer	South Manchester	37.00	26.08
6184	Fish and Potash	Hartford	30.00	22.19
6185	High Grade Potato Fertilizer	Warehouse Point	....	27.80
6182	Special Phosphate	Hartford	35.00	25.36
	Parmenter & Polsey Fertilizer Co., Boston, Mass.			
5766	Plymouth Rock Brand	Wallingford	32.00	20.94
6188	Potato Fertilizer	New Haven	29.00	18.47
6187	Special Tobacco Grower	New Haven	38.00	26.09
	Frank S. Platt Co., New Haven, Conn.			
5767	Platco Market Garden Phosphate	New Haven	35.00	25.64
	The Rogers & Hubbard Co., Middletown, Conn.			
5934	Tobacco Special	South Manchester	45.00	25.46
6190	War Special Formula, All Soils All Crops Phosphate	Branford	41.00	21.62
6191	†War Special Formula, Complete Phosphate	Hazardville	28.00	13.46
6275	†War Special Formula, Complete Phosphate	Branford	....	12.79
5933	War Special Formula, Oats and Top Dressing	Hazardville	56.00	38.94

* For further explanation see page 10.
† See note page 37.
§ See remarks on nitrogen solubility pages 39 to 41.

Analyzed in 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
			3.60		4.67	4.53	1.40	4.95	0.65	7.00	4.0	6.35	3.0	[50]3.33	3.0	5636
1.02	0.05															
0.31	1.28	0.31	0.36	0.29	2.55	2.47	5.26	4.04	1.41	10.71	9.0	9.30	8.0	2.96	3.0	5840
....	0.48	0.53	0.18	0.22	1.41	1.24	4.58	2.37	0.27	7.22	8.0	6.95	7.0	2.14	2.0	5841
0.86	0.04	0.43	0.71	0.42	2.46	2.46	6.77	1 49	0.63	8.89	9.0	8.26	8.0	3.95	4.0	6180
1.00	0.08	0.95	1.20	0.57	3.80	4.10	3.26	4.41	0.90	8.57	7.0	7.67	6.0	[51]3.48	3.0	5929
0.65	0.05	0.04	0.58	0.40	1.72	1.64	5.14	2.39	0.91	8.44	8.0	7.53	7.0	4.07	4.0	6181
0.34	0.90	0.54	0.38	0.39	2.55	2.46	5.47	4.12	0.52	10.11	9.0	9.59	8.0	3.17	3.0	5765
0.28	3.62	0.63	2.03	4.75	11.31	10.69	2.11	8.90	1.00	12.01	11.0	11.01	10.0	2.60	2.0	6130
1.75	0.10	0.97	0.56	0.36	3.74	3.30	0.09	6.38	1.59	8.06	6.0	6.47	6.0	[52]3.23	3.0	6183
1.43	0.08	0.40	1.06	0.45	3.42	3.30	3.02	4.74	1.20	8.96	6.0	7.76	6.0	4.54	3.0	6186
0.99	0.05	1.08	1.69	1.17	4.98	4.50	0.04	3.25	0.10	3.39	3.0	3.29	3.0	[53]3.29	3.0	5931
0.64	0.05	0.13	1.29	0.60	2.71	2.50	3.36	3.61	0.77	7.74	7.0	6.97	6.0	4.06	3.0	6184
1.51	0.09	0.28	1.24	0.52	3.64	3.30	3.12	4.57	0.82	8 51	6.0	7.69	6.0	5.42	4.0	6185
2.09	0.10	0.30	1.40	0.64	4.53	4.18	2.16	2.99	2.21	7.36	...	5.15	4.0	[54]2.80	2.0	6182
0.42	0.80	0.62	0.41	0.25	2.50	2.46	6.29	2.33	0.97	9.59	9.0	8.62	8.0	3.12	3.0	5766
0.10	0.74	0.35	0.31	0.27	1.77	1.64	5.66	3.55	0.38	9.59	9.0	9.21	8.0	3.05	3.0	6188
1.20	0.06	0.73	1.35	0.80	4.14	4.10	4.70	2.98	0.70	8.38	7.0	7.68	6.0	[55]2.82	3.0	6187
1.44	0.42	0.36	0.75	0.45	3.42	3.25	3.55	5.66	1.60	10.81	...	9.21	9.0	3.91	3.5	5767
0.26	0.06	0.25	2.80	0.88	4.25	4.12	0.15	4.32	1.68	6.15	5.5	4.47	3.0	[56]3.09	3.0	5934
2.55	0.06	0.17	0.25	0.21	3.24	3.30	4.50	4.04	1.57	10.11	9.0	8.54	8.0	2.55	2.5	6190
0.38	0.06	0.45	0.33	0.22	1.44	1.50	1.07	5.24	2.06	8.37	8.0	6.31	7.0	1.75	1.66	6191
0.32	0.09		1.06		1.47	1.50	0.91	4.85	2.30	8.06	8.0	5.76	7.0	1.45	1.66	6275
8.00	0.02	0.49	0.28		8.79	8.50	....	6.74	1.74	8.48	8.0	6.74	4.5	3.84	4.0	5933

[50] 0.24% as muriate, 3.09% as sulphate.
[51] 0.74% as muriate, 2.74% as sulphate.
[52] 0.80% as muriate, 2.43% as sulphate.
[53] 3.15% as muriate, 0.14% as sulphate.
[54] 0.68% as muriate, 2.12% as sulphate.
[55] 0.56% as muriate, 2.26% as sulphate.
[56] 0.64% as muriate, 2.45% as sulphate.

Nitrogenous Superphosphates

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent:			
	The Rogers & Hubbard Co., Middletown, Conn. (*Continued.*)			
6192	War Special Formula, Potato Phosphate	Hazardville	$33.00	$18.86
5932	War Special Formula, Seeding Down and Fruit	Windsor Locks ..	45.00	25.04
6193	War Special Formula, Soluble Corn and General Crops	Branford	....	20.11
6194	War Special Formula, Soluble Potato Manure	Putnam	44.00	27.39
6189	War Special Formula, Soluble Tobacco Manure	Windsor	50.00	31.37
	The Rogers Mfg. Co., Rockfall, Conn.			
6196	Complete Potato and Vegetable Fertilizer	Chester	35.00	21.63
5936	H. G. Complete Corn and Onion Manure	Somerville	....	24.21
5768	H. G. Fertilizer, Oats and Top Dressing	Meriden	49.00	33.75
6197	H. G. Grass and Grain Fertilizer	Rockfall	....	30.21
6198	H. G. Soluble Tobacco Manure	Glastonbury	43.70	35.50
6195	H. G. Soluble Tobacco and Potato Manure ..	Somerville	....	28.66
5935	H. G. Tobacco Grower, Vegetable and Carbonate Formula	Suffield	38.50	30.73
	F. S. Royster Guano Co., Baltimore, Md.			
6226	Dreadnought Fertilizer	Glastonbury	....	16.95
5791	Favorita Compound	Stamford	34.00	18.67
6132	Parfait Compound	Pomfret Center..	40.00	27.60
6131	Solace Compound	Westport	40.00	25.40
5769	†Tomahawk Compound	Ellington	37.50	22.51
6225	†Tomahawk Compound	Glastonbury	37.50	23.58
5792	Truckers' Delight	Greens Farms ...	....	26.92
5842	Utopia Compound	Ellington	33.00	21.03
	Sanderson Fertilizer & Chemical Co., New Haven, Conn.			
5844	§Atlantic Coast Bone, Fish and Potash Revised	Guilford	27.00	17.52
6137	§Corn Superphosphate	New Canaan	31.00	17.24
6134	Hale's Special Mixture	South Glastonbury	32.00	20.90
6135	Kelsey's Bone, Fish and Potash Revised	Branford	32.00	23.61
5770	§Potato Manure Revised	New Canaan	32.00	19.51
5937	Special Complete Tobacco Grower	Glastonbury	....	26.85
5843	Special Formula A	Plainville	39.00	26.16
6136	Special Formula B	Warehouse Point	....	26.47
6133	Special with Potash Revised	New Haven	34.50	22.17
5793	Special Top Dressing for Grass and Grain ..	Guilford	39.00	28.91

* For further explanation see page 10.
† See note page 37.
§ See remarks on nitrogen solubility pages 39 to 41.

Analyzed in 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.78	0.03	0.44	0.48	0.42	2.15	2.00	2.19	6.48	2.92	11.59	10.0	8.67	9.0	2.29	2.25	6192
0.20	0.20	0.34	0.97	0.48	2.19	2.20	0.08	10.12	7.36	17.56	16.0	10.20	6.5	4.08	4.0	5932
1.50	0.07	0.17	0.46	0.39	2.59	2.50	2.02	5.63	1.94	9.59	8.0	7.65	6.0	3.04	3.0	6193
3.28	0.10	0.55	0.92	0.43	5.28	5.00	0.53	6.80	2.65	9.98	10.0	7.33	7.0	[57]2.06	2.0	6194
3.06	0.08	0.46	1.23	0.43	5.26	5.00	0.77	7.30	2.93	11.00	10.0	8.07	7.0	[58]3.74	3.33	6189
0.60	0.02	0.42	1.24	0.66	2.94	2.25	2.56	4.99	2.48	10.03	10.0	7.55	8.0	2.60	2.5	6196
1.27	0.05	0.32	1.52	0.56	3.72	3.60	1.44	4.23	4.82	10.49	8.0	5.67	6.0	2.99	3.0	5936
4.56	0.05	0.43	0.96	0.40	6.40	6.30	1.68	6.62	2.19	10.49	9.0	8.30	7.0	3.68	3.0	5768
0.15	....	0.09	1.83	0.90	2.97	2.75	0.11	9.89	9.45	19.45	18.0	10.00	...	4.85	4.0	6197
1.61	0.08	0.67	1.95	1.00	5.31	5.00	0.70	6.59	2.00	9.29	7.0	7.29	5.0	[59]5.69	4.0	6198
0.99	0.12	0.76	1.12	0.68	3.67	3.50	0.15	6.99	3.16	10.30	9.0	7.14	7.0	[60]5.10	4.0	6195
0.98	0.18	0.99	2.30	1.18	5.63	5.00	0.23	3.62	0.65	4.50	4.0	3.85	3.0	[61]3.88	3.0	5935
0.04	0.96	0.05	0.37	0.28	1.70	1.65	4.48	4.14	2.20	10.82	8.5	8.62	8.0	2.25	2.0	6226
....	1.01	0.57	0.34		1.92	1.65	6.86	3.90	1.14	11.90	10.5	10.76	10.0	2.00	2.0	5791
0.14	2.18	0.42	0.78	0.57	4.09	4.11	4.24	4.41	1.20	9.85	8.5	8.65	8.0	3.96	4.0	6132
0.14	1.81	0.45	0.62	0.45	3.47	3.70	6.01	3.75	1.52	11.28	9.5	9.76	9.0	3.26	3.0	6131
0.08	2.02	0.13	0.95	0.77	3.95	4.11	2.74	1.69	0.37	4.80	4.5	4.43	4.0	[62]2.90	3.0	5769
0.13	2.11	0.05	1.00	0.73	4.02	4.11	2.48	2.04	0.42	4.94	4.5	4.52	4.0	[63]3.37	3.0	6225
....	1.98	0.54	0.68	0.48	3.68	3.29	4.96	3.85	1.23	10.04	8.5	8.81	8.0	4.21	4.0	5792
0.12	1.27	0.25	0.52	0.34	2.50	2.47	4.93	3.97	1.37	10.27	8.5	8.90	8.0	3.08	3.0	5842
....	0.22	0.61	0.50	0.67	2.00	1.64	2.03	6.80	1.05	9.88	9.0	8.83	8.0	1.93	2.0	5844
....	0.12	0.71	0.44	0.66	1.93	1.64	1.41	7.09	1.18	9.68	9.0	8.50	8.0	2.02	2.0	6137
0.54	0.23	0.40	0.54	0.70	2.41	2.47	3.02	5.38	2.56	10.96	9.0	8.40	8.0	3.02	3.0	6134
....	1.09	0.35	0.71	0.70	2.85	2.47	5.17	4.35	1.79	11.31	9.0	9.52	8.0	[64]3.03	3.0	6135
0.44	0.80	0.27	0.38	0.39	2.28	2.06	3.07	5.55	0.72	9.34	9.0	8.62	8.0	3.01	3.0	5770
0.25	0.15	0.31	3.06	0.97	4.74	4.50	0.79	3.01	0.29	4.09	4.0	3.80	3.0	[65]3.35	3.0	5937
0.86	0.59	0.89	0.60	0.56	3.50	3.30	4.76	4.03	1.25	10.04	9.0	8.79	8.0	4.02	4.0	5843
....	1.66	0.33	0.75	0.61	3.35	3.30	5.16	3.93	2.12	11.21	9.0	9.09	8.0	[66]3.84	4.0	6136
0.63	0.27	0.65	0.50	0.60	2.65	2.88	2.42	5.48	1.32	9.22	9.0	7.90	8.0	3.81	4.0	6133
1.90	1.00	0.38	0.44	0.40	4.12	4.12	6.96	2.79	0.74	10.49	10.0	9.75	9.0	4.50	4.0	5793

[57] 0.68% as muriate, 1.38% as sulphate.
[58] 0.64% as muriate, 3.10% as sulphate.
[59] 0.64% as muriate, 5.05% as sulphate.
[60] 1.83% as muriate, 3.27% as sulphate.
[61] 0.56% as muriate, 1.89% as sulphate, 1.43% as carbonate.
[62] 0.24% as muriate, 2.66% as sulphate.
[63] 0.48% as muriate, 2.89% as sulphate.
[64] 0.64% as muriate, 2.39% as sulphate.
[65] 0.44% as muriate, 2.91% as sulphate.
[66] 0.64% as muriate, 3.20% as sulphate.

Nitrogenous Superphosphates

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent:			
	The C. M. Shay Fertilizer Co., Groton, Conn.			
5794	Formula	Guilford	$36.00	$27.25
	M. L. Shoemaker & Co., Philadelphia, Pa.			
6201	Swift-Sure Guano for Truck, Corn and Onions	East Haven	35.00	21.66
5938	Swift-Sure Superphosphate for Potatoes	Suffield	36.00	23.94
6200	Swift-Sure Superphosphate for Tobacco and General Use	Glastonbury	....	29.63
	Springfield Rendering Co., Springfield, Mass.			
6138	Animal Brand for All Crops	Thompsonville	34.00	21.87
	Tanner & Wilcox, Winsted, Conn.			
6140	War Brand Grass and Corn Phosphate	Winsted	38.00	28.47
6139	War Brand Potato Phosphate	Winsted	36.00	27.79
	Virginia-Carolina Chemical Co., New York City.			
6143	†§H. G. Corn and Vegetable Compound with 4% Potash	Milford	36.25	22.13
5940	Indian Brand for Tobacco	Glastonbury	35.00	26.52
6144	§National Corn, Grain & Grass Top Dressing with 4% Potash	Guilford	36.00	26.45
5796	Owl Brand Potato & Truck Fertilizer with 4% Potash	Guilford	35.25	22.93
5797	Star Brand Potato and Vegetable Compound with 4% Potash	Guilford	36.00	24.01
6141	Tobacco and Onion Special	Poquonock	37.00	25.49
6142	Universal Fertilizer for All Crops	Winsted	31.00	17.67
5795	XXX Fish and Potash	Wallingford	30.00	17.87
	Whitman & Pratt, Lowell, Mass.			
6262	Corn Success	Bloomfield	32.00	17.01
6263	Potato Manure	Bloomfield	34.00	19.34
	Wilcox Fertilizer Co., Mystic, Conn.			
6145	Complete Bone Superphosphate	North Stonington	31.50	19.68
6147	§Corn Special	Enfield	....	24.11
5941	Fish and Potash	Meriden	....	21.26
6148	Grass Fertilizer	Mystic	....	29.18
6149	H. G. Fish and Potash	Mystic	....	26.94
6151	H. G. Tobacco Special	Ellington	40.00	31.79

* For further explanation see page 10.
† See note page 37.
§ See remarks on nitrogen solubility pages 39 to 41.

Analyzed in 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.87	0.12	0.61	1.21	0.74	3.55	3.30	4.42	3.19	1.15	8.76	8.0	7.61	...	4.89	4.0	5794
1.04	....	0.40	0.45	0.36	2.25	2.50	7.77	3.11	0.56	11.44	10.0	10.88	8.0	3.13	3.0	6201
1.30	....	0.60	0.93	0.27	3.10	3.29	7.17	2.72	0.59	10.48	...	9.89	8.0	3.13	3.0	5938
0.92	....	0.77	0.84	0.47	3.00	3.29	7.39	3.47	0.65	11.51	12.0	10.86	9.0	[67]5.52	4.5	6200
0.56	0.79	0.49	0.41	0.39	2.64	2.46	6.17	3.45	0.40	10.02	9.0	9.62	8.0	3.13	3.0	6138
0.07	3.25	0.26	0.32	0.30	4.20	4.12	6.76	1.64	0.54	8.94	9.0	8.40	8.0	[68]4.38	4.0	6140
0.26	2.58	0.17	0.39	0.36	3.76	3.29	6.75	2.32	0.78	9.85	9.0	9.07	8.0	[69]4.35	4.0	6139
0.16	1.31	0.42	0.27	0.29	2.45	2.47	6.77	3.10	0.88	10.75	9.0	9.87	8.0	3.49	4.0	6143
0.23	2.89	0.23	0.54	0.58	4.47	4.12	3.33	0.97	0.31	4.61	5.0	4.30	4.0	[70]4.44	4.0	5940
0.15	2.61	0.17	0.26	0.29	3.48	3.29	6.48	3.04	0.78	10.30	9.0	9.52	8.0	[71]4.15	4.0	6144
0.11	1.25	0.35	0.32	0.31	2.34	1.65	6.29	2.75	0.81	9.85	9.0	9.04	8.0	4.54	4.0	5796
0.08	1.98	0.28	0.65	0.35	3.34	3.29	3.98	2.14	0.61	6.73	7.0	6.12	6.0	4.62	4.0	5797
0.57	1.82	0.09	0.61	0.77	3.86	3.29	6.07	1.92	0.38	8.37	9.0	7.99	8.0	[72]3.34	3.0	6141
....	0.34	0.29	0.20	0.23	1.06	0.82	4.85	5.15	1.13	11.13	10.0	10.00	9.0	[73]3.35	3.0	6142
0.12	1.14	0.38	0.18	0.23	2.05	1.65	5.66	2.96	0.72	9.34	9.0	8.62	8.0	[74]2.29	2.0	5795
0.07	0.71	0.43	0.25	0.15	1.61	1.64	3.22	4.68	0.84	8.74	10.0	7.90	8.0	3.09	3.0	6262
0.18	1.26	0.40	0.25	0.13	2.22	2.46	5.18	1.37	0.87	7.42	9.0	6.55	7.0	3.81	4.0	6263
0.89	0.97	0.01	0.17	0.18	2.22	2.05	6.58	3.25	0.40	10.23	9.0	9.83	8.0	2.90	3.0	6145
1.57	0.12	0.32	0.37	0.43	2.81	2.46	7.39	2.04	0.36	9.79	9.0	9.43	8.0	4.29	4.0	6147
....	0.20	0.77	1.37	0.36	2.70	2.40	4.22	2.36	0.23	6.81	6.0	6.58	5.0	3.54	3.0	5941
3.09	0.09	0.02	0.82	0.67	4.69	4.12	5.95	3.00	0.64	9.59	9.0	8.95	8.0	3.98	3.0	6148
0.21	0.29	0.59	1.97	0.48	3.54	3.30	4.56	2.23	0.57	7.36	7.0	6.79	6.0	4.95	4.0	6149
1.10	0.05	0.55	1.67	1.51	4.88	4.11	0.24	6.86	0.70	7.80	7.0	7.10	5.0	[75]4.82	4.0	6151

[67] 0.60% as muriate, 4.92% as sulphate.
[68] 1.33% as muriate, 3.05% as sulphate.
[69] 0.44% as muriate, 3.91% as sulphate.
[70] 0.76% as muriate, 3.68% as sulphate.
[71] 1.67% as muriate, 2.48% as sulphate.
[72] 0.74% as muriate, 2.60% as sulphate.
[73] 2.13% as muriate, 1.22% as sulphate.
[74] 1.35% as muriate, 0.94% as sulphate.
[75] 0.80% as muriate, 4.02% as sulphate.

NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Station Agent:			
	Wilcox Fertilizer Co., Mystic, Conn. *(Continued.)*			
6146	§Potato Fertilizer	Suffield	$33.00	$20.51
5950	Potato Onion and Vegetable Phosphate	Brooklyn	....	28.93
5798	Potato Onion and Vegetable Phosphate	Guilford	36.00	24.64
6150	Special Superphosphate	Mystic	....	15.51
	S. D. Woodruff & Sons, Orange, Conn.			
5799	Home Mixture Fertilizer	Orange	33.00	29.29
	Worcester Rendering Co., Auburn, Mass.			
6152	Royal Worcester Potato Fertilizer	Norwich	34.00	29.29
6153	Royal Worcester Corn and Grain Fertilizer	Norwich	28.00	27.64
	Sampled by Purchasers and others:			
5618	Frisbie's Corn and Grain Fertilizer	*Norwich:*—Kitemaug Orchard Co.	25.50	....
5619	Frisbie's Vegetable and Potato	*Norwich:*—Kitemaug Orchard Co.	32.50	....
6254	Lister's Revised H. G. Special for Spring Crops	*Newark, N. J.:*—Manufacturer	....	18.11
6255	Lister's Special Tobacco Fertilizer	*Newark, N. J.:*—Manufacturer	....	22.06
6256	Lister's U. S. Superphosphate	*Newark, N. J.:*—Manufacturer	....	13.64
5695	Lowell Special Tobacco	*E. Windsor:*—H. A. Middleton	39.00	33.12
5654	Mapes Tobacco Manure, Wrapper Brand	*Poquonock:*—T. F. Connor	†50.00	45.01
6281	Olds & Whipple's Complete Tobacco Fertilizer	*Hartford:*—Amer. Sumatra Tob. Co.	37.00	30.80
5694	Olds & Whipple's Complete Tobacco Fertilizer	*Suffield:*—K. C. Kulle	38.00	31.26
6304	Olds & Whipple's Complete Tobacco Fertilizer	*Hockanum:*—N. H. Brewer	....	....
6260	Olds & Whipple's Complete Tobacco Fertilizer	*Silver Lane:*—J. G. Harvey	38.00	....
6284	Olds & Whipple's Special Mixture	*South Windsor:*—W. W. Jennings	....	31.02

* For further explanation see page 10.
† Car lot.
§ See remarks on nitrogen solubility pages 39 to 41.

ANALYZED IN 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		Station No.
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Total. Found.	Total. Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.	
1.40	0.08	0.16	0.26	0.33	2.23	2.06	4.42	4.36	0.88	9.66	7.0	8.78	6.0	3.69	3.5	6146
1.59	0.06	0.63	0.69	0.44	3.41	3.30	6.38	4.90	0.75	12.03	9.0	11.28	8.0	[76]4.75	4.0	5950
1.52	0.70	0.11	0.69	0.56	3.58	3.30	6.72	2.23	0.64	9.59	9.0	8.95	8.0	[77]4.25	4.0	5798
0.98	0.02	0.09	0.29		1.38	1.23	5.76	3.65	0.82	10.23	9.0	9.41	8.0	2.10	2.0	6150
1.34	0.08	1.10	0.55	0.61	3.68	3.30	6.19	2.71	0.69	9.59	...	8.90	8.0	5.47	4.0	5799
1.17	0.05	1.66	0.51	0.51	3.90	3.28	3.74	4.83	6.08	14.65	9.0	8.57	8.0	6.14	4.0	6152
0.76	0.05	1.28	0.46	0.43	2.98	2.05	4.38	4.85	8.49	17.72	9.0	9 23	8.0	3.91	3.0	6153
....	....	....	....	....	1.33	1.64	....	....	....	9.10	...	....	8.0	3.28	3.0	5618
....	....	....	....	....	3.16	3.28	....	....	....	9.54	...	....	8.0	4.73	4.0	5619
....	0.02	0.56	0.60	0.50	1.68	1.65	7.49	2.74	0.84	11.07	11.0	10.23	10.0	2.05	2.0	6254
....	0.09	0.96	0.71	0.59	2.35	2.05	5.33	3.13	1.13	9.59	9.0	8.46	8.0	[78]3.44	3.0	6255
....	0.11	0.39	0.29	0.29	1.08	1.03	5.95	2.07	1.19	9.21	9.0	8.02	8.0	1.72	2.0	6256
0.61	0.04		4.23		4.88	4.10	5.60	1.23	0.33	7.16	8.0	6.83	7.0	[79]5.08	4.0	5695
3.60	0.05		3.25		6.90	6.18	0.14	4.07	1.48	5.69	4.5	4.21	...	[80]9.71	10.5	5654
0.77	0.05		4.09		4.91	....	0.10	2.65	0.26	3.01	...	2.75	...	[81]5.70	...	6281
1.06	0.06		3.79		4.91	....	0.36	3.05	0.74	4.15	...	3.41	...	[82]5.71	...	5694
....	....	....	....	....	4.61	4.50	....	....	....	3.81	3.0	....	3.0	[83]3.57	3.0	6304
....	....	....	....	....	4.51	4.50	....	....	....	4.22	3.0	....	3.0	[84]3.22	3.0	6260
0.79	0.01		3.74		4.54	....	0.53	7.65	0.20	8.38	...	8.18	...	[85]4.59	...	6284

[76] 2.87% as muriate, 1.88% as sulphate.
[77] 2.95% as muriate, 1.30% as sulphate.
[78] 1.24% as muriate, 2.20% as sulphate.
[79] 0.15% as muriate, 4.93% as sulphate.
[80] 1.46% as muriate, 0.99% as sulphate, 7.26% as carbonate.
[81] 0.40% as muriate, 1.09% as sulphate, 4.21% as carbonate.
[82] 0.48% as muriate, 1.92% as sulphate, 3.31% as carbonate.
[83] 0.56% as muriate, 0.73% as sulphate, 2.28% as carbonate.
[84] 0.36% as muriate, 0.88% as sulphate, 1.98% as carbonate.
[85] 0.88% as muriate, 1.29% as sulphate, 2.42% as carbonate.

Nitrogenous Superphosphates

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Average retail cost of like amounts of nitrogen, phos. acid and potash in raw materials.*
	Sampled by Purchasers and others:			
6214	Rogers' Tobacco Grower and Vegetable Carbonate, No. 1	*Somers:*—T. J. Hurlburt	$40.00	....
6215	Rogers' Tobacco Grower and Vegetable Carbonate, No. 2	*Somers:*—T. J. Hurlburt	40.00	....
5893	Sanderson's Kelsey's Bone, Fish and Potash	*Branford:*—A. E. Plant Sons Co.	32.00	$24.80
6077	Sanderson's Special Top Dressing for Grass and Grain	*Shelton:*—O. G. Beard	....	....
5776	Shay's Fertilizer	*Stepney:*—B. Rose	36.00	27.02
5894	Tanner & Wilcox's Potato Fertilizer	*Winsted:*—P. W. Newton	36.00	24.65
5813	Virginia-Carolina Indian Brand Tobacco Fertilizer	*Tariffville:*—Conn. Tob. Corp.	35.25	25.82
5939	†Virginia-Carolina Owl Brand Potato and Truck Fertilizer	*Suffield:*—R. Greer	....	28.28
5892	Wilcox's Potato, Onion and Vegetable Phosphate	*Branford:*—A. E. Plant Sons Co.	35.00	26.63

* For further explanation see page 10.
† Old stock.

Analyzed in 1915—*Continued.*

Nitrogen.							Phosphoric Acid.							Potash.		
					Total.					Total.		Available.				
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, inactive-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
....	....	....	....	....	5.10	5.00	....	....	....	4.86	4.0	....	3.0	[86]4.86	3.0	6214
....	....	....	....	....	5.04	5.00	....	....	....	5.18	4.0	....	3.0	[87]4.25	3.0	6215
....	1.13	0.45	0.71	0.54	2.83	2.47	6.11	4.03	1.62	11.76	9.0	10.14	8.0	[88]3.46	3.0	5893
....	....	....	....	....	4.05	4.12	....	....	....	10.17	10.0	....	9.0	4.21	4.0	6077
0.92	0.13	0.60	0.79	0.97	3.41	3.30	3.69	3.67	1.39	8.75	8.0	7.36	...	5.18	4.0	5776
....	2.37	0.28	0.28	0.22	3.15	....	7.34	1.69	0.68	9.71	...	9.03	...	[89]3.85	...	5894
0.20	2.64		1.50		4.34	4.12	3.21	0.87	0.33	4.41	5.0	4.08	4.0	[90]4.31	4.0	5813
0.09	0.89	0.06	0.19	0.31	1.54	1.65	3.48	5.81	1.02	10.31	9.0	9.29	8.0	9.33	10.0	5939
1.26	0.94	0.09	0.66	0.56	3.51	3.30	6.89	2.17	0.65	9.71	9.0	9.06	8.0	[91]4.34	4.0	5892

[86] 0.60% as muriate, 2.09% as sulphate, 2.17% as carbonate.
[87] 0.52% as muriate, 2.62% as sulphate, 1.11% as carbonate.
[88] 0.48% as muriate, 2.98% as sulphate.
[89] 1.48% as muriate, 2.37% as sulphate.
[90] 0.80% as muriate, 3.51% as sulphate.
[91] 2.91% as muriate, 1.43% as sulphate.

Two things are evident in the tabulation on page 43. If the prices charged for the formulas in the first column are reasonable, the formulas listed in the second column are bargains which should be jumped at by any purchaser; and if those in the second column are sold at a reasonable price, no one can afford to pay the prices asked for the lower grade formulas of the first column. As the fertilizer manufacturer is not destitute of business sense, we must accept the second alternative as the true one. Or, expressing the facts of the case in another way, this year the Connecticut farmer had the opportunity of paying from $30 to $40 per ton for the formula 2-8-3, from $26 to $35 for the formula 2-8-2 and from $28 to $42 for the formula 3-9-4. The purchaser who bought these formulas at the higher prices simply made a gift to the manufacturer or dealer of from $9 to $14 per ton. Such generosity is incompatible with good business judgment and indicates extreme carelessness on the part of the consumer.

HOME MIXTURES.

Four samples of home mixed fertilizers were analyzed. The small number of samples of this nature submitted this year was doubtless due to the scarcity of potash salts and their consequent high price.

6206. Mixture for Strawberries. Mixed, sampled and sent by L. M. Benham, Highwood Station. The mixture was made from 1,000 lbs. bone, 1,000 lbs. tankage, 1,200 lbs. acid phosphate and 400 lbs. muriate of potash.

6248. Mixture for Corn and General Crops. Made, sampled and sent by W. A. Simpson, Wallingford. The mixture was made from 150 lbs. nitrate of soda, 250 lbs. bone, 800 lbs. tankage and 800 lbs. acid phosphate. Cost per ton $26.65.

6031. Made by J. W. Crowell, Burnside. Sampled by Station. The mixture was made from 200 lbs. nitrate of soda, 600 lbs. bone, 200 lbs. tankage, 600 lbs. acid phosphate and 200 lbs. muriate of potash.

5845. Mixture for General Market Garden Crops. Made, sampled and sent by F. E. Peckham, Norwich. The mixture was made of 280 lbs. Peruvian guano, 220 lbs. nitrate of soda, 840 lbs. acid phosphate and 335 lbs. muriate of potash.

Station No.	6206	6248	6031	5845
Per cent of				
Nitrogen in nitrates	0.05	1.10	2.15	2.84
" " ammonia	0.05	0.00	0.10	0.66
" as organic	2.62	3.36	1.64	1.54
" total	2.72	4.46	3.89	5.04
Phosphoric acid, water-soluble	4.38	5.11	3.70	7.43
" " citrate-soluble	8.13	4.60	6.71	3.00
" " citrate-insoluble	2.93	0.63	3.21	0.20
" " total	15.44	10.34	13.62	10.63
Potash as muriate	6.77	....	4.68	6.64

VI. MISCELLANEOUS FERTILIZERS, LIME, ASHES, ETC.

SHEEP MANURE.

5821. Pulverized Sheep Manure, sold by American Agricultural Chemical Co., New York City. Stock of C. Buckingham, Southport.

5789. Sheep's Head Pulverized Sheep Manure, sold by Natural Guano Co., Aurora, Ill. Stock of Frank S. Platt Co., New Haven.

5790. Wizard Brand Manure, sold by Pulverized Manure Co., Chicago, Ill. Stock of Frank S. Platt Co., New Haven.

6199. South American Sheep and Goat Manure, sold by Sanderson Fertilizer and Chemical Co., New Haven. Sampled at factory.

Station No.	5821	5789	5790	6199
Per cent of				
Nitrogen in nitrates	0.10	0.20	0.29	0.13
" " ammonia	0.39	0.12	0.15	0.05
" organic, water-soluble	0.57	0.51	0.42	0.13
" " active insoluble	0.51	0.49	0.42	0.38
" " inactive insoluble	1.17	1.32	1.14	0.76
" total found	2.74	2.64	2.42	1.45
" " guaranteed	2.06	2.25	1.80	1.25
Phosphoric acid, water-soluble	1.25	0.82	0.86	0.03
" " citrate-soluble	0.18	0.45	0.54	0.70
" " citrate-insoluble	0.23	0.27	0.20	0.10
" " total found	1.66	1.54	1.60	0.83
" " " guaranteed	1.25	1.25	1.00	1.00
Potash found	2.07	2.11	2.38	2.28
" guaranteed	1.00	1.50	1.00	3.50
Chlorine	0.56	0.46	0.72	1.23
Cost per ton	$26.50	30.00	30.00	....

Sample **6199** failed to meet its potash guaranty, although another sample sent in by the purchaser contained 0.65 per cent. more of potash than was guaranteed.

Sheep manure being dry, having little odor while dry, and containing few if any weed seeds, has uses in the greenhouse and on small city lawns. The question is often asked, how its fertilizing value compares with that of horse manure. As pointed out last year, horse manure at $2.90 per ton would supply for $30, the usual price of sheep manure, about three times as much nitrogen, five times as much phosphoric acid and about two and one-half times as much potash. For general farm purposes, therefore, sheep manure could not probably be profitably used even if its present price were cut in half.

Four other samples of manure were sent in by the purchasers.

4800. Sheep Manure, sent by F. C. Dowd, Madison.

5125. Pig Manure, sold by J. J. Cahill, Warehouse Point, sent by G. W. Christoph, Warehouse Point.

5126. Sheep Manure, sold by J. J. Cahill, Warehouse Point, sent by G. W. Christoph, Warehouse Point.

5420. Sheep Manure, sold by Sanderson Fertilizer and Chemical Co., New Haven, sent by John Coombs, Hartford.

Station No.	4800	5125	5126	5420
Per cent of				
Nitrogen	2.60	1.91	1.92	1.51
Phosphoric acid	....	2.26	1.47	1.02
Potash	....	....	....	4.15
Water and volatile matter	....	4.85	5.50	....
Organic matter	....	47.12	41.40	....
Ash	....	48.03	53.10	....
Cost per ton	....	$24.00	24.00	30.00

Fully one-half of the nitrogen in these manures is classed as "inactive insoluble." This nitrogen is not without value. It is probably much more available to crops than that of leather or garbage tankage. It may compare fairly with that of fresh stable manure, but it must be borne in mind that in a commercial fertilizer nitrogen should be present in a much more quickly available form than in manure.

The nitrogen of manure of any kind is not so quickly available and therefore not so valuable as that of high grade nitrogenous matters.

TOBACCO STEMS.

Nine samples of this material were analyzed.

5613, "A" and **5614,** "B," sold by Kentucky Tobacco Product Co., Louisville, Ky. Sent by R. S. Williams, Glastonbury.

5634 and **6373,** sold by The John Meehan & Sons Co., Philadelphia, Pa. Sent by R. S. Williams, Glastonbury.

6010 and **6011.** Sent by F. S. Firtion, Broad Brook.

6247. Sold by Virginia-Carolina Chemical Co., New York City. Stock of John Parker, Poquonock. Cost $21 per ton.

5866. Sent by S. J. Stevens, Glastonbury.

4867. Sold by Walter H. Hills, Glastonbury. Sent by H. C. Wickham, Glastonbury. Cost $13 per ton.

Station No.	5613	5614	5634	6373	6010	6011	6247	5866	4867	Average of 50 analyses.
Per cent of										
Nitrogen in nitrates	....	....	....	....	....	....	0.88	0.78	....	....
" " ammonia	....	....	....	....	....	....	0.22	0.42	....	....
" as organic	....	....	....	....	....	....	1.50	1.50	....	....
" total	1.01	2.04	....	2.08	2.12	1.87	2.60	2.70	....	2.08
Phosphoric acid	0.68	0.64	....	....	....	....	0.64	0.70	....	0.53
Potash	4.94	7.19	8.47	4.50	5.63	4.90	7.85	6.28	5.73	6.39

The question is frequently asked whether a sample of stems has been "extracted" (to recover nicotine). Such extraction would probably very considerably reduce the percentage of nitrogen and would also reduce the potash content. Only one of these samples, **5613,** has much less nitrogen than the average shown in the last column of the table, and the percentage of potash is also low.

MUCK, PEAT AND LEAF MOLD.

Professor Johnson, the former director of this station, in his Essay on Peat, published many years ago, mentions and adopts the distinction between muck and peat which is in use among farmers of this state.

While "muck" is a general term applicable to manure of any sort, *swamp muck* means the light fibrous surface layers of vegetable deposits, which generally overlie the more compact black layer of peat.

Peat consists of vegetable matter which slowly decays without access of air, when lying under water or charged with water.

The amounts of phosphoric acid and potash in such deposits are very small, but dried peats may contain from one to four per cent or more of nitrogen. This nitrogen, however, is in forms which have longest resisted the process of decay, while the more soluble and "available" forms have been released and lost. For this reason, the nitrogen of peat is of very little immediate use to any crop, though by various methods of composting it may be made more available.

The use of peat, therefore, in mixed fertilizers *as a source of nitrogen* is to be condemned, and if so used will show in the analysis by the low solubility of the nitrogen in the mixture. It may be legitimately used in such fertilizers in small amount as a "conditioner," as it keeps in loose condition certain mixtures which without some such addition would cake in the bags and become unusable.

If the guaranteed amount of nitrogen is present *in other and soluble forms,* the addition of small quantities of peat is justified.

While these facts show that the fertilizing value of peat and muck is very small, they are, however, of very considerable value as absorbents and amendments. This value, as stated by Professor Johnson (Essays on Manures, 1858, p. 67), depends on

1. A remarkable power of absorbing and retaining water, both as liquid and vapor. No other material will absorb, pound for pound, so much water. Even when dry to the feel, peat may still hold from ten to thirty or forty per cent of water. By virtue of this property, therefore, half-dry peat in sufficient quantity will make light sandy soils more retentive of moisture and, partly for that reason, more responsive to fertilizers.

2. An absorbent power for ammonia, which with the first-named quality makes it an excellent absorbent and deodorizer in stables. The ammonia is held in firm chemical combination.

3. Action in moderating the decay of organic bodies, animal or vegetable. When fresh manure is mixed with peat or animal bodies are covered with it decay goes on but at a moderate rate, without the noisome odors of putrefaction or the waste of firefang.

4. Regulation of the temperature of light sandy soils, which suffer the widest range of temperature. A dressing of peat will make the soil cooler by day through the evaporation of the store of water in it, and warmer at night by the condensation of atmospheric moisture.

The methods of cutting, drying and storing peat and a discussion of its use as fuel may be found in Bulletin 165 of the Vermont Agricultural Experiment Station.

Of its value for the uses named above there is on record the experience of Connecticut farmers, gathered many years ago by Professor Johnson and printed in the essay cited above. Some of these experiences are worth quoting here and it is hoped may induce farmers who have a store of clear peat near at hand to consider using it in their stable trenches and on thin land.

From Plainville:—"This muck" (with 64 per cent of humus) "is worth for manure half as much as yard manure; when composted it is equal to yard manure. It makes a very good soil when used alone on sand.

"I find it an excellent absorbent, and sometimes pump from a cistern in my yard the liquid it contains, and pour it upon piles of muck, which makes it a good fertilizer. I have used it with either yard manure, lime, ashes, guano, or clay, with about equal success.

"To one load of muck, one of clay, or ¼ yard manure, or two bushels of lime, or four bushels of ashes. The clay, lime and ashes may be mixed, but the yard manure must be placed in layers so as to cause fermentation."

From Colebrook:—"Composting has not, I believe, been practiced to much extent. Whenever it has been done, stable manure and ashes have been the materials used. Experiments made by myself have confirmed me in the opinion that a compost of equal parts muck and stable manure is equal to the same quantity of stable manure. I found a compost made of two bushels of unleached ashes to twenty-five of muck superior to stable manure as a top-dressing for grass on a warm, dry soil. We, however, use it mostly as an absorbent, the acidity is corrected by the exposure it receives, and much fertilizing matter is saved that would otherwise be lost." The peat referred to contained 92.6 per cent of humus.

From West Cornwall:—"We formerly composted it with stable manure, and with ashes, but have remodeled our stables, and now use it as an absorbent and to increase the bulk of manure to double its original quantity, and consider it more valuable than the same quantity of stable manure.

"Have composted in the yard by putting a layer of muck on the ground a foot thick, and then a layer of manure (by wheeling the cleanings of the stables every morning) of about ⅔ the quantity of the muck, and so on until the pile is completed. This should be turned some days before using.

"I have mixed 25 bushels of ashes with the same number of loads of muck, and applied it to ¾ of an acre. The result was far beyond that obtained by applying 300 lbs. best guano to the same piece." The peat referred to above contained 81.4 per cent humus.

From Poquonock:—"This muck" (with 92.7 per cent humus) "is composted with stable manure in proportion of 8 loads of muck and 4 of manure; but it is principally carted into the barnyard and pigstyes. The 8 loads of muck and 4 of manure, when properly forked over, are equal to 12 loads barnyard manure on sandy soil."

From Brooklyn:—"One load of muck to one of stable-cellar manure makes a compost equal to two loads of clear manure. In preparing the compost I begin with a layer of muck of 10 inches depth. Upon this the manure is spread, and the whole is covered with muck to the depth of one foot. In this way there is no loss either by volatilization or leaching." The peat had 90 per cent of humus.

From Brooklyn:—"In composting, 20 loads are drawn on to upland in September and thrown up in a long pile. Early in the Spring 20 loads of stable manure are laid alongside, and covered with the muck. As soon as it has heated moderately, the whole is forked over and well mixed. This compost has been used for corn (with plaster in the hill), on dry sandy soil, to great advantage. I consider the compost worth more per cord than the barnyard manure. A compost of 500 lbs. of horn shavings to 10 loads of muck and 10 bushels of unleached ashes, made the best manure I ever used; stable or yard manure used beside it did not produce more than half as much. I have used the compost principally for a corn crop—always with success—also for potatoes. It is not so good for that crop. For small grain it makes too much straw, and the grain seed is not so heavy." The peat had 89 per cent of humus.

From New Canaan:—"Our stables are sprinkled with muck every morning at the rate of one bushel per stall, and the smell of ammonia, etc., so offensive in most stables, is never perceived in ours. Not only are the stables kept sweet, but the ammonia is saved by this procedure. Our privies are also deodorized by the use of muck, which is sprinkled over the surface of the pit once a week, and from them alone we thus prepare annually enough "poudrette" to manure our corn in the hill. The wagons we use in drawing fish in the summer shortly become very offensive from the blood, oil, etc., which adheres to them; but a slight sprinkling of muck renders them perfectly inodorous in a short space of time.

"Very much of our muck is composted with yard manure. Our proportions are one load of manure to three of muck. I think as much muck should be used as can be made to heat properly. The quantity varies of course with the kind of manure employed." This peat contains only about 25.7 per cent humus.

The analyses of peat, muck and leaf mold made this year are given in the following table. Some of them were received in their original state and others more or less dried. A judgment of quality and comparison of samples can best be made by considering them in the water-free condition. The analyses are therefore arranged in order according to the percentage of dry organic matter in them.

The first four samples contained from 91 to 96 per cent of humus. These are remarkably high grade peats, excellent for absorbents when partly dried and for composting. It is questionable whether these peats will dry out quite as easily as those, like the next five, of which more than two-thirds is humus, but which are somewhat less plastic by reason of the sand or soil mixed with them.

All of them have excellent absorbent qualities. As the amount of sand and soil increases, the most valuable quality of the material diminishes, and the cost of digging and perhaps of drying bears a larger ratio to the value of the peat. Still if the deposit is near by it may pay to handle peat with 50 per cent or less of humus for use in stable trenches and manure heaps.

DESCRIPTION OF THE SAMPLES.

5131, 5132, 5130, 5129 are from a swamp owned by E. L. Conant, New Canaan. The surface soil, two or three inches deep, consists of moss and roots.

5129 was taken about 8 inches below the surface.

5130 taken from 12 to 48 inches below the surface.

5131 and **5132** are taken at still lower depth.

5133 is the widely advertised "Alphano Humus" which chiefly consists of peat and sells for $8.00 per ton in bulk.

5134 is "Natural Humus Soil Builder," another peat dug in New Jersey and sold for $7.00 per ton in bulk. Both were sent by Mr. Conant.

6799, 6800 and **6801** were sent by J. C. Howell, Salisbury, without explanations.

6211. Leaf mold sent by M. J. Warner, Pine Orchard, with the question whether it would take the place of "humus" which was on the market. It was a homogenous fine mold and will no doubt be as effective an amendment as "humus" dug in some other place.

5194, 5195 and **5196.** Sent by the F. F. Rockwell Co., Putnam, as a bog soil which it was proposed to drain and use for celery culture. While the amount of plant food in such soil is small and will need supplementing with fertilizers, its mechanical condition is apparently excellent for the purpose.

6368. Muck from the Greenwich Nurseries, which has proved excellent for young shrubs and evergreens when mixed with soil.

6303. Muck sent by the Sanderson Fertilizer & Chemical Co. from a swamp in the eastern part of the State.

4746. Muck sent by F. C. Dowd, Madison, from a swamp owned by him.

5740. Sent from New Canaan by P. H. O'Neill.

6340. A peaty soil in which rhododendrons do especially well.

ANALYSES OF PEAT, MUCK, LEAF MOLD, ETC.

Station No.		Composition as received.						Calculated water-free.				
		Water.	Mineral Matter.	Organic Matter.	Nitrogen.	Phosphoric Acid.	Potash.	Mineral Matter.	Organic Matter.	Nitrogen.	Phosphoric Acid.	Potash.
5131	From E. L. Conant, New Canaan. Four feet or more below surface	82.85	0.65	16.50	0.25	0.01	...	3.79	96.21	1.48	0.06	...
5132	From E. L. Conant, New Canaan. Four feet or more below surface	76.50	1.00	22.50	0.50	0.02	...	4.26	95.74	2.13	0.08	...
5130	From E. L. Conant, New Canaan. One to four feet below surface	82.14	0.95	16.91	0.29	...	...	5.32	94.68	1.62	...	...
5129	From E. L. Conant, New Canaan. Three to twelve inches below surface	76.67	1.92	21.41	0.64	0.07	...	8.23	91.77	2.74	0.30	...
6799	From J. C. Howell, Salisbury	68.43	4.85	26.72	0.93	...	...	15.36	84.64	2.96	...	...
6801	From J. C. Howell, Salisbury	18.83	12.68	68.49	2.17	...	...	15.62	84.38	2.67	...	...
6211	Leaf mold from woods. From M. J. Warner, Pine Orchard	68.08	5.01	26.91	0.62	...	...	15.70	84.30	1.93	...	...
5134	From E. L. Conant. "Natural Humus" $7.00 per ton bulk	11.90	14.80	73.30	1.56	0.13	...	16.80	83.20	1.77	0.15	...
5133	From E. L. Conant. "Alphano Humus" $8.00 per ton bulk	19.43	22.18	58.39	2.35	0.96	...	27.52	72.47	2.92	1.19	...
5195	From F. F. Rockwell Co., Putnam. "Bog soil"	8.97	31.11	59.92	1.60	...	...	34.17	65.83	1.76	...	...
6368	From Dehn & Bertolf, Greenwich	74.00	9.11	16.89	0.42	...	...	35.04	64.96	1.62	...	...
6800	From J. C. Howell, Salisbury	15.68	33.80	50.52	1.67	...	...	40.08	59.92	1.98	...	...
6303	From Sanderson Fertilizer & Chemical Co.	9.39	42.69	47.92	1.57	0.56	0.02	47.11	52.89	1.73	0.63	0.02
5196	From F. F. Rockwell Co., Putnam. "Bog soil"	7.55	44.68	47.77	1.58	...	...	48.33	51.67	1.71	...	...
4746	From Frank C. Dowd, Madison	46.63	26.13	27.24	0.93	...	...	48.77	51.23	1.74	...	...
5194	From F. F. Rockwell Co., Putnam. "Bog soil"	8.45	45.23	46.32	1.48	...	...	49.40	50.60	1.62	...	...
5740	From P. H. O'Neill, New Canaan	32.88	36.40	30.72	0.88	...	...	54.23	45.77	1.31	...	...
6340	From Elm City Nursery Co. Humus from edge of woods	21.42	68.48	10.10	0.24	...	...	87.15	12.85	0.31	...	...

GROUND LIMESTONE AND OTHER LIMES.

Six samples of limestone stated to be from stock sold by the Grangers Lime and Marble Co., West Stockbridge, Mass., were tested for insoluble matter: **5403** and **5404**, sent by M. C. Griffin, East Granby, contained 14.18 and 13.89 per cent, respectively. **5600**, sent by W. E. Mallory, Danbury, contained 0.82 per cent. **5681**, sent by Wilson H. Lee, Orange, contained 1.45 per cent. **5846**, sent by C. G. Simons, Hazardville, contained 11.25 per cent, **5867** sent by E. C. Bacon, Hazardville, contained 11.15 per cent. The percentages of insoluble matter in **5403, 5404** and **5846** are too high for shipping limestone.

5214 contained 3.86 per cent insoluble matter.

5215, 5222, 5223, 5224 and **5225.** Sent by R. T. Fairchild, Bridgeport, contained 5.15, 0.76, 1.72, 6.67 and 3.46 per cent insoluble matter, respectively. Magnesia was present in considerable amount in the first and last samples.

5723. Sent by T. J. Hurlburt, Somers, contained 1.40 per cent insoluble matter.

6298. Sent by M. B. Wakeley, Bridgeport, contained 35.10 per cent insoluble matter.

5236 (blue) and **5237** (white). Sent by C. Irving Place, Sharon, contained 30.00 and 29.90 per cent of lime, respectively.

6448. Sent by W. H. Burr, Westport, contained 40.80 per cent of insoluble matter.

A more complete analysis was made of the following samples:

5218, 5612, 5633, 6217, 5655 and **5737.** Sold by the Grangers Lime and Marble Co., West Stockbridge, Mass. Sent by Wilson H. Lee, Orange; R. D. Tomlinson, West Stockbridge, Mass.; M. C. Griffin, East Granby; Conn. Agricultural College, Storrs; W. E. Mallory, Danbury, and sampled from stock of C. E. Treat, Orange, respectively.

6205. Sent by James Marsh, New Milford.

6273. Sold by Long Hill Quarry Co., Long Hill. Sampled at factory.

6282. Sent by J. B. Stewart, Somers.

6283. Oyster- and clam-shell lime. Sent by C. C. Hewitt, Uncasville.

6317. Sold by Long Hill Quarry Co., Long Hill. Sent by J. H. Loverin, Shelton.

6332. Sent by A. W. Manchester, Litchfield.

6331. Sent by F. G. Clark, Chester.

6396 and **6397.** Sent by E. L. Peabody, Lakeville, are samples of deposits on his farm.

6796. From Coe's Lime Mill in Durham. Sent by F. E. Rogers, County Agent.

6797. From a quarry in Long Hill. Sent by J. A. Sherwood, Long Hill.

6798. Limestone from J. C. Howell, Salisbury.

ANALYSES OF LIMESTONE AND SHELL LIME.

Station No.	5218	5612	5633	6217	5655	5737	6205	6273	6282
Per cent of									
Lime	37.50	52.80	52.84	53.30	54.04	40.10	30.40	40.84	37.70
Magnesia	....	0.93	0.72	0.83	0.58	5.83	20.14	0.43	0.25
Insoluble in acid	14.85	4.05	4.20	3.20	2.95	15.70	4.00	26.60	2.70

Station No.	6283	6317	6332	6331	6396	6397	6796	6797	6798
Per cent of									
Lime	48.90	41.64	30.20	24.56	32.00	32.70	45.90	35.10	25.90
Magnesia	0.51	....	21.65	1.90	18.94	19.12	....	....	17.60
Insoluble in acid	7.80	23.30	1.15	1.40	3.50	1.95	17.00	34.05	16.80

The value of a limestone for agricultural use depends of course on the quantity of lime and magnesia in it. The economy of its purchase where freight and cartage have to be considered depends a good deal on the amount of insoluble material, "ballast," which it contains.

Thus it will not pay a farmer to buy from a distance limestone with more than five or ten per cent of insoluble matter in it. If there is a lime deposit close by his farm, however, the use of such impure limestone may be economical.

LIME WASTE FROM ACETYLENE GAS PLANT.

A sample of this product was submitted by E. H. Raquet, New Haven, with an inquiry as to possible injurious effects arising from its use. Pot tests were made with clover, using an application equivalent to two and one-half tons of lime per acre. No injurious effect on the germination of the clover seeds was observed.

6390. Sent by F. W. Stoll, Jr., Chester, who stated that it was a residue from a manufacturing plant. It contained 28.0 per cent of lime, 1.45 per cent of magnesia and 0.20 per cent of insoluble matter, with about 20 per cent of moisture.

WOOD AND LIME KILN ASHES.

In a following table are given the analyses of samples of these materials. The analyses of wood ashes are arranged according to the percentage of water-soluble potash, which it appears ranges from 6.99 to 1.37 per cent. Four per cent of water-soluble potash is a fair average for hardwood ashes. Anything less than that is inferior.

The very high prices asked for good ashes reflect the general shortage of potash.

6231 was sold by the American Agricultural Chemical Co., New York City.

5526 and **5527** were sent by F. S. Saybrook, from the factory of E. E. Dickenson, Essex.

MISCELLANEOUS MATERIALS.

6003. Kelp Fertilizer from San Diego, Cal. Sent by Burdett Loomis, Hartford. It contained

Nitrogen	0.46	per cent
Phosphoric acid	0.83	"
Potash	10.36	"
Chlorine	9.81	"

6286. Siftings from city garbage plant. Sent by J. W. Simendinger, Stratford. It contained 2.46 per cent nitrogen, 3.33 per cent phosphoric acid and 0.56 per cent potash, about the same as average garbage tankage and probably as inactive agriculturally.

6274. Gelatin roller waste. It contained 3.29 per cent nitrogen, no phosphoric acid and 0.06 per cent potash.

5620. Glue factory refuse. Sent by E. N. Austin, Suffield. It contained 0.73 per cent nitrogen, 0.24 per cent phosphoric acid, 0.02 per cent potash, 23.68 per cent lime and 5.03 per cent matter insoluble in acid.

5771. Chimney soot. Sent by F. F. Kochick, Bridgeport. The sample was soot from soft coal and contained 0.24 per cent nitrogen. Its value as a fertilizer is very slight.

5946. Ash from layer of material underlying a peat and lignite bed. It contained 0.51 per cent phosphoric acid, 0.13 per cent potash, 0.70 per cent lime, 0.51 per cent magnesia and 88.35 per cent matter insoluble in acid. Its fertilizing value is very small.

ANALYSES OF ASHES.

Station No.	Car No. and Name of Purchaser or Dealer.	Water.	Sand and Soil.	Water-soluble Potash.	Lime.	Magnesia.	Phosphoric Acid.	Cost per ton.
	Wood Ashes.							
5724	90021 Olds & Whipple, Hartford. M. Driscoll, Poquonock	...	9.25	6.99	33.90	3.91	2.60	$17.00
5725	16365 Olds & Whipple, Hartford. W. S. Pinney, Suffield	...	9.40	6.71	32.18	3.91	2.12	17.00
5584	8745 Olds & Whipple, Hartford. C. F. Segee, East Hartford	8.28	13.15	6.24	30.10	3.73	2.49	18.00
5637	46536 Olds & Whipple, Hartford. W. H. Brewer	...	17.45	5.59	30.24	3.75	2.26	20.00
6276	30513 Olds & Whipple, Hartford. Olin Wheeler, Burnside	...	....	4.78	30.90	3.19	1.85	17.00
5585	147114 Olds & Whipple, Hartford. R. McJunkin, Hartford	8.60	18.65	4.77	28.16	3.59	2.41	18.00
6316	101252 Olds & Whipple, Hartford. W. S. Pinney, Suffield	...	....	4.12	....	...	1.88	17.00
6805	19403 Olds & Whipple, Hartford. J. B. Stewart, Windsor	...	....	4.09	....	...	...	....
6231	..... Lighthbourn & Pond, New Haven	...	6.20	3.60	32.50	3.63	2.37	20.00
6240	..... G. L. Munroe & Son, Oswego, N. Y. F. B. Newton, Plainville	...	11.75	3.38	33.60	3.15	1.60	15.00
4801	..... Sent by Keiser & Boasberg Plantation, Inc., East Windsor Hill	4.25	13.40	3.25	29.66	4.14	2.05	....
6324	115090 Olds & Whipple. John Wolf, Haydens	...	....	3.03	....	...	1.65	16.00
5532	..... John Joynt, Lucknow, Can. Conn. Hospital for Insane	13.23	21.12	3.02	29.32	3.21	1.22	12.50
5697	40699 John Joynt, Lucknow, Can. G. S. Phelps & Co., Thompsonville	...	18.15	2.95	24.12	2.93	1.45	15.50
6238	..... John Joynt, Lucknow, Can. F. S. Bidwell, Windsor Locks	...	19.50	2.88	21.90	2.39	1.60	13.75
5680	..... Sent by J. E. Shepard, So. Windsor. "Canada Ashes"	32.00	10.31	2.85	24.56	2.30	1.67	....
6271	..... Sent by A. H. Griswold, Wethersfield. "Wood Ashes"	...	13.30	2.54	32.00	2.03	1.34	....
6339	..... Sent by A. B. Smith, Clintonville	...	....	1.99	....	...	1.66	....
5622	..... Sent by A. Pons, Bristol	37.50	5.20	1.34	28.01	4.95	1.61	....
5414	..... Sent by C. H. Evans, Gaylordsville. "Wood Ashes"	...	54.95	0.23	20.62	2.20	0.71	....
	Birch Ashes, Lime-Kiln Ashes, Brick-Kiln Ashes.							
6277	..... Ashes from black birch. E. L. Crane, Groton	23.05	16.00	2.79	22.90	3.51	3.26	....
5526	..... Ashes of black birch wood which was extracted for oil	0.13	21.10	2.61	37.90	5.10	4.48	....
5527	..... Ashes of black birch mixed with some coal ashes	0.68	36.70	4.37	22.96	2.80	2.32	....
5413	..... Lime-Kiln ashes. C. H. Evans, Gaylordsville	2.30	3.45	1.76	38.12	17.86	0.96	....
6391	..... Ashes from brick-kilns, North Haven	...	35.00	1.37	33.20	3.95	2.17	....

CORRECTIONS FOR PART II, FERTILIZER REPORT, 1914.

P. 46, line 4 from bottom, for "Fertilizers Element" read Fertilizer Elements.

Pp. 52 and 53, last columns, under headings "Nitrogen costs cents per pound," strike out %.

P. 65, 2d paragraph, line 3, for 2.45 read 24.5.

PART II.

FIFTEENTH REPORT

OF THE

State Entomologist of Connecticut

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

I have the honor to submit herewith my fifteenth report as State Entomologist of Connecticut for the fiscal year ending September 30, 1915. Some of the nurseries have been inspected and their certificates issued since that date, but it is desirable to include them all in one list. Two important entomological developments of the year are, the new law relating to the gipsy and brown-tail moths, and the discovery of the presence of a destructive European pine sawfly, *Diprion simile* Hartig, in Connecticut. These, with a large number of less important matters, are discussed in the following pages.

Respectfully submitted,

W. E. Britton,
State Entomologist.

Report of the Receipts and Expenditures of the State Entomologist from October 1st, 1914, to September 30th, 1915.

Insect Pest Account.

Receipts.

From E. H. Jenkins, Treasurer	$4,250.00	
Account of 1914, balance	500.53	
State Comptroller, Apiary Inspection Account	15.40	
Gypsy Moth Control Account	7.18	
		$4,773.11

EXPENDITURES.

For Field, office and laboratory assistance:		
B. H. Walden, salary	$1,500.00	
Q. S. Lowry, salary	750.01	
I. W. Davis, salary	200.00	
M. P. Zappe, salary	375.00	
Frances M. Valentine, salary	440.00	
Grace A. Foote, salary	178.33	
Other assistance	62.00	
		$3,505.34
Printing and illustrations		19.20
Postage		50.01
Stationery		11.18
Telegraph and telephone		1.77
Office supplies		25.68
Library		102.52
Laboratory supplies		47.71
Express, freight and cartage		3.05
Rental and storage		7.00
Tools and supplies		61.19
Traveling expenses		176.92
Balance, cash on hand		761.54
		$4,773.11

*Gipsy Moth Control Account.**

RECEIPTS.

From E. H. Jenkins, Treasurer		$8,000.00
Account of 1914, balance		2.39
Ford Motor Co., Rebate on car		50.00
I. W. Davis, Use of car		5.00
		$8,057.39

EXPENDITURES.

For salaries, board of scouts, etc.:		
I. W. Davis, salary	$ 866.64	
Q. S. Lowry, salary	249.99	
M. P. Zappe, salary	525.00	
Other assistance, labor, etc.	1,918.38	
Board of scouts	784.11	
		$4,344.12
Printing and illustrations		8.55
Postage		13.46
Telegraph and telephone		22.23
Office supplies		36.30
Express, freight and cartage		150.31
Rental and storage		$ 38.00
Insurance		75.83
Tools and supplies		2,815.33
Traveling expenses		553.26
		$8,057.39

* Including cost of inspecting imported nursery stock.

Memorandum:—These accounts of the State Entomologist have been duly audited by the State Auditors of Public Accounts.

SUMMARY OF INSPECTION AND OFFICE WORK.

287 samples of insects received for identification.
77 nurseries inspected (some twice).
74 regular nursery certificates issued.
3 parcels of nursery stock inspected and certified.
28 orchards and gardens examined.
264 shipments, containing 1,349 cases, 2,102,222 plants imported nursery stock inspected.
57 shipments found infested with insects or fungi.
494 apiaries, containing 4,241 colonies, inspected.
129 apiaries, containing 441 colonies, found infested with European foul brood.
4 apiaries, containing 8 colonies, found infested with American foul brood.
10 apiaries, containing 20 colonies, found infested with sac or pickled brood.
2147 letters written on official work.
642 post cards written on official work.
228 circular letters sent out.
276 reports of inspection to Federal Horticultural Board.
1866 bulletins, etc., mailed on request or to answer inquiries.
90 packages sent by mail or express.
24 lectures and addresses made at institutes, granges, etc.

PUBLICATIONS OF ENTOMOLOGICAL DEPARTMENT, 1915.

By W. E. Britton:

Fourteenth Report of the State Entomologist (Part III. of Station Report for 1914): 86 pages, 16 plates, 6 text figures; 10,000 copies distributed in April.

Bulletin 186, "The Gipsy Moth," 24 pages, 16 figures; 12,000 copies distributed in April.

Report of Committee on Injurious Insects, Proceedings Connecticut Pomological Society, page 23, 4 pages, 1915.

Report of Entomologist, Society of American Florists and Ornamental Horticulturists, Boston meeting, page 189, 3 pages, 1 plate, February, 1915.

Report of Entomologist, Society of American Florists and Ornamental Horticulturists, San Francisco meeting, printed in *Florists' Exchange*, Vol. XL, page 537, 1 column, September 4, 1915.

Bulletin State Board of Health, "The Mosquito Problem of Connecticut and How to Solve It," 16 pages, 9 figures, July, 1915.

"Anti-Mosquito Work in Connecticut": *Proceedings of the First Annual Meeting of the New Jersey Mosquito Extermination Association,* page 63, 9 pages, February, 1915.

"The Academic Training of the Entomologists in Colleges and Experiment Stations of the United States": *Journal of Economic Entomology,* Vol. 8, page 72, 7 pages, February, 1915.

"A Simple Record System for Apiary Inspection": *Journal of Economic Entomology,* Vol. 8, page 121, 2 pages, February, 1915.

"A Destructive Pest of Pine Trees Introduced from Europe, *Diprion (Lophyrus) simile* Hartig": *Journal of Economic Entomology,* Vol. 8, page 379, 3 pages, 1 plate, June, 1915.

Review of "Manual of Fruit Insects" by M. V. Slingerland and C. R. Crosby: *Journal of Economic Entomology,* Vol. 7, page 408, 1 page, October, 1914.

"Prevalence of *Macrosargus cuprarius* Linn. in the United States": *Psyche,* Vol. XXII, page 29, 2 pages, 1 figure, February, 1915.

"A Pest of Shade Trees, The White-marked Tussock Moth": *Tree Talk,* page 6, 2 pages, 2 figures, May, 1915.

Eliminating Cutworms: *Florists' Exchange,* Vol. XL, page 536, 1 column, September 4, 1915.

Correspondence Slip "Cutworms," Revised edition, 1,000 copies, May, 1915.

"Insects as Carriers of Disease," Proceedings Third Connecticut State Conference of Charities and Correction, Waterbury, April 14-16, 1912, page 147, 10 pages, published 1914.

Chapter on Insect Pests "The Potato as a Cash Crop," Joint Circular of Information No. 1 (Agricultural College and both Stations of Connecticut), 1 page, March, 1915.

"Summer Work against the Brown-Tail Moth," 2 columns, 3 figures, published in *Windham County Observer* (Putnam), May 5, and the *Putnam Patriot,* May 7, 1915.

By W. E. Britton and G. P. Clinton:

Bulletin 183, "Spray Calendar," 28 pages, 63 figures, on folding card printed on both sides; 13,000 copies distributed in January, 1915.

Bulletin 184, "Spray Treatment, etc., for Orchards," 12 pages, 1 figure, 10,000 copies distributed in January, 1915.

By B. H. Walden:

"Mosquito Control Work": *Saturday Chronicle* (New Haven), 1¼ pages, 2 figures, February 13, 1915.

Entomological Staff.

W. E. Britton, Ph.D. ..... *State and Station Entomologist.*
B. H. Walden, B.Agr. ..... *First Assistant.*
Quincy S. Lowry, B.Sc. ..... *Assistant.*
Irving W. Davis, B.Sc. ..*Assistant and Deputy in Charge of Moth Work.*
Max P. Zappe, B.S. ..... *Assistant.*
Miss Frances M. Valentine* ..... *Clerk and Stenographer.*
Miss Grace A. Foote, B.A.† ..... *Clerk and Stenographer.*

Mr. Walden has been in charge of all work during the absence of the Entomologist, has done most of the photographic work of the department, has helped inspect nurseries and imported nursery stock, and as time permitted conducted investigations, identified insects and worked on the collections.

Mr. Lowry has assisted in the inspection and general work of the department, has conducted a series of experiments in an attempt to control the cabbage maggot, and has made observations on other insects attacking cabbage and other vegetable crops.

Mr. Davis has also helped in the inspection of nurseries and imported nursery stock and has been in charge of the field work in suppressing the gipsy and brown-tail moths. Mr. Davis spent a greater part of the winter in charge of scouting crews in Stonington and North Stonington. On the passage of the new law he was appointed assistant and deputy in charge of this work, and during the summer until August 7th, superintended the spraying and other field work in the eastern end of the state.

Mr. Zappe during the winter scouted for gipsy moth eggs with Mr. Davis and the remainder of the year has served as general assistant. During the summer he has been in charge of the insectary and the breeding and collection records, and has helped inspect nurseries and imported nursery stock. He has given considerable time and attention to a study of the distribution, life history and habits of *Diprion simile.*

Mr. Matthew H. Stanley, a member of the gipsy moth force during the summer, was employed for five weeks in August and September to help inspect nurseries.

Messrs. H. W. Coley of Westport and A. W. Yates of Hartford, as formerly, have inspected apiaries on a *per diem* basis.

* Until June 20, 1915. † From June 22, 1915.

Mr. P. L. Buttrick has been employed as a special agent of the Station under the direction of this department to make a mosquito survey at the mouth of the Connecticut River and to prepare a report thereon.

Miss Frances M. Valentine, who for three years served as clerk and stenographer in this department, on account of gradually failing health was obliged to give up her work about June 20th; she continued to fail and died September 17th. Miss Valentine had the benefit of a long experience in the keeping of office records and systems and was particularly efficient in this part of the work. She was extremely faithful, often working beyond her failing strength, and was cheerful and courageous to the end.

Miss Grace A. Foote, who comes to the department with a thorough training and considerable experience, has done the necessary clerical and stenographic work since June 22d.

All members of the staff have worked energetically and conscientiously. Whatever has been accomplished during the year is therefore due not to any one in particular but to all, and the Entomologist wishes to here express his appreciation to all for their faithful and efficient services.

New Equipment.

New bookshelves have been installed which give 49 linear feet of additional shelving for books. A low-power Bausch & Lomb binocular microscope was purchased for use in studying insects in the laboratory. For the moth work, as has been mentioned elsewhere, were purchased a Ford touring car, an Indian motor cycle, and a Fitzhenry-Guptill high-power sprayer with the necessary hose and nozzles.

Chief Lines of Work.

The inspection of nurseries and imported nursery stock and the routine and control work continues to occupy a large portion of the time and attention of members of the staff. Especially during October, when most of the shipments of *Azalea indica* arrive, and also in November, December and January there are constant arrivals of imported nursery stock. In March and April, perhaps, the greatest rush comes.

During August and September all men are needed in making the annual inspection of nurseries.

The gipsy and brown-tail moth suppression work has also taken much time and attention. This, in charge of Mr. Davis, will hereafter be placed on a different basis, as provided in the new law. Nevertheless, the Entomologist will continue to have general charge, must make rules and regulations, approve all accounts, etc. Though all bills are to be paid by the State Comptroller, it will be necessary for the State Entomologist to keep records about the same as before.

Considerable attention has been given to the pine sawfly, *Diprion simile* Hartig, in an attempt to learn of its present distribution in Connecticut, and to ascertain its habits, food preferences, and seasonal life history. Mr. Zappe has done most of this work under the direction of the Entomologist, though he has been aided somewhat in the field by Messrs. Lowry and Walden. An account of this insect will be found in this report.

Successful experiments in controlling the cabbage maggot were conducted by Mr. Lowry at the Station farm at Mt. Carmel, and minor tests were also made at A. N. Farnham's. Mr. Lowry has also made observations on other insects attacking cabbage and vegetable crops.

A general entomological supervision has been given the Station orchards at Mt. Carmel. Some of the spraying work, more especially as regards the old apple orchard, has been in coöperation with the botanical department. The young peach and apple orchards have been examined for borers, and the apple trees treated for aphids.

Mr. Walden has continued his experiments and observations on the control of the white pine weevil and has made a number of visits to examine pine plantations and to give advice regarding insects attacking the trees.

Mr. Walden and Mr. Buttrick, special agent, made a mosquito survey of Stonington, and are making records of the changes which take place in the vegetation of a salt marsh after and on account of draining. Mr. Buttrick has also made a survey of the mosquito-breeding areas at the mouth of the Connecticut River and his report was published as Bulletin 189, and is included in this report. The expense of making this survey and of pub-

lishing the report as a bulletin was borne, in part, by the Old Saybrook Town Improvement Association.

The Entomologist and Mr. Walden have both examined marsh areas and have given advice regarding treatment, and have attended meetings to answer questions and explain the habits of mosquitoes and how to abolish the nuisance.

Mention should be made of the occurrence of three species of scale-insects not hitherto recorded from the state; of the juniper web-worm; the larch sawfly; two psyllids and a weevil from Europe, all of which are described in greater detail in the following pages.

Exhibits were made this year at two agricultural fairs, Norwich, September 6-8, and Berlin, September 14-17. These were in charge of Mr. Zappe.

Bulletin No. 22 of the Connecticut Geological and Natural History Survey, "The Hymenoptera of Connecticut," which is now in press, has required considerable attention especially in reading proof and preparing the index. The manuscript of another bulletin of the Survey, "A Check-List of Connecticut Insects," which was submitted more than four years ago, and which will soon go to press, required revision on account of many additions and the rearrangement of certain groups caused by recently accepted changes in classification.

INSPECTION OF NURSERIES.

Commencing August 16th, the work of inspecting the growing stock in the nurseries of Connecticut was carried along rapidly and was finished October 11th. This work was done by Messrs. Walden, Lowry, Davis, Zappe and Stanley. All worked together in the larger nurseries, but separated in examining the smaller ones.

The Ford car proved very useful in inspecting nurseries, particularly the larger ones. Four or five men could be transported to and from the nursery at much less expense than is possible by railroad, and by taking an early start it was found possible to get in a good day's work and to be home again fully as early as under the old system. No time was wasted in waiting for trains or trolley cars or in walking from them to the nurseries

and back again. The motor cycle was also used by Mr. Zappe for a part of the inspection work and proved efficient and particularly useful where one man only was needed, as is the case with some of the small nurseries. It was found especially convenient where the nursery is not near a steam or trolley road. The use of these two motor vehicles must have saved the department several hundred dollars this season in this work alone.

On account of the possible presence of the pine shoot moth, *Evetria buoliana,* the imported pine sawfly, *Diprion simile,* the pine blister rusts, the chestnut blight, and certain other pests, the annual inspection each year, especially of the woody plants, has been growing more and more rigid, and particular attention has been given to certain species which formerly were never or seldom found infested. The inspection of 1915 was especially rigid. On the whole the nurseries were in good condition. In 31 nurseries no pests were found; in 27, traces of San José scale, only two having infestations that could be called serious. Oyster shell scale was found in 24; scurfy scale, 5; tulip scale, 6; pine leaf scale, 4; West Indian peach scale, 2; spruce gall louse, 2; euonymus scale, 1; linden borer, 1; lilac borer, 2; and chestnut blight, 4.

In all cases the infested trees or plants were suitably marked and reported to the owner with written orders regarding destruction or treatment. No certificates were issued until these instructions had been carried out.

In addition to the inspection of regular nurseries, a certain number of requests are received each year for the inspection and certification of small lots or packages of scions, shrubs, etc., that some one wishes to send away and cannot do so without such inspection and certification. During the year 3 such inspections have been made and in each case a certificate has been issued.

One nursery has been inspected twice, and two or three were inspected before we learned that the owner had gone out of business. Thus altogether 77 nurseries were inspected during the year and 74 certificates granted.

The list of nurserymen this year contains 72 names, the same number as last year. Six have discontinued the nursery business and six new ones have started. The list of nurseries for 1915, with date and number of each certificate, is as follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1915.

Name of Firm	Address	Certificate Issued	No. of Certificate
Barnes Brothers Nursery Co.	Yalesville	Sept. 27,	670
Beattie, Wm. H.	New Haven	Oct. 11,	699
Bowditch, J. H.	Pomfret Center	Sept. 27,	665
Brainard Nursery & Seed Co.	Thompsonville	Oct. 4,	688
Bradley, H. M.	Derby	Jan. 8, '16,	722
Braley & Co., S. A.	Burnside	Oct. 5,	690
Bretschneider, A.	Danielson	Sept. 27,	666
Brooks Bros.	Westbrook	Sept. 28,	672
Burroughs, Thos. E.	Deep River	Oct. 2,	685
Burr & Co., C. R.	Manchester	Aug. 31,	652
Chapman, C. B.	Groton	Oct. 7,	694
Chapman, C. E.	North Stonington	Sept. 10,	655
Comstock & Lyon	Norwalk	Oct. 13,	703
Conine Nursery Co., The F. E.	Stratford	Oct. 1,	681
Conn. Agricultural College (Prof. A. G. Gulley)	Storrs	Sept. 27,	664
Conn. Agr. Experiment Station, (W. O. Filley, State Forester)	New Haven	Sept. 24,	663
Conway, W. B.	New Haven	Sept. 23,	661
Cross Highway Nurseries	Westport	Oct. 6,	692
Dallas, Inc., Alexander	Waterbury	Dec. 13,	718
Dehn & Bertolf	Greenwich	Oct. 8,	697
Dowd, Frank C.	Madison	Dec. 1,	715
Elm City Nursery Co., Woodmont Nurseries, Inc.	New Haven & Woodmont	Sept. 30,	676
Fairfield Landscape & Nurseries Co.	Cannon Station	Oct. 2,	684
Gardner's Nurseries	Cromwell	Sept. 21,	659
Geduldig, G., Estate of	Norwich	Oct. 7,	696
Hartford Park Commissioners (G. A. Parker, Supt.)	Hartford	Nov. 3,	710
Heath & Co., H. S.	Manchester	Aug. 31,	654
Hilliard, H. J. (2)	Sound View	Nov. 3,	709
Horan & Son, Jas.	Bridgeport	Oct. 2,	686
Houston & Sons, J. R.	Mansfield	Dec. 17,	719
Hoyt's Sons Co., The Stephen	New Canaan	Oct. 8,	698
Hubbard & Co., Paul M.	Bristol	Oct. 5,	689
Hunt & Co., W. W.	Hartford	Oct. 11,	700
Intravaia, Joseph	Middletown	Sept. 21,	658
Kelley, James	New Canaan	Sept. 20,	656
Kellner, Herman H.	Danbury	Oct. 2,	682
Kelsey & Sons, David	West Hartford	Oct. 11,	701
Long, J. A.	East Haven	Sept. 30,	677
Mallett & Co., G. A.	Bridgeport	Sept. 29,	675

Name of Firm	Address	Certificate Issued	No. of Certificate
Maplewood Nursery Co. (S. Hartridge, Mgr.)	Norwich	Oct. 26,	708
McDermott, E. F.	Windsor	Oct. 1,	680
Meier & Gillette	West Hartford	Oct. 1,	679
Munro, Charles	New Haven	Sept. 23,	662
New Haven Nurseries Co.	New Haven	Oct. 13,	702
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	Nov. 12,	714
New London Cemetery Association (F. S. Newcomb, Pres.)	New London	Oct. 7,	693
New London County Nurseries (W. J. Schoonman, Prop.)	New London	Jan. 4, '16	720
Northeastern Forestry Co.	Cheshire	Aug. 31,	651
Oakland Nurseries	Manchester	Aug. 31,	653
Palmer, L. M.	Stamford	Sept. 27,	669
Park Gardens	Bridgeport	Sept. 29,	674
Phelps, J. Wesson	Bolton	Nov. 12,	712
Phelps & V. T. Hammer Co., The J. W.	Branford	Nov. 12,	711
Pierson, Inc., A. N.	Cromwell	Sept. 21,	657
Platt Co., The Frank S.	New Haven	Sept. 28,	671
Pomeroy, Edwin C.	Northville	Oct. 5,	691
Purinton, C. O.	Hartford	Dec. 13,	717
Raab, Joseph O.	Ansonia	Oct. 15,	705
Reck, Julius	Bridgeport	Nov. 12,	713
Roehrich, W. G.	Stratford	Sept. 29,	673
Saxe & Floto	Waterbury	Dec. 10,	716
Schleichert, F. C.	Bridgeport	Oct. 2,	687
Scott, J. W.	Hartford	Jan. 7, '16	721
Sierman, C. H.	Hartford	Sept. 27,	668
South Wilton Nurseries	South Wilton	Oct. 2,	683
Steck, Charles A.	Bethel	Oct. 7,	695
Stratfield Nursery Co.	Bridgeport	Oct. 20,	707
Turner & Co., Charles	Hartford	Oct. 18,	706
Vidbourne & Co., J.	Hartford	Sept. 27,	667
Woodruff, C. V.	Orange	Sept. 30,	678
Yale University Forest School	New Haven	Sept. 22,	660
Young, Mrs. Nellie A.	Pine Orchard	Oct. 13,	704

INSPECTION OF IMPORTED NURSERY STOCK.

On account of the war in Europe it was expected that there would be a marked decrease in the amount of European nursery stock shipped into Connecticut, but such was not the case. The fact that all species of pines from Europe are now prohibited from entering this country would also still further tend to reduce

the amount. It is true that the number of shipments (264) is less than that of last year (303) and the number of cases corresponding smaller (1,349 as against 1,477 last year). Nevertheless, the total number of plants inspected was considerably greater, amounting to 2,102,222 in comparison with 1,646,130 last year.

This inspection work has been done by the Entomologist and his assistants in coöperation with the Federal Horticultural Board at Washington, and three members of the staff are also collaborators of the Board. The Board issues permits for the stock to enter the United States and provides for a system of notices to be sent to the official in charge of the inspection work in each state to which shipments are consigned. The stock is then inspected on arrival at its destination by state inspectors. A report of each inspection is then sent to the Board at Washington and a duplicate report is kept on file in the office of the state inspector.

For the past year this inspection work has necessitated the equivalent of one man working 180 days of 7½ hours each, or about three-fifths of the working time in an entire year. The cost, including salaries and travelling expenses, amounts to about $1,100.00. As provided by the legislature, the expense of this work is defrayed from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock.

The proportions of this stock from the various countries run about the same as last year (see Report of this Station for 1914, page 123), except that a slight increase may be noted from Belgium, and a slight decrease from Holland, England, Ireland and Germany. The source of this imported stock was as follows:

Country	No. Shipments	No. Cases
Holland	100	624
Belgium	100	471
France	30	206
England	14	23
Ireland	4	4
Germany	4	4
Scotland	6	8
Japan	3	6
Italy	1	1
Bermuda	1	1
Not given	1	1
Total	264	1349

In addition to the figures given above, notice was received of 12 shipments containing 25 cases. Of this stock, 8 cases were reshipped without inspection, 4 were refused, 2 were not received, 1 was inspected by a Federal inspector, and 10 contained herbaceous perennials, or greenhouse grown stock, which was not inspected.

Of the 264 shipments examined, 57 or 21.5 per cent. were found infested with insects or plant diseases, some of which are pests, as follows:

INFESTATIONS FOUND.

PLANT DISEASES.

Crown gall, *Bacterium tumifaciens* Smith & Towns. (7 shipments.)
On Manetti rose stock.
M. J. Gielen, Oudenbosch; Ebbinge & Van Groos, Wm. C. Hage & Co., Boskoop, Holland; Vincent Lebreton's Nursery, Angers, France; George Mount & Son, Canterbury; Kings Acre Nursery, Hereford; Walter Slocock, Woking, Surrey, England.
On *Philadelphus.* L. Renault, Orleans, France.
On *Ligustrum.* Louis Leroy, Angers, France.
On apple. Louis Leroy, Angers, France.

Hairy root on apple. Louis Leroy, Angers, France.

Fungus, *Exobasidium* on *Azalea indica.* (16 shipments.)
Van Dillewyn & Thiel, K. J. Kuyk, C. Petrick, Ghent; August Toeffaert, Destelbergen; De Bruycker & Drosbeke, Wynckel, St. Croix; Meirelbeke Nurseries, Meirelbeke; De Coster Bros., Bier & Ankersmit, Melle, Belgium; De Bruyne Bros., Loochristy, Belgium.

Pestalozzi guepini Desm. on Rhododendron. Barbier & Co., Orleans, France.

Ascomycete on Rhododendron. (2 shipments.)
Barbier & Co., Orleans, France.
C. Van Kleef & Co., Boskoop, Holland.

Rust, probably *Phragmidium subcorticium* (Schrank) Wint. on *Rosa rubiginosa.* L. Renault, Orleans, France.

INSECTS.

Aleyrodes sp. on *Azalea indica.*
Meirelbeke Nurseries, Meirelbeke, Belgium.

Scale on Bay trees. Aug. Toeffaert, Destelbergen, Belgium.

Scale, *Coccus hesperidum,* on Bay trees.
August Toeffaert, Destelbergen, Arthur De Meyer, Ghent, Belgium.

Oyster-shell scale, *Lepidosaphes ulmi* Linn. (9 shipments.)
On Boxwood, *Buxus.*
J. Blaauw & Co., W. Van Kleef & Sons, G. W. Van Gelderen, Schaum & Van Tol, Ebbinge & Van Groos, Boskoop (2); Verkade Van Kleef, Waddinxveen; Van Zonneveld Bros. & Phillipo (2), Sassenheim, Holland.

Diaspine Scale. On palm.
Arthur De Meyer, Ghent, Belgium.
Scale, *Saissetia nigra,* on Hibiscus.
Th. Outerbridge, Sunnylands, Bermuda.
Scale on Kentia.
La Soc. Anony. Hort. Ghent, Belgium.
Scale on palm.
Vander Sypt Freres, Loochristy, Belgium.
Galls on Oak. Louis Leroy, Angers, France.
Two Neuropteroids, Coccinellidae, Thysanura, on Bay trees.
Arthur De Meyer, Ghent, Belgium.
Dipterous larvae in soil with Rhododendrons.
Emile Vercauteren, Melle, Belgium.
Sawfly, *Emphytus cinctus* Linn., on Rose stock.
L. Renault, Orleans, France.
Borer (probably sawfly) on Manetti stock.
Franco-American Seedling Co. (A. Fermand) (2), Angers, France.
Larvae of sawfly on Manetti stock.
Franco-American Seedling Co., Angers, France.
Larvae and pupae (Sawfly?) on Manetti stock.
Louis Leroy Nursery Company, Angers, France.
Lepidopterous larva on Bay trees.
August Toeffaert, Destelbergen, Belgium.
Lepidopterous pupa on Camperdown elm.
Louis Leroy, Angers, France.
Lepidopterous cocoon containing parasites, on *Azalea indica.*
K. Rosbergen & Son, Boskoop, Holland.
Lepidopterous cocoon (probably *Acronycta rumicis* Linn.) on Manetti rose stock. M. J. Gielen, Oudenbosch, Holland.
Lepidopterous pupa on *Azalea indica.*
De Coster Bros., Melle, Belgium.
Lepidopterous (?) eggs on bird's nest on Boxwood.
W. Van Kleef & Sons, Boskoop, Holland.
Pupa on *Azalea indica.* Van Dillewyn & Thiel, Ghent, Belgium.
Noctuid cocoon on *Azalea indica.* Van Dillewyn & Thiel, Ghent, Belgium.
Noctuid pupa on *Azalea indica.* Van Dillewyn & Thiel, Ghent, Belgium.
Tiger moth caterpillar on *Azalea indica.*
Arthur De Meyer, Ghent, Begium.
Tussock moth eggs and cocoon case on Roses.
F. J. Grootendorst & Son, Boskoop, Holland.
Egg-mass (probably rusty tussock moth) on fruit stock.
Franco-American Seedling Co., Angers, France.
Work of red spider on *Araucaria.*
Vander Sypt Freres, Loochristy, Belgium.
Work of European Pine Shoot moth on *Pinus montana.*
C. Van Kleef & Co., Boskoop, Holland.
Corms of grass. Franco-American Seedling Co., Angers, France.

INSPECTION OF APIARIES.

The number of apiaries as well as the number of colonies inspected in 1915 exceeds that of any preceding year, and it was done at a smaller average cost than ever before. As in former years, this work was done by Messrs. H. W. Coley of Westport, who has jurisdiction over Fairfield, New Haven, Middlesex and New London counties, and A. W. Yates of Hartford, who has the four northern counties of Litchfield, Hartford, Tolland and Windham.

Inspections were made in each county but of course not all apiaries were inspected or can be inspected in any one season. Neither was it possible to make inspections in every town in the state, though work was done in 1915 in 90 towns as against 77 towns in 1914.

There is in some cases an urgent demand each year from bee-keepers for this inspection. Hence it is necessary to go into certain towns each year, but it is part of our general plan, as we can now inspect without complaints, to cover all the towns of the state at least once in three or four years. Thus inspections were made in a number of towns in 1915 not visited in 1914, as may be seen by comparing the accompanying table with a similar one given on page 127 of the Report of this Station for 1914.

Hartford county leads the other counties in the number of apiaries inspected (190), while Fairfield county leads in the number of colonies examined (1,206).

A larger proportion of both apiaries and colonies were found to be free from disease than ever before. Most of the trouble was due to European Foul Brood, as has been the case in previous years. The only American Foul Brood found was in one apiary in New Canaan and in three apiaries in Old Lyme. The statistics of this apiary inspection are shown in the following table, which gives the number of apiaries and colonies inspected in each town where work was done, and in each county, as well as the number in each found diseased:

Apiaries Inspected, 1915.

Arranged by Counties and Towns.

Town	No. Apiaries Inspected	Diseased*	Quarantined	No. Colonies Inspected	Diseased
Fairfield County.					
Bethel	4	2	1	29	9
Bridgeport	1	0	0	9	0
Danbury	4	2	0	33	5
Darien	1	0	0	20	0
Easton	3	1†	0	173	1†
Fairfield	11	3§	0	236	9¶
New Canaan	6	4**	1	37	11††
Norwalk	3	0	0	30	0
Redding	5	0	0	35	0
Ridgefield	14	1	1	58	4
Stamford	11	4‡	2	87	9‡
Stratford	2	1	0	81	1
Trumbull	1	1†	0	72	3
Weston	2	0	0	7	0
Westport	8	2‡	0	91	2‡
Wilton	19	1	0	208	1
Total 16 towns ...	95	22	5	1206	55
New Haven County.					
Beacon Falls	2	2	0	13	13
Cheshire	6	1	0	54	2
Derby	4	2	0	33	4
Hamden	3	2	0	37	2
Madison	1	1	0	28	5
Meriden	3	0	0	91	0
Middlebury	1	1	0	2	2
Milford	1	0	0	24	0
Naugatuck	3	0	0	20	0
New Haven	1	0	0	3	0
Seymour	3	0	0	27	0
Waterbury	4	1	1	75	8
Total 12 towns ...	32	10	1	407	36
Middlesex County.					
Chatham	4	2	1	83	29
Haddam	2	0	0	13	0
Killingworth	5	3§	0	37	7‖
Middletown	1	1	0	3	2
Portland	2	0	0	28	0
Total 5 towns	14	6	1	164	38

Town	No. Apiaries Inspected	Diseased*	Quarantined	No. Colonies Inspected	Diseased
New London County.					
Bozrah	2	1	1	8	3
Colchester	1	1	0	14	2
Griswold	1	1†	0	6	2†
Groton	1	0	0	6	0
Ledyard	4	0	0	36	0
Lisbon	3	2	0	12	5
Montville	10	9	4	51	36
New London	2	1	1	27	6
North Stonington	1	1	0	4	4
Norwich	7	3	0	143	81
Old Lyme	4	3§§	1	51	4‡‡
Stonington	3	2‡	0	41	2‡
Waterford	4	2	2	72	16
Total 13 towns ...	43	26	9	471	161
Litchfield County.					
Barkhamsted	4	2	0	59	2
Bethlehem	5	1	0	30	1
Colebrook	1	1	0	7	7
Harwinton	1	0	0	1	0
Morris	2	0	0	6	0
New Hartford	2	2	0	19	3
Plymouth	6	4	0	34	14
Thomaston	11	5	0	40	6
Torrington	9	4	0	123	10
Watertown	7	3	1	55	4
Winchester	22	7	2	127	17
Total 11 towns ...	70	29	3	501	64

* European foul brood unless otherwise indicated.
† Sacbrood.
‡ One infested with sacbrood.
§ Two infested with sacbrood.
‖ Three infested with sacbrood.
¶ Eight infested with sacbrood.
** One apiary has both American and European foul brood.
†† Seven colonies European, four American foul brood.
‡‡ Three colonies American, one both European and American foul brood.
§§ Two colonies American, one both European and American foul brood.

Town	No. Apiaries Inspected	Diseased	Quarantined	No. Colonies Inspected	Diseased
HARTFORD COUNTY.					
Berlin	16	1	0	75	1
Bloomfield	7	0	0	138	0
Bristol	6	2	0	34	4
Burlington	4	0	0	19	0
Canton	7	4	0	17	9
East Granby	5	2	0	29	4
East Hartford	3	0	0	22	0
East Windsor	14	0	0	73	0
Enfield	9	1	0	24	3
Farmington	9	5	0	37	12
Glastonbury	17	2	0	69	4
Granby	7	0	0	77	0
Hartford	1	0	0	4	0
Hartland	4	3	2	18	6
Manchester	10	4	1	23	5
New Britain	15	1	0	101	1
Newington	4	0	0	57	0
Plainville	7	2	0	35	5
Rocky Hill	5	1	0	17	0
South Windsor	5	1	0	31	1
West Hartford	11	1	0	80	0
Wethersfield	10	1	0	57	4
Windsor	9	0	0	48	0
Windsor Locks	5	1	1	48	2
Total 24 towns	190	32	4	1,133	61
TOLLAND COUNTY.					
Andover	2	1	0	54	1
Bolton	2	0	0	9	0
Coventry	5	1	1	20	4
Ellington	4	0	0	23	0
Vernon	11	0	0	93	0
Total 5 towns	24	2	1	199	5
WINDHAM COUNTY.					
Killingly	4	2	0	28	4
Pomfret	12	6	1	52	18
Putnam	7	5	0	29	10
Woodstock	3	3	1	51	17
Total 4 towns	26	16	2	160	49
Grand total 90 towns	494	143	26	4,241	469

SUMMARY OF APIARY INSPECTION.

County	No. Towns	No. Apiaries Inspected	Diseased	No. Colonies Inspected	Diseased
Fairfield	16	95	22	1,206	55
New Haven	12	32	10	407	36
Middlesex	5	14	6	164	38
New London	13	43	26	471	161
Litchfield	11	70	29	501	64
Hartford	24	190	32	1,133	61
Tolland	5	24	2	199	5
Windham	4	26	16	160	49
Total	90	494	143	4,241	469

	Apiaries	Colonies
Number inspected	494	4,241
Infested European foul brood	129	441
Per cent. infested	26.1	10.3
Infested American foul brood	4	8
Per cent. infested	.8	.18
Pickled or sacbrood	10	20
Average number of colonies per apiary		8.58
Cost of inspection		$746.31
Average cost per apiary		1.51
Average cost per colony		.175

GIPSY MOTH SUPPRESSION WORK IN 1915.

By W. E. BRITTON AND IRVING W. DAVIS.

WINTER SCOUTING.

Scouting for gipsy moth egg-clusters in Connecticut during the winter of 1913-14 by Federal men resulted in finding ten towns infested with this pest. (See Report for 1914, page 133.) This winter, therefore, these ten towns, together with those bordering them on the west, were searched, also by Federal men, and ten additional towns were found infested; namely, Eastford, Chaplin, Hampton, Scotland, Canterbury, Plainfield, Sterling, Sprague, Lisbon and Griswold. These towns are all shown east of the quarantine line of the map in figure 1 on page 100.

The State kept one crew in the field this past winter, which, besides working in Stonington and North Stonington, scouted the old infested area at Wallingford. This crew consisted of five men,—Messrs. Zappe and Davis of the Station staff, and C. W. Bolton, H. B. Bursley and J. S. Shepard.

The method employed in this scouting was to examine carefully all the trees along each roadside, paying particular attention to fruit trees and oaks, which are the favorite food plants of the gipsy moth. All trees around the houses were examined, as well as old apple orchards and scrub apple trees, many of the latter being a mile or more back from the highway. The pasture oaks and other scattering trees in the fields were scouted,

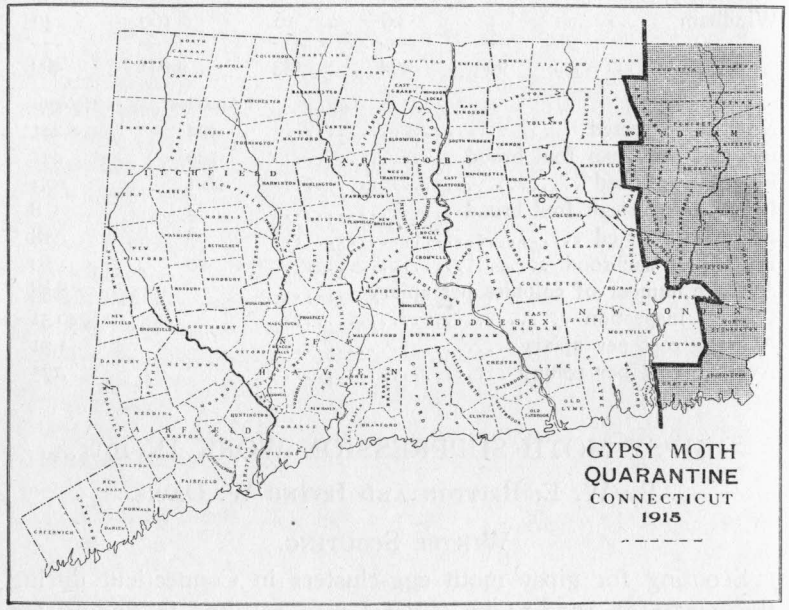

FIG. 1. Map of Connecticut showing towns infested by the Gipsy Moth, and quarantined in 1915.

while in the woodland along each highway a strip varying from 50 to 100 feet in width was worked.

No egg-clusters and only one pupa case were found. The pupa case, a female, was taken in the northern part of the town of Stonington near the Anquilla infestations of a year ago. Around this section every effort was made to locate further traces of the pest but none were found.

In Wallingford, the scouting was essentially the same as a year ago. The section which had been burlapped during the previous summer was scouted and no egg-clusters were found. We now believe that the Wallingford colony has been exterminated.

SUMMER WORK.

For the past two years the Federal Government has done the most of the scouting work in Connecticut as the limited funds permitted the State to work only two or three towns.

The Legislature this year granted an increased appropriation for this work which became available about the 20th of May, and soon after this date the entire area infested was taken over by the State.

Federal men had by that time worked nearly two weeks. At all of the infestations tanglefoot had been applied to the trees and the infestations were being patrolled regularly by the Government men.

Mr. L. H. Worthley, who is in charge of the Federal scouts, very kindly offered their services for the remainder of the summer work. This offer was readily accepted and the men were placed upon the State pay roll for a few weeks.

The first part of June a power sprayer was purchased, and 62 infestations in the worst infested towns were sprayed. Although this work was done rather late for the best results, the outfit will be available another year as soon as the season opens.

The work closed on July 24, but the most serious infestations, which are in the northeastern corner of the State (Thompson, Woodstock and Putnam), were watched until after the first of August.

Thompson—166 Infestations.

Many more infestations were found in the town of Thompson than in any other infested town in this State, but this may be partly accounted for by the fact that the entire area of the town was scouted during the summer of 1914. This naturally divided the infestations into two classes, i. e., the woodland and the roadside, the former numbering 73 and the latter 93.

Some of the infestations in Thompson are among the most serious in the State, and though 70 of them showed larvae, in most cases it was for a short period only and they were not abundant.

During June the sprayer was taken into Thompson, and 28 of the worst infestations in the town were sprayed.

The work of examining the tanglefoot bands commenced about the middle of May and continued until the seventh of August. The town will be scouted this coming winter and vigorous methods will be taken to exterminate this pest.

Woodstock—40 Infestations.

This town is a rather large one and contains a great many apple orchards and white oak trees, which are among the favorite food plants of the gipsy caterpillars, and during last winter 40 infestations were found here.

The majority of the egg-clusters were in a line running from the northeast to the southwest, while in the other sections the infestations were scattering.

There were a large number of infestations near the village of East Woodstock, but of the 40 in the entire town, only 13 showed larvae and 12 of these were sprayed.

During the latter part of the summer work, two new infestations were located, one a little out from East Woodstock, and the other in a swamp near the south part of the town.

At the former infestation a large apple tree was taken down and four egg-clusters found, while on that and neighboring trees 338 caterpillars were killed. In the later visits to this infestation none of the pests were found.

The last infestation was found on the 29th of July, and from then on until August 7th 100 larvae were taken.

Putnam—24 Infestations.

The twenty-four infestations in this town made Putnam one of the most thickly infested towns in the State, due to the fact that Putnam, as regards area, is one of the smaller towns in that section of Connecticut.

Larvae were found at twelve of these infestations, and eleven of them were sprayed. Three infestations, one in the city itself, and two on a cross-road a few miles east of the city, were by far the worst infestations within the town boundaries. At these three places were taken approximately five-sixths of the larvae found in Putnam. Few, however, were taken after the first of July.

On the seventeenth of July several caterpillars were discovered outside of the banded district at an infestation on Putnam

Heights. Extra work was done there, and during the last few visits nothing was found.

Pomfret—22 Infestations.

The twenty-two infestations in Pomfret were well distributed throughout the town. Only three showed larvae to any extent and these only a few as compared with infestations in other towns. Two of these infestations were near the village of Abington in the south part of the town, while the one furnishing the most larvae was north of Pomfret Street on the road leading to Woodstock.

The sprayer was used at two of these infestations and they were all patrolled until the first of August.

Eastford—4 Infestations.

This was one of the westernmost towns infested and contained four separate infestations which, with one exception, were on roads leading from the Eastford Post-office to the Pomfret line. The fourth infestation was a pupa case on the road from Phoenixville to Ashford.

At two of the infestations in the north part of the town a few larvae were taken. Both of these infestations were sprayed in June and were patrolled until the last of July, the larvae taken during that time numbering eight for both infestations.

Killingly—15 Infestations.

The northern portion, near the Putnam line, was the worst infested section of Killingly, eight of the fifteen infestations being located there.

At the beginning of the season several larvae were taken at two infestations on the State road leading from Danielson to Putnam and these were sprayed early in June.

Toward the end of June, at one of the two infestations in the village of Danielson, a marked increase in the number of larvae was noted. The trees near by were thoroughly sprayed and thereafter only a few scattering larvae were seen, the last being taken on July 24th.

Of the other infestations, five showed larvae in the early part of the season but none were found after the first of July so were not considered as serious.

Brooklyn—2 Infestations.

Only two infestations were found in Brooklyn, one of seven, and the other of eight egg-clusters. These were both some distance from orchards or oak woods. Larvae of the gipsy moths were found at both until well into July.

Hampton—8 Infestations.

Eight gipsy moth infestations were found in the town of Hampton during the past winter's scouting. While these were scattered throughout the town, none of them appeared to be very serious. Larvae were found at seven of the eight infestations and during June three of the worst were sprayed. There were no larvae taken after the middle of July although the work did not close until the first of August.

Chaplin—1 Infestation.

The result of scouting this town was the finding of one infestation of seven egg-clusters. This was visited numerous times during the summer but no larvae were found.

Sterling—2 Infestations.

There were two infestations in this town, one near the central part of the town, north of Sterling Station, and the other in the south part near the Rhode Island line.

Both of these infestations showed larvae. At the former ten were found, the last one being taken on the 13th of July.

At the southern infestation 813 larvae were found. Early in June, 15 egg-clusters were located in some rocks about four rods from the infested tree. The brush was cut and burned and the remaining foliage sprayed. Scattering larvae were taken until the 28th of July, but from then until the work closed nothing more was found.

Plainfield—1 Infestation.

A single egg-cluster was found in this town as the result of the winter's scouting, but no larvae were taken here during the summer.

Canterbury—6 Infestations.

Six widely separated infestations were found in this town, but there were only two at which larvae were taken, one in the south

part of the town near the Griswold line, and the other in the very northern part near the Hampton line.

At the latter three larvae were taken on the first visit, but after that nothing was found.

The infestation near the southern boundary of the town was located in a roadside white oak. A total of 13 larvae were taken at this infestation previous to July 6th and none later, though many visits were made.

Scotland—1 Infestation.

The single infestation in this town contained twenty-six egg-clusters. This, like the other infestations throughout the State, was watched during the caterpillar season and twenty-six larvae were taken.

Voluntown—1 Infestation.

Only one infestation was located in this town and that a pupa case. No larvae were found here during the summer.

Griswold—4 Infestations.

Of the four infestations in this town, two were in the southern portion and two in the northern portion of the town.

In the south part, both infestations consisted of pupa cases and no larvae were found.

The northern infestations contained respectively ten and thirty egg-clusters. At the former several larvae were taken during May, but none thereafter. The latter, however, appeared rather serious at first and extra work was done during June. The number of larvae steadily diminished until no more larvae were found, although four visits were made to this infestation after the last larva was taken.

Lisbon—3 Infestations.

These three infestations were widely separated and the only one at which larvae were taken was near the center of the town on the road from Versailles to Newent. Five larvae were discovered here early in June, and from then until the work closed the last of July nothing more was found.

Sprague—2 Infestations.

The visits to the two infestations in this town were made at various times during the summer, but no larvae were found.

North Stonington—1 Infestation.

The winter scouting of this town resulted in finding only one egg-cluster. This was located near Spalding Pond and although visited several times this summer, no larvae were found.

Stonington.

This town contained the original gipsy moth infestation in this State, which was found near the borough of Stonington in 1906. From that time until 1913 control measures were practiced and the colony exterminated (see former reports for full account of the work). The windspread of 1913 resulted in seven infestations being found in Stonington but during this last year no egg-clusters were located. During the past summer the old infestations were examined occasionally and nothing found.

Groton—4 Infestations.

At Groton the infestations were all on the easterly side of Pearl St., in the village of Mystic.

The work was started here early in May and several trees were sprayed, tin patches put on, and some general pruning done.

The infestations were inspected on the average of four times a week during the caterpillar season. During the latter part of May and first part of June, several caterpillars were found, but during the rest of the season no larvae were taken.

Altogether, therefore, 20 towns were found infested in 308 separate localities, due, it is now believed, to windspread soon after the hatching season of 1913, though some of the infestations were only recently discovered. In all, about 6,000 tanglefoot bands were applied, and 62 infestations were sprayed. In six towns no caterpillars were found and possibly these towns are no longer infested, though considerable additional work must be done in them to make sure.

The following table shows the statistics of this work for the year:

SUMMARY OF GIPSY MOTH WORK

	No. of Infestations	No. with larvae	No. Sprayed	Total No. of larvae	Work closed
Thompson	166	70	27	2,132	Aug. 7
Putnam	24	12	11	1,442	July 31
Woodstock	40	13	12	2,163	Aug. 7
Pomfret	22	10	2	208	July 31
Brooklyn	2	2	0	56	" "
Scotland	1	1	0	26	" "
Killingly	15	8	3	358	" "
Eastford	4	2	2	8	" "
Canterbury	6	2	0	16	" "
Sterling	2	2	1	823	" "
Hampton	8	8	3	269	" "
Plainfield	1	0	0	0	" "
Lisbon	3	1	0	5	" "
Voluntown	1	0	0	0	" "
Sprague	2	0	0	0	" "
Griswold	4	2	0	161	" "
North Stonington	1	0	0	0	" "
Stonington	1	0	0	0	" "
Groton	4	1	1	147	" "
Chaplin	1	0	0	0	" "
Totals:					
20 towns infested	308	134	62	7,814	

New Equipment.

To enable us to properly supervise the work in the several towns, a Ford touring car was purchased. This arrived early in June and has been in constant use since. With this car Mr. Davis can visit each infestation frequently and keep in touch with the work of all of the men. He can also use it to advantage in transporting men from one town to another and for carrying small tools and supplies from one point to another.

An Indian motor cycle was purchased in May for one of the men to use in going from one infestation to another. This enables one man to visit several places in one day, even though five or ten miles apart, and is about the only way of handling small and isolated infestations distant from steam and electric railroads.

As some of the worst infestations were in woodlands and needed spraying, and the Federal organization did not have a sufficient number of power sprayers to supply Connecticut and attend to the other infestations, it seemed best for the State to

purchase an outfit for use within its borders. A Fitzhenry-Guptill power sprayer was therefore purchased, together with 1,500 feet of pressure hose, 100 feet of suction hose and two Worthley nozzles. This outfit (shown on plate IV, b), was found to be most efficient and with it 62 of the most dangerous infestations were sprayed with arsenate of lead.

Legislation.

As regards suppressive work against the gipsy and brown-tail moths, the 1915 session of the General Assembly was an important one. Two measures were introduced, one asking for an appropriation of $30,000.00 to enable the State Entomologist to cope with the situation. After the usual hearings and conferences, the legislature in due season granted a total of $25,000.00 for the purpose, but divided it into two separate items—one of $21,000.00 for the two fiscal years ending September 30, 1917,—and one of $4,000.00 as a deficiency measure taking effect upon its passage (May 18th) and becoming immediately available for summer work. As will be seen from the financial statement on page 82, this money in addition to that previously appropriated was all expended.

The other important measure was a new bill, making provision for towns to carry on suppressive measures against these insects under the direction of, and when requested to do so by, the State Entomologist. The new law is given below:

CHAPTER 267, PUBLIC ACTS OF 1915.

An Act Concerning the Suppression of Gipsy Moths and Brown Tail Moths.

Section 1. The selectmen of any town, the warden of any consolidated town and borough, or the mayor of any consolidated town and city, upon request of the state entomologist and with his concurrence, shall appoint an agent in such town who shall perform the duties required by the provisions of this act and such duties as may be prescribed by the rules and instructions of the state entomologist approved as herein provided. Upon the failure of such selectmen, warden, or mayor to make such appointment within fifteen days from the receipt of notice from the state entomologist of the existence of gypsy moths or brown tail moths in such town, the state entomologist may appoint an agent therein and fix his compensation.

Sec. 2. Each agent appointed pursuant to the provisions of section one, on ascertaining the presence of such moths in any stage of development in the town wherein he is appointed to act as such agent, shall forthwith investigate the extent of the area infested and report to the selectmen, warden, or mayor, as the case may be, or to the state entomologist, and any agent of a town adjacent to the town wherein he is serving as such agent. The state entomologist, subject to the approval of the board of control of the Connecticut agricultural experiment station, shall issue such orders, rules, and instructions concerning the suppression of said moths as he may deem advisable, and copies thereof shall be sent by him to the agents in the several towns and to the selectmen thereof, wardens of boroughs, mayors of cities, and such other state and local officials as he may consider advisable. In the performance of the duties prescribed by this act and such duties as may be imposed by the rules and regulations of the state entomologist, the agents shall be under the direction of the state entomologist, or such assistants or deputies as may be appointed by the board of control of the Connecticut agricultural experiment station.

Sec. 3. The state entomologist shall receive no additional compensation for services performed under the provisions of this act. The salaries of the assistants or deputies appointed by the board of control of the Connecticut agricultural experiment station shall be fixed by said board and, with the expenses of the state entomologist and of such assistants or deputies, shall be paid by the comptroller in monthly installments, upon vouchers approved by the state entomologist. The state entomologist, subject to the approval of said board, may procure such equipment, apparatus, and supplies, as may be necessary for the performance of his duties under the provisions of this act, upon vouchers approved by the state entomologist, and the cost thereof shall be paid by the treasurer upon order of the comptroller. Each agent shall receive compensation to be fixed by the selectmen of the town, the warden of the borough, or the mayor of the city, subject to the approval of the state entomologist, which compensation shall not exceed three dollars per day while engaged in the extermination or suppression of such moths. Any person employed by such agent to assist in such work shall, on approval of the state entomologist, receive such compensation from the town as may be determined by the selectmen, the warden, or mayor, as the case may be. Such agent shall render to the selectmen a statement of the services rendered by him and his employees and of his and their necessary expenses on the first day of each month for the month preceding. Such statement shall show in detail the amount and character of the services performed, the duration thereof, and the disbursements, charges, and expenses incurred by him during such period. A copy of such statement shall be forwarded to the state entomologist and, when approved by him, the selectmen of the town wherein such services were rendered and expenses incurred, or the warden or mayor, as the case may be, shall draw an order on the treasurer of such municipality for the amount thereof. The supplies used in any town by the state entomologist, his deputy or assistant, or by any town agent shall be furnished by the state. All accounts which have been paid by any municipality

within thirty days of the approval thereof by the state entomologist, shall be certified by the treasurer of such municipality to the comptroller during the first ten days of January, April, July, and October in each year, and one-half the amount thereof expended during the quarter next preceding shall be paid by the state, and the comptroller shall draw his order on the treasurer in favor of the treasurer of such municipality for such amount, provided the amount which the state may expend in any year, including the compensation of the assistants or deputies and other expenses, and the expenses of the state entomologist, with the cost of apparatus and equipment, shall not exceed the sum appropriated for the suppression of the gipsy and brown tail moth for any year, and provided the portion of the expense for which any municipality shall be liable in any year under the provisions of this act shall not exceed seven hundred and fifty dollars.

SEC. 4. Any person who shall hinder or obstruct the state entomologist, his assistant, deputy, or any agent appointed under the provisions of this act, or any other person employed by him, while engaged in the suppression of such moths, shall be fined not less than five nor more than fifty dollars. No action for trespass shall lie against any person authorized under the provisions of this act, or against any duly authorized agent of the United States department of agriculture, for necessary damage done while engaged in the performance of his duties in suppressing such moths.

SEC. 5. The state entomologist shall report to each regular session of the general assembly, during the first week thereof, his doings and expenses incurred under the provisions of this act, with such recommendations as he may deem advisable.

Approved, May 18, 1915.

As the old law gave the State Entomologist authority to do certain things, and also provided a heavy penalty for transporting living gipsy or brown-tail moths in any of their stages, it was thought best to let this law stand, rather than to repeal it and include its provisions in the new law. This old law is as follows:

CHAPTER 114, PUBLIC ACTS OF 1907.

AN ACT CONCERNING GIPSY AND BROWN-TAIL MOTHS.

SECTION 1. The insect commonly known as the gipsy moth and the brown-tail moth, being serious pests of vegetation, are, in all stages of their development, hereby declared to be a public nuisance.

SEC. 2. The state entomologist shall have authority to suppress and exterminate said gipsy and brown-tail moths, and may employ such assistants and laborers as he deems expedient; may cut and burn brush and worthless trees in fields, pastures, or woodlands, or along the roadsides on any public or private grounds; and may prune, spray, scrape, or fill cavities in any fruit, shade, or forest trees, or clean up any rubbish for the purpose of furthering said work. The said state entomologist,

or any of his assistants, deputies, agents, or employes, shall have the right, at all times, to enter any public or private grounds in the performance of their duties.

SEC. 3. Any person transporting living eggs, larvae, pupae, or adults of the gipsy or brown-tail moths into the state, or from an infested region within the state to a region not hitherto infested, shall be fined not more than one thousand dollars or imprisoned not more than one year.

SEC. 4. Any person wilfully obstructing or hindering said state entomologist or his assistants or employes, in the work of suppressing said insects, shall be fined not less than twenty-five nor more than five hundred dollars.

Approved, June 5, 1907.

BROWN-TAIL MOTH WORK, SEASON OF 1914-15.

By W. E. BRITTON AND IRVING W. DAVIS.

The gipsy moth having spread into the eastern end of Connecticut during the early summer of 1913, it seemed advisable to use our limited available funds in checking this pest rather than to spend any considerable portion of the money in scouting for the brown-tail moth which now infests about one-half of the State. For this reason there was less scouting for brown-tail moth nests than in any previous winter since the State became infested. This scouting, which was done by Messrs. J. H. Osgood and E. R. Sherman, consisted of working the row of towns just west of the present quarantine line to determine the spread of the moths during the year and in collecting nests in various towns already infested, to ascertain the presence of introduced parasites. This latter work was under the direction of the Federal Government.

Since the object of this scouting was merely to determine the spread of the brown-tail moth beyond the present quarantined area, each town bordering this line on the west was scouted and if no nests were found the entire town was covered; when nests were taken, showing that town to be infested, the scouts immediately proceeded to the next town west. Seventeen towns were thus visited and only three towns found infested for the first time; namely, Wethersfield, Newington and New Britain. These three towns are near together in the central part of the State, and just south of Hartford and West Hartford, which have been infested for at least two years.

The following eight towns were scouted and brown-tail nests were cut for the purpose of recovering parasites:—Stonington, Lyme, Norwich, Lebanon, Chatham, Mansfield, Hartford and Suffield. In none of these towns were the moths found in large numbers, about 100 nests being taken in the eastern part of Stonington, 28 in Suffield, 12 each in Hartford and Norwich, while 10 were cut in Lebanon. In the three remaining towns, Lyme, Mansfield and Chatham, nothing was found. The finding of only 12 nests in Hartford is a notable feature, for it shows a marked decrease since two years ago when 747 nests were taken in that city.

Aside from this, reports have been received in regard to the prevalence of brown-tail moths in various towns within the district already infested, which indicate that the northeastern corner of the State, including the towns of Thompson, Woodstock, Putnam and Pomfret, are the most thickly infested at the present time. But even here the nests were not very abundant anywhere, and apparently less so than in 1912-1913 and 1913-1914. Nearly all nests were small and scattered and in many of them the larvae were dead. This may be due in part to climatic conditions, as there was a heavy frost in September, while the caterpillars were making their nests. It may also be in part due to parasites.

As only three new towns,—Wethersfield, Newington and New Britain,—were found infested, it hardly seems worth while to publish herein a map of the state showing the area infested by this insect, and the reader is referred to the map in last year's report (1914), page 135.

Introduced Natural Enemies.

Mention has been made at various times in this and preceding reports and bulletins that certain parasites of the gipsy and brown-tail moths had been introduced into this country, and that some of them had been colonized in Connecticut. Some of these attack both gipsy moths and brown-tail moths. Some have been colonized in Connecticut, while others have spread into the State from Rhode Island and Massachusetts.

For the following records we are indebted to Mr. A. F. Burgess, who is in charge of the moth work for the Federal Bureau of Entomology. Most of the recoveries have been made from brown-tail nests.

Apanteles lacteicolor Viereck, a small hymenopterous or four-winged fly parasitic on brown-tail caterpillars, was colonized in 1912 at Putnam; in 1913 at Killingly, Hampton, Plainfield, Griswold, Norwich, Stonington, Mansfield, Suffield and Hartford; in 1915, at Lebanon, Chester and Manchester. Recovered in 1913 from Thompson, Woodstock, Pomfret, Stafford and Somers; in 1914, from Hartford and Waterford; in 1915, from Suffield and Stonington.

Pteromalus egregius Foerster, a minute four-winged fly parasitic on brown-tail caterpillars, not colonized, but recovered from Hartford in 1913 and in 1915.

Monodontomerus æreus Walker, a minute four-winged fly parasitic on the pupae of both gipsy and brown-tail moths. Not colonized, but recovered from Putnam in 1911, and from Suffield and Hartford in 1913.

Meteorus versicolor Wesm., a minute four-winged fly parasitic on brown-tail caterpillars. No attempted colonization, but cocoons were probably mixed with those of *Apanteles lacteicolor*. Recovered from Hartford in 1914.

Compsilura concinnata Meigen, a medium-sized two-winged fly parasitic on the caterpillars of both the gipsy and the brown-tail moths. Colonized at Putnam in 1912; at Hartford, 1913; at Mansfield, Plainfield and Stonington in 1914, and at Stafford, Suffield, Colchester, Norwich and Old Lyme in 1915. Recovered from Woodstock in 1913.

Calosoma sycophanta Linn. A large predaceous ground beetle which in both its larval and adult stages feeds upon gipsy caterpillars. A colony was planted at Stonington in 1914. Recovered in 1914 from Thompson, whence it had probably spread from Massachusetts or Rhode Island. On May 24, 1915 an adult of this species was taken at light by Mr. Harry L. Johnson, at Meriden, at least 40 miles from the nearest known point where a colony had been liberated.

It seems, therefore, that these natural enemies of the gipsy moth and the brown-tail moth are well established in Connecticut and may be counted upon to aid in holding these pests in check. It will be many years, however, before they can become sufficiently abundant to control these pests absolutely, and perhaps that time may never come. Artificial control measures must be practiced, in order to reduce to the minimum the areas infested.

FUTURE MOTH WORK.

The new law, printed on page 108 of this report, provides that towns carry on suppression work against both the gipsy and brown-tail moths, when instructed to do so by the State Entomologist, and under his direction. Effective work against the gipsy moth can be done only by men who have had experience and careful training, and it would be difficult to find such men who could be appointed as town agents to do this work. Consequently we deem it advisable, at least for the present, to leave the gipsy moth work entirely in the hands of trained men employed directly by the State Entomologist and by the Federal Bureau of Entomology.

On the other hand, certain towns will be asked to cut off the brown-tail moth nests, especially where the insect is abundant and threatens to become a great nuisance, or where there is particular danger of its spreading to new territory.

These plans, however, are subject to change and revision whenever conditions warrant it.

EXPERIMENTS IN CONTROLLING THE CABBAGE MAGGOT IN 1915.

By W. E. Britton and Quincy S. Lowry.

One of the most important insect pests of early cabbages in Connecticut is the cabbage root maggot, *Phorbia brassicæ* Bouché, which was described in the Report of this Station for 1914, page 142, and on page 152 of the same Report is given an account of the experiments in controlling this insect in 1914.

In 1915, the maggots were very abundant and did more damage than usual; consequently the season was particularly favorable for control experiments. The warm weather of the latter part of April caused the adult flies to appear unusually early and the first eggs were found April 28th.

Experiments at Station Farm.

For the purposes of this experiment there was assigned a small field having an area of about half an acre, at the Station farm at Mt. Carmel, its greatest dimension, and consequently the rows, extending nearly north and south. On this land soy beans had been grown in 1914, and before setting the plants, the ground was thoroughly plowed, harrowed, and enriched by an application of about 800 lbs. of a complete home-mixed chemical fertilizer. No stable manure was applied. This field is shown on plate VI, a.

The plants used were purchased from A. N. Farnham of New Haven. The seed was sown February 22d, and the young plants transplanted into cold frames March 16th. On April 16th, they were set in the field, in 16 rows and about 18 inches apart in the row. The varieties were Early Jersey Wakefield 5 rows, Copenhagen Market 5 rows, Succession 5 rows, and one row of Market Gardener's No. 2. Each variety filled the entire space in the rows, which were about 550 feet long and contained 362 plants per row, and a total of about 5,800 plants.

The field was divided crosswise into twelve equal sections, each containing 480 plants, the varieties mentioned being proportioned the same in each section. As the south end was considerably higher than the north end, treatment was duplicated in order to act as a check on the final results. Hot and dry weather followed the setting of the plants, and some of them were watered several times. Nevertheless, a number of plants died and were replaced a few days later with plants of the same varieties.

The first maggots were found on May 18th, and as might be expected were most abundant on the lower or north end of the field. The sections were numbered beginning at the north end and were given treatment as follows:

Sec.	Treatment	Sec.	Treatment
1.	Tarred paper disks.	7. 8.	Poisoned bait to kill adults.
2.	Check (no treatment).		
3.	Crude carbolic acid emulsion.	9.	Sludge (Lime-sulphur).
4.	Naphthaline (moth balls).	10.	Crude carbolic acid emulsion.
5.	Corrosive sublimate.	11.	Check (no treatment).
6.	Sludge (Lime-sulphur).	12.	Tarred paper disks.

As these were all early varieties, the damage caused by the maggot was apparent in May and early in June. A careful examination of all plants was made June 18th and the results are included in the following descriptions of the various treatments:

Sections 1 and 12. Tarred Paper Disks.

The hexagonal disks, described in the Report of this Station for 1914, page 147, were used in this experiment and were applied shortly after the plants were set in the field. Though many eggs were laid on, under and around these disks, a comparatively small

number of plants were damaged by the maggots. As has already been stated, maggots were more abundant in Section 1 at the lower end of the field than on Section 12 at the upper end, a total of 24 plants in Section 1, and 19 plants in Section 12, or an average loss of 4.4 per cent. were killed by maggots. This was the most effective of any treatment tested in this experiment, as the table on page 117 will show.

Sections 2 and 11. Check (No Treatment).

In Section 2, 157 plants were killed as against 24 plants in Section 1 adjoining. The difference is well shown on plate VI, b, photographed on June 18th. In Section 11, 67 plants were killed by maggots, making a total average loss of 23.3 per cent. where no treatment was given.

Sections 3 and 10. Crude Carbolic Acid Emulsion.

The second best results were obtained from the use of crude carbolic acid emulsion prepared after the following formula:

Hard soap, 1 lb., or soft soap, 1 qt.
Boiling water, 1 gal.
Crude carbolic acid, 1 pt.

Dissolve the soap in the boiling water, add the acid and churn as in making kerosene emulsion. This mixture thickens on cooling, and should be diluted with 30 times its bulk of water before using.

Two applications were given to the plants, April 28th and May 27th, about three fluid ounces being poured from a ladle into a depression around the stem of each plant. The loss resulting from the attack of the maggots was 31 in Section 3, and 27 in Section 10, an average loss of 6 per cent.

Section 4. Naphthaline (Moth Balls).

Naphthaline was tried again this year, one moth ball being placed about 1½ inches from the stem of each plant, directly after setting. A loss of 17.5 per cent. was obtained in this section, which was not duplicated.

Section 5. Corrosive Sublimate or Mercuric Chloride.

Corrosive sublimate, being recommended by market gardeners to kill maggots, was given a trial in Section 5. It should be applied as soon as the first maggots appear.

Formula used:—4 ounces corrosive sublimate to 55 gallons of water. This section was treated May 19th and again May 27th,

about one teacupful of the solution being applied around the stem of each plant. A loss of 14.7 per cent. was the result. The treatment was not duplicated elsewhere.

Sections 6 and 9. Lime Sulphur Sludge.

This material is a waste product from the manufacture of commercial lime-sulphur and was tried last year with results which seemed to warrant further tests. It is diluted with water and applied in the form of a paste, which with the soil hardens on drying, forming a disk similar to the tarred disks, about four inches in diameter. This treatment proved itself the third best treatment tried last year and ranks the same again this year.

The sludge was diluted five times its bulk with water, about three fluid ounces being applied to each plant. One application was made on April 26th. The resulting loss was 69 plants in Section 6, and 35 plants in Section 9, or a total average loss of 10.8 per cent.

Sections 7 and 8. Poisoned Bait (Adult Treatment).

This poison in a sweetened mixture and sprayed upon the leaves has been found an effective method of controlling the onion maggot in Wisconsin by Professor J. G. Sanders. Consequently it was given a trial against the cabbage maggot in Sections 7 and 8. It should be sprayed upon the foliage of the plants as soon as possible after setting, in order that the flies may feed on this sweetened poisoned spray and be killed before laying eggs. The following formula was used:

1 gram sodium arsenite
1 gallon water
¼ pint molasses.

The result was an average loss of 15.8 per cent. by maggots. No injury was caused to the foliage by the spray.

Summary of Results Obtained in 1915.

Treatment	No. Plants	No. Infested	Per cent. Infested
Tarred Paper Disks	960	43	4.4
Crude Carbolic Acid Emulsion	960	58	6.0
Lime Sulphur Sludge	960	104	10.8
Corrosive Sublimate	480	71	14.7
Poisoned Bait	960	152	15.8
Naphthaline Balls	480	80	17.5
Check	960	224	23.3

Experiments at Mr. A. N. Farnham's.

On May 10th a complaint was made by Mr. Farnham that there were a great many cabbage maggot flies laying eggs on and underneath the tarred paper disks which had been applied to his entire field of cabbages. The field was examined and found to be quite badly infested. Eggs were found under the disks, due to the fact that most of the disks were not properly applied. The disks were removed from the field, and on 12 rows, each row containing 50 plants, crude carbolic acid emulsion was applied around the stems of the plants.

On May 20th the field was examined. At a glance one could tell just where the treated section was located in the field. Out of the 600 plants treated only two were badly wilted due to the attack of the maggot, while on either side of the treated section there was a loss, in some rows of one-third, by maggot injury. A second application was given May 24th. On June 21st a final count was taken. There was a loss of 24 plants or 4 per cent. in the crude carbolic acid emulsion section and 120 plants or 20 per cent. killed in the check section adjoining.

A DESTRUCTIVE EUROPEAN PINE SAWFLY IN CONNECTICUT.

Diprion (*Lophyrus*) *simile* Hartig.

While inspecting a nursery in New Haven, August 1914, with my assistants, Mr. I. W. Davis and Mr. M. P. Zappe, we noticed some sawfly larvae feeding upon pine trees. The work continued for several days and in another part of the nursery these larvae were even more abundant. We gathered all that could be found, and where they were thickest all hands spent an hour or more collecting them. All of this material was taken to the laboratory.

Prior to this time Dr. Alexander D. MacGillivray had prepared the manuscript on sawflies for the Hymenoptera of Connecticut, which is now in press; he has also made a study of sawfly larvae, and has requested that material be sent him. Supposing this sawfly to be a native species, though unfamiliar to us, we sent a portion of this material to Dr. MacGillivray, and placed the remainder in our breeding cages for the purpose of rearing the adults. Dr. MacGillivray was unable to identify the species from the larvae but thought that he might recognize it in the adult stage.

A male emerged from the cocoons in the cages, April 8, 1915, followed by others, and on April 15 the first female was obtained. Living specimens of both sexes were placed in cages containing potted white pines, and the females soon laid eggs.

I wrote a letter to Dr. MacGillivray April 21, informing him of the emergence of the adults. He looked in his own cages and found that the adults had emerged there also. He replied that he did not recognize the species but that it belonged to the genus *Diprion,* formerly known as *Lophyrus;* that the species are badly confused; and that Mr. S. A. Rohwer of the Bureau of Entomology at Washington was trying to straighten them out and had already examined many of the types in the British Museum. He suggested that material should be sent to Mr. Rohwer. This was done on May 6, and Mr. Rohwer soon replied as follows:

> I have determined this species, tentatively, as *Diprion simile* Hartig. The adults agree more closely with those in the collection under the name *pini* but the larvæ answer exactly the description of *simile,* and as these two species are very closely allied and easily confused in the adults I have made the determination from the larvæ rather than from the adults.
>
> This species is one of the most injurious sawflies on European conifers and has been associated in practically all of the depredations caused by *pini,* and is recorded in the literature in a number of cases under the name of *pini.* You are no doubt familiar with the economic importance of *Diprion pini* in Europe. It is highly important that immediate measures be taken to combat this injurious insect as it has a large number of host trees and would no doubt adapt itself readily to the conditions in America, where, if it were thoroughly established without its parasites, it would do a great deal of damage.

With Mr. Rohwer's help and approval, a brief article, calling attention to the presence of this insect in America and containing a description and illustrations, was prepared and sent to the Journal of Economic Entomology for the June number. (See Vol. 8, page 379.) The illustrations are reproduced as plate VII of this report.

Distribution in Connecticut.

At the time of publishing the article, this insect had been found only in New Haven. Since then other areas have been examined

with the result that the larvae were found in five separate towns, as follows:—New Haven, Derby, Hartford, New Canaan and Greenwich. The pest is, therefore, apparently established within the state and perhaps already occurs in other states. It is therefore probably too late to carry out exterminative measures with success.

Distribution and Damage in Europe.

As there is some question whether or not *simile* is distinct from *pini,* its distribution as given in the literature is rather uncertain. In some cases both species are mentioned as occurring together, and in others, all injury is credited to *pini.*

For several years *Lophyrus pini* has seriously damaged the pine forests of Southwestern Russia,* especially the young trees. This species was particularly destructive in France† in 1906, and it has also done damage in Prussia and in Sweden. In England it is said to injure Scotch Fir‡ as well as pine.§

Habits and Injury.

The larvae of the first brood feed upon the older, instead of the newly-formed leaves. When the new leaves become mature they may serve as food for the larvae of the second brood. In this way the larvae are able when abundant to entirely defoliate the tree, which will then soon die. Plate IX shows two trees, perhaps six or seven feet tall, which were almost defoliated. Some of the cocoons are fastened to the twigs of the host tree as shown on plate VII, 3. Others are found beneath the dead leaves and other rubbish on the ground. In Europe it is said that the first brood cocoons are fastened to the twigs, and those of the second brood placed upon the ground. In our breeding cages, all cocoons were made on the twigs.

Life History.

There were two complete generations in our breeding cages in 1915, and males of the third brood emerged late in the fall.

* Review of Applied Entomology, Vol. I, pp. 395 and 493, 1913.

† A. Barbey, Traité d'Entomologie Forestière, p. 269, 1913.

‡ W. E. Collinge, A Manual of Injurious Insects, p. 217, 1912.

§ E. A. Ormerod, Manual of Injurious Insects and Methods of Prevention, p. 250, 1890.

There were no females of the third brood, but as some of the first-laid eggs of this brood failed to hatch on account of the food becoming dry, it is possible that a third brood may occur under favorable conditions. These broods are not well separated. The first adults emerged from their cocoons in April and continued to emerge through May and even until July 6th. Meantime the early-hatched larvae had reached maturity and had spun their cocoons by the middle of June.

The second brood larvae feed during August and September. The larval state, on the average, lasts about 30½ days.

This species like many other sawflies is strongly parthenogenetic; unfertilized eggs not only hatched but the larvae developed normally to the pupa stage, in which condition they are now passing the winter.

Food Plants.

In Connecticut we have found the larvae feeding upon the white pine, *Pinus strobus;* the Japanese or Bhotan pine, *P. excelsa;* the Austrian pine, *P. laricio* var. *Austriaca;* the Scotch pine, *P. sylvestris;* the Mugho pine, *P. montana;* the Korean pine, *P. Koraiensis; P. densiflora; P. cembra* and *P. flexilis.* Newly-hatched larvae died on Austrian pine but after the first molt were able to mature upon it. Probably the older larvae will be able to subsist upon almost any species of pine and possibly upon other conifers.

Description.

The following description was published in the Journal of Economic Entomology, Vol. 8, page 380, and should enable one to identify the insect:

Egg.—The eggs are laid end to end in slits made along one of the ridges at the edge of the needle. The eggs are pale blue in color, smooth and slightly shining. The sides are parallel with the ends rounded. Length, 1.25 mm., thickness, .33 mm. In the material examined the newly laid eggs were slightly separated in the slits. The eggs before hatching increase in size, becoming crowded in the slits so that the ends are flattened like peas in a pod.

Larva.—Length, 25 mm. (1 inch) to 28 mm. (1 1/8 inches). Thickness, 4 mm. (5/32 inch). Head black, body greenish yellow with a mid-dorsal double stripe of brown extending the entire length. On either side of the dorsal stripe is a yellow stripe broken with transverse markings of brown. The remainder of sides dark brown with many

irregular yellow or whitish spots. Ventral surface pale yellow or white. Pro-legs yellow with a transverse black mark at base, true legs marked with black and yellow.

COCOON.—9 mm. long (about 3/8 inch), thickness about 5 mm., oval in shape, tough leathery and fairly smooth. Color, sepia.

MALE.—Wing-spread, 14 mm. (9/16 inch). Length, 7 mm. Large pectinate antennæ. Head and pronotum coarsely punctured. Head, antennæ and body, black. Cerci and tip of the last abdominal segment, orange. Legs yellow, with the trochanters and basal two-thirds of the femora, brownish black.

FEMALE.—Wing-spread, 20 mm. (little over 3/4 inch). Length, 8 mm. (5/16 inch). Robust, head and antennæ black. Thorax coarsely punctured, yellow with a large shield-shaped black spot on mesothorax, extending from the anterior margin and covering about two-thirds of the space between the parapsidal grooves. On either side are a pair of L-shaped black marks which approach each other posteriorly. Posterior margin of the mesothorax, postscutellum and prosternum, black. Abdomen yellow with dorsal surface of 3d, 4th, 5th, 6th, and the anterior portion of 7th segment, black. Legs yellow with the outer surface of hind femora, the apex of the middle and hind tarsi, dark.

Other illustrations of cocoons and larvae are shown on plate VIII.

PARASITES.

One dipterous and three hymenopterous parasites have been reared from *Diprion simile* in Connecticut: all are native American species and we are indebted to Mr. S. A. Rohwer of the Bureau of Entomology for their identification. Tachinid eggs are frequent upon the larvae and one adult fly emerging from the cocoons proved to be *Exorista petiolata* Coq. Of 152 overwintering cocoons, 46 or about 31 per cent. were parasitized by a small chalcid fly, *Pachyneuron (Dibrachys) nigrocyaneus* Norton. One specimen each has been reared of the ichneumonid, *Hemiteles utilis* Norton, and a species of *Cerambycobius*.

It is evident that *Diprion simile* is freely attacked here by American species of parasitic Hymenoptera and Diptera, but it is not known as yet whether any European species were brought into this country in the cocoons of the sawfly.

POSSIBLE MANNER OF INTRODUCTION.

It will probably never be known just how this sawfly was introduced into the United States. The most plausible theory is that it came on nursery stock.

Since 1909, when nests of the brown-tail moth were found on nursery stock coming into this country, an attempt has been made to inspect all shipments of field-grown woody stock coming into Connecticut from foreign sources. At first we were unable to trace all shipments and therefore a few escaped inspection, but since the establishment of the Federal Horticultural Board in 1912, the system of notices and permits has enabled us to make the inspection more complete. On account of the blister rust diseases and the pine shoot moth, all pines are now prohibited from entering the United States from Europe.

It is quite probable, however, that a few cocoons attached to the leaf-covered twigs escaped notice, and cocoons might easily be brought in the burlap-covered ball of earth at the roots. Possibly this insect was thus introduced in the very nursery where it was first discovered, though several Connecticut nurseries have imported pine trees, and any one of them might easily have become infested in this way.

DANGER TO PINE GROWING IN AMERICA.

Just how serious a pest this sawfly may become in the United States is impossible to foretell. Any introduced insect which feeds upon an important crop is dangerous; doubly so if its natural enemies are left behind. The food plants of *Diprion simile* are abundant here and the climate seems to favor it. Therefore, it is probably a question of parasites and other natural enemies. It is encouraging to learn that our native species attack it.

MEANS OF CONTROL.

In the infested nurseries the owners were required to spray the pines with lead arsenate (3 lbs. in 50 gallons of water) late in summer when the larvae were feeding. Afterwards a careful inspection was made of each tree and all cocoons removed. These precautions seemed necessary to reduce to the minimum the danger of further distributing the pest on nursery stock.

Pines planted on private grounds can likewise be sprayed, but the cost would be prohibitive in large forests.

In Europe, raking up and destroying the leaves and other rubbish under the trees in fall is recommended to destroy the cocoons.

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THE LARCH SAWFLY.

Lygæonematus (*Nematus*) *erichsoni* Hartig.

Although the larch sawfly has undoubtedly occurred in Connecticut for many years, not since this department was established in 1901 has the insect been noticed by any member of the staff until the season of 1915. On July 13th, larvae were received by mail from Mr. N. S. Stevens of East Canaan, from trees on the place of Mrs. Annis Porter. As most of the larvae were either dead or about ready to transform, Mr. Zappe was sent to the place at once to make a record of the conditions there. He found two larch or tamarack trees growing in a grove of white pines, which had been entirely defoliated by the larvae. At this time nearly all had transformed and Mr. Zappe collected a good number of pupae from the surface of the ground under the trees. Later Mr. Lowry happened to visit this corner of the state and made a photograph of these trees, which is reproduced on plate V, b.

On July 14th, a number of living larvae were received from Mr. Francis H. Adriance of New Canaan, who wrote as follows:

> I am sending under another cover a number of caterpillars or worms which I found eating the foliage of a Japanese larch tree, which has been growing on my place for a number of years, and until this season has been free from insect pests.

On July 16th Mr. Walden visited Woodstock, where a small area of larch had been partially stripped, and made the photograph reproduced on plate V, a.

The writer visited Windham county the last week of July and from the train observed several small areas of larch which, on account of the defoliation, were brown as though damaged by fire.

Mr. Davis also observed that this insect was feeding on larch trees in Pomfret and in Waterford, yet certain trees in Putnam and Plainfield showed no signs of attack.

Mr. W. O. Filley, State Forester, observed the caterpillars on one large tree in Litchfield, two or three large trees in Cornwall, and on a few small trees in Union. Assistants inspecting nurseries in various parts of the state in August and September, examined many small trees, which were not eaten, and a small larch on the Station grounds was also examined and found not infested.

Distribution and Damage in America.

The larch sawfly was first noticed in this country in Massachusetts by Hagen, who published in 1881 a note in the Canadian Entomologist regarding the insect. In 1881 and 1882 it caused much damage in Maine. In 1883, many square miles of larch swamps in New York were infested. In 1892 it was reported from Pennsylvania as injuring hemlock. In 1910, according to Ruggles,* it caused great injury to tamarack in Northern Minnesota. At various times there have been destructive outbreaks in southeastern Canada, the worst occurring in 1882 and in 1906. Hopkins† estimates that it has killed from 50 to 100 per cent. of the mature larch over vast areas in the northeastern states and southeastern Canada during the extensive outbreaks since 1880.

In Canada the pest seems to be gradually spreading westward and Dr. Hewitt‡ states that in eastern Canada (and probably the same holds true for the northeastern United States) the distribution of the larch sawfly corresponds with that of the American larch.

Distribution and Injury in Europe.

The larch sawfly has been reported at various times during the last 75 years in Germany, Switzerland, Holland, Denmark, Sweden, Finland, England, Scotland and Wales. According to Dr. Hewitt§ this insect is not known to occur in France but has

* Canadian Entomologist, Vol. 42, page 93, 1910.
† Bureau of Entomology, Bull. 58, page 60, 1909.
‡ Can. Dept. of Agr., Bull. 10, 12, 1912.
§ Can. Dept. of Agr., Bull. 10, second series, page 9, 1912.

been destructive in Great Britain, where in the Lake District 15,000 trees had died in 1909 from its attacks.

Food Plants.

The larch sawfly feeds upon the various species of larch (*Larix*) including the American larch, *Larix americana;* the European larch, *L. europæa,* the Japanese larch, *L. leptolepis,* and the Siberian larch, *L. sibirica.* Although it was reported as attacking hemlock in Pennsylvania in 1892, Dr. Hewitt* was unable to make it feed upon various species of spruce (*Picea*), fir (*Abies*), and pine (*Pinus*) in Canada.

Habits and Injury.

The larch sawfly injures the trees, in both its adult and larval stages—the female by cutting into the new shoots to lay eggs, and the larvae by devouring the leaves. Dr. C. Gordon Hewitt has published illustrations showing the distorting effect on the branches by the injury to the shoots by the adults, which he describes as follows:

> In depositing the eggs, the sawfly invariably chooses the young, green, terminal twig in which to insert the eggs, as I have already indicated in describing the oviposition. The result of the injuries inflicted during this process is that the terminal twig either dies or is permanently injured and distorted. Where a large number of eggs have been deposited all round the length of the young terminal shoot, it usually turns brown and dies and the presence of these curled-up, brown, dead terminal shoots often serves to indicate the presence of the larvae on the tree. When the terminal shoot is killed in this manner the growth is arrested and the form of the tree may be affected. In many cases the eggs are deposited along one side only of the young terminal shoot, with the result that the growth on that side is seriously interfered with and retarded, causing the shoot to curl in the direction of the injured side. The extent of the curvature varies, but not infrequently it will curve through a complete circle and continue growing in the original direction.
>
> When the apical terminal shoot is affected in either of the above ways, the result is serious to the growth of the tree. If the shoot is killed, its place is usually taken by a lateral shoot which will affect the straight character of the subsequent timber. Where the shoot is not killed, but is bent or curled, a permanent kink may be caused. In those parts of Canada in which the sawfly was abundant and destructive in the years

* Ibid.

1882-6, the effect of the injury of the sawflies to the apical terminal shoots of the young trees constituting the second growth at that time on the growth of the trees is very plainly shown by the crooked character of the trunks of young trees which have now grown up and are upwards of thirty years old. The effect of this type of injury upon the young trees whether the growth is natural or planted is a serious one as affecting the ultimate value of the trees as timber. Further, it is an injury which cannot be prevented if the adult sawflies are present.*

As soon as the eggs hatch the young larvae begin to feed; at first eating notches in the sides of the leaves, causing them to wither and turn brown. Later they devour the entire leaf, commencing at the tip. The defoliation usually begins on the lower branches, and if the insects are abundant the entire tree is soon stripped. Closely-planted trees and those growing in a native forest are more seriously injured than isolated or scattered larch trees growing in the open. This is because the tree in a thick woodland has only a few leaves at the ends of the branches, or perhaps at the top. If these are eaten there are only a few buds to produce new leaves and consequently the tree is unable to manufacture cell tissues from its sap. The tree grown in the open country is often covered with leaves, from the tip to the base of the branches and sometimes on the main stem. Under these conditions, frequently some of the leaves escape destruction, and the defoliation, therefore, is not complete. Even when all leaves are eaten, the tree is able to recover sooner than a crowded tree in the forest, probably on account of the more abundant supply of light, air and moisture. In cases of complete defoliation in midsummer, especially if followed by rains, the buds which normally remain dormant until the following spring, open and produce tender leaves which are usually killed by the early frosts. The trees are not able to form other strong buds for the next year and consequently they are greatly weakened. Complete defoliation for three successive years will kill the trees. Even where the defoliation is only partial, the vitality of the tree is so reduced that it soon falls a prey to the bark beetles of the family Ipidæ or Scolytidæ. One of the most destructive of these is the eastern larch beetle, *Dendroctonus simplex* LeC.

* Division of Entomology, Can. Dept. of Agr., Bull. 10, second series, page 18, 1912.

Life History.

There is probably only one brood each year. The winter is passed as a larva inside the cocoon, the real pupa not being formed until the following spring as is the case with other sawflies.

The eggs are laid in May in Ontario, and hatched in eight to ten days. The larvae then feed for a period varying from three to four weeks, then make their cocoons. The different individuals, however, do not all emerge and undergo their transformations at the same time. Thus, eggs from late-emerging females may produce newly-hatched larvae which feed side by side with those which are nearly mature.

The larch sawfly, like many other sawflies, is parthenogenetic: that is, the females lay unfertilized eggs from which the larvae hatch and develop normally. Consequently the females greatly outnumber the males.

Dr. C. Gordon Hewitt, Dominion Entomologist of Canada, records* obtaining 6,158 females and 23 males from a total of 6,181 cocoons.

Description.

Egg.—About 1.5 mm. in length, white, cylindrically oval, though on account of unequal pressure where deposited the eggs vary somewhat in shape. The eggs are wholly inserted in a slit made by the female in the tender terminal shoot.

Larva.—The newly-hatched larvae are greenish-white and 2 mm. long. In a few hours they show a green color and the head becomes brown. They have the habit, common to many sawfly larvae, of turning their posterior extremities upward and forward over their backs. They do not feed upon the leaves of the terminal shoots but devour those around its base. The fully-grown larva is from 16 to 18 mm. (about three-fourths of an inch) in length and of a dull grayish or olive green color dorsally with a small area back of the head and the ventral surface pale green. The head and legs are black. The skin is folded transversely and on some of these folds are rows of minute warts or tubercles. Small scattered tubercles occur on the back and small brownish spines are scattered over the body. There are seven pairs of abdominal appendages or prolegs. The mandibles have four teeth and the maxillae are four-jointed.

There are probably five instars, or stages between molts, from the hatching of the egg to the spinning of the cocoon.

* Division of Entomology, Can. Dept. of Agr., Bull. 10, second series, page 13, 1912.

COCOON.—The cocoon is about 10 mm. long and half as thick, cylindrical, with ends bluntly rounded. The color is dark brown and the outside is firm and tough. It is fibrous or leathery in appearance. The cocoons are formed in the ground or on the surface underneath the litter and near the base of the tree. Inside the case the larva remains until the following spring, assuming the pupa stage about two weeks before the adult emerges.

ADULT.—The female is about 11 mm. (nearly half an inch) in length with a wing-spread of about 20-22 mm. (four-fifths of an inch). Head, antennae, thorax, base of first segment and apex of abdomen shining black, distal portion of first, second, third and fourth abdominal segments, femora, tips of anterior tibiae and their tarsi orange-yellow; basal two-thirds of tibiae yellowish-white. Forewings infuscated near center, anal vein whitish, costa fulvous, all other veins black; rear wings not infuscated, veins black.

Male smaller and more slender than the female, black except antennae, a part of the first, second, third, fourth and all but the lateral portions of the fifth and sixth abdominal segments, and legs, which are reddish-yellow. Wings as in female.

Larvae and pupae are shown on plate IV, a.

NATURAL ENEMIES.

The chief factors in the control of the larch sawfly are its natural enemies, which consist of birds, mammals, a large number of parasitic and predaceous insects, and a fungous parasite. The natural enemies have been studied and recorded in Canada by Dr. Hewitt and it is from his publications that a large part of this chapter is taken.

The meadow mouse and the deer mouse destroy large numbers of the cocoons by gnawing holes at one end and eating out the contents.

Several kinds of birds feed upon the younger larvae.

An ichneumon fly, *Mesoleius tenthredinis* Morley, is parasitic on the larch sawfly in England and has been introduced into Canada and liberated at several places.

A small native chalcid parasite, *Cœlopisthis* (*Pteromalus*) *nematicida* Packard occurs in Massachusetts and no doubt also in Connecticut. Apparently this chalcid is an important natural check on the species.

A species of *Diglochis* parasitized from ten to fifteen per cent. of the cocoons in Minnesota in 1909-1910. A species of *Perilampus* emerged from cocoons collected in Wisconsin in 1909, and Lintner reared a *Microgaster* in New York in 1885.

In England, *Microcryptus labralis* Grav., *Aptesis nigrocinctor* Foerster, *Spilocryptus incubitor* Ström, *Cœlichneumon fuscipes* Grav., *Gratichneumon annulator* Fabr., and *Cryptus minator* Grav., all ichneumon parasitic flies, have been reared from the larch sawfly.

A tachinid fly, *Frontina* (*Masicera*) *tenthredinidarum* Townsend, was reared from *L. erichsoni* in New Brunswick in 1910 and two species of *Exorista* attack this sawfly in England.

A soldier bug, *Apateticus* (*Podisus*) *modestus* Dall., preys upon the larvae in Quebec and in New York state. This species occurs also in New Jersey and probably will be found in Connecticut.

A fungus, *Isaria farinosa* (Dicks) Fr., grows upon the cocoons in Canada and in England, destroying the insect within. This fungus appears to be widely distributed and may prove an important check under favorable climatic conditions. Its artificial use, however, is of questionable value.

CONTROL MEASURES.

Spraying.—In small plantations like those of Connecticut, and with ornamental trees in parks and on private grounds, spraying with poison, preferably lead arsenate, will prevent defoliation. Just what proportions should be advised without definite experiments in Connecticut is a question. It is almost certain that three pounds of the poison in fifty gallons of water will suffice, and it is more than probable that half as much poison will answer, as sawfly larvae are easily killed. In the larch plantations of Connecticut, which have medium-sized trees and are only a few acres in extent, spraying by means of one of the large power sprayers like that shown on plate IV, b, of this report is perfectly practicable and can be done at a cost varying between five and ten dollars per acre, depending, of course, upon accessibility, nearness of water, and the cost of labor. If the trees are small, it will cost much less. In large forest areas, even this kind of spraying treatment would be out of the question. A few ornamental trees can easily be sprayed with hand-power pumps. Spraying, in order to be effective, should be done during the first half of June.

Destroying Cocoons.—Raking together the cocoons from under the trees and burning them has been suggested as a control measure, but the cost of this is so great as to be prohibitive.

Banding of Trees.—As many of the larvae are disturbed by storms and drop to the ground, it has been recommended that sticky bands like tanglefoot be placed around the trunks of trees to prevent the larvae from returning to feed upon the foliage. As many will not drop to the ground at all, and others only after they have done considerable damage, this banding method seems to be of doubtful value, especially under Connecticut conditions. The cost, too, would probably approach that of spraying, which would entirely save the foliage for the season.

Mixed plantings as a Preventive Measure.—In order that forest trees may not be killed over large areas by the depredations of this insect, it has been suggested that the larch should not be planted exclusively in a pure stand on such areas but should be mixed with other species of trees. As the larch also thrives better in mixed plantings, this recommendation should by all means be carried out, even irrespective of the larch sawfly. Mr. W. O. Filley, State Forester, regards the white pine as perhaps the best kind of tree to mix with larch in forest planting.

Prepare for a possible infestation in 1916.—It is generally impossible to predict insect outbreaks and the writer has no desire to pose as a prophet, but common sense teaches us that on account of the presence of this in destructive numbers in certain parts of the state in 1915, there is a possibility of a similar or worse attack in 1916. All owners of larch should watch their trees during May and be prepared to spray before the leaves have been seriously injured.

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EXPERIMENTS IN CONTROLLING THE WHITE PINE WEEVIL IN 1915.

By B. H. WALDEN.

In 1914 experiments to control the white pine weevil were started in a two-acre block of white pine (No. 29) in the plantation at Rainbow. The land was planted in the fall of 1907 with 3-year transplants, and in the spring of 1914 the trees were from

3 to 5 feet high. Weevil injury was first observed in 1913, and the infested leaders were removed about the first of July.

At the time the experiments were started the leaders were missing from 93 out of a total of 2,882 trees.

This loss was not all due to attacks of the white pine weevil. The leaders are sometimes injured by sun scald, broken by snow, and possibly weakened by aphids, and it has been the practice in the plantations when cutting the weeviled leaders to remove all that are dying or are seriously injured from any cause.

The plan of the experiment was to apply various treatments to sections of this block for a period of years, the trees being at this time at the age when the weevils usually begin their injury, and continue the experiment each year until the trees were too large to treat.

The block was divided into four sections:

On the first section the leaders were sprayed with commercial lime and sulphur, one part in eight parts of water.

The second section was left untreated as a check.

On the third section the leaders were sprayed with dry lead arsenate, 1 oz. in a gallon of water (3 lbs. in 48 gallons).

On the fourth section the weevils were collected with a net as recommended in the Report for 1914.*

In 1914 the lime and sulphur and the lead arsenate were applied May 7th and 8th.

On the fourth block the weevils were collected five times, viz; May 7th, 14th, 21st, 28th and June 3rd.

In 1915 the lime and sulphur and the lead arsenate were applied May 7th and 11th.

Six collections were made with the net on the fourth block, on the following dates:

May 7th, 14th, 24th, 28th, June 4th and 10th.

The following table shows the results of such treatment in 1914 and 1915:

Treatment	Total No. Trees	No. Trees Weeviled 1914	No. Trees Weeviled 1915
Lime and sulphur 1-8	830	2	2
Check	665	3	14
Lead arsenate 1 oz.-1 gal.	626	5	8
Net	761	6	7

* 14th Rept. State Ent. Conn., page 174.

In both 1914 and 1915 the smallest number of weeviled trees occurred where sprayed with lime and sulphur. In 1915 the lead arsenate and net gave about the same degree of freedom and the injured leaders were only about half as numerous as on the untreated or check trees.

Of course it will be necessary to continue these experiments for several years before any definite and conclusive results can be obtained.

FUMIGATING A GRAPERY WITH HYDROCYANIC ACID GAS TO KILL MEALY BUGS.

By B. H. Walden.

On January 20th, 1915, the writer superintended the fumigation with hydrocyanic acid gas of a grapery infested with mealy bug. This grapery was on a large estate in New Haven and the gardener had experienced considerable trouble with the pest. Various treatments, such as tobacco solutions and whale oil soap, had been applied without success. During the preceding season the house was infested to such an extent that it was necessary when cutting the grapes to wash practically every bunch to remove the bugs.

The house was 64 feet long and 24 feet wide, of modern construction and comparatively tight. The vines were planted along the side walls and had been pruned and scraped previous to fumigating.

The house contained approximately 17,440 cubic feet of space, and 5 lbs. of cyanide, or slightly less than ½ oz. to 100 cu. ft., was used, the formula being as follows:

Cyanide	½ oz. to 109 cu. ft.
Commercial Sulphur Acid	1 oz.
Water	2 oz.

Four generators were used. Owing to a difference in size in the generators, 1½ lbs. of cyanide was used in two, and 1 lb. in each of the others. The generators were placed on the ground through the center of the house, the larger ones being placed near either end.

The fumigation was started at about 5 o'clock in the afternoon and the house remained closed over night.

The treatment was successful, and no injury to the vines was observed. The crop of grapes was free from the mealy bugs, though the pest reappeared on the vines during the latter part of the summer, having been brought in from infested bedding plants growing near the grapery.

THE JUNIPER WEB-WORM.

Dichomeris marginellus Fabr.

On May 7th juniper twigs were received from Mr. George H. Hollister, Superintendent of Keney Park, Hartford, which had been webbed together and small larvae were feeding on the leaves in the web. The same kind of larvae upon *Juniperus communis* were received on June 7th from Mr. W. C. Homan of Meriden, and threatened to do considerable damage in ornamental plantings of this species. Mr. Hollister wrote:

> I am sending a package containing a branch of *Juniperus communis* with the nests or webs and some insect larvae with which I am not familiar. Will you kindly tell me what they are?

From Mr. Homan's letter I quote as follows:

> I am enclosing with this, a small branch cut from a common juniper, which was transplanted from the fields some four or five years ago and has grown very thriftily under cultivation ever since, but this year I find it completely infested with a small brown worm which has formed webmasses in nearly all the branches—similar to the one which I enclose. I also send a small bottle containing a few of the worms and chrysalids.
>
> I have other junipers near the one from which this branch was taken, some of which are infested and others which are not. I also have red cedars growing nearby—none of which are infested.
>
> I would like to enquire if you can advise any treatment to eradicate this pest, as I fear that I may lose all my junipers if the worms are not cleaned off. Any advice that you can give will be greatly appreciated.

In both cases it was advised that the worst branches be cut and burned and that the remaining portion of the junipers be sprayed with lead arsenate (3 lbs. paste or 1½ lbs. powder, in 50 gallons water).

Later the adults were obtained in our breeding cages and proved to be *Dichomeris marginellus* Fabr. Both larva and adult are shown on plate XVI, b and c.

This web-worm has probably been sent to the laboratory in preceding years but we thought that it might be *Phalonia rutilana* Hubn. and the adults were not reared. On November 4th, 1909, webbed juniper twigs were received from Greenwich, with the statement that the larvae feed all winter and do much damage to ornamental junipers. On May 21st, 1912, similar webbed twigs from red cedar were sent to the office from Wilton and a note was published in the report for 1912, page 295. This note states that the adults were not reared but that probably the insect was *Phalonia rutilana* Hubn., a species listed by Dyar* as occurring in Maine and New York. On April 9, 1914, larvae on Irish juniper were received from Greenwich. I am now satisfied that these insects were not *P. rutilana* but *Dichomeris marginellus* Fabr., which was first reported in New York State in 1910 by Dr. Felt.† In our specimens the larvae are nearly twice as long as the measurements given by Felt, but otherwise the description fits fairly well.

LARVA.—Length 10-12 mm. Body light brown (almost mauve) with narrow median longitudinal stripe, and two broader dorso-lateral stripes of darker or chocolate brown. Head, thoracic shield and legs dark brown or black, shining. The body segments bear scattered light-brown hairs, the length of which equals one-half the thickness of the body.

ADULT.—Length 7 mm., wingspread 15 mm. Forewings brown, with white front and rear margins, the white disappearing before reaching the apex of the wing. Rear wings heavily fringed, uniform pearl gray above and below, shining. Legs light brown, antennæ long and slender, dark brown. Thorax and abdomen above and below light brown with a tuft of creamy white hairs on head and prothorax.

The life history of this insect seems not to have been carefully worked out. The moths appear early in June. The larvae feed together in the webbed mass and the cocoons are formed in the web. Dr. Felt‡ states that the larvae feed quite as readily upon the dried as upon the fresh leaves and that there may be more than one generation each year.

In case of a serious attack, a thorough spraying of lead arsenate should prevent further damage. This application should

*H. G. Dyar, List of N. A. Lepidoptera, Bull. 52, U. S. National Museum, page 486, 1902.

†E. P. Felt, Report N. Y. State Entomologist, 26, page 35, 1910.

‡Ibid.

be made when the larvae are feeding, and preferably when they are small. The webs will then also be small, and if the larvae can then be killed little damage will result.

THREE SPECIES OF SCALE INSECTS NEW TO CONNECTICUT.

Leucaspis japonica Cockerell. On October 27, 1914, some material was received from the Frost & Bartlett Company of Stamford, which on superficial examination was pronounced oyster shell scale. The scales were on Norway maple. More material, including infested stems of California privet, were received from the same source on December 8, 1914, with a statement that the material was collected in Greenwich. Instead of the oyster shell scale, it proved to be a Japanese species, *Leucaspis japonica* Ckll.

The Frost & Bartlett Company sent some material from the same place to Dr. E. P. Felt, State Entomologist of New York, and Dr. Felt published a brief note regarding it in Journal of Economic Entomology, Vol. 8, page 160.

During the summer of 1915 (August 3rd) after a storm, a branch was broken from one of the silver maple trees on McKinley Avenue, New Haven. The writer noticed one day in passing that this branch was thoroughly covered with scales and on examination they proved to be *Leucaspis japonica.* The entire branch, which was perhaps one and one-half inches in diameter at the fracture, was then taken to the laboratory so that we now have considerable of this material.

The female scales are about the same color and greatly resemble those of the oyster-shell scale, though somewhat smaller and broader in relation to the length. They are about the same color as the bark. The males are not tricarinate as in the genus *Chionaspis.* Under the microscope the pygidium does not show any groups of ventral glands, as in the oyster shell scale, though there are a number of scattered glands.

This insect is shown on plate XII, c.

In the summer of 1910, while the gipsy moth work was in progress at Wallingford, Mr. Wâlden and the writer noticed on South Orchard Street several silver maples on which many of

the lower branches had been killed or severely injured by a scale insect which we took to be the oyster shell scale. No microscopic examination was made of it, and little attention was afterward paid to it. It is quite probable, however, that this scale on the trees in Wallingford was also the Japanese species.

Little seems to be known, or at least little has been published about this insect and its life history. Probably it can be controlled by some method of spraying but until some knowledge is gained of the life history of the species we shall be unable to suggest a vulnerable point of attack.

Lepidosaphes newsteadi Sulc. On February 3rd, 1915, we received from the Hartford Forestry Company some leaves of the umbrella pine, *Sciadopitys verticillata,* which were infested with unfamiliar scale insects. The scales were clustered along the veins, were longer than broad, and gray with whitish margins, as shown on plate XII, a. Specimens were sent to the Bureau of Entomology at Washington, where they were identified as *Lepidosaphes newsteadi* Sulc.

This species was described from Europe on tea, *Thea japonica,* and Kuwana has described the variety *tokionis* on *Codiæum* from Japan. Very little has been published regarding *newsteadi* and apparently little is known of its life history or of its distribution and food plants. It is probably too rare to become a pest.

Diaspis echinocacti Bouché var. **cacti** Comstock. This scale insect was received on *Phyllocactus* from West Hartford January 4, 1916. This is a common greenhouse scale which may attack nearly all kinds of cactus plants. It will probably not live out of doors in Connecticut, and has not hitherto been recorded from the state. It is nearly circular in outline and light gray or nearly white and is shown on plate XII, b. The remedies used against other greenhouse scales will probably control this species.

MOSQUITO CONDITIONS IN CONNECTICUT IN 1915.

Legislation.

In the report of this Station for 1913, page 242, mention is made of a law passed by the General Assembly of that year and of another measure which passed the House and Senate but was vetoed by the Governor.

A meeting of those interested in anti-mosquito work was held December 4, 1914, and the situation discussed. The meeting was unanimous in passing a resolution authorizing the chairman to appoint a committee to amend the former bill, to introduce it into the legislature, and to work for its passage. Accordingly this was done.

In due season a hearing was held before the Committee on Public Health and Safety, to which the matter was referred. A goodly number favored the measure and there was little opposition. When the measure came before the Clerk of Bills, he considered that it was not in proper form and needed redrafting, although the same bill substantially in the same form had been passed upon by the same Clerk at the preceding session.

Consequently the bill was entirely changed and in due time became a law, but on account of the unfavorable financial condition of the State no appropriation was granted. This law follows:

CHAPTER 264, PUBLIC ACTS OF 1915.

AN ACT PROVIDING FOR THE ELIMINATION OF MOSQUITO BREEDING PLACES OR AREAS.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

SECTION 1. The director of the Connecticut agricultural experiment station may make rules and orders concerning the elimination of mosquitoes and mosquito breeding places or areas, and he or his agents or employees may enter upon any swamp, marsh, or land to ascertain if mosquitoes breed thereon, or to survey, drain, fill, or otherwise eliminate any such mosquito breeding place.

SEC. 2. Whenever sufficient funds have been raised for the purpose by the state or by any city, borough or town in which such swamp, marsh, or land is located, or by voluntary contributions, said director shall drain, fill, or otherwise treat such place or area or cause any such place or area to be drained, filled, or mosquito breeding therein otherwise eliminated, and shall cause notice of any such order to be given to the owners of any such place or area by publishing a copy of such order containing a description of the place or area proposed to be drained, filled, or mosquito breeding therein otherwise eliminated, with the proposed plan of elimination, at least three times in a newspaper having a circulation in the locality where such place or area is situated, such publication to begin not less than ten days before beginning such elimination. Any person claiming to be aggrieved because of any such proposed draining or filling may, within ten days after publication of such notice, apply

to the superior court or any judge thereof in the county in which such land is located, for relief from such order, and shall cause a copy of such application to be served upon said director not less than six days before hearing thereon, and said court or such judge may make any proper order concerning the proposed plan of elimination of mosquito breeding.

SEC. 3. Any city, borough, or town wherein any such place or area has been drained to the approval of said director shall keep in repair and free from obstruction any ditch, canal, or drain connected with such place or area, and, upon order of said director, shall construct and maintain suitable tide gates, and may appropriate funds for such purposes and for use under the provisions of this act.

SEC. 4. Any person obstructing the work of examining, surveying, or ditching, or otherwise treating such mosquito breeding areas, or obstructing any ditch, canal, or drain, or the natural outlet of any marsh forming mosquito breeding areas, shall be fined not more than one hundred dollars, or imprisoned not more than ninety days, or both.

SEC. 5. This act shall take effect from its passage.

Approved May 18, 1915.

The Attorney General has given an opinion to the effect that Section 2 does not apply to any work done prior to the passage of the act.

A NOTABLE MOSQUITO YEAR.

Seldom are mosquitoes so abundant along the Connecticut coast as they were in 1915. The salt marsh mosquito, *Aëdes sollicitans* Walker, was chiefly responsible for the mosquito nuisance. It was breeding in nearly every undrained salt marsh. The chief contributing causes seemed to be an abundance of rain in July and August coupled with high tides. The latter flooded many of the salt marshes and the rains kept the depressions supplied with water. Consequently many communities were aroused and considered the advisability of draining salt marsh areas.

MAINTENANCE WORK.

In New Haven the Anti-Mosquito Committee of the Civic Federation raised money and employed Mr. James E. Hitchcock to examine the ditches, clean them when necessary, and to scout for mosquito-breeding places around New Haven. In like manner all ditches cut in 1912 have been kept in working order since.

A small area, owned by the New York, New Haven & Hartford Railroad Company, and situated between the Boulevard and the tracks of the Berkshire Division, was a bad breeding place in 1915 and was ditched at the owner's expense by Mr. Hitchcock.

A portion of West River was oiled by Mr. Hitchcock to kill the larvae of *Culex pipiens* which were found breeding there late in July.

Ditches in Greenwich, Stamford, Darien, Norwalk and Fairfield have also been maintained.

MOSQUITO SURVEYS.

As the new law provides a method by which mosquito drainage may legally be carried out, several communities asked for surveys. Thus Mr. Walden spent two days in July at Saybrook and Lyme, and two more in August at Stonington in company with Mr. P. L. Buttrick. As no appropriation for this work was made by the legislature, it was necessary that funds be raised locally to cover the expenses of these surveys. Thus Mr. P. L. Buttrick was appointed a special agent of the Station to make a detailed survey of the region at the mouth of the Connecticut River. This work was done in August and September under our direction, and the report with colored map was printed as Bulletin 189 of this Station, the cost of printing being borne in part by the Old Saybrook Town Improvement Association. As only a small edition of this bulletin was issued, the paper is made a part of this report and may be found on page 144.

The report of Messrs. Walden and Buttrick for the town of Stonington was similar in scope, and though not printed, a typewritten copy with map was submitted to the Stonington people interested in the work.

Similar surveys were made by Mr. Buttrick for the towns of Branford and Westbrook, where mosquito drainage is contemplated. These were made independent of the Station, though the same methods were followed of classifying the breeding areas according to a scheme original with Mr. Buttrick, and of showing these areas in colors on a map drawn to a convenient scale. Mr. Buttrick also did some survey work in Greenwich to supplement work done there in 1913 and 1914.

In addition to the towns mentioned above, portions of Guilford and Madison are interested and have planned to raise money for actual drainage work.

Anti-Mosquito Meetings.

Mr. Walden spoke at a public meeting at the town hall in Old Saybrook on July 31st; Dr. E. H. Jenkins and Mr. Walden spoke at a similar meeting at the Yacht Club, Sachem's Head, August 14th, and the State Entomologist gave an illustrated lecture on mosquitoes at Borough Hall, Stonington, September 4th.

REPORT ON A MOSQUITO SURVEY AT THE MOUTH OF THE CONNECTICUT RIVER

By P. L. Buttrick, Special Agent
of the
Connecticut Agricultural Experiment Station, New Haven, Conn.

August-September, 1915

Prefatory Note.

The Director of the Connecticut Agricultural Station is authorized by law to make rules and orders regarding the elimination of mosquitoes and personally or by his agent to enter premises for inspection and to survey and to eliminate by drainage, filling or otherwise treating mosquito-breeding areas. Due notice of the proposed plan of elimination must be given by him, and any one claiming to be aggrieved by the proposed operations may appeal to the Superior Court.

No funds are provided by the State for the purposes of this act and therefore the work of mosquito elimination can be undertaken only at the expense of individuals or local organizations.

The following survey was made at the request and at the expense of The Old Saybrook Town Improvement Association. Dr. W. E. Britton, the State and Station Entomologist, who has had years of experience and study of the mosquito problem in this State, was given the general superintendence of the matter and the survey itself was made by Mr. P. L. Buttrick. Mr. Buttrick has made a number of mosquito surveys in other parts of

the State and the principles of work and form of the present survey will have interest and value to other communities which are considering the elimination of mosquitoes. The object of such a survey is to ascertain the location and character of mosquito-breeding places, to determine how they can best be eliminated and to roughly estimate the probable cost. It is believed that this survey, with the accompanying map, makes it possible for those interested to decide what work is most necessary, where money can best be spent and the approximate cost of any portion or of all the work.

E. H. Jenkins, *Director.*

Introduction.

Area Covered. This survey covers all the salt and brackish marshes in the townships of Old Saybrook and Old Lyme, together with portions of those in Essex and Lyme. Particular attention has been given to the marshes bordering the river. Fresh marshes and other mosquito-breeding places have been included where it seemed that they were of sufficient importance to warrant it. In many cases the notes on fresh water areas are not as complete as those on the salt marsh areas. The notes for the towns on opposite sides of the river are given separately. In Saybrook the notes on salt and fresh water areas are separated; in Lyme this was impracticable though when possible the estimates are given separately.

General Observations on Salt Marshes. The region of this survey contains probably the largest group of salt marshes in the state east of New Haven. The total area of salt and brackish marshes is:

Old Saybrook	1,373.5	acres
Old Lyme	1,383.1	"
Lyme	492.5	"
Total	3,249.1	"

These marshes vary in character in proportion to the amount of submergence which they undergo by action of the tide. There are at least four classes as follows:

Areas covered with wild rice (*Zizania aquatica*) and vegetation of like nature which are flooded either constantly or at every high tide. They are known as tidal flats and do not breed mosquitoes. No areas of this class are shown on the accompanying map.

The next class includes the so-called sedge grass marshes which are quite generally flooded at perigee and apogee tides and upon which water frequently stands for a considerable time thereafter. Marshes of this character are inveterate mosquito breeders. The vegetation upon them, although sometimes cut for hay, is generally of inferior value.

Marshes less frequently flooded and standing at a higher level than those just mentioned constitute the next class. They are generally covered with hay grasses of various kinds, the most common of which are popularly called black grass (*Juncus gerardi*) and red top, or red salt grass (*Spartina patens,* formerly known as *S. juncea*). These marshes breed mosquitoes more or less, but only under very exceptional conditions do they breed them as abundantly as the preceding.

As the marsh stretches further and further back from the shore it is less frequently flooded by salt water and more frequently by fresh water. This change shows in the vegetation, which is usually composed either of a sedge called 3-square, (*Scirpus*), from the triangular shape of its stems; or of cat-tails. Such areas vary from brackish to entirely fresh, but when the latter stage is reached, the nature of this herbage changes to that of some of the types of purely fresh marshes. Marshes of this type are casual breeding places, sometimes breeding both salt and fresh water mosquitoes. The borders of many of the marshes, particularly on the Lyme side of the river, consist of tidal flats.

The Sound marshes, particularly on the Saybrook side, are mostly of the second or sedge grass type and the same is true of those at the mouth of Black Hall River and on South Cove, and it is upon them that the worst mosquito breeding takes place. Further back most of the marshes are of the hay grass type. Above the railroad bridge they become less and less salt in character and finally above Essex the salt marsh entirely disappears.

Along the Sound shore of Lyme conditions are somewhat different. Here the tidal current sweeps in from the east and the

heavy east winds which blow from the open Atlantic have piled up the sands along the shore and partly or completely blocked the marsh drainage, turning many salt marshes into fresh ones without outlets, or into brackish ones with only occasional outlets. As far as mosquito breeding is concerned, these factors have produced rather special conditions which will be discussed later.

Observations on Mosquito Breeding. No attempt was made to identify all the species of mosquitoes found. They were grouped into the general classes of salt marsh species, fresh water species, and malarial species. The most common mosquito is the ordinary banded Salt Marsh Mosquito (*Aëdes sollicitans,* Walker), which breeds in flood pools wherever they occur on the salt marshes. This species was found breeding under somewhat unusual conditions far up the river above the area of salt marshes, both in drainage ditches on Nott's Island, which is a reclaimed fresh marsh, and in a mud puddle in the road on the edge of the Essex marsh just up stream from the second Range Light. At the edges of salt marshes and along the river, where owing to the influx of fresh water the saline content was light, salt and fresh water mosquitoes were apparently breeding in the same pools.

Concerning the fresh water breeding perhaps the most noteworthy feature is the presence of numerous sink holes which form ideal *Anopheles* breeding places.

Life History of Salt Marsh Mosquito. In order to understand the mosquito problem on salt marshes, some knowledge of the life history of the salt marsh mosquito is necessary. The eggs are laid upon the salt marsh mud, and not, as with most species of mosquitoes, on the surface of the water. When covered with water they hatch, and in about a week, in warm weather, the adults are ready to fly. They then invade the uplands, often flying in large numbers for many miles. The salt marshes are covered periodically by high tides and irregularly by heavy rains.

Effects of the Tides. Generally speaking, the breeding of the salt marsh mosquito is much more affected by the tides than by rainfall. Under typical conditions the marshes are flooded once or twice a month at perigee and apogee, and definite broods of mosquitoes are produced once or twice a month in consequence and can be predicted in advance. This is the condition on marshes along streams emptying directly into the Sound, par-

ticularly at Saybrook; but on marshes along the river this condition is complicated by the rise and fall of the river due to local or more often upstream rainfall, so that it is impossible accurately to predict the time of flooding and the resulting appearance of mosquito broods. In fact, flooding at irregular intervals by fresh water is the normal condition on the up-river marshes, so that in dry seasons they probably breed sparingly if at all, and in wet seasons moderately but continuously. Above the railroad bridge the influence of tides on mosquito breeding grows less and at Essex and beyond it is negligible.

Mosquito Drainage. In order to prevent the breeding of the salt marsh mosquito it is only necessary to prevent flood water from standing on the marshes. This is generally accomplished by putting in a system of ditches which allows water to drain off within a few hours after the marsh is flooded by tides or rainfall. Such a system requires a good clear outlet and a main drainage course of dimensions suited to the size of the area.

A system of parallel ditches from 10 to 18 inches wide and from 24 to 36 inches deep should be cut at distances varying from 100 to 300 feet apart, at right angles to this main course.

Most of the marshes at Lyme and Saybrook have main drainage courses which can be used as a groundwork for ditching systems, although in some cases it will be necessary to modify or supplement them. There are also many old ditches which if cleaned can be incorporated as part of the new system.

Maintenance of Drainage Ditches. Deep straight-sided ditches such as are used for mosquito drainage will last almost indefinitely if they are kept open and in working order. They should be thoroughly cleaned every year, in the spring, and it is advisable to have them patrolled during the breeding season and any casual obstructions removed. Occasional breeding spots can also be treated when discovered. In all probability it will require two inspectors to do this patrol work and assist and supervise the annual cleaning operation. One inspector should be assigned to each town. The cost of such cleaning and inspection should not exceed $1,000.00 per annum.

According to a recent law passed by the Legislature, towns are obliged to maintain such ditches if the plan and execution of the work are duly approved by the Director of the Agricultural Experiment Station.

Salt Hay. Formerly the marshes of Lyme and Saybrook were regarded as of more value than at present as sources of salt hay and were ditched frequently so as to allow tide water to drain off as this increases the hay yield and improves its quality. Some of the meadows are still ditched for this purpose but on many of them the ditches are no longer maintained.

This ditching of hay land operates to prevent mosquito breeding and there are few mosquitoes breeding on the areas so treated. On the other hand, ditching to eliminate mosquitoes improves the hay yield. If all marshes were ditched to increase the hay yield there would be few mosquitoes, or if all were ditched to prevent mosquito breeding there would be a vastly increased hay yield.

Map. The map submitted with this report shows all the salt marshes examined and most of them very accurately. A few dotted areas were mapped in roughly in the field as the base map did not cover them. This map shows the larger ditches and drainage channels and in some cases the proposed location of new main ditches, but it does not show the location of proposed small ditches as those can as well be laid out in the field and would scarcely show on the map owing to its reduced scale. Each area which forms a unit has been assigned a number which is placed upon the map. A description of the area will be found by reference to the same number in the notes. Those on the Saybrook side refer to that town and to Essex; those on the opposite side to Lyme and Old Lyme. A cross indicates a bad breeding place or point requiring special consideration. The charts of the U. S. Coast and Geodetic Survey were used as a base map.

Classification of Areas According to Mosquito-breeding Conditions.

In order to bring out clearly the breeding conditions and relative importance of the different marsh areas they have been divided into five groups on the basis of their breeding character, and each group is colored differently on the map. It should be understood that this classification is not a permanent one, but on account of possible changes in the marsh may need revision in about three years.

Following is a description of these different groups:

A. Low sodden marshes, flooded at every perigee and apogee tide period, and at many intermediate ones. This water remains long enough for all mosquito larvae to complete their development. Such areas respond quickly to rainfall and may produce added broods because of it. Such marshes are almost constant mosquito breeders and yield little salt hay. They are colored blue on the accompanying map.

B. High tide grass breeding marshes. Marshes of this kind have large areas covered with certain grasses or sedges where water stands long enough twice each month, following perigee and apogee tides, for mosquitoes to develop. In other portions mosquito breeding may occur only at perigee tides. It is the areas of Class B that give rise to the immense broods which occur only once or twice in a season. In discussing the different areas of this type of marsh an attempt has been made to give an estimate of the percentage of the total area which remains water-covered long enough to breed mosquitoes. Hay yields on this type of meadow are apt to be small. Areas of this character are colored purple on the map.

C. Marshes covered with open or grassy pools in which mosquitoes breed abundantly. In this class of marsh the general surface may or may not be capable of breeding mosquitoes, so in the descriptions it is sometimes necessary to resort to other classifications in addition to this one. The hay yield may be good, but the broken character of the surface renders it difficult to cut. Marsh of this character is colored red on the accompanying map.

D. Marshes on which mosquitoes breed occasionally and scatteringly, either in grass or pools. Generally these are fair or good hay producers. They are colored green on the map.

E. Marshes which breed only casually or rarely and only in small amounts, generally in small pools along their inner edges, or perhaps in clogged ditches. Marshes of this type are generally either tidal or are high and well drained. The latter are valuable for salt hay, the former seldom so. This type of marsh is colored yellow on the map.

Estimate of Cost of Ditching and other Work Necessary to Eliminate Mosquito Breeding. One object of this survey was of course to arrive at the probable cost of treating the marshes so as to prevent mosquito breeding. In preparing this estimate the following factors were considered for each area:

Amount of old ditch to be cleaned;
Footage of lateral 10″ x 30″ ditch to be excavated;
Footage of secondary outlet, generally 2′ x 3′ ditches required;
Footage of primary ditches of larger dimensions required;
Amount of special work, such as building and enlarging culverts, erecting tide gates, bulkheads, etc.

The cost of each was then estimated, in the case of ditch digging by applying a footage rate; in the case of cleaning old ditches and doing other work by figuring roughly the amount of labor and materials required. The footage rate for 10″ x 30″ lateral ditches is taken as 2½ cents per foot; for 2′ x 3′ secondary ditching 5 cents per foot is used. For larger ditches special rates have been used and specified. Likewise special rates for the different fresh water areas have been made to meet their special conditions.

Summary of Costs.

It should cost roughly $19,000.00 to eliminate all the salt marsh and more important fresh water breeding areas in the region of this survey. But $15,000.00 spent on the salt marshes should be sufficient for them, while $2,000.00 spent on the important fresh water areas should suffice for all practical purposes. Total $17,000.00.

Following is a summary of the amount of ditching and costs in round figures:

AREA SALT MARSHES.

Areas of Old Saybrook	1,375	acres
" Old Lyme	1,380	"
" Lyme	490	"
Total	3,245	"

DITCHING REQUIRED:

10 x 30-inch laterals Old Saybrook	236,500	feet
" " " Old Lyme	265,000	"
" " " Lyme	10,000	"
Total	511,500	"

2 x 3-foot secondary ditch	Old Saybrook	10,700 feet
" " " "	Old Lyme	200 "
	Total	10,900 "
Larger special ditches	Old Saybrook	3,100 "

COST:

Cleaning old ditches	Old Saybrook	$ 400.00
" " "	Old Lyme	250.00
Cutting lateral ditches	Old Saybrook	5,900.00
" " "	Old Lyme	6,850.00
" " "	Lyme	250.00
Digging of 2 x 3-foot ditches	Old Saybrook	550.00
" " " " "	Old Lyme	50.00
Special ditches	Old Saybrook	400.00
Cost of special work	Old Saybrook	550.00
" " " "	Old Lyme	700.00
	Total cost for salt marshes	$15,900.00

By eliminating certain areas as mentioned in the notes this sum could be reduced to the neighborhood of $15,000.00.

The rough estimate of the fresh water areas made under conditions mentioned above is:

Old Saybrook	$1,200.00
Essex	900.00
Old Lyme	800.00
Total	$2,900.00
Grand Total	$18,800.00

Notes on Township of Old Saybrook.

INTRODUCTION.

In Old Saybrook Township the breeding areas have been divided into two classes, salt marsh and fresh water areas, and each is discussed separately. The salt marshes being the more important are discussed first.

SALT MARSHES.

The salt marshes may further be divided more or less naturally into six groups as follows:

Chalker Beach and Chapman's Point Marshes (Nos. 1-3 on map).

Oyster River Marshes (Nos. 3-7 on map).

Back River and Plum Bank Creek Marshes (Nos. 8-21 on map).

South Cove and Fenwick Point Marshes (Nos. 22-40 on map).

North Cove and Church House Marshes (Nos. 41-48 on map).

Marshes north of railroad line (Nos. 48-52 on map).

Of these groups, the first, third and fourth are the most important—not so much because of their proximity to the settled portion of the town as because of their breeding qualities. Marshes north of the railroad are both remote and largely non-breeding and therefore of comparatively little importance. The Oyster River and North Cove and Church House marshes are moderate breeders and close enough to the settled portions of the town to require consideration but excepting the marshes north of the railroad are less important than the others.

If there is only a limited sum of money available so that only a portion of the area can be treated, the above will serve as a guide to indicate the sections which can best be omitted.

Detailed Description of Individual Salt Marsh Breeding Areas.

The following points regarding individual breeding areas are taken up:

Location of Area. Each area is numbered and in some cases also named. These numbers and names also occur upon the map and afford a ready means of locating it.

Grade of Breeding. Expressed by letters from A to E, the significance of which has been explained on pages 149-50. In the case of grass breeding areas, a figure giving approximate percentage of the surface of the marsh capable of breeding mosquitoes is also given.

Size of Area. Given in acres and tenths of acres.

Vegetation and Value of Salt Hay. Brief description only.

Work Necessary to Eliminate Mosquito Breeding. Gives footage of ditching of various sizes required as well as other work necessary. The requirements for lateral ditch of 10" x 24"-30" dimensions are given in terms of the average distance apart these ditches should be placed. The common distances are 150 and 200 feet. They are expressed thus: 1/150, 1/200, etc.

25. Class B, 15 per cent. breeding. Area, 58.3 acres. Good hay meadow but beginning to deteriorate. Larger ditches in fair shape but smaller ones badly choked and need cleaning. New ditches required 1/200 system. Footage: old ditches to be cleaned, 2,800; new ditches, 12,000. Cost: cleaning old ditches, $70.00; digging new ones, $300.00. Total, $370.00.

26. Class A. Area, 3.2 acres; no hay. Open main channel 2 x 3 feet, length 350 feet, and ditch 1/100. Footage, 1,300. Cost: main ditch, $18.00; laterals, $32.50. Total, $50.50.

27. Class B, 20 per cent. breeding surface. Area, 14.9 acres. Hay light. Clean upper portion of main channel and ditch 1/150. Footage, 4,300. Cost, $107.50.

28. Class A. Area less than 1 acre. No hay. Requires 1 main and 1 cross ditch. Footage, 500. Cost, $12.50.

29. Class E. Area, 3.2 acres. Black grass hay. Clean main ditch, 1,000 feet. Cost, $25.00.

30. Class E. Area 3.2 acres. No hay. Ditch 1/200, footage, 650. Cost, $16.25.

31. Class D. Area, 3.9 acres. A little hay. Ditch 1/200, spaced closer toward eastern end. Footage, 800. Cost, $20.00.

32. Class C. Area less than 1 acre. Hay good. Has ditching system which is badly clogged. If opened would be sufficient. Cost, $10.00.

33. Smaller lagoon at Fenwick Point. Shores of this lagoon are a Class D salt marsh. Area, 1.9. Edges here should be cleaned up and the material thrown back upon the marsh which should then be ditched 1/100. Footage, 800. If it is decided to excavate this marsh sufficiently to add to the lagoon and use excavated material to fill in other portions so that marsh is entirely abolished a special estimate will have to be prepared. The costs of ditching as laid out will be about $20.00.

34. Fenwick Point marsh and larger lagoon. This is a Class B marsh with 50 per cent. breeding. Area, 25.3 acres. Hay of little value. Drain, 1/150. Footage, 7,300. Cost, $182.50. Probably it will be necessary to lower outlet by removing rocks below bridge (a small job) and to install tide gates at that point. Measurements: Distance across bridge, 13 feet. Height from stream bed to bridge head, 6 feet. Depth of water at high tide, 4½ feet. Bottom sand and rock. Runway rock-faced, tight enough to support gate. The cost of such a gate would probably not exceed $50.00, including deepening of channel below. A desirable way in which to treat this whole marsh would be to erect a sod dike around the lagoon and along the stream draining it, put in a tide gate as indicated and fill in the marsh with material from the channel the next time it is dredged. Total cost of ditching and tide gate, $232.50.

35. Class E, but a single bad B area as indicated by X. Area, 8.4 acres. Hay in pockets is good but along shore is valueless. Ditches 1/300. Footage, 1,200. Cost, $30.00.

36. Class B west of creek, D east. Area, 13 acres. Salt grass hay. Clean old ditches and add equal amount of new to connect with 37. Old ditches, 1,500; new ditches, 1,500. Cost: old ditches, $37.50; new ditches, $37.50. Total, $75.00.

37. Class D, possibly B. Area, 1 acre. Hay fair. Clean ditches (400 feet) and open culvert. May be necessary to enlarge this culvert. Cost for cleaning ditches, $10.00.

38. Class E. A few small B places. Area, 3.2 acres. Hay black grass. Ditch 1/250 but spaced according to necessity. Footage, 800. Cost, $20.00.

39. Class D. Area, 17.5. Good hay. Ditch 1/200 where needed. Footage, 3,600. Cost, $90.00.

40. Class E. Area, 7.1 acres. Hay doubtful. No treatment required beyond keeping ditches open.

North Cove and Church House Marshes.

41. Class D. Area, 51.2 acres. Salt and black grass hay. Upper end of many branches covered with cat-tails. This area has a good ditching system, but ditches should be thoroughly cleaned and opened, or in a few years marsh will be in bad shape. A marginal ditch should be dug around whole meadow to look after casual breeding along inner end and ditches to main creek should be dug into ends at a, b, c and d. Footage, old ditches to be cleaned, 7,000 more or less. New ditches, 10,000 more or less. Cost: cleaning old ditches, $100.00; digging new ones, $250.00. Total, $350.00.

42. Class D. Area, 3.2 acres. Hay good. Requires ditching 1/150 and a marginal ditch. Footage, 1,000. Cost, $25.00.

43. Class E. Area, 2.6 acres. To clean existing ditches is enough. Cost, $10.00-$15.00.

44. Class E. Area less than an acre. No treatment required.

45. Class E. Largely cat-tails, upper end potential fresh water and malarial breeder. Area, 3.2 acres. Open main channel 2 x 3 feet through 46 to cove. Footage, 1,200. Cost, $60.00.

46. Class D. Area, 12.9 acres. Good hay. Marsh fairly well ditched, but new ones should be spaced between existing ones where distance exceeds 400 feet between them. Footage, 2,000, more or less. Cost, $50.00.

47. Church House Lot. Class D, a few B or C areas as indicated by X. Otherwise breeding is casual. Area, 309 acres. Inner edge largely cat-tails and most of larger ditches are bordered by them or equivalent vegetation. Outer portions mostly black grass; other parts excellent salt grass. By cleaning old ditches and cutting new ones where distance between present ones exceeds 400 feet, area could be made mosquito proof. Footage required, 2,500. Cost, $62.50.

48. Island part of Church House Lot, Class E. Area, 19.4 acres. Mostly black grass hay. A 1/300 ditching system would drain a few potential breeding pools and improve the hay. Footage, 2,500. Cost, $62.50.

Marshes North of Railroad Line.

49. Class D. Area, 29.8 acres. Mostly good black grass hay but there are a few bad breeding corners as indicated by Xs. The ditches in some of them are badly clogged and are breeding both *Culex* and *Anopheles*. These should be cleaned carefully and a new 1/200 system opened. Footage: old ditches, 2,000; new, 6,200. Cost: old ditches, $20.00, new, $155.00. Total, $175.00.

50. Class D. Area, 12.9 acres. Distinctly a salt marsh but now breeding fresh water mosquitoes in clogged ditches. Hay, red salt grass. Open old ditches and ditch 1/200. Footage: old ditches, 1,600; new ditches, 2,600. Cost: old ditches, $20.00; new ditches, $65.00. Total cost, $85.00.

51. Class D. Area, 32.4 acres. Lower end (north) brackish, upper end (south) practically fresh, breeds *Culex* and *Anopheles* and might easily become a plague spot although not now bad. Is classed as a salt marsh because of its vegetation. A main ditch 4 x 4 feet square and an outlet cut under Ferry Road to 49 would probably be sufficient. Footage of ditch required, 1,800. Cost, $300.00, more or less. Cost of culvert under road, $150.00, more or less. Total, $450.00, more or less.

52. Class E. Area, 110.8 acres. Largely cat-tail (outer portion) and 3-square grass (inner) brackish, breeds both salt and fresh water mosquitoes. To render entirely safe a 1/200 ditching system required but as compared with other areas scarcely worth doing. Footage, 23,000. Cost, $575.00.

Fresh Water Breeding Areas.

Although no special attempt was made to study the fresh water breeding places of the town, enough were seen to warrant a brief description of them, together with a few general comments.

Malarial Breeding Places. Practically all fresh water breeding places examined are capable of breeding the *Anopheles* or malarial mosquito, and wherever sufficient search was made they were found breeding. That Saybrook (and the same is true of Lyme) does not suffer extensively from malaria is apparently due to the absence of the disease itself rather than to the absence of its hosts. Certainly the stage is set for an epidemic and should a sufficient number of cases become established the disease would probably speedily become widespread.

Advisability of Controlling Fresh Water Breeding Places. As far as obtaining freedom from the mosquito nuisance is concerned little or nothing would be accomplished save here and there locally to do away with the fresh water breeding areas, although the menace of malaria would be eliminated. On the other hand, to abolish the salt marsh breeding areas and leave the fresh water ones untouched would practically abate the nuisance except in the immediate neighborhood of the fresh water areas but would do nothing to eliminate the danger of malaria.

In case funds are not forthcoming to do both, it is our opinion that some of the salt marshes up the river could be safely neglected and the money necessary to ditch them be spent instead on some of the large and more important fresh water areas near the village.

Kinds of Fresh Water Breeding Places. There are several kinds of fresh water breeding places in Saybrook: The inland ends of many of the salt marshes are often fresh or at least only faintly brackish. These are often cat-tail areas. They are generally not very serious breeders and can best be treated along with the salt marshes of which they are really a part.

Open Fresh Marshes. Many of these are covered with cat-tails, but are frequently bad breeding areas and produce many malarial mosquitoes. They must be ditched or otherwise treated.

Wooded Marshes. These are apt to breed mosquitoes only early in the season and are seldom of much importance—at least so long as the other areas are untreated.

Sink Holes. Sometimes these areas are swampy and sometimes are open pools or puddles. The latter are usually less troublesome. The best treatment of sink holes is to fill them. By the use of a team and a drag scraper such an operation is not expensive, and at a trifling expense an area capable of cultivation takes the place of a breeding hole. When filling is not practicable an outlet should be provided.

Edges of Sluggish Streams. These are sometimes bad breeding places for malarial mosquitoes but there seem to be few places of this kind in Saybrook.

Following is a brief description of some of the important fresh water breeding places west of the Connecticut River. The estimates of cost are very rough but should come within 30 per cent.

The total estimated cost of treating the fresh water breeding places is $1,175.00, not including the Essex marsh.

DESCRIPTION OF INDIVIDUAL FRESH WATER BREEDING AREAS.

F 1. Open marsh, semi-permanent breeder. Open main drain into 2. Footage, 1,600. Cost, $50.00, more or less.

F 2. Lily pond and open swamp, permanent breeder. Lower the outlet to pond so as to drain swamp. (Not an expensive job. Cost, perhaps, $25.00.)

F 3. Fresh water pond hole, constant breeder on small scale. Open channel to salt marsh 50 feet away. Cost, perhaps, $35.00.

F 4. Pond hole once connected with marsh at 10. Reopen ditch.

F 5. Two wooded sink holes each about 100 feet in diameter. Permanent or semi-permanent breeders. Fill to depth of 4 feet, moving earth from surrounding banks. Requires movement of 2,000 cubic yards of earth. The cost of moving with drag scraper would be about 10 cents per yard or about $200.00.

F 6. Two wooded sink holes. Permanent or semi-permanent breeders. Their treatment would be rather expensive as it would be necessary either to cut off the timber and scrape earth into them, or else to cart it from a distance. A 25-foot bank lies between them and the salt marsh, calling for considerable excavating which would make it expensive to open an outlet. It would probably cost $250.00.

F 7. Wooded sink hole, permanent or semi-permanent breeder. Open drain to salt marsh at 17, 100 feet away. Cost, $25.00, more or less.

F 8. Pond hole semi-permanent breeder. Dig drain into salt marsh at 17, some 60 feet distant. Cost, $15.00, more or less.

F 9. Pond hole, permanent or semi-permanent breeder. Place culvert under roadway to salt marsh at 17, some 25 feet distant. Cost, with 24-inch tile pipe, about $40.00.

F 10. Swampy pool on both sides of Cornfield Point road. Place culvert under old roadway to drain portion east of highway and fill the west portion. Cost of both operations, perhaps, $60.00.

F 11. Pond hole 100 x 50 feet and 3 feet deep. Breeds along edges and might be filled but unimportant till much other work is done.

F 12. Low lying grass area. Breeds only during very wet seasons. 150 feet of ditch, 12 x 18 inches through center parallel to road, and a culvert under road to beach would probably keep this area dry. Cost, probably $15.00 to $25.00.

F 13. Fresh water lagoon and cat-tail swamp at Saybrook Point. Area of swamp, 6.5 acres. Breeds whenever water stands in the cat-tails. It would be futile to ditch this area as it stands, since the water stands at the same level in the swamp as in the lagoon, but if an opening were made into the river so that the tide would rise and fall in the lagoon, then by ditching the marsh breeding could be checked. Footage of ditch required for marsh would be 1,300. Cost, at 2½ cents per foot, $19.50. The cost of placing culvert under railroad might be as high as $100.00. A 4-foot tile drain would not be too big.

F 14. Small fresh water and cat-tail swamp. Requires 300 feet of main ditch and 100 feet cross ditch opening into a culvert draining into 43. Cost, $40.00, or less.

F 15. Fresh water cat-tail swamp and shallow lagoon draining into 46, through ditch parallel with railroad. This is a large and intensive malarial breeding place and should have attention. The drainage ditch is rather badly choked and should be thoroughly cleaned. Two-foot drains should then be dug to each neck of marsh. Total footage, 2,500. Cost, $125.00. Cleaning main ditch, $25.00.

F 16. Open fresh marsh. Drainage badly choked. Open up drain to outlet from F 15. Length, 500 feet. Cost, $15.00, more or less.

F 17. Fresh marsh, upper end wooded, lower end covered with cat-tail. Open up channel into creek in 47.

F 18. Large marsh back of railroad station at Saybrook Junction with growth of wood and cat-tail. In wet seasons it may breed mosquitoes enough to be dangerous and annoying; in an ordinary season it may give no trouble at all. The only remedy is to open up the main channels and add laterals if it becomes necessary. The main channels are about 6,000 feet long, and it might cost $150.00 to clean and open them.

F 19. Small wooded marsh of little consequence.

F 20. Small pond edged with cat-tails and swamp. Clean up the edges.

F 21 and 22. Cat-tail swamps. Too small and remote to be of consequence.

F 23. Essex Marsh area, 155 acres. Vegetation, cat-tails and sedges of various kinds. At time of visit water stood over whole marsh and it was in condition to breed fresh water mosquitoes abundantly. However, in a dry season it probably would be much less dangerous. This marsh even at its worst is probably of little importance to Old Saybrook and Old Lyme. There would be no difficulty about draining it. A 1/200 system should be sufficient. Footage, 32,000. Cost at 2½ cents per foot, $800.00.

Summary of Costs for Saybrook.

Area	1,373.5 acres
Cost of cleaning old ditches	$ 405.00
Footage of lateral ditches, 236,500; cost	5,912.00
Footage, 2′ x 3′, secondary ditches, 10,720; cost	538.00
Footage, larger special ditches, 3,100; cost	430.00
Tide gates, culverts, etc.; cost	540.00
Total for salt marshes	$7,825.00
Total for fresh marshes	1,175.00
Total for town of Old Saybrook	$9,000.00
Essex Marshes	800.00
Total west of River	$9,800.00

Average cost per acre for work on salt marshes is estimated at $5.70.

Notes on Townships of Lyme and Old Lyme.

The salt marshes of Lyme may be divided not altogether arbitrarily into the following groups:

Great Island, Nos. 1-6 inclusive.
Back River, Nos. 7-10 inclusive.
Lieutenant River, Nos. 11-15 inclusive.
Up-river marshes, Nos. 16-19 inclusive.
Duck River and Black Hall marsh, Nos. 20-32 inclusive.
Black Hall River marshes, Nos. 33-56 inclusive.
Shore marshes, Nos. 57-75 inclusive.

Of these groups the Great Island, Duck River and Black Hall, and Black Hall River marshes are the most important. The Lieutenant River and Back River marshes are of little importance despite their proximity to the settled portions of the town, owing to their character, while the up-river marshes are both remote and sparse-breeding. The shore marshes are some of them bad breeders but constitute a separate problem for the people of Sound View, South Lyme and the various shore resorts of the section, and east of the Mill Creek marsh the shore marshes might be safely disregarded as far as their effect on the village of Old Lyme is concerned.

The fresh water breeding areas of Lyme, excepting along the south shore, are chiefly at the upper ends of the salt marshes and

will largely be taken care of along with them. Along the south shore some of the old salt marshes which have become fresh require special treatment as has been mentioned under the detailed descriptions.

Although the notes for fresh and salt breeding areas are not separated in the summary, they are so far as possible tabulated under different headings.

Much of the introductory matter given for Saybrook (see page 152) also applies to Lyme.

Detailed Description of Individual Breeding Areas in Lyme and Old Lyme Townships.

Great Island Marsh.

1. Class C except at Xs where moderate-sized B areas exist and near the north end where there is an E cat-tail area. Except on this area hay is red salt grass. Area, 171.1 acres. The creek branches much more than is shown on map, extending nearly to the lower islands, but is rather clogged with vegetation. It should be cleaned out and a 1/200 system installed with reference to it and to the shore. Footage, 35,590. Cost, $889.75. The cost of cleaning out the creek can only be guessed at, but I should think it might cost $200.00, more or less. Total cost, $1,089.75.

2. Class D, a few small B spots. Area, 15.6 acres. Excellent black grass hay. Will not require more than 1/300 ditching spaced so as to drain individual breeding places. Footage, 2,750. Cost, $68.75.

3. Class C. Good salt and black grass hay. Area, 46 acres. Ditch 1/200. Footage, 9,570. Cost, $239.25.

4. Class C. Hay fair along lower end, excellent at upper end. Area, 33 acres. Requires ditching 1/200 average but rather closer at the lower end. Footage, 6,860. Cost, $171.50.

5. Class C, except at X which is B. Area, 16.8 acres. Poor quality salt grass hay. Requires, 1/150 ditching system. Footage, 4,870. Cost, $121.75.

6. Class C, except at X which is B, an acre or so of solid 95 per cent. breeding. Area, 36.9 acres. Upper end good black grass hay but of course many holes and small grass breeding depressions exist. Requires ditching 1/200. Footage, 7,670. Cost, $191.75.

Note. The total area of Great Island is 319.4 acres and the estimated cost of ditching and other improvements is $1,882.75.

Back River Marshes.

7. Nameless island, Class D. On east side of the island chiefly wild rice grows, on the west side black grass. Area, 29.8 acres. Western side requires ditching 1/200. Footage required, 3,100. Cost, $77.50.

8. Class D, but scattering non-breeding areas. Chiefly cat-tail covered, rest hay grasses. Area, 135.4 acres. Requires 1/300 ditching. Footage, 19,630. Cost, $490.75.

9. Class D. Black and salt grass hay. Area, 42.1 acres. Clean old ditches and add 1/200 new ones. Footage: old ditches, 700, more or less; new ditches, 8,760. Cost: cleaning old ditches, $17.50; digging new ones, $219.00. Total, $236.50.

10. Class D, except the portion above railroad embankment which is B. Area, 48.8 acres. Black grass and cat-tails. Main channel in portion above railroad should be opened, length 200 feet, and made 2 x 3 feet and 200 feet of laterals dug. If it proves necessary a tide gate should be hung on the culvert under the railroad. Cost, $25.00, more or less. The main marsh should be ditched 1/200 but by using present ditches the total amount can be reduced probably 30 per cent. Footage required, 7,100. Footage, 2 x 3-foot ditch, 200. Cost, at 5 cents per foot, $10.00. Cost, lateral ditches, $177.50. Total cost, $187.50.

Lieutenant River Marsh.

11. Class D, possibly rarely breeds as a B area. Area, 9.7 acres. Good salt and black grass hay. Requires ditching 1/125. Footage, 3,200. Cost, $80.00.

12. Class D. Area, 32.4 acres. About 40 per cent. of this area is covered with cat-tails which follow the creeks and ditches and cover most of the ends and pockets, thus preventing them from being bad breeders. Outside of this the vegetation is mostly of hay grasses. Channels should be opened into the various ends and ditches dug in spaces where distance between existing ditches exceeds 400 feet. Estimated footage of 2 x 3 ditch 200, of laterals 3,500, more or less. Cost, 2 x 3-foot ditch, $10.00; laterals, $87.50. Total, $97.50.

13. Class D. Area, 16.2 acres. Hay good. Requires 1/200 ditching. Footage, 3,370. Cost, $84.25.

14. Class D. Area, 32.4 acres. Partly cat-tails; rest good hay. Requires ditches into dead ends and 1/200 system. Footage, 6,740. Cost, $168.50.

15. Class D, or possibly E. Upper Lieutenant River Marsh; lower end salt; upper brackish or perhaps entirely fresh. Vegetation mostly cat-tails and sedges of various kinds, the two being about equally divided. Approximate acreage, 162 acres. The lower end of this marsh is a typical Class D area. Above, where it is brackish or fresh it may breed fresh

water species more or less, but owing to its remoteness could possibly be neglected. To properly ditch this marsh would require a 1/200 system. Footage, 33,700. Cost, $842.50. Probably one-third of this sum spent on the lower end would be sufficient.

Up-River Marshes.

16. Calves Island. Class E, with few B spots as indicated. Area, 44.1 acres. A typical salt marsh; vegetation mostly black grass. This area is probably seldom flooded. A 1/300 ditching system, spacing ditches so as to drain individual pools would be sufficient. Footage, 6,390. Cost, $159.75.

17. Goose Island. Class E. Area, 88.8 acres. Mostly cat-tails except along eastern shore where it is an old black grass marsh, but is being rapidly overrun by cat-tails. This outer area might breed more or less but a system of 1/200 ditches extending 150 feet back from shore would be sufficient to drain it. Footage, 3,000. Cost, $75.00.

18. Lord's Cove Marsh. Class E. Area, 492.5 acres. Lower end black grass and cat-tails; upper 3-square grass and cat-tails. The latter together with similar forms of vegetation cover more than 50 per cent. of the marsh and are increasing. They follow the hay ditches and small creeks and are constantly encroaching still further on the general surface of the marsh. Wherever possible hay is still collected and the yield is high. The general character of this area is a low, occasionally flooded meadow, yet even at its north end it is distinctly brackish in character. It is flooded only by heavy rains and freshets. Occasional depressions breed salt marsh mosquitoes in more or less abundance. The highest point of salt marsh breeding actually found was opposite the north end of Nott's Island, as shown by cross on map. In a dry season it would probably breed very few mosquitoes. The only treatment that this marsh requires is to clean some of the smaller ditches and to dig new ones here and there to drain individual breeding areas. Footage, 10,000. Cost, $250.00. Very rough estimate.

19. Nott's Island. A reclaimed marsh used for hay farming. A few depressions near middle of lower half of the island are breeding salt marsh mosquitoes but in a dry season would probably not do so. A thorough cleaning of existing ditches and a new median ditch would not only render this area non-breeding but would improve its hay yield. Footage: old ditches needing cleaning 4,000; (rough approximation) new ditches, 1,000. Cost: cleaning old ditches, $40.00; digging new ones, $50.00. Total, $90.00.

Duck River and Black Hall Marshes.

20. Lower Duck River Marsh. Class D. Area, 27.2 acres. Sedge grass hay, but is used. Clean existing ditches, particularly those running into the various ends, and ditch 1/200. Footage, 5,660. Cost, $141.50.

21. Upper Duck River, Nos. 21, 22 and 23, Class B. Ten per cent. breeding surface. Area, 12.3 acres. Upper portion and edges brackish and

covered with cat-tail. Hay poor. Open creek for 200 feet toward upper end and clean culvert under roadway. Ditch 1/100. Footage, 5,120. A tide gate at the highway bridge may prove necessary here. A small fresh water lily pond drains immediately into this area. It is a potential malarial breeder on a considerable scale. The edges should be cleaned and the swamp at its upper end dug out. Cost: lily pond, $100.00; main creek and culvert work, $35.00; lateral ditches, $128.00. Total, $263.00. Tide gate, if necessary, $50.00.

22. Class B, 10 per cent. breeding surface. Area, 7.8 acres. Upper end cat-tail and wooded swamp. Straighten main creek and ditch 1/100. Footage, 3,240. Total cost, $81.00.

23. Fresh marsh. Three-square grass and some cat-tails. Area, 16.2 acres. Probably always contains a few breeding places but particularly bad at this time owing to rains and unsatisfactory condition of salt marsh below. Clean main creek at lower end. This means digging a 2 x 3-foot channel 1,000 feet long. Cut 1/200 laterals. Footage, 3,370. Cost, at 2½ cents per foot, $84.25. Main creek, at 5 cents per foot, $50.00. Total, $134.25.

24. Class E. Area, 3.2 acres. Excellent black grass hay but ditch is almost blocked and if not cleaned area will deteriorate rapidly. Footage required, 250. Cost, $10.00.

25. Down-stream portion, Class D; up-stream, B. Area, 9.1 acres. Hay is cut. Ditch 1/150. Footage, 2,640. Cost, $66.00.

26. Well ditched fresh marsh now largely reclaimed; satisfactory so long as ditches are kept open.

27. Pond hole 200 feet long, 50 feet wide. Intensive breeder of both salt and fresh water species of mosquitoes. Open outlet to salt marsh at 25 to connect with ditching system there. Length required, 100 feet. Height of land between, 2 feet. Cost of 2′ x 3′ ditch, approximately, $15.00.

28. Class D. Area, 9.1 acres. Hay good. Ditch 1/150. Footage, 2,640. Cost, $66.00.

29. Fresh cat-tail marsh. Area, 1 acre. Potential malarial mosquito breeder of considerable size. Culvert under roadway at lower end too small. Cost of enlarging, perhaps $100.00. Main channel needs cleaning, 300 feet; cost, $15.00. Laterals, 1/150. Footage, 290. Cost, $7.25. Total cost, $122.25.

30. Upper end of 29 above railroad. In wet weather fresh water and malarial mosquito breeder. Requires main ditch and lateral ditch parallel to railroad embankment, with possible enlargement of culvert under railroad. Footage, 250 feet more or less. Cost of ditch work, $10.00-$15.00.

31. Class D. Area, 3.2 acres. Clean main ditch (length 200 feet) and ditch 1/150. Footage, 930. Cost: cleaning creek, $10.00; lateral ditches, $23.25. Total, $33.25.

32. Class D. Area, 6.5 acres. Hay good. Ditch 1/150. Footage, 1,880. Cost, $47.00.

Black Hall River Marshes.

33. Class C, with B area as indicated. Area, 14.3 acres. Yields good hay but could not be machine cut. Ditch, 1/150. Footage, 4,150. Cost, $103.75.

34. Class B, with 50 per cent. breeding surface. Area, 89.4 acres. This is one of the worst breeding areas encountered in the whole survey; certainly the worst in Lyme, not so much because of the percentage of breeding surface as because it seems to breed regularly with every tide. In rainy seasons such as the present it probably breeds as a Class A area. Hay almost worthless. Many of the dead ends on the eastern side require 1/100 laterals as well as the cleaning of the central ditches into them. Some parts of the area will require only 1/200 ditching but the average will be 1/150. Footage, 25,930. Cost, $648.25.

35. Class E. Area, 6.5 acres. Excellent hay. Well ditched and largely non-breeding but ditches should be cleaned.

36. Fresh marsh fed by sluggish stream. Area, 2.5 acres. Both marsh and stream are potential malarial breeders on a considerable scale. The ditching of the salt marsh at 34 and opening of main channel through swamp portion would go a long way toward quickening the current in the stream. The swamp should be ditched 1/150. Footage: main ditch, 350; laterals, 720. Cost: main ditch, at 5 cents, $17.50; laterals, at 2½ cents. per foot, $18.00. Total, $35.50.

37. Class D. Area, 5.8 acres. Hay fair. Ditch 1/150. Footage, 1,680. Cost, $42.00.

38. Class A. Area, 1.3 acres. No hay. Open drainage ditch along railroad to Black Hall River at 39. Footage, 250, more or less. Cost, $25.00. Laterals, 200 feet. Cost, $5.00. Total cost, $30.00.

39. Class C. Area, 6.5 acres. Hay crop fair, but the land is much cut up by pools. Ditch 1/150. Footage, 1,880. Cost, $47.00.

40. Class B, 25 per cent. breeding surface. Area, 2.6 acres. Hay fair. Ditch 1/150. Footage, 750. Cost, $18.75.

41. Down-stream, Class B, 25 per cent. breeding; up-stream, D. Area, 11.0 acres. Red top and black grass hay. Ditch, 1/180 including main ditch into pocket which runs back to highway. Footage, 2,520. Cost, $63.00.

42. Class D. Area, 32.4 acres (approximate). The upper portion of this marsh is only slightly brackish and probably breeds fresh water as well as salt water mosquitoes. Owing to its remoteness the upper portion of this marsh could be neglected if funds for entire eradication measures

were not forthcoming. Ditch, 1/200. Footage (approximate), 6,740. Cost (roughly), $168.50.

43. Open alder swamp and peat bog. Probably a bad malarial breeder but too remote to greatly affect settled portions of town. Open up course of main stream.

44. Red maple swamp. Probably a semi-permanent breeder. Too remote to be of especial consequence. Clean main channel into 42 and 43.

45. Class E. Area, 1.9 acres. Good non-breeding black grass marsh. No treatment needed at present.

46. Class D. Area, 9.1 acres. Fair hay. Ditch 1/200 spacing irregularly as required. Footage, 1,890. Cost, $47.25.

47. Class B, 50 per cent. breeding surface. Area, 14.9 acres. Hay fair. Ditch 1/100. Footage, 6,200. Cost, $155.00.

48. Class B, 25 per cent. breeding surface. Area, 1.9. acres. Open main ditch and ditch 1/100. Footage, 790. Cost, $19.75.

49. Class C. Outer portion Class E. Area, 6.5 acres. Hay good. Ditch 1/150. Footage, 1,880. Cost, $47.00.

50. Brush swamp, a casual fresh water and malarial breeder. Open outlet to salt marsh at 49. Partial overflow outlet already exists. Should be lowered at least 2 feet. Cost, $15.00, more or less.

51. Pond hole. Potential malarial breeder on a large scale. A ditch about 150 feet long carries overflow into 50. If this ditch were lowered 8 feet it would probably entirely drain this area. Cost, $50.00, more or less.

52. Pond hole. Willows along border. Potential and malarial breeder on considerable scale. Fill to depth of 3 feet and repair culvert under railroad to carry off flood water. Requires 3,000 cubic yards, more or less, of earth. Cost of moving earth, $300.00, more or less.

53. Wooded marsh. Potential wet weather breeder but rather remote to be of much consequence. It might be advisable to spend $25.00, more or less, to open up outlet in 48.

54. Class B, 10 per cent. breeding surface (average), but varies from 0 to 100. Upper end cat-tail covered and Class E in character. Area, 29.2 acres. Ditch 1/200 average, but would require special spacing in some cases. Footage, 6,100. Cost, $152.50.

55. Class B, 90 per cent. breeding surface. Area, 1 acre. No hay grasses. Requires single main ditch, 2 x 3 feet, 130 feet long. Cost, at 5 cents per foot, is $6.50.

56. Class B, 25 per cent. breeding surface. Area, 3.2 acres. No value for hay. Marginal and outlet ditch, 450 feet. Cost, $11.25.

Shore Marshes.

57. Class B, 50 per cent. breeding surface. Area, 9.7 acres. Produced only a poor sedge grass. Has good primary ditching system which requires cleaning and addition of 1/150 lateral system. Footage, 2,800. Cost, $70.00.

58. Class B, 50 per cent. breeding surface. Area, 1 acre. Hay, poor salt grass. Requires single main ditch 130 feet long. Cost, at 2½ cents per foot, $3.25.

59. Class A. Area, 1 acre. No hay of any value. Requires 200 feet main ditch, at 2½ cents per foot, $5.00.

Note. The Class E area around the edges of the cove into which 58 and 59 drain is mostly wild rice and tidal flat and may be safely disregarded.

60. Fresh water swamp hole without an outlet. Breeds in wet seasons, more or less. Treatment would be difficult and expensive.

61. Salt lagoon and marsh without outlet. Marsh is Class D. Area, 2.6 acres. Extreme tides break over the sand beach, fill lagoon and flood the swamp. Drainage only by seepage. Fortunately swamp stands about 3 inches above what appears to be normal level of lagoon so that a ditching system is possible. Central and 1/100 lateral ditches. Footage, 400. Cost, $10.00.

62. Fresh water cat-tail swamp. Possibility of intensive breeding of both salt and fresh water species. An outlet might be opened to the Sound but it would be somewhat expensive to drain this area and it is doubtful whether the ditch could be kept open any length of time. The most satisfactory remedy would be to fill the swamp, but this also would be quite expensive. It might be better to watch it carefully for a season to determine fully its importance before doing anything with it.

63. Fresh water cat-tail swamp with small lagoon near lower end. It might prove a serious fresh water and malarial mosquito breeder. Two remedies suggest themselves: (1) to restore the old outlet which leads out at the eastern end, and (2) to dig out the bottom of the lagoon so as to lower the water level enough to drain the swamp. Either would be somewhat expensive and perhaps not worth while. It would take a special and careful engineering estimate to arrive at the cost of either method.

64. Wooded marsh, apparently never much of a breeder and probably can be safely disregarded.

65. Small fresh marsh probably of some local importance. Could be filled for $100.00 or less. An outlet could also be opened to the Sound but difficulty would be experienced in keeping it open.

66. Fresh water lagoon near shore and wooded swamp in rear. Probably a fresh water breeding place of more than casual importance, but a difficult area to treat. An outlet and a tide gate would have to be constructed to drain it and it would also be necessary to place bulkheads on each side of outlet channel in order to prevent tidal current from blocking this outlet. It would require a careful and special estimate to arrive at the cost of such measures. Probably it would be well to observe the area carefully over a full season in order to determine its importance.

67. Mill Creek Salt Marsh. Class B, 30 per cent. breeding surface. Area, 60.9 acres, below railroad tracks. Mostly sedge grass of little value for hay. The outlet of this marsh is at present blocked by a wide sand bar. It will be necessary first to remove this bar and second to construct bulkheads on each side of the channel where it passes through the beach to prevent it from again becoming blocked. These bulkheads should be about 100 feet long and constructed of piles and 2-inch plank. The cost of materials and labor would be about $250.00. The cost of removing the bar at a very rough estimate would be $300.00. The marsh itself should be ditched 1/150. Footage, 12,700. Cost, $317.50. Total, $867.50.

Note. The upper portion of 67 is a fresh and wooded marsh but is so remote as to be of almost no consequence and was not specifically examined.

68. Lagoon surrounded by a Class D salt marsh. Upper end is a cat-tail and 3-square grass marsh. Area of marsh, 19.4 acres. A tide gate in good working condition controls water in lagoon. A 1/200 ditching system should be installed with reference to the lagoon. Footage, 4,000. Cost, $100.00.

69. Fresh water cat-tail marsh without outlet. Might breed extensively in a wet season. Is now partly filled and work should be continued.

70. Wooded marsh, casual breeder but of no very great importance.

71. Small marsh area of little importance.

72. Two fresh water lagoons. Might breed slightly along edges and in small marsh areas at upper ends.

73. Series of fresh water pools back of railroad track potential malarial breeders.

74. Small salt marsh along Four-Mile River above railroad track. Apparently of minor importance and not examined specifically.

Summary of Costs for Lyme.

Fresh water areas which were estimated separately	$800.00
Acreage of salt and brackish marshes, Old Lyme	1,393.1
" " " " " " Lyme	492.5
Total east of Connecticut River	1,885.6
Footage of lateral ditch required	275,000
" " larger " "	200

Cost of cleaning old ditches	$ 250.00
" " lateral ditches	6,850.00
" " larger ditches	50.00
" " special work	700.00
Total cost for salt marshes east of river	$7,850.00
Cost for Old Lyme only	7,600.00
Total cost for all areas estimated east of river	$8,650.00
Cost for Old Lyme township only	8,400.00

Note. Costs rounded to nearest $50.00 for sake of convenience.

Average cost per acre for work on salt marshes in Old Lyme township $5.50

CHANGES IN THE VEGETATION OF SALT MARSHES RESULTING FROM DITCHING.

By W. E. Britton, B. H. Walden and P. L. Buttrick.

It has long been known that ditching a salt marsh induces a heavier growth of the salt grasses and sedges growing there, and that different kinds of grasses and sedges appear after the ditches are cut. For instance, a soggy, undrained marsh usually has large bare areas and the vegetation often consists of rush grass, *Spartina glabra* var. *pilosa,* dead men's fingers, *Salicornia herbacea,* and marsh rosemary, *Statice limonium* var. *carolinianum*—plants which are of no agricultural value. After draining the marshes, these plants are largely replaced by spike grass, *Distichlis maritima,* black grass, *Juncus gerardi,* and red salt grass, *Spartina patens* (*juncea*). These last-named plants are of considerable economic value and furnish the bulk of the salt hay.

Though these facts are more or less generally known, there seem to be few, if any, definite recorded experiments or observations bearing on the subject.

The object of the work described in this paper is to obtain records of such changes in vegetation, after ditching the salt marsh, and to establish practicable methods for conducting more extensive investigations on the subject, if the results are promising.

In October, 1912, two plots, each containing one-fourth of an acre, were laid out on the salt marsh in the town of East Haven, just east of Lighthouse Point—an area which had just been ditched to eliminate mosquito breeding. The two plots mentioned were on opposite sides of the marsh and were drained by the same main ditch. It is apparent that the amount of ditching required to remove the standing water—which is necessary in eliminating mosquito breeding—is not necessarily sufficient to produce the maximum growth of salt hay. In the sample plots described in this paper there were probably enough ditches to eliminate mosquito breeding but it was found later that the main ditch was not adequate to remove the water at all times. When this became clogged, the water stood upon the surface so that there was some mosquito breeding at times. Owing to this fact, the changes in the character of the vegetation are not as marked as might be the case in some other areas, but while they do not show such great changes as was expected, they are nevertheless quite favorable.

The plots were divided into ten-foot squares and the areas of the different kinds of vegetation were carefully plotted. Levels were taken at intervals of 20 feet to note the change, if any, due to drainage, in the elevation of the marsh surface. The corners of the plots were marked with chestnut stakes two inches square and four feet long. These were driven about three feet into the marsh. Bearings were taken in each case from a permanent rock on the highland so that the plots could be re-located in case the stakes were removed. These rocks also served as bench marks in making the levels.

Plot No. 1.

This plot is on the South End Marsh near the highland east of the grove, 100 feet in the rear of a sand bar and about 200 feet from the Sound. The main ditch of the marsh is at a distance of 378 feet. Until lateral ditches were cut during the summer of 1912 this plot had probably not been adequately drained for many years.

The marsh was soggy, and the muck had an average depth of 1.95 feet. The underlying surface is sandy.

This plot was again mapped in the fall of 1915, three years after the first observations were made. The accompanying maps (figures 2 and 3) show the areas of the different kinds of vegetation in 1912 and in 1915, respectively.

The following table gives the areas in square feet of the different kinds of vegetation in 1912 and 1915:

Vegetation.	1912 sq. feet.	1915 sq. feet.	Increase or decrease sq. feet.	per cent.
Black grass	1839.38	1636.62	— 202.76	— 11.02
Spike grass	5615.50	3464.71	—2150.79	— 38.3
Spike grass and red salt grass	.....	3455.07	+3455.07	+100.
Red salt grass	217.21	466.87	+ 249.66	+114.9
Rush grass	1943.34	1186.79	— 756.55	— 38.9
Rush grass and spike	.....	346.46	+ 346.46	+100.
Highland vegetation	.....	259.48	+ 259.48	+100.
Dead grass area	557.36	.....	— 557.36	—100.
Bare area	643.21	.....	— 643.21	—100.

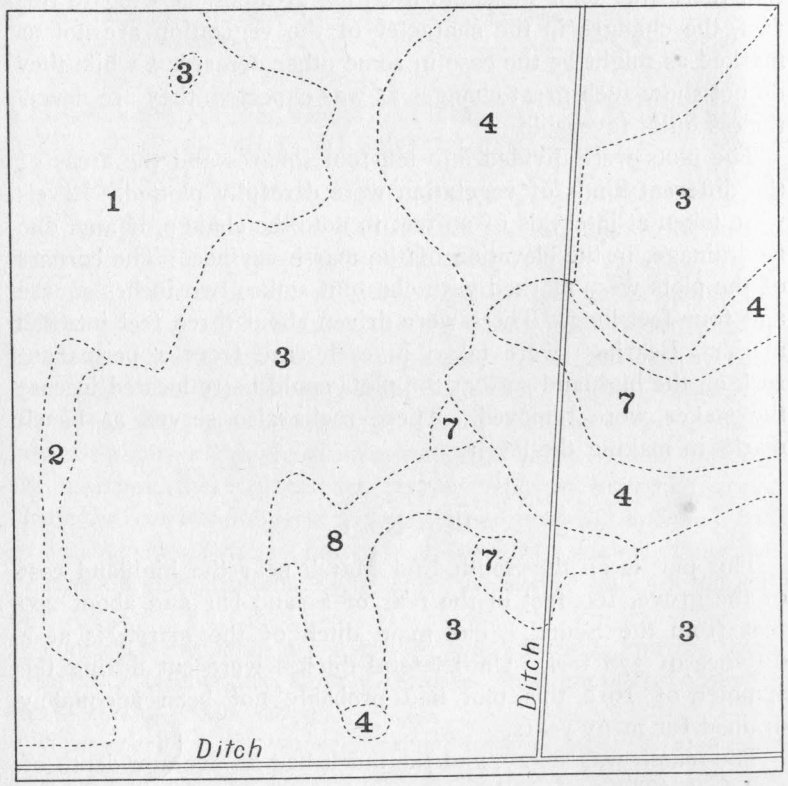

FIG. 2. Map or diagram of Plot No. 1, showing vegetation at time of ditching in 1912.

EXPLANATION OF MAPS.

1 Black grass
2 Red salt grass
3 Spike grass
23 Red salt and spike
4 Rush grass
43 Rush grass and spike grass
5 Highland vegetation
6 Salicornia
46 Rush grass and Salicornia
7 Dead grass area
8 Bare area

Black grass was the principal salt hay species present in 1912, the area being 1,839.38 square feet. In 1915 this had decreased to 1,636.62 (11.02 per cent.) due to the highland vegetation advancing on the west side and to the increase of red salt grass on the opposite side of the plot. Probably no further advance of highland vegetation will occur. In 1912 there was one area of red salt grass of 217.21 sq. ft. covering 2.01 per cent. of the whole plot. In 1915 there were two areas of red salt grass covering 466.87 sq. ft., or 4.31 per cent. of the area, making an increase

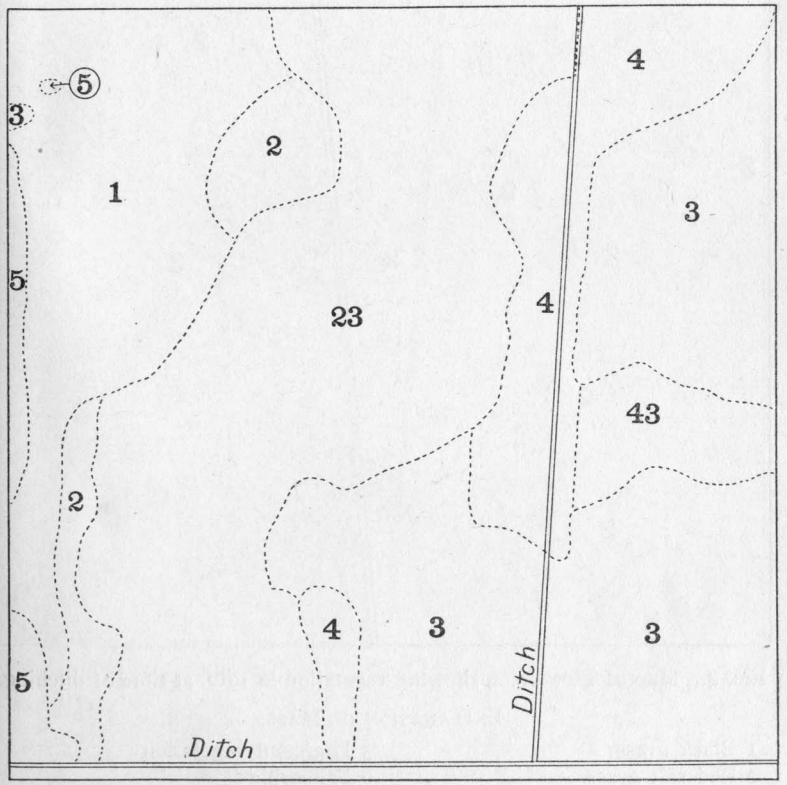

FIG. 3. Map of Plot No. 1, showing changes in vegetation three years after ditching, 1915.

in area of 114.9 per cent. This species is also advancing into the large spike grass area. It now averages nearly one-half the stand on 3,455.07 sq. ft., so that red salt grass is present on 36.26 per cent. of the whole plot, making its increase in area in proportion

to the size of the plot 34.25 per cent. The indications are that it will eventually replace most of the spike and rush grass areas. The spike grass is replacing the rush grass and has advanced over part of the dead grass and bare areas. The rush grass has covered the remaining portions of the dead grass and

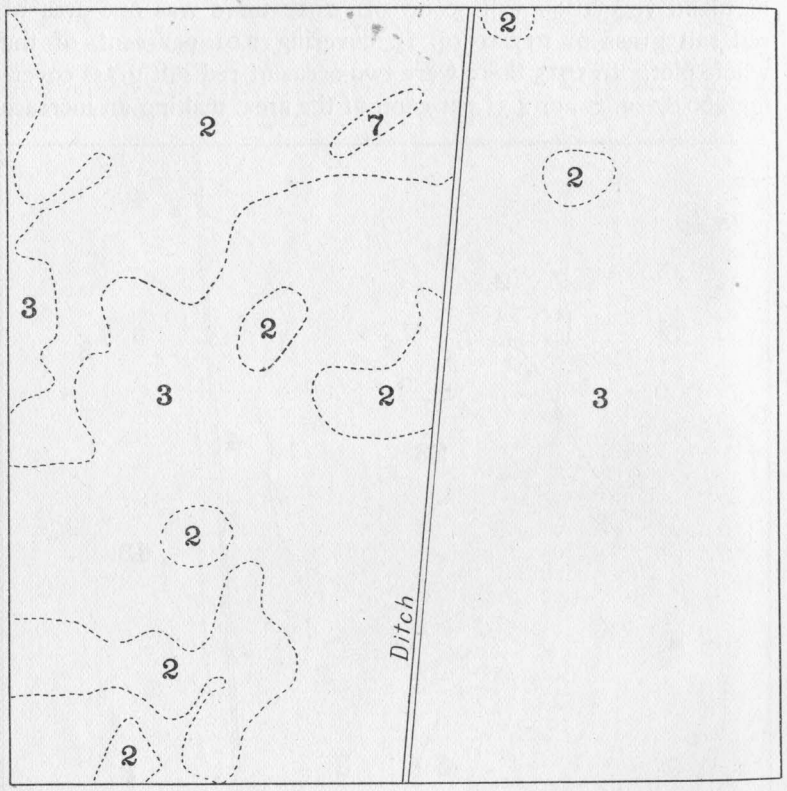

FIG. 4. Map of Plot No. 2, showing vegetation in 1912, at time of ditching.

EXPLANATION OF MAPS.

1 Black grass
2 Red salt grass
3 Spike grass
23 Red salt and spike
4 Rush grass
43 Rush grass and spike grass
5 Highland vegetation
6 Salicornia
46 Rush grass and Salicornia
7 Dead grass area
8 Bare area

bare areas but is being gradually replaced by the spike grass so that during the three years there has been a decrease in the rush grass area of 38.9 per cent.

The improvement in the character of the vegetation on this plot, while not as marked as it would be were the drainage more adequate, is nevertheless apparent. The bare and dead grass areas have been covered by rush and spike grass. The rush grass is being replaced by the spike grass, which in turn is being rapidly

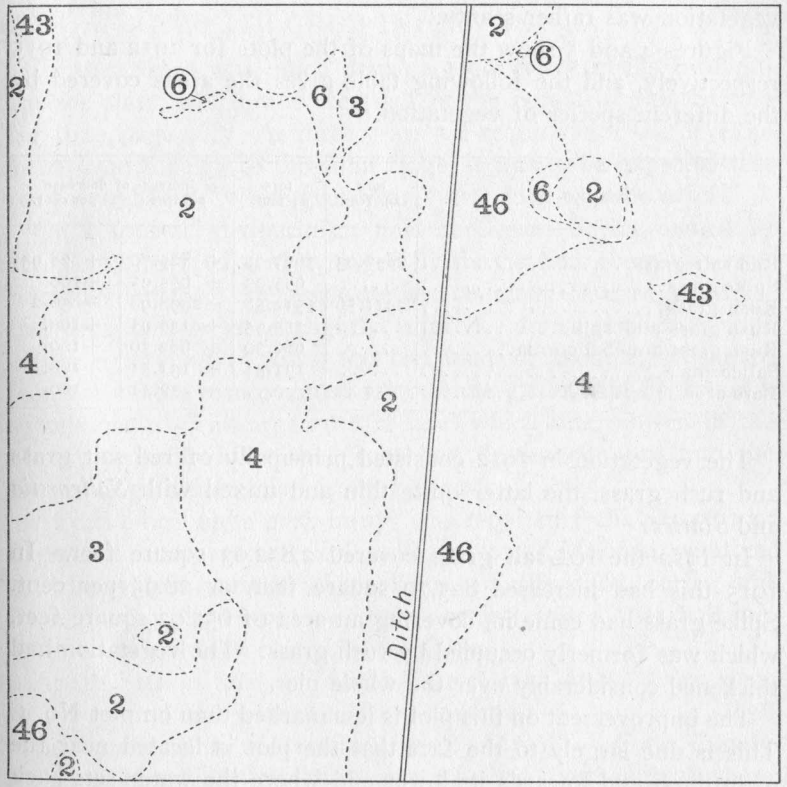

FIG. 5. Map of Plot No. 2, showing vegetation three years after ditching, 1915.

invaded by the red salt grass. The black grass, however, may be replaced by the red salt grass which seems to be the dominant species of the plot, and will probably in time cover it all. It is interesting to note that in three years, an area which was practically a bog hole has been turned by partial and insufficient drainage into a marsh of which the vegetation is heavy enough to warrant cutting for salt hay.

Plot No. 2.

Plot No. 2 is located on the opposite side of the same marsh as No. 1. It is 54 feet from the highland and 27 feet from the main ditch. The average depth is 2.2 feet with a sandy bottom. Before drainage the surface was frequently flooded and the vegetation was rather scanty.

Figures 4 and 5 show the maps of the plots for 1912 and 1915 respectively, and the following table gives the areas covered by the different species of vegetation.

Vegetation.	1912 sq. feet.	1915 sq. feet.	Increase or decrease sq. feet.	per cent.
Red salt grass	2852.03	3677.73	+ 825.70	+ 28.95
Spike grass	.....	655.93	+ 655.93	+100.
Rush grass	7911.56	5512.58	−2398.98	− 30.2
Rush grass and spike	.....	155.95	+ 155.95	+100.
Rush grass and Salicornia	.....	682.30	+ 682.30	+100.
Salicornia	.....	131.51	+ 131.51	+100.
Bare area	52.41	.....	− 52.41	−100.

The vegetation in 1912 consisted principally of red salt grass and rush grass, the latter quite thin and mixed with *Salicornia* and *Statice*.

In 1912 the red salt grass covered 2,852.03 square feet. In 1915 this had increased 825.70 square feet, or 28.95 per cent. Spike grass had come in, covering an area of 655.93 square feet, which was formerly occupied by rush grass. The vegetation had thickened considerably over the whole plot.

The improvement on this plot is less marked than on plot No. 1. This is due largely to the fact that the plot is located near the main ditch and towards its lower end where the water sets back sufficiently to keep the soil of the plot more or less water-soaked. Unless the main ditch is increased in cross section, this plot may never be entirely covered by red salt grass, which is the most desirable vegetation for it, but the improvement under partial drainage is substantial and significant.

These experiments show how rapidly changes take place in salt marsh vegetation following mosquito drainage, but the data are too incomplete to base any further conclusion than that these changes favor the more valuable hay grasses: and further that these grasses may take possession of even a poor marsh in a few years after its drainage. We hope to continue these experiments by re-mapping these plots every few years, and possibly by laying out others on a larger scale under more favorable drainage conditions.

WHITE GRUB INJURY IN 1915.

In 1912 there was much damage from white grubs throughout the state, which was recorded in the report of this Station for 1912, page 288. As three years are required for the development from the egg to the adult stage, it was to be expected that 1915 would be a "white grub year," and such was the case.

On a four-acre experiment field at Greens Farms owned by Mr. E. T. Bedford, and managed by the Station, there was considerable damage. The grubs ate lettuce, mangels, corn, potatoes, and even onions were slightly injured. In a small patch of lettuce containing 15 rows, 100 feet long, or about 1,750 square feet, one of the men counted 1,800 white grubs, and he found 7 on one plant. This was on turf land which was plowed in the winter, probably after the grubs had descended deep into the ground to gain protection from the frosts.

At this office white grub injury was reported from Saugatuck; Greenwich, strawberries; Yalesville, potatoes; Meriden, potatoes, strawberry and various other plants; Wethersfield, corn; and from Southport, where one correspondent stated that half his potato crop had been ruined by the grubs.

At the Station farm at Mount Carmel most of the crops were on old ground and were free from damage.

In September, the writer was asked by Mr. W. A. Cook, County Agent of Hartford County, to visit a field in Wethersfield where corn had been seriously injured. The visit was made September 13 in company with Mr. Cook. The field was owned by Mr. Dudley Wells and was planted with a mixture of corn and soy beans for silage. The entire center of the field had been greatly injured. The plants were dwarfed and brown and dying. On pulling at the stalks most of them came up easily as the roots had been eaten off. There were many grubs in the soil, and innumerable holes where skunks had dug to get them. Most of the damage had been to the corn, yet in some cases they had also eaten off the roots of the soy beans as well. Illustrations of this injury appear on plates X and XI.

In order to give as complete a summary as possible of white grub injury, I have asked the seven county agricultural agents in the state regarding their records and the distribution of white grub damage. The reports follow:

Fairfield County, S. J. Wright, Agent, Norwalk.

"The white grub has been the most injurious during the past season in the southwestern towns of Fairfield County, particularly New Canaan, where they have attacked grass sod, corn and potatoes principally. From Stamford and Darien, I have had several reports of their work on potatoes, and from all towns have come a few reports of some injury to potatoes."

New Haven County, F. E. Rogers, Agent, New Haven.

"Injury from white grubs has been reported to me from the following towns:—Middlebury 1, Prospect 1, Orange 2, Meriden 2, North Branford 1, Milford 1. The numbers after the towns indicate the number of cases reported. In most cases corn has been the crop injured. Occasionally strawberries have been mentioned, together with meadows and pastures."

Middlesex County, John H. Fay, Agent, Middletown.

"We have no information regarding the white grub on file in our office, and in my travels I have not found any reports of serious injury."

New London County, F. C. Warner, Agent, Norwich.

"Norwichtown, Lebanon, Lisbon and Colchester all reported white grub injury the past summer to the potato crop, I should estimate a total of ten cases having been reported at the office throughout the season. I inspected several fields personally and found that the white grub had eaten potato tubers, causing considerable injury."

Litchfield County, A. W. Manchester, Agent, Litchfield.

"I regret to say that I have kept no exact record of the sources of inquiries regarding injuries from the attacks of white grubs. At one time during the summer, I communicated with you about the matter as there were a large number of inquiries at that time. At present I can only say in a general way that more of the questions came from New Milford than from any other town and injuries to corn roots, potatoes and strawberry plants were reported."

Hartford County, W. A. Cook, Agent, Windsor.

"The only serious grub attack that was brought to my attention during the past season was at Wethersfield, which you and I visited together."

Tolland County. No organization. No report.

Windham County, W. C. Kennedy, Agent, Putnam.

"I am glad to say that I have not observed any extensive injury from white grubs. There must have been some through parts of Windham County, but I have not yet come in touch with it."

White grubs are the larvae of the June beetles of the genus *Lachnosterna,* of which there are at least fifteen species in Connecticut. Of this number *L. fusca* Fröh., *L. fraterna* Harris, *L. hirticula* Knoch, *L. crenulata* Foerster, and *L. nova* Smith, are the most common and presumably are responsible for the damage. We have not reared the adults from any grubs actually found feeding on the roots of grass or cultivated crops.

White grubs may be expected to be again abundant in 1918 and farmers should plan accordingly.

Control Measures.

Cultural practices should be followed to lessen white grub injury. Plowing and disk-harrowing in the fall will expose and kill many of the grubs. Crops most liable to be injured, such as corn, potatoes and strawberries, should not be placed on turf ground, weedy land, nor follow small grains, on years when white grubs are expected to be abundant.

ENTOMOLOGICAL FEATURES OF 1915.

The preceding winter was rather mild and not marked by any period of unusually low temperature. The spring and early summer of 1915 were rather cool and backward with little rainfall. Consequently many crops developed slowly. Heavy rains came late in July and were frequent during August and September, yet the total rainfall for the year was somewhat below the normal.

Tent caterpillars were even more abundant than in 1914, if it is possible for them to be more abundant.

Aphids of various kinds were common and abundant and caused considerable damage. The green apple aphis was present on the young trees at the Station Farm at Mount Carmel and required treatment, and the rosy apple aphis caused a portion of the fruit in the old orchard to be stunted and worthless. Certain other kinds of aphids were responsible for considerable injury of beet seed growing in Milford.

The San José Scale is now highly parasitized in Connecticut and is on the decline as an orchard pest, though spraying should still be persistently practiced against it.

The season of 1915 was remarkable for the great abundance of the apple maggot or railroad worm, which infested apples generally, especially the less acid and early ripening varieties; also the cabbage maggot was unusually abundant and caused great injury to early cabbages where no control measures were practiced.

Probably the chief entomological feature of 1915 was the discovery in Connecticut of the destructive European pine sawfly, *Diprion* (*Lophyrus*) *simile* Hartig, which is described on page 118 of this report. Though the larvae were first found in 1914, the identity of the species was not learned until May, 1915. Studies of this insect are being continued.

Another forest insect, the larch sawfly, was observed in Connecticut for the first time in 1915, and a full account may be found on page 125.

The summer was marked by an unusual amount of injury to grass and hoed crops by white grubs, the most since 1912. There were no signs of army worms noticed during the year and no reports were received of their presence within the state.

Red bug injury is apparently increasing in orchards, though the insects can scarcely be called abundant anywhere.

Progress has been made in suppressing the gypsy moth, no new infestations have been discovered in the state, and probably the pest has been eradicated in some of the twenty towns marked infested on the map. The spread of the brown-tail moth was very slight, only three new towns being found infested. Most of the nests were small and in many of them the larvae were dead.

There seems to be a slight subsidence in the amount of damage caused by the hickory bark beetle though many trees have died during the year.

There were a number of reports of serious damage to apple and peach trees by borers, so it seems as if 1915 might be called a "borer year."

It may not be out of place here to record also the discovery in the state of three scale insects, of two psyllids, the juniper webworm, and a snout beetle from Europe not hitherto known to occur here. These insects are all treated separately elsewhere in this report.

The summer of 1915 will long be remembered as one of the worst mosquito years of which we have record along the Connecticut coast. As most of these mosquitoes were the salt marsh species, their great abundance may perhaps be explained by the very high tides combined with heavy rains late in the season.

As a result many communities were aroused and in several towns preliminary measures were taken toward draining the worst mosquito-breeding areas. It is to be hoped that in each case the matter will be carried through so that some definite benefit will follow the advent of this "mosquito year" of 1915.

MISCELLANEOUS INSECT NOTES.

The Banded Flea-Beetle.—On July 7th specimens of the banded flea-bettle, *Systena tæniata* Say, were brought to the office from North Haven where they were abundant and causing injury to beans, tomato, egg-plant and sunflower, by feeding upon

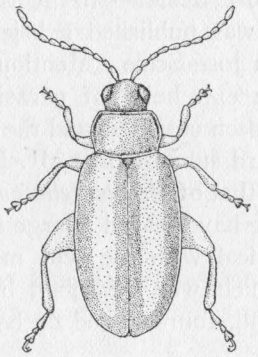

FIG. 6. The Banded Flea-Beetle *Systena tæniata* Say, nine times enlarged.

the leaves. This beetle is about one-eighth of an inch in length, shining, and varies from pale brown to nearly black, marked longitudinally with white stripes, as shown in figure 6. Spraying with lead arsenate will prevent serious injury.

Unusual Galls on Wild Rose.—On August 27th specimens were received from Sharon containing leaves of rose (probably *Rosa carolina*) which bore curious fleshy galls with corrugated

margins. They are made by a cynipid or four-winged gall-fly, *Rhodites gracilis* Ashm., first described in Proceedings U. S. National Museum, Vol. XIX, page 135, 1896, and reprinted by Beutenmüller in Bulletin of the American Museum of Natural History, Vol. XXIII, page 645, 1907. Its habitat was given as "unknown," and this is the first Connecticut record for this species.

The Lime-Tree Span-Worm.—The caterpillar of this insect (shown on plate XV, d) was found by the writer feeding upon birch leaves in New Haven June 1st. Mr. Zappe collected the species in Derby from linden June 11th. Some of these larvae pupated June 15th and one adult was obtained in December. This is a native insect which also feeds upon the apple, and its scientific name is *Erannis tiliaria* Harris. Like the fall canker worm the females are wingless, and the eggs are laid in November and December. It is much less abundant than the canker worms though often found feeding with them. Spraying with arsenical poisons is the remedy.

Parasite of San José Scale.—In the report of this Station for 1913, page 254, was published a brief note regarding the subsidence of the San José Scale. Mention was made of finding material showing the exit holes of parasites, but at that time the parasites had not been obtained, and the species was unknown. Material was afterward submitted to Mr. Daniel G. Tower, who identified the work as that of *Prospaltella perniciosi* Tower. During the past season we have reared a large number of these parasites which are identical with the type material of the species mentioned above, which was described by Mr. Tower. This parasite is a very small, four-winged fly belonging to the family Chalcididae.

The Buffalo Tree Hopper.—The Buffalo tree hopper, *Ceresa bubalus* Fabr., is a rather common insect in Connecticut, yet it is rather unusual to find its characteristic injury on apple twigs. Such injury is much more common in some of the other states. On March 18, however, we received from Wethersfield some apple twigs which had been badly scarred by this tree hopper in laying its eggs. This twig and some of the insects are shown on plate XV, c and e. This insect cannot be overcome by the

usual sprays, but thorough cultivation, and the burning over of weedy borders in June, will help to control it. Cutting off and burning in autumn the twigs having the freshly-made egg-scars will also aid in its suppression.

Leaf Roller on Privet.—The leaf roller attacking privet hedges, which was studied by Mr. Walden in 1913,* was present on the Station grounds in 1915 and was once brought to the office from Willow Street, New Haven. The larva rolls the new growth, ties the leaves together with silk threads, and inside this nest it feeds. The adult is a small, olive brown moth bearing the Latin name of *Archips rosana* Linn. A full description and life history are published in the report of this Station mentioned below.

Apple Red Bugs.—The false apple red bug or lined red bug, *Lygidea mendax* Reuter, continues to do considerable damage in the southwestern corner of the state but is less abundant elsewhere. In both 1914 and 1915 this insect was present on the Station grounds and on June 2, 1915, a trace of its work was found by the writer in the apple orchard of W. A. Henry & Son, in Wallingford, though after hunting for an hour only one insect was found. On June 7th samples of its work were brought to the office from Cheshire. Where red bugs are prevalent, the trees should be sprayed just before the blossom buds open and again just after the petals fall, with Black Leaf 40, one pint in 50 gallons of water. This can be added to a mixture of lead arsenate and fungicides.

Sawfly on Imported Manetti Rose Stock.—For the past two years manetti rose stock from France has contained sawfly larvae in the pith of the stumps where the tops had been cut off. On rearing the adults it proved to be *Emphytus cinctus* Linn., a European species already established in this country. This insect apparently does not bore into the plants in any injurious manner but merely goes into the pith of the cut stems because this is a convenient place in which to pupate. Nearly all were within two inches of the cut end and naturally would be cut off in grafting

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* B. H. Walden, Report Connecticut Agricultural Experiment Station, page 223, 1913.

or budding. They are shown on plate XIII, a. In Europe the larva feeds upon the leaves of rose and raspberry and is recognized as an injurious insect. The larvae can be killed by spraying the foliage with lead arsenate or hellebore.

The Linden Borer.—In one of the nurseries for several years there has been considerable injury to linden trees by the linden borer, *Saperda vestita* Say. The trees are attacked near the base, and large tunnels are cut under the bark. A fungus usually follows, causing the wood to decay and the trees soon break over. The injured trunks and the beetle causing the injury are shown on plate XIII, b. Apparently the life history of this beetle has not been carefully worked out, but as some of the other species require two years for their complete development we may expect the same to be true of the linden borer. All trees should be carefully examined at least twice each year, carbon disulphide injected into the burrows, and their openings tightly plugged to keep the fumes inside.

Two Psyllids New to Connecticut.—On May 29th some boxwood (*Buxus*) twigs were sent to the Station from Pomfret infested with nymphs and adults of a psyllid supposed to be *Psylla buxi* Linn. More material was later sent at our request. In order to make sure of the identity of the insect, specimens were sent to Dr. Edith M. Patch of Orono, Maine, who replied that *P. buxi* was present but that most of the psyllids were a different species which she had identified provisionally as *Spanioneura fonscolombii* Foerster. *Psylla buxi* was first recorded in the United States in 1884, and it has been reported many times since, though not from Connecticut. *Spanioneura fonscolombii* has not previously been reported from this country. Both are European insects and were probably brought to the United States on nursery stock.

Injury by the Strawberry Root Worm.—On August 21, some soil containing injured strawberry plants were received at the laboratory from a private garden in the western part of the city of New Haven. The leaves were riddled with holes, and in the soil were many adult beetles of the species commonly known as the strawberry root worm, *Typophorus canellus* Fabr. The writer visited the garden August 27th and examined the plants.

Nearly all leaves had been badly eaten, but the roots had not been injured. The beetles feed upon the leaves in May and the larvae live in the soil and eat the roots, becoming mature in July. They pupate in earthen cells from which the adult beetles emerge during August. They feed upon the leaves for a time, then go into winter quarters. There is but one brood each season. A thorough spraying with lead arsenate when the beetles begin to feed in May and August will probably prevent serious damage.

A Woolly Aphis on Silver Maple.—In June there was brought to the Station, from Derby, a branch of cut-leaved silver maple, containing a mass of woolly aphids shown on plate XVI, d. This insect was formerly known as *Pemphigus acerifolii* Riley but in the recent studies of Dr. Edith M. Patch* at Orono, Maine, it is shown to be identical with the so-called alder blight, *Pemphigus tessellata* Fitch. The tree in question was sprayed in the morning with kerosene emulsion, and when examined by the writer in the afternoon, all aphids had been killed which were hit by the spray. A few twigs remained unsprayed and the gardener was instructed to either cut them off or treat them with the emulsion.

White Ants in House at Ridgefield.—On May 12, 1915, specimens of white ants, probably *Leucotermes* (*Termes*) *flavipes* Kollar, were received from Ridgefield, where they had tunneled in the structural timbers of a dwelling house, eating their way out into the kitchen where they emerged in large numbers. These insects are quite common and swarm at about this time of the year. A few years ago they emerged from the board walks in the Station greenhouse, and once the writer noticed them swarming from the boards along the edges of the tar walks on the New Haven Green. They also breed in old stumps in fields and woodlands. Occasionally they cause considerable damage to buildings, bridges, trestles, etc., by tunneling in the timbers, greatly weakening the structure. If it is known that they are present, it is a simple matter to kill them by boring into the infested posts or beams, injecting some carbon disulphide and plugging the opening.

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*Edith M. Patch, Journal of Economic Entomology, Vol. 2, page 35, 1909.

The Chrysanthemum Leaf Miner or Marguerite Fly.—Plants of the family Compositæ, and especially chrysanthemums and marguerite daisies growing under glass, are occasionally attacked and disfigured by this insect, *Phytomyza chrysanthemi* Kow. Thus samples of infested marguerites were received from Milford, April 8, 1911, and from New Canaan December 17, 1915. The larva tunnels in the leaf, eating out the green tissue and leaving only the veins and epidermal layers. Where thus eaten, the leaves have a whitish appearance as shown on plate XVI, a. Both larval and pupal stages are passed in the tunnels. The most comprehensive account of this insect which has been published occurs in a bulletin of the Massachusetts Station* and this publication recommends as a control measure spraying with the nicotine solutions, such as Black Leaf 40, diluted at the rate of one part in about 400 parts of water, and applied at intervals of about twelve days.

A New Leaf Weevil in Connecticut.—On May 24, 1914, the writer collected in his own garden some small, bright green snout beetles. They seemed to be in the grass of the lawn under a birch tree and would crawl over one's clothes. Other specimens were taken on June 12 and 30, 1915, in the same locality. The species was identified as *Polydrusus impressifrons* Gyll. from Europe, by Mr. W. Dwight Pierce of the Bureau of Entomology, of Washington, D. C. The writer has not made any observations upon its food habits or life history, and apparently little has been published in Europe regarding it. In a paper recently read before the Ontario Entomological Society by P. J. Parrott and Hugh Glasgow of the New York Agricultural Experiment Station, Geneva, N. Y., it was stated that this weevil was first noticed in New York at Geneva in 1906, and that it is now exceedingly abundant in some localities. It feeds upon unfolding buds and later upon the margins of leaves, especially of willow, poplar and birch. The larvae feed upon the roots. At present this insect is regarded as a minor pest in New York State, particularly in nurseries, though it can doubtless be controlled by spraying with lead arsenate.

* M. T. Smulyan, Mass. Agr. Expt. Station, Bull. 157, 1914.

A Tortricid on Oak.—On May 22d, small caterpillars feeding on oak were received from Mr. G. H. Hollister, Superintendent of Keney Park, Hartford, who wrote as follows:

"I am sending a package containing oak twigs which are infested with some insect which is doing considerable damage in the woods in the northern part of the park. I found it on four species of the black oak type, but none were on white oak. It had apparently commenced work soon after the leaves were out on some trees. I shall not attempt spraying the trees this year, but probably shall next year."

We did not recognize the caterpillars, which were small, greenish and semi-transparent, but the adults emerged on June 15, and proved to be *Tortrix albicomana* Clemens, a species which has long been known to feed upon oak. It has also been recorded upon rose and *Aquilegia canadensis*. The adult is a small moth having a wing-spread of five-eighths of an inch. The fore wings are sulphur yellow and the rear wings silver gray. Spraying with lead arsenate soon after the leaves unfold will probably prevent any serious injury.

The Iris Borer.—Several times during the past few years the writer's attention has been attracted to a larva boring in the rootstocks of German iris in gardens. Infested rootstocks were received from New Haven, June 30, 1906; July 23, 1909; July 6, 1910; July 5, 1913, and from Danbury July 29, 1915. In 1906, larvae were sent to the Bureau of Entomology at Washington, and thought to be *Macronoctua onusta* Grote. A brief note was published* regarding it. In all cases the material has been very meager and we did not succeed in rearing the adult, which is of course necessary for a definite identification.

From the material received this year from Danbury, an ortalid fly emerged but may not have been connected in any way with the borer. On July 29, Mr. Lowry collected on the Station grounds some infested rootstocks and from them, on October 4th, there emerged an adult of *Macronoctua onusta* Grote, which is shown on plate XV, b. This insect is apparently not very abundant but will be found here and there wherever iris is grown. The only control measure that can be recommended is to destroy the infested rootstocks as found when resetting the plants.

* Report Conn. Agr. Expt. Station, page 306, 1906.

Mites Injuring Bermuda Lilies.—On March 27, 1915, Easter lilies were sent to the Station by a local florist who had imported the bulbs from Japan in the summer of 1914. The plants were nearly ready to blossom when they began to droop and could not be made to recover. They were found to be infested with the Bermuda lily mite, *Rhizoglyphus hyacinthi* Boisdv., many of which were burrowing in the roots and main stem as shown on plate XIV. I am indebted to the Bureau of Entomology for the positive identification of this pest. Many of the roots were entirely dead; others were only partially killed, and a new set of roots had started out from the main stem above the bulb, which, of course, is abnormal. When plants reach this condition, they cannot be saved. Over 3,000 plants had thus been ruined.

The mites were probably on the bulbs when imported and perhaps might have been killed by dipping the bulbs in fir tree oil or a nicotine solution. At present there is no systematic inspection of bulbs imported into Connecticut, and florists should order bulbs on condition that they are not infested.

A New Enemy of Peach Trees.—On July 3d, we received from Mr. George A. Hopson of Wallingford, some small beetles causing injury in the orchard of a peach grower, with the following statement:

"I am enclosing a sample of insect which has wrought havoc in a peach orchard here by eating the green leaf buds as the leaves are beginning to start on newly-set trees. They seem to come up out of the ground about dusk and before daylight have crawled into the ground or under stones near the base of the trees. They completely cleaned about 1,000 trees. Are they something new or am I behind the times? A letter from you would greatly please the owner who is an Italian; says he has dug as many as 40 from one tree."

The beetles in question were *Diplotaxis atlantis* Fall, and look like small June beetles, to which they are in fact closely related. An adult is shown on plate XV, a. Ordinarily they feed upon the leaves of native trees in the woodlands. It is a native species and is not supposed to do much damage to cultivated trees or plants. It is possible that the peach orchard was near a woodland where the beetles have been abundant. The writer learned that the beetles entirely disappeared soon after the samples were sent, so there was no opportunity for experiment. This record of injury is interesting and is mentioned here to show that frequently our native species may, when abundant, attack and injure cultivated trees and plants, when under ordinary conditions they are not regarded as injurious. Possibly a heavy coating of lead arsenate on the buds and unfolding leaves might serve to check the pest and prevent further or serious injury.

Aphids on Seed Beets.—The writer was called to examine a field of beets grown for seed in the town of Milford on July 19th. This field was owned by The Everett B. Clark Seed Company and contained several acres. Most of the plants had blossomed and were loaded with the immature seed. The plants generally were infested with three species of aphids, some so badly as to ruin the seed crop. On account of this infestation some plants would produce only worthless seed, but by far the greater part of them would produce a crop of seeds which would be of light weight and therefore greatly inferior to the full-sized and heavy seed.

The most abundant aphid, and therefore the one chiefly responsible for the damage, is common on beans, dock and various native and cultivated plants. It is brown or nearly black and is commonly called the bean plant-louse, *Aphis rumicis* Linn. The other two are both more slender, light-green species which have been positively identified by Dr. Patch as *Macrosiphum solanifolii* Ashm. and *Myzus persicæ* Sulz. The former is found on a number of cultivated plants and weeds, especially potatoes, and the latter is the green aphis of peach trees.

Lady beetles of several species were abundant over the field and many of the lice had been parasitized by *Lysiphlebus,* and their empty shells were still adhering to the leaves.

Both kinds of aphids were also found on the weeds, lambs' quarters, *Chenopodium album,* and pigweed, *Amarantus retroflexus,* which were growing throughout the field.

At the time of the visit, the damage had all been done and it was too late for any kind of treatment. It is probable that thoroughly spraying the plants with a nicotine solution like Black Leaf 40, applied under high pressure (one-half pint in 50 gallons of water, with 2 lbs. of soap) two or three weeks earlier in the season would have killed most of the aphids, saved the entire crop and proved a profitable investment. Mr. Clark was advised to try this treatment in a small way and watch results.

SENDING INSECTS FOR IDENTIFICATION.

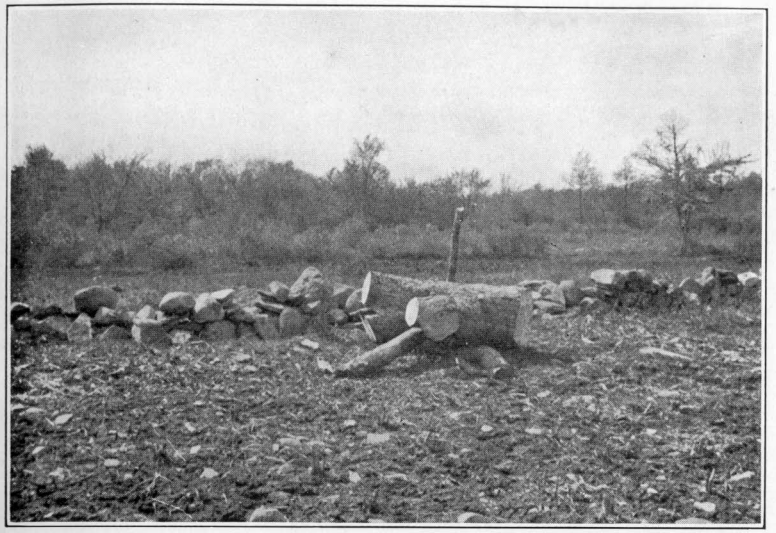
In writing to the State Entomologist or to the Station regarding insect injuries, specimens of the insects or of their work should be sent, if possible, because such specimens form the basis of definite advice, whereas without them only general recommendations can be made to the correspondent.

Many insect specimens are received and identified each year, and if injurious, treatment is advised. This service must be of considerable value to the farmers, gardeners and orchardists of the State. It has resulted in the discovery of several insects not previously known to occur in the State, and has therefore been of value to this office as well as to the correspondents.

Except for rearing, the specimens should be killed before sending. This can be done by placing them in an oven for a few moments, suitably enclosed in a metal box; also by immersing them in gasoline or alcohol, both of these liquids soon evaporating on exposure to the air. Insects may also be killed by a few drops of chloroform, or carbon disulphide placed with the specimen in a gas-tight box. The entomologist employs cyanide tubes and jars for killing insects when they are to be preserved for the collection; sometimes chloroform is used for moths which are too large for the cyanide jar.

There is a State law (see page 111, Sec. 3), providing a heavy penalty for transporting living gipsy or brown-tail moths in any of their stages from the infested region to a region not hitherto infested, so that all insects suspected of being either of these pests should be killed before sending. A Federal law also imposes a heavy penalty for thus distributing important pests through the mails.

Never send any insects loose in an envelope or folded in the letter, where they are usually crushed beyond recognition, often rendering the accompanying letter illegible. Place them in a strong box or mailing case; it is not necessary to punch holes in it. If insects are alive, and in the feeding stage, a bit of the food plant should be enclosed. Give what data you possess about the specimen. Above all, do not forget to place your *name and address* on the package. Several specimens are received each year with no indication who sent them, and the sender is probably still wondering why he did not receive a reply.

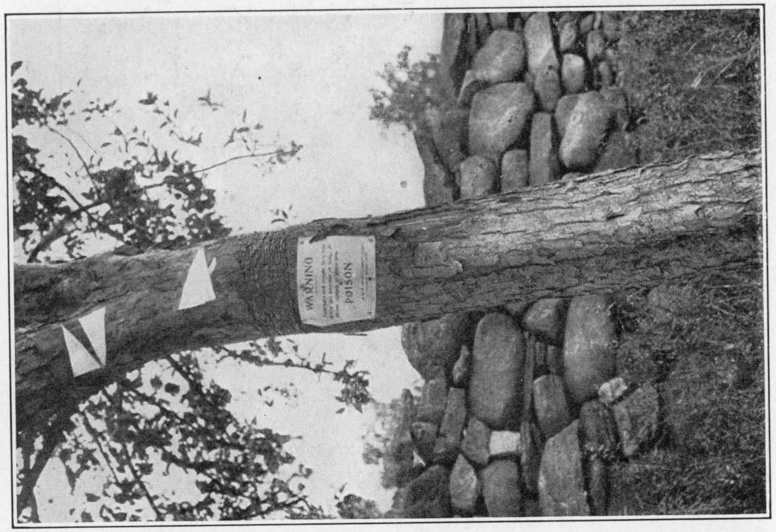


a. Infestation No. 5, Hampton, 1914; 40 egg-clusters were found in the stone-wall, and in the old apple-tree which has since been cut.

b. Woodland infestation (A), Thompson, 1914, after cleaning. One egg-cluster was found here.

GIPSY MOTH WORK.

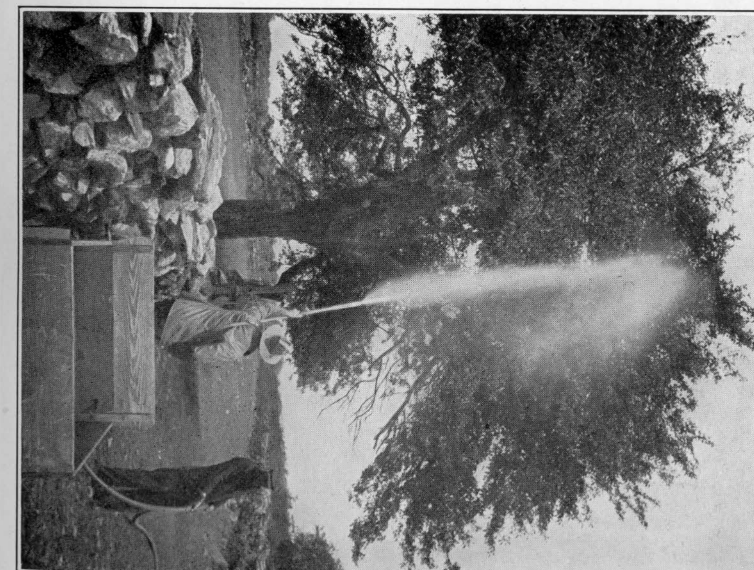
a. Infestation No. 1, Putnam, 1915, after cleaning. Seven egg-clusters were found.



b. Roadside apple-tree at infestation No. 8, Killingly. Tree shows tanglefoot band, warning notice, and triangular stickers informing general foreman where men may be found.

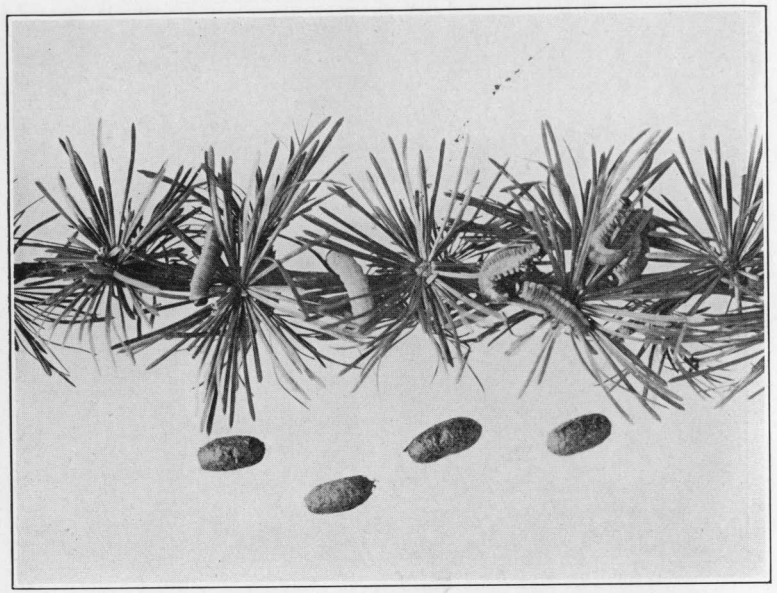
GIPSY MOTH WORK.

a. Spraying woodland trees in Thompson.

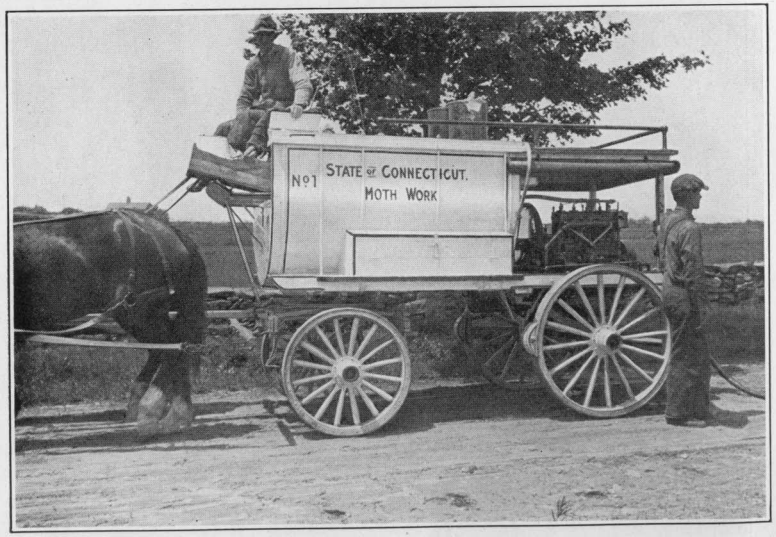


b. Spraying large apple-tree. Infestation No. 12, Putnam.

GIPSY MOTH WORK.



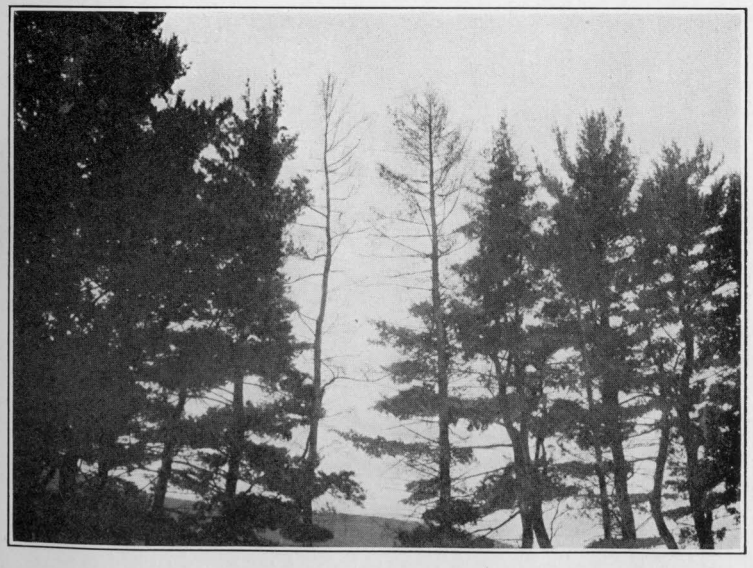
a. Larvæ and pupæ of the larch sawfly. Natural size.



b. High-power sprayer used in woodland infestations.

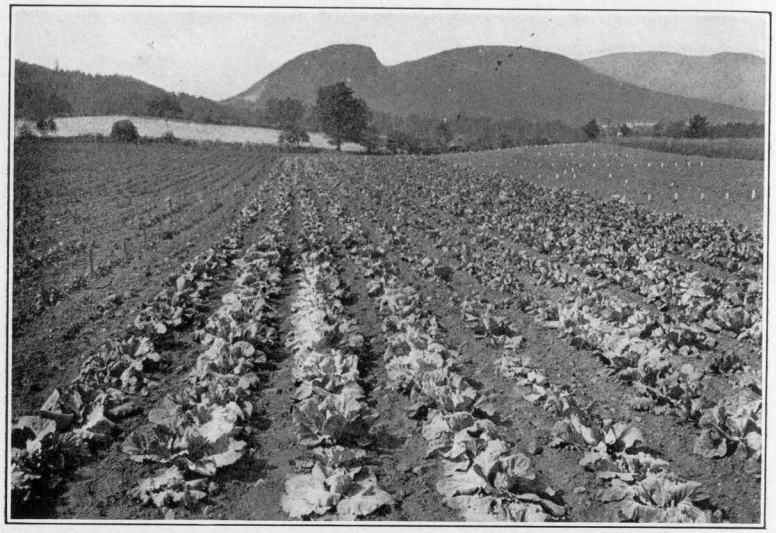
LARCH SAWFLY AND GIPSY MOTH WORK.

a. Grove of larch trees in Woodstock, partially stripped by larvæ.



b. The two larch trees between pines were entirely defoliated. Canaan.

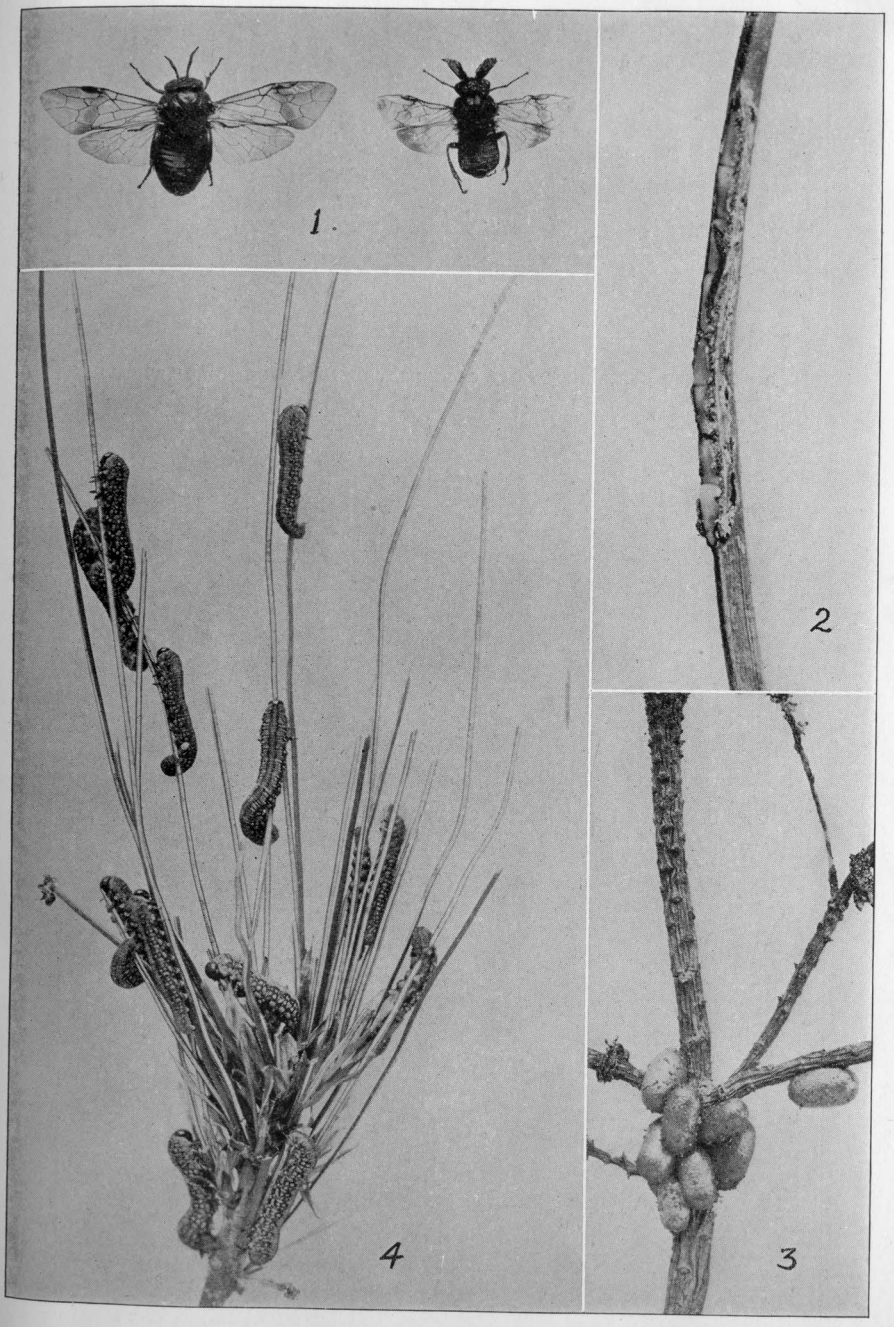
THE LARCH SAWFLY.



a. General view of experiment field at Mt. Carmel.

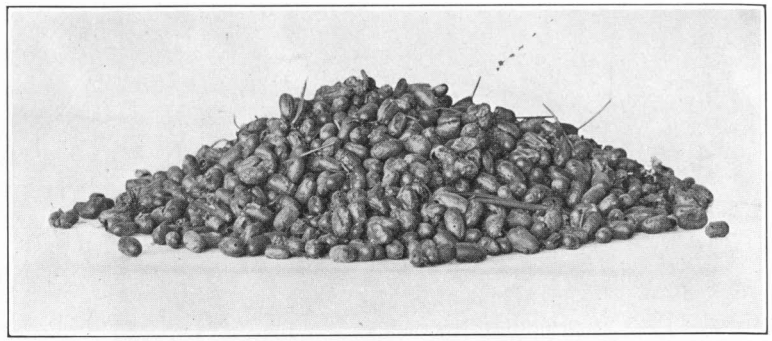
b. Plants at left were protected by tarred paper disks, 5 per cent. infested. Plants at right untreated, one-third ruined.

CABBAGE MAGGOT EXPERIMENTS.

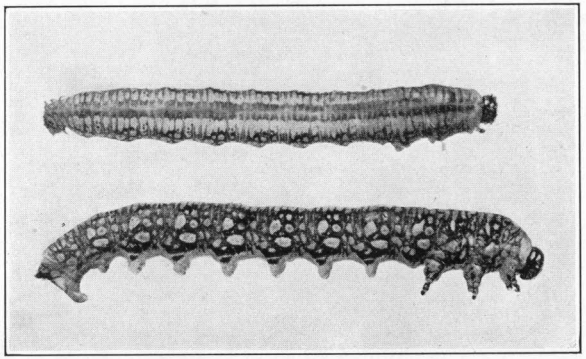


Diprion simile: Hartig. 1. Adults, twice natural size; 2. Eggs in pine needle, about 4 times enlarged; 3. Cocoons, natural size; 4. Larvæ feeding on pine, natural size.

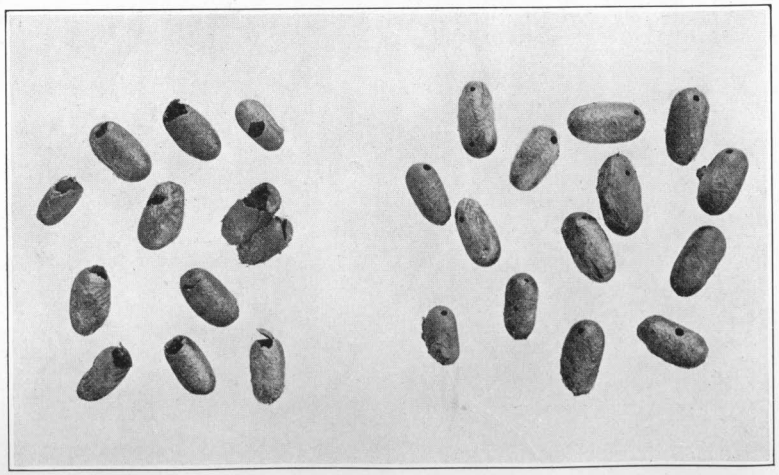
IMPORTED PINE SAWFLY.



a. A heap containing 1,617 cocoons, collected from pine twigs.

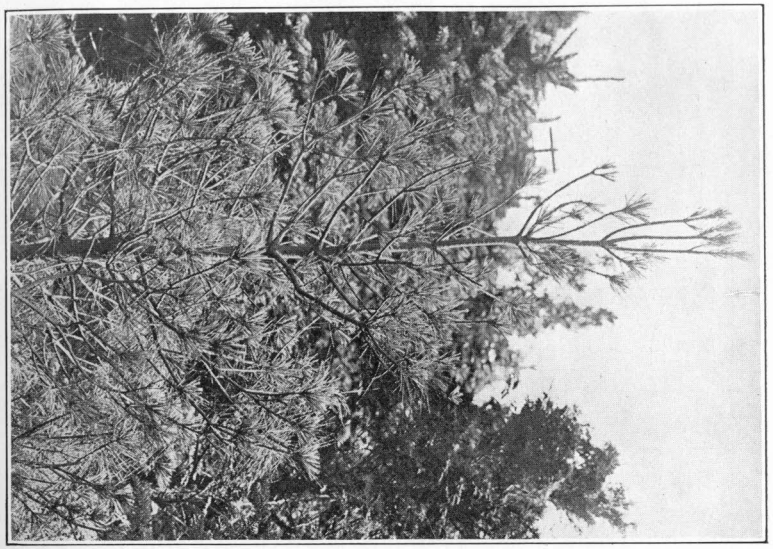


b. Dorsal and lateral view of larva, twice enlarged.

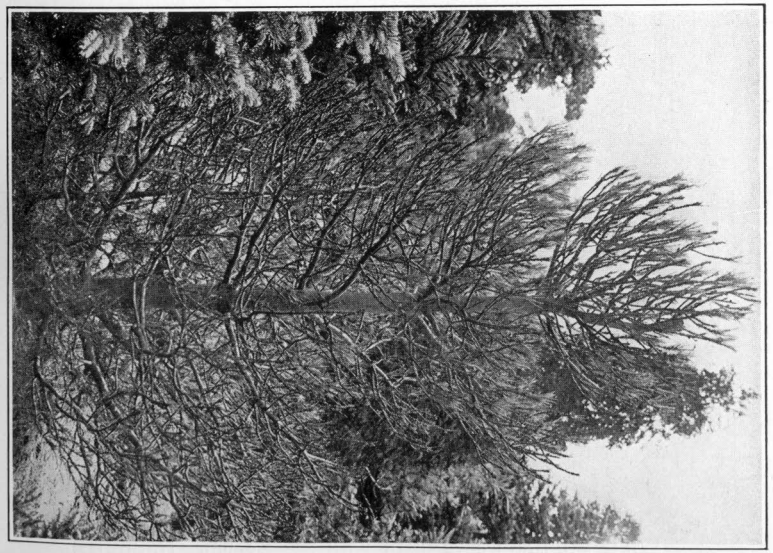


c. Cocoons at left have been torn open, probably by birds; those at right show exit holes of Chalcid parasite. Natural size.

IMPORTED PINE SAWFLY.

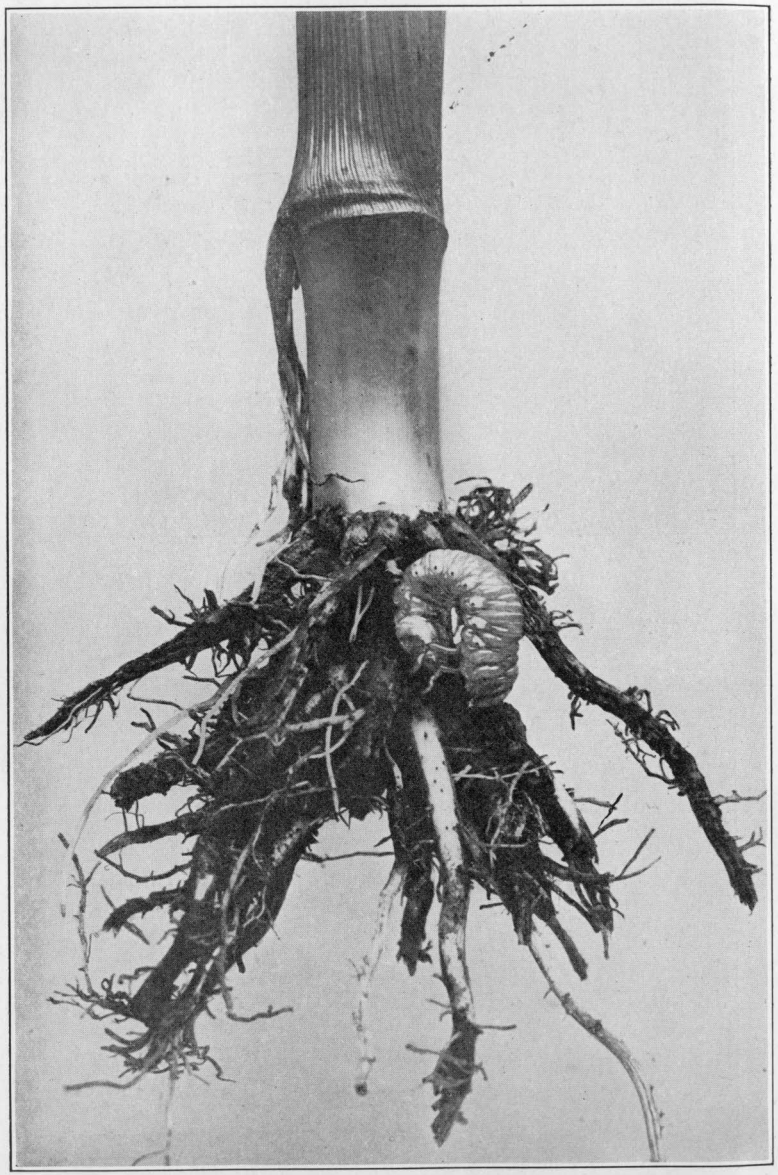


a. Japanese or Bhotan pine. *Pinus excelsa*, partially stripped by larvæ.

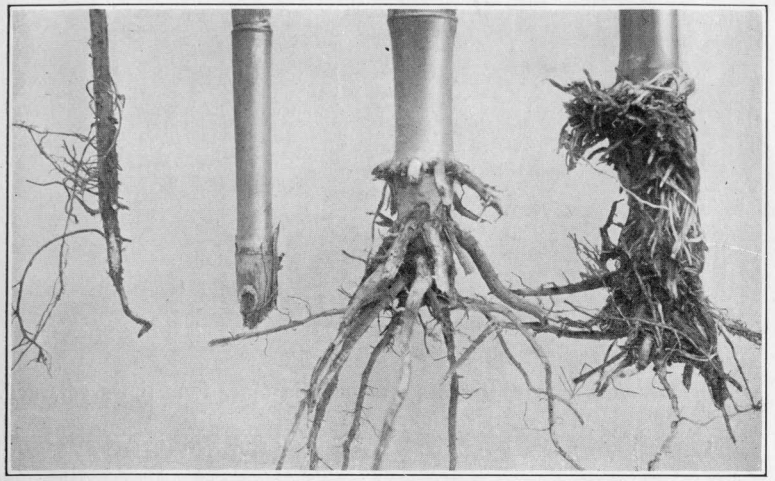


b. *Pinus cembra* about 7 feet tall almost defoliated by larvæ.

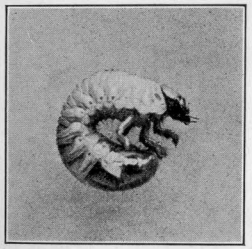
IMPORTED PINE SAWFLY.



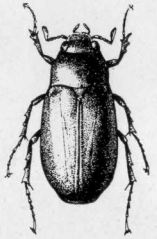
White grub and corn plant with roots eaten. Natural size.



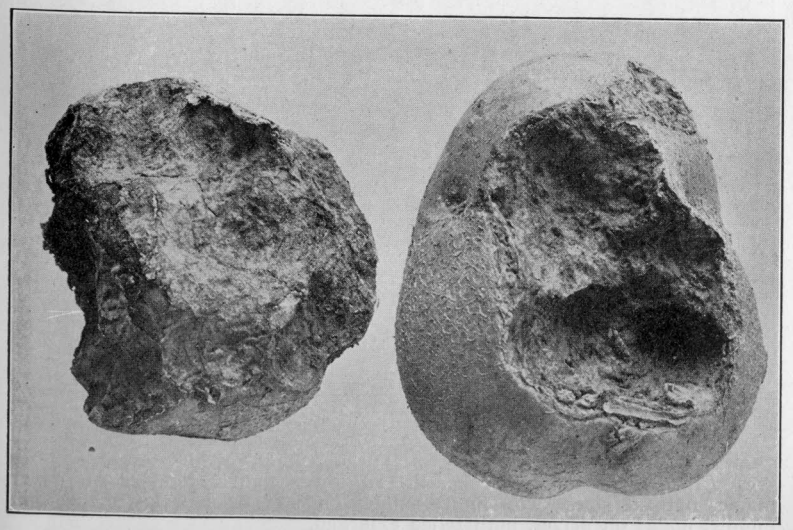
a. Soy bean (at left) and corn plants with roots eaten off by white grubs.



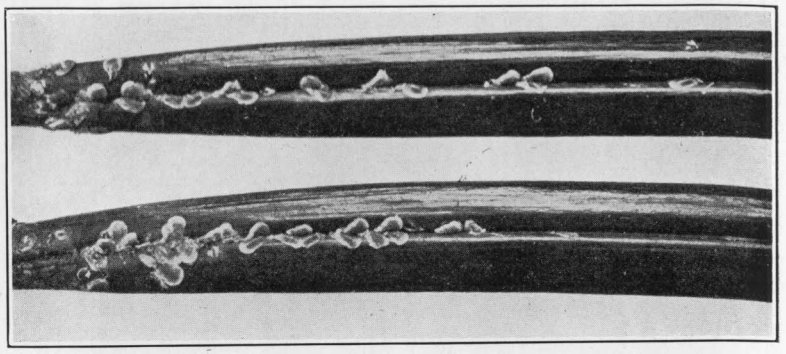
b. White grub. Natural size.



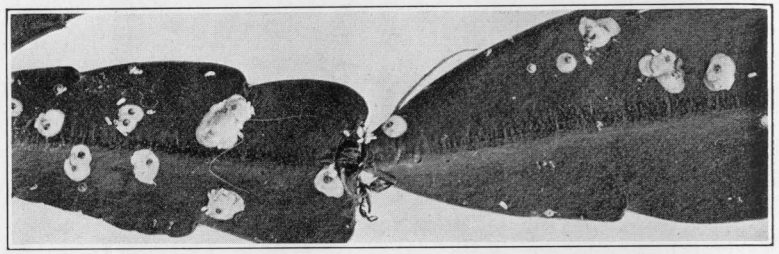
c. Adult June beetle. Natural size.



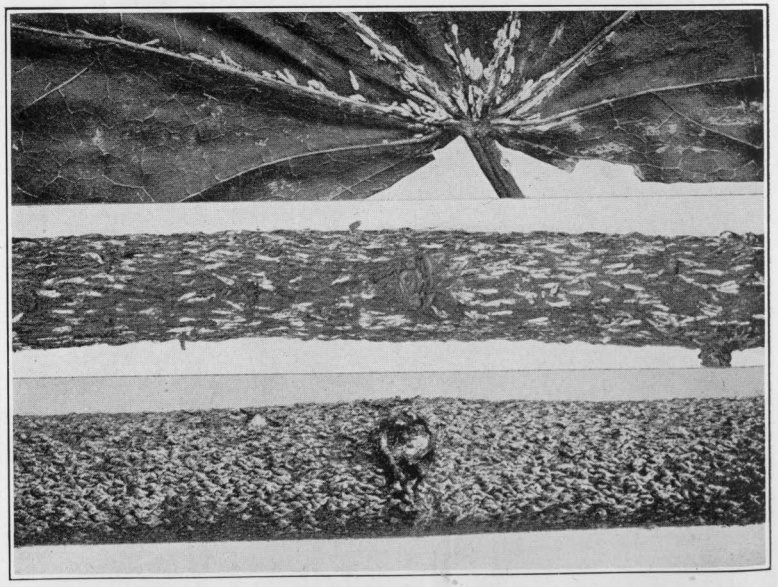
d. Potatoes eaten by white grubs.



a. *Lepidosaphes newsteadi* Sulc. on umbrella pine, four times enlarged.

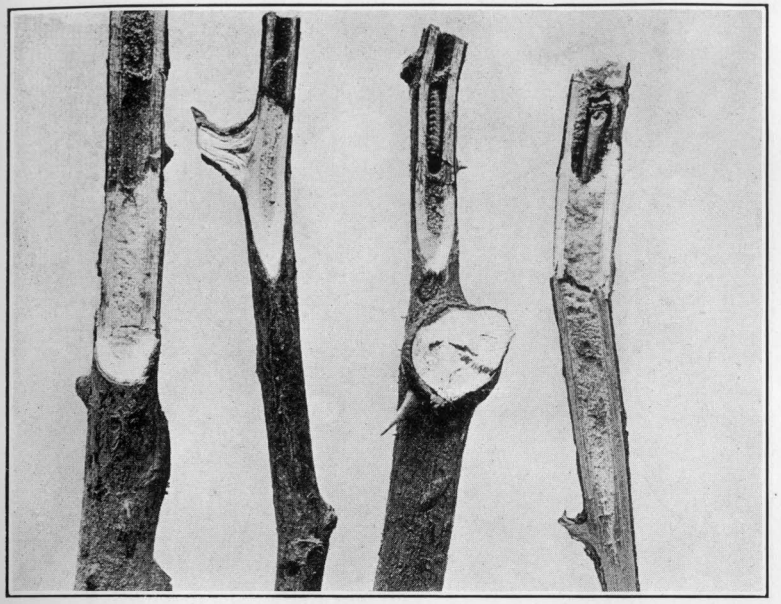


b. Cactus scale, *Diaspis echinocacti* Bouché var. *cacti* Comst., twice enlarged.

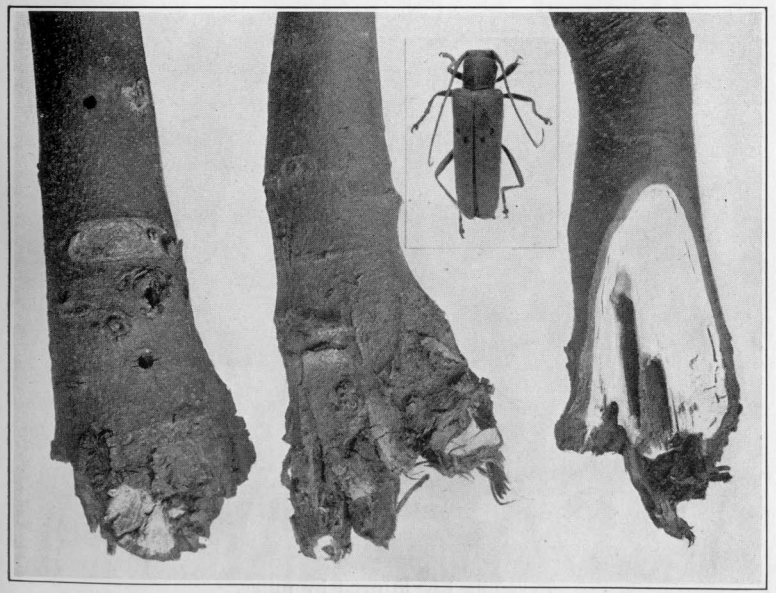


c. *Leucaspis japonica* Cockerell. In lower figure, females on silver maple, natural size. Top figure, males on leaf of Norway maple; in middle, males on privet, both twice enlarged.

SCALE INSECTS.

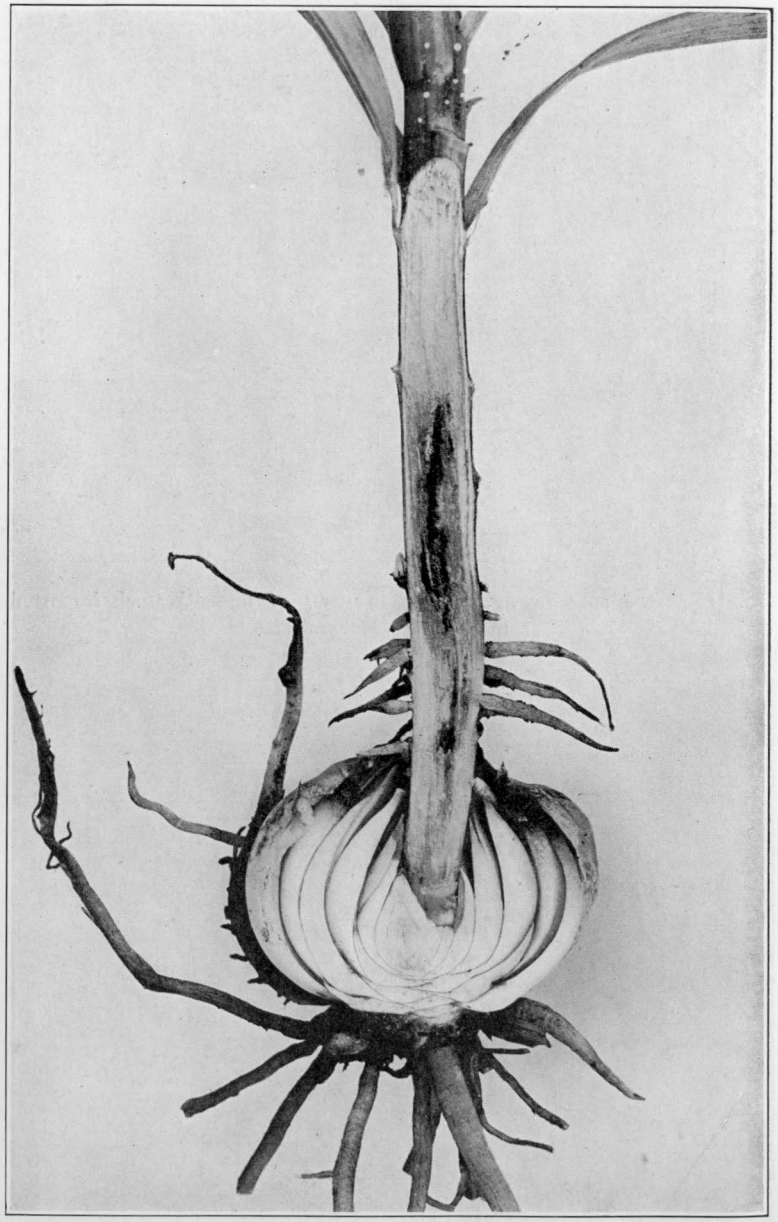


a. Imported rose sawfly. Larvæ in stubs of manetti stock imported from Europe. Natural size.



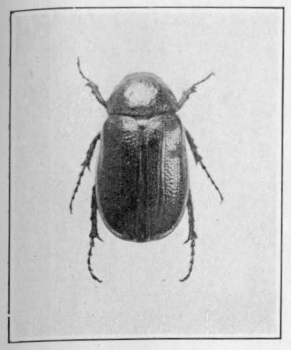
b. Linden borer, *Saperda vestita,* natural size, and its injury to young linden trees, greatly reduced.

IMPORTED ROSE SAWFLY AND LINDEN BORER.

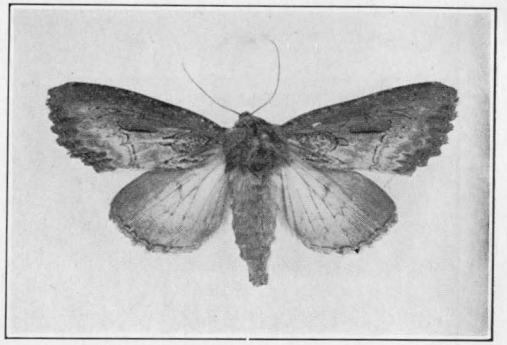


Bermuda lily injured by mites.

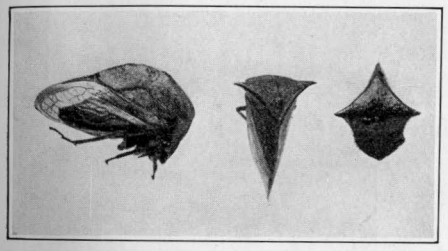
LILY BULB MITE.



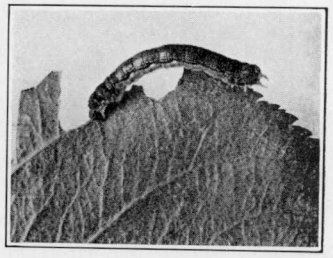
a. *Diplotaxis atlantis* Fall., twice enlarged.



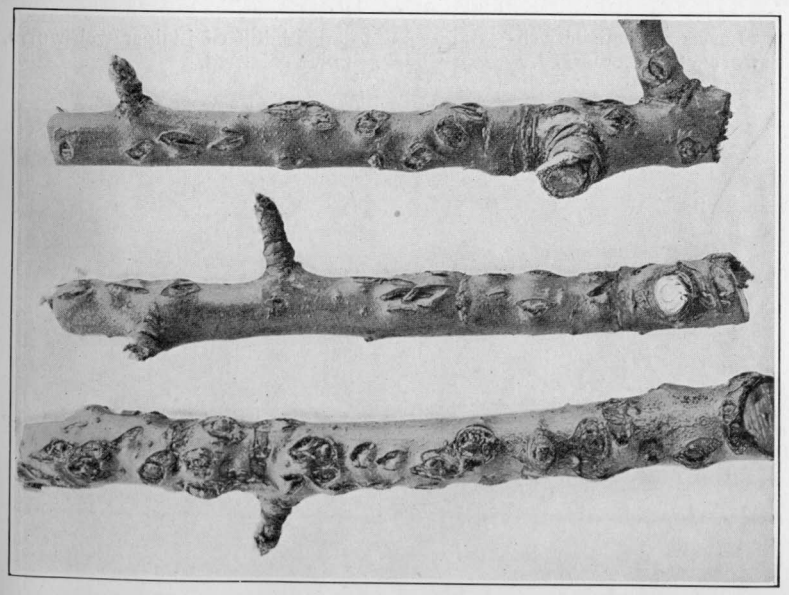
b. *Macronoctua onusta* Grote. Natural size.



c. Buffalo tree hopper, *Ceresa bubalus* Fabr., twice enlarged.



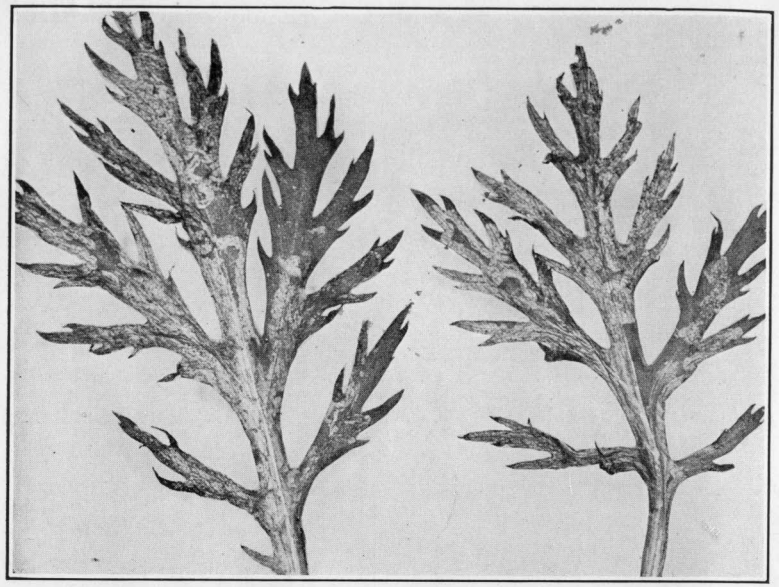
d. Lime tree span worm, *Erannis tiliaria* Harr. Natural size.



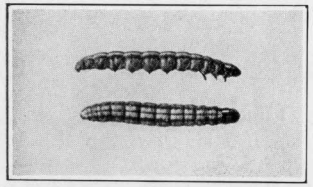
e. Apple twigs showing scars made by Buffalo tree hopper in laying eggs. Natural size.

MISCELLANEOUS INSECTS.

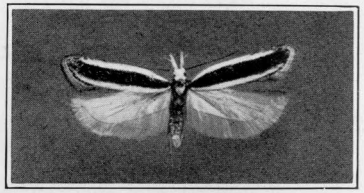
PLATE XVI.



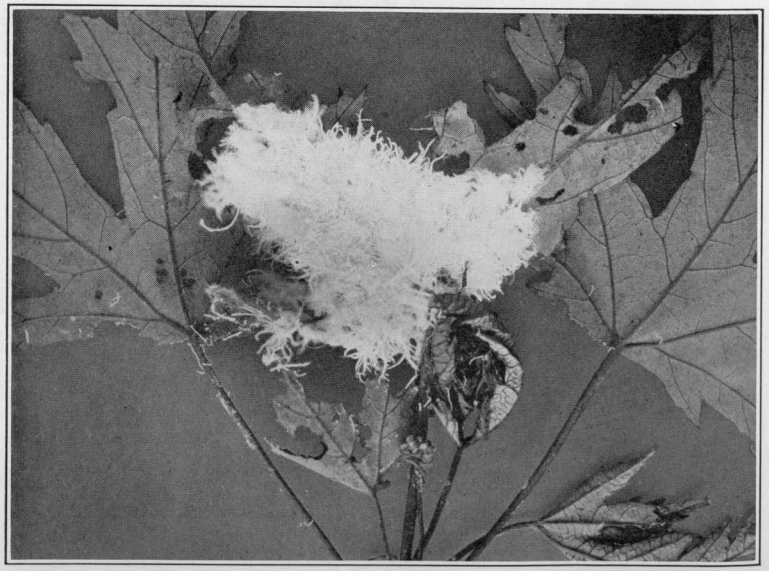
a. Marguerite daisy leaves injured by leaf-miner. Natural size.



b. Larvæ of juniper web-worm, twice enlarged.



c. Adult of juniper web-worm, twice enlarged.



d. Woolly aphis of maple. *Pemphigus tessellata* Fitch. Natural size.

PART III.

Report of the Forester for 1915

BEING THE

EIGHTH REPORT OF THE STATE FORESTER.

The report of the State Forester forms a part of the Annual Report of the Connecticut Agricultural Experiment Station because the forester of the Station is, *ex-officio,* State Forester. Owing to lack of space the report of the forestry department was omitted from the Station report for 1914. This is therefore the first report of the State Forester published since 1913, and covers the work of two years. The most important investigative projects during that time were an extensive forest survey of the entire state, completed in 1914, and an intensive forest survey of the town of Redding, made in the summer of 1915. The results of the former form the body of this report, but those of the latter will be published as a bulletin.

The years 1914 and 1915 were the most serious for forest fires of any since the records of the State Fire Warden were started in 1905. The number of fires reported in any one year exceeded 1,000 for the first time in 1914, and 1915 showed a further increase of nearly 40 per cent. During these years, however, some towns reported less fires than in previous years, and there were many in which the vigilance of the wardens alone prevented small fires from becoming large ones. Much credit is due to all wardens throughout the state who labored against such unusual conditions to protect the forests from fire.

In 1914, there were 482 fires reported in April and May, and 433 in October and November. In 1915, April and May show 523 fires, but there was an unusually small number during the fall months. The month of March, 1915, however, was responsible for 787 fires, a larger number than the total for all the

other months of that year. The fires of 1914 were divided nearly equally between spring and fall, while in 1915, fully 95 per cent. occurred before July 1. (See tables on pages following.)

Reference to U. S. Weather Bureau reports for 1914 shows that throughout Connecticut, September was the month of least precipitation. The average total for that month as reported from sixteen points in the state was but .32 of an inch. The New Haven station reported only .62 of an inch precipitation from August 22 to October 15, and more than two-thirds of this amount fell before September 1. Such a prolonged period of drought coming at the season when the leaves were falling, produced an abnormal fire hazard just at the beginning of the hunting season.

A similar period of drought occurred the following spring, when the New Haven records show a precipitation of but .25 of an inch from February 27 to April 3, and aside from a heavy snow on the latter date, the total precipitation for April was only 1.06 inches. The preceding winter was one of comparatively light snow fall, so that the leaves on the ground were not well matted down, and high winds prevailing during the dry period again produced an abnormal fire hazard. The precipitation during the latter half of 1915 was well distributed, and that for July and August was considerably in excess of normal. As a result the fall months were unusually free from forest fires.

It seems evident that climatic conditions determine the seasons of fire danger, although the carelessness of human beings must be held accountable for the fact that forest fires occur in such abundance at any season. In other words, human carelessness is the constant factor and climatic conditions the variable one. Fortunately the constant factor is one which we should be able to control. It is largely a question of enforcing the laws and educating the public to the necessity for care with fire.

WALTER O. FILLEY,
State Forester.

FOREST FIRES IN CONNECTICUT DURING 1914.

TABLE I.—SUMMARY BY COUNTIES.

County.	Total No. fires.	Causes.						Acres burned.	Estimated damage to standing timber.	Estimated damage to forest products and buildings.	Cost of fighting.	Cost of protection.
		Unknown.	Railroad.	Careless.	Hunters.	Brush burning.	Incendiary.					
Fairfield....	156	62	44	17	22	9	2	4,921	$ 20,512	$ 2,375	$ 1,393.11	$ 237.71
Hartford ...	202	88	34	28	28	19	5	6,910	19,669	7,849	3,299.22	201.92
Litchfield...	172	54	76	20	9	10	3	8,325	23,782	8,476	5,314.22	236.99
Middlesex..	68	29	15	5	11	7	1	6,501	23,414	170	1,482.59	132.08
New Haven.	143	65	26	27	8	12	5	2,453	3,943	467	1,415.03	117.52
New London	89	37	12	11	20	6	3	5,737	7,285	615	1,751.91	25.53
Tolland.....	110	42	35	16	11	5	1	1,872	6,445	2,927	1,335.02	39.45
Windham...	116	26	55	19	9	6	1	4,744	8,958	527	1,899.25	78.15
TOTAL..	1,056	403	297	143	118	74	21	41,463	$114,008	$23,406	$17,890.35	$1,069.35

TABLE II.—NUMBER OF FIRES BY MONTHS.

County.	Total number.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Fairfield....	156	1	6	3	50	19	9	..	1	2	36	27	2
Hartford....	202	..	..	..	46	51	8	1	1	6	61	26	2
Litchfield...	172	..	1	..	47	53	1	..	..	17	43	10	..
New Haven.	143	2	..	1	36	26	1	..	..	10	29	36	2
New London	89	..	..	1	19	17	1	..	..	8	32	11	..
Middlesex..	68	..	..	2	11	14	..	..	..	1	26	14	..
Tolland.....	110	..	..	2	26	18	5	1	3	10	28	17	..
Windham...	116	..	2	..	19	30	11	2	..	14	25	12	1
TOTAL..	1,056	3	9	9	254	228	36	4	5	68	280	153	7

TABLE III.—NUMBER AND AREA OF FIRES.

	All fires.	Fires not more than 100 acres in extent.	Fires more than 100 acres in extent.
Number.....	1,056.	958	98
Total acreage burned.....	41,463	10,820	30,643
Average acreage per fire.....	39.26	11.29	312.68

FOREST FIRES IN CONNECTICUT DURING 1915.

TABLE I.—SUMMARY BY COUNTIES.

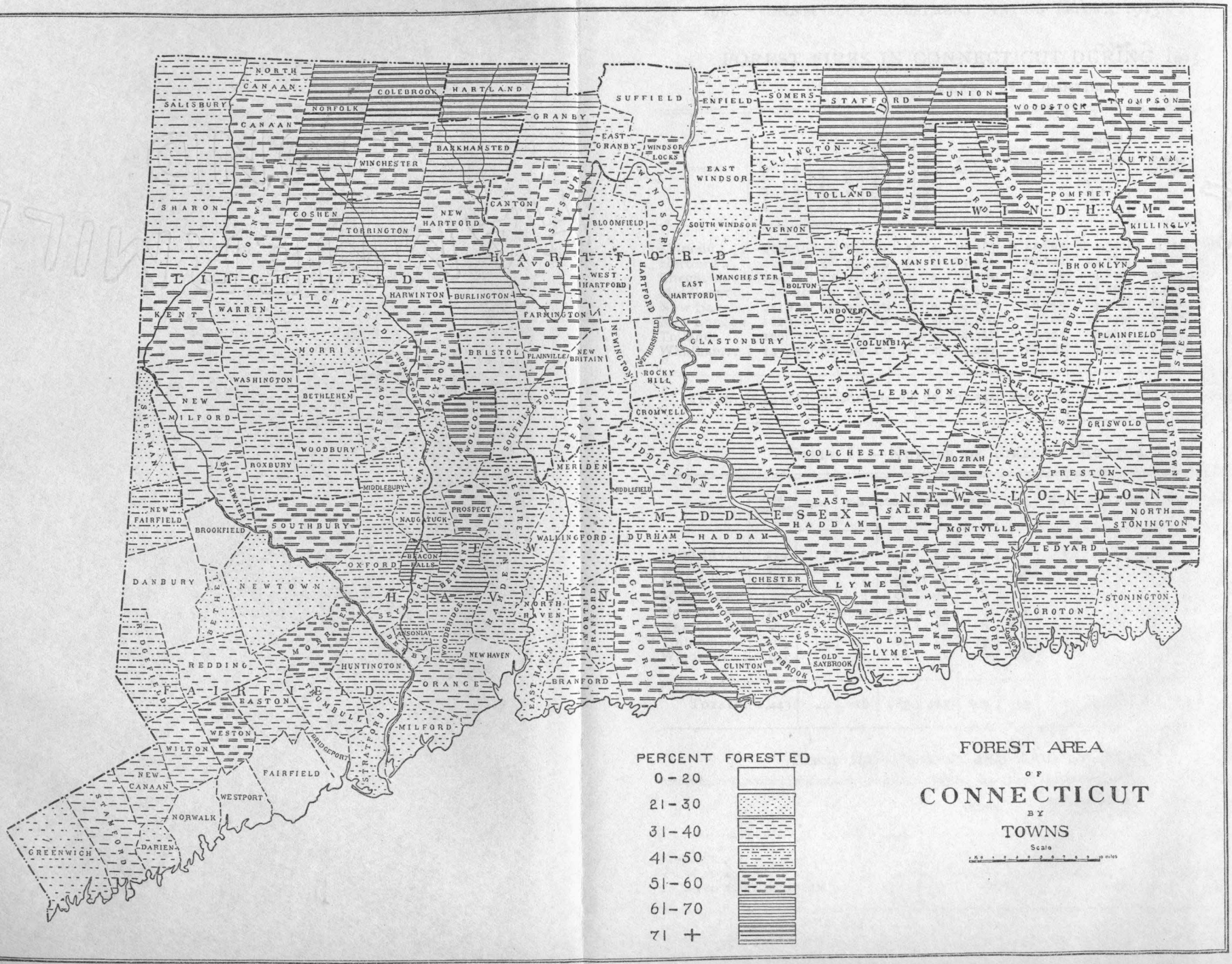
County.	Total No. fires.	Causes.						Acres burned.	Estimated damage to standing timber.	Estimated damage to forest products, buildings and grass.	Cost of fighting.	Cost of protection.
		Unknown.	Railroad.	Careless.	Burning brush.	Hunters.	Incendiary.					
Fairfield....	219	110	46	29	26	4	4	10,918	$ 12,866	$ 4,344	$ 2,345.71	$ 288.35
Hartford....	250	127	48	35	33	6	1	24,388	28,340	20,119	3,472.55	224.05
Litchfield...	174	57	52	30	26	3	6	9,454	25,175	4,870	2,241.47	183.25
Middlesex..	95	49	17	13	14	2	..	10,858	41,986	1,867	1,508.81	135.42
New Haven.	231	132	36	33	25	3	2	9,100	18,053	4,786	2,231.47	178.64
New London	162	106	15	17	18	2	4	23,186	75,140	10,275	3,368.45	44.76
Tolland.....	169	71	53	21	17	4	3	8,357	36,984	2,380	2,577.11	39.21
Windham...	143	43	60	23	11	4	2	7,294	18,167	1,436	2,017.91	49.24
TOTAL..	1,443	695	327	201	170	28	22	103,555	$256,711	$50,077	$19,763.48	$1,142.92

TABLE II.—NUMBER OF FIRES BY MONTHS.

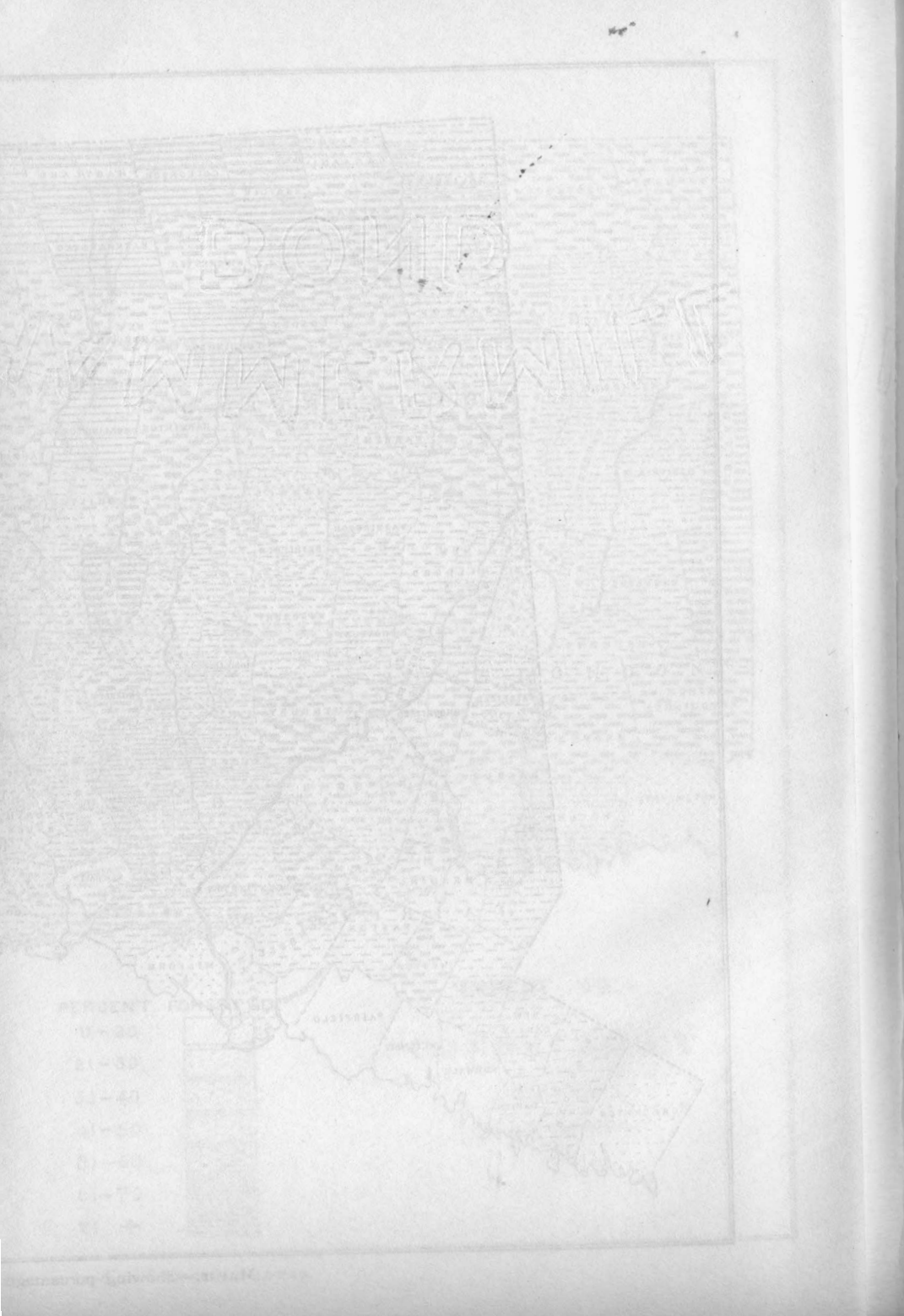
County.	Total number.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Fairfield....	219	..	5	140	57	9	..	1	..	..	2	5	..
Hartford....	250	..	..	114	81	22	7	..	..	1	10	15	..
Litchfield...	174	..	1	86	58	16	11	..	..	..	1	1	..
Middlesex..	95	..	3	53	22	8	2	..	..	..	4	3	..
New Haven.	231	..	4	163	45	8	1	..	..	..	2	8	..
New London	162	..	2	81	57	6	4	..	..	..	4	8	..
Tolland.....	169	..	..	84	56	19	7	..	..	..	..	3	..
Windham...	143	..	1	66	41	18	6	..	..	..	6	5	..
TOTALS.	1,443	..	16	787	417	106	38	1	..	1	29	48	..

TABLE III.—NUMBER AND AREA OF FIRES.

	All fires.	Fires not more than 100 acres in extent.	Fires more than 100 acres in extent.
Number.....	1,443	1,306	137
Total acreage burned.....	103,555	26,349	77,206
Average acreage per fire.....	71.8	20.2	563.5



MAP 1.—Showing percentage of forest land in Connecticut towns.



A FOREST SURVEY OF CONNECTICUT

By Albert E. Moss, M.F.,

Assistant Forester.

In 1901 the Connecticut General Assembly provided for the appointment of a State Forester who should be a member of the staff of the Connecticut Agricultural Experiment Station. At that time there was little definite knowledge of the forest conditions of the state as a whole and for lack of funds the work of securing such knowledge was necessarily postponed. During the summers of 1907 and 1908 a stand and type map of Litchfield and Fairfield counties was made by students from the Yale Forest School, supervised by former State Forester, A. F. Hawes. The area was covered by the use of bicycles and with the geodetic survey maps of the state as a base. New Haven County was mapped during 1908, under the direction of Prof. R. C. Hawley as a part of the Forest School work, the ground being covered as the individual students found most convenient. The reports and final results of the surveys in Litchfield and New Haven counties were published as Bulletin 162 of the Experiment Station. After 1908 the work was abandoned because the rapid change in forest conditions of individual towns due to the cutting of mature timber, as well as changes in character caused by removal of special material and destruction by fire, made it evident that a map showing forest areas regardless of age or type would be more useful. At the annual meeting of the Connecticut Forestry Association in 1913, the need of such a map showing the total forest area of the state was made evident and the State Forester was asked to prepare one, if possible, in order that a clear understanding of the amount of wooded land in the state might be available.

After a series of field experiments, the most satisfactory method proved to be the use of an automobile. The U. S. Geological Survey maps of the state were used as a base. Every road was traversed and the boundaries of the woodland sketched in, an odometer being used to check distances between points on the road map, distances to the woodland boundaries being

estimated by eye. In this manner every woodland tract was completely circled and boundaries noted. In many places it was hard to distinguish the dividing line between the old field type and the land still being used for pasture. The general character of the town was taken into consideration and where a tendency to improve the land was evident, the line was not drawn as closely as in those towns in which much land was manifestly reverting to forest. The woodland areas, as indicated on the map, were then colored, hardwoods and conifers being the only types separated. This method, while not as accurate as that in which the area was cross sectioned on foot as in the first three counties, was sufficiently accurate for the purpose, since any errors would tend to be compensating.

This work was completed in 1914, so that to the three counties already mentioned, the other five have now been added. A complete map of the state was then made on which the forest areas are shown. This makes it possible to compute the wooded areas of the various towns, and to locate large tracts of woodland suitable for State forests. 1,482,700 acres or 46.4% of the area of the state is found to be wooded, with the larger areas in the northwest corner, the northeast quarter, and along the Connecticut River near its mouth, extending some distance to the west. Tolland County with 56% forest is the most heavily wooded, but Litchfield County has the largest total wooded area. A detailed table of forest areas by town and county is given on pages 224-230.

PHYSIOGRAPHY.

The State of Connecticut is nearly a rectangle in form with a base line extending about 100 miles east and west along the Sound and reaching inland about 50 miles. The state is divided into three distinct physiographic provinces: a western upland, a central lowland, and an eastern upland. The drainage is from northwest to southeast by three main rivers. The streams are characterized by rather wide, rounded valleys at the headwaters with narrow, deep valleys in the central portion, while the bordering hills are of slight elevation along the lower reaches. The hill tops of the uplands are in a comparatively uniform plane which slopes from the northwest to the south and east. The elevations range from 2,350 feet in the western upland, and 1,200 feet in the eastern, down to sea level.

The western upland extends from New Haven to Granby and is separated from the central lowland by an abrupt slope, which is broken by the Pequabuck and Farmington Rivers. The area is drained by the Housatonic River and its branches, the Connecticut through the Farmington, and several smaller rivers which empty directly into the Sound. In the northern portion the valleys are flat with rounded, flat-topped hills, especially near the divides. The forests occur on the steeper, more rugged hills and on the slopes, while the valleys and the flat-topped hills are cultivated. In the central portion the main drainage is through deeper valleys and with correspondingly swifter current in the streams. The water power is used in manufacturing, while the more level upland between these deep valleys is used for agriculture. The forests are largely of the slope type. In the southern portion there is less difference in elevation between the hills and the valleys, and a greater amount of swamp land. The forest areas are located on the rough stony hills or on swamp areas, and woodlots are numerous in this region. The eastern face of the upland is very uniformly wooded due to the generally steep, rocky character of its slopes.

The central lowland has the form of a wedge with its apex at New Haven and a base from Granby to Somers. This is a fairly level area in which some of the most valuable land of the state is to be found. The forests are in the form of woodlots except where outcrops of trap rock occur, which are heavily wooded. The Connecticut River follows this valley until it reaches Middletown, and there leaves it to cut across the lower corner of the eastern upland. Along the upper edge of the lowland, elevations of 300 feet occur but the Connecticut River is practically at sea level the entire distance across the state. The trap ridges, which have a general north and south direction, reach elevations as high as 1,000 feet.

The eastern upland extends east from Somers and New Haven to the Rhode Island line. The slope is to the south or southeast with more or less abrupt escarpments on the western face, while the interior hills are rounded, with wide valleys, especially in the eastern portion. The highest elevations are near the northern border in the towns of Union and Somers, while the southeastern portion of the state is characterized by wide, relatively level areas and abrupt hills of low elevation. At the north

the forest areas are on the steep slopes and hill tops. In the central portion the hills are cleared and the forests are found on the slopes, while the valleys are narrow and rounded on the smaller streams and the large streams have cut deeper with narrow, level agricultural areas in the valleys. The forests in the southern portion are located on the poorer, level areas as well as on the abrupt slopes. East of the Connecticut River a number of woodlot areas occur, while in the triangle between Middletown, New Haven and Saybrook large bodies of forest are to be found both on the hills and in the valleys.

The first settlements made in Connecticut were along the waterways and from these the interior was gradually settled. The greater part of the timber then accessible to tidewater by animal transportation was exported both raw and in manufactured form. The location of this colony between New York and the colonies to the north and east necessitated the development of a number of main highways which crossed the state in the most direct way. The forest distribution still shows the effect of these overland highways in the amount of cleared land which extends in nearly straight lines between the original colonies, irrespective of the present lines of travel. The good water power to be found on most of the small streams was developed in numerous small manufacturing plants, especially in the eastern part of the state. The development of the railroads tended to centralize the manufacturing interests in the better locations, which has resulted in the abandonment of many small plants and a consequent migration of the population. As railroads must be built with a low per cent of grade, they must of necessity follow the topography. They have thus developed new lines of travel and other sections of the state have been made accessible to lumbermen.

The location of the state along the shores of Long Island Sound and extending inland to the lower elevations of the Berkshires, with corresponding variations in climate, topography, and site conditions, has resulted in the occurrence of a large number of tree species. Sweet gum and persimmon are examples of trees which reach their northern range here. Many shrubs and trees found in New Jersey extend across Long Island and to some extent into Connecticut. The number of white cedar swamps in the region east of the Thames is an example. To

the north the occurrence of spruce and larch with an increase of northern hardwoods and typical northern shrub growth indicates a much lower seasonal average in temperature.

Although this state is near the northern limit of the range for chestnut, this tree has been the most valuable one of the region. With the increase in the ravages of the chestnut blight, the oaks are becoming of more importance and may soon occupy the position formerly held by chestnut in the lumber industry of the state, although it is probable that the spread of the gypsy and brown-tail moths will tend to make them undesirable forest trees in the future. Other species of more or less commercial importance in the state include white pine, hemlock, white and red cedar for the conifers; and hickory, ash, maple, tulip, elm and birch as the most common deciduous trees.

FOREST TYPES.

Chestnut:

This tree occurs in nearly pure stands, usually in the form of coppice, on the best of the well drained sites. There is usually a small percentage of oak, tulip, dogwood and iron wood in the stand, the two latter with viburnum forming the understory.

Oak-Chestnut:

This type is a mixture of red, black and white oaks with from 10 to 50% of the stand chestnut. A great variety of species is found in the type, which occurs on warm first and second quality sites. Ash and tulip appear on the moister portions with hard maple and scarlet oak as the quality of the site decreases. The understory consists of a great variety of shrubs depending on the density of the crown cover.

Oak:

This type usually occurs on the dry ridges and consists of the scarlet, chestnut and scrub oaks. Another oak type found in limited areas is the swamp oak type in which the pin and swamp white oak are the dominant species. On some of the poorer sites the scrub oak occurs in pure stands.

Mixed Hardwoods:

This type is found on the cooler sites and is an extension of the northern hardwoods. It consists of a mixture of the follow-

ing species: Black oak, beech, black, yellow and white birch, hemlock, maple, elm and ash, with tulip and chestnut appearing in the southern portion. The understory consists of the same species with dogwood, hop hornbeam, witch hazel, iron wood, and a variety of shrubs.

Pine:

Two pines, pitch and white, occur in commercial quantity in this state. The former occurs in scattering pure stands throughout the state in the driest situations, especially on sand. The undergrowth either is lacking or consists of scrub oak. This type may follow a fire on a sandy site in which the original stand was destroyed. The white pine type is the more important and is found along the northern border, extending to the Sound in the eastern portion of the state. It occurs pure over small areas, with very little undergrowth due to the density of the shade. The relatively light seed of this species, together with its ability to germinate in open conditions as well as under light shade, makes it one of the most valuable for natural reforestation of old fields. The type is gradually increasing over its original range with the slow reversion of farms to forest. It was much more common in colonial days, and the region north of Harwinton and New Hartford was then called the "Greenwoods" for this reason.

Pine and Hardwood:

This type is very common in the northern part of the state and consists of mixed hardwoods with 10% to 60% pine. The percentage of pine seems to be increasing in these stands, especially where fires are kept out. The type occurs to some extent throughout the state, but only on the cool slopes and tops of the high hills in the southern portion, gradually extending to the warmer sites in the north.

White Cedar:

This type is only found in swamps in the eastern and southern portions of the state. The stands are usually pure and very dense, with good reproduction but of very slow growth. The wood of this tree is especially valuable for shingles, posts and boat timber. Its value to the early settlers led to the custom of

holding these areas in shares and in many such swamps this is still the case.

Old Field:

This type, as the name indicates, is the one which follows the abandoning of a field formerly cleared for agriculture. It results in an uneven-aged stand of seedling trees of the locality, especially such light-seeded species as poplar and birch. Red cedar commonly occurs in this type. There are usually many open spaces still in turf and the ground cover is apt to be heavy, but is gradually shaded out as the openings become filled with tree species.

Gray Birch:

This short-lived species occurs very abundantly throughout the state and forms dense pure stands in many places. It is one of the transition types that follow very heavy fires or the abandoning of farmland. The stands are dense but the shade is only sufficient to form forest soil conditions, and does not prevent the under stocking of such species as oak and pine. If overtopped the tree soon dies and very quickly rots after falling to the ground. It coppices very freely, and can be handled on a short coppice rotation but if left to itself is in time naturally supplanted by other species.

Hemlock:

This slow-growing tree occurs in pure stands over small areas throughout the state. The soil and moisture requirements of the species is such as to limit its occurrence to the deep, cool valleys and cool, moist, north slopes. The tree is very tolerant and where seeding occurs will persist and develop in the densest shade.

THE STATE BY COUNTIES.

Fairfield County:

This county is in the form of a rough triangle located in the southwest corner of the state. It is bounded on the east by the Housatonic River and on the west by New York state. The base is on the Sound, with the apex well within the lower Berkshires north of Danbury. The drainage is for the most part directly into the Sound, although there are a few small streams that flow into the Housatonic.

Except at the headwaters and near the coast the valleys are steep-sided with narrow bottomlands. The divides are much more rounded and form very good agricultural land. In the northern part there are a number of open valleys with isolated high hills; to the south of Danbury there is a divide which runs east and west; and below this the ridges run north and south, the higher elevations being more widely separated. The forests of this region are of the chestnut and oak types with a high percentage of chestnut in the past. There are a number of soft maple swamps in this area. In the northern section, hemlock and white birch occur in the mixed hardwood types of the northern slopes. The remaining stands are in the form of woodlots over the greater part of the area. The exceptions are where large stands are found on the more abrupt hills and in the region adjacent to the Housatonic River.

The colonists settled this region at an early date, especially near the Sound and in the region around Danbury. The lines of travel passed along the shore between the colonies and New York, and through Danbury either to the north or to the Hudson River. The greater part of the region was cultivated, as it is located close to the New York market. Dairy and beef cattle provided the principal agricultural industry, with the manufacture of hats as a very important output of the towns. To the north the occurrence of iron led to the early establishment of iron furnaces by the settlers. These required large amounts of charcoal in the past, and the forests were cut on a short rotation, the entire crop being coaled. The pine and gray birch were left, if possible, as the former does not make good coal and the latter is too small for profitable chopping. As a result of this discrimination the proportion of these species has increased.

The present lines of travel are very close to the old lines and have not developed new regions as in other parts of the state. The entire area has been accessible for a long period and has been cut over a number of times. To the southeast this county is within the influence of the brass factories of the Naugatuck Valley, and this also causes a short rotation with the product in the form of cordwood. To the south and southwest the influence of the city of New York has always been felt and has tended to increase the length of rotation for aesthetic reasons. This influence is increasing rapidly with the improvements in transportation and has led to the establishing of a number of large estates with more or less complete systems of forest management. This county was the first to suffer from the chestnut blight and at the present time most of the chestnut has either been killed or is infected, which has necessitated very heavy damage cuttings. This has resulted in the establishing of almost pure oak stands even on the better sites formerly occupied by chestnut. The forest is at present in a transition stage, and until the remaining species occupy the area formerly covered by chestnut, much of it will be very open. In many cases the less valuable species have gained control of these areas for the present.

Litchfield County:

Litchfield County occupies the northwestern portion of the state and is entirely within the western upland. The Housatonic River with its branches drains all except the northeastern portion of the county, where the Farmington crosses through the eastern border and flows toward the Connecticut.

To the north, except along the divide between the Housatonic and Naugatuck drainage, the slopes become abrupt, with deep narrow valleys, having a varying amount of level land, and the hills are higher with more mountainous conditions than in other parts of the state. An elevation of over 2,300 feet is reached in the extreme northwest part of the county. The agricultural land lies in the valleys and on the hills having the more level tops. The slopes are forested and the largest forest areas in the state are found in this region. The southern portion of the county is characterized by broad ridges and fairly open valleys with the exception of the Naugatuck. Here the forests are in the form of woodlots although there are a few large unbroken areas. Along the southern border the hills and valleys are both cultivated, with the forest appearing as a slope type. In the northeastern and eastern portion the slopes from the river rise very abruptly, but the tops of the divides are more level and the headwaters of the small streams furnish areas suitable for agriculture, although the slopes are entirely forested.

The forest of this region approaches the northern hardwoods type more closely than that of any other region in the state. The cooler slopes are entirely mixed hardwoods in which are found a

large percentage of pine, hemlock, white birch, and hard maple. The old fields are gray birch with pine seeding in wherever seed trees occur. The percentage of chestnut increases on the warmer sites and at the lower elevations, and this with oak forms the larger percentage of the stands throughout the southern portion of the county.

The broad, rolling character of the divides between the drainage led to the early clearing and developing of this region by the colonists. Dairying was the most important industry with cheese as the export product. Goshen is reported as having sold 380,000 pounds in one year and Norfolk as selling 100 tons the same year. Maple sugar was one of the most important of the forest products but the clearing of the forest for agriculture reduced the production of sugar at an early date. One town reported as high as 20,000 pounds of sugar in one season. At the present time there are a number of small sugar bushes in operation but the output is small and uncertain. Many extensive clearings of the colonial days in this county have been abandoned because of economic changes due to the settlement of the West. Much of this land was only used for range and rapidly became forested, while some formerly cultivated areas are at present in the transition stages of reversion to forest.

The presence of iron in the northwestern part of the county led to the establishing of iron furnaces by the colonists, and these were operated up to within the last few years. The demand for charcoal was great and all the available forests were cut and coaled on short rotations. The distance that charcoal could be hauled made a much greater area of forest accessible than is at present possible except for sawed material. The lime kilns in the same region at present create a demand for cordwood in 3 foot lengths but the area accessible is less than for charcoal. In the eastern portion, especially in the Naugatuck Valley, there is a good demand for cordwood for the brass industry and here also the forest has been cut on short rotation. The northeastern part of the county has never been accessible until the past few years and up to that time contained the only virgin timber of the state, but this region has been cut over recently, destroying the last remnant of the "Greenwoods" of the colonial days. There is at present a small tract of pine in Cornwall which closely resembles virgin timber, if it is not actually in that class. The

stand is estimated to run 100,000 feet to the acre with trees 150 feet in height.

The Berkshire portion of this county shows somewhat the same influence from the city of New York that is shown in Fairfield county but in a slightly different form. The estates in this region are on the whole larger and being more for summer residences, the natural conditions are to be kept. In many cases the forest area will be increased by planting of waste land. The railroads follow the rivers and have made possible the exportation of forest products from this region. With the change in transportation many farms have been abandoned and have reverted to forest through natural seeding of birch and pine.

Goshen hardhack (*Potentilla fruticosa*) is a shrub occurring in great abundance in open fields if the soil is heavy and of a clay formation. Its growth is very dense and the reproduction of forest trees is prevented except where this shrub is shaded by trees situated on the borders of the patch. It is intolerant and easily killed if once overtopped by forest trees, but at present is in possession of much of the abandoned land in the northern portion of the county. The possibility of forcing it out by planting white and red pine is worthy of serious consideration and is being tried by several owners. Saw timber will be the future forest product in the greater part of this county rather than cordwood, judging from present market indications, and pine should increase in value.

Hartford County:

This county has as diversified topography as is found in any county in Connecticut. The eastern boundary follows the western edge of the eastern upland, except in the southwest part where the upland extends well within the border. The central portion of the county contains some of the best farming land of the state. The Connecticut River crosses from north to south in the east central portion and forms a waterway the entire length of the county. Toward the west, the county is within the borders of the western upland and is drained by the Farmington River which flows to the southeast along the western boundary, then turns to the north, flowing around the end of the trap rock outcrop called the Talcott ridge and then to the east into the

Connecticut. The western portion of the central lowland is crossed from north to south by a series of narrow trap rock outcrops from one quarter of a mile to two miles wide and varying from 100 to 700 feet elevation above the surrounding level.

The forests which lie within the eastern upland are mostly located in the southeast corner of the county and are in large unbroken areas. The agricultural areas here are small and are located on the more level hill tops or at the headwater valleys of the streams, while the steeper hills and deep valleys of the lower streams are wooded. In the western upland the agricultural land is on the flat topped hills and in the narrow river valleys, while the forests as a whole are on the slopes. In the northern portion, the pine and hardwood type occurs on the slopes with pine seedlings coming in under gray birch in the old field type. In the southern portion there are limited areas of pure chestnut while the dry ridges are oak. The deep stream beds and the north slopes bear mixed hardwoods with or without pine, depending on the presence of seed trees. This area was part of the "Greenwoods" of colonial times.

The central lowland is timbered to the west of the trap ridges with a mixture of pitch and white pine types and on the better sites the chestnut and oak-chestnut types appear. Scrub oak and pitch pine follow the fires on this area. East of the trap ridges the soil is light and with a water table near the surface. Pine, oak and chestnut types occur on the better drained sites, while the poorer situations are soft maple swamps with a few areas of swamp oaks.

This county was one of the earliest settled and much of the best timber was exported for staves and ship-timbers; consequently the pine and oak forests were cut first. The river made an easy means of transportation for forest products and as a result a strip was cleared of merchantable timber on both sides of the stream as far as animal transportation would allow. The county was crossed by three main turnpikes:—New Haven and Hartford to Springfield; Danbury and Farmington to Hartford, Tolland and Providence; Hartford to New London. These highways were for the most part on the relatively level plain and are the approximate locations of the present railroads. For this reason modern methods of transportation show only an indirect effect on the forests.

In colonial times areas on the hills of the eastern and western uplands were cleared and farmed with dairy products as the main crop. With the development of the western states many of these farms have been abandoned and are at present in timber. This shows in the composition of the stands and the character of the timber as found in the old field and gray birch types. These are being replaced by natural pine reproduction wherever seed trees occur.

The areas of light sandy soil in the lowland near the river were found to be too poor to cultivate by the colonists and were not cleared. With the modern method of tobacco culture this land is being rapidly cleared and it is only a question of time until the entire area is under cultivation except for occasional woodlots. At present this development has progressed most rapidly west of the river as far as the trap rock ridges, but the areas east of the river and west of the ridges show the same influences. On the upland area in the southeast portion of the county there is a tendency to reclear many of the abandoned farms for fruit culture, largely by foreigners.

There are three regions that contain forest areas:—in the eastern upland, the steep slopes and rocky hills of the southeast portion of the county; the slopes of the western upland; and the trap ridges. There is a probability that a portion of the upland area now in farm land will be reforested with the object of watershed protection. It is also possible that some of the forest will be cleared for agriculture, but at present the tendency seems to be the other way. There are very few areas which contain merchantable timber in this county, although some of the best stands of young pine are to be found here. A few good stands of mixed hardwoods on large estates are more or less under forest management. There have been a number of forest plantations made in the county, especially by water companies.

Aside from the local markets there is a demand for pile timber delivered at the river, and the numerous brick yards scattered through the county burn large quantities of cordwood, a greater part of which has to be shipped in from adjoining counties.

Cutting on account of unjust taxation is probably not very great. There is a demand for cordwood in the western part for brass manufacture, which tends to favor the pine, as it is not desired for this use and is not cut with the hardwoods. The clearing of tobacco land has caused cutting in all classes of timber irrespective of the merchantable quality or age. Much of the product is used as building material in the erection of tobacco sheds. Many posts are used in the shade-grown areas to support the cloth.

New Haven County:

In this county is to be found the continuation of physiographic provinces described in Hartford County. The central lowland is in the form of a wedge with the apex at New Haven and the base reaching from Cheshire to the eastern boundary of the county. The eastern upland is in the form of a rectangle with the base reaching from the mouth of the Hammonasset River to the East Haven River. Its extreme elevation at the north is 700 feet on Totoket Mountain. The western upland includes the remainder of the county with the Housatonic as the western boundary. The portion of the eastern upland in this county is drained directly into the Sound by a number of short streams, the largest of which is the Hammonasset. Except for a strip along the Sound, and a portion of the valleys of the East and West Rivers in Guilford, the woodland is in large unbroken areas. The chestnut, oak-chestnut, old field, and swamp types are the most common although mixed hardwoods and white cedar occur. Pine is to be found along the shore, especially on the islands.

This area was crossed by only one or two of the earlier highways, as the Sound furnished the easiest method of travel from New Haven to the eastern colonies and it was out of the direct line to the more northern settlements. The timber along the shore was cut and readily shipped to other markets. As the demand for timber increased the greater part of this area was cut over, and the timber hauled to the shore for shipment. The land was not used for agriculture to any great extent and all early reports credit the northern part of the area as being forested. The modern development of transportation has not greatly changed this condition as there are no railroads crossing this area except along the shore line.

The central lowland is of a slightly more rolling character than in Hartford County and is broken by a number of short trap ridges which terminate in East and West Rocks and Saltonstall ridge. The forests of the area are in the form of woodlots except on the trap outcrops, which are entirely forested. The lowland is drained by the Quinnipiac River, which at present occupies very nearly what was the bed of the Connecticut River before certain geologic upheavals caused it to cut a new channel through the eastern upland. The most common types are chestnut and oak-chestnut on the better sites with the oak type appearing on the ridges. Old field and gray birch types are to be found on the poorer fields that have been abandoned, while in the valley of the Quinnipiac there is a sand plain in which semi-desert conditions are found. Pine is very scattering and of little value.

This was one of the earliest settled portions of the state and its light soil caused much of the area to be cleared and cultivated. The turnpikes from New Haven to the northern colonies crossed it, making transportation of the timber to market relatively easy. The present lines of travel follow the original highways very closely and have added little to the accessibility of the forest products. There are a number of brick yards in the region which draw their wood supply from the upland area of this and adjoining counties. At present the agricultural land is being used for the growing of truck produce and fruit with a gradual reduction of the woodlot areas.

The larger portion of the county is in the western upland with the drainage toward the south into the Housatonic River. The river valleys, as a rule, are narrow and furnish very good water power, especially the Naugatuck. The elevations are most abrupt and also highest along the eastern border where 1,000 feet is reached. To the west the hills are more rolling with wider valleys forming suitable agricultural land. In this region, as a result, the farms are on the hill tops and in the valleys with the forests as a slope type. The eastern border is an almost unbroken forest, while large forest areas also occur along the Naugatuck River and in the western corner of the county. Over

the remainder of the area the forest holdings are in the form of relatively large woodlots.

Practically every type of forest in the state is to be found in this county, although the white cedar and pine stands are small. The mixed hardwood type is found on the northern slopes at the greater elevations, while hemlock is to be found in the deep, narrow river valleys where it occurs in almost pure stands of small area. The river valleys formed the natural lines of highways for the colonies and as the manufacturing centers were also located along them, the valley highways were the best developed. The shortest lines of travel crossed the ridges and made development of the agricultural land possible. For the most part, the farms are either dairy or hay, with fruit gradually spreading at the present time. The farm area as a whole has not increased, although there has been an extension of the cleared areas near the centers of population. This clearing has been offset by reforestation of abandoned farm lands.

Practically the entire area has been accessible for a long time and has been repeatedly cut over. A rotation of 20 to 30 years has been used with the reproduction entirely coppice. The use of cordwood both in brick yards and brass manufacture has drawn on the wood supplies of adjoining counties as well as on New Haven County. At present this county has some of the largest cordwood users in the state. The wagon and carriage shops of New Haven formed large markets for suitable wood and the number of abandoned wood-turning establishments in this section of the state shows the effect of western competition on the eastern vehicle industry. The oyster business at one time made a large demand for kegs and bungs which were supplied to some extent by the local woods.

Middlesex County:

This county is located entirely in the eastern upland with the exception of the northwest corner, which extends into the central lowland. The Connecticut River crosses it and forms the main drainage, having a very narrow valley with restricted areas of agricultural land, except in the vicinity of Middletown where a small portion of the central lowland is included in this county. There the forest is in the form of scattering woodlots which

are being gradually cleared as the value of the land increases. The remainder of the county is characterized on the west by a series of short, fairly swift streams having narrow, deep valleys and swampy headwaters; while on the east the drainage valleys are more abrupt, but the hills are flatter and more suitable for agriculture. The forests in the eastern portion are of the slope type in which the greater part of the stands are oak and chestnut, with hemlock and mixed hardwoods on the cooler sites. The forests of the western portion are more extensive and show a greater number of swamp areas in which are found the white cedar and swamp maple types. The region is characterized by an abundance of red cedar in the old field type.

The early settlement of this region caused the development of a large part of the area suitable for agriculture. The river provided a means of transportation and the result was an early cutting of the best timber. The main lines of travel were along the river, and a highway along the divide between the Hammonasset and Connecticut Rivers. The rapid development of agriculture in this section in colonial times resulted in extensive clearings. In many of the towns much of this land has been allowed to revert to forest. There are no good local markets for small products and, as a result, a cutting is usually a slashing with only the sawed material removed. The exception to this is where there is a short haul to the railroad, or to the brick yards in Middletown. The manufactories of East Hampton use a limited amount of charcoal, much of which is supplied locally. The burning of charcoal is also carried on to some extent west of the river.

Since the building of railroads the eastern and western portions of the county have been only partially accessible. An increased demand, together with the fact that the wood on many old field areas had become merchantable, has caused excessive cutting for the past few years. As a whole the county is one of long rotations and a large percentage of old field, chestnut, oak-chestnut and swamp types, with very few pine stands. At present there is little tendency to reclaim the agricultural land. Manufacturing is largely centered along the river and as water transportation enables the handling of coal at low cost, there is very little demand for cordwood. This section contains some

of the largest witch hazel and black birch distillation plants in the state. Saw timber and ship timber with piling should form a large part of the future forest crop.

Tolland County:

This county is almost entirely within the eastern upland. The only exception is a small area along the western edge where it descends to the central lowland. As in the case of the western upland, the rise from the central lowland is abrupt and heavily wooded. The elevations are not as high, however, as 1,200 feet is the maximum. The slope is to the south and southeast, being drained by the Willimantic River except for the lowland, which drains to the Connecticut. The southwest portion of the county also drains to the Connecticut. The lowland area is fairly level and inclined to be sandy, with the result that there is a fairly well distributed stand of pine, and the scrub oak type on burned areas. The eastern upland is rugged with relatively sharp-pointed hills and narrow valleys in the north. These become flatter to the south, although the valleys are inclined to be narrow except at the headwaters of the streams. The divides become broad and rolling to the south.

The forests at the north are in large areas but as the more rolling country is reached the farming land increases in extent, until in the south central and southern portion the forest is in the form of woodlots or slope forests of small areas. The records of the region show that a number of the northern towns have always been heavily wooded and the northern part of the county was once covered with valuable forests of pine, oak and chestnut. At the present time these are the predominating species and, with the addition of the old field type, are the ones typically found in this county, although the gray birch is common in many places. Pine shows the same tendency to spread here as noted in the western upland and the pine stands in the northern portion are among the best in the state. Chestnut is not as common as in the counties to the west and south, and the oaks take its place. The pure chestnut type is rare in this region.

This county was traversed by some of the more important highways of colonial times and as a result there were several distinct lines of settlement with the customary large clearings. These highways were the Hartford and Providence through

Bolton and Mansfield; the Hartford and New London through Hebron; the Windham to Springfield; and the Tolland to Windsor. As there was no water transportation, the early markets were in all probability local except for a few manufactured products. The modern lines of travel have followed the river valleys and made the timber adjoining them accessible. There is no large market for cordwood but the wood which is near the railroad is corded and shipped to brick yards and other cordwood consumers. The recent rise in prices has made all timber in the county accessible for lumbering and much of it has been cut. Where fires have been kept out there is a marked increase in the amount of pine reproduction. The manufactories of the region are largely textile with a number of thread factories. Birch is the best wood for spools and formerly there was a demand for gray birch for this purpose, but with increased output and increased use of railroad facilities it has become necessary to resort to the white birch of the north. This has to a large extent displaced gray birch for the purpose.

There is a slight tendency to reclaim the agricultural land in some sections of this county. The central lowland is being cleared for tobacco as in Hartford County. Portions of the upland are being settled by foreigners who are repeating the work of the early settlers. The agricultural land in the south portion is dairy country much resembling that in the region about Watertown and Goshen. The cleared areas here have been fairly stable for the past generation and only a few are being increased at the present time.

Windham County:

This county is in the northeast corner of the state and entirely within the eastern upland. The slope is to the south with several elevations of 1,000 feet or over at the north. The drainage is almost entirely to the Thames. The northern portion is characterized by high hills more or less isolated, and by broad open valleys as the Rhode Island line is approached. To the south the valleys are deeper but do not have the abrupt slopes found near the border of the uplands. As a whole the forest areas are in the form of large woodlots, with the exception of the west side where a few large forest areas occur. The forests are of pine and oak with a number of cedar swamps in the low

places. Chestnut forms a smaller percentage of the forest here than in other parts of the state. Along the Rhode Island line there are also large forest areas but only their western edges extend into this state.

The streams as a whole are of fair size and furnish very good water power. The region was on the overland route from Hartford to the Rhode Island colonies and was one of the earliest settled. Much of the power was developed in the textile industry with the result that a great number of small towns were established along the streams. The relatively open valleys and rounded hills enabled the settlers to farm a large part of the county. Probably much of the original forest of the region was destroyed in clearing the land, as there were no means of exporting the lumber and the local markets were limited.

With the establishing of the railroads the economic conditions of this region were so changed that a large part of the poorer farming land in the more broken regions was abandoned. The railroads followed the river beds, with the exception of the Air Line from Willimantic to Putnam. This diverted the travel from the turnpike through Mansfield and Ashford, and this region, together with that to the north, shows a great number of abandoned farms. The region to the east of this was naturally more level and has retained its agricultural character to a greater extent. The valleys are the lines of travel and show large farming areas, especially along the Quinebaug and some of the branches of the Willimantic. As this is a pine region the old fields were naturally reforested with this species and form some of the best stands of it to be found in the state.

Up to within the past few years much of this county was inaccessible for lumbering but with the increase in value of lumber, practically the entire stand of merchantable timber has been cut. The greater part of it has been exported as there are no large local users. A number of the towns in this region have such a high tax rate that the holding of timber is not possible in some cases and has caused premature cutting of some stands. Except adjacent to the centers of population there is very little reclaiming of land in the county. There are a number of forest plantations, some of them at least fifty years old. Gray birch was formerly of importance for spool wood but is of little value at present.

New London County:

This county is within the eastern upland with its highest elevation (600 feet) in the north central part and a general slope to the south. The main drainage is by the Connecticut and Thames Rivers, although there are a few small streams that empty directly into the Sound. East of the Thames the county is comparatively low at the north with drainage to the west. A line of hills follows the Thames River and another crosses the center of the county from west to east. South of this ridge the drainage is to the Sound with conditions in the southeast corner of the state closely resembling the central lowland. The eastern portion of the county is characterized by the number of cedar swamps that occur.

The forests are in relatively large areas in the northeastern portion and along the ridge east of the Thames. Throughout the remainder of the area the timber is in woodlots. There is some very good timber in this section but it is being cut rapidly. To the west of the Thames the elevations are higher and the valleys are characterized by broad headwaters which narrow as the mouths of the streams are approached. Large forest areas are found in the central southern portion, the forests being almost entirely on the hills while the valleys are cultivated. Oak, chestnut and old field are the most common types in the western portion, with pure stands of oak near the shore. In the east, chestnut is not common and pine forms a large percentage of the stand, especially in the sandier sites near the Rhode Island line. Hemlock and mixed hardwoods occur on a few of the cooler sites. The old field type is characterized by the amount of red cedar it contains.

One of the earliest of the colonies settled in this county, and as there was very good water transportation, much of the timber within the region which could be logged with animals was cut and exported or used in the local shipyards. The county was crossed by the New London and Hartford turnpike, and the roads from Norwich to Windham, Providence, Worcester and Tolland. Much of the county was cultivated, especially that between Norwich, Windham and Colchester, the more level region east of Norwich, and that along the shore. The railroads did not follow the old highways but the rivers, with the result that the

former were less used or abandoned and much of the poorer land was allowed to revert to forest. The old highways still show their effect in the areas cultivated, but the general tendency is to decrease the amount of cultivated land rather than to reclaim it.

The recent rise in prices has made the whole of this county accessible for lumbering and the greater part has been cut over within the past few years. There is no market for cordwood and the inferior species have been left to occupy the ground, together with the merchantable species too small for cutting. This has resulted in a poor condition of the stand in many cases. Pine restocks very readily, especially on the abandoned agricultural land in the eastern portion of the county. The cedar swamps are at present only of value for shingles and posts but were formerly very important as a source of supply for boat siding in the colonial days, when the largest market for forest products was in the shipyards of the coast towns.

DESTRUCTIVE INFLUENCES.

Parasites:

The most important destructive parasite in the state at present is the so-called chestnut blight (*Endothia parasitica*), which is found throughout the northern range of chestnut. This disease has almost exterminated the species in the southwestern part of the state. It is a parastic fungus which kills the trees by destroying the inner bark or cambium layer. The spores obtain entrance through any break in the bark, and the fungus spreads rapidly to other parts of the tree. The external indications are a reddish, sunken area of bark, or the persistence through the winter of dead leaves and burrs in the tops of the trees. The orange-colored fruiting pustules are to be seen at the base of the tree in many cases. In the summer the early yellowing of the leaves and their wilted appearance is an indication of the attack. At present there seems to be no way to prevent such attacks or to aid the trees that have been infected. The damage this fungus causes to stands of chestnut has led to wholesale cutting of the timber throughout the state without regard to the condition of the individual stand. In many cases because of the blight, lumbermen have been able to secure tracts which otherwise could not have been bought.

The forests of this state have no serious native insect pests but there have been introduced into Massachusetts from Europe two insects that threaten to become serious here. The brown-tail moth is at present found over the eastern half of the state in small numbers. The caterpillar of this moth feeds on the apple and oak by preference but will defoliate other hardwoods under certain conditions. The gipsy moth is the more serious pest of the two and at present is found in a number of towns in the eastern part of the state. The caterpillar of this species will feed on the foliage of most trees. When very young, however, they cannot feed on pines and other conifers. Hence coniferous stands are seldom damaged by gipsy moths, unless there are oaks, birches or other favored food plants near by, upon the foliage of which the newly hatched caterpillars can exist.

The great amount of damage done in Massachusetts by these two insects in the last twenty-five years should warn Connecticut of the necessity for control work. Much expense was incurred in Massachusetts with very small results until the present methods of control were devised. Of recent years the U. S. Department of Agriculture has coöperated with all the New England states in propagating and distributing insect parasites of the two moths, which appear to have materially reduced the damage in infested regions. Methods of handling woodlands by the elimination of favorite food trees have been experimented with, and it may prove necessary to adopt such methods if these pests become permanently established in this state, as now seems probable.

It is evident that the natural enemies of these moths should be encouraged as the best means of keeping them in check, but it will require some time to breed them in sufficient numbers to combat the pests in all infested regions. Meanwhile much can be done by hand methods, such as destroying winter nests in the case of brown-tails, and creosoting the gipsy moth egg masses. Under certain conditions spraying foliage with arsenate of lead is also advisable. (See Report of the Entomologist, 1905 and after.) Such control work must necessarily be undertaken by communities rather than individuals, and should be under the direction of the State Entomologist. It will necessitate larger appropriations than have been granted for the purpose in

the past, but with the orchards of the state, as well as the woodlands, in danger of destruction, large expenditures will be justified. The lessons learned in other states will be taken advantage of here, and with continued coöperation from the Department of Agriculture, it should prove possible to prevent much of the threatened damage. Unless funds are provided, and the work undertaken on an adequate scale, the destruction of a large part of our remaining forest resources is inevitable.

Fires:

The most destructive agent with which the forests of the state have had to contend is fire. Fire was the method that the Indians used in clearing the land for their crops. Repeated burnings in some places destroyed all forest growth, as on the hills in the region about the present town of Litchfield. The dense forest growth confronting the early settlers and the lack of markets for forest products led to slashing and burning of the forests to aid in clearing farms. Repeated burning of the pastures was necessary, as the trees found there produced coppice very abundantly and there were also a great many shrubs which seed in open fields not cultivated. This use of fire developed a careless attitude toward the damage resulting, both directly to the forest stand and indirectly to the local soil and moisture conditions. With the introduction of the railroad another source of fires was brought into the state. This burning of the forests by carelessness and neglect was only checked by individual efforts of the owners of timberland in protecting their holdings.

With the recent development of a State forestry policy, steps were taken to reduce the number of fires by educating people to the losses incurred, and by establishing an efficient fire warden system. This system is at present well organized and its efficiency is increasing with the growth of the idea that forests should be protected. At the present time the railroads are beginning to show the effects of the public desire to protect the forests, by closer attention to the condition of engines operated over lines within the state.

Such repeated burning of the forests of the region has not only changed the species and density of the stand directly, but has also greatly reduced the soil fertility by destruction of the humus already formed, and the layers of leaves which would

in time become humus. This has changed the seed-bed conditions, and the seed of some species is not able to germinate in the new conditions, even if seed-trees survive the fires. Some of the light-seeded species of inferior quality have the ability to germinate in open seed-bed conditions and are very frequently found as pure stands on the more destructive burns. The continued burning of certain portions of the forest area has thus led to the extension of some of the more resistant species at the expense of more valuable ones. Scrub oak and pitch pine are examples of fire resistant trees, and poplar and gray birch are in the same class. With protection from fire the more valuable species are gradually regaining their lost range, as shown by the spreading of white pine within recent years.

The loss of humus and soil cover in the forest produces conditions which cause the rapid run-off of moisture falling in the form of rain or snow. This is especially true in the winter when a dense layer of leaves and humus protects the surface of the ground from frost. Under such conditions much of the snow-water can enter the ground, which without this cover would be frozen so that the water would drain directly into the streams instead of being retained in the ground as a reserve supply. Such a rapid run-off tends to increase the floods in the spring, and in summer the periods of drought are apt to be more severe because of the failure of springs dependent on the ground water throughout the forest areas.

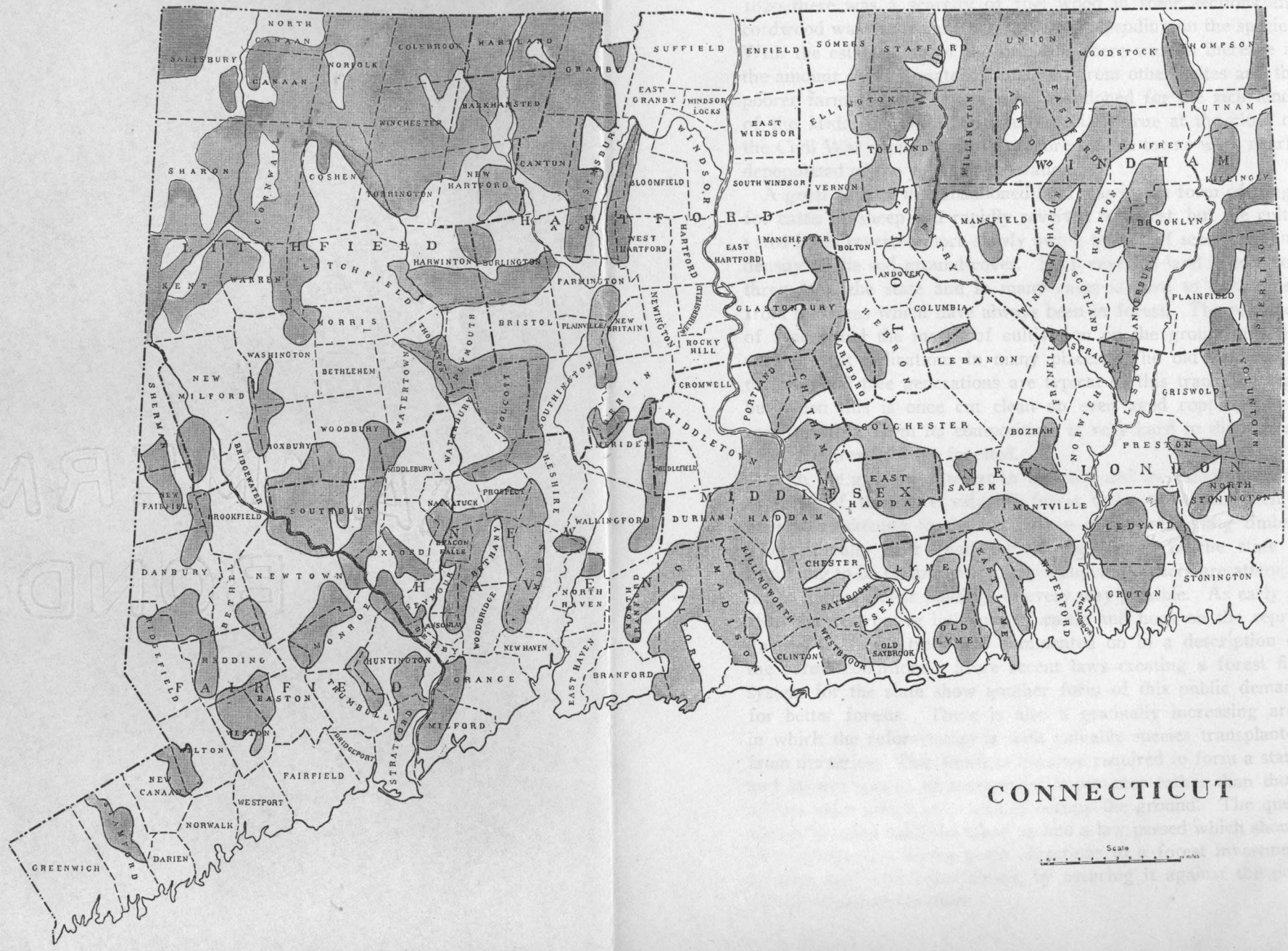
CONCLUSION.

The Indians who originally inhabited the region now known as Connecticut were hunters and only cleared small areas for their crops of corn. The early settlers depended mainly on their crops for their food supply, and the forest that occupied the land was treated as an enemy. Much of it was destroyed by fire as the only way to clear the ground. The colonies near the tide waters of the state exported much of the oak and pine to Europe for ship timber or to the Indies as stave material. The forest was the source of fuel and building material for the settlers, and since animals formed the only means of transportation, extensive clearing for agriculture soon caused a change in the methods of handling the woodlands near the larger settlements. As early as

1820 there was a scarcity of fuel wood in some sections and cordwood was quoted at $3.00 to $6.00, depending on the species. With the establishing of the railroads there was an increase in the amount of food material imported from other states and the poorer farms of this region were abandoned for the rich lands of the Middle West. This was especially true at the close of the Civil War when some of the more remote towns were nearly depopulated of the younger generation.

A great part of this abandoned land was in the form of range for cattle or sheep and rapidly reverted to forest, but the cultivated lands reverted more slowly owing to lack of seed trees and density of the sod ground-cover. Such reverted land is common throughout the state and in many cases is hard to distinguish from the areas which have always been in forest. The presence of fences and the marks of cultivation on the ground are the only present indications in many places. The old fields with their several tree generations are typical of this transition type but when this is once cut clean an even aged coppice forest results which, from its composition, is very hard to distinguish from the areas always forested.

With the growing interest in forestry and increasing scarcity of some of the more valuable forest trees, there has been a general awakening to the importance of the remaining timber. The generally poor character of the forests in the state is beginning to be realized and many woodland owners are attempting to improve their holdings in every way possible. As early as 1819 the destructive influence of cattle and hogs on the reproduction of forest trees was commented on in a description of the forest conditions. More recent laws creating a forest fire system for the state show another form of this public demand for better forests. There is also a gradually increasing area in which the reforestation is with valuable species transplanted from nurseries. This shortens the time required to form a stand and insures species of commercial importance rather than those of less value which may tend to occupy the ground. The question of taxation has been taken up and a law passed which should help remove one of the great objections to a forest investment as compared with other forms, by assuring it against the possibility of unjust taxation.



MAP 2.—Showing regions containing the most extensive forest areas in Connecticut.

With a better understanding of the forestry problems there has developed a need for suitable demonstration forests and areas where experiments may be carried on for a long period. Such areas should be owned by the state and located in the various counties so that they may serve as models for the surrounding regions. These forest areas should be handled on a long rotation with the idea of producing timber of large size which private individuals will seldom be able to do. For this reason the areas should be of sufficient size to be handled economically. Large publicly-owned forests are already established in other states, while Connecticut, one of the leaders in forestry legislation, has been left far behind in this respect.

SUMMARY OF FOREST AREA.

In the following tables the results of the survey are summarized by counties and towns. The total areas used are those given by the Connecticut Bureau of Labor Statistics in its annual report for 1902, and the total for the state includes an estimated water area of 91,200 acres. So far as possible this water area has been eliminated from the estimates of forest area. These, however, include not only land which is growing merchantable wood and timber, but pasture-land and old field with sufficient tree growth to indicate that it is reverting to forest.

STATE OF CONNECTICUT.

County	Total Area Acres	Forest Area Acres	Per cent Forest
Fairfield	417,118	127,600	31
Hartford	472,154	192,750	41
Litchfield	611,184	308,550	50
Middlesex	249,377	132,300	53
New Haven	389,853	178,000	46
New London	451,676	217,700	48
Tolland	272,577	152,850	56
Windham	330,506	173,550	53
	3,194.445	1,483,300	46.4

LITCHFIELD COUNTY.

Town	Total Area Acres	Forest Area Acres	Per cent Forest
Barkhamsted	25,093	15,300	61
Bethlehem	12,698	3,950	31
Bridgewater	10,201	3,350	33
Canaan	26,754	15,500	58
Colebrook	20,931	15,400	74
Cornwall	31,784	18,100	57
Goshen	27,997	15,100	54
Harwinton	20,958	11,700	56
Kent	31,542	16,700	53
Litchfield	34,034	16,000	47
Morris	12,203	3,550	29
New Hartford	24,075	13,000	54
New Milford	40,321	14,900	37
Norfolk	29,006	22,300	77
North Canaan	12,480	5,850	47
Plymouth	13,546	6,900	51
Roxbury	17,525	8,050	46
Salisbury	38,761	17,800	46
Sharon	38,819	17,000	43
Thomaston	8,606	4,550	53
Torrington	24,244	16,200	67
Warren	17,801	8,900	50
Washington	26,959	9,450	35
Watertown	18,753	6,750	36
Winchester	22,750	12,700	56
Woodbury	23,343	9,550	41
	611,184	308,550	50

MIDDLESEX COUNTY.

Town	Total Area Acres	Forest Area Acres	Per cent Forest
Chatham*	23,147	14,100	61
Chester	10,338	6,500	63
Clinton	10,524	5,150	49
Cromwell	8,455	2,100	25
Durham	15,417	6,450	42
East Haddam	35,712	19,600	55
Essex	7,559	3,750	50
Haddam	29,375	19,900	68
Killingworth	23,791	19,000	80
Middlefield	8,406	2,900	35
Middletown	27,287	9,500	35
Old Saybrook	11,561	3,900	34
Portland	17,283	7,400	43
Saybrook	9,452	6,000	63
Westbrook	11,070	6,050	55
	249,377	132,300	53

* Name changed to East Hampton by the General Assembly of 1915.

NEW HAVEN COUNTY.

Town	Total Area Acres	Forest Area Acres	Per cent Forest
Ansonia	3,715	1,750	47
Beacon Falls	5,972	3,850	64
Bethany	13,261	9,150	69
Branford	15,219	5,500	36
Cheshire	15,601	6,400	41
Derby	3,293	1,300	39
East Haven	8,069	2,100	26
Guilford	30,193	17,800	59
Hamden	21,054	10,500	50
Madison	25,948	18,400	71
Meriden	10,483	3,050	29
Middlebury	12,479	5,350	43
Milford	16,290	4,900	30
Naugatuck	9,145	3,750	41
New Haven	14,260	1,550	11
North Branford	16,498	8,250	50
North Haven	13,890	4,150	30
Orange	18,388	7,150	39
Oxford	23,035	10,800	47
Prospect	8,726	5,250	60
Seymour	9,509	3,600	38
Southbury	25,818	15,200	59
Wallingford	23,933	6,450	27
Waterbury	18,405	5,500	30
Wolcott	13,911	10,200	73
Woodbridge	12,758	6,100	48
	389,853	178,000	46

NEW LONDON COUNTY.

Town	Total Area Acres	Forest Area Acres	Per cent Forest
Bozrah	12,812	6,650	52
Colchester	34,131	18,000	53
East Lyme	23,515	12,600	54
Franklin	12,569	5,250	42
Griswold	23,659	9,450	40
Groton	22,331	10,700	48
Lebanon	35,371	13,700	39
Ledyard	25,952	15,000	58
Lisbon	10,966	5,250	48
Lyme	23,564	13,100	56
Montville	27,791	15,800	57
New London	3,452	1,950	56
North Stonington	36,316	18,500	51
Norwich	18,708	5,050	27
Old Lyme	16,893	7,100	42
Preston	20,325	6,700	33
Salem	18,597	10,200	55
Sprague	8,620	3,600	42
Stonington	25,222	7,550	30
Voluntown	25,640	22,500	88
Waterford	25,242	9,050	36
	451,676	217,700	48

TOLLAND COUNTY.

Town	Total Area Acres	Forest Area Acres	Per cent Forest
Andover	10,452	4,700	45
Bolton	9,660	5,200	54
Columbia	14,467	5,450	38
Coventry	24,588	12,200	50
Ellington	22,685	11,300	50
Hebron	25,489	11,900	47
Mansfield	29,455	12,600	43
Somers	19,218	9,000	47
Stafford	38,495	28,800	75
Tolland	25,818	16,500	64
Union	18,594	15,000	81
Vernon	11,750	4,300	37
Willington	21,906	15,900	73
	272,577	152,850	56

WINDHAM COUNTY.

Town	Total Area Acres	Forest Area Acres	Per cent Forest
Ashford	21,610	14,600	68
Brooklyn	18,379	7,500	41
Canterbury	27,882	12,800	46
Chaplin	12,399	6,800	55
Eastford	18,269	13,100	72
Hampton	16,001	7,350	46
Killingly	33,065	19,100	58
Plainfield	27,119	13,000	48
Pomfret	27,206	12,500	46
Putnam	12,662	5,550	44
Scotland	12,002	4,800	40
Sterling	17,504	13,600	78
Thompson	31,129	16,400	53
Windham	16,268	6,650	41
Woodstock	39,011	19,800	51
	330,506	173,550	53

BULLETINS RELATING TO FORESTRY AND SHADE TREES.

The following publications on forestry and allied subjects are recommended as especially relating to Connecticut conditions. They may be obtained from the sources indicated free of charge, except when a price is stated.

From the Forester, Connecticut Agricultural Experiment Station, New Haven, Conn.

Forestry publication No. 5; Forest survey of Litchfield and New Haven counties. 1909. (Exp. Station Bulletin 162.)

Forestry publication No. 7: Wood-using industries of Connecticut. 1913. (Exp. Station Bulletin 174.)

Forestry publication No. 8: Sixth report of the State Forester; guide to Rainbow forest plantations; forest planting in Connecticut. 1913. (Part VI, Exp. Station Report, 1912.)

Forestry publication No. 9: Connecticut's forest taxation law. 1913. (Exp. Station Special Bulletin.)

Forestry publication No. 10: Seventh report of the State Forester; preliminary working plan for the Portland state forest. 1914. (In part VI, Exp. Station Report, 1913.)

Forestry publication No. 11: Eighth report of the State Forester: forest survey of Connecticut. 1916. (Part III, Exp. Station Report, 1915.)

Guide to the Rainbow forest plantations. 1913. (Reprint from part VI, Exp. Station Report, 1912.)

Report of special commission on taxation of woodland. 1912. Postage 2 cents.

State parks for Connecticut. 1914. (Reprint of first report of the State Park Commission.) Postage 3 cents.

Proceedings of the Connecticut Forestry Association, 1909-1911. (Publication No. 7.) Postage 2 cents.

Proceedings of the Connecticut Forestry Association, 1912-1914: State forest number. (Publication No. 8.) Postage 2 cents.

From the Botanist, Connecticut Agricultural Experiment Station, New Haven, Conn.

Report of the Botanist, 1907: heteroecious rusts. (Part II, Exp. Station Report, 1907-1908.)

Report of the Botanist, 1908: chestnut bark disease. (Part XII, Exp. Station Report, 1907-1908.)

Report of the Botanist, 1909: diseases of pine. (Part X, Exp. Station Report, 1909-1910.)

Report of the Botanist, 1912: chestnut bark disease; pine and currant rusts. (Part V, Exp. Station Report, 1912.)

Report of the Botanist, 1913: chestnut blight poisoning. (Part I, Exp. Station Report, 1914.)
Report of the Botanist, 1915: chestnut blight. (Part VI, Exp. Station Report, 1915.)

From the Entomologist, Connecticut Agricultural Experiment Station, New Haven, Conn.

Eighth report of the State Entomologist: gipsy and brown-tail moths; canker worms; elm leaf beetle. (Part XI, Exp. Station Report, 1907-1908.)
Tenth report of the State Entomologist: gipsy and brown-tail moths; birch bucculatrix. (Part IX, Exp. Station Report, 1909-1910.)
Eleventh report of the State Entomologist: gipsy and brown-tail moths; leopard moth. (Part IV, Exp. Station Report, 1911.)
Twelfth report of the State Entomologist: gipsy and brown-tail moths; walnut weevil; walnut bud-moth. (Part III, Exp. Station Report, 1912.)
Thirteenth report of the State Entomologist: gipsy and brown-tail moths; dying hickory trees. (Part III, Exp. Station Report, 1913.)
Fourteenth report of the State Entomologist: gipsy and brown-tail moths; white pine weevil. (Part III, Exp. Station Report, 1914.)
Fifteenth report of the State Entomologist: gipsy and brown-tail moths; European pine sawfly; larch sawfly. (Part II, Exp. Station Report, 1915.)
The elm leaf beetle. 1907. (Experiment Station Bulletin 155.)
The leopard moth. 1911. (Experiment Station Bulletin 169.)
The apple tree tent caterpillar, 1913. (Experiment Station Bulletin 177.)
The brown-tail moth, 1914. (Experiment Station Bulletin 182.)
The gipsy moth. 1915. (Experiment Station Bulletin 186.)

From Storrs Agricultural Experiment Station, Storrs, Conn.

New England trees in winter. 1911. (Exp. Station Bulletin 69.) Free to residents of Connecticut.

From the Civic Federation of New Haven, New Haven, Conn.

The planting and growing of shade trees. 1912. Document No. 8. Price 10 cents.

From the Superintendent of Documents, Government Printing Office, Washington, D. C.

Second growth hardwoods in Connecticut, 1912. (Forest Bulletin 96.) 15 cents.
Forestry publications for sale by the Superintendent of Documents. (Price List 43.)

PART IV.

Commercial Feeding Stuffs.

By John Phillips Street.*

Under the Connecticut statutes the term "concentrated commercial feeding stuff" covers practically all feeds excepting hay and straw, whole seeds, unmixed meal made directly from any of the cereals or from buckwheat, and feed ground from whole grain and sold directly from manufacturer to consumer.

Section 4592 requires that every lot or parcel of concentrated commercial feeding stuff shall bear a statement giving the name and address of manufacturer or importer, the number of net pounds in the package, the name of the article, and the percentages of protein and fat contained in it. Attention is called to an amendment of the law which was enacted by the last General Assembly: *"But such lot or parcel shall not be sold, offered or exposed for sale with such statement affixed thereto by any wire or other metal."*

No registration of feeds or payment of analyses or license fees is required.

The penalty for violation of the statute is not more than $100 fine for the first offense and not more than $200 for each subsequent offense.

The law authorizes this station to take samples from any manufacturer or dealer, in a prescribed manner, and requires the station to analyze annually at least one sample of each brand which it has collected, and to publish these analyses "together with such additional information in relation to the character, composition and use thereof as may be of importance."

Inspection of 1915.

In compliance with the above requirements the following report has been prepared. During the fall of 1915 the station

* The chemical analyses here reported were made by C. H. Shepard and G. L. Davis.

sampling agent visited 53 towns and villages of this state and collected 216 samples of feeds. The results of the examination of these samples are here discussed and the chemical analyses are given in Table III.

The analyses of 57 samples sent by individuals are also separately reported, as well as 120 samples of ensilage corn, soy bean fodder, corn grain and mangels grown in connection with experimental work.

The official samples may be grouped as follows:

18 Cotton seed meal	11 Corn gluten feed
1 Linseed meal, new process	12 Hominy feed
6 Linseed meal, old process	5 Dried brewers' grains
13 Wheat bran	4 Dried distillers' grains
20 Wheat mixed feed	10 Dried beet pulp
17 Wheat middlings	1 Hominy and corn cob feed
2 Rye feed	1 Wheat bran and corn cob feed
1 Rye middlings	7 Corn and oat feeds
1 Barley feed	62 Horse, dairy and stock feeds
1 Cracked corn	21 Poultry feeds
2 Corn gluten meal	
	216 Total

Comments on Analyses.

The following brands were found offered for sale without the guaranties required by law:

6484, *Wheat Bran* sold by A. F. Lane and Co., New York; **6629,** *Crescent Mixed Feed;* **6483,** *Wheat Middlings* sold by A. F. Lane and Co., New York; **6551,** *Vincent Bros. C. and O. Feed;* **6467,** *J. T. B. Mash;* **6468,** *W. E. C. Mash;* **6615,** *Ensign's Dry Mash,* and **6603,** *Gilt-Edge Brand Cotton Seed Meal* (no fat guaranty).

Four of these products were manufactured by firms within this state, and it would seem as if the opinion were prevalent that the law's requirements did not affect products of local manufacture in the same way as brands manufactured beyond the borders of this state. This of course is not true, and the sale of the above named brands, under the conditions found by our agent, is clearly illegal.

Of the 216 official samples 41 did not meet their guaranties in some particular; 19 in protein, 20 in fat and 2 in both protein and fat. Twenty per cent of the brands showed deficiencies

this year as compared with 10 per cent last year. Cotton seed meals and molasses feeds were the chief offenders.

Table I shows the individual brands which failed to satisfy their guaranties.

Table I.—Feeds Below Guaranty.

Station No.	Brand.	* Deficiency in Protein. %	* Deficiency in Fat. %
6630	Forfat Brand Cotton Seed Meal	1.68	....
6675	Canary Brand Cotton Seed Meal	2.11	....
6662	Louisville Brand Cotton Seed Meal	1.62	....
6618	Connecticut Brand Cotton Seed Meal	2.25	....
6682	Dirigo Brand Cotton Seed Meal	2.06	....
6517	Pilgrim Brand Cotton Seed Meal	2.87	....
6674	Hecker-Jones-Jewell Mill. Co. Choice Wheat Bran	1.31	....
6635	Nokomos Durum Wheat Bran	....	0.53
6552	Wisconsin Milling Co. Wheat Bran	1.06	....
6540	Winona Mixed Feed	1.56	....
6487	Crescent Mixed Feed	....	0.34
6663	Maple Leaf Mixed Feed	1.00	0.31
6602	Pillsbury's Fancy Mixed Feed	....	0.28
6672	Honest Mixed Feed	1.06	....
6608	Washburn-Crosby's Mixed Feed	1.75	....
6680	Winona Wheat Middlings	1.31	....
6527	Hamilton's Flour Middlings	1.25	0.58
6626	Pillsbury's "B" Middlings	1.19	....
6671	Pennant Wheat Middlings	1.37	....
6656	Cream of Corn Gluten Feed	....	0.30
6475	K. K. K. Gluten Feed	1.37	....
6558	Wirthmore Hominy Feed	....	0.56
6593	Miner Hillard's Hominy Feed	....	0.39
6523	Ajax Flakes	....	0.73
6627	Continental Gluten Feed	....	2.07
6606	Iroquois Dairy Feed	....	0.99
6578	Peerless Dairy Feed	....	1.88
6529	Clover Leaf Horse Feed	....	0.38
6545	Eatall Horse Feed	....	0.42
6644	Algrane Horse Feed	....	0.88
6556	Bonnie Horse Feed	....	0.30
6493	Cream City Horse Feed	1.69	....
6500	Ginger Horse Feed	....	0.27
6477	Purina Cow Chow Feed	....	0.97
6567	Republic Horse Feed	....	0.37
6566	Supreme Dairy Feed	3.06	....
6498	Creamo Calf Meal	1.62	....
6582	Syragold Stock Feed	....	0.55
6574	Wirthmore Growing Feed	....	1.37
6511	Wirthmore Poultry Mash	....	1.53
6548	V.B. XXXX Mash	4.06	....

* A deficiency of less than one per cent. of protein and 0.25 per cent. of fat is not noted.

Cotton Seed Meal averaged one per cent less protein than in 1914 with a price $6 per ton higher. The quality of this feed apparently is growing poorer year by year, due chiefly to a greater admixture of hulls. In 1910 the fiber averaged 8.28 per cent, in 1911 8.56, in 1912 8.23, in 1913 9.97, in 1914 9.73, while this year it was 10.69 per cent.

Six of the 18 samples were below guaranty in protein, the shortage ranging from 1.62 to 2.87 per cent. The price per ton seems to have been in no way dependent upon the meal's composition, the highest protein meal costing $37 per ton, and the lowest protein meal $38 per ton. While in 1914 66 per cent of the samples exceeded 40 per cent protein, this year only 47 per cent exceeded that amount. The rebates offered by commission houses for deficiency in protein are quite inadequate at the present prices of cotton seed meal and other "ammoniates."

Linseed Meal, New Process. The single sample analyzed was of normal composition, with a price $4 higher than in 1914. *Linseed Meal, Old Process,* averaged 35.34 per cent protein, 1.38 per cent higher than last year, but the ton price was $6 higher.

Wheat Products. The Association of Feed Control Officials among its definitions of feeding stuffs includes the following:

"*Wheat bran with mill run screenings* is pure wheat bran plus the screenings which were separated from the wheat used in preparing the bran.

"*Wheat bran with screenings not exceeding mill run* is either wheat bran with the whole mill run of screenings or wheat bran with a portion of the mill run of screenings, provided that such portion is not an inferior portion thereof."

In our judgment these definitions open the way to great abuse on the part of the manufacturer. Five of our samples of wheat bran this year are labeled "wheat bran with ground screenings," and under the usual interpretation of the Food and Drug Act such a product might contain 51 per cent of wheat bran and 49 per cent of screenings and yet be sold legally under the label given above. It would seem that the "mill run of screenings" must vary with almost every lot of wheat, and that the definitions adopted by the Association therefore have no exact meaning.

The wheat products were last inspected by us in 1912, and the following tabulation shows that the average protein in wheat bran, feed and middlings has decreased while the fiber content has increased. The prices likewise show a slight decrease.

	Protein.		*Fiber.*		*Price.*	
	1912	1915	1912	1915	1912	1915
Wheat bran	15.82	14.94	9.50	10.50	$27.85	$26.92
Wheat feed	16.70	15.88	7.28	7.81	30.23	29.95
Wheat middlings	17.76	15.74	5.85	6.77	31.48	30.18

Three samples of wheat bran, 6 of wheat feed and 4 of wheat middlings failed to meet their guaranties. The protein deficiencies ranged from 1.00 to 1.75 per cent, the fat from 0.28 to 0.58 per cent.

Corn Gluten Meal. The two samples were high-grade, and well above their guaranties for protein and fat, the price being slightly lower than last year.

Corn Gluten Feed. The eleven samples ranged in protein from 21.63 to 29.56 per cent, the selling price of the extreme brands being the same, an anomaly in the prices of cattle feeds to which we have directed attention several times. The ash likewise showed a wide range, from 2.05 to 6.28 per cent, probably due in large part to the use or exclusion of the "steep liquor." Attention is again called to the unsatisfactory protein guaranties of the *Buffalo* and *Globe* brands. The guaranty of 23 per cent has but little relation to the true composition, the samples showing on the average 28.32 per cent. The average selling price of gluten feed this year was $30.17 per ton; in 1914 it was $33.54.

Hominy Feed. The average composition was about the same as last year, while the price was somewhat lower.

Dried Brewers' Grains. The five samples showed the same high quality usually observed with this excellent feed. As in the case of certain brands of gluten feeds, the protein guaranty of this feed is generally too low. The average protein guaranty this year was 25.4 per cent compared with an actual content of 29.85 per cent.

In these days of high prices the composition of dried brewers' grains and their cost compared with other standard feeds is worthy of the careful consideration of the feeder. These data are given in the following table:

	Protein.	*Fat.*	*Price.*
Dried brewers' grains	29.85	6.82	$29.80
Cotton seed meal	39.35	7.19	38.83
Linseed meal, new process	36.38	1.86	42.00
Linseed meal, old process	35.34	6.07	43.17
Wheat bran	14.94	5.11	26.92
Wheat feed	15.88	5.13	29.95
Wheat middlings	15.74	5.40	30.18
Corn gluten meal	44.32	2.76	37.20
Corn gluten feed	28.32	2.63	30.17
Hominy feed	11.55	7.71	31.50
Dried distillers' grains, h. g.	31.69	9.10	36.20
Dried distillers' grains, l. g.	21.63	8.12	30.50
Dried beet pulp	8.42	0.66	28.30
Corn and oat feeds	9.39	4.22	31.17
Proprietary mixed feeds, h. g.	24.52	5.01	33.64
Proprietary mixed feeds, l. g.	10.05	3.08	32.56

Dried Distillers' Grains. These feeds likewise are relatively cheap feeds, especially when compared with most of the proprietary mixtures. The fat guaranties of *Ajax Flakes* and *Continental Gluten Feed* are both too high.

Dried Beet Pulp. The ten samples showed remarkably uniform composition. The average price was $1.41 lower than last year.

Hominy and Corn Cob Feed. This sample contained 2.42 per cent less protein, 0.89 per cent less fat and 6.02 per cent more fiber than average straight hominy feed, but sold for $4.50 less per ton.

Wheat Bran and Corn Cob Feed. The brand examined contained 3.88 per cent less protein, 2.29 per cent less fat, and 4.02 per cent more fiber than average wheat bran, and the price was $2.92 lower per ton. The reduction in price is scarcely sufficient to warrant the economical feeder in selecting this feed in preference to straight wheat bran.

Corn and Oat Feeds, and Chop Feeds. The samples were of normal composition, the high amounts of fiber in certain of the chop feeds indicating the probable use of low-grade oats or excessive oat hulls. The single sample of oat feed was typical of its class, containing 24.25 per cent fiber.

Proprietary Horse, Dairy and Stock Feeds. These samples cover a wide range of products; in some of them high-grade materials are used in their compounding, while in many of them

relatively inferior materials are sold at a price entirely out of proportion to their value. Nearly half of them contain molasses, the popularity of this class of feeds apparently being on the increase.

The presence of molasses, as we have pointed out for the last three years, entails certain analytical difficulties. Our experiments have shown that the official method for determining ether extract does not always give correct results when molasses is present. Under the law, however, we are obliged to use the official method, and the results given in Table III were obtained in this way. Nevertheless, we have not included among the deficient samples those which yielded the guaranteed amount of fat when tested by the modified method published in our 1913 report. The following tabulation shows the results obtained by the two methods:—

TABLE II.—COMPARATIVE ETHER EXTRACT DETERMINATIONS.

	Method.	
	Official.	*Modified.*
Iroquois Dairy Feed	1.65	3.01
Iroquois Horse Feed	1.40	2.17
Peerless Dairy Feed	5.12	4.74
Clover Leaf Dairy Feed	3.41	3.80
Clover Leaf Horse Feed	1.28	1.62
Derby Horse Feed	0.98	1.78
Hobby Horse Feed	1.21	1.79
Honeysuckle Feed	0.44	0.98
Eatall Alfalfa Horse Feed	1.73	1.85
Eatall Horse Feed	1.89	2.08
Purekane Molasses Feed	0.68	1.89
Quality Feed	1.58	2.19
H and S Horse, M. & D. Feed	2.50	3.60
Cream City Horse Feed	1.25	1.70
Ginger Horse Feed	1.66	1.73
Peerless Horse Feed	1.47	1.88
P. and P. Horse Feed	1.40	1.97
Peters King Corn	0.80	1.72
Purina Cow Chow Feed	4.03	3.56
Republic Horse Feed	1.15	1.63
Syragold Stock Feed	2.45	1.98
Xtra Vim Feed	0.36	0.81
Average	1.75	2.20

In all but three of the twenty-one samples an increased amount of ether extract was yielded by the modified method. While

the average increase was only 0.45 per cent, in three cases it was over one per cent, and in one instance nearly three times as much ether extract was obtained.

Thirteen of the proprietary feeds failed to meet their guaranties, three being deficient in protein and ten in fat. *Peerless Dairy Feed* was deficient in fat by 1.88 per cent, while *Cream City Horse Feed, Supreme Dairy Feed* and *Creamo Calf Meal* showed respective shortages in protein of 1.69, 3.06 and 1.62 per cent.

Many of these proprietary feeds are sold at excessive prices, when their composition is considered, and furthermore there seems to be little relation between cost and feeding value. We find brands containing from 8 to 22 per cent protein selling for $28 to $30 per ton, brands containing from 8 to 27 per cent protein selling for $31 to $33 per ton, brands containing from 4 to 26 per cent protein selling for $34 to $36 per ton, and one containing 10 per cent selling for $41 per ton. The following table shows these absurdities of price more clearly:

PROPRIETARY FEEDS.

	Protein.	*Fat.*	*Nitrogen-free Extr.*	*Fiber.*
Selling for $28	8.31	3.71	55.80	17.53
	16.81	4.41	44.86	13.55
Selling for $29	8.81	0.57	59.62	18.20
	18.44	3.57	45.43	10.75
Selling for $30	10.00	1.40	60.01	11.88
	21.94	3.21	46.37	13.08
Selling for $31	10.00	2.45	61.33	12.38
	26.50	5.40	43.73	9.03
Selling for $32	8.31	1.25	56.20	16.23
	24.25	5.81	47.09	9.03
Selling for $34	4.44	0.36	66.60	6.80
	25.00	3.61	41.60	12.78
Selling for $35	9.19	1.40	58.38	9.93
	25.75	6.55	44.29	9.75
Selling for $36	10.81	3.48	64.21	6.33
	26.50	4.03	39.18	14.08

The above figures reveal a startling situation. While in the low-graded feeds the dairyman secures from one-fifth to two-thirds more carbohydrates at the same price, he also obtains only from one-fifth to one-half as much protein and from one-tenth to four-fifths as much fat. If he feels he must purchase carbohydrates no matter what the price, why should he not give the preference over these low-grade feeds to staple products like wheat bran, wheat feed, wheat middlings and corn gluten feed, which at prices from $27 to $30 per ton not only yield from 53 to 57 per cent carbohydrates, but at the same time supply from 15 to 29 per cent protein and from 3 to 5 per cent fat. To pay from $28 to $36 per ton for mixed feeds containing from 8 to 10 per cent protein is to cast all ideas of economy to the winds and to invite financial disaster.

Proprietary Poultry Feeds. Three of these brands did not bear the guaranties required by law. *Wirthmore Growing Feed* and *Wirthmore Poultry Feed* were 1.37 and 1.53 per cent deficient in fat, respectively. *V.B. XXXX Mash* was 4.06 per cent low in protein. Again attention is called to the fact that the guaranty of *M. and S. Dry Mash* gives little idea of the feed's composition, an excess of 8.19 per cent protein and 2.39 per cent fat being shown.

UNOFFICIAL SAMPLES.

Fifty-seven samples sent by individuals have also been analyzed. The station is responsible for the accuracy of the analysis, but not for the sampling, of these samples.

COTTON SEED MEAL. Twenty-four samples were analyzed; the descriptions follow:

Dixie Brand, Humphreys, Godwin Co., Memphis, Tenn. **5247,** sent by S. J. Orr, West Suffield; **5423** and **5424,** sent by M. C. Dean, Falls Village; **5859,** sent by W. E. Wheelock, Quinebaug.

Good Luck Brand, S. P. Davis, Little Rock, Ark. **5528,** sent by S. J. Orr, West Suffield; **5624,** sent by N. Osteroff, Cornwall Bridge.

Pioneer Brand, J. E. Soper Co., Boston, Mass. **5531,** sent by W. W. Osborne, Brookfield; **6980,** sent by J. M. Bahr, Warehouse Point.

Pilgrim Brand, J. E. Soper Co., Boston, Mass. **5691** and **5862,** sent by The Coles Co., Middletown.

Owl Brand, F. W. Brode and Co., Memphis, Tenn. **6981,** sent by W. W. Palmer, Chestnut Hill.

Dirigo Brand, W. Newton Smith, Baltimore, Md. **5672,** sent by B. M. Patterson, Torrington; **5690,** duplicate sample taken by our agent.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	OIL SEED PRODUCTS.	
	Cotton Seed Meal.	
6638	Red Tag Brand. Amer. Cotton Oil Co., Huntsville, Ala.	*Hartford:* Smith, Northam & Co.
6586	Owl Brand. F. W. Brode & Co., Memphis, Tenn.	*Middlefield:* A. E. Miller Est.
6610	Buckeye Brand. Buckeye Cotton Oil Co., Cincinnati, O.	*Unionville:* F. D. Lawton & Son
6614	Good Luck Brand. S. P. Davis, Little Rock, Ark.	*New Hartford:* W. Case
6603	Gilt-Edge Brand. Empire Cotton Oil Co., Atlanta, Ga.	*Waterbury:* Spencer Grain Co.
6573	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn.	*Meriden:* Grain & Feed Co.
6652	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn.	*Danbury:* H. E. Meeker
6630	Forfat Brand. Humphreys, Godwin Co., Memphis, Tenn.	*Stafford Springs:* G. L. Dennis
6675	Canary Brand. Lanier Bros., Nashville, Tenn.	*Winsted:* E. Manchester & Sons
6662	Louisville Brand. Louisville Cotton Seed Prod. Co., Louisville, Ky.	*New Milford:* Geo. E. Ackley Co.
6673	Kineda Brand. J. M. Macdonald, Cincinnati, O.	*Winsted:* M. D. Leonard
6607	Macado Brand. J. M. Macdonald, Cincinnati, O.	*Thomaston:* L. E. Blackmer
6618	Connecticut Brand. Meech & Stoddard, Middletown	*Granby:* E. H. Rollins
6559	Canary Brand. C. L. Montgomery & Co., Memphis, Tenn.	*Norwalk:* Holmes, Keeler & Kent Co.
6682	Dirigo Brand. W. Newton Smith, Baltimore, Md.	*Torrington:* F. W. Wadhams
6517	Pilgrim Brand. J. E. Soper Co., Boston, Mass.	*New London:* P. Schwartz Co.
6599	Pioneer Brand. J. E. Soper Co., Boston, Mass.	*Plainville:* Eaton Bros.
6641	American Red Tag Brand. Union Seed & Fert. Co., Huntsville, Ala.	*Hartford:* G. M. White & Co.
		Average guaranty
		Average of these 18 analyses
		Average digestible
	Linseed Meal, New Process.	
6501	Hypro. American Linseed Co., New York	*East Haven:* F. A. Forbes
		Guaranty
		Digestible
	Linseed Meal, Old Process.	
6640	American Linseed Co., Buffalo, N. Y.	*Hartford:* G. M. White & Co.
6660	Kelloggs & Miller, Amsterdam, N. Y.	*New Milford:* G. T. Soule
6568	Midland Linseed Prod. Co., Minneapolis, Minn.	*Wallingford:* E. E. Hall
6576	Minnesota Linseed Oil Co., Minneapolis, Minn.	*Meriden:* Grain & Feed Co.
6485	Spencer Kellogg & Sons, Buffalo, N. Y.	*Hamden:* I. W. Beers
6600	Major Brand. Toledo Seed & Oil Co., Toledo, O.	*Bristol:* Goodsell Bros.
		Average guaranty
		Average of these 6 analyses
		Average digestible

SAMPLED IN 1915.

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
6638	8.81	5.28	39.00	11.45	28.27	7.19	$40.00
6586	9.01	6.48	41.38	8.73	26.51	7.89	39.00
6610	7.85	5.60	38.19	13.53	28.08	6.75	38.00
6614	7.41	6.85	40.56	8.58	29.82	6.78	38.00
6603	8.49	5.58	37.75	10.70	31.02	6.46	38.00
6573	7.37	6.63	41.38	9.78	27.61	7.23	39.00
6652	7.69	6.58	40.06	9.45	28.86	7.36	39.00
6630	9.12	5.53	36.94	12.53	28.64	7.24	37.00
6675	8.15	5.58	38.88	11.03	29.21	7.15	37.00
6662	8.70	5.65	39.38	11.35	28.17	6.75	40.00
6673	8.11	6.20	38.88	11.08	29.03	6.70	38.00
6607	7.47	6.48	41.13	9.05	28.24	7.63	43.00
6618	7.68	5.73	38.75	11.20	29.73	6.91	39.00
6559	6.03	5.48	40.63	11.78	28.59	7.49	40.00
6682	8.27	5.90	38.94	9.55	29.12	8.22	39.00
6517	7.23	5.90	35.63	13.35	30.44	7.45	38.00
6599	6.97	6.65	41.63	8.23	29.30	7.22	37.00
6641	7.73	5.75	39.25	11.05	29.27	6.95	40.00
....	....	....	39.66	....	....	6.22	....
....	7.89	5.99	39.35	10.69	28.89	7.19	38.83
....	....	....	33.1	3.7	22.5.	6.8	....
6501	9.16	5.50	36.38	9.00	38.10	1.86	42.00
....	....	....	33.00	....	....	2.00	....
....	....	....	30.6	6.7	30.5	1.7	....
6640	9.55	5.33	36.88	7.50	35.43	5.31	43.00
6660	9.47	5.15	37.06	7.25	34.93	6.14	45.00
6568	9.43	4.93	35.13	7.70	34.73	8.08	39.00
6576	9.10	5.50	37.31	7.73	34.18	6.18	48.00
6485	9.21	5.78	35.81	7.60	36.50	5.10	42.00
6600	10.72	6.30	29.81	8.85	38.69	5.63	42.00
....	....	....	32.33	....	....	4.83	....
....	9.58	5.50	35.34	7.77	35.74	6.07	43.17
....	....	....	31.5	4.4	27.9	5.4	....

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	WHEAT PRODUCTS.	
	Wheat Bran.	
6592	Spring. Western Canada Flour Mills Co., Canada	*Middletown:* Meech & Stoddard
6674	*Choice. Hecker-Jones-Jewell Mill. Co., Buffalo, N. Y.	*Winsted:* M. D. Leonard
6561	Palace. Kehlor Flour Mills Co., St. Louis, Mo.	*No. Haven:* Coöperative Feed Co.
6488	Bran & Screenings. R. E. Kidder Flour Mills, Kansas City, Mo.	*Hamden:* I. W. Beers
6484	†Bought of A. F. Lane & Co., New York	*Ansonia:* Flour & Grain Co.
6623	Choice. Niagara Falls Mill. Co., Niagara Falls, N. Y.	*Suffield:* Spencer Bros.
6598	‡Bell Cow. Quaker Oats Co., Chicago, Ill.	*Plainville:* Eaton Bros.
6654	‡Bixota. Red Wing Mill. Co., Red Wing, Minn.	*Danbury:* F. C. Benjamin
6572	Sleepy Eye Mill. Co., Minneapolis, Minn.	*Meriden:* Grain & Feed Co.
6506	‡Southwestern Mill. Co., Kansas City, Mo.	*Branford:* S. V. Osborn
6635	Nokomos Durum. Yerxa, Andrews & Thurston, Minneapolis, Minn.	*Rockville:* Edw. White
6502	‡Washburn-Crosby Co., Minneapolis, Minn.	*East Haven:* F. A. Forbes
6552	‡Wisconsin Milling Co., Menominee, Wis.	*Bridgeport:* Vincent Bros. Co.
		Average guaranty
		Average of these 13 analyses
		Average digestible
	Wheat Feed (Mixed Feed).	
6540	Winona. Bay State Mill. Co., Winona, Minn.	*Willimantic:* E. A. Buck
6482	Bull's Eye. Blish Mill. Co., Seymour, Ind.	*Derby:* Peterson & Hendee
6508	‡Boston. Duluth Superior Mfg. Co., Duluth, Minn.	*Guilford:* Morse & Landon
6664	‡Lucky. Federal Milling Co., Lockport, N. Y.	*New Milford:* Geo. E. Ackley Co.
6471	Manhattan. Hecker-Jones-Jewell Mill. Co., New York	*New Haven:* Crittenden-Benham Co.
6487	Crescent. Kemper Mill & Elev. Co., Kansas City, Mo.	*Hamden:* I. W. Beers
6495	‡Badger Fancy. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*W. Cheshire:* G. W. Thorpe
6663	‡Maple Leaf. Maple Leaf Mill. Co., Toronto Can.	*New Milford:* Geo. E. Ackley Co.
6624	Perfect. Niagara Falls Mill. Co., Niagara Falls, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.
6629	§Bought of J. Parkwith & Smith, Boston, Mass.	*W. Stafford:* C. P. Bradway & Son
6602	‡Fancy. Pillsbury Co., Minneapolis, Minn.	*Waterbury:* H. S. Coe & Co.
6580	‡Buckeye. Quaker Oats Co., Chicago, Ill.	*Milford:* E. L. Oviatt
6521	Occident. Russell-Miller Mill. Co., Minneapolis, Minn.	*Westerly:* C. W. Campbell Co.
6661	Regular. Russell-Miller Mill. Co., Minneapolis, Minn.	*New Milford:* Geo. T. Soule
6577	Gold Mine. Sheffield King Mill. Co., Minneapolis, Minn.	*Meriden:* A. Grulich

* With trace of screenings.
† Statement of dealer; no guaranty.
‡ With ground screenings.
§ Billed as Crescent Mixed Feed; no tags or guaranty; to be sold as bran.

SAMPLED IN 1915—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
6592	10.79	4.98	16.13	9.13	53.12	5.85	$26.00
6674	9.90	6.20	13.69	11.18	53.47	5.56	28.00
6561	9.71	6.78	16.13	9.58	53.20	4.60	26.00
6488	11.20	6.35	16.63	9.20	52.59	4.03	26.00
6484	10.92	6.03	13.88	10.53	53.19	5.45	27.00
6623	9.32	4.98	14.88	9.63	55.36	5.83	29.00
6598	9.88	5.00	15.44	9.53	54.89	5.26	26.00
6654	9.60	5.70	14.50	12.05	52.23	5.92	28.00
6572	10.50	6.90	15.00	11.63	51.12	4.85	28.00
6506	9.49	6.83	17.31	8.43	54.41	3.53	27.00
6635	9.17	5.38	12.38	14.23	53.87	4.97	28.00
6502	9.93	6.48	14.25	10.93	52.95	5.46	26.00
6552	10.13	6.00	13.94	10.45	54.38	5.10	25.00
....	....	....	**14.51**	....	....	**4.08**	....
....	**10.04**	**5.97**	**14.94**	**10.50**	**53.44**	**5.11**	**26.92**
....	....	....	**11.5**	**4.1**	**37.9**	**3.2**	....
6540	9.93	4.98	15.44	6.68	58.05	4.92	33.00
6482	10.17	5.85	16.94	7.25	55.47	4.32	30.00
6508	10.66	4.80	15.63	8.55	54.79	5.57	28.00
6664	11.24	5.05	15.06	7.80	55.31	5.54	29.00
6471	10.18	5.00	15.75	8.18	55.91	4.98	30.00
6487	10.88	5.65	17.00	7.33	55.48	3.66	30.00
6495	9.70	4.18	14.00	5.10	60.12	7.00	31.00
6663	10.82	5.03	16.00	9.28	53.18	5.69	27.00
6624	8.99	5.05	14.94	8.10	57.50	5.42	33.00
6629	9.69	7.10	17.56	9.50	51.92	4.23	28.00
6602	11.04	4.95	17.56	6.10	56.13	4.22	31.00
6580	9.62	5.20	15.44	9.18	55.07	5.49	29.00
6521	10.20	6.65	15.44	7.95	53.85	5.91	29.40
6661	9.34	4.85	16.13	8.38	55.52	5.78	30.00
6577	10.15	5.15	15.19	8.48	55.69	5.34	29.00

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	WHEAT PRODUCTS—*Continued.*	
	Wheat Feed (Mixed Feed)—Continued.	
6546	Try-Me. Sparks Mill. Co., Alton, Ill.	*Manchester:* Little & McKinney
6672	Honest. David Stott, Detroit, Mich.	*Torrington:* F. L. Wadhams
6499	Waggoner-Gates Mill. Co., Independence, Mo.	*Willimantic:* H. A. Bugbee
6608	*Washburn-Crosby Co., Minneapolis, Minn.	*Thomaston:* L. E. Blackmer
6657	Kent. Williams Bros. Co., Kent, O.	*New Milford:* Geo. T. Soule
		Average guaranty
		Average of these 20 analyses
		Average digestible
	Wheat Middlings.	
6560	*Atlas Flour. Atlas Flour Mills, Milwaukee, Wis.	*No. Haven:* Coöperative Feed Co.
6680	*Winona. Bay State Mill. Co., Winona, Minn.	*Torrington:* D. L. Talcott
6678	*Standard. Gardner Mills, Hastings, Minn.	*Winsted:* E. Manchester & Sons
6505	*Standard. Gardner Mills, Hastings, Minn.	*Branford:* S. V. Osborn
6527	Flour. Wm. Hamilton & Son, Honeoye Falls, N. Y.	*Norwich:* Norwich Grain Co.
6494	*Badger Fancy. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*W. Cheshire:* G. W. Thorpe
6483	†Bought of A. F. Lane & Co., New York	*Ansonia:* Flour & Grain Co.
6613	*Fancy Canadian. Maple Leaf Mill. Co., Toronto, Can.	*Collinsville:* F. W. Konold
6634	*Shorts. Marshall Mill. Co., Marshall, Minn.	*Rockville:* Edw. White
6639	*Ogilvie Flour Mills Co., Canada	*Hartford:* Smith, Northam & Co.
6665	*"A." Pillsbury Co., Minneapolis, Minn.	*New Milford:* Geo. E. Ackley Co.
6626	*"B." Pillsbury Co., Minneapolis, Minn.	*Thompsonville:* Geo. S. Phelps & Co.
6668	Standard. Russell-Miller Mill. Co., Minneapolis, Minn.	*Litchfield:* The Wadhams Co.
6671	Pennant. David Stott, Detroit, Mich.	*Torrington:* F. L. Wadhams
6596	*Angelus. Thompson Mill. Co., Lockport, N. Y.	*Plantsville:* C. A. Cowles
6677	Arlington Flour Strong Clear. Washburn-Crosby Co., Minneapolis, Minn.	*Winsted:* E. Manchester & Sons
6503	*Standard. Washburn-Crosby Co., Minneapolis, Minn.	*E. Haven:* F. A. Forbes
		Average guaranty
		Average of these 17 analyses
		Average digestible
	RYE PRODUCTS.	
6478	Feed. Boutwell Mill. & Grain Co., Troy, N. Y.	*New Haven:* Crittenden-Benham Co.
6564	Choice Middlings. Miner-Hillard Mill. Co., Wilkes Barre, Pa.	*Wallingford:* E. E. Hall
6588	Irving Mills Feed. VanVechten Mill. Co., Rochester, N. Y.	*Middletown:* Meech & Stoddard

* With ground screenings.
† Statement of dealer; no guaranty.

SAMPLED IN 1915—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
6546	9.54	5.18	16.19	8.23	55.66	5.20	$30.00
6672	10.76	5.65	15.44	7.65	55.42	5.08	29.00
6499	10.18	7.63	18.25	7.08	52.13	4.73	29.00
6608	9.71	5.10	14.25	8.93	56.90	5.11	33.00
6657	11.10	5.68	15.31	6.63	56.88	4.40	31.00
....	....	....	**15.26**	....	....	**4.18**	....
....	**10.20**	**5.44**	**15.88**	**7.81**	**55.54**	**5.13**	**29.95**
....	....	....	**12.4**	**4.8**	**42.8**	**4.5**	....
6560	11.47	4.40	16.56	5.85	56.83	4.89	32.00
6680	10.24	5.68	15.69	6.45	56.85	5.09	28.00
6678	10.44	4.93	16.00	9.43	52.77	6.43	29.00
6505	11.34	6.18	15.31	8.83	52.96	5.38	30.00
6527	11.69	2.35	14.75	3.45	63.59	4.17	32.00
6494	10.33	3.15	12.94	3.83	62.37	7.38	31.00
6483	11.43	4.25	16.44	6.28	55.54	6.06	27.00
6613	11.22	4.35	17.13	8.27	53.16	5.87	29.00
6634	10.36	5.28	17.00	8.73	53.36	5.27	29.00
6639	10.19	3.88	16.75	7.40	55.78	6.00	29.00
6665	10.25	5.25	16.13	5.28	57.72	5.37	34.00
6626	10.46	5.35	14.81	11.03	53.31	5.04	31.00
6668	9.59	4.60	15.56	8.70	55.43	6.12	32.00
6671	11.18	4.60	15.63	6.28	57.21	5.10	29.00
6596	11.50	3.63	15.50	6.13	58.14	5.10	28.00
6677	11.22	2.05	14.88	0.43	67.98	3.44	36.00
6503	10.34	6.35	16.63	8.73	52.94	5.01	27.00
....	....	....	**15.20**	....	....	**4.52**	....
....	**10.78**	**4.49**	**15.74**	**6.77**	**56.82**	**5.40**	**30.18**
....	....	....	**12.1**	**2.0**	**45.3**	**4.8**	....
6478	11.13	3.43	15.69	3.73	63.00	3.02	29.00
6564	11.19	3.33	14.75	3.73	63.96	3.04	29.00
6588	12.09	4.45	16.38	4.83	58.90	3.35	28.00

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	BARLEY PRODUCTS.	
6676	Eagle Feed. J. B. A. Kern & Sons, Milwaukee, Wis.	*Winsted:* E. Manchester & Sons
	MAIZE PRODUCTS.	
	Cracked Corn Meal.	
6679	Ground by D. L. Talcott, Torrington	*Torrington:* Manufacturer ...
		Digestible
	Corn Gluten Meal.	
6491	Diamond. Corn Products Ref. Co., New York	*W. Cheshire:* G. W. Thorpe..
6525	Diamond. Corn Products Ref. Co., New York	*Westerly:* C. W. Campbell Co.
		Guaranty
		Average of these 2 analyses ..
		Average digestible
	Corn Gluten Feed.	
6656	Cream of Corn. American Maize Prod. Co., New York	*Brookfield:* C. R. Dubia
6669	Cream of Corn. American Maize Prod. Co., New York	*Torrington:* F. L. Wadhams..
		Average guaranty
		Average of these 2 analyses ..
		Average digestible
6490	Buffalo. Corn Products Ref. Co., New York	*Hamden:* I. W. Beers
6507	Buffalo. Corn Products Ref. Co., New York	*Branford:* S. V. Osborn
6562	Buffalo. Corn Products Ref. Co., New York	*No. Haven:* Coöperative Feed Co.
6646	Buffalo. Corn Products Ref. Co., New York	*New Britain:* C. W. Lines Co.
		Average guaranty
		Average of these 4 analyses ..
		Average digestible
6481	Globe. Corn Products Ref. Co., New York	*Shelton:* Ansonia Flour & Grain Co.
6648	Globe. Corn Products Ref. Co., New York	*New Haven:* R. G. Davis & Sons
		Average guaranty
		Average of these 2 analyses ..
		Average digestible
6512	Douglas. Douglas Co., Cedar Rapids, Ia.	*New London:* I. N. Bragaw ..
6667	Douglas. Douglas Co., Cedar Rapids, Ia.	*Litchfield:* The Wadhams Co.
		Average guaranty
		Average of these 2 analyses ..
		Average digestible
6475	K. K. K. J. C. Hubinger Bros. Co., Keokuk, Ia.	*New Haven:* Crittenden-Benham Co.
		Guaranty
		Digestible
	Hominy Feed.	
6601	Homco. American Hominy Co., Indianapolis, Ind.	*Bristol:* Eaton Bros.
6617	Homco. American Hominy Co., Indianapolis, Ind.	*Granby:* E. H. Rollins
		Guaranty
6575	Bufceco. Buffalo Cereal Co., Buffalo, N. Y.	*Meriden:* Grain & Feed Co. ..

SAMPLED IN 1915—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
6676	9.65	4.03	12.88	8.90	60.99	3.55	$35.00
6679	12.98	1.20	9.38	1.83	71.76	2.85	32.00
....	....	....	6.3	....	66.1	2.6	....
6491	9.58	0.85	44.75	1.50	40.01	3.31	36.00
6525	9.89	0.98	43.88	1.48	41.57	2.20	38.40
....	....	....	40.00	....	....	1.50	....
....	9.73	0.91	44.32	1.49	40.79	2.76	37.20
....	....	....	37.2	....	35.9	2.7	....
6656	10.51	3.10	25.44	5.88	53.37	1.70	32.00
6669	10.21	4.48	27.00	5.40	50.83	2.08	30.00
....	....	....	24.50	....	....	1.75	....
....	10.36	3.79	26.22	5.64	52.10	1.89	31.00
....	....	....	22.3	4.9	46.9	1.5	....
6490	7.69	3.73	29.56	7.05	48.84	3.13	30.00
6507	9.33	2.88	27.13	6.30	52.83	1.53	30.00
6562	8.59	6.28	28.06	5.70	48.83	2.54	28.00
6646	8.26	4.23	27.94	6.80	51.01	1.76	32.00
....	....	....	23.00	....	....	1.00	....
....	8.47	4.28	28.17	6.46	50.38	2.24	30.00
....	....	....	23.9	5.6	45.3	1.8	....
6481	9.11	4.18	28.94	6.33	50.12	1.32	31.00
6648	9.00	5.53	28.31	6.00	48.71	2.45	30.00
....	....	....	23.00	....	....	1.00	....
....	9.05	4.85	28.63	6.16	49.42	1.89	30.50
....	....	....	24.3	5.4	44.5	2.2	....
6512	9.81	3.43	23.88	6.20	53.85	2.83	28.00
6667	10.18	2.93	25.38	6.35	51.95	3.21	31.00
....	....	....	23.00	....	....	1.00	....
....	10.00	3.18	24.63	6.27	52.90	3.02	29.50
....	....	....	20.9	5.5	47.6	2.4	....
6475	8.19	2.05	21.63	7.03	54.67	6.43	30.00
....	....	....	23.00	....	....	2.40	....
....	....	....	18.4	6.1	49.2	5.2	....
6601	8.80	2.93	11.69	4.05	63.45	9.08	30.00
6617	9.80	2.65	11.31	4.60	62.91	8.73	30.00
....	....	....	10.00	....	....	7.00	....
6575	10.03	2.80	11.75	4.55	63.67	7.20	33.00

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

SAMPLED IN 1915—*Continued.*

Station No.	Brand.	Retail Dealer.	Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	MAIZE PRODUCTS—*Continued.*								
	Hominy Feed—Continued.								
6651	Bufceco. Buffalo Cereal Co., Buffalo, N. Y.	*Danbury:* H. E. Meeker	10.48	2.75	11.00	4.50	64.56	6.71	$32.00
		Guaranty	....	....	10.00	....	....	6.00	....
6558	Wirthmore. Chas. M. Cox Co., Boston, Mass. ...	*Norwalk:* Holmes, Keeler & Kent Co.	8.82	2.55	11.69	4.48	65.52	6.94	32.00
		Guaranty	....	....	9.50	....	....	7.50	....
6620	*R. J. Hardy & Sons, Boston, Mass.	*Suffield:* Arthur Sikes	8.70	2.68	11.56	4.68	63.30	9.08	31.00
		Guaranty	....	....	10.00	....	....	6.00	....
6496	Badger. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*W. Cheshire:* G. W Thorpe ..	9.38	2.85	11.44	4.80	63.75	7.78	33.00
		Guaranty	....	....	10.00	....	....	6.00	....
6513	Steam Cooked. Miner-Hillard Mill. Co., Wilkes Barre, Pa.	*New London:* I. N. Bragaw ..	10.30	2.78	11.75	4.58	63.73	6.86	30.00
		Guaranty	....	....	10.00	....	....	5.00	....
6593	*Miner-Hillard Mill. Co., Wilkes Barre, Pa.	*E. Hampton:* R. H. Hall	9.94	2.80	11.75	3.03	65.87	6.61	32.00
		Guaranty	....	....	9.00	....	....	7.00	....
6504	Patent Cereals Co., Geneva, N. Y.	*Branford:* S. V. Osborn	9.43	2.93	12.00	4.58	64.03	7.03	32.00
		Guaranty	....	....	10.00	....	....	6.00	....
6543	Yellow. Quaker Oats Co., Chicago, Ill.	*Manchester:* Little & McKinney	11.12	2.50	10.81	3.63	64.77	7.17	32.00
		Guaranty	....	....	9.00	....	....	4.00	....
6622	Blue Ribbon. J. E. Soper Co., Boston, Mass.	*Suffield:* Spencer Bros.	8.54	2.68	11.88	4.45	63.15	9.30	31.00
		Guaranty	....	....	10.00	....	....	6.00	....
		Average guaranty of all	....	....	9.46	....	....	6.13	....
		Average of these 12 analyses..	9.61	2.74	11.55	4.33	64.06	7.71	31.50
		Average digestible	....	....	7.5	2.9	57.0	7.1	....
	BREWERY AND DISTILLERY PRODUCTS.								
	Dried Brewers' Grains.								
6653	Anheuser-Busch Brewing Asso., St. Louis, Mo. ..	*Danbury:* F. C. Benjamin	6.80	4.10	29.81	14.35	37.94	7.00	28.00
		Guaranty	....	....	22.00	....	....	6.00	....
6535	Bull Brand. Farmers Feed Co., New York	*Yantic:* A. R. Manning	7.07	3.98	28.13	12.93	41.22	6.67	30.00
6479	Bull Brand. Farmers Feed Co., New York	*New Haven:* Crittenden-Benham Co.	7.55	3.73	30.25	12.88	38.66	6.93	30.00
		Guaranty	....	....	27.20	....	....	6.30	....
6621	Crown. Milwaukee Grains & Feed Co., Milwaukee, Wis.	*Suffield:* Arthur Sikes	6.30	3.55	32.19	12.98	38.04	6.94	30.00
		Guaranty	....	....	26.00	....	....	6.00	....
6489	Providence Brewing Co., Providence, R. I.	*Hamden:* I. W. Beers	6.14	3.20	28.88	13.68	41.54	6.56	31.00
		Guaranty	....	....	25.00	....	....	5.00	....
		Average of these 5 analyses ..	6.77	3.71	29.85	13.37	39.48	6.82	29.80
		Average digestible	....	....	24.2	6.6	23.1	6.1	....
	Dried Distillers' Grains.								
6523	Ajax Flakes. Ajax Mill. & Feed Co., New York	*Westerly:* C. W. Campbell Co.	6.74	2.58	34.56	10.40	35.45	10.27	36.40
		Guaranty	....	....	30.00	....	....	11.00	....
		Digestible	....	....	25.2	9.9	28.7	9.8	....
6627	Continental Gluten Feed. Continental Cereal Co., Peoria, Ill.	*Hazardville:* A. D. Bridge Sons Co.	6.98	4.48	28.81	6.30	45.50	7.93	36.00
		Guaranty	....	....	29.00	....	....	10.00	....
		Digestible	....	....	21.0	6.0	36.9	7.5	....
6539	Bourbon 3 D Grains. Dewey Bros. Co., Blanchester, O.	*Willimantic:* E. A. Buck	7.11	2.90	23.38	13.83	43.26	9.52	34.00
		Guaranty	....	....	24.00	....	....	8.00	....
		Digestible	....	....	14.1	13.1	35.0	9.0	....
6587	Dried Grain. Fleischmann	*Middletown:* Meech & Stoddard	5.81	2.30	19.88	16.90	48.39	6.72	27.00
		Guaranty	....	....	18.00	....	....	6.50	....
		Digestible	....	....	14.4	16.1	39.2	6.4	....

* Statement of dealer.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	MISCELLANEOUS FEEDS.	
	**Dried Beet Pulp.*	
6569	Holland-St. Louis Sugar Co., Decatur, Ind.	*Wallingford:* E. E. Hall
6589	Menominee River Sugar Co., Menominee, Mich.	*Middletown:* Meech & Stoddard
6609	Michigan Sugar Co., Alma, Mich.	*Unionville:* F. D. Lawton & Son
6616	Michigan Sugar Co., Caro, Mich.	*Granby:* E. H. Rollins
6537	Michigan Sugar Co., Croswell, Mich.	*Willimantic:* H. A. Bugbee
6643	Minnesota Sugar Co., Chaska, Minn.	*Hartford:* G. M. White & Co.
6619	Mt. Clemens Sugar Co., Mt. Clemens, Mich.	*Suffield:* Arthur Sikes
6516	Owosso Sugar Co., Lansing, Mich.	*New London:* P. Schwartz Co.
6631	Owosso Sugar Co., Lansing, Mich.	*Rockville:* Rockville Mill. Co.
6625	Toledo Sugar Co., Toledo, O.	*Thompsonville:* Geo. S. Phelps & Co.
		Guaranty
		Average of these 10 analyses
		Average digestible
	PROPRIETARY MIXED FEEDS.	
	Hominy and Corn Cob Feed.	
6591	Star Feed. Toledo Elevator, Indianapolis, Ind.	*Middletown:* Meech & Stoddard
		Guaranty
	†Wheat Bran and Corn Cob Feed.	
6469	Sterling Feed. Indiana Mill. Co., Terre Haute, Ind.	*New Haven:* Crittenden-Benham Co.
		Guaranty
		Digestible
	Corn and Oat Feeds, and Chop Feeds.	
6480	Bufceco Chop Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Shelton:* Ansonia Flour & Grain Co.
		Guaranty
6544	‡Provender. Feed Products Mill. Co., Chicago, Ill.	*Manchester:* Little & McKinney
6659	No. 1 Chop Feed. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* Geo. T. Soule
		Guaranty
6563	Korn-Oato Feed. Meech & Stoddard, Middletown	*Wallingford:* E. E. Hall
		Guaranty
6549	Oat Feed. Robin Hood Mills, Moose Jaw, Can.	*Bridgeport:* Vincent Bros. Co.
		Guaranty
6670	Winner Chop Feed. David Stott, Detroit, Mich.	*Torrington:* F. L. Wadhams
		Guaranty
6551	C. and O. Feed. Vincent Bros. Co., Bridgeport	*Bridgeport:* Manufacturer
	Horse, Dairy and Stock Feeds.	
6655	Sucrene Dairy Feed. American Mill. Co., Peoria, Ill.	*Brookfield:* C. R. Dubia
		Guaranty
6531	RKD, Arcady Dairy Feed. Arcady Farm, Lake Forest, Ill.	*Norwich:* Chas. Slosberg
		Guaranty

* Sold by the Larrowe Milling Co., Detroit, Mich.
† With ground screenings.
‡ Statement of dealer.

SAMPLED IN 1915—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
6569	8.76	3.15	8.81	19.85	58.90	0.53	$27.00
6589	7.24	2.55	8.38	19.90	61.35	0.58	27.00
6609	9.04	3.15	8.00	18.48	60.74	0.59	29.00
6616	8.79	3.15	8.38	18.75	60.33	0.60	29.00
6537	8.59	3.25	8.63	23.33	55.57	0.63	28.00
6643	7.94	3.23	8.75	19.33	60.22	0.53	28.00
6619	7.31	3.18	8.19	19.40	61.17	0.75	29.00
6516	8.56	3.18	8.25	20.98	58.39	0.64	28.00
6631	9.59	3.13	8.13	19.40	58.85	0.90	29.00
6625	8.60	3.25	8.69	20.25	58.40	0.81	29.00
....	....	....	**8.00**	....	....	**0.50**	....
....	**8.44**	**3.12**	**8.42**	**19.97**	**59.39**	**0.66**	**28.30**
....	....	....	**5.4**	**16.8**	**54.0**	....	....
6591	9.09	2.73	9.13	10.35	61.88	6.82	27.00
....	....	....	**7.00**	....	....	**5.50**	....
6469	9.40	4.35	11.06	14.52	57.85	2.82	24.00
....	....	....	**10.00**	....	....	**3.00**	....
....	....	....	**7.0**	**4.1**	**41.1**	**2.6**	....
6480	10.24	4.38	9.38	9.93	60.40	5.67	31.00
....	....	....	**7.00**	....	....	**3.00**	....
6544	10.44	3.03	10.06	6.45	66.40	3.62	32.00
6659	10.49	3.65	9.19	8.60	64.06	4.01	32.00
....	....	....	**7.00**	....	....	**3.00**	....
6563	10.21	2.95	8.38	10.50	64.60	3.36	30.00
....	....	....	**7.00**	....	....	**3.00**	....
6549	6.87	5.68	7.06	24.25	53.10	3.04	....
....	....	....	**5.25**	....	....	**2.50**	....
6670	10.41	2.68	10.00	5.03	66.58	5.30	34.00
....	....	....	**8.00**	....	....	**5.00**	....
6551	10.53	3.33	11.06	4.85	65.69	4.54	28.00
6655	11.39	8.98	16.81	13.55	44.86	4.41	28.00
....	....	....	**16.50**	....	....	**3.50**	....
6531	11.66	10.15	18.44	10.75	45.43	3.57	29.00
....	....	....	**16.00**	....	....	**3.50**	....

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
6519	Pennant Stock Feed. E. W. Bailey & Co., Swanton, Vt.	*Mystic:* Mystic Grain Co. .... Guaranty ....
6536	Blatchford's Calf Meal. Blatchford Calf Meal Fact., Waukegan, Ill.	*Yantic:* A. R. Manning ..... Guaranty ....
6604	Bufceco Creamery Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer .. Guaranty ....
6642	Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Hartford:* G. M. White & Co. Guaranty ....
6650	Bufceco Stock Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Danbury:* H. E. Meeker ..... Guaranty ....
6606	Iroquois Dairy Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer.. Guaranty ....
6570	Iroquois Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Meriden:* Grain and Feed Co. Guaranty ....
6522	Nobotheration Dairy Feed. C. W. Campbell Co., Westerly	*Westerly:* Manufacturer ..... Guaranty ....
6524	Lactola Dairy Feed. Chapin and Co., Hammond, Ind.	*Westerly:* C. W. Campbell Co. Guaranty ....
6597	Unicorn Dairy Ration. Chapin and Co., Hammond, Ind.	*Plainville:* Eaton Bros. ..... Guaranty ....
6578	Peerless Dairy Feed. Chesbro Mill. Co., Salamanca, N. Y.	*Meriden:* A. Grulich ..... Guaranty ....
6526	Clover Leaf Dairy Feed. Clover Leaf Mill. Co., Buffalo, N. Y.	*Norwich:* Norwich Grain Co. Guaranty ....
6529	Clover Leaf Horse Feed. Clover Leaf Mill. Co., Buffalo, N. Y.	*Norwich:* Norwich Grain Co. Guaranty ....
6510	Wirthmore Balanced Ration. Chas. M. Cox Co., Boston, Mass.	*Chester:* Leet Bros. ..... Guaranty ....
6514	Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass.	*New London:* I. N. Bragaw.. Guaranty ....
6632	Hobby Horse Feed. Albert Dickinson Co., Chicago, Ill.	*Rockville:* Edw. White ..... Guaranty ....
6633	Honeysuckle Feed. Albert Dickinson Co., Chicago, Ill.	*Rockville:* Edw. White ..... Guaranty ....
6637	Stag Stock Feed. Albert Dickinson Co., Chicago, Ill.	*Hartford:* Smith Northam & Co. .... Guaranty ....
6681	Eatall Alfalfa Horse Feed. Feed Products Mill. Co., Chicago, Ill.	*Torrington:* F. U. Wadhams Guaranty ....
6545	Eatall Horse Feed. Feed Products Mill. Co., Chicago, Ill.	*Manchester:* Little and McKinney .... Guaranty ....
6658	Anchor Horse Feed. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* Geo. T. Soule.. Guaranty ....
6515	Grandin's Stock Feed. D. H. Grandin Mill. Co., Jamestown, N. Y.	*New London:* P. Schwartz Co. Guaranty ....
6533	H and S Alfalfa Feed. Dwight E. Hamlin, Pittsburgh, Pa.	*Norwich:* Chas. Slosberg .... Guaranty ....

SAMPLED IN 1915—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
6519	9.25	3.38	10.38	8.93	60.77	7.29	$33.00
....	....	....	**10.00**	....	....	**6.50**	....
6536	10.80	5.60	25.00	7.28	46.27	5.05	68.00
....	....	....	**24.00**	....	....	**5.00**	....
6604	9.16	4.38	19.00	11.08	51.51	4.87	35.00
....	....	....	**18.00**	....	....	**4.00**	....
6642	9.71	3.53	12.44	9.88	60.24	4.20	33.00
....	....	....	**10.00**	....	....	**4.00**	....
6650	9.40	3.60	10.13	10.28	61.08	5.51	32.00
....	....	....	**8.00**	....	....	**4.00**	....
6606	10.68	8.98	14.94	9.10	54.65	*1.65	28.00
....	....	....	**17.00**	....	....	**4.00**	....
6570	10.77	10.33	9.19	9.93	58.38	*1.40	35.00
....	....	....	**9.00**	....	....	**2.00**	....
6522	8.72	5.10	24.25	9.03	47.09	5.81	32.40
....	....	....	**20.00**	....	....	**5.50**	....
6524	9.68	8.78	16.63	10.53	51.05	3.33	29.40
....	....	....	**16.50**	....	....	**3.00**	....
6597	9.11	4.55	25.75	9.75	44.29	6.55	35.00
....	....	....	**26.00**	....	....	**5.00**	....
6578	8.25	4.93	25.63	9.68	46.39	*5.12	35.00
....	....	....	**24.00**	....	....	**7.00**	....
6526	10.33	10.05	16.81	10.80	48.60	3.41	28.00
....	....	....	**16.50**	....	....	**3.50**	....
6529	9.46	6.45	10.50	14.73	57.58	*1.28	31.00
....	....	....	**10.00**	....	....	**2.00**	....
6510	9.44	5.90	26.50	9.03	43.73	5.40	31.00
....	....	....	**25.50**	....	....	**5.20**	....
6514	9.16	3.65	11.00	7.83	60.55	7.81	31.00
....	....	....	**9.00**	....	....	**4.00**	....
6632	11.15	6.48	11.63	11.25	58.28	*1.21	36.00
....	....	....	**9.00**	....	....	**1.50**	....
6633	10.51	9.78	13.81	18.58	46.88	*0.44	30.00
....	....	....	**10.00**	....	....	**0.50**	....
6637	10.34	2.95	10.69	8.88	63.51	3.63	32.00
....	....	....	**9.00**	....	....	**3.00**	....
6681	10.75	7.70	11.50	15.08	53.24	*1.73	32.00
....	....	....	**10.00**	....	....	**2.00**	....
6545	10.13	7.68	11.81	16.03	52.46	*1.89	32.00
....	....	....	**10.00**	....	....	**2.50**	....
6658	12.04	3.13	10.81	6.33	64.21	3.48	36.00
....	....	....	**9.00**	....	....	**3.00**	....
6515	9.15	3.83	10.25	9.45	60.92	6.40	30.00
....	....	....	**8.50**	....	....	**3.50**	....
6533	8.33	6.53	23.94	12.88	43.22	5.10	35.00
....	....	....	**20.00**	....	....	**3.50**	....

* See page 239.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
6571	Purekane Molasses Feed. Dwight E. Hamlin, Pittsburgh, Pa.	*Meriden:* Grain and Feed Co.
		Guaranty
6538	Quality Feed. Dwight E. Hamlin, Pittsburgh, Pa.	*Willimantic:* E. A. Buck
		Guaranty
6532	H and S Horse, Mule and Dairy Feed. Dwight E. Hamlin, Pittsburgh, Pa.	*Norwich:* Chas. Slosberg
		Guaranty
6530	Haskell's Stock Feed. W. H. Haskell & Co., Toledo, O.	*Norwich:* Chas. Slosberg
		Guaranty
6644	Algrane Horse Feed. H. O. Co., Buffalo, N. Y.	*New Britain:* C. W. Lines Co.
		Guaranty
6583	Algrane Milk Feed. H. O. Co., Buffalo, N. Y.	*So. Norwalk:* S. Roodner
		Guaranty
6584	De-Fi Feed. H. O. Co., Buffalo, N. Y.	*So. Norwalk:* S. Roodner
		Guaranty
6470	New England Stock Feed. H. O. Co., Buffalo, N. Y.	*New Haven:* Crittenden-Benham Co.
		Guaranty
6556	Bonnie Horse Feed. Holmes, Keeler & Kent Co., Norwalk	*Norwalk:* Manufacturer
		Guaranty
6550	Steam Cooked Feed. Imperial Grain and Mill. Co., Toledo, O.	*Bridgeport:* Vincent Bros. Co.
		Guaranty
6595	Blue Top Stock Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Plantsville:* C. A. Cowles
		Guaranty
6493	Cream City Horse Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*W. Cheshire:* G. W. Thorpe
		Guaranty
6594	Derby Horse Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Plantsville:* C. A. Cowles
		Guaranty
6557	Larro-Feed. Larrowe Mill. Co., Detroit, Mich.	*Norwalk:* Holmes, Keeler & Kent Co.
		Guaranty
6554	M. and S. Stock Feed. Meech and Stoddard, Middletown	*Bridgeport:* Berkshire Mills
		Guaranty
6520	*Dried Beet Pulp and Molasses. Michigan Sugar Co., Bay City, Mich.	*Westerly:* C. W. Campbell Co.
		Guaranty
6500	Ginger Horse Feed. Omaha Alfalfa Mill. Co., Omaha, Neb.	*Willimantic:* H. A. Bugbee
		Guaranty
6553	Peerless Horse Feed. Omaha Alfalfa Mill. Co., Omaha, Neb.	*Bridgeport:* Berkshire Mills
		Guaranty
6611	Park and Pollard Horse Feed. Park and Pollard Co., Boston, Mass.	*Unionville:* F. D. Lawton & Son
		Guaranty
6612	Park and Pollard Stock Feed. Park and Pollard Co., Boston, Mass.	*Unionville:* F. D. Lawton & Son
		Guaranty
6518	Peters King Corn. H. C. Peters Mill. Co., Omaha, Neb.	*New London:* P. Schwartz Co.
		Guaranty
6477	Purina Cow Chow Feed. Purina Mills, St. Louis, Mo.	*New Haven:* Crittenden-Benham Co.
		Guaranty

* Sold by the Larrowe Milling Co., Detroit, Mich.

SAMPLED IN 1915—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free (Starch, gum, etc.) Extract.	Ether (Crude Fat.) Extract.	
6571	14.67	7.18	8.38	5.00	64.09	*0.68	$34.00
....	....	....	6.00	....	....	1.50	....
6538	9.23	8.68	11.56	13.88	55.07	*1.58	34.00
....	....	....	8.00	....	....	2.00	....
6532	8.93	7.25	18.06	9.78	53.48	*2.50	35.00
....	....	....	14.00	....	....	3.50	....
6530	8.53	3.70	10.50	8.18	60.90	8.19	32.00
....	....	....	8.00	....	....	4.00	....
6644	10.25	5.40	11.13	9.75	60.35	3.12	32.00
....	....	....	11.00	....	....	4.00	....
6583	9.85	6.95	14.63	12.08	52.49	4.00	30.00
....	....	....	14.00	....	....	4.00	....
6584	8.25	6.40	8.31	17.53	55.80	3.71	28.00
....	....	....	8.00	....	....	3.00	....
6470	9.39	4.65	10.00	8.75	62.03	5.18	31.00
....	....	....	9.00	....	....	4.00	....
6556	9.78	7.03	15.25	8.25	55.99	3.70	29.00
....	....	....	13.00	....	....	4.00	....
6550	10.15	2.43	10.06	4.60	68.28	4.48	41.00
....	....	....	9.50	....	....	4.00	....
6595	8.78	4.53	10.88	12.38	58.15	5.28	32.00
....	....	....	9.00	....	....	4.00	....
6493	11.18	6.83	8.31	16.23	56.20	*1.25	32.00
....	....	....	10.00	....	....	1.50	....
6594	9.26	7.43	9.31	18.25	54.77	0.98	....
....	....	....	10.00	....	....	1.00	....
6557	9.09	4.93	20.81	13.18	47.74	4.25	34.00
....	....	....	19.00	....	....	3.00	....
6554	7.94	3.88	8.44	14.85	58.97	5.92	33.00
....	....	....	9.00	....	....	3.00	....
6520	8.47	4.33	8.81	18.20	59.62	0.57	29.40
....	....	....	9.00	....	....	0.50	....
6500	11.82	6.55	11.38	11.36	57.23	*1.66	32.00
....	....	....	10.00	....	....	2.00	....
6553	10.63	6.20	10.06	12.43	59.21	*1.47	34.00
....	....	....	10.00	....	....	2.00	....
6611	10.51	6.20	10.00	11.88	60.01	*1.40	30.00
....	....	....	8.00	....	....	2.00	....
6612	9.05	4.80	10.44	9.28	61.21	5.22	31.00
....	....	....	9.00	....	....	3.00	....
6518	10.04	8.00	11.94	13.85	55.37	*0.80	34.00
....	....	....	9.00	....	....	1.50	....
6477	9.28	6.93	26.50	14.08	39.18	*4.03	36.00
....	....	....	24.00	....	....	5.00	....

* See page 239.