State of Connecticut

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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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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 valua-

* See note on p. 9.

tion; 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.

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
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

* A sample sent by the manufacturer was analyzed.

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.	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		
6075	88997	" " "	6.22	6.50	31.90	22.1
6076	87334	" " "	6.30	6.50	31.90	21.9
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 FISH MANURES.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. As Ammonia.	Nitrogen. As Organic.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Phosphoric acid. Water-soluble.	Phosphoric acid. Citrate-soluble.	Phosphoric acid. Citrate-insoluble.	Total Phosphoric Acid. Found.	Total Phosphoric Acid. Guaranteed.	Cost per ton.	Average retail cost of like amounts of nitrogen and phosphoric acid in other raw materials.
	Sampled by Station:												
5905	American Agr. Chem. Co.	F. S. Bidwell & Co., Windsor Locks	0.37	8.87	9.24	8.23	0.72	5.18	1.07	6.97	6.0	$49.00	$45.76
5906	American Agr. Chem. Co.	G. S. Phelps, Thompsonville	0.39	8.77	9.16	8.23	0.72	5.60	1.16	7.48	6.0	48.00	45.78
5706	Apothecaries Hall Co.	Factory	0.25	9.53	9.78	8.20	...	...	...	9.52	5.5	46.00	50.33
6235	Bowker Fertilizer Co.	S. Veits, West Suffield	0.10	8.08	8.18	8.23	0.86	5.86	0.57	7.29	6.0	49.00	41.69
6236	E. D. Chittenden Co.	Wm. Norton, Broad Brook	0.24	7.78	8.02	8.20	0.42	3.20	0.92	4.54	6.0	....	38.60
5819	*Niantic Menhaden Oil & Guano Co.	T. J. Coleman, Warehouse Point	1.58	7.30	8.88	8.25	1.22	4.31	0.83	6.36	...	....	42.11
5804	Olds & Whipple	Factory	0.18	9.60	9.78	7.40	0.43	5.99	1.64	8.06	5.5	48.00	49.25
5913	Wilcox Fertilizer Co.	E. H. Woodward, Enfield	0.21	9.24	9.45	8.24	0.87	6.32	0.87	8.06	6.0	52.00	47.76
	Sampled by Purchaser:												
5666	American Agr. Chem. Co.	E. N. Austin, Suffield	...	...	8.82	8.23	...	...	...	12.00	...	45.00	48.41
5667	G. F. Taylor Commission Co.	E. N. Austin, Suffield	...	...	10.41	9.46	...	...	...	9.81	...	45.00	53.65
6314	Bought from F. H. Thrall, Windsor	J. A. Du Bon, Poquonock	...	...	6.04	...	0.69	11.60	7.92	20.21	...	38.00	42.73

* 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 $\frac{1}{50}$-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 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 Bone Manures.

Station No.	Manufacturer and Brand.	Dealer or Purchaser.	Chemical Analysis. Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Found.	Phosphoric Acid. 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.
	Sampled by Station:									
5986	American Agr. Chem. Co., Bone Meal	Silliman Hardware Co.	1.95	1.65	16.38	13.75	62	38	$31.00	$20.08
5985	American Agr. Chem. Co., Fine Ground Bone	C. Buckingham	2.16	2.47	28.66	22.88	57	43	30.00	30.05
6229	American Agr. Chem. Co., High Grade Ground Bone	E. O. Chapman	2.98	3.29	21.21	20.59	58	42	33.00	27.59
5987	Armour Fertilizer Works, Bone Meal	Brower & Malone	2.64	2.47	23.28	22.00	62	38	37.00	28.03
6233	Berkshire Fertilizer Co., Ground Bone	Factory	2.91	2.50	23.41	20.00	61	39	32.00	29.15
5988	Valentine Bohl, Self-Recommending Fertilizer	Apothecaries Hall Co.	3.94	3.82	22.13	23.03	55	45	32.00	31.86
5989	Bowker Fertilizer Co., Fresh Ground Bone	W. B. Rice	2.68	2.47	24.43	22.88	58	42	27.75	28.88
5635	Coe-Mortimer Co., Fine Ground Bone	J. A. Martin	2.83	2.47	25.79	22.89	56	44	....	30.38
5678	L. T. Frisbie Co., Fine Bone Meal	Highwood Veg. Growers' Asso.	2.75	2.47	26.87	23.00	58	42	....	31.00
5990	L. T. Frisbie Co., Fine Bone Meal	W. A. Simpson	2.90	2.47	26.23	23.00	70	30	....	32.20
5991	International Agr. Corp., Buffalo Bone Meal	Apothecaries Hall Co.	2.51	2.50	23.16	22.00	49	51	30.00	27.39
6239	Lister's Agr. Chem. Works, Bone Meal	F. C. Benjamin	2.74	2.67	25.46	22.88	55	45	35.00	29.77
5992	Lowell Fertilizer Co., Ground Bone	M. E. Cooke	2.92	2.46	26.74	23.00	59	41	30.00	31.62
5993	Olds & Whipple, Bone Meal	Factory	2.49	2.50	25.46	22.00	65	35	34.00	29.26
5994	Rogers & Hubbard Co., Pure Raw Knuckle Bone Flour	Factory	3.99	3.82	24.95	24.70	58	42	42.00	34.33
5995	Rogers & Hubbard Co., Strictly Pure Fine Bone	R. H. Hall	3.56	3.70	22.39	22.00	40	60	41.00	29.81
6242	Rogers & Hubbard Co., Strictly Pure Fine Bone	Factory	3.85	3.70	23.62	22.00	34	66	35.00	31.48
6063	Rogers Mfg. Co., Fine Ground Bone	F. S. Platt Co.	3.50	3.50	26.74	25.00	90	10	40.00	35.54
6062	Rogers Mfg. Co., Pure Knuckle Bone Flour	Factory	3.90	3.80	26.61	25.00	52	48	36.00	34.89
6243	F. S. Royster Guano Co., Fine Ground Bone Meal	C. B. Sikes, Jr.	2.49	2.47	23.21	22.90	70	30	35.00	27.73
6061	Sanderson Fert. & Chem. Co., Fine Ground Bone	Morse & Landon	2.98	2.47	25.71	20.00	50	50	31.00	30.60
5996	C. M. Shay Fertilizer Co., Pure Ground Bone	G. M. Williams Co.	2.32	2.06	28.14	25.00	66	34	35.00	30.67
6246	M. L. Shoemaker & Co., Swift-Sure Bone Meal	F. A. Forbes	5.86	4.53	22.06	20.00	61	39	38.00	39.59
5997	Van Iderstine Co., Pure Ground Bone	E. B. Clark Seed Co.	2.14	2.00	27.89	27.00	44	56	30.00	28.77
5998	Wilcox Fertilizer Co., Pure Ground Bone	Factory	2.75	2.48	22.39	22.00	72	28	32.50	28.21
	Sampled by Purchaser:									
5617	L. T. Frisbie Co., Bone Meal	F. W. Browning	2.93	3.00	27.10	22.90	62	38	30.00	32.07
6064	E. L. James, Ground Bone	Factory	4.02	3.00	20.09	20.00	1	99	37.00	27.76
5974	Not known	C. M. Geer	3.59	...	22.77	....	30	70	35.00	29.69

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 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 TANKAGE.

Station No.	Manufacturer.	Dealer or Purchaser.	Chemical Analysis. Nitrogen. As Ammonia.	Nitrogen. As Water-Soluble Organic.	Nitrogen. As Active-Insoluble Organic.	Nitrogen. As Inactive-Insoluble Organic.	Nitrogen. Total Found.	Nitrogen. Total Guaranteed.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. 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.
	Sampled by Station:													
5703	American Agr. Chem. Co.	D. L. Clark & Son, Milford	0.47	1.25	2.30	1.07	5.09	4.94	15.31	13.73	56	44	$35.00	$31.15
6230	American Agr. Chem. Co.	H. S. Davis, New Haven	0.12	0.79	3.82	2.08	6.81	7.41	11.58	9.15	53	47	40.94	34.77
5708	Apothecaries Hall Co.	Factory	0.21	1.75	2.29	1.12	5.37	4.94	15.22	15.00	46	54	32.00	31.58
6070	Coe-Mortimer Co.	J. W. Crowell, Burnside	0.19	1.73	2.05	1.53	5.50	4.94	13.34	13.73	46	54	32.00	30.67
6067	L. T. Frisbie Co.	Factory	0.22	2.00	1.55	1.10	4.87	4.94	14.46	15.00	42	58	....	28.92
5677	L. T. Frisbie Co.	Highwood Veg. Growers' Asso., Highwood	0.17	...	7.32†	...	7.49	7.41	11.22	9.15	42	58	....	36.31
5909	L. T. Frisbie Co.	W. A. Simpson, Wallingford	0.07	1.52	4.58	1.31	7.48	7.41	2.07	9.15	44	56	....	29.60
5912	Lister's Agr. Chem. Works	S. J. Orr, West Suffield	0.07	0.59	1.36	0.80	2.82	2.67	10.93	12.00	52	48	28.00	18.97
5713	Nitrate Agencies Co.	A. D. Clark, Orange	0.20	2.75	1.73	1.30	5.98	5.76	6.60	6.38	55	45	....	27.95
6244	Sanderson Fert. & Chem. Co.	A. Ure, Highwood	0.12	3.01	3.25	1.03	7.41	7.41	13.01	9.00	54	46	....	38.21
5717	S. D. Woodruff & Sons	Factory	0.22	4.29	2.38	1.33	8.22	...	5.50	....	35	65	....	34.30
	Sampled by Purchaser:													
5729	Bowker Fertilizer Co.	C. Greenbacker, Meriden	0.23	1.57	1.84	1.32	4.96	4.94	14.05	13.73	41	59	....	28.92
5730	Bowker Fertilizer Co.	C. Greenbacker, Meriden	0.23	2.02	2.20	1.34	5.79	4.94	14.47	13.73	55	45	....	33.17
5684	Bowker Fertilizer Co.	John Gotta, Portland	...	...	...	...	5.00	4.94	15.56	13.73	39	61	....	30.07
5772	Apothecaries Hall Co.	J. M. Taylor, Kensington	0.10	1.23	2.94	1.16	5.43	4.94	10.34	15.00	53	47	30.00	28.56
5616	....	Barnes & Co., Wallingford	...	...	...	...	7.51	...	5.12	....	..	..	....	....
5665	....	E. N. Austin, Suffield	...	...	...	...	7.48	...	*9.65	....	35	65	28.00	34.62

* Contained also 0.39% potash. † Total organic.

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.

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.

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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. Nitrogen.	Available 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. Nitrogen.	Available 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.	Water-soluble.	Alkaline Method.			Neutral Method.		
				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 Analyzed in 1915.

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

* For further explanation see page 10.

§ See remarks on nitrogen solubility pages 39 to 41.

[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 ANALYZED IN 1915—*Continued.*

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.*	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, active-insoluble.	Nitrogen. Organic, in-active-insoluble.	Nitrogen. Total. Found.	Nitrogen. Total. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station No.
	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	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
5830	Special Potato Manure	New Canaan	35.00	19.49	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
	Quinnipiac Branch:																				
5832	Corn Manure	Southport	29.00	17.46	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
5959	Phosphate	New London	38.00	18.86	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
5831	Potato Phosphate	Westport	34.00	20.38	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
6159	Special Fish and Potash Mixture	Gildersleeve	....	24.33	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
5833	Special Market Garden Manure	Southport	36.50	25.85	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
6108	Special Wrapper Leaf Brand Tobacco Manure	Warehouse Point	40.00	26.37	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
	Wheeler Branch:																				
6109	§Corn Fertilizer	Granby	29.00	16.11	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
6110	Cuban Tobacco Grower	Granby	37.00	26.14	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
6111	Potato Manure	Granby	....	19.25	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
	Williams and Clark Branch:																				
5962	Americus Ammoniated Bone Superphosphate	Norwich	34.50	19.98	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
5881	Americus Corn Phosphate	Milford	32.00	17.32	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
5834	Americus H. G. Special for Potatoes and Root Crops	Waterbury	40.00	25.71	....	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
5882	Americus Potato Manure	South Manchester	34.00	19.51	....	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
5960	Meadow Queen Fertilizer	Milford	35.00	20.68	....	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
5883	Special Clark's Root Manure	Wallingford	....	14.53	....	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
5961	Special Seed Leaf Tobacco Manure	South Manchester	37.00	25.76	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
	Apothecaries Hall Co., Waterbury, Conn.																				
5884	§Victor Corn Phosphate	Windsorville	34.00	22.49	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
6033	Victor Potato and Vegetable Special	Waterbury	35.00	23.55	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
5963	Victor Tobacco Special	Windsorville	38.00	26.34	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
6034	Victor Top Dresser for Grass and Grain	Waterbury	54.00	40.10	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
	Armour Fertilizer Works, Baltimore, Md.																				
5747	All Soluble	Norwalk	39.00	24.08	....	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
5964	Ammoniated Bone with Potash	Bridgeport	32.00	17.70	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
5886	Bidwell's 3-8-4	Windsor Locks	34.00	25.03	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
6035	Brewer's Special	East Hartford	37.00	27.45	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
5887	Fish and Potash	Norwalk	33.00	17.36	....	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
6162	Grain Grower	South Manchester	35.00	15.93	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
5885	3-8-3	Bridgeport	34.00	20.98	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
6160	5-8-3	Thompsonville	40.00	25.26	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
6161	†§4-8-3	Thompsonville	37.00	22.76	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
6112	5-8-4	Bridgeport	38.00	28.11	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
5748	5½-4-3	Rockville	38.00	25.72	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

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

[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 ANALYZED IN 1915—*Continued.*

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

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

* 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.

[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

ANALYZED IN 1915—*Continued.*

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

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

[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 ANALYZED IN 1915—*Continued.*

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.*	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, active-insoluble.	Nitrogen. Organic, inactive-insoluble.	Nitrogen. Total. Found.	Nitrogen. Total. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent: **Lowell Fertilizer Co., Boston, Mass.** (*Continued.*)																				
5758	§Potato Phosphate	Wallingford	$34.00	$23.14	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
5784	§Potato Manure	New Britain	38.00	17.57	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
6223	Special Grass Mixture, Top Dressing and Lawns	South Manchester	39.00	28.77	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
6123	Special Tobacco from Vegetable and Animal Matter	Warehouse Point	38.00	25.90	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
5785	§Superior Fertilizer	Rockville	39.00	26.82	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
	E. Manchester & Sons, Winsted, Conn.																				
6125	§1915 Formula	Ellington	30.00	24.10	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
6126	1915 Special	Litchfield	38.00	31.28	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
	The Mapes Formula & Peruvian Guano Co., New York City.																				
5786	Average Soil Complete Manure	Southington	40.00	31.42	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
5761	Complete Manure, "A" Brand	Meriden	43.00	22.86	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
5762	Corn Manure	Ellington	41.00	28.70	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
6066	Dissolved Bone	Stonington	....	22.44	....	0.10		2.31		2.41	2.06	5.52	11.56	2.11	19.19	...	17.08	12.0	....	...	6066
5838	Economical Potato Manure	Southington	40.00	36.57	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
6127	Fruit and Vine Manure	Meriden	51.00	31.79	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
5837	Potato Manure	Ellington	45.00	32.38	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
5839	Seeding Down Manure	Forestville	47.00	39.21	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
6171	Special for Tobacco, Two in One	Ellington	48.00	36.62	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
6172	Tobacco Manure, Wrapper Brand	Ellington	54.00	36.63	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
5927	Tobacco Starter Improved	Suffield	40.00	23.35	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
5763	Top Dresser Improved, Full Strength	Ellington	57.00	45.70	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
5787	Top Dresser Improved, Half Strength	Meriden	40.00	24.40	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
6173	Vegetable Manure, Complete for Light Soils	Hartford	51.00	33.98	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
	National Fertilizer Co., New York City.																				
6179	Ammoniated Bone Phosphate	Guilford	....	16.67	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
5764	Fish and Potash Special	Hazardville	34.50	24.50	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
5930	†Special Complete Root and Grain Fertilizer	Silver Lane	38.00	22.72	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
6224	†Special Complete Root and Grain Fertilizer	Hazardville	36.00	23.16	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
6176	Special Eureka Potato Fertilizer	South Manchester	39.00	23.12	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
6174	Special Complete Grass Fertilizer	South Manchester	44.00	27.33	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
6175	Special H. G. Top Dressing	South Manchester	58.00	36.31	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
5788	Special Potato Phosphate	Greenwich	34.00	19.80	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
6177	Tobacco Special with Carbonate Potash, Revised	Hazardville	39.00	27.75	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
6178	Tobacco Special Revised	Hazardville	37.50	26.21	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

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

[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 Analyzed in 1915—*Continued.*

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.*	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, active-insoluble.	Nitrogen. Organic, in-active-insoluble.	Nitrogen. Total. Found.	Nitrogen. Total. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent:																				
	National Fertilizer Co., New York City. (*Continued.*)																				
5636	Tobacco Special Revised	Thompsonville	$37.00	$28.03	1.02	0.05		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
5840	XXX Fish and Potash Special	Greenwich	39.00	21.18	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
	New England Fertilizer Co., Boston, Mass.																				
5841	Corn and Grain Fertilizer	Rockville	28.00	14.09	....	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
6180	High Grade Potato Fertilizer	Meriden	....	22.06	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
5929	Improved Tobacco Grower	West Suffield	38.00	26.09	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
6181	Potato Fertilizer	Meriden	....	19.05	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
5765	§Superphosphate	Rockville	34.00	21.65	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
	Nitrate Agencies' Co., New York City.																				
6130	High Grade Peruvian Guano	Clinton	70.00	52.95	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
	Olds & Whipple, Hartford, Conn.																				
6183	Complete Grass Fertilizer, Top Dressing	Hartford	32.50	23.90	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
6186	Complete Corn and Potato Fertilizer	Warehouse Point	....	25.74	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
5931	Complete Tobacco Fertilizer	South Manchester	37.00	26.08	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
6184	Fish and Potash	Hartford	30.00	22.19	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
6185	High Grade Potato Fertilizer	Warehouse Point	....	27.80	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
6182	Special Phosphate	Hartford	35.00	25.36	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
	Parmenter & Polsey Fertilizer Co., Boston, Mass.																				
5766	Plymouth Rock Brand	Wallingford	32.00	20.94	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
6188	Potato Fertilizer	New Haven	29.00	18.47	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
6187	Special Tobacco Grower	New Haven	38.00	26.09	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
	Frank S. Platt Co., New Haven, Conn.																				
5767	Platco Market Garden Phosphate	New Haven	35.00	25.64	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
	The Rogers & Hubbard Co., Middletown, Conn.																				
5934	Tobacco Special	South Manchester	45.00	25.46	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
6190	War Special Formula, All Soils All Crops Phosphate	Branford	41.00	21.62	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
6191	†War Special Formula, Complete Phosphate	Hazardville	28.00	13.46	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
6275	†War Special Formula, Complete Phosphate	Branford	....	12.79	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
5933	War Special Formula, Oats and Top Dressing	Hazardville	56.00	38.94	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

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

[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 ANALYZED IN 1915—*Continued.*

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.*	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, active-insoluble.	Nitrogen. Organic, in-active-insoluble.	Nitrogen. Total. Found.	Nitrogen. Total. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent:																				
	The Rogers & Hubbard Co., Middletown, Conn. (*Continued.*)																				
6192	War Special Formula, Potato Phosphate	Hazardville	$33.00	$18.86	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
5932	War Special Formula, Seeding Down and Fruit	Windsor Locks ..	45.00	25.04	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
6193	War Special Formula, Soluble Corn and General Crops	Branford	....	20.11	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
6194	War Special Formula, Soluble Potato Manure	Putnam	44.00	27.39	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
6189	War Special Formula, Soluble Tobacco Manure	Windsor	50.00	31.37	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
	The Rogers Mfg. Co., Rockfall, Conn.																				
6196	Complete Potato and Vegetable Fertilizer	Chester	35.00	21.63	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
5936	H. G. Complete Corn and Onion Manure	Somerville	....	24.21	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
5768	H. G. Fertilizer, Oats and Top Dressing	Meriden	49.00	33.75	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
6197	H. G. Grass and Grain Fertilizer	Rockfall	....	30.21	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
6198	H. G. Soluble Tobacco Manure	Glastonbury	43.70	35.50	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
6195	H. G. Soluble Tobacco and Potato Manure ..	Somerville	....	28.66	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
5935	H. G. Tobacco Grower, Vegetable and Carbonate Formula	Suffield	38.50	30.73	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
	F. S. Royster Guano Co., Baltimore, Md.																				
6226	Dreadnought Fertilizer	Glastonbury	....	16.95	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
5791	Favorita Compound	Stamford	34.00	18.67	....	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
6132	Parfait Compound	Pomfret Center..	40.00	27.60	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
6131	Solace Compound	Westport	40.00	25.40	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
5769	†Tomahawk Compound	Ellington	37.50	22.51	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
6225	†Tomahawk Compound	Glastonbury	37.50	23.58	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
5792	Truckers' Delight	Greens Farms ...	....	26.92	....	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
5842	Utopia Compound	Ellington	33.00	21.03	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
	Sanderson Fertilizer & Chemical Co., New Haven, Conn.																				
5844	§Atlantic Coast Bone, Fish and Potash Revised	Guilford	27.00	17.52	....	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
6137	§Corn Superphosphate	New Canaan	31.00	17.24	....	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
6134	Hale's Special Mixture	South Glastonbury	32.00	20.90	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
6135	Kelsey's Bone, Fish and Potash Revised	Branford	32.00	23.61	....	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
5770	§Potato Manure Revised	New Canaan	32.00	19.51	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
5937	Special Complete Tobacco Grower	Glastonbury	....	26.85	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
5843	Special Formula A	Plainville	39.00	26.16	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
6136	Special Formula B	Warehouse Point	....	26.47	....	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
6133	Special with Potash Revised	New Haven	34.50	22.17	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
5793	Special Top Dressing for Grass and Grain ..	Guilford	39.00	28.01	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

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

[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 ANALYZED IN 1915—*Continued.*

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.*	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, active-insoluble.	Nitrogen. Organic, inactive-insoluble.	Nitrogen. Total. Found.	Nitrogen. Total. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent:																				
	The C. M. Shay Fertilizer Co., Groton, Conn.																				
5794	Formula	Guilford	$36.00	$27.25	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
	M. L. Shoemaker & Co., Philadelphia, Pa.																				
6201	Swift-Sure Guano for Truck, Corn and Onions	East Haven	35.00	21.66	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
5938	Swift-Sure Superphosphate for Potatoes	Suffield	36.00	23.94	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
6200	Swift-Sure Superphosphate for Tobacco and General Use	Glastonbury	....	29.63	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
	Springfield Rendering Co., Springfield, Mass.																				
6138	Animal Brand for All Crops	Thompsonville	34.00	21.87	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
	Tanner & Wilcox, Winsted, Conn.																				
6140	War Brand Grass and Corn Phosphate	Winsted	38.00	28.47	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
6139	War Brand Potato Phosphate	Winsted	36.00	27.79	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
	Virginia-Carolina Chemical Co., New York City.																				
6143	†§H. G. Corn and Vegetable Compound with 4% Potash	Milford	36.25	22.13	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
5940	Indian Brand for Tobacco	Glastonbury	35.00	26.52	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
6144	§National Corn, Grain & Grass Top Dressing with 4% Potash	Guilford	36.00	26.45	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
5796	Owl Brand Potato & Truck Fertilizer with 4% Potash	Guilford	35.25	22.93	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
5797	Star Brand Potato and Vegetable Compound with 4% Potash	Guilford	36.00	24.01	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
6141	Tobacco and Onion Special	Poquonock	37.00	25.49	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
6142	Universal Fertilizer for All Crops	Winsted	31.00	17.67	....	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
5795	XXX Fish and Potash	Wallingford	30.00	17.87	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
	Whitman & Pratt, Lowell, Mass.																				
6262	Corn Success	Bloomfield	32.00	17.01	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
6263	Potato Manure	Bloomfield	34.00	19.34	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
	Wilcox Fertilizer Co., Mystic, Conn.																				
6145	Complete Bone Superphosphate	North Stonington	31.50	19.68	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
6147	§Corn Special	Enfield	....	24.11	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
5941	Fish and Potash	Meriden	....	21.26	....	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
6148	Grass Fertilizer	Mystic	....	29.18	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
6149	H. G. Fish and Potash	Mystic	....	26.94	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
6151	H. G. Tobacco Special	Ellington	40.00	31.79	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

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

[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 Analyzed in 1915—*Continued.*

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.*	Nitrogen.							Phosphoric Acid.							Potash.		Station No.
					In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, active-insoluble.	Organic, in-active-insoluble.	Total. Found.	Total. Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Total. Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.	
	Sampled by Station Agent: **Wilcox Fertilizer Co., Mystic, Conn.** (*Continued.*)																				
6146	§Potato Fertilizer	Suffield	$33.00	$20.51	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
5950	Potato Onion and Vegetable Phosphate	Brooklyn	....	28.93	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
5798	Potato Onion and Vegetable Phosphate	Guilford	36.00	24.64	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
6150	Special Superphosphate	Mystic	....	15.51	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
	S. D. Woodruff & Sons, Orange, Conn.																				
5799	Home Mixture Fertilizer	Orange	33.00	29.29	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
	Worcester Rendering Co., Auburn, Mass.																				
6152	Royal Worcester Potato Fertilizer	Norwich	34.00	29.29	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
6153	Royal Worcester Corn and Grain Fertilizer	Norwich	28.00	27.64	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
	Sampled by Purchasers and others:																				
5618	Frisbie's Corn and Grain Fertilizer	*Norwich:*—Kitemaug Orchard Co.	25.50	....	....	....	....	....	....	1.33	1.64	....	....	....	9.10	...	....	8.0	3.28	3.0	5618
5619	Frisbie's Vegetable and Potato	*Norwich:*—Kitemaug Orchard Co.	32.50	....	....	....	....	....	....	3.16	3.28	....	....	....	9.54	...	....	8.0	4.73	4.0	5619
6254	Lister's Revised H. G. Special for Spring Crops	*Newark, N. J.:*—Manufacturer	....	18.11	....	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
6255	Lister's Special Tobacco Fertilizer	*Newark, N. J.:*—Manufacturer	....	22.06	....	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
6256	Lister's U. S. Superphosphate	*Newark, N. J.:*—Manufacturer	....	13.64	....	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
5695	Lowell Special Tobacco	*E. Windsor:*—H. A. Middleton	39.00	33.12	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
5654	Mapes Tobacco Manure, Wrapper Brand	*Poquonock:*—T. F. Connor	†50.00	45.01	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
6281	Olds & Whipple's Complete Tobacco Fertilizer	*Hartford:*—Amer. Sumatra Tob. Co.	37.00	30.80	0.77	0.05		4.09		4.91	....	0.10	2.65	0.26	3.01	...	2.75	...	[81] 5.70	...	6281
5694	Olds & Whipple's Complete Tobacco Fertilizer	*Suffield:*—K. C. Kulle	38.00	31.26	1.06	0.06		3.79		4.91	....	0.36	3.05	0.74	4.15	...	3.41	...	[82] 5.71	...	5694
6304	Olds & Whipple's Complete Tobacco Fertilizer	*Hockanum:*—N. H. Brewer	....	....	....	....	....	....	....	4.61	4.50	....	....	....	3.81	3.0	....	3.0	[83] 3.57	3.0	6304
6260	Olds & Whipple's Complete Tobacco Fertilizer	*Silver Lane:*—J. G. Harvey	38.00	....	....	....	....	....	....	4.51	4.50	....	....	....	4.22	3.0	....	3.0	[84] 3.22	3.0	6260
6284	Olds & Whipple's Special Mixture	*South Windsor:*—W. W. Jennings	....	31.02	0.79	0.01		3.74		4.54	....	0.53	7.65	0.20	8.38	...	8.18	...	[85] 4.59	...	6284

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

[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 ANALYZED IN 1915—*Continued.*

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.*	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, active-insoluble.	Nitrogen. Organic, in-active-insoluble.	Nitrogen. Total. Found.	Nitrogen. Total. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. Available. Found.	Phosphoric Acid. Available. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sampled by Purchasers and others:																				
6214	Rogers' Tobacco Grower and Vegetable Carbonate, No. 1	*Somers:*—T. J. Hurlburt	$40.00	....	....	....	....	....	....	5.10	5.00	....	....	....	4.86	4.0	....	3.0	[86]4.86	3.0	6214
6215	Rogers' Tobacco Grower and Vegetable Carbonate, No. 2	*Somers:*—T. J. Hurlburt	40.00	....	....	....	....	....	....	5.04	5.00	....	....	....	5.18	4.0	....	3.0	[87]4.25	3.0	6215
5893	Sanderson's Kelsey's Bone, Fish and Potash	*Branford:*—A. E. Plant Sons Co.	32.00	$24.80	....	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
6077	Sanderson's Special Top Dressing for Grass and Grain	*Shelton:*—O. G. Beard	....	....	....	....	....	....	....	4.05	4.12	....	....	....	10.17	10.0	....	9.0	4.21	4.0	6077
5776	Shay's Fertilizer	*Stepney:*—B. Rose	36.00	27.02	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
5894	Tanner & Wilcox's Potato Fertilizer	*Winsted:*—P. W. Newton	36.00	24.65	....	2.37	0.28	0.28	0.22	3.15	....	7.34	1.69	0.68	9.71	...	9.03	...	[89]3.85	...	5894
5813	Virginia-Carolina Indian Brand Tobacco Fertilizer	*Tariffville:*—Conn. Tob. Corp.	35.25	25.82	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
5939	†Virginia-Carolina Owl Brand Potato and Truck Fertilizer	*Suffield:*—R. Greer	....	28.28	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
5892	Wilcox's Potato, Onion and Vegetable Phosphate	*Branford:*—A. E. Plant Sons Co.	35.00	26.63	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

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

[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 1/4 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	...... Lightbourn & 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

* Including cost of inspecting imported nursery stock.

Rental and storage	$ 38.00	
Insurance	75.83	
Tools and supplies	2,815.33	
Traveling expenses	553.26	
		$8,057.39

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 publishing 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
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 correspondingly 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	No. Apiaries Diseased*	No. Apiaries Quarantined	No. Colonies Inspected	No. Colonies 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	No. Apiaries Diseased*	No. Apiaries Quarantined	No. Colonies Inspected	No. Colonies 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,

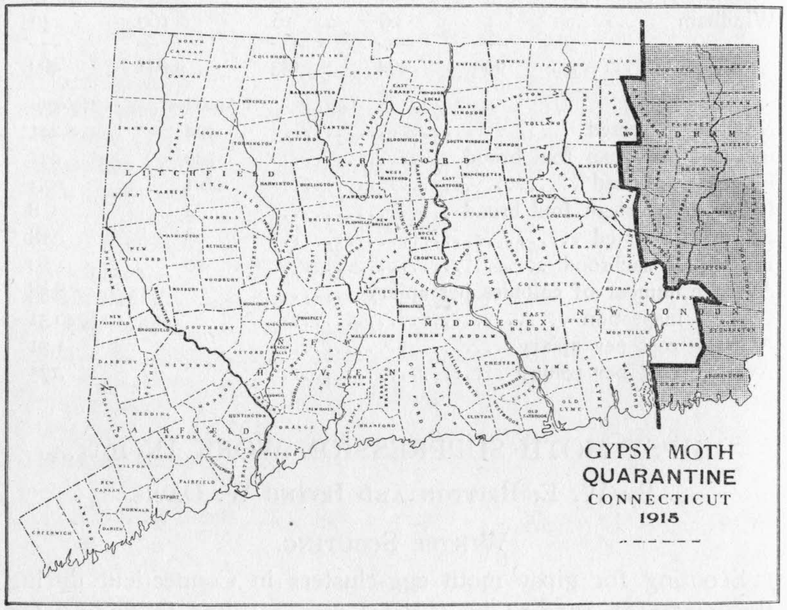

FIG. 1. Map of Connecticut showing towns infested by the Gipsy Moth, and quarantined in 1915.

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 outft 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 over-wintering 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

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*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. Walden 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, particularly 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 cattails, 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.

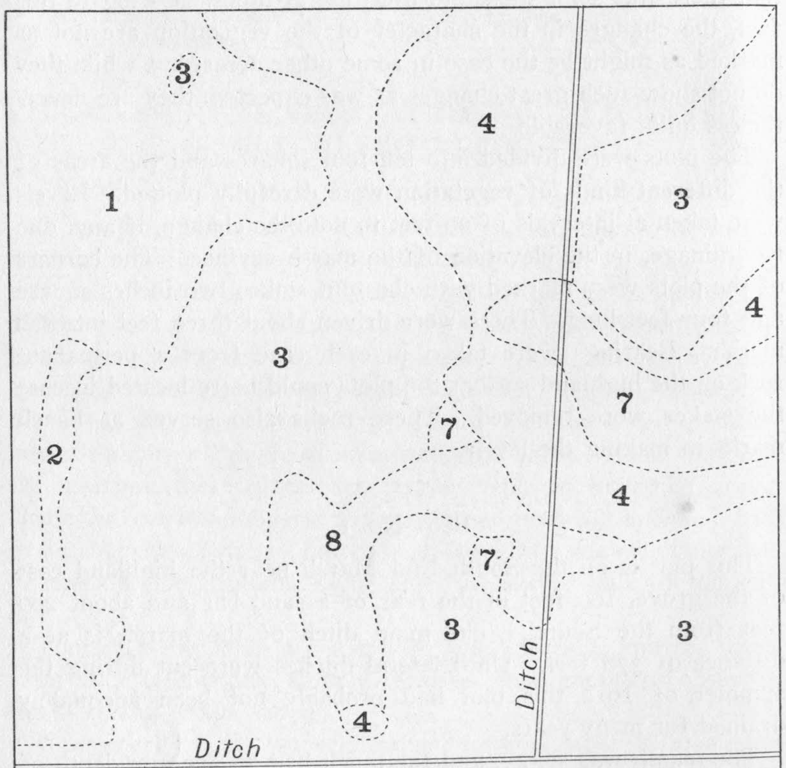


FIG. 2. Map or diagram of Plot No. 1, showing vegetation at time of ditching in 1912.

EXPLANATION OF MAPS.

1 Black grass	5 Highland vegetation
2 Red salt grass	6 Salicornia
3 Spike grass	46 Rush grass and Salicornia
23 Red salt and spike	7 Dead grass area
4 Rush grass	8 Bare area
43 Rush grass and spike grass	

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

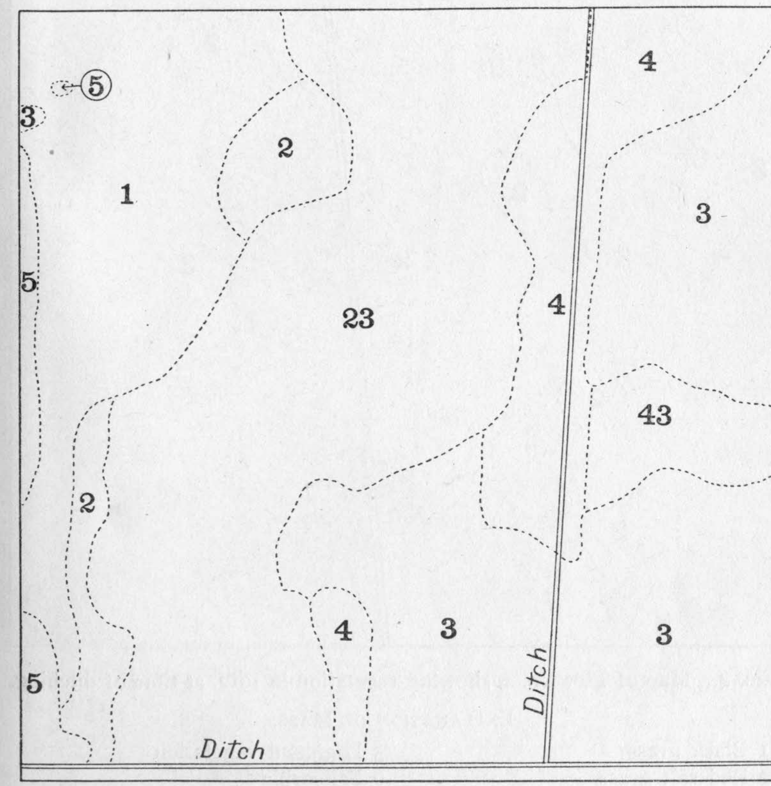


FIG. 3. Map of Plot No. 1, showing changes in vegetation three years after ditching, 1915.

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

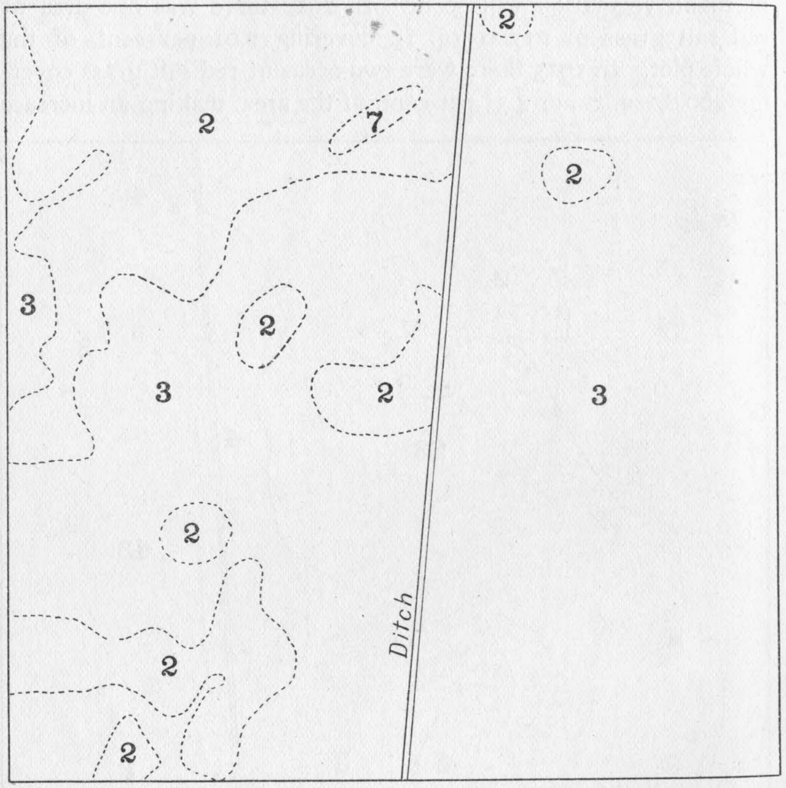


FIG. 4. Map of Plot No. 2, showing vegetation in 1912, at time of ditching.

EXPLANATION OF MAPS.

1 Black grass	5 Highland vegetation
2 Red salt grass	6 Salicornia
3 Spike grass	46 Rush grass and Salicornia
23 Red salt and spike	7 Dead grass area
4 Rush grass	8 Bare area
43 Rush grass and spike grass	

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

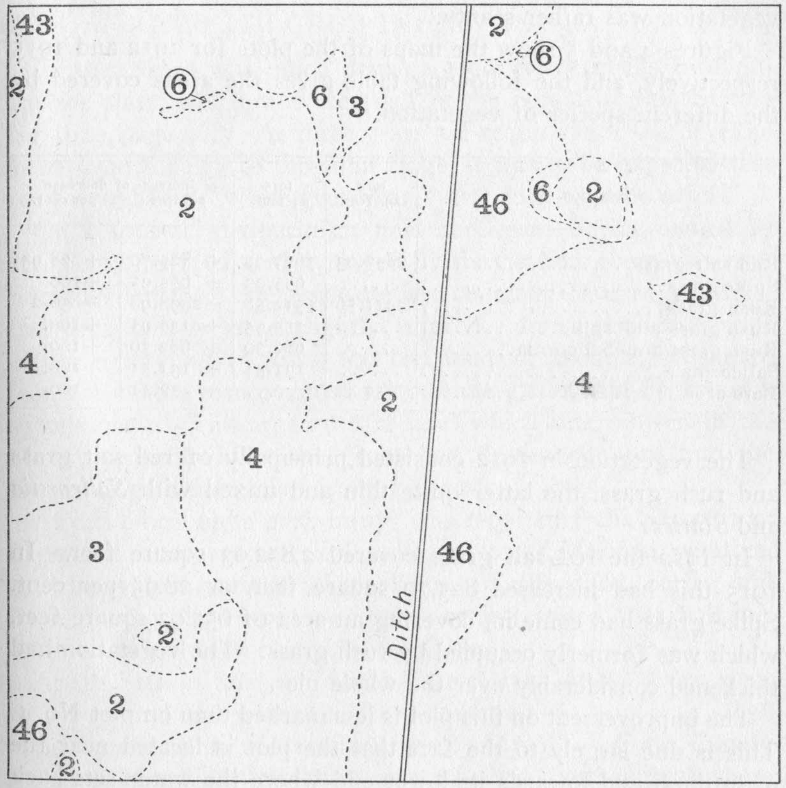


FIG. 5. Map of Plot No. 2, showing vegetation three years after ditching, 1915.

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 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.

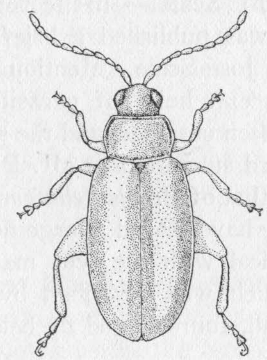


FIG. 6. The Banded Flea-Beetle *Systena tæniata* Say, nine times enlarged.

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

* 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.

* 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.

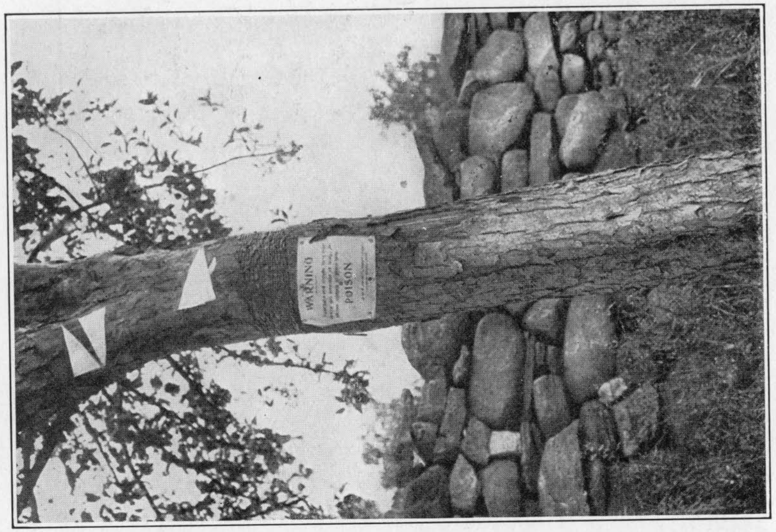
Never send any insects loose in an envelope or folded in the letter, where they are usually crushed beyond recognition, often rendering the accompanying letter illegible. Place them in a strong box or mailing case; it is not necessary to punch holes in it. If insects are alive, and in the feeding stage, 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.

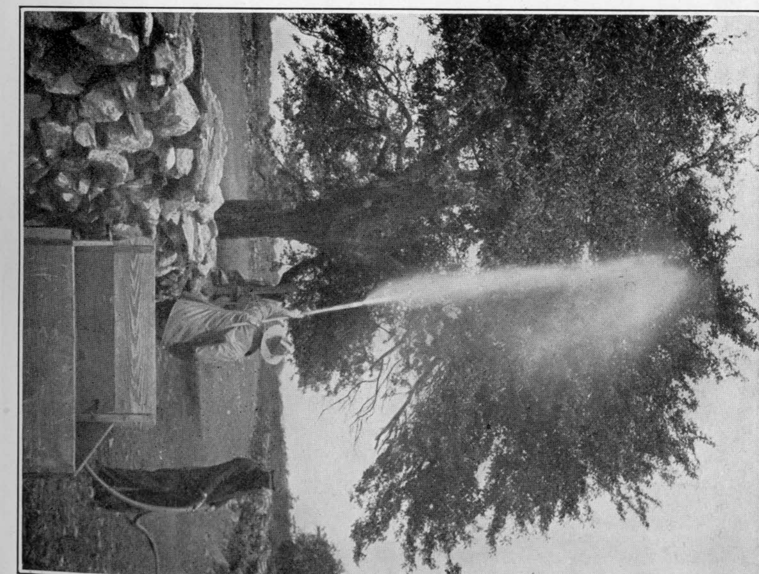
a. Infestation No. 1, Putnam, 1915, after cleaning. Seven egg-clusters were found.



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.

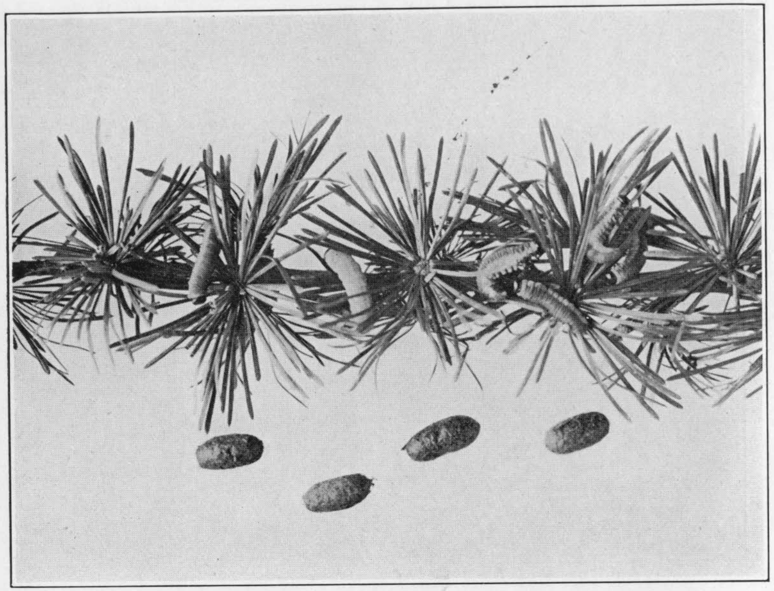
GIPSY MOTH WORK.

a. Spraying woodland trees in Thompson.



b. Spraying large apple-tree. Infestation No. 12, Putnam.

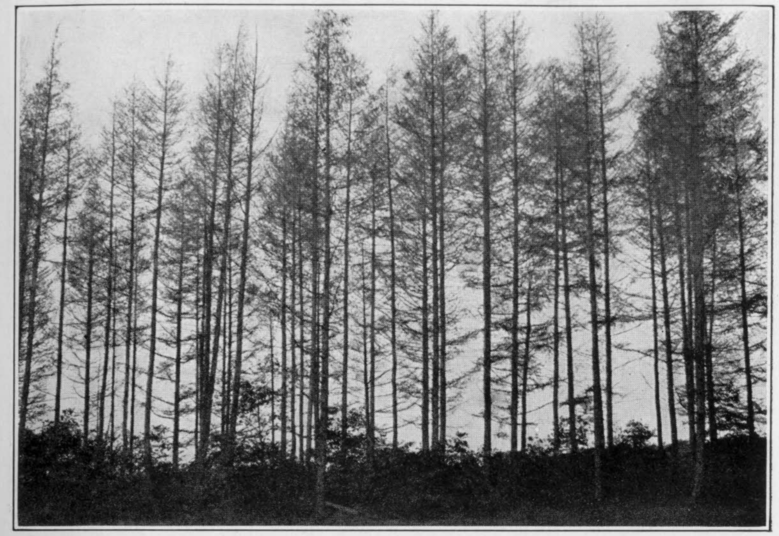
GIPSY MOTH WORK.



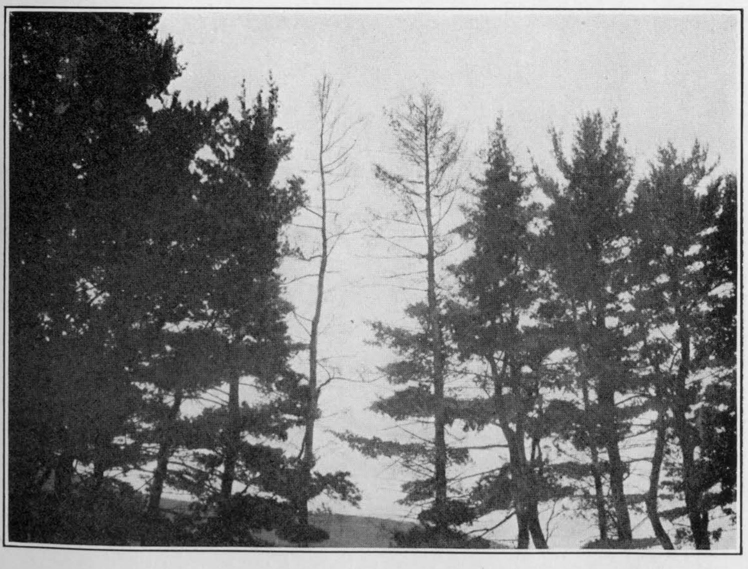
a. Larvæ and pupæ of the larch sawfly. Natural size.

b. High-power sprayer used in woodland infestations.

LARCH SAWFLY AND GIPSY MOTH WORK.

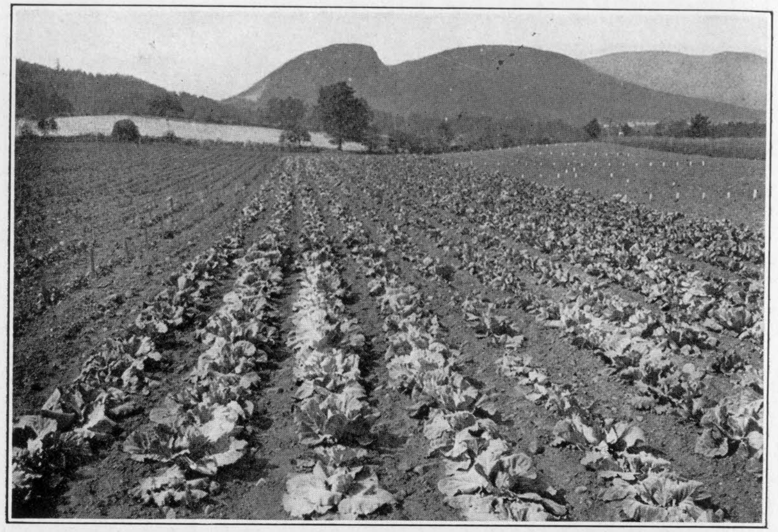


a. Grove of larch trees in Woodstock, partially stripped by larvæ.



b. The two larch trees between pines were entirely defoliated. Canaan.

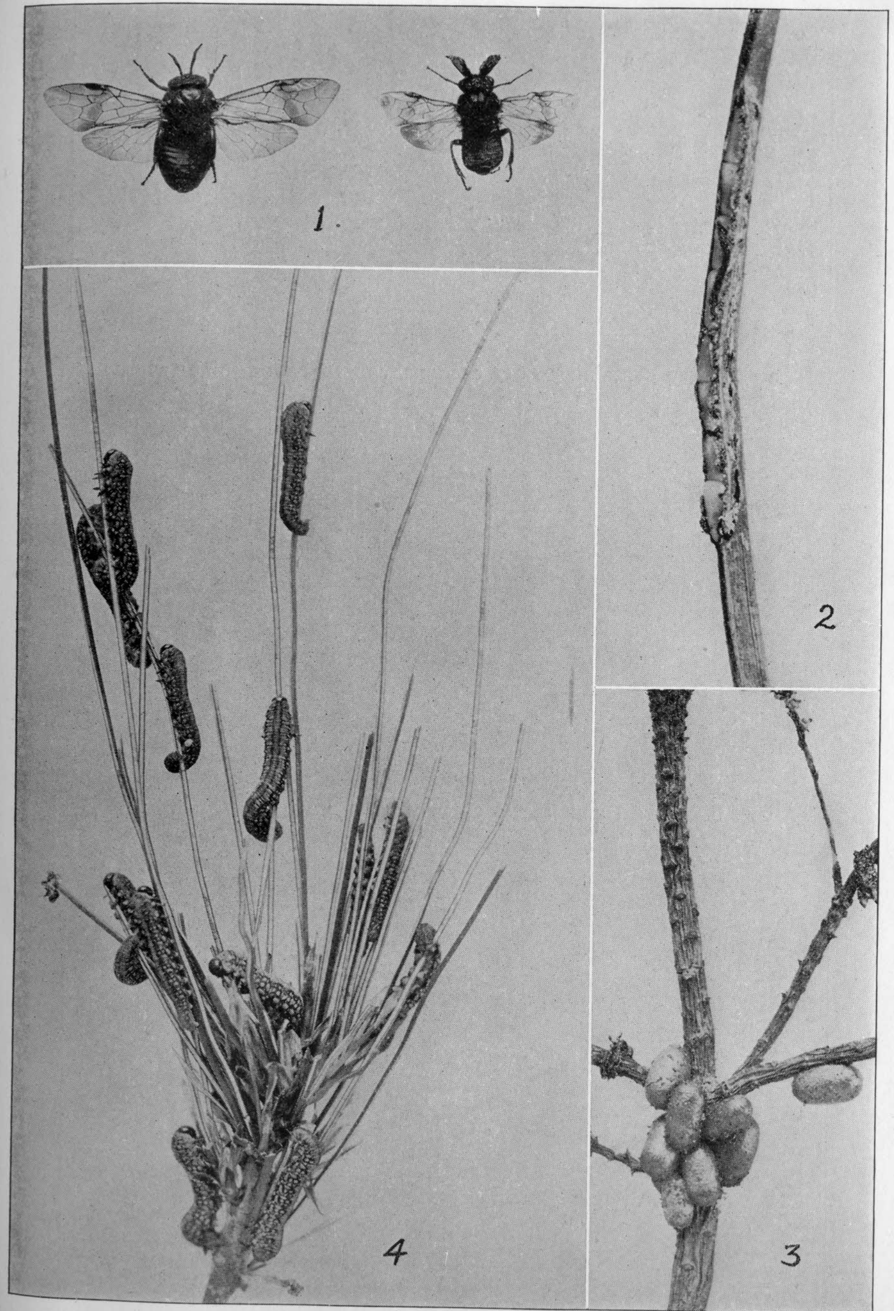
THE LARCH SAWFLY.



a. General view of experiment field at Mt. Carmel.

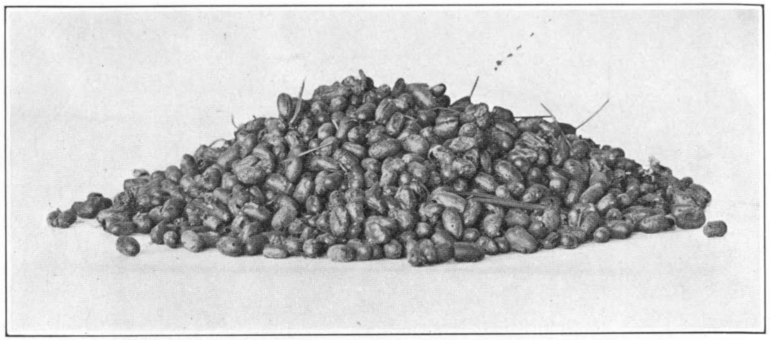
b. Plants at left were protected by tarred paper disks, 5 per cent. infested. Plants at right untreated, one-third ruined.

CABBAGE MAGGOT EXPERIMENTS.

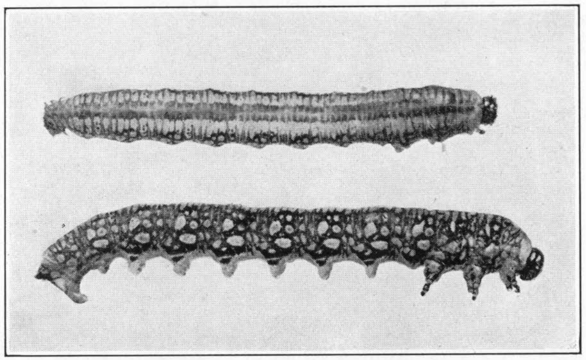


Diprion simile: Hartig. 1. Adults, twice natural size; 2. Eggs in pine needle, about 4 times enlarged; 3. Cocoons, natural size; 4. Larvæ feeding on pine, natural size.

IMPORTED PINE SAWFLY.



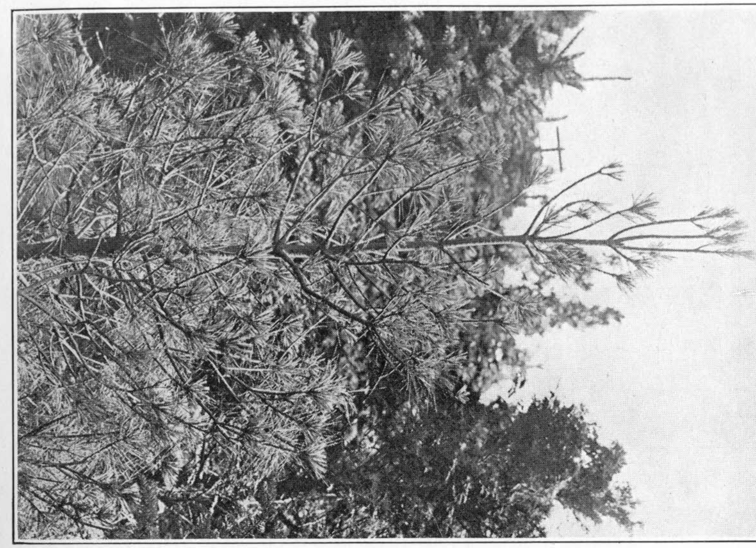
a. A heap containing 1,617 cocoons, collected from pine twigs.



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.

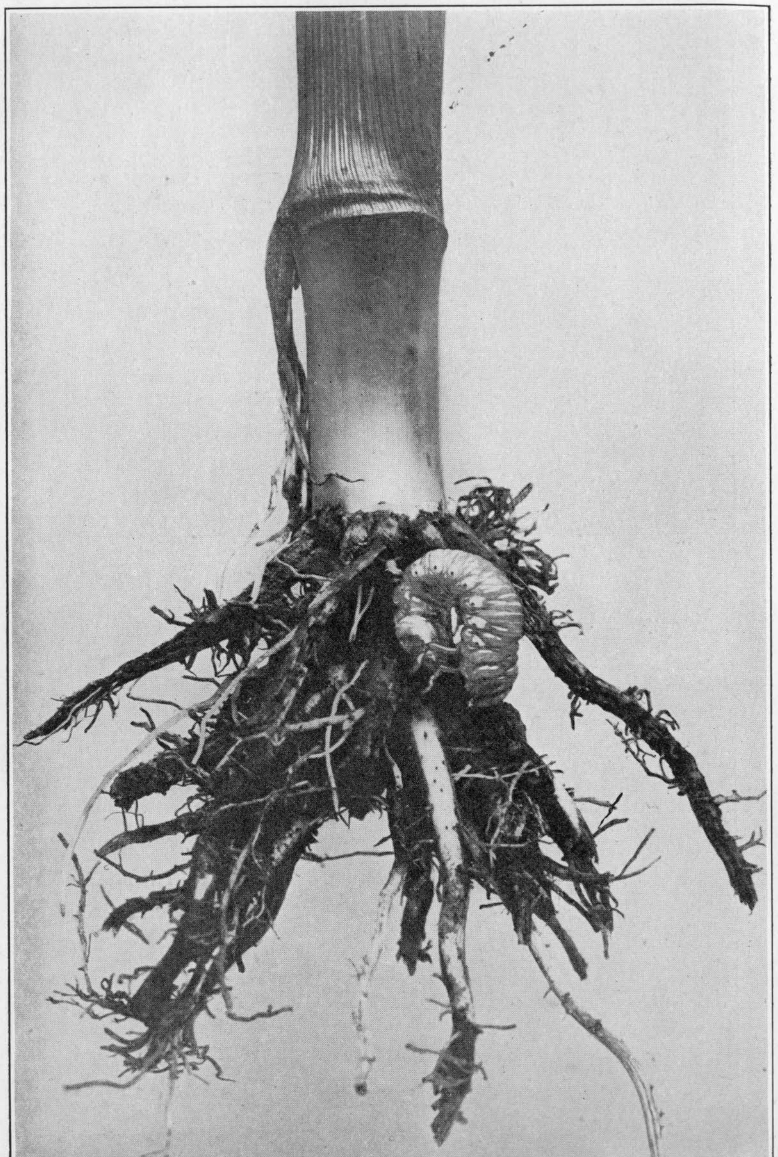


a. Japanese or Bhotan pine. *Pinus excelsa*, partially stripped by larvæ.

b. *Pinus cembra* about 7 feet tall almost defoliated by larvæ.

IMPORTED PINE SAWFLY.

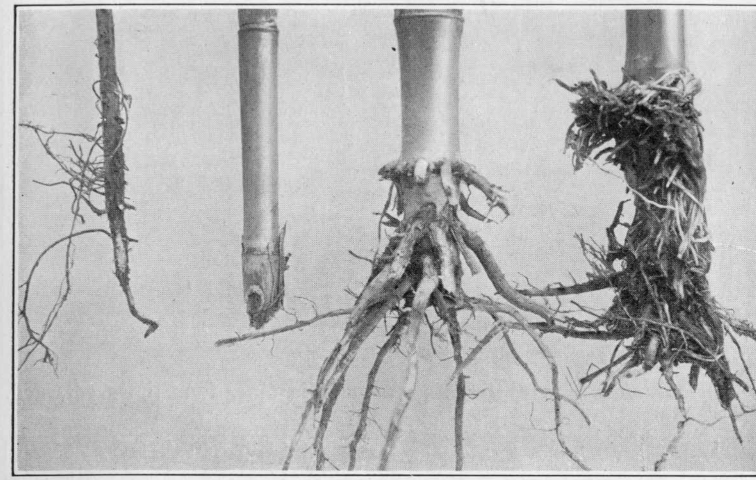
PLATE X.



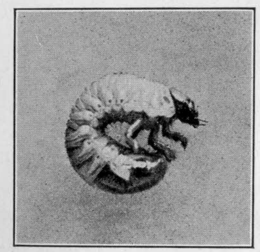
White grub and corn plant with roots eaten. Natural size.

THE WHITE GRUB.

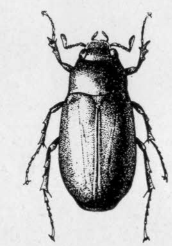
PLATE XI.



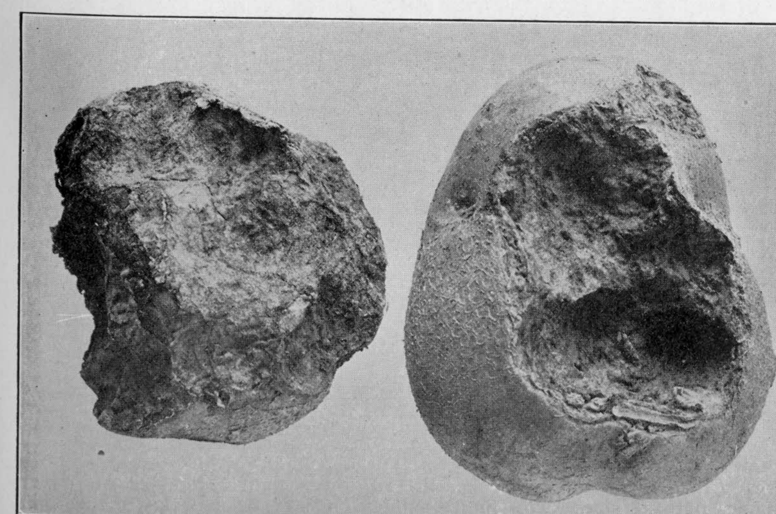
a. Soy bean (at left) and corn plants with roots eaten off by white grubs.



b. White grub. Natural size.



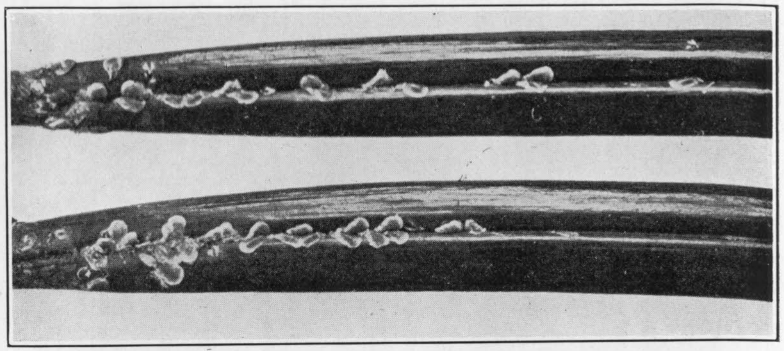
c. Adult June beetle. Natural size.



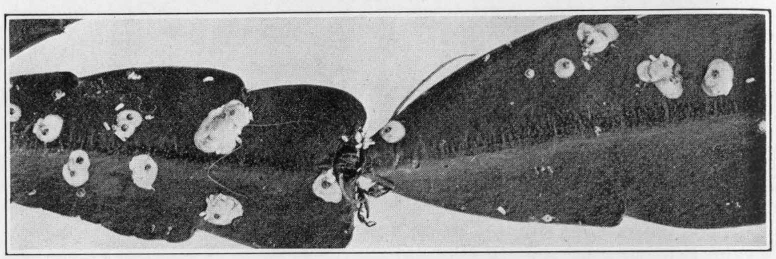
d. Potatoes eaten by white grubs.

THE WHITE GRUB.

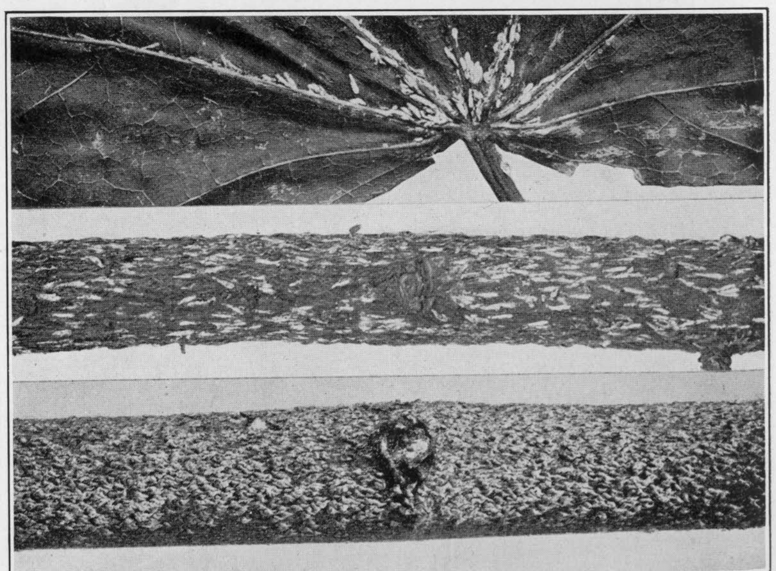
PLATE XII.



a. *Lepidosaphes newsteadi* Sulc. on umbrella pine, four times enlarged.



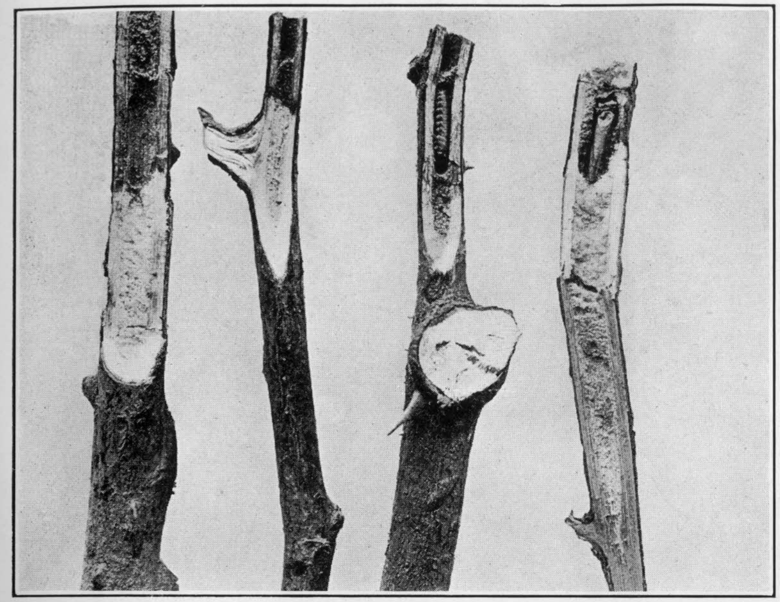
b. Cactus scale, *Diaspis echinocacti* Bouché var. *cacti* Comst., twice enlarged.



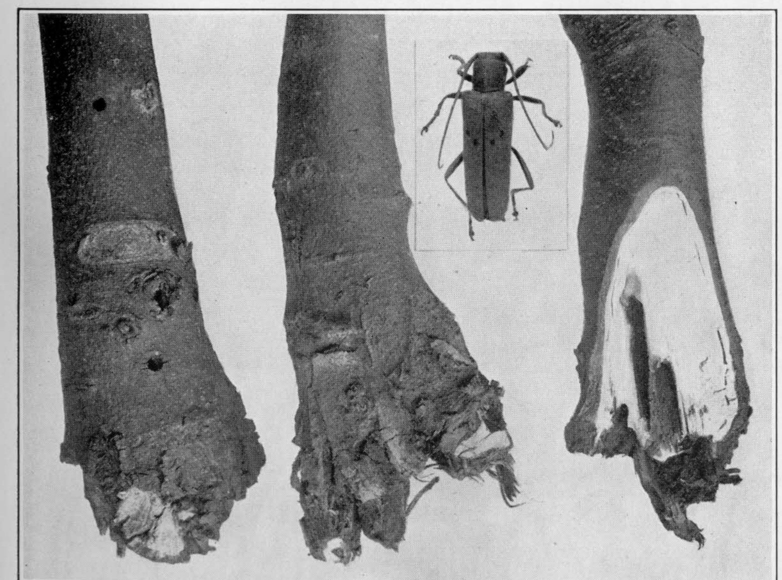
c. *Leucaspis japonica* Cockerell. In lower figure, females on silver maple, natural size. Top figure, males on leaf of Norway maple; in middle, males on privet, both twice enlarged.

SCALE INSECTS.

PLATE XIII.

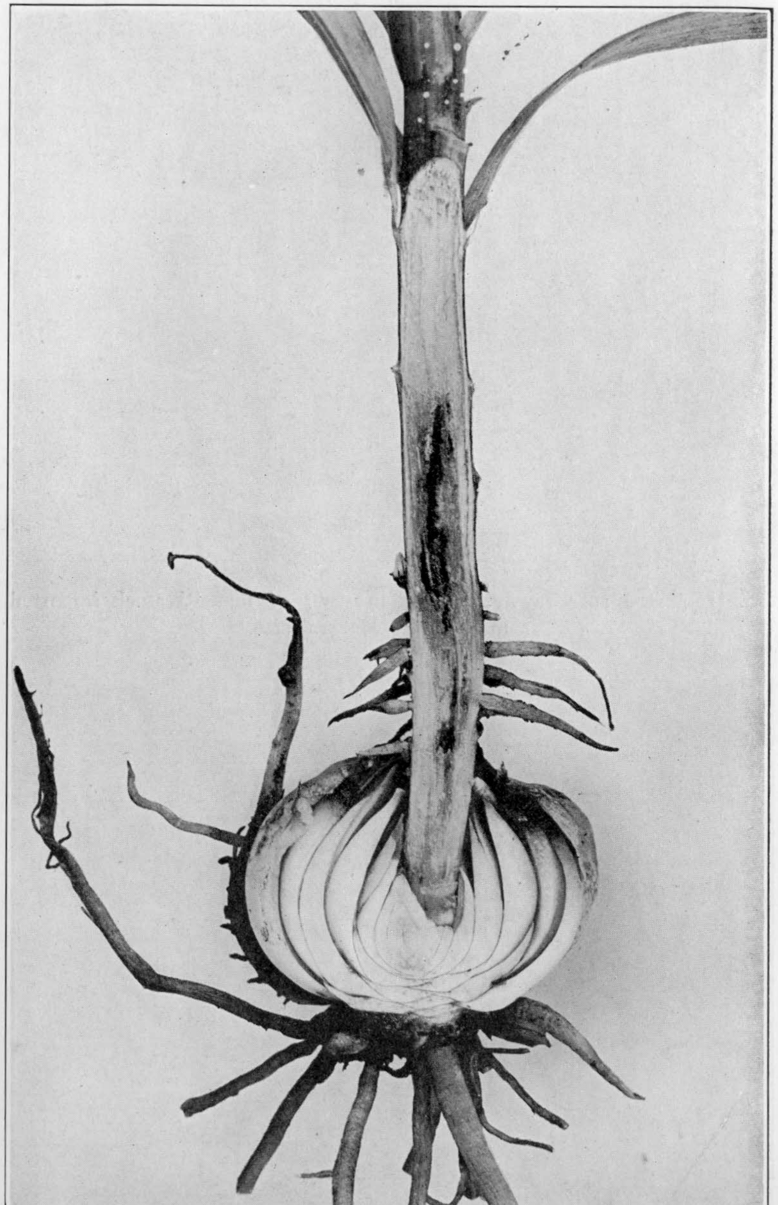


a. Imported rose sawfly. Larvæ in stubs of manetti stock imported from Europe. Natural size.



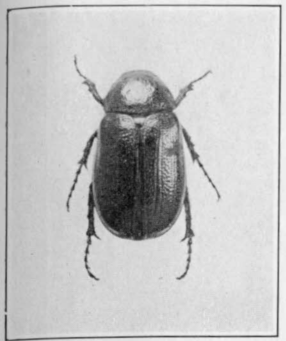
b. Linden borer, *Saperda vestita,* natural size, and its injury to young linden trees, greatly reduced.

IMPORTED ROSE SAWFLY AND LINDEN BORER.

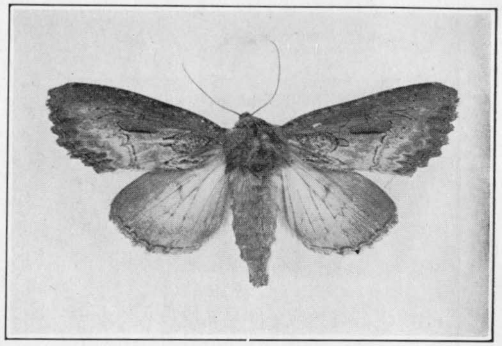


Bermuda lily injured by mites.

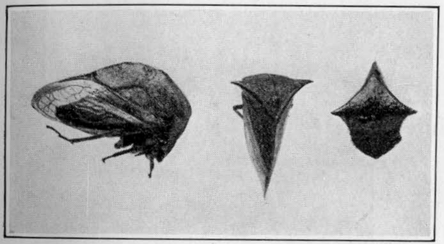
LILY BULB MITE.



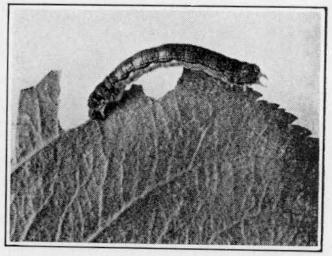
a. *Diplotaxis atlantis* Fall., twice enlarged.



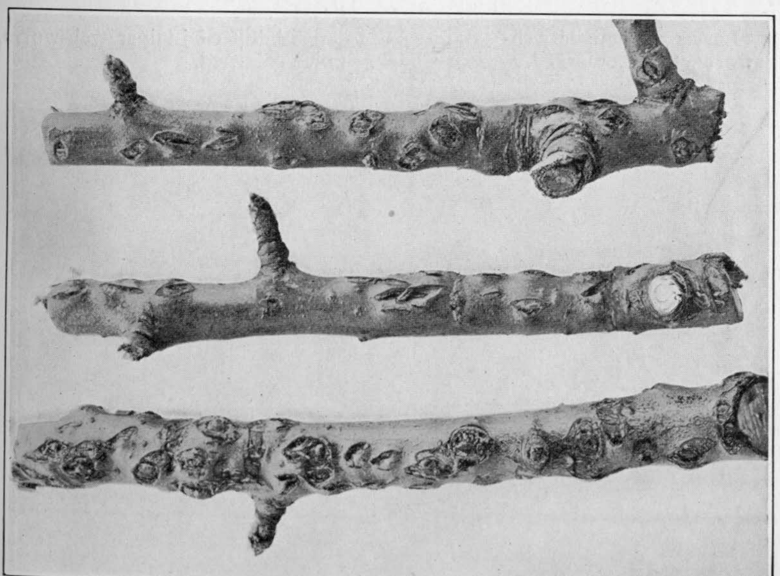
b. *Macronoctua onusta* Grote. Natural size.



c. Buffalo tree hopper, *Ceresa bubalus* Fabr., twice enlarged.

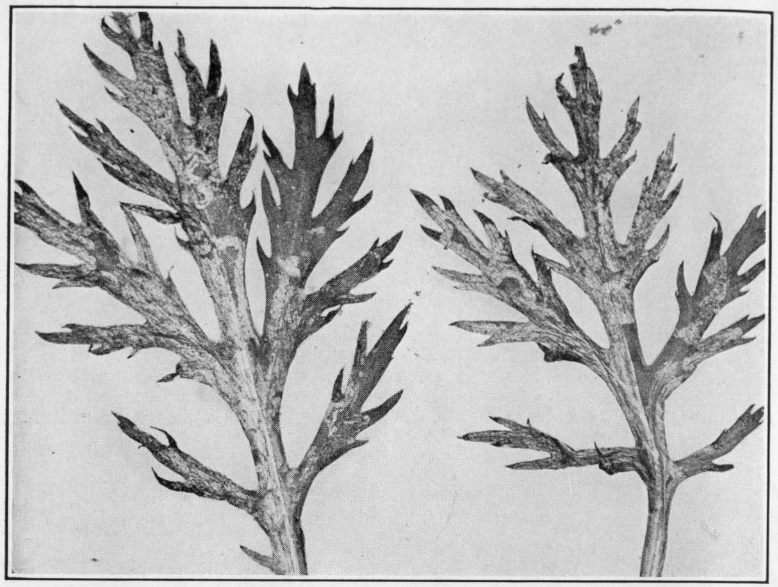


d. Lime tree span worm, *Erannis tiliaria* Harr. Natural size.

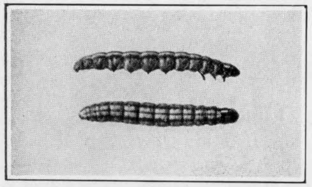


e. Apple twigs showing scars made by Buffalo tree hopper in laying eggs. Natural size.

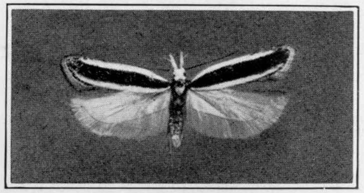
MISCELLANEOUS INSECTS.



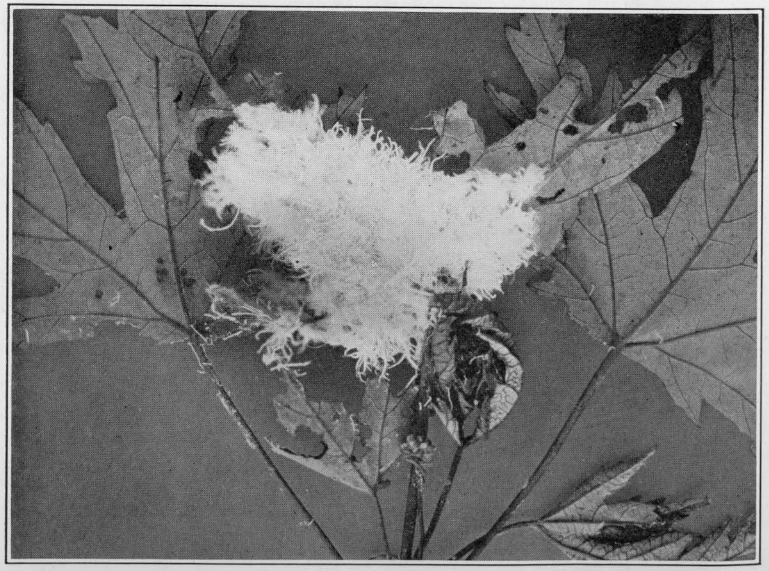
a. Marguerite daisy leaves injured by leaf-miner. Natural size.



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.

MISCELLANEOUS INSECTS.

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.

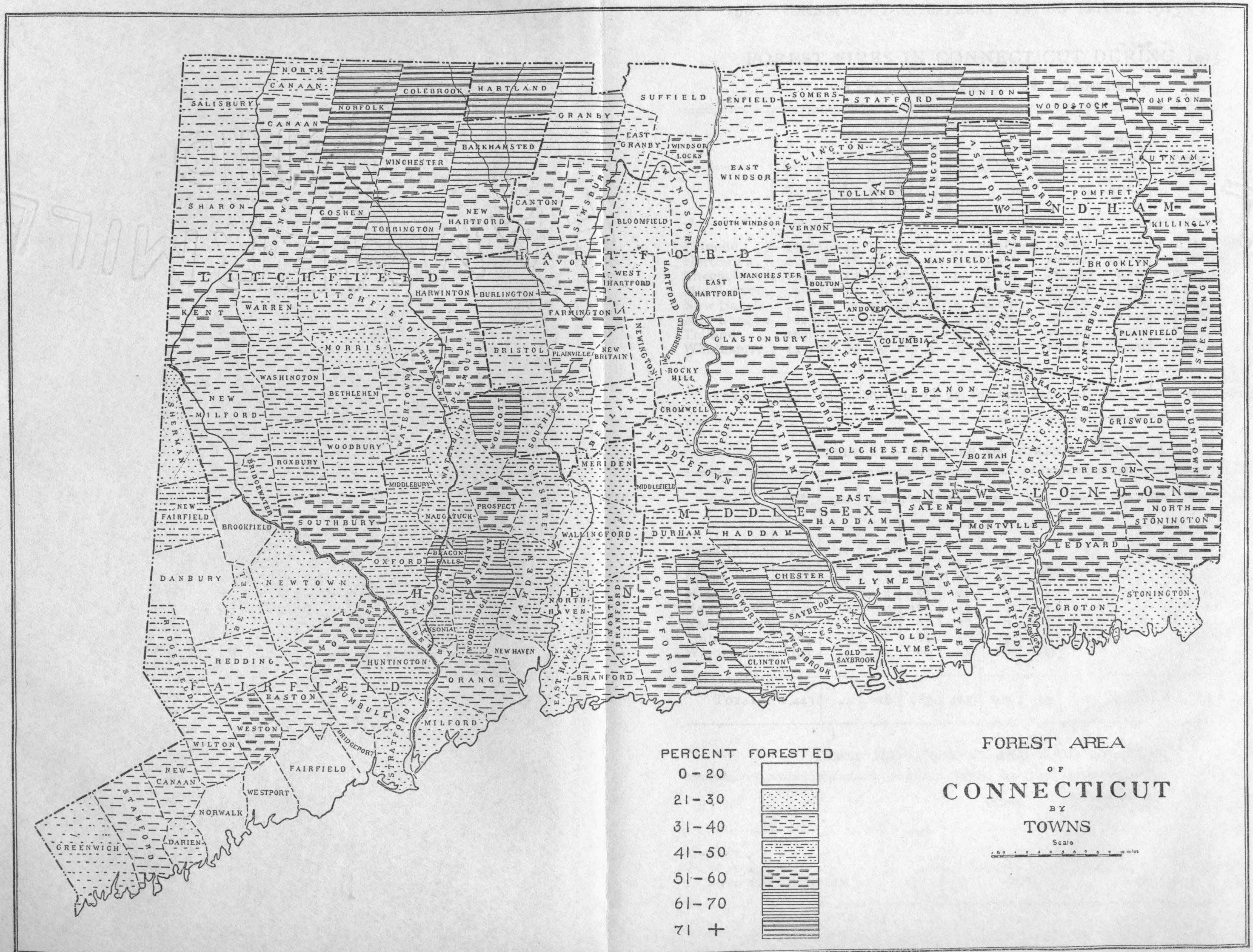
County.	Total No. fires.	Causes.						Acres burned.	Estimated damage to standing timber.	Estimated damage to forest products, buildings and grass.	Cost of fighting.	Cost of protection.
		Unknown.	Railroad.	Careless.	Burning brush.	Hunters.	Incendiary.					
Fairfield....	219	110	46	29	26	4	4	10,918	$ 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 I.—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 following 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.

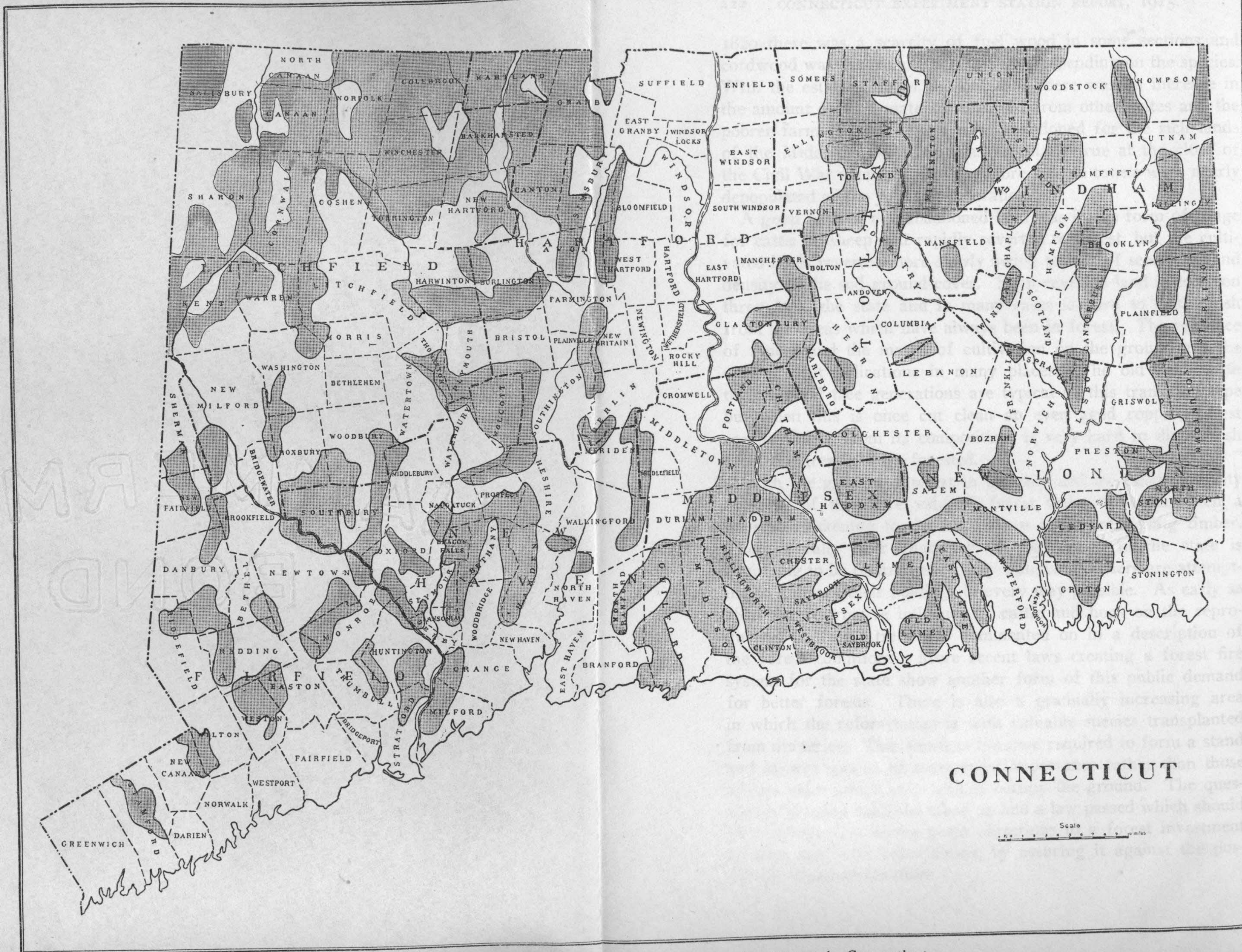
CONCLUSION.

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.	Method. 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 SAMPLED IN 1915.

Station No.	Brand.	Retail Dealer.	Pounds per Hundred. Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	OIL SEED PRODUCTS. *Cotton Seed Meal.*								
6638	Red Tag Brand. Amer. Cotton Oil Co., Huntsville, Ala.	*Hartford:* Smith, Northam & Co.	8.81	5.28	39.00	11.45	28.27	7.19	$40.00
6586	Owl Brand. F. W. Brode & Co., Memphis, Tenn.	*Middlefield:* A. E. Miller Est.	9.01	6.48	41.38	8.73	26.51	7.89	39.00
6610	Buckeye Brand. Buckeye Cotton Oil Co., Cincinnati, O.	*Unionville:* F. D. Lawton & Son	7.85	5.60	38.19	13.53	28.08	6.75	38.00
6614	Good Luck Brand. S. P. Davis, Little Rock, Ark.	*New Hartford:* W. Case	7.41	6.85	40.56	8.58	29.82	6.78	38.00
6603	Gilt-Edge Brand. Empire Cotton Oil Co., Atlanta, Ga.	*Waterbury:* Spencer Grain Co.	8.49	5.58	37.75	10.70	31.02	6.46	38.00
6573	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn.	*Meriden:* Grain & Feed Co.	7.37	6.63	41.38	9.78	27.61	7.23	39.00
6652	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn.	*Danbury:* H. E. Meeker	7.69	6.58	40.06	9.45	28.86	7.36	39.00
6630	Forfat Brand. Humphreys, Godwin Co., Memphis, Tenn.	*Stafford Springs:* G. L. Dennis	9.12	5.53	36.94	12.53	28.64	7.24	37.00
6675	Canary Brand. Lanier Bros., Nashville, Tenn.	*Winsted:* E. Manchester & Sons	8.15	5.58	38.88	11.03	29.21	7.15	37.00
6662	Louisville Brand. Louisville Cotton Seed Prod. Co., Louisville, Ky.	*New Milford:* Geo. E. Ackley Co.	8.70	5.65	39.38	11.35	28.17	6.75	40.00
6673	Kineda Brand. J. M. Macdonald, Cincinnati, O.	*Winsted:* M. D. Leonard	8.11	6.20	38.88	11.08	29.03	6.70	38.00
6607	Macado Brand. J. M. Macdonald, Cincinnati, O.	*Thomaston:* L. E. Blackmer	7.47	6.48	41.13	9.05	28.24	7.63	43.00
6618	Connecticut Brand. Meech & Stoddard, Middletown	*Granby:* E. H. Rollins	7.68	5.73	38.75	11.20	29.73	6.91	39.00
6559	Canary Brand. C. L. Montgomery & Co., Memphis, Tenn.	*Norwalk:* Holmes, Keeler & Kent Co.	6.03	5.48	40.63	11.78	28.59	7.49	40.00
6682	Dirigo Brand. W. Newton Smith, Baltimore, Md.	*Torrington:* F. W. Wadhams	8.27	5.90	38.94	9.55	29.12	8.22	39.00
6517	Pilgrim Brand. J. E. Soper Co., Boston, Mass.	*New London:* P. Schwartz Co.	7.23	5.90	35.63	13.35	30.44	7.45	38.00
6599	Pioneer Brand. J. E. Soper Co., Boston, Mass.	*Plainville:* Eaton Bros.	6.97	6.65	41.63	8.23	29.30	7.22	37.00
6641	American Red Tag Brand. Union Seed & Fert. Co., Huntsville, Ala.	*Hartford:* G. M. White & Co.	7.73	5.75	39.25	11.05	29.27	6.95	40.00
....		Average guaranty	....	....	39.66	....	....	6.22	....
....		Average of these 18 analyses	7.89	5.99	39.35	10.69	28.89	7.19	38.83
....		Average digestible	....	....	33.1	3.7	22.5	6.8	....
	Linseed Meal, New Process.								
6501	Hypro. American Linseed Co., New York	*East Haven:* F. A. Forbes	9.16	5.50	36.38	9.00	38.10	1.86	42.00
....		Guaranty	....	....	33.00	....	....	2.00	....
....		Digestible	....	....	30.6	6.7	30.5	1.7	....
	Linseed Meal, Old Process.								
6640	American Linseed Co., Buffalo, N. Y.	*Hartford:* G. M. White & Co.	9.55	5.33	36.88	7.50	35.43	5.31	43.00
6660	Kelloggs & Miller, Amsterdam, N. Y.	*New Milford:* G. T. Soule	9.47	5.15	37.06	7.25	34.93	6.14	45.00
6568	Midland Linseed Prod. Co., Minneapolis, Minn.	*Wallingford:* E. E. Hall	9.43	4.93	35.13	7.70	34.73	8.08	39.00
6576	Minnesota Linseed Oil Co., Minneapolis, Minn.	*Meriden:* Grain & Feed Co.	9.10	5.50	37.31	7.73	34.18	6.18	48.00
6485	Spencer Kellogg & Sons, Buffalo, N. Y.	*Hamden:* I. W. Beers	9.21	5.78	35.81	7.60	36.50	5.10	42.00
6600	Major Brand. Toledo Seed & Oil Co., Toledo, O.	*Bristol:* Goodsell Bros.	10.72	6.30	29.81	8.85	38.69	5.63	42.00
....		Average guaranty	....	....	32.33	....	....	4.83	....
....		Average of these 6 analyses	9.58	5.50	35.34	7.77	35.74	6.07	43.17
....		Average digestible	....	....	31.5	4.4	27.9	5.4	....

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1915—*Continued.*

Station No.	Brand.	Retail Dealer.	Pounds per Hundred. Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	WHEAT PRODUCTS. *Wheat Bran.*								
6592	Spring. Western Canada Flour Mills Co., Canada	*Middletown:* Meech & Stoddard	10.79	4.98	16.13	9.13	53.12	5.85	$26.00
6674	*Choice. Hecker-Jones-Jewell Mill. Co., Buffalo, N. Y.	*Winsted:* M. D. Leonard	9.90	6.20	13.69	11.18	53.47	5.56	28.00
6561	Palace. Kehlor Flour Mills Co., St. Louis, Mo.	*No. Haven:* Coöperative Feed Co.	9.71	6.78	16.13	9.58	53.20	4.60	26.00
6488	Bran & Screenings. R. E. Kidder Flour Mills, Kansas City, Mo.	*Hamden:* I. W. Beers	11.20	6.35	16.63	9.20	52.59	4.03	26.00
6484	†Bought of A. F. Lane & Co., New York	*Ansonia:* Flour & Grain Co.	10.92	6.03	13.88	10.53	53.19	5.45	27.00
6623	Choice. Niagara Falls Mill. Co., Niagara Falls, N. Y.	*Suffield:* Spencer Bros.	9.32	4.98	14.88	9.63	55.36	5.83	29.00
6598	‡Bell Cow. Quaker Oats Co., Chicago, Ill.	*Plainville:* Eaton Bros.	9.88	5.00	15.44	9.53	54.89	5.26	26.00
6654	‡Bixota. Red Wing Mill. Co., Red Wing, Minn.	*Danbury:* F. C. Benjamin	9.60	5.70	14.50	12.05	52.23	5.92	28.00
6572	Sleepy Eye Mill. Co., Minneapolis, Minn.	*Meriden:* Grain & Feed Co.	10.50	6.90	15.00	11.63	51.12	4.85	28.00
6506	‡Southwestern Mill. Co., Kansas City, Mo.	*Branford:* S. V. Osborn	9.49	6.83	17.31	8.43	54.41	3.53	27.00
6635	Nokomos Durum. Yerxa, Andrews & Thurston, Minneapolis, Minn.	*Rockville:* Edw. White	9.17	5.38	12.38	14.23	53.87	4.97	28.00
6502	‡Washburn-Crosby Co., Minneapolis, Minn.	*East Haven:* F. A. Forbes	9.93	6.48	14.25	10.93	52.95	5.46	26.00
6552	‡Wisconsin Milling Co., Menominee, Wis.	*Bridgeport:* Vincent Bros. Co.	10.13	6.00	13.94	10.45	54.38	5.10	25.00
....		Average guaranty	....	....	14.51	....	....	4.08	....
....		Average of these 13 analyses	10.04	5.97	14.94	10.50	53.44	5.11	26.92
....		Average digestible	....	....	11.5	4.1	37.9	3.2	....
	Wheat Feed (Mixed Feed).								
6540	Winona. Bay State Mill. Co., Winona, Minn.	*Willimantic:* E. A. Buck	9.93	4.98	15.44	6.68	58.05	4.92	33.00
6482	Bull's Eye. Blish Mill. Co., Seymour, Ind.	*Derby:* Peterson & Hendee	10.17	5.85	16.94	7.25	55.47	4.32	30.00
6508	‡Boston. Duluth Superior Mfg. Co., Duluth, Minn.	*Guilford:* Morse & Landon	10.66	4.80	15.63	8.55	54.79	5.57	28.00
6664	‡Lucky. Federal Milling Co., Lockport, N. Y.	*New Milford:* Geo. E. Ackley Co.	11.24	5.05	15.06	7.80	55.31	5.54	29.00
6471	Manhattan. Hecker-Jones-Jewell Mill. Co., New York	*New Haven:* Crittenden-Benham Co.	10.18	5.00	15.75	8.18	55.91	4.98	30.00
6487	Crescent. Kemper Mill & Elev. Co., Kansas City, Mo.	*Hamden:* I. W. Beers	10.88	5.65	17.00	7.33	55.48	3.66	30.00
6495	‡Badger Fancy. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*W. Cheshire:* G. W. Thorpe	9.70	4.18	14.00	5.10	60.12	7.00	31.00
6663	‡Maple Leaf. Maple Leaf Mill. Co., Toronto Can.	*New Milford:* Geo. E. Ackley Co.	10.82	5.03	16.00	9.28	53.18	5.69	27.00
6624	Perfect. Niagara Falls Mill. Co., Niagara Falls, N. Y.	*Thompsonville:* Geo. S. Phelps & Co.	8.99	5.05	14.94	8.10	57.50	5.42	33.00
6629	§Bought of J. Parkwith & Smith, Boston, Mass.	*W. Stafford:* C. P. Bradway & Son	9.69	7.10	17.56	9.50	51.92	4.23	28.00
6602	‡Fancy. Pillsbury Co., Minneapolis, Minn.	*Waterbury:* H. S. Coe & Co.	11.04	4.95	17.56	6.10	56.13	4.22	31.00
6580	‡Buckeye. Quaker Oats Co., Chicago, Ill.	*Milford:* E. L. Oviatt	9.62	5.20	15.44	9.18	55.07	5.49	29.00
6521	Occident. Russell-Miller Mill. Co., Minneapolis, Minn.	*Westerly:* C. W. Campbell Co.	10.20	6.65	15.44	7.95	53.85	5.91	29.40
6661	Regular. Russell-Miller Mill. Co., Minneapolis, Minn.	*New Milford:* Geo. T. Soule	9.34	4.85	16.13	8.38	55.52	5.78	30.00
6577	Gold Mine. Sheffield King Mill. Co., Minneapolis, Minn.	*Meriden:* A. Grulich	10.15	5.15	15.19	8.48	55.69	5.34	29.00

* 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.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1915—*Continued.*

Station No.	Brand.	Retail Dealer.	Pounds per Hundred. Water.	Ash.	Protein (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	WHEAT PRODUCTS—*Continued.*								
	Wheat Feed (Mixed Feed)—Continued.								
6546	Try-Me. Sparks Mill. Co., Alton, Ill.	*Manchester:* Little & McKinney	9.54	5.18	16.19	8.23	55.66	5.20	$30.00
6672	Honest. David Stott, Detroit, Mich.	*Torrington:* F. L. Wadhams	10.76	5.65	15.44	7.65	55.42	5.08	29.00
6499	Waggoner-Gates Mill. Co., Independence, Mo.	*Willimantic:* H. A. Bugbee	10.18	7.63	18.25	7.08	52.13	4.73	29.00
6608	*Washburn-Crosby Co., Minneapolis, Minn.	*Thomaston:* L. E. Blackmer	9.71	5.10	14.25	8.93	56.90	5.11	33.00
6657	Kent. Williams Bros. Co., Kent, O.	*New Milford:* Geo. T. Soule	11.10	5.68	15.31	6.63	56.88	4.40	31.00
....		Average guaranty	....	....	15.26	....	....	4.18	....
....		Average of these 20 analyses	10.20	5.44	15.88	7.81	55.54	5.13	29.95
....		Average digestible	....	....	12.4	4.8	42.8	4.5	....
	Wheat Middlings.								
6560	*Atlas Flour. Atlas Flour Mills, Milwaukee, Wis.	*No. Haven:* Coöperative Feed Co.	11.47	4.40	16.56	5.85	56.83	4.89	32.00
6680	*Winona. Bay State Mill. Co., Winona, Minn.	*Torrington:* D. L. Talcott	10.24	5.68	15.69	6.45	56.85	5.09	28.00
6678	*Standard. Gardner Mills, Hastings, Minn.	*Winsted:* E. Manchester & Sons	10.44	4.93	16.00	9.43	52.77	6.43	29.00
6505	*Standard. Gardner Mills, Hastings, Minn.	*Branford:* S. V. Osborn	11.34	6.18	15.31	8.83	52.96	5.38	30.00
6527	Flour. Wm. Hamilton & Son, Honeoye Falls, N. Y.	*Norwich:* Norwich Grain Co.	11.69	2.35	14.75	3.45	63.59	4.17	32.00
6494	*Badger Fancy. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*W. Cheshire:* G. W. Thorpe	10.33	3.15	12.94	3.83	62.37	7.38	31.00
6483	†Bought of A. F. Lane & Co., New York	*Ansonia:* Flour & Grain Co.	11.43	4.25	16.44	6.28	55.54	6.06	27.00
6613	*Fancy Canadian. Maple Leaf Mill. Co., Toronto, Can.	*Collinsville:* F. W. Konold	11.22	4.35	17.13	8.27	53.16	5.87	29.00
6634	*Shorts. Marshall Mill. Co., Marshall, Minn.	*Rockville:* Edw. White	10.36	5.28	17.00	8.73	53.36	5.27	29.00
6639	*Ogilvie Flour Mills Co., Canada	*Hartford:* Smith, Northam & Co.	10.19	3.88	16.75	7.40	55.78	6.00	29.00
6665	*"A." Pillsbury Co., Minneapolis, Minn.	*New Milford:* Geo. E. Ackley Co.	10.25	5.25	16.13	5.28	57.72	5.37	34.00
6626	*"B." Pillsbury Co., Minneapolis, Minn.	*Thompsonville:* Geo. S. Phelps & Co.	10.46	5.35	14.81	11.03	53.31	5.04	31.00
6668	Standard. Russell-Miller Mill. Co., Minneapolis, Minn.	*Litchfield:* The Wadhams Co.	9.59	4.60	15.56	8.70	55.43	6.12	32.00
6671	Pennant. David Stott, Detroit, Mich.	*Torrington:* F. L. Wadhams	11.18	4.60	15.63	6.28	57.21	5.10	29.00
6596	*Angelus. Thompson Mill. Co., Lockport, N. Y.	*Plantsville:* C. A. Cowles	11.50	3.63	15.50	6.13	58.14	5.10	28.00
6677	Arlington Flour Strong Clear. Washburn-Crosby Co., Minneapolis, Minn.	*Winsted:* E. Manchester & Sons	11.22	2.05	14.88	0.43	67.98	3.44	36.00
6503	*Standard. Washburn-Crosby Co., Minneapolis, Minn.	*E. Haven:* F. A. Forbes	10.34	6.35	16.63	8.73	52.94	5.01	27.00
....		Average guaranty	....	....	15.20	....	....	4.52	....
....		Average of these 17 analyses	10.78	4.49	15.74	6.77	56.82	5.40	30.18
....		Average digestible	....	....	12.1	2.0	45.3	4.8	....
	RYE PRODUCTS.								
6478	Feed. Boutwell Mill. & Grain Co., Troy, N. Y.	*New Haven:* Crittenden-Benham Co.	11.13	3.43	15.69	3.73	63.00	3.02	29.00
6564	Choice Middlings. Miner-Hillard Mill. Co., Wilkes Barre, Pa.	*Wallingford:* E. E. Hall	11.19	3.33	14.75	3.73	63.96	3.04	29.00
6588	Irving Mills Feed. VanVechten Mill. Co., Rochester, N. Y.	*Middletown:* Meech & Stoddard	12.09	4.45	16.38	4.83	58.90	3.35	28.00

* With ground screenings.
† Statement of dealer; no guaranty.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1915—*Continued.*

Station No.	Brand.	Retail Dealer.	Pounds per Hundred. Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	BARLEY PRODUCTS.								
6676	Eagle Feed. J. B. A. Kern & Sons, Milwaukee, Wis.	*Winsted:* E. Manchester & Sons	9.65	4.03	12.88	8.90	60.99	3.55	$35.00
	MAIZE PRODUCTS. *Cracked Corn Meal.*								
6679	Ground by D. L. Talcott, Torrington	*Torrington:* Manufacturer	12.98	1.20	9.38	1.83	71.76	2.85	32.00
....		Digestible	....	....	6.3	....	66.1	2.6	....
	Corn Gluten Meal.								
6491	Diamond. Corn Products Ref. Co., New York	*W. Cheshire:* G. W. Thorpe	9.58	0.85	44.75	1.50	40.01	3.31	36.00
6525	Diamond. Corn Products Ref. Co., New York	*Westerly:* C. W. Campbell Co.	9.89	0.98	43.88	1.48	41.57	2.20	38.40
....		Guaranty	....	....	40.00	....	....	1.50	....
....		Average of these 2 analyses	9.73	0.91	44.32	1.49	40.79	2.76	37.20
....		Average digestible	....	....	37.2	....	35.9	2.7	....
	Corn Gluten Feed.								
6656	Cream of Corn. American Maize Prod. Co., New York	*Brookfield:* C. R. Dubia	10.51	3.10	25.44	5.88	53.37	1.70	32.00
6669	Cream of Corn. American Maize Prod. Co., New York	*Torrington:* F. L. Wadhams	10.21	4.48	27.00	5.40	50.83	2.08	30.00
....		Average guaranty	....	....	24.50	....	....	1.75	....
....		Average of these 2 analyses	10.36	3.79	26.22	5.64	52.10	1.89	31.00
....		Average digestible	....	....	22.3	4.9	46.9	1.5	....
6490	Buffalo. Corn Products Ref. Co., New York	*Hamden:* I. W. Beers	7.69	3.73	29.56	7.05	48.84	3.13	30.00
6507	Buffalo. Corn Products Ref. Co., New York	*Branford:* S. V. Osborn	9.33	2.88	27.13	6.30	52.83	1.53	30.00
6562	Buffalo. Corn Products Ref. Co., New York	*No. Haven:* Coöperative Feed Co.	8.59	6.28	28.06	5.70	48.83	2.54	28.00
6646	Buffalo. Corn Products Ref. Co., New York	*New Britain:* C. W. Lines Co.	8.26	4.23	27.94	6.80	51.01	1.76	32.00
....		Average guaranty	....	....	23.00	....	....	1.00	....
....		Average of these 4 analyses	8.47	4.28	28.17	6.46	50.38	2.24	30.00
....		Average digestible	....	....	23.9	5.6	45.3	1.8	....
6481	Globe. Corn Products Ref. Co., New York	*Shelton:* Ansonia Flour & Grain Co.	9.11	4.18	28.94	6.33	50.12	1.32	31.00
6648	Globe. Corn Products Ref. Co., New York	*New Haven:* R. G. Davis & Sons	9.00	5.53	28.31	6.00	48.71	2.45	30.00
....		Average guaranty	....	....	23.00	....	....	1.00	....
....		Average of these 2 analyses	9.05	4.85	28.63	6.16	49.42	1.89	30.50
....		Average digestible	....	....	24.3	5.4	44.5	2.2	....
6512	Douglas. Douglas Co., Cedar Rapids, Ia.	*New London:* I. N. Bragaw	9.81	3.43	23.88	6.20	53.85	2.83	28.00
6667	Douglas. Douglas Co., Cedar Rapids, Ia.	*Litchfield:* The Wadhams Co.	10.18	2.93	25.38	6.35	51.95	3.21	31.00
....		Average guaranty	....	....	23.00	....	....	1.00	....
....		Average of these 2 analyses	10.00	3.18	24.63	6.27	52.90	3.02	29.50
....		Average digestible	....	....	20.9	5.5	47.6	2.4	....
6475	K. K. K. J. C. Hubinger Bros. Co., Keokuk, Ia.	*New Haven:* Crittenden-Benham Co.	8.19	2.05	21.63	7.03	54.67	6.43	30.00
....		Guaranty	....	....	23.00	....	....	2.40	....
....		Digestible	....	....	18.4	6.1	49.2	5.2	....
	Hominy Feed.								
6601	Homco. American Hominy Co., Indianapolis, Ind.	*Bristol:* Eaton Bros.	8.80	2.93	11.69	4.05	63.45	9.08	30.00
6617	Homco. American Hominy Co., Indianapolis, Ind.	*Granby:* E. H. Rollins	9.80	2.65	11.31	4.60	62.91	8.73	30.00
....		Guaranty	....	....	10.00	....	....	7.00	....
6575	Bufceco. Buffalo Cereal Co., Buffalo, N. Y.	*Meriden:* Grain & Feed Co.	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.	Pounds per Hundred. 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 SAMPLED IN 1915—*Continued.*

Station No.	Brand.	Retail Dealer.	Pounds per Hundred. Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	MISCELLANEOUS FEEDS. **Dried Beet Pulp.*								
6569	Holland-St. Louis Sugar Co., Decatur, Ind.	*Wallingford:* E. E. Hall	8.76	3.15	8.81	19.85	58.90	0.53	$27.00
6589	Menominee River Sugar Co., Menominee, Mich.	*Middletown:* Meech & Stoddard	7.24	2.55	8.38	19.90	61.35	0.58	27.00
6609	Michigan Sugar Co., Alma, Mich.	*Unionville:* F. D. Lawton & Son	9.04	3.15	8.00	18.48	60.74	0.59	29.00
6616	Michigan Sugar Co., Caro, Mich.	*Granby:* E. H. Rollins	8.79	3.15	8.38	18.75	60.33	0.60	29.00
6537	Michigan Sugar Co., Croswell, Mich.	*Willimantic:* H. A. Bugbee	8.59	3.25	8.63	23.33	55.57	0.63	28.00
6643	Minnesota Sugar Co., Chaska, Minn.	*Hartford:* G. M. White & Co.	7.94	3.23	8.75	19.33	60.22	0.53	28.00
6619	Mt. Clemens Sugar Co., Mt. Clemens, Mich.	*Suffield:* Arthur Sikes	7.31	3.18	8.19	19.40	61.17	0.75	29.00
6516	Owosso Sugar Co., Lansing, Mich.	*New London:* P. Schwartz Co.	8.56	3.18	8.25	20.98	58.39	0.64	28.00
6631	Owosso Sugar Co., Lansing, Mich.	*Rockville:* Rockville Mill. Co.	9.59	3.13	8.13	19.40	58.85	0.90	29.00
6625	Toledo Sugar Co., Toledo, O.	*Thompsonville:* Geo. S. Phelps & Co.	8.60	3.25	8.69	20.25	58.40	0.81	29.00
....		Guaranty	....	....	8.00	....	....	0.50	....
....		Average of these 10 analyses	8.44	3.12	8.42	19.97	59.39	0.66	28.30
....		Average digestible	....	....	5.4	16.8	54.0	....	....
	PROPRIETARY MIXED FEEDS. *Hominy and Corn Cob Feed.*								
6591	Star Feed. Toledo Elevator, Indianapolis, Ind.	*Middletown:* Meech & Stoddard	9.09	2.73	9.13	10.35	61.88	6.82	27.00
....		Guaranty	....	....	7.00	....	....	5.50	....
	†Wheat Bran and Corn Cob Feed.								
6469	Sterling Feed. Indiana Mill. Co., Terre Haute, Ind.	*New Haven:* Crittenden-Benham Co.	9.40	4.35	11.06	14.52	57.85	2.82	24.00
....		Guaranty	....	....	10.00	....	....	3.00	....
....		Digestible	....	....	7.0	4.1	41.1	2.6	....
	Corn and Oat Feeds, and Chop Feeds.								
6480	Bufceco Chop Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Shelton:* Ansonia Flour & Grain Co.	10.24	4.38	9.38	9.93	60.40	5.67	31.00
....		Guaranty	....	....	7.00	....	....	3.00	....
6544	‡Provender. Feed Products Mill. Co., Chicago, Ill.	*Manchester:* Little & McKinney	10.44	3.03	10.06	6.45	66.40	3.62	32.00
6659	No. 1 Chop Feed. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* Geo. T. Soule	10.49	3.65	9.19	8.60	64.06	4.01	32.00
....		Guaranty	....	....	7.00	....	....	3.00	....
6563	Korn-Oato Feed. Meech & Stoddard, Middletown	*Wallingford:* E. E. Hall	10.21	2.95	8.38	10.50	64.60	3.36	30.00
....		Guaranty	....	....	7.00	....	....	3.00	....
6549	Oat Feed. Robin Hood Mills, Moose Jaw, Can.	*Bridgeport:* Vincent Bros. Co.	6.87	5.68	7.06	24.25	53.10	3.04	....
....		Guaranty	....	....	5.25	....	....	2.50	....
6670	Winner Chop Feed. David Stott, Detroit, Mich.	*Torrington:* F. L. Wadhams	10.41	2.68	10.00	5.03	66.58	5.30	34.00
....		Guaranty	....	....	8.00	....	....	5.00	....
6551	C. and O. Feed. Vincent Bros. Co., Bridgeport	*Bridgeport:* Manufacturer	10.53	3.33	11.06	4.85	65.69	4.54	28.00
	Horse, Dairy and Stock Feeds.								
6655	Sucrene Dairy Feed. American Mill. Co., Peoria, Ill.	*Brookfield:* C. R. Dubia	11.39	8.98	16.81	13.55	44.86	4.41	28.00
....		Guaranty	....	....	16.50	....	....	3.50	....
6531	RKD, Arcady Dairy Feed. Arcady Farm, Lake Forest, Ill.	*Norwich:* Chas. Slosberg	11.66	10.15	18.44	10.75	45.43	3.57	29.00
....		Guaranty	....	....	16.00	....	....	3.50	....

* Sold by the Larrowe Milling Co., Detroit, Mich.
† With ground screenings.
‡ Statement of dealer.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1915—*Continued.*

Station No.	Brand.	Retail Dealer.	Pounds per Hundred. Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	PROPRIETARY MIXED FEEDS—*Continued.* *Horse, Dairy and Stock Feeds—Continued.*								
6519	Pennant Stock Feed. E. W. Bailey & Co., Swanton, Vt.	*Mystic:* Mystic Grain Co.	9.25	3.38	10.38	8.93	60.77	7.29	$33.00
....		Guaranty	....	....	10.00	....	....	6.50	....
6536	Blatchford's Calf Meal. Blatchford Calf Meal Fact., Waukegan, Ill.	*Yantic:* A. R. Manning	10.80	5.60	25.00	7.28	46.27	5.05	68.00
....		Guaranty	....	....	24.00	....	....	5.00	....
6604	Bufceco Creamery Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer	9.16	4.38	19.00	11.08	51.51	4.87	35.00
....		Guaranty	....	....	18.00	....	....	4.00	....
6642	Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Hartford:* G. M. White & Co.	9.71	3.53	12.44	9.88	60.24	4.20	33.00
....		Guaranty	....	....	10.00	....	....	4.00	....
6650	Bufceco Stock Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Danbury:* H. E. Meeker	9.40	3.60	10.13	10.28	61.08	5.51	32.00
....		Guaranty	....	....	8.00	....	....	4.00	....
6606	Iroquois Dairy Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer	10.68	8.98	14.94	9.10	54.65	*1.65	28.00
....		Guaranty	....	....	17.00	....	....	4.00	....
6570	Iroquois Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Meriden:* Grain and Feed Co.	10.77	10.33	9.19	9.93	58.38	*1.40	35.00
....		Guaranty	....	....	9.00	....	....	2.00	....
6522	Nobotheration Dairy Feed. C. W. Campbell Co., Westerly	*Westerly:* Manufacturer	8.72	5.10	24.25	9.03	47.09	5.81	32.40
....		Guaranty	....	....	20.00	....	....	5.50	....
6524	Lactola Dairy Feed. Chapin and Co., Hammond, Ind.	*Westerly:* C. W. Campbell Co.	9.68	8.78	16.63	10.53	51.05	3.33	29.40
....		Guaranty	....	....	16.50	....	....	3.00	....
6597	Unicorn Dairy Ration. Chapin and Co., Hammond, Ind.	*Plainville:* Eaton Bros.	9.11	4.55	25.75	9.75	44.29	6.55	35.00
....		Guaranty	....	....	26.00	....	....	5.00	....
6578	Peerless Dairy Feed. Chesbro Mill. Co., Salamanca, N. Y.	*Meriden:* A. Grulich	8.25	4.93	25.63	9.68	46.39	*5.12	35.00
....		Guaranty	....	....	24.00	....	....	7.00	....
6526	Clover Leaf Dairy Feed. Clover Leaf Mill. Co., Buffalo, N. Y.	*Norwich:* Norwich Grain Co.	10.33	10.05	16.81	10.80	48.60	3.41	28.00
....		Guaranty	....	....	16.50	....	....	3.50	....
6529	Clover Leaf Horse Feed. Clover Leaf Mill. Co., Buffalo, N. Y.	*Norwich:* Norwich Grain Co.	9.46	6.45	10.50	14.73	57.58	*1.28	31.00
....		Guaranty	....	....	10.00	....	....	2.00	....
6510	Wirthmore Balanced Ration. Chas. M. Cox Co., Boston, Mass.	*Chester:* Leet Bros.	9.44	5.90	26.50	9.03	43.73	5.40	31.00
....		Guaranty	....	....	25.50	....	....	5.20	....
6514	Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass.	*New London:* I. N. Bragaw	9.16	3.65	11.00	7.83	60.55	7.81	31.00
....		Guaranty	....	....	9.00	....	....	4.00	....
6632	Hobby Horse Feed. Albert Dickinson Co., Chicago, Ill.	*Rockville:* Edw. White	11.15	6.48	11.63	11.25	58.28	*1.21	36.00
....		Guaranty	....	....	9.00	....	....	1.50	....
6633	Honeysuckle Feed. Albert Dickinson Co., Chicago, Ill.	*Rockville:* Edw. White	10.51	9.78	13.81	18.58	46.88	*0.44	30.00
....		Guaranty	....	....	10.00	....	....	0.50	....
6637	Stag Stock Feed. Albert Dickinson Co., Chicago, Ill.	*Hartford:* Smith Northam & Co.	10.34	2.95	10.69	8.88	63.51	3.63	32.00
....		Guaranty	....	....	9.00	....	....	3.00	....
6681	Eatall Alfalfa Horse Feed. Feed Products Mill. Co., Chicago, Ill.	*Torrington:* F. U. Wadhams	10.75	7.70	11.50	15.08	53.24	*1.73	32.00
....		Guaranty	....	....	10.00	....	....	2.00	....
6545	Eatall Horse Feed. Feed Products Mill. Co., Chicago, Ill.	*Manchester:* Little and McKinney	10.13	7.68	11.81	16.03	52.46	*1.89	32.00
....		Guaranty	....	....	10.00	....	....	2.50	....
6658	Anchor Horse Feed. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* Geo. T. Soule	12.04	3.13	10.81	6.33	64.21	3.48	36.00
....		Guaranty	....	....	9.00	....	....	3.00	....
6515	Grandin's Stock Feed. D. H. Grandin Mill. Co., Jamestown, N. Y.	*New London:* P. Schwartz Co.	9.15	3.83	10.25	9.45	60.92	6.40	30.00
....		Guaranty	....	....	8.50	....	....	3.50	....
6533	H and S Alfalfa Feed. Dwight E. Hamlin, Pittsburgh, Pa.	*Norwich:* Chas. Slosberg	8.33	6.53	23.94	12.88	43.22	5.10	35.00
....		Guaranty	....	....	20.00	....	....	3.50	....

* See page 239.

Table III.—Analyses of Commercial Feeds Sampled in 1915—*Continued.*

Station No.	Brand.	Retail Dealer.	Pounds per Hundred. Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free (Starch, gum, etc.) Extract.	Ether (Crude Fat.) Extract.	Price per ton.
	Proprietary Mixed Feeds—*Continued.* *Horse, Dairy and Stock Feeds—Continued.*								
6571	Purekane Molasses Feed. Dwight E. Hamlin, Pittsburgh, Pa.	*Meriden:* Grain and Feed Co.	14.67	7.18	8.38	5.00	64.09	*0.68	$34.00
....		Guaranty	....	....	6.00	....	....	1.50	....
6538	Quality Feed. Dwight E. Hamlin, Pittsburgh, Pa.	*Willimantic:* E. A. Buck	9.23	8.68	11.56	13.88	55.07	*1.58	34.00
....		Guaranty	....	....	8.00	....	....	2.00	....
6532	H and S Horse, Mule and Dairy Feed. Dwight E. Hamlin, Pittsburgh, Pa.	*Norwich:* Chas. Slosberg	8.93	7.25	18.06	9.78	53.48	*2.50	35.00
....		Guaranty	....	....	14.00	....	....	3.50	....
6530	Haskell's Stock Feed. W. H. Haskell & Co., Toledo, O.	*Norwich:* Chas. Slosberg	8.53	3.70	10.50	8.18	60.90	8.19	32.00
....		Guaranty	....	....	8.00	....	....	4.00	....
6644	Algrane Horse Feed. H. O. Co., Buffalo, N. Y.	*New Britain:* C. W. Lines Co.	10.25	5.40	11.13	9.75	60.35	3.12	32.00
....		Guaranty	....	....	11.00	....	....	4.00	....
6583	Algrane Milk Feed. H. O. Co., Buffalo, N. Y.	*So. Norwalk:* S. Roodner	9.85	6.95	14.63	12.08	52.49	4.00	30.00
....		Guaranty	....	....	14.00	....	....	4.00	....
6584	De-Fi Feed. H. O. Co., Buffalo, N. Y.	*So. Norwalk:* S. Roodner	8.25	6.40	8.31	17.53	55.80	3.71	28.00
....		Guaranty	....	....	8.00	....	....	3.00	....
6470	New England Stock Feed. H. O. Co., Buffalo, N. Y.	*New Haven:* Crittenden-Benham Co.	9.39	4.65	10.00	8.75	62.03	5.18	31.00
....		Guaranty	....	....	9.00	....	....	4.00	....
6556	Bonnie Horse Feed. Holmes, Keeler & Kent Co., Norwalk	*Norwalk:* Manufacturer	9.78	7.03	15.25	8.25	55.99	3.70	29.00
....		Guaranty	....	....	13.00	....	....	4.00	....
6550	Steam Cooked Feed. Imperial Grain and Mill. Co., Toledo, O.	*Bridgeport:* Vincent Bros. Co.	10.15	2.43	10.06	4.60	68.28	4.48	41.00
....		Guaranty	....	....	9.50	....	....	4.00	....
6595	Blue Top Stock Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Plantsville:* C. A. Cowles	8.78	4.53	10.88	12.38	58.15	5.28	32.00
....		Guaranty	....	....	9.00	....	....	4.00	....
6493	Cream City Horse Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*W. Cheshire:* G. W. Thorpe	11.18	6.83	8.31	16.23	56.20	*1.25	32.00
....		Guaranty	....	....	10.00	....	....	1.50	....
6594	Derby Horse Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Plantsville:* C. A. Cowles	9.26	7.43	9.31	18.25	54.77	0.98	....
....		Guaranty	....	....	10.00	....	....	1.00	....
6557	Larro-Feed. Larrowe Mill. Co., Detroit, Mich.	*Norwalk:* Holmes, Keeler & Kent Co.	9.09	4.93	20.81	13.18	47.74	4.25	34.00
....		Guaranty	....	....	19.00	....	....	3.00	....
6554	M. and S. Stock Feed. Meech and Stoddard, Middletown	*Bridgeport:* Berkshire Mills	7.94	3.88	8.44	14.85	58.97	5.92	33.00
....		Guaranty	....	....	9.00	....	....	3.00	....
6520	*Dried Beet Pulp and Molasses. Michigan Sugar Co., Bay City, Mich.	*Westerly:* C. W. Campbell Co.	8.47	4.33	8.81	18.20	59.62	0.57	29.40
....		Guaranty	....	....	9.00	....	....	0.50	....
6500	Ginger Horse Feed. Omaha Alfalfa Mill. Co., Omaha, Neb.	*Willimantic:* H. A. Bugbee	11.82	6.55	11.38	11.36	57.23	*1.66	32.00
....		Guaranty	....	....	10.00	....	....	2.00	....
6553	Peerless Horse Feed. Omaha Alfalfa Mill. Co., Omaha, Neb.	*Bridgeport:* Berkshire Mills	10.63	6.20	10.06	12.43	59.21	*1.47	34.00
....		Guaranty	....	....	10.00	....	....	2.00	....
6611	Park and Pollard Horse Feed. Park and Pollard Co., Boston, Mass.	*Unionville:* F. D. Lawton & Son	10.51	6.20	10.00	11.88	60.01	*1.40	30.00
....		Guaranty	....	....	8.00	....	....	2.00	....
6612	Park and Pollard Stock Feed. Park and Pollard Co., Boston, Mass.	*Unionville:* F. D. Lawton & Son	9.05	4.80	10.44	9.28	61.21	5.22	31.00
....		Guaranty	....	....	9.00	....	....	3.00	....
6518	Peters King Corn. H. C. Peters Mill. Co., Omaha, Neb.	*New London:* P. Schwartz Co.	10.04	8.00	11.94	13.85	55.37	*0.80	34.00
....		Guaranty	....	....	9.00	....	....	1.50	....
6477	Purina Cow Chow Feed. Purina Mills, St. Louis, Mo.	*New Haven:* Crittenden-Benham Co.	9.28	6.93	26.50	14.08	39.18	*4.03	36.00
....		Guaranty	....	....	24.00	....	....	5.00	....

* Sold by the Larrowe Milling Co., Detroit, Mich.

* See page 239.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1915—*Continued.*

Station No.	Brand.	Retail Dealer.	Station No.	Pounds per Hundred. Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	PROPRIETARY MIXED FEEDS—*Continued.* *Horse, Dairy and Stock Feeds—Continued.*									
6476	Purina Feed with Molasses. Purina Mills, St. Louis, Mo.	*New Haven:* Crittenden-Benham Co.	6476	11.60	5.65	9.44	9.60	61.38	2.33	$33.00
		Guaranty	....	....	....	**8.30**	....	....	**1.70**	....
6541	Blue Ribbon Dairy Feed. Quaker Oats Co., Chicago, Ill.	*So. Manchester:* G. W. Strant	6541	9.56	7.45	25.00	12.78	41.60	3.61	34.00
		Guaranty	....	....	....	**25.00**	....	....	**3.50**	....
6486	Green Cross Horse Mixed Feed with Molasses. Quaker Oats Co., Chicago, Ill.	*Hamden:* I. W. Beers	6486	11.22	5.40	9.88	11.80	59.10	2.60	34.00
		Guaranty	....	....	....	**10.00**	....	....	**2.50**	....
6585	Schumacher's Calf Meal. Quaker Oats Co., Chicago, Ill.	*Stamford:* C. E. Slauson Co.	6585	8.58	4.55	18.88	2.50	56.94	8.55	....
		Guaranty	....	....	....	**19.00**	....	....	**8.00**	....
6509	Schumacher's Special Horse Feed. Quaker Oats Co., Chicago, Ill.	*Chester:* Leet Bros.	6509	10.56	2.98	9.69	7.23	65.70	3.84	34.00
		Guaranty	....	....	....	**9.25**	....	....	**3.25**	....
6473	Schumacher's Stock Feed. Quaker Oats Co., Chicago, Ill.	*New Haven:* Crittenden-Benham Co.	6473	8.66	4.30	12.00	11.93	58.69	4.42	32.00
		Guaranty	....	....	....	**10.00**	....	....	**3.25**	....
6472	Victor Feed. Quaker Oats Co., Chicago, Ill.	*New Haven:* Crittenden-Benham Co.	6472	8.91	3.95	9.56	11.43	61.04	5.11	31.00
		Guaranty	....	....	....	**8.00**	....	....	**3.00**	....
6565	Republic Dairy Feed. Republic Mill. Co., E. St. Louis, Ill.	*Wallingford:* E. E. Hall	6565	9.55	11.20	18.94	14.10	43.03	3.18	25.00
		Guaranty	....	....	....	**16.50**	....	....	**3.00**	....
6567	Republic Horse Feed. Republic Mill. Co., E. St. Louis, Ill.	*Wallingford:* E. E. Hall	6567	10.15	7.35	10.38	15.63	55.34	*1.15	31.00
		Guaranty	....	....	....	**9.00**	....	....	**2.00**	....
6566	Supreme Dairy Feed. Republic Mill. Co., E. St. Louis, Ill.	*Wallingford:* E. E. Hall	6566	9.67	5.73	21.94	13.08	46.37	3.21	30.00
		Guaranty	....	....	....	**25.00**	....	....	**3.00**	....
6498	Creamo Calf Meal. Ryde and Co., Chicago, Ill.	*Willimantic:* H. A. Bugbee	6498	10.55	5.30	23.38	5.83	49.85	5.09	60.00
		Guaranty	....	....	....	**25.00**	....	....	**5.00**	....
6582	Syragold Stock Feed. Syracuse Mill. Co., Syracuse, N. Y.	*So. Norwalk:* S. Roodner	6582	8.91	4.93	10.00	12.38	61.33	*2.45	31.00
		Guaranty	....	....	....	**10.00**	....	....	**3.00**	....
6497	Biles Ready Ration (Union Grains). Ubiko Mill. Co., Cincinnati, O.	*Willimantic:* H. A. Bugbee	6497	7.49	5.70	24.88	10.10	44.79	7.04	34.00
		Guaranty	....	....	....	**24.00**	....	....	**7.00**	....
6547	Stock Feed. Vincent Bros. Co., Bridgeport	*Bridgeport:* Manufacturer	6547	7.91	5.05	9.06	16.40	57.27	4.31	32.00
		Guaranty	....	....	....	**8.43**	....	....	**1.27**	....
6528	Xtra Vim Feed. Xtra Vim Molasses Feed Co., Boston, Mass.	*Norwich:* Norwich Grain Co.	6528	15.25	6.55	4.44	6.80	66.60	*0.36	34.00
		Guaranty	....	....	....	**4.61**	....	....	**0.81**	....
	POULTRY FEEDS.									
6649	Bufceco Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y.	*New Haven:* R. G. Davis and Sons	6649	9.76	3.58	17.19	5.20	59.27	5.00	40.00
		Guaranty	....	....	....	**15.00**	....	....	**4.00**	....
6605	Iroquois Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer	6605	9.15	4.30	16.94	8.60	55.82	5.19	43.00
		Guaranty	....	....	....	**14.00**	....	....	**4.00**	....
6574	Wirthmore Growing Feed. Chas. M. Cox Co., Boston, Mass.	*Meriden:* Grain and Feed Co.	6574	10.88	5.53	14.13	3.93	62.40	3.13	45.00
		Guaranty	....	....	....	**15.00**	....	....	**4.50**	....
6511	Wirthmore Poultry Mash. Chas. M. Cox Co., Boston, Mass.	*Chester:* Leet Bros.	6511	9.90	7.28	18.13	7.53	54.69	2.47	46.00
		Guaranty	....	....	....	**17.00**	....	....	**4.00**	....
6467	J. T. B. Mash. Crittenden-Benham Co., New Haven	*New Haven:* Manufacturer	6467	9.78	10.83	16.56	8.83	48.96	5.04	41.00

* See page 239.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1915—*Concluded.*

Station No.	Brand.	Retail Dealer.	Pounds per Hundred. Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	POULTRY FEEDS—*Continued.*								
6468	W. E. C. Mash. Crittenden-Benham Co., New Haven	*New Haven:* Manufacturer	9.89	7.18	18.00	6.65	53.08	5.20	$41.00
6647	Dickinson's Egg Mash. Albert Dickinson Co., Chicago, Ill.	*New Haven:* R. G. Davis & Sons	10.82	5.30	21.25	6.23	51.82	4.58	43.00
....		Guaranty	....	....	16.00	....	....	3.00	....
6636	Queen Poultry Mash. Albert Dickinson Co., Chicago, Ill.	*Hartford:* Smith Northam & Co.	11.01	3.70	11.69	6.08	63.01	4.51	40.00
....		Guaranty	....	....	11.00	....	....	2.50	....
6615	Dry Mash. R. H. Ensign Mills, Simsbury	*Simsbury:* Manufacturer	10.13	8.20	17.56	9.30	50.89	3.92	42.00
6492	Blue Ribbon Laying Mash. Globe Elevator Co., Buffalo, N. Y.	*W. Cheshire:* G. W. Thorpe	9.99	9.13	20.19	8.65	47.08	4.96	41.00
....		Guaranty	....	....	20.00	....	....	3.00	....
6645	H. O. Poultry Feed. H. O. Co., Buffalo, N. Y.	*New Britain:* C. W. Lines Co.	9.52	4.13	18.25	6.20	57.46	4.44	39.00
....		Guaranty	....	....	17.00	....	....	4.50	....
6581	H. O. Dry Poultry Mash. H. O. Co., Buffalo, N. Y.	*So. Norwalk:* S. Roodner	9.01	4.63	18.56	11.35	52.33	4.12	44.00
....		Guaranty	....	....	18.00	....	....	3.50	....
6555	Bonnie Poultry Mash. Holmes, Keeler & Kent Co., Norwalk	*Norwalk:* Manufacturer	9.82	10.15	17.69	8.00	50.28	4.06	44.00
....		Guaranty	....	....	16.00	....	....	4.00	....
6590	M. & S. Dry Mash Feed. Meech & Stoddard, Middletown	*Middletown:* Manufacturer	9.48	11.20	20.19	5.85	47.89	5.39	37.00
....		Guaranty	....	....	12.00	....	....	3.00	....
6628	Growing Feed. Park & Pollard Co., Boston, Mass.	*Hazardville:* A. D. Bridge Sons Co.	10.58	5.38	13.81	4.50	61.27	4.46	42.00
....		Guaranty	....	....	10.00	....	....	3.50	....
6534	Lay or Bust Dry Mash. Park & Pollard Co., Boston, Mass.	*Yantic:* A. R. Manning	9.45	15.95	21.63	6.45	42.56	3.96	44.00
....		Guaranty	....	....	18.00	....	....	3.50	....
6579	Platco Laying Mash. Frank S. Platt Co., New Haven	*New Haven:* Manufacturer	9.31	17.33	19.13	6.63	42.21	5.39	40.00
....		Guaranty	....	....	18.00	....	....	4.00	....
6542	American Poultry Feed. Quaker Oats Co., Chicago, Ill.	*So. Manchester:* G. W. Strant	10.66	3.48	13.38	4.95	62.46	5.07	38.00
....		Guaranty	....	....	12.00	....	....	3.50	....
6474	Purina Chicken Chowder. Ralston Purina Co., St. Louis, Mo.	*New Haven:* Crittenden-Benham Co.	9.80	7.85	19.50	7.55	50.62	4.68	44.00
....		Guaranty	....	....	17.00	....	....	3.00	....
6666	Shredded Wheat Waste. Shredded Wheat Co., Niagara Falls, N. Y.	*Washington Depot:* Washington Supply Co.	9.54	2.80	10.63	1.90	73.53	1.60	47.00
....		Guaranty	....	....	10.00	....	....	1.50	....
6548	V.B. XXXX Mash. Vincent Bros. Co., Bridgeport	*Bridgeport:* Manufacturer	8.32	7.80	17.44	10.98	50.73	4.73	39.00
....		Guaranty	....	....	21.50	....	....	4.90	....

Canary Brand, Lanier Bros., Nashville, Tenn. **5687,** sent by G. T. Soule, New Milford; **5773,** sent by K. B. Musser, Storrs.

Connecticut Brand, Meech and Stoddard, Middletown. **5863,** sent by The Coles Co., Middletown.

Robin Brand, Geo. B. Robinson, Jr., New York. **5530,** sent by G. S. Phelps, Warehouse Point.

5355, sold by Meech and Stoddard, Middletown, sent by E. H. Rollins, Granby. **5529,** sold by Humphreys, Godwin Co., Memphis, Tenn., sent by J. L. Blackman, West Redding. **5597,** sold by J. E. Soper Co., Boston, Mass., sent by The Coles Co., Middletown. **5806,** sold by International Agricultural Corporation, Montgomery, Ala., sent by A. J. Ensign, Silver Lane. **6404** and **6405,** sent by The Coles Co., Middletown.

Protein Content of Cotton Seed Meals.

No.	Found.	Guar.	No.	Found.	Guar.	No.	Found.	Guar.
5247	40.31	38.62	5691	37.44	38.50	5530	38.19	41.00
5423	42.75	41.00	5862	40.31	38.50	5355	41.63	.....
5424	38.31	41.00	6981	37.81	41.00	5529	38.31	41.00
5859	41.00	38.62	5672	38.88	41.00	5597	38.81	41.00
5528	40.94	41.00	5690	38.56	38.62	5806	39.88	41.00
5624	43.87	41.00	5687	41.88	41.00	5895	39.88	41.18
5531	41.31	41.00	5773	40.56	41.00	6404	40.19	.....
6980	37.56	40.63	5863	39.00	41.00	6405	38.38	.....

Cocoanut Meal, **5417,** and *Peanut Meal,* **5418** and **5419,** sold by Dwight E. Hamlin, Pittsburgh, Pa.

Wheat Bran, **6836,** and *Wheat Middlings,* **6837,** Mansfield Milling Co., Mansfield, O., both sent by W. C. Kennedy, Putnam.

	5417	5418	5419	6836	6837
Water	6.42	5.05	6.49	9.30	9.30
Ash	4.50	8.84	4.41	6.38	4.18
Protein (N x 6.25)	25.81	43.13	36.00	14.13	16.75
Fiber	9.50	2.75	7.95	11.38	6.60
Nitrogen-free extract	45.03	33.10	35.47	53.03	56.97
Ether extract	8.74	7.13	9.68	5.78	6.20

Palmo Middlings, **6886,** sold by Henry Jennings, Boston, Mass., contained 16.69 per cent protein.

Buffalo Corn Gluten Feed, **6873,** sent by R. F. Porter, Turnerville, contained 25.50 per cent protein. Another sample of *Gluten Feed,* **5732,** sent by the Storrs station, contained 23.38 per cent protein.

Provender, **6258,** sent by F. H. Snyder, New Hartford, contained 10.56 per cent protein.

Oats, **6319,** sent by E. D. Bartlett, Guilford, who complained that his horses did not relish these oats. No appreciable amount of sulphur dioxid was found and no smut. The oats, however, were not of good quality and somewhat musty, only 10 per cent of them germinating.

Fleischmann's Dried Grains, **6381,** sold by Western Grains and Feed Co., Chicago, Ill., sent by Meech and Stoddard, Middletown, guaranteed 18 per cent protein and 6.5 fat. The sample contained 8.14 per cent moisture, 19.31 per cent protein and 6.32 per cent fat.

Supreme Dairy Feed, **6394** and **6395,** made by Republic Milling Co., East St. Louis, Ill., and both sent by T. A. Stanley, New Britain; *Hog Fattening Feed,* **6838,** sold by Dwight E. Hamlin, Pittsburgh, Pa., said to be composed of corn flakes, distillers' grains and molasses, and sent by C. M. Jarvis, Berlin; and **6380,** a commercial mixed feed, said to contain corn, oats and molasses, also sent by Mr. Jarvis showed the following composition:

	6394	6395	6838	6380
Water	11.98	10.68	8.29	14.44
Ash	5.33	6.13	3.58	7.43
Protein (N x 6.25)	19.94	18.50	8.88	13.88
Fiber	12.88	18.30	3.30	9.39
Nitrogen-free extract ...	47.87	43.14	74.83	53.14
Ether extract	2.00	3.25	1.12	1.72

Clover Leaf Dairy Feed, **5598,** and *Clover Leaf Horse Feed,* **5599,** made by Clover Leaf Milling Co., Buffalo, N. Y., and sent by C. H. Davenport, Washington, contained 17.81 and 10.63 per cent protein, respectively.

Horse Feed, **6329,** and *Cattle Feed,* **6330,** sent by W. E. Barrett, Southport, contained 11.71 and 13.74 per cent moisture, 12.81 and 13.31 per cent protein, and 0.43 and 3.20 per cent fat, respectively.

Platco Laying Mash, **6325,** made by Frank S. Platt Co., New Haven, contained 11.00 per cent moisture, 20.31 per cent protein and 5.54 per cent fat.

Alfalfa, **6378,** first cutting, and **6379,** third cutting, both sent by C. M. Jarvis, Berlin.

Dried Brewers' Grains Siftings, **6392,** and *Dried Distillers' Grains Siftings,* **6393,** analyzed for T. B. Osborne of this station.

	6392	6393	6378	6379
Water	7.35	10.67	13.53	13.06
Ash	3.22	3.70	8.03	8.60
Protein (N x 6.25)	43.65	30.19	14.71	20.01
Fiber	6.24	6.13	27.37	26.54
Nitrogen-free extract	32.94	41.50	34.36	29.96
Ether extract	6.60	7.81	2.00	1.83

Alfalfa Meal, **5868**, sent by W. B. Dayton, Greens Farms, contained 15.75 per cent protein.

Cracker Wastes, sent by C. M. Jarvis, Berlin. **6894**, clear crackers; **6895**, with large proportion of cookies and cakes; **6896**, mixture with crackers predominating; **6897**, mixture with cookies predominating; **6898**, heavier and darker colored than **6895**, and **6897**; **6899**, mixture of crackers and cookies with some bread; **6900**, a mixture of the other six samples in approximately equal amounts by measure.

	6894	6895	6896	6897	6898	6899	6900
Water	6.59	5.61	5.60	6.62	7.31	5.07	6.08
Ash	1.60	19.35	26.83	1.60	8.10	1.00	7.58
Protein (N x 6.25)	7.94	7.25	7.44	8.00	8.63	9.44	8.75
Nitrogen-free extract and fiber	73.06	59.94	55.08	71.23	66.44	74.26	68.52
Ether extract	10.81	7.85	5.05	12.55	9.52	10.23	9.07

Pastura Cattle Powder, **5689**, sent by L. A. Osborn, Litchfield, contained 10.43 per cent protein, 25.68 per cent ash and 24.30 per cent charcoal. The organic matter, other than charcoal, consisted chiefly of weed seeds (probably from screenings), some flaxseed and cotton seed meal. Magnesia, sulphates, chlorides, iron, lime and phosphates were present in the ash.

Mangels. Ten varieties grown on the experimental field at Greens Farms contained the following percentages of protein in the water-free material:

6811	Golden Tankard	11.47	6817	Mammoth Long Red	9.15
6812	Riverhall Giant	12.58	6818	Mammoth Long Red	9.31
6813	Sugar	11.04	6819	Norbiton Giant Long Red	9.03
6814	Prize Winner	16.03			
6815	Intermediate Red	13.11	6820	Giant Half Sugar	10.33
6816	Colossal Long Red	7.82			

Ensilage Corn, 17 samples, *Corn Grain,* 72 samples, and *Soy Bean Fodder,* 21 samples, were analyzed in connection with experimental work at the station farm at Mt. Carmel. The results will be published elsewhere.

PART V.

Twentieth Report on Food Products and Eighth Report on Drug Products, 1915.

By John Phillips Street.*

Of the 756 samples collected by the station agent 174 were adulterated, misbranded or below standard, exclusive of the 49 proprietary medicines. The Dairy and Food Commissioner submitted to the laboratory 1,397 samples, chiefly butter, cheese, milk, soda water syrups, temperance drinks and drug products. Of these 522 were adulterated, misbranded or below standard, and 24 were legally labeled compounds. Besides the above, 257 samples have been examined for city and health officials and other individuals. In all 2,200 samples were analyzed of which 806 were adulterated, misbranded or below standard (exclusive of proprietary medicines), showing that the pure food millennium has not yet arrived.

The station again emphasizes the impossibility of examining samples for manufacturers and dealers. This is work for a commercial chemist. State funds cannot properly be used in making analyses for individuals to be used solely in the course of their business or to satisfy curiosity.

I. FOOD PRODUCTS.

CEREAL BREAKFAST FOODS.

Fourteen samples of the newer brands of cereal breakfast foods were examined. Only a few of these require special notice.

* The analytical work herein reported was done mainly by E. M. Bailey, C. B. Morison, C. E. Shepard and G. L. Davis.

Cero-Vita claims to be "rich in vitamines and phosphates." Since this is the first time we have met with the claim that a food product contains "vitamines" it seems worth while to explain the meaning of this term.

Feeding experiments with "purified or partly purified" foods, or with artificial mixtures containing all of the *known* ingredients heretofore supposed to be essential for the support of life, have shown that some still unknown substance or substances must be present in a food in order to make it capable of long supporting life. The nature of these substances is at present entirely unknown, their existence being assumed from the effect produced by adding small amounts of extracts of or parts of

various vegetable or animal tissues to the above mentioned inefficient diets. Probably the so-called "vitamines" include a variety of chemical substances which are widely distributed throughout the animal and vegetable tissues. As a consequence nearly all of the unmanipulated food products contain enough of these vitamines to supply the requirements of normal nutrition.

The claim that a food is "rich in vitamines," even if true, adds little to its value, for, however essential these substances may be, they are so widely distributed among all of the common articles of food that every person who has an ordinary normal diet gets quite enough of them. The phrase does not carry with it the idea of any special process having been used, or even

TABLE I:—BREAKFAST FOODS.

Station No.	Brand and Manufacturer.	Price per Package.	Net Weight. Claimed.	Net Weight. Found.	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Ether Extract.	Starch by Diastase Method.
			oz.	oz.							
5551	Cero-Vita (Toasted Cereal Flakes). Kellogg Food Co., Battle Creek, Mich.	10	8	9.5	4.60	3.45[2]	8.88	0.33	82.07	0.67	52.26
5558	Comet Cereal (Rice Breakfast Food). Seaboard Rice Milling Co., Galveston, Tex.	..	16	16.1	11.25	0.33[1]	7.19	0.20	80.70	0.33	*
5563	F. B. A. Laxative Health Biscuit. F. B. A. Biscuit Co., New York.	..	..	....	11.13	3.13	6.13	0.68	77.20	1.73	*
5560	Granose Flakes. Kellogg Food Co., Battle Creek, Mich.	..	6	10.2	5.96	3.93	10.31	0.48	55.46	3.93	55.46
5548	Laxa. Kellogg Food Co., Battle Creek, Mich.	50	..	7.6	6.60	5.03[3]	12.38	6.58	66.63	2.78	*
5541	Sanitas Granuto. Kellogg Food Co., Battle Creek, Mich.	15	16	16.4	4.89	1.25	10.13	0.35	81.66	1.72	43.43
5544	Toasted Rice Biscuit. Kellogg Toasted Rice Flake & Biscuit Co., Battle Creek, Mich.	10	6	8.7	4.98	3.65	10.06	0.18	80.80	0.33	57.38
5553	Toasted Rice Flakes. Kellogg Toasted Rice Flake & Biscuit Co., Battle Creek, Mich.	10	8	10.7	4.71	3.35	10.00	0.18	81.40	0.36	55.74
5550	Toasted Rye Flakes. Kellogg Food Co., Battle Creek, Mich.	15	6	4.7	8.10	2.23	11.44	0.60	76.09	1.54	45.68
5549	Toasted Wheat Biscuit. Kellogg Food Co., Battle Creek, Mich.	15	12.5	14.7	5.80	2.35	14.19	1.53	74.76	1.37	45.79
5552	Toasted Wheat Flakes. Kellogg Food Co., Battle Creek, Mich.	15	8	10.6	5.21	2.65	9.25	1.15	80.61	1.13	57.04
5041	Uncle Sam Health Food. Uncle Sam Breakfast Food Co., Omaha, Neb.	15	12	12.3	6.25	3.10	21.25	3.98	40.99	24.43	*
5559	Whole Wheat Wafers. Battle Creek Sanitarium Co., Battle Creek, Mich.	15	12	12.7	6.04	1.88	10.44	0.63	73.38	7.63	*
5545	Zwieback. Battle Creek Sanatarium Co., Battle Creek, Mich.	15	14	15.6	6.21	1.63	14.25	0.23	76.07	1.61	60.41

* Not determined.

[1] Ash insoluble in acid, 0.006%.

[2] Contains 0.26% P_2O_5 and 0.11% iron and alumina phosphates, only a trace of iron being present.

[3] Contains 2.41% P_2O_5 and 0.20% iron and alumina phosphates, only a trace of iron being present; much lime present.

any special food having been selected, but rather that natural, unmanipulated foods are present, and that the manufacturer, alert to the advertising value of a new catch phrase, claims for his product a virtue common to the majority of our most familiar foods.

The claim that *Cero-Vita* is "rich in phosphates" is not supported by the analysis, which shows only 0.26 per cent of phosphoric acid to be present. The common cereal grains, corn, oats, rye and wheat, contain from 0.61 to 0.96 per cent of phosphoric acid, while wheat bran contains nearly 3 per cent. In fact *Cero-Vita* differs but little from the better-known cereal breakfast foods except that it contains somewhat less protein and fat, and considerably more ash; the amount of this last ingredient, however, is affected very little by the small amount of phosphoric acid present.

F. B. A. Laxative Health Biscuit appears to contain what is claimed: "flaxseed, bran and agar agar."

Granose Flakes claimed to "enrich the blood," which they probably do in the same sense that any nutritious, digestible food does.

The claim that *Laxa* contains "sterilized wheat bran and Ceylon moss (agar agar)," appears to be true. The claim "rich in iron and phosphates" is not so tenable. *Laxa* contains 2.41 per cent of phosphoric acid, which is about 80 per cent of the amount found in average unmixed wheat bran; this phosphoric acid, however, is not present as phosphates but chiefly in the from of nucleic acid. Only a trace of iron is present in the food, the total iron and alumina phosphates (chiefly the latter) amounting to but 0.20 per cent.

Granuto is claimed to be "thoroughly dextrinized and predigested by the diastase of malt." Our analysis, however, shows that 43.43 per cent of unaltered starch is present, indicating that over half of the carbohydrates of the food have escaped the dextrinization and diastatic action of the malt.

Uncle Sam Health Food is claimed to be composed of "flaxseed and whole wheat flavored with salt and celery." The claim seems to be correct, and the composition stated by the manufacturer agrees reasonably well with that found by us.

Laxa bore no statement of net weight as required by law; *Toasted Rye Flakes* claimed 6 oz., only 4.7 oz. being found.

The other samples as a rule considerably exceeded the net weights claimed for them.

CHEESE.

The standard for cheese is as follows:

"Cheese is the sound, solid, and ripened product made from milk or cream by coagulating the casein thereof with rennet or lactic acid, with or without the addition of ripening ferments and seasoning, and contains, in the water-free substance, not less than fifty (50) per cent of milk fat."

Eighty-six samples of cheese were examined for the Dairy and Food Commissioner in a study of the variations in its content of water and fat, and of the presence of foreign fats. Sixty-one samples were sold as "Cream Cheese," 13 as "Whole Milk Cheese" or "Milk Cheese," 10 simply as "Cheese" and one each as "Swiss Cheese" and "Skim Milk Cheese."

The term "Cream" or "Full Cream" as applied to cheese made from whole milk has caused much misunderstanding and confusion. While long established trade practice may perhaps excuse the use of these terms, it is obviously just as misleading to brand a cheese made simply from milk as "Full Cream Cheese" as was the former practice of branding unsweetened condensed milk as "Evaporated Cream."

It is apparent from the analyses herewith reported that the terms "Cream," "Full Cream," "Whole Milk" and "Milk" cheese are used interchangeably in this State. The question of the nomenclature of cheese is now under consideration by the Federal Committee on Food Definitions and Standards, and pending the committee's report the samples examined in the present inspection will be discussed solely as regards their content of water and fat.

Three of the samples although sold as "Cream" or "Whole Milk" cheese were made from partly skimmed milk; they contained only 45.9, 40.0 and 31.1 per cent of fat in the water-free material. A fourth sample sold as "Skim Milk Cheese" was true to name. Three of these four samples contained high percentages of water, 43.7, 46.9 and 45.7 per cent, a condition quite natural for cheeses of this grade.

The other 81 samples of Cheddar cheese satisfied the standard of 50 per cent fat in the water-free substance. The fat ranged

TABLE II:—CHEESE.

Sold as	Water.	Fat. Original Cheese.	Fat. Water-free Cheese.	Sold as	Water.	Fat. Original Cheese.	Fat. Water-free Cheese.
Cream Cheese	29.7	37.5	53.3	Cream Cheese	32.8	36.0	53.6
" "	29.4	39.0	55.2	" "	36.0	36.0	56.3
" "	34.0	35.3	53.5	" "	33.1	37.5	56.1
" "	31.7	38.3	56.1	" "	39.6	36.0	59.6
" "	30.4	36.8	52.9	" "	36.1	36.0	56.3
" "	35.8	36.0	56.1	" "	36.2	36.0	56.4
" "	33.6	37.5	56.5	" "	31.9	39.0	57.3
" "	32.0	38.3	56.3	" "	34.1	40.5	61.5
" "	36.3	36.0	56.5	" "	33.4	39.0	58.6
" "	32.9	37.5	55.9	" "	34.1	37.5	56.9
" "	26.5	40.5	55.0	" "	35.5	36.0	55.8
" "	37.5	36.0	57.6	" "	37.5	36.0	57.6
" "	33.5	37.5	56.4	" "	33.1	36.0	53.8
" "	32.9	36.8	54.8	" "	37.9	36.0	58.0
" "	34.4	36.0	54.9	Whole Milk, or			
" "	38.5	35.3	57.4	Milk Cheese	35.9	39.0	60.8
" "	36.4	34.5	54.2	" " "	34.0	38.3	58.0
" "	36.8	36.0	56.9	" " "	32.0	36.0	52.9
" "	32.1	37.5	55.2	" " "	30.6	36.0	51.9
" "	33.0	36.0	53.7	" " "	33.5	37.5	56.4
" "	32.3	39.0	57.6	" " "	34.1	35.3	53.6
" "	32.9	39.0	58.1	" " "	38.4	33.0	53.6
" "	30.2	40.5	58.0	" " "	29.2	39.8	56.2
" "	31.5	42.8	62.5	" " "	33.5	37.5	56.4
" "	35.2	39.0	60.2	" " "	33.6	39.0	58.7
" "	39.1	34.5	56.7	" " "	*46.9	*16.5	*31.1
" "	31.0	39.0	56.5	" " "	32.0	36.0	52.9
" "	32.3	39.0	57.5	" " "	32.0	40.5	59.6
" "	27.4	39.0	53.7	Cheese	29.4	40.5	57.4
" "	31.6	37.5	54.8	"	30.8	37.5	54.2
" "	35.8	36.0	56.1	"	32.7	37.5	55.7
" "	34.0	35.3	53.5	"	26.0	40.5	54.7
" "	34.1	34.5	52.4	"	36.1	36.8	57.6
" "	37.0	36.0	57.1	"	34.3	39.0	59.4
" "	36.3	36.0	56.5	"	38.0	33.8	54.5
" "	32.8	37.5	55.8	"	36.0	36.0	56.3
" "	*34.7	*30.0	*45.9	"	32.8	38.3	57.0
" "	*43.7	*22.5	*40.0	"	30.0	39.0	55.7
" "	35.1	36.0	55.5	Swiss Cheese ..	32.7	36.0	53.5
" "	37.5	34.5	55.2	Skim Milk			
" "	33.5	37.5	56.4	Cheese	*45.7	*19.5	*35.9
" "	34.0	37.5	56.8				
" "	35.9	37.5	58.5	*Maximum* ...	*39.6*	*42.8*	*62.5*
" "	32.8	37.5	55.8	*Minimum*	*26.0*	*33.0*	*51.9*
" "	32.7	37.5	55.7	*Average*	*33.7*	*37.3*	*56.3*
" "	33.9	39.0	59.0				
" "	33.4	37.5	56.3				

* Omitted from the average.

from 33.0 to 42.8 per cent in the original cheese, or from 51.9 to 62.5 on the water-free basis.

It has been claimed frequently that cheese manufacturers are incorporating more and more water in their product. Our present inspection does not bear out this contention, the water content ranging from 26.0 to 39.6 per cent. While all of our samples were taken from whole cheeses and were analyzed immediately on receipt, it is possible of course that the cheeses contained much more water originally than our figures show. However, our analyses indicate the composition of the cheese at the time it reached the consumer, the point in which we are chiefly interested. From the standpoint of quality too little water is almost as objectionable as too much.

No foreign fat was detected in any of the samples, and we may assume that the sale of "filled cheese" for the genuine product no longer is practiced in this State.

COCOA AND CHOCOLATE PREPARATIONS.

5536. *Health Koko Mixture* "consisting of Cocoa, Nuts, Meltose, Sugar. Theobromin removed." The Kellogg Food Co., Battle Creek, Mich. Price 25 cents per box of 8 oz.

5301. *Hygiama Food-Recuperative.* Dr. Theinhardt's Food Co., Stuttgart-Cannstatt, Germany. Price one dollar per can of 18 oz.

6389. *Ziegler's Breakfast Cocoa.* George Ziegler Co., Milwaukee, Wis.

6387. *Achor's Choco-Lactine.* "High Grade Chocolate, Pure Evaporated Milk, Pure Refined Sugar, Nothing Else." Achor Choco-Lactine Co., Philadelphia, Pa. Small bags of the mixture averaged one ounce in net weight.

6462. *Broken Cocoa (Nibs).* S. S. Pierce Co., Boston, Mass.

The analysis of *Health Koko* shows that cocoa makes up certainly less than three-fourths of its weight. The claim is made that the theobromine has been removed. Analyses made in this laboratory show that pure cocoa contains on the average 1.15 per cent of theobromine and 0.16 per cent of caffeine. Our analysis shows 0.13 per cent of these combined bases in this particular preparation, indicating therefore, only about one-tenth the amount usually found in cocoa. Undoubtedly much of the theobromine has been removed as claimed, but the apparent reduction may be due, at least in part, to the "nuts, meltose, and sugar" which, according to the label, are ingredients of the compound. "Meltose" by the way is the Kellogg name for the well-known sugar, maltose. In spite of the claim on the label that no cane sugar is used in the preparation of this cocoa, we found 27.41 per cent present.

TABLE III:—COCOA AND CHOCOLATE.

	Health Koko. 5536	Hygiama. 5301	Ziegler's Cocoa. 6389	Achor's Choco-Lactine. 6387	Broken Cocoa. 6462
Water	5.17	4.55	6.95	3.12	2.83
Ash	1.80	3.54*	7.09	2.22	3.88
Protein (N x 6.25)	16.88	20.25	21.50	9.38	14.69
Fiber	4.10	1.40	6.62	1.24	4.32
Nitrogen-free extract	54.50	60.23	37.34	69.49	22.86
Fat	17.55	10.03	20.50	14.55¶	51.42
Sol. in water at 100° C.	31.50	....	22.20	68.16	....
Theobromine and Caffeine	0.13	0.05	....	....	....
Starch	11.20	13.16	10.62	3.43	7.48
Sucrose	26.77	27.41	‡	56.48	§
Lactose	....	†	‡	7.20	....
Invert sugar, from direct reduction	....	3.20	....	....	....
Gums, dextrins, as dextrose	....	4.83	....	....	....
Undetermined carbohydrates	....	11.63	....	2.38	15.38
Polarization at 25° C., direct	+26.8	....	+1.4	....	....
Polarization at 25° C., after inversion	—5.6	....	±0.0	....	....

Hygiama is recommended as a "Food-Recuperative," and as "an Ideal Food Beverage" for all sorts and conditions of people, well and sick, including "Food Reformers." An analysis printed on the label conforms very closely with our own. According to Zipperer|| *Hygiama* is made from defatted cocoa, condensed milk and cereals. Our analysis appears to confirm this statement, although we could not obtain evidence of the presence of milk sugar by mucic acid formation. However, if lactose is present it is included mainly in the water-soluble carbohydrates, which, after excluding sucrose, we have calculated as dextrose; a part of the lactose may also have been included in our value for invert sugar. The ash of this food contains 1.00 per cent of phosphoric acid, alluded to by the manufacturer as "bone forming and digestive matter," which suggests that wheat bran may be one of the constituents of the food.

* 1.00% phosphoric acid. † See text. ‡ Not sweetened.

¶ Reichert-Meissl No. 7.0 (5 gms. fat).

§ Water-soluble carbohydrates by direct reduction, none; after hydrolysis, 0.94%.

|| The Manufacture of Chocolate, p. 256.

Hygiama, as far as we have been able to learn, makes no claim as to a reduced theobromine content. We find, however, only 0.05 per cent of theobromine and caffeine, about one-twenty-fifth of the amount usually found in cocoa. As in *Health Koko* this reduction may be caused in part by the presence of the other ingredients of the compound.

The price of *Hygiama,* one dollar for 18 ounces, certainly removes it from the category of cheap foods.

Ziegler's Breakfast Cocoa has the composition of a normal cocoa, the high ash indicating that the so-called "Dutch" process was used in its manufacture. Its ash showed an alkalinity of 6.7 cc. of tenth-normal acid per gram of cocoa.

Achor's Choco-Lactine claims to be composed of chocolate, evaporated milk and sugar, a claim confirmed by our analysis. The Reichert-Meissl No. of 7.0 for 5 grams of fat indicates the presence of considerable milk fat, and accordingly that condensed whole milk had been used. The cane sugar makes up over 56 per cent of the compound.

While the manufacturer's claim as to composition is correct, other claims made for the product are open to serious objection. For instance:—"Instantly soluble in hot water"; we find only 68 per cent of the compound to be soluble in boiling water and 56 per cent of this soluble material is cane sugar. "Perfectly digestible"; it is well known that cocoa fat is far from being perfectly digestible and it is by no means certain that a 56 per cent solution of cane sugar could "be retained by the weakest stomach without distress, though every other form of food is rejected." "Unrivalled as a brain and nerve food"; the idea that any food is specifically a food for the brain or nerves or in fact for any organ or tissue of the body long ago joined the numerous company of scientific myths.

Pierce's Broken Cocoa (apparently cocoa nibs of average composition) was examined at the request of an authority on diabetes to determine the amount of sugars in the finished beverage as offered to the patient. The method of preparing the cocoa infusion was as follows:—

Place a teacupful of the cocoa in a pot together with three pints of boiling water. Allow the mixture to boil on the stove for nine hours, adding boiling water from time to time to maintain the volume of three pints; strain through a fine sieve before serving.

The cocoa beverage thus prepared showed a specific gravity of 1.0020, and 0.032 gm. of direct reducing sugars and 0.138 gm. of total reducing sugars per 100 cc., both calculated as dextrose.

HYGIENIC COFFEES.

Four brands of coffee making special claims as regards healthfulness have been examined and compared with a sample of commercial Java coffee.

5040. *Kaffee Hag,* "Perfect Coffee, 95 per cent of the Caffeine Removed," "Pure Coffee," Kaffee Hag Corporation, New York.

6333. *G. Washington Prepared Coffee, Crystal,* "Absolutely Pure Soluble Coffee," "Does not contain Chicory or any other Adulterant. Refined from Selected Coffee Beans."

6335. *Café des Invalides,* "A compound of the Finest Coffees and other Vegetable Substances." "This compound is not all coffee, but contains about seven-eighths coffee, of the finest grades, blended with vegetable substances, which have been found to render it more healthful than pure coffee, in that it does not produce nervousness or wakefulness. It may be taken freely by many who have found ordinary coffee to be harmful to them, and will be especially gratifying to those who have tried to like cereal substitutes." S. S. Pierce Co., Boston.

6336. *Richelieu Brand Vacuum Improved Coffee,* "Subjected before roasting to the Evers Vacuum Process. This process is purely mechanical, no drugs or chemicals being used, the only agencies employed are vacuum and superheated steam." Sprague, Warner and Co., Chicago.

6334. *Java Coffee.* A high-grade commercial coffee.

In 1907 this station exposed certain brands of coffee sold under fraudulent claims as to the removal of either the caffeine or the tannins, or both. Such brands as *De-Tan-ated Coffee, Digesto Coffee* and *Royal Dutch Coffee* enjoyed a short-lived popularity

until the fraudulency of their claims was established. For the purpose of comparison with the four brands recently examined by us, the percentages of caffetannic acid and caffeine found in 1907 are given below, as well as the amounts of these ingredients found in three grades of commercial coffee.

	Caffetannic Acid.	Caffeine.
De-Tan-ated Coffee	9.89	1.14
Digesto Coffee	9.45	1.11
Royal Dutch Coffee	9.96	1.12
Java Coffee	9.51	1.13
Mocha Coffee	9.96	1.26
Rio Coffee	9.47	1.13

The above tabulation shows very clearly that the "special processes" used gave resultant products scarcely distinguishable from ordinary coffee.

The brands examined this year are in a somewhat different category.

Kaffee Hag claims the removal of 95 per cent of the caffeine, with no reference to the caffetannic acid.

G. Washington Prepared Coffee on its label uses the indefinite word "refined." One of the company's circulars states that "The coffee berry contains anti-digestive, deleterious substances, which are not essentials of the true coffee when refined.—Mr. Washington's refining process eliminates these harmful indigestible substances, along with all the other waste." These extracts intimate more or less directly that the "refining" consists in at least a partial elimination of coffee's objectionable ingredients.

Café des Invalides makes no direct claim as to either caffeine or caffetannic acid, but asserts "that it does not produce nervousness or wakefulness" results generally attributed to these ingredients. Likewise we are told that "it may be taken freely by many who have found ordinary coffee to be harmful."

Richelieu Brand Improved Coffee lays emphasis on a "vacuum process" of preparation. The claims made for this process will be discussed below.

In view of these claims, in which the reduction or elimination of the objectionable ingredients of coffee is maintained with more or less directness, it seemed desirable to determine to what extent these claims were fulfilled. In this discussion we will not attempt to consider the physiological effects of coffee drinking, other than to call attention to the possibly somewhat undue emphasis which has been placed on the harmfulness of caffeine, while the possible harmful effect of the caffetannic acid has been in the main ignored.

TABLE IV:—HYGIENIC COFFEES.

	5040	6333	6335	6336	6334
Water	5.42	8.58	5.03	4.57	5.62
Solids soluble in cold water	22.60	90.30	27.53	22.41	23.01
Petroleum ether extract	16.38	0.26	13.68	16.43	16.57
Ash, total	4.57	16.68	5.04	4.21	4.27
Ash, water-soluble	3.65	13.36	4.03	3.31	3.29
Ash, water-insoluble	0.92	3.32	1.01	0.90	0.98
Ash, acid-insoluble	0.02	0.02	0.09	0.03	0.03
Alkalinity of water-soluble ash	4.55*	18.34*	3.90*	4.07*	4.09*
Alkalinity of water-insoluble ash	2.26*	7.40*	2.30*	2.10*	2.08*
Phosphoric acid, water-soluble	0.06	0.40	0.17	0.15	0.12
Phosphoric acid, water-insoluble	0.32	1.23	0.29	0.29	0.32
Potash	2.29	8.92	2.09	2.07	2.01
Chlorine	0.06	0.09	0.49	0.01	0.01
Nitrogen	1.92	3.42	2.31	2.32	2.22
Caffeine, from residue	0.04	5.11	1.00	1.18	1.22
Caffeine, calculated from N in residue	0.03	4.96	0.97	1.15	1.20
Caffetannic acid	11.47	48.04	11.56	11.82	11.37
Reducing sugars, as dextrose	0.72	4.04	2.70	1.11	0.98
Sucrose from increase after inversion	1.01	2.06	2.57	0.80	0.73
Carbohydrates insoluble in 95% alcohol and convertible by diastase (starch, dextrins, etc., calculated as dextrose)	6.56	13.50	7.25	5.00	6.75

The table gives a detailed analysis of the four brands, together with that of a sample of commercial Java coffee as a basis for comparison.

All the samples are unadulterated coffees, in the sense that no foreign ingredient has been added, except *Café des Invalides*, which on the label claims to be only seven-eighths coffee, the balance being vegetable matter, apparently chiefly chicory.

* cc. N/10 HCl per gram of coffee.

KAFFEE HAG. The claim that 95 per cent of the caffeine has been removed is a just one; we find but 0.03 per cent as compared with 1.20 per cent in ordinary Java coffee. It contains, however, quite as much caffetannic acid as ordinary coffee, but concerning this ingredient no claim is made. That this product is "Perfect Coffee," as the label claims, is not strictly tenable, for a characteristic, probably the most distinctive, ingredient of coffee has been almost entirely eliminated.

G. WASHINGTON PREPARED COFFEE. This brand was also analyzed by us in 1911 and the present analysis is in substantial agreement with the previous one. Its composition indicates that it is probably a finely pulverized dessicated coffee extract. The only respects in which it differs from normal coffee is its almost complete solubility, which naturally excludes most of the fat and oil (petroleum ether extract) and the insoluble nitrogenous compounds and carbohydrates. The other analytical data show that with these exceptions it is about four times as concentrated as ordinary coffee. This concentration likewise affects the content of caffeine and caffetannic acid, the percentages found, 4.96 and 48.04, respectively, being somewhat over four times as much as shown in normal coffee. Whatever the Washington refining process has done, it has caused no diminution whatever in the two ingredients to which the harmful effect of coffee is generally attributed.

CAFÉ DES INVALIDES. The analysis represents what would be expected in a mixture of seven parts of coffee and one part of chicory and other vegetable substances. The caffeine is reduced from 1.20 to 0.97 per cent, while the caffetannic acid is somewhat higher than in the sample of Java coffee, indicating that a coffee of high tannin content had been used. The slight reduction in caffeine is due simply to the diluent vegetable substances employed, and is without significance. If normal coffee will cause "nervousness and wakefulness" we would expect the same results to follow from the use of this special brand, if these results are to be attributed to the caffeine and caffetannic acid present.

RICHELIEU BRAND VACUUM IMPROVED COFFEE. In a folder issued by the manufacturer, entitled "For the Merchant and his Clerks," we are told

Both the virtue and the harm in coffee have long been credited to the caffeine which it contains. * * * Until only a comparatively short time ago caffeine was the only one of these properties which was commonly known, and as it was recognized that its consumption in quantity was disturbing in its effect, it was but natural that it should have been considered the uncomfortable disturber to large numbers of people. The results of investigations, experiments and tests which have been performed by recognized authorities in very recent years, and the determined campaign of research which we have conducted in reference to coffee, have convinced us that caffeine, in such quantities as is contained in coffee, as ordinarily consumed, is not a harmful property, but on the contrary is a beneficial one.

The circular then states that coffee, when roasted in the ordinary manner, develops certain oils, both fixed and volatile, "whose effects are disturbing to persons of nervous or sensitive temperaments." The Vacuum Improved Process, it goes on to say, requires so much less heat than the ordinary methods in which this preliminary treatment is not employed, that while these coffees contain "all the desirable elements which make of coffee the most delicious and satisfying drink known to man, they contain the disturbing properties in such small quantities as to make these coffees a safe and harmless drink, no matter what may have been the results produced by the drinking of other coffees."

It may be that the above abstract from the manufacturer's literature refers to the work of Burmann, who reported in 1913 in the *Bulletin général de la therapeutique, 166*, 379, that he had discovered certain compounds in coffee, which he called "Coffeotoxins." These products were so poisonous that "certain people who are sensitive to coffee effects, which cause them to have headache, nervous trembling and insomnia, need not even drink coffee but only inhale the vapors which develop while brewing the coffee, to develop the above symptoms." Burmann completely ignored the fact that his discovery (?) had been anticipated by Erdmann in 1902, *Ber. deut. chem., Gesell., 35* (2) 1846, who by exactly the same process isolated from 150 kilograms of coffee 83.5 grams of "Caffeol," or 0.0557 per cent. This caffeol was not a homogeneous substance as claimed by Burmann, but contained about 50 per cent of furfuralcohol and small quantities of phenols. Based on the caffeol content as determined by Erdmann a cup of coffee, therefore, made from 5 grams of pulverized coffee, might contain from 0.0007 to 0.0010 gm. of this "poison," which, according to Burmann's claims for its toxicity would almost class it with strychnine for deadliness, as even the vapors from a cup of coffee containing this infinitesimal amount are alleged to have shattered the nerves of "certain people who are sensitive to coffee effects."

Our analysis of this brand is almost identical with that of our sample of Java coffee. Whatever the Evers Vacuum Process may have removed, it seems to have had no effect on the caffeine and caffetannic acid content of the resultant product, which are present in quite as large amounts as in untreated roasted Java coffee.

To summarize, *Kaffee Hag* is almost caffeine-free, but contains the normal amount of caffetannic acid. *G. Washington Coffee* contains about four times as much caffeine and caffetannic acid as normal coffee. *Café des Invalides* contains about 80 per cent as much caffeine as ordinary coffee, the decrease being due to its dilution with other vegetable substances; its caffetannic acid content is somewhat higher than in normal coffee. *Richelieu Vacuum Coffee* contains practically the same amounts of caffeine and caffetannic acid as ordinary coffee.

COFFEE SUBSTITUTES.

5546. *Caramel Cereal.* Kellogg Food Co., Battle Creek, Mich. Price 15 cents per package of 18.4 oz.

3562. *Minute Brew* (*Caramel Cereal, Concentrated*). "Made wholly from Grain." Kellogg Food Co., Battle Creek, Mich. Price 35 cents per can of 8.6 oz.

5574. *Monco.* The Monroe Co., Quincy, Ill. "A Healthful Drink, made of pure grains and vegetables, etc. Does not contain a particle of coffee or any other harmful ingredients." Price 25 cents per can of 16 oz.

	5546	3562	5574
Water	5.04	6.98	5.90
Ash	4.93	5.68	2.22
Protein (N x 6.25)	16.19	13.31	13.75
Fiber	12.60	6.81	7.43
Nitrogen-free extract	58.95	66.04	68.96
Ether extract	2.29	1.18	1.74
Soluble in water	....	44.08	....
Caffeine	none	none	none

It is difficult from the analytical data to see in what way *Minute Brew* is a concentrated form of *Caramel Cereal,* as it contains considerably less protein and fat. *Minute Brew* yields 328 Calories, while *Caramel Cereal* yields only slightly less, 321. None of the three samples contained caffeine, indicating the absence of coffee.

DIABETIC FOODS.

Nine new "diabetic" preparations have been examined this year. Their descriptions were as follows:

5561. *Casein Flour,* Lyster Bros., Whitefield, N. H.

5562. *Casein Bread,* Lyster Bros., Whitefield, N. H.

6267. *Allison's Cotton Seed Flour,* Schulenburg Oil Mill, Schulenburg, Tex.

6268. *Gluten Zwieback,* Loeb's Diabetic Food Bakery, N. Y.

6269. *Gluten Almond Zwieback,* Loeb's Diabetic Food Bakery, N. Y.

5869. *Gluten Bread,* Weston's Bakery, Boston, Mass.

5870. *Gluten Cookies,* Weston's Bakery, Boston, Mass.

	5561	5562	6267	6268	6269	5869	5870
Water	5.70	38.27	9.38	8.39	7.84	....	....
Ash	5.78	4.24	5.95	1.45	2.38	....	....
Protein (N x 6.25)	84.50	36.57	50.38	46.69	42.56	20.87	30.40
Fiber	0.05	0.05	2.70	0.18	0.60	....	....
Nitrogen-free extract	0.37	2.49	20.35	29.84	26.03	....	....
Ether extract	3.60	18.38	11.24	13.45	20.59	....	....
Starch	none	none	1.07	23.43	19.13	28.16	19.59

6265. *Champagne Vin Nature sans Sucre,* A. Pierlot & Cie., Bouzy-Reims.

6266. *Brauneberger* (Moselle Wine), Wilhemi, Hock & Co., Frankfurt a.M., Germany.

	6265	6266
Spec. gr. at 15.5° C.	0.9922	0.9952
Alcohol by volume	11.97	11.10
Total sugars as invert	0.36	0.25

Attention is also called to *Carnrick's Soluble Food,* whose analysis is given in the section on Infant's Foods, page 328. The manufacturer of this food claims that "in diabetes, diarrhoea, phthisis and pregnancy it is the food 'par excellence,'" in spite of the fact that our analysis shows the presence of 25.99 per cent of starch and 53.45 per cent of water-soluble carbohydrates.

It is one of the most unfit foods for the diabetic patient that we have ever examined.

FIG PREPARATIONS.

5554. *Fig Marmalade.* Cudahy Orchards Co., Chicago, Ill.

5402. *Black Fig Marmalade Mixture.* "Composed of Black Figs, Prunes, Meltose." Kellogg Food Co., Battle Creek, Mich. Price 40 cents per jar of 16.5 oz.

5401. *White Fig Marmalade Mixture.* "Composed of White Figs, Meltose." Kellogg Food Co., Battle Creek, Mich. Price 40 cents per jar of 16.0 oz.

5542. *Fig Bromose.* Kellogg Food Co., Battle Creek, Mich. Price 30 cents per tin of 7.3 oz.

	5554	5402	5401	5542
Water	27.62	48.92	37.92	10.06
Ash	0.96	0.96	1.14	1.87
Protein (N x 6.25)	1.21	1.28	1.78	15.75
Fiber	2.27	1.49	1.77	1.93
Nitrogen-free extract	67.40	46.85	56.69	51.29
Ether extract	0.54	0.50	0.70	19.10
Polarization at 23° C., direct	+29.4	+45.4	+52.2	+83.0
Polarization at 23° C., after inversion	—18.7	+45.1	+50.4	+78.1

No artificial color, saccharin or preservatives were found. The first sample was made with cane sugar; the other three with "Meltose" the Kellogg name for maltose.

FLAVORING EXTRACTS.

One hundred and twenty-one samples of flavoring extracts were examined, including all the common extracts, except vanilla, and a number of those which are less frequently analyzed.

ALMOND EXTRACT.

Standard almond extract is

> "the flavoring extract prepared from oil of bitter almonds, free from hydrocyanic acid, and contains not less than 1 per cent by volume of oil of bitter almonds."

Fourteen samples were analyzed. **5336** and **5103** were deficient in oil; the other twelve samples ranged from 1.00 to 3.85 gms. per 100 cc. Cane sugar (sucrose) was present in three samples, 1.12 gms. per 100 cc. in **5314**, 12.34 gms. in **5042**, and a trace in **5085**. None of the samples contained nitrobenzol, hydrocyanic acid, artificial color or wood alcohol. The alcohol was extremely variable, ranging from 28.79 to 78.16 per cent.

Table V:—Almond Extract (grams per 100 cc.)†

Station No.	Brand.	Price per Bottle.	Volume. Claimed.	Volume. Found.	Specific Gravity @ 15.6° C.	Ethyl Alcohol by Volume.	Non-volatile Solids.	Sucrose.	Almond Oil.
		cts.	fl. oz.	fl. oz.		%			
5336	Finest Extract of Lemon. Acker, Merrall & Condit Co., New York	25	2	2.1	.9310	51.65	.004	0	0.84
5314	Sunbeam Pure Food Extract Almond. Austin, Nichols & Co., New York	25	2	2.1	.9448	45.95	1.20	*1.12	1.37
5058	Pure Extract Almond. Baker Extract Co., Springfield, Mass.	23	..	2.1	.9601	34.25	.05	0	1.18
5316	Crown Aster Finest Extract Almond. A. F. Beckmann & Co., New York	15	..	2.3	.9668	28.79	.01	0	1.17
5267	Superior Extract of Almond. Jos. Burnett Co.	25	2	1.9	.9355	49.45	.008	0	2.33
5340	Tiger-Head Pure Extract of Bitter Almond. Edwin J. Gillies & Co., New York	10	1	{0.9 0.8}	.9401	46.75	.016	0	1.50
5042	A. & P. Almond Extract. The Great Atl. & Pac. Tea Co., Jersey City, N. J.	25	2	2.0	.9660	59.45	13.12	*12.34	2.25
5310	Howco Brand Pure Extract Almond. Howland's, Bridgeport	13	1.5	1.4	.8965	67.40	0	0	1.30
5103	Mohican Pure Extract of Almond. The Mohican Co.	20	2	2.2	.9406	46.71	.05	0	0.76
5296	True Extract Almond. Wm. B. Riker & Son Co., New York. "76% Alcohol"	21	..	1.5	.8692	78.16	.04	0	1.00
5454	Foss' Pure Extract Almond. Schlotterbeck & Foss Co., Portland, Maine	25	2	2.1	.8732	76.56	0	0	1.35
5074	Foss' Pure Extract Almond. Schlotterbeck & Foss Co., Portland, Maine	25	..	1.9	.8762	75.32	.008	0	1.38
5085	Robin Hood Brand Pure Flavoring Extract Almond. R. C. Williams & Co., New York	25	2	2.1	.9507	40.73	.23	*Trace	3.85
5050	Williams' Extract of Almond. The Williams & Carleton Co., Hartford	20	2	1.9	.9401	46.75	.11	0	2.48

* Trace of reducing sugar.
† No nitrobenzol or hydrocyanic acid present.

Four samples, **5058**, **5316**, **5296** and **5074**, bore no statement of net volume as required by law. The other samples satisfied the claims made for them.

Ginger Extract.

Standard ginger extract is

"the flavoring extract prepared from ginger, and contains in each 100 cc. the alcohol-soluble matters from not less than 20 grams of ginger."

Seven samples were analyzed. From a study of genuine extracts made in this laboratory in 1910 it was concluded that a properly made standard ginger extract shall contain from one

to two per cent of solids (dependent upon the variety of ginger used), practically all of which should be soluble in 95 per cent alcohol, and not over 15 per cent of it soluble in cold water.

The samples examined this year showed from 1.14 to 2.03 per cent of solids, of which from 84 to 99 per cent was soluble in 95 per cent alcohol, and from 7 to 29 per cent soluble in cold water. While all the samples are sufficiently high in solids, **5350** and **5051** show a comparatively low solubility in 95 per cent alcohol and a rather high amount of water-soluble material. It is noticeable also that these two samples contain much less alcohol, 65.25 and 65.75 per cent, than the other brands which range from 83.31 to 91.41 per cent.

TABLE VI:—GINGER EXTRACT.

Station No.	Brand.	Price per bottle.	Volume. Claimed.	Volume. Found.	Specific Gravity @ 15.6° C.	Ethyl Alcohol by Volume.	Solids. Total.	Solids. Soluble in Cold Water.	Solids. Soluble in 95% Alcohol.
		cts.	fl. oz.	fl. oz.		%	%	%	%
5350	Colton's Essence or Extract of Jamaica Ginger. "Alcohol 70%" ...	25	2	2.1	.9012	65.25	1.14	0.33	0.96
5051	Benefit Brand Pure Jamaica Ginger. Direct Importing Co., Boston	13	2	2.1	.8996	65.75	2.03	0.46	1.73
5462	Grand Union Extract Ginger. Grand Union Tea Co., Brooklyn, N. Y. "Alcohol 93%"	25	2	2.1	.8229	91.41	1.65	0.09	1.56
5482	Osgood's Extract Jamaica Ginger. Lee & Osgood Co., Norwich. "Alcohol 84.6%"	20	3¾	3.5	.8543	83.31	1.48	0.21	1.29
5477	Sauer's Pure Extract Ginger. The C. F. Sauer Co., Richmond, Va. "90% Alcohol"	10	..	{0.7, 0.8}	.8281	91.06	1.76	0.13	1.66
5321	Sauer's Pure Extract Ginger. The C. F. Sauer Co., Richmond, Va. "90% Alcohol"	10	..	{0.7, 0.8}	.8308	90.00	1.83	0.13	1.81
5288	Van Duzer's Jamaica Ginger. Van Duzer Extract Co., New York. "90% Alcohol"	25	2	2.1	.8408	90.15	1.90	0.18	1.71

5477 and **5321**, both from the same manufacturer, bore no statement of net volume on the label. The other samples substantially agreed with their claims.

LEMON EXTRACT.

Standard lemon extract is

"the flavoring extract prepared from oil of lemon, or from lemon peel, or both, and contains not less than 5 per cent by volume of oil of lemon."

TABLE VII:—LEMON EXTRACT.

Station No.	Brand.	Price per bottle.	Volume. Claimed.	Volume. Found.	Specific Gravity @ 15.6° C.	Ethyl Alcohol by Volume.	Lemon Oil by Volume. Mitchell Precipitation Method.	Lemon Oil by Volume. Polariscope Method.	Color.
		cts.	fl. oz.	fl. oz.		%	%	%	
5337	Finest Extract of Lemon. Acker, Merrall & Condit Co., New York	50	4	4.1	.8278	85.79	5.9	5.9	Natural
5186	Republic Extract Lemon. Austin, Nichols & Co., New York	25	4	4.0	.8487	81.53	5.8	*6.8	"
5317	Crown Aster Finest Extract Lemon. A. F. Beckmann & Co., New York	50	..	3.5	.8483	80.96	4.2	3.9	"
5077	Surpassing Brand Extract of Lemon. H. C. Bibeau, Meriden	35	..	3.7	.8457	79.38	7.7	7.3	"
5108	Monogram Brand Finest Extract Pure Lemon. Bridgeport Public Market, Bridgeport	40	4	3.8	.8355	82.75	6.7	6.7	"
5268	Burnett's Lemon. Jos. Burnett Co.	50	4	3.6	.8186	85.37	9.8	10.2	"
5346	Colton's Select Flavors Lemon. The J. W. Colton Co., Springfield, Mass.	50	4	3.7	.8460	81.21	6.0	5.7	"
5046	Benefit Brand Pure Lemon. Direct Importing Co., Boston	13	2	{2.3, 2.1}	.8403	83.81	5.8	5.8	"
5188	Country Club Pure Extract Lemon. The John T. Doyle Co., New Haven	10	..	{0.9, 0.9, 0.9}	.8357	83.06	6.5	6.6	"
5079	A. & P. Lemon Extract. The Great Atl. & Pac. Tea Co., Jersey City, N. J.	25	2	{1.9, 2.0}	.8342	86.25	5.2	5.3	"

* Contains 1.35% sucrose.

TABLE VII:—LEMON EXTRACT—*Continued.*

Station No.	Brand.	Price per bottle.	Volume. Claimed.	Volume. Found.	Specific Gravity @ 15.6° C.	Ethyl Alcohol by Volume.	Lemon Oil by Volume. Mitchell Precipitation Method.	Lemon Oil by Volume. Polariscope Method.	Color.
		cts.	fl. oz.	fl. oz.		%	%	%	
5311	Howco Brand Pure Extract Lemon. Howland's, Bridgeport	13	1½	1.5, 1.5	.8443	80.85	5.5	5.6	Natural
5287	Rogers' Lemon. McMonagle & Rogers, Middletown, N. Y.	20	..	1.8, 1.9	.8209	88.28	7.0	7.4	"
5344	Miller's Extract of Lemon. The Miller Mfg. Co., New York	35	4	2.9	.8323	84.24	6.7	6.9	"
5101	Mohican Pure Extract of Lemon. The Mohican Co.	33	..	4.0	.8301	84.94	6.6	6.7	"
5070	Foss' Pure Extract Lemon. Schlotterbeck & Foss Co., Portland, Maine	25	2	1.9, 1.9	.8360	80.58	8.9	9.1	"
5452	Foss' Pure Extract Lemon. Schlotterbeck & Foss Co., Portland, Maine	25	2	1.8, 1.9	.8352	80.47	9.1	9.3	"
5178	White Rose Brand Extract of Lemon. Seeman Bros. New York ..	20	2	1.9, 2.0	.8457	81.77	6.5	6.6	"
5096	Village Store Co. Pure Extract of Lemon. G. W. Smith, Bridgeport	10	1	0.9, 1.0, 1.1, 1.2	.8472	80.37	5.4	5.2	"
5458	Standard Brand Pure Extract Lemon. The Standard Pickle Co., Hartford	10	1	1.0, 1.0, 1.1	.8565	76.80	5.2	5.5	"
5071	Polo Brand Pure Lemon. Stoddard, Gilbert & Co., New Haven ...	10	1	1.0, 1.0, 0.9, 1.0	.8191	88.84	5.1	5.3	"
5339	Thompson's Extract Pure Lemon. J. E. Thompson, New York ...	20	2	1.8, 1.9	.8265	85.33	6.7	6.7	"
5097	Sovereign Pure Lemon Extract. The Union Pacific Tea Co., New York	20	2	1.9, 1.9	.8381	85.00	5.9	5.8	"
5090	Williams' Choice Extract of Lemon. The Williams & Carleton Co., Hartford	45	4	3.9	.8370	84.48	6.2	5.9	"
5080	Charter Oak Brand Pure Lemon. The Williams & Carleton Co., Hartford	10	1	1.0, 1.0	.8388	83.72	5.7	5.6	"
5313	Whiting's Extract Pure Lemon. R. T. Whiting, Bridgeport	40	4	3.9	.8374	83.78	6.2	6.3	"
5122	Un-X-LD Absolutely Pure Extracts Lemon. Wise, Smith & Co., Hartford	15	2	2.0, 2.0	.8416	81.25	5.5	5.2	"
	Terpeneless Lemon Extracts								
5307	Atlas Brand Pure Flavoring Extracts Terpeneless Lemon. Andrew Davey, New York	45	4	3.9	.9387	46.90	0	Trace	"
5338	Atlas Brand Terpeneless Lemon. Andrew Davey, New York	25	2	1.9, 1.9	.9354	49.30	0	0	"
5326	Premium Pure Extract of Lemon Terpeneless. East India Tea Co., So. Norwalk	20	2	2.0, 2.0	.9096	61.67	0.5	Trace	"
5086	†St. John's Extract of Lemon. St. John & Co., New York	10	..	1.8, 1.7	.9607	34.40	0	0	Turmeric
5088	‡Union Brand Lemon Substitute. Union Tea Co., New Britain ...	25	4	4.3	.9545	39.40	0	0	Naphthol Yellow S.

† "Formula compound: 70 parts hydro-alcoholic solution oil lemon, 30 parts water. Colored artificially with trace of tumeric."

‡ "Made from citral, alcohol and water. Artificially colored."

Thirty-one samples were analyzed, all of them, with five exceptions sold as the genuine extract. Five were sold as terpeneless extracts the quality of the latter being more or less clearly indicated on the label.

The twenty-six brands of alleged pure extract contained from 4.2 to 9.8 per cent of oil, **5317** being the only brand below standard. **5186** contained 1.35 per cent of cane sugar, but with the proper amount of oil of lemon. No artificial color was observed in any of these twenty-six samples, and the alcohol, all of which was ethyl, ranged from 76.80 to 88.84 per cent.

The terpeneless extracts contained no lemon oil, or not more than a trace. In three of them the color was natural, while in **5086**, turmeric, and in **5088** the permitted coal-tar dye, Naphthol Yellow S, were employed. The alcohol, all ethyl, ranged from 34.40 to 61.67 per cent.

5086 was labeled "St. John's Extract of Lemon," with a separate sticker reading "Formula compound: 70 parts hydro-alcoholic solution oil lemon, 30 parts water. Colored artificially with trace of tumeric." The sample is clearly misbranded, as it is a terpeneless, not a pure, extract of lemon, and the alleged formula is absolutely meaningless.

Six samples, **5317**, **5077**, **5188**, **5287**, **5101** and **5086**, did not bear the required statement of net volume. While there was a general tendency to shade under the claimed volume, **5344** showed the only serious shortage, claiming 4 oz. and delivering only 2.9 oz.

Orange Extract.

Standard orange extract is

"the flavoring extract prepared from oil of orange, or from orange peel, or both, and contains not less than 5 per cent by volume of oil of orange."

The twelve samples examined were of standard quality, the oil ranging from 5.5 to 10.7 per cent, and no artificial color being detected. The alcohol, all of which was ethyl, ranged from 76.18 to 88.77 per cent.

5054 and **5087** did not bear the required statement of net volume; the other samples satisfied the claims made for them.

Table VIII:—Orange Extract.*

Station No.	Brand.	Price per bottle.	Volume. Claimed.	Volume. Found.	Specific Gravity @ 15.6° C.	Ethyl Alcohol by Volume.	Orange Oil by Volume.
		cts.	fl. oz	fl. oz.			
5269	Burnett's Superior Extract of Orange. Jos. Burnett Co.	25	2	2.0, 2.0	0.8170	88.10	9.0
5312	Howco Brand Pure Extract Orange. Howland's, Bridgeport	13	1.5	1.5	0.8229	82.37	6.4
5054	Imperial Pure Orange Extract. Packed at 27 Hampden St., Springfield, Mass.	10	..	0.9, 1.0, 1.0, 0.9	0.8265	88.77	6.0
5091	A. & P. Orange Extract. Great Atl. & Pac. Tea Co., Jersey City, N. J.	25	2	2.2, 1.9	0.8301	83.83	5.5
5087	Cabinet Brand Pure Extract Orange. The Miller Mfg. Co., New York	15	..	1.2, 1.1	0.8454	76.18	6.6
5455	Sauer's Pure Extract Orange. The C. E. Sauer Co., Richmond, Va.	25	2	1.9, 2.0	0.8568	76.89	6.6
5089	Foss' Pure Extract Orange. Schlotterbeck & Foss Co., Portland, Maine	20	2	2.0, 2.0	0.8303	85.88	8.4
5177	White Rose Brand Extract Orange. Seeman Bros., New York	20	2	2.1, 2.1	0.8380	87.70	5.7
5483	Slade's Absolutely Pure Orange Extract. D. & L. Slade Co., Boston	20	2	1.9, 1.9	0.8234	81.42	10.7
5319	Sovereign Pure Orange Extract. Union Pacific Tea Co., New York	20	2	2.1, 2.0	0.8486	80.06	6.8
5187	Orange Extract. Van Duzer Extract Co., New York	25	2	1.9, 2.0	0.8280	84.74	6.6
5484	Williams' Pure Extract Orange. Williams & Carleton Co., Hartford	25	2	1.8, 2.0	0.8360	80.87	6.5

Wintergreen Extract.

Standard wintergreen extract is

"the flavoring extract prepared from oil of wintergreen, and contains not less than 3 per cent by volume of oil of wintergreen."

Eight samples were analyzed, no effort being made to determine whether or not they were made from oil of wintergreen, oil of birch, or from methyl salicylate. The methyl salicylate was determined and calculated in terms of oil of wintergreen. All the samples contained an amount of methyl salicylate corresponding to the oil of wintergreen of the standard, except **5327**, which contained only 0.95 per cent one-third the required amount.

* Color natural in all the samples.

This sample also was colored with a coal-tar dye, although on the carton label "artificial color veg." was claimed and it bore no statement of net volume. The alcohol, all ethyl, ranged from 45.20 to 82.85 per cent. The other brands were what was claimed for them.

TABLE IX:—WINTERGREEN EXTRACT.

Station No.	Brand.	Price per bottle.	Volume. Claimed.	Volume. Found.	Specific Gravity @ 15.6° C.	Ethyl Alcohol by Volume.	Wintergreen Oil by Volume.	Color.
		cts	fl oz	fl oz				
5265	Burnett's Essence of Wintergreen. Jos. Burnett Co.	25	2	2.1	0.8373	82.85	5.00	Natural
5253	Colton's Select Flavors, Wintergreen	25	2	2.0	0.9239	50.45	3.65	Natural
5052	Benefit Brand Pure Wintergreen. Direct Importing Co., Boston	13	2	2.1	0.9231	54.60	3.51	Natural
5327	*Acme Highly Concentrated Extract Wintergreen. East India Tea Co.	20	..	1.6	0.9478	45.20	0.95	Coal-tar
5463	Grand Union Extract Wintergreen. Grand Union Tea Co., Brooklyn, N. Y.	25	2	2.1	0.9112	57.95	3.29	Natural
5076	A. & P. Flavoring Extracts Wintergreen Birch. Great Atl. & Pac. Tea Co.	25	2	1.9	0.9089	61.60	3.43	Natural
5043	Mohican Pure Extract Wintergreen. The Mohican Co.	21	2	2.0	0.8912	71.05	2.97	Natural
5099	Sovereign Pure Wintergreen Extract. Union Pacific Tea Co., New York	20	2	2.0	0.8824	67.40	4.12	Natural

* Carton labelled "artificial color veg. .02"; no statement of color on bottle.

MISCELLANEOUS EXTRACTS.

Here are included a number of the less commonly used, and still less frequently analyzed, flavoring extracts. Some of them are almost always synthetic, such as banana, pineapple, raspberry and strawberry, while for others definite standards have already been determined. These have been grouped somewhat arbitrarily in our tables into two classes, those in which an essential oil is present, and those which are either synthetic or which depend on some other principle than an essential oil for their flavoring effect.

The following standards have been established for certain of these extracts.

Celery extract, the flavoring extract prepared from celery seed, or from oil of celery, or both, and contains not less than 0.3 per cent by volume of oil of celery seed.

Cinnamon extract, the flavoring extract prepared from oil of cinnamon, and contains not less than 2 per cent by volume of oil of cinnamon.

Clove extract, the flavoring extract prepared from oil of cloves, and contains not less than 2 per cent by volume of oil of cloves.

Nutmeg extract, the flavoring extract prepared from oil of nutmeg, and contains not less than 2 per cent by volume of oil of nutmeg.

Peppermint extract, the flavoring extract prepared from oil of peppermint, or from peppermint, or both, and contains not less than 3 per cent by volume of oil of peppermint.

Rose extract, the flavoring extract prepared from otto of roses, with or without red rose petals, and contains not less than 0.4 per cent by volume of otto of roses.

Spearmint extract, the flavoring extract prepared from oil of spearmint, or from spearmint, or both, and contains not less than 3 per cent by volume of oil of spearmint.

In the following lists of extracts no wood alcohol was found in any case, and no coal-tar dyes except where indicated. The chemical data regarding these samples appear in Tables X and XI.

Celery Extract. Two of the samples contained much more oil of celery seed than the standard requires, and one only half as much.

Cinnamon Extract. The sample tested was of standard composition.

Clove Extract, Nutmeg Extract. The single samples tested of each were nearly of standard strength. Too much significance should not be given to the apparent shortage of oil in the nutmeg extract, as the methods for determining this oil give scarcely more than approximate results.

Peppermint Extract. The five samples tested met requirements as to strength. **5270** bore no statement of net volume, and **5478** and **5320** were "spirit" of peppermint rather than "extract."

Rose Extract. Three samples were of standard quality. **5465**, however, has less than one-fourth of the standard amount of otto of roses and **5284** had no statement of net volume.

Spearmint Extract. The single sample was of standard strength.

Imitation Banana Extract, Imitation Cherry Extract. A single sample of each bore no statement of net volume. The former was colored with Naphthol Yellow S, and the latter with Amaranth, both permitted coal-tar colors.

Chocolate Extract, Coffee Extract. The single samples tested of each were genuine but bore no statement of net volume.

Onion Extract. As appears in Table XI the three samples probably contained oil of onion, but they were very unlike in their chemical composition.

Imitation Peach Extract. The two samples were quite unlike in composition; nothing was found not permitted by law.

Pineapple Extract. Two of the samples were claimed to be genuine, and five were imitations. One of the latter, **5341**, was colored with Naphthol Yellow S, a permitted coal-tar dye. **5102** and **5107** bore no statement of net volume.

Pistachio Extract. The sample tested was an imitation.

Raspberry Extract. Five samples were tested and were not found adulterated.

TABLE X:—FLAVORING EXTRACTS.

(CELERY, CINNAMON, CLOVE, NUTMEG, PEPPERMINT, ROSE, SPEARMINT.)

Station No.	Manufacturer and Brand.	Price per bottle.	Volume. Claimed.	Volume. Found.	Specific Gravity @ 15.6° C.	Ethyl Alcohol by Volume.	Oil.	Color.
		cts.	fl. oz.	fl. oz.		%	%	
	Celery Extract.							
5078	H. C. Bibeau, Meriden. Surpassing Extract of Celery	20	2	1.8	0.8334	89.60	1.40	Natural
5263	Jos. Burnett Co., Boston. Superior Extract of Celery	25	2	1.9	0.8227	93.65	0.71	"
5464	Grand Union Tea Co., Brooklyn, N. Y. Grand Union Extract Celery	25	2	1.9	0.8179	94.70	0.13	"
	Cinnamon Extract.							
5264	Jos. Burnett Co., Boston. Superior Extract of Cinnamon	25	2	2.1	0.8230	91.49	2.33	"
	Clove Extract.							
5258	Jos. Burnett Co., Boston. Superior Extract of Clove	25	2	2.1	0.8218	94.02	1.91	"
	Nutmeg Extract.							
5260	Jos. Burnett Co., Boston. Superior Extract of Nutmeg	25	2	1.9	0.8200	92.13	[2]1.80	"
	Peppermint Extract.							
5257	Colton's Select Flavors, Peppermint	25	..	1.9	0.8905	69.00	3.80	None
5045	Direct Importing Co., Boston. Benefit Brand Pure Peppermint	13	2	1.9	0.8868	70.00	4.00	"
5075	Great Atl. & Pac. Tea Co., Jersey City, N. J. A. & P. Peppermint	25	2	1.9	0.8514	77.30	3.40	No coal tar or tumeric
5478	The Nichols & Harris Co., New London. Essence Peppermint	10	1	{0.9 1.0}	0.8309	86.29	11.40	" " " "
5320	The C. F. Sauer Co., Richmond, Va. Sauer's Pure Extract Peppermint[1]	10	0.8	{0.8 0.9}	0.9004	64.00	11.40	" " " " "
	Rose Extract.							
5259	Jos. Burnett Co., Boston. Superior Extract of Rose	25	2	2.0	0.8203	92.50	0.38	Natural
5254	Colton's Select Flavors, Rose	25	..	2.2	0.8326	88.85	0.47	"
5285	Francis H. Leggett & Co., New York. Premier Flavoring Extracts, Rose	25	2	1.9	0.8282	89.65	0.37	"
5465	Seeman Bros., New York. White Rose Brand Extract of Rose	20	2	2.0	0.9598	37.65	0.09	(?)
	Spearmint Extract.							
5252	Colton's Select Flavors, Spearmint	25	2	2.1	0.8557	87.30	3.00	No coal-tar or tumeric

[1] Claims on label "10% oil."

[2] Only an approximate determination.

Imitation Raspberry Extract. Two of the three samples tested contained a coal-tar dye, **5176** Erythrosin, and **5342** (probably) Amaranth.

Strawberry Extract. Three samples were sold as genuine and no evidence of adulteration was found.

Imitation Strawberry Extract. Five samples were examined. **5044** bore no statement of net volume.

TABLE XI:—MISCELLANEOUS FLAVORING EXTRACTS.

(BANANA, CHERRY, CHOCOLATE, COFFEE, ONION, PEACH, PINEAPPLE, PISTACHIO, RASPBERRY AND STRAWBERRY.)

Station No.	Manufacturer and Brand.	Price per bottle.	Volume. Claimed.	Volume. Found.	Specific Gravity @ 15.6° C.	Ethyl Alcohol by Volume.	Non-volatile Solids, gms. per 100 cc.	Glycerine, gms. per 100 cc.	Ash, gms. per 100 cc.	Alkalinity of Soluble Ash. (cc. N/10 acid per 100 cc.)	Esters. (cc. N/10 KOH per 100 cc.)	Reducing Sugars as Dextrose. Direct, gms. per 100 cc.	Reducing Sugars as Dextrose. After inversion, gms. per 100 cc.	Acidity. (cc. N/10 NaOH per 100 cc.)	Color.
		cts	fl oz	fl oz											
	Banana Extract.														
4851	[1]Seeman Bros., New York. White Rose Imitation Banana Flavor	20	..	1.8	0.9519	44.80	....	....	...	...	202.7	....	....	....	Naphthol Yellow S.
	Cherry Extract.														
5053	The Mohican Co. Pure Extract of Imitation Cherry	21	..	2.1	0.9241	60.40	....	....	...	...	50.0	....	....	....	Amaranth
	Chocolate Extract.														
5348	Colton's Select Flavors, Chocolate	25	..	2.0	1.0187	31.90	22.32	17.76	0.31	27.5	*	Tr.	Tr.	....	Natural
	Coffee Extract.														
5255	Colton's Select Flavors. Coffee	25	..	2.1	1.0060	17.20	7.85	0.00	0.84	89.5	†	Tr.	Tr.	....	"
	Onion Extract.														
5459	Baker Extract Co., Springfield, Mass. Pure Extract Onion	25	2	2.0	1.0449	13.40	20.79	12.46	0.45	28.5	‡	3.94	4.10	52.0	No coal-tar
5261	Jos. Burnett Co., Boston. Imitation Onion Flavoring	25	2	2.0	0.9160	59.15	0.06	0.00	0.02	...	‡	0.00	0.00	1.0	" "
5453	The Williams & Carleton Co., Hartford. Williams' Pure Extract Onion	25	2	2.0	0.9471	44.35	1.43	0.00	0.07	...	‡	0.62	0.62	333.0	" "
	Peach Extract.														
5460	[2]Baker Extract Co., Springfield, Mass. Imitation Peach Flavor	25	2	2.0	0.9602	44.90	9.16	6.77	0.09	...	91.0	1.28	1.32	....	" "
5262	Jos. Burnett Co., Boston. Imitation Peach Flavoring	25	2	2.0	0.8232	92.10	....	....	...	...	16.0	....	....	....	None
	Pineapple Extract.														
5461	[2]Baker Extract Co., Springfield, Mass. Imitation Pineapple Flavor	25	2	2.2	0.9640	45.70	10.12	6.99	0.11	8.0	87.0	1.48	1.73	....	No coal-tar
4849	Jos. Burnett Co., Boston. Superior Extract of Pineapple	25	2	2.0	0.9905	38.80	8.78	0.00	0.41	23.5	13.0	6.78	7.01	....	" "
5341	[3]E. J. Gillies & Co., New York. Tiger Head Brand Imitation Pineapple Flavor	10	1	{1.0 1.0}	0.9659	42.50	....	....	...	...	12.5	....	....	....	Naphthol Yellow S.
5335	The Miller Mfg. Co., New York. Artificial Pineapple Flavor	25	2	1.8	0.9386	51.80	....	....	...	...	143.0	....	....	....	None
5102	The Mohican Co. Pure Extract of Finest Pineapple Flavor Artificial	20	..	1.8	0.9547	44.60	....	....	...	...	146.0	....	....	....	"
5107	[4]Wightman's Extract of Pineapple	15	..	1.9	0.9173	56.30	....	....	...	...	192.0	....	....	....	No coal-tar
5457	Schlotterbeck & Foss Co., Portland, Me. Foss' Pure Extract Pineapple	25	2	2.0	1.0252	23.40	14.60	5.77	0.42	28.5	14.5	7.00	7.00	....	" "

[1] "Harmless artificial color."
[2] "Artificial oil 10.72, alcohol 42.89, glycerin 5.69, fruit juice 16.08, water 24.62."
[3] "Artificially colored."
[4] On bottle "Extract of Ethereal Pineapple."

* Contains 0.27 gm. caffeine and theobromine per 100 cc.
† Contains 2.68 gms. caffeine per 100 cc.
‡ Sulphur compounds present.

TABLE XI:—MISCELLANEOUS FLAVORING EXTRACTS—*Concluded.*

Station No.	Manufacturer and Brand.	Price per bottle.	Volume. Claimed.	Volume. Found.	Specific Gravity @ 15.6° C.	Ethyl Alcohol by Volume.	Non-volatile Solids. gms. per 100 cc.	Glycerine. gms. per 100 cc.	Ash. gms. per 100 cc.	Alkalinity of Soluble Ash. (cc. N/10 acid per 100 cc.)	Esters. (cc. N/10 KOH per 100 cc.)	Reducing sugars as Dextrose. Direct. gms. per 100 cc.	Reducing sugars as Dextrose. After Inversion. gms. per 100 cc.	Acidity. (cc. N/10 NaOH per 100 cc.)	Color.
	Pistachio Extract.														
5349	Colton's Select Flavors, Imitation Pistachio	25	2	1.9	1.0179	32.05	18.07	8.77	0.14	...	6.0	0.69	6.98	....	No coal-tar
	Raspberry Extract.														
5266	Jos. Burnett Co., Boston. Superior Extract of Raspberry	25	2	2.1	1.0099	13.00	5.96	0.00	0.23	20.0	12.0	4.29	4.29	....	" "
5256	Colton's Select Flavors, Raspberry	25	2	2.2	1.0293	16.80	12.09	0.00	0.46	42.0	28.0	8.09	8.22	....	" "
5342	[3]E. J. Gillies & Co., New York. Tiger Head Brand Imitation Raspberry Flavor	10	1	0.9 0.9	0.9553	47.60	....	....	...	...	8.0	....	....	....	Probably amaranth
5286	Schlotterbeck & Foss Co., Portland, Me. Foss' Pure Extract Raspberry	25	2	2.0	1.0659	18.00	24.72	6.32	0.30	26.0	21.0	14.98	15.34	....	No coal-tar
5456	Schlotterbeck & Foss Co., Portland, Me. Foss' Pure Extract Raspberry	25	2	2.0	1.0625	21.70	25.41	6.60	0.30	25.0	22.0	14.77	15.12	....	" "
5176	[3]Seeman Bros., New York. White Rose Brand Imitation Raspberry Flavor	20	2	2.1	0.9787	34.90	....	....	...	...	68.0	....	....	....	Erythrosin
5318	Union Pacific Tea Co., New York. Sovereign Pure Raspberry Extract	25	2	2.1	1.0436	25.70	18.28	0.00	0.66	59.0	8.0	12.65	12.75	....	No coal-tar
5308	[3]Made at Hartford. High Grade Imitation of Raspberry	25	2	2.0	0.9629	35.10	....	....	...	...	8.0	....	....	....	" "
	Strawberry Extract.														
4850	Jos. Burnett Co., Boston. Superior Extract of Strawberry	25	2	2.0	0.9575	48.00	5.11	0.00	0.05	...	19.0	3.52	3.55	....	" "
5347	Colton's Select Flavors, Strawberry	25	2	1.9	1.0539	20.10	18.71	0.00	1.03	90.0	23.0	12.40	12.75	....	" "
5343	[3]E. J. Gillies & Co., New York. Tiger Head Brand Imitation Strawberry Flavor	10	1	0.8 1.0	0.9680	40.30	....	....	...	...	12.0	....	....	....	Probably amaranth
5304	Great Atl. & Pac. Tea Co., Jersey City, N. J. A. & P. Imitation Strawberry Flavoring	25	2	2.1	0.9788	39.80	....	....	...	...	34.0	....	....	....	No coal-tar
5309	[3]Hartford Extract Co., Hartford. Stuart Brand Improved Substitute for Strawberry	25	1.5	1.7	0.9749	23.90	....	....	...	...	15.5	....	....	....	Amaranth
5044	The Mohican Co. Pure Extract of Finest Strawberry Flavor Artificial	21	..	2.0	0.9644	38.60	....	....	...	...	19.5	....	....	....	"
5476	Schlotterbeck & Foss Co., Portland, Me. Foss' Pure Extract Strawberry	25	2	2.1	1.0690	19.40	25.80	5.26	0.34	32.0	9.0	16.78	16.98	....	No coal-tar
5098	Union Pacific Tea Co., New York. Sovereign Imitation Strawberry	20	2	2.1	0.9946	41.70	....	....	...	...	72.0	....	....	....	" "

[3] "Artificially colored."

CANNED FRUITS.

This investigation was undertaken to test the accuracy of the net weights claimed for the various fruits, the relative amounts of fruit and liquor in the different brands, the variations in the densities of the syrups used, and to secure data which might possibly assist in preparing definitions for the different grades of canned fruits.

Three hundred and three samples, representing 101 brands were analyzed, with the results given in Table XII. The method of examination was as follows:—After weighing the can with its contents, the can was opened and the liquor drained from the fruit through a sieve. The drained solids and the separated liquid were then weighed, and the specific gravity of the liquid portion calculated from the gravity reading by a Brix spindle. In all cases, except with cherries and sliced peaches, the number of pieces of fruit was counted to determine the relative size of the fruit used. The fruit was examined as to whether it was hard or soft, and an attempt was made to determine its quality from the standpoint of taste, a matter of course depending in large part on the taster himself. Allowing for all possible differences of judgment, however, it was clear that some of the finest appearing fruit was quite deficient in taste and flavor, showing that when quality is to be considered mere size and appearance are by no means the determining factor.

TABLE XII:—CANNED FRUIT.

Station No.	Brand.	Can Size.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.	Weight of Drained Fruit.	Drained Fruit.	Liquid.	Spec. Gravity of Liquid @ 15.6° C.	Sugar in Liquid from Spec. Grav.	No. of Pieces of Fruit.	Av. Weight of Pieces of Fruit.	Quality.
			cts.	oz.	oz.	oz.	%	%		%		oz.	
	Apples.												
5479	Social Brand. Dist. by Edward D. Depew & Co., New York	3	15	30	29.5	17.8	60	40	1.0252	6.4	11	1.62	Good
				30	29.8	20.1	67	33	1.0282	7.1	15	1.34	"
				30	28.8	17.0	59	41	1.0280	7.1	22(?)	0.77(?)	Very soft
5474	Oswego Brand. Oswego Preserving Co., Oswego, N. Y.	3	10	29	33.7	18.2	54	46	1.0281	7.1	27	0.67	Good
				29	33.2	18.7	56	44	1.0283	7.1	23	0.81	"
				29	33.7	16.9	50	50	1.0264	6.7	25	0.68	"
5119	Waverly Brand. Seeman Bros., Dist., New York	3	10	30	31.8	22.3	70	30	1.0331	8.3	33	0.68	"
				30	32.2	22.8	71	29	1.0355	8.9	34	0.67	"
				30	32.1	22.2	69	31	1.0355	8.9	43	0.51	"
5447	Mt. Parnassus Brand Baldwins and Greenings, Fancy. Geo. C. Smith, East Haddam, Conn.	3	13	30	30.8	21.6	70	30	1.0349	8.8	35	0.62	Fair; many small pieces
				30	32.5	22.6	70	30	1.0349	8.8	37	0.61	" " " "
				30	30.4	21.7	71	29	1.0352	8.8	34	0.64	" " " "
5082	Robin Hood Brand Choice. Dist. by R. C. Williams & Co., New York	3	12	30	32.2	20.5	64	36	1.0285	7.2	39	0.53	Many small broken pieces
				30	32.1	20.5	64	36	1.0289	7.3	40	0.51	" " "
				30	32.2	18.5	58	42	1.0278	7.0	21	0.88	Better than other two
5445	Robin Hood Brand. R. C. Williams & Co., Dist., New York	3	10	30	31.2	18.2	58	42	1.0266	6.7	29	0.63	Pieces of various
				30	32.1	20.3	63	37	1.0283	7.1	38	0.53	shapes and sizes
				30	31.7	21.0	66	34	1.0322	8.1	29	0.72	in all three cans
	Apricots.												
5473	Davisco Brand California. Packed for F. H. Davis & Co., New London	2½	25	32	29.9	17.0	57	43	1.0736	17.8	25	0.68	Good
				32	31.3	18.2	58	42	1.0798	19.2	25	0.73	"
				32	31.6	18.4	58	42	1.0868	18.6	22	0.84	"
5092	Hunt's Staple Quality. Hunt Bros. Co., Hayward, Cal.	?	15	16	17.7	10.6	60	40	1.0975	23.2	23	0.46	Appearance poor; taste good, skins on
				16	17.7	10.1	57	43	1.1051	24.8	19	0.53	Appearance poor; taste good, skins on
				16	17.6	9.2	53	47	1.1156	27.1	19	0.48	Appearance poor; taste good, skins on

TABLE XII:—CANNED FRUIT—*Continued.*

Station No.	Brand.	Can Size.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.	Weight of Drained Fruit.	Drained Fruit.	Liquid.	Spec. Gravity of Liquid @ 15.6° C.	Sugar in Liquid from Spec. Grav.	No. of Pieces of Fruit.	Av. Weight of Pieces of Fruit.	Quality.
			cts.	oz.	oz.	oz.	%	%		%		oz.	
5271	Hunt's Staple Quality. Hunt Bros. Co., Hayward, Cal.	2½	25	30	32.0	17.8	56	44	1.1159	27.1	26	0.68	Soft
				30	32.5	19.4	60	40	1.1043	24.6	31	0.63	"
				30	32.5	19.6	60	40	1.1050	24.8	26	0.75	"
5081	Nabob. Dist. by Francis H. Leggett & Co., New York	2½	25	30	31.6	17.6	56	44	1.0976	23.2	24	0.73	Good. Skins not removed
				30	32.0	18.2	57	43	1.0972	23.1	21	0.87	" " "
				30	32.0	18.6	58	42	1.0940	22.4	22	0.85	" " " "
5446	Libby's California Fruits, Extra. Libby, McNeill & Libby, Chicago	2½	25	30	31.5	16.8	53	47	1.1001	23.7	17	0.99	"
				30	32.1	19.2	60	40	1.1001	23.7	22	0.87	"
				30	31.9	20.0	63	37	1.0940	22.4	21	0.95	"
5480	Warfield Brand. Seeman Bros., Dist., New York ...	2½	25	30	32.1	18.8	59	41	1.0983	23.3	25	0.75	"
				30	31.7	16.6	53	47	1.1045	24.7	22	0.75	"
				30	32.0	17.9	56	44	1.0999	23.7	26	0.68	"
5426	Famous Royal Scarlet Brand, Peeled. R. C. Williams & Co., New York	2½	28	0	32.6	17.2	52	48	1.0945	22.5	34(?)	0.51(?)	Very soft
				0	32.8	16.9	52	48	1.0875	21.0	33(?)	0.51(?)	" " ; can corroded
				0	33.1	19.8	60	40	1.0885	21.2	31	0.64	Soft
	Cherries.												
5334	Noreca Brand Extra Standard Quality Royal Anne. Packed for Acker, Merrall & Condit Co., New York	2½	24	0	31.3	19.9	64	36	1.0671	16.3	..	...	Large and fine
				0	30.7	19.4	63	37	1.0672	16.4	..	...	" " "
				0	31.2	19.2	62	38	1.0671	16.3	..	...	" " "
5067	Preferencia Brand Syrup White. Dist. by Austin, Nichols & Co., New York	2	15	21	22.0	9.9	45	55	1.1018	24.1	..	...	Good
				21	21.3	10.0	47	53	1.0961	22.8	..	...	"
				21	21.6	10.0	46	54	1.0966	23.0	..	...	"
5323	Crown Aster Brand Royal Anne White. Packed for A. F. Beckmann & Co., New York	2½	25	30	31.6	17.4	55	45	1.0938	22.3	..	...	"
				30	32.1	16.6	52	48	1.0999	23.7	..	...	"
				30	31.6	16.6	53	47	1.0988	23.4	..	...	"
5332	Oval Brand White Wax, Extra Syrup. The Booth Packing Co., Baltimore, Md.	2	18	21	21.0	12.2	58	42	1.0623	15.2	..	...	"
				21	21.1	12.0	57	42	1.0690	16.8	..	...	Fair; poor taste
				21	20.7	11.7	57	43	1.0544	13.4	..	...	Small fruit
5056	American Club Brand Pitted Red. The Burt Olney Canning Co., Oneida, N. Y.	2	25	0	22.7	11.0	49	51	1.1900	42.0	..	...	Good
				0	23.0	10.4	45	55	1.2022	44.4	..	...	"
				0	22.6	11.3	50	50	1.1857	41.2	..	...	"
5443	Meadow Brook Brand Pitted Red, Best Quality. The Burt Olney Canning Co., Oneida, N. Y.	2	25	21	21.4	11.5	54	46	1.1606	36.3	..	...	"
				21	22.4	12.2	55	45	1.1709	38.3	..	...	"
				21	21.5	11.0	51	49	1.1706	38.3	..	...	"
5487	Blue Seal Royal Anne. Packed for Lewis DeGroff & Son, New York	?	15	15	16.0	10.0	62	38	1.0916	21.9	..	...	"
				15	17.5	9.6	55	45	1.0901	21.5	..	...	"
				15	17.6	10.0	56	44	1.0951	22.6	..	...	"

TABLE XII:—CANNED FRUIT—*Continued.*

Station No.	Brand.	Can Size.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.	Weight of Drained Fruit.	Drained Fruit.	Liquid.	Spec. Gravity of Liquid @ 15.6° C.	Sugar in Liquid from Spec. Grav.	No. of Pieces of Fruit.	Av. Weight of Pieces of Fruit.	Quality.
			cts.	oz.	oz.	oz.	%	%		%		oz.	
5277	Pride of Egypt Brand Red Sweet. Egypt Canning Co., Egypt, N. Y.	2	15	0	21.5	12.8	60	40	1.0779	18.8	..	...	Good
				0	21.9	12.9	60	40	1.0878	21.0	..	...	Can blown
				0	22.0	13.6	62	38	1.0881	21.1	..	...	Good
5109	Ajax Brand Royal Anne. Golden Gate Packing Co., San José, Cal.	2½	22	30	32.2	21.8	68	32	1.0840	20.2	..	...	"
				30	31.8	21.4	67	33	1.0830	20.0	..	...	"
				30	31.7	20.5	64	36	1.0820	19.7	..	...	"
5111	Sultana Brand. Dist. by The Great Atl. & Pac. Tea Co., Jersey City, N. J.	2½	20	30	30.6	20.9	68	32	1.0679	16.5	..	...	"
				30	30.6	21.1	69	31	1.0627	15.3	..	...	"
				30	31.3	18.4	60	40	1.0863	20.7	..	...	"
5302	Anchor Brand White Wax in Syrup. H. F. Hemingway, Baltimore, Md.	2	15	18	21.3	11.7	55	45	1.0665	16.2	..	...	"
				18	21.1	10.8	51	49	1.0664	16.2	..	...	"
				18	21.0	11.2	53	47	1.0656	16.0	..	...	"
5272	Libby's Extra Royal Anne California. Libby, McNeill & Libby, Chicago	2½	30	30	32.0	18.0	56	44	1.0891	21.3	..	...	Very fine
				30	31.6	17.2	54	46	1.0907	21.7	..	...	" "
				30	31.7	17.3	55	45	1.0874	20.9	..	...	" "
5475	Mon-Ro-Co Brand White Sweet in Granulated Sugar Syrup. Dist. by Monroe Canning Co., Brockport, N. Y.	2	15	19	21.0	12.5	60	40	1.0722	17.5	..	...	Good
				19	21.0	11.6	55	45	1.0723	17.5	..	...	"
				19	21.0	11.4	54	46	1.0763	18.4	..	...	"
5325	Tiger Brand White Wax in Syrup. Platt & Co., Baltimore, Md.	2	15	21	22.1	11.9	54	46	1.0903	21.6	..	...	"
				21	21.6	11.6	54	46	1.0888	21.2	..	...	"
				21	21.8	11.7	53	47	1.0848	20.4	..	...	"
5431	White Birch Brand Red. Sodus Canning Co., Sodus, N. Y.	1	10	19	11.7	7.6	65	35	1.0699	17.0	..	...	"
				19	11.9	7.0	58	42	1.0847	20.3	..	...	"
				19	11.7	6.7	57	43	1.0734	17.8	..	...	"
5183	White Birch Brand White. Sodus Canning Co., Sodus, N. Y.	2	15	19	21.7	14.0	65	35	1.0796	19.2	..	...	Lavender color
				19	21.9	12.9	59	41	1.0919	21.9	..	...	White
				19	21.4	12.2	57	43	1.0834	20.0	..	...	Lavender color
5481	Hermitage Brand California White, Our Finest Quality. Packed for Stoddard, Gilbert & Co., New Haven	2½	30	30	32.8	18.6	57	43	1.1141	26.7	..	...	Good
				30	32.9	18.2	55	45	1.1219	28.4	..	...	"
				30	32.9	18.8	60	40	1.0890	21.3	..	...	"
5450	Big Elm White, in Syrup. Victor Preserving Co., Victor, N. Y.	2	15	18	21.4	13.4	63	37	1.0667	16.3	..	...	"
				18	20.9	14.2	68	32	1.0558	13.7	..	...	"
				18	21.3	15.4	72	28	1.0623	15.2	..	...	"
5084	Webster's Best Brand White, in Syrup. Webster-Butterfield Co., Baltimore, Md.	2	18	20	21.3	11.7	55	45	1.0823	19.8	..	...	Several rotten spots
				20	21.4	11.8	55	45	1.0822	19.8	..	...	" " "
				20	21.8	11.6	53	47	1.0728	17.7	..	...	" " "

TABLE XII:—CANNED FRUIT—*Continued.*

Station No.	Brand.	Can Size.	Price per Can.	Net Weight. Found.	Net Weight. Claimed.	Weight of Drained Fruit.	Drained Fruit.	Liquid.	Spec. Gravity of Liquid @ 15.6° C.	Sugar in Liquid from Spec. Grav.	No. of Pieces of Fruit.	Av. Weight of Pieces of Fruit.	Quality.
			cts.	oz.	oz.	oz.	%	%		%		oz.	
5069	Red Line. Dist. by R. C. Williams & Co., New York	2½	15	30	29.7	20.6	69	31	1.0382	9.6	..	...	Mostly small fruit
				30	30.6	19.3	63	37	1.0503	12.4	..	...	Some exudation on opening; small fruit
				30	30.1	20.7	69	31	1.0287	7.2	..	...	
	Peaches.												
5333	Noreca Brand Extra Standard Quality Yellow Cling. Packed for Acker, Merrall & Condit Co., New York	2½	19	30	30.6	19.7	64	36	1.0783	18.9	12	1.64	Good
				30	30.4	18.2	60	40	1.0806	19.4	11	1.65	"
				30	30.1	19.7	66	34	1.0728	17.7	12	1.64	"
5118	Scottish Chief Crawford California. Austin, Nichols & Co., Dist., New York	2½	25	30	30.2	21.2	70	30	1.0368	9.2	16	1.33	Soft and broken; poor taste
				30	30.4	20.1	66	34	1.0740	17.9	14	1.44	" " " " "
				30	31.4	18.8	60	40	1.0938	22.3	16	1.18	" " " " "
5324	Crown Aster Brand Lemon Cling. Dist. by A. F. Beckmann & Co., New York	2½	25	30	29.9	19.6	65	35	1.0838	20.1	11	1.78	Good
				30	30.6	21.2	69	31	1.0980	23.3	11	1.93	"
				30	30.1	19.6	65	35	1.0866	20.8	10	1.96	"
5055	American Club Brand Sliced Yellow Crawford, Best Quality. The Burt Olney Canning Co., Oneida, N. Y.	2	22	0	23.0	16.5	72	28	1.1399	32.1	Slices	...	"
				0	23.1	16.3	71	29	1.1484	33.9	"	...	Some exudation on opening
				0	22.0	16.4	75	25	1.1252	29.1	"	...	Good
5064	Navy Brand Extra Quality. Cobb Preserving Co., Fairport, N. Y.	2	18	20	21.0	11.2	54	46	1.0912	21.8	15	0.75	Fair
				20	21.4	10.9	51	49	1.1142	26.8	13	0.84	"
				20	20.9	11.5	55	45	1.0996	23.6	14	0.82	"
5113	Yellow Extra Quality. Curtice Bros. Co., Rochester, N. Y.	2½	25	31	31.0	19.5	63	37	1.1075	25.3	17	1.15	Good taste; poor appearance
				31	32.1	19.5	61	39	1.1335	30.8	12	1.63	" " " "
				31	31.3	18.3	59	41	1.1154	27.0	14	1.31	" " " "
5315	Atlas Brand Lemon Cling. Dist. by Andrew Davey, N. Y.	2½	25	30	30.6	21.4	70	30	1.0579	14.2	13	1.65	Good
				0	32.5	18.5	57	43	1.0964	22.9	7	2.64	"
				0	31.9	18.6	58	42	1.1020	24.1	7	2.66	"
5331	Health Brand Yellow Crawford. Lewis DeGroff & Son, New York	2½	25	30	30.8	17.1	55	45	1.0860	20.6	11	1.55	Good taste; poor appearance
				30	31.1	17.1	55	45	1.0940	22.4	10	1.71	" " " "
				30	30.9	17.5	57	43	1.0804	19.4	10	1.75	" " " "
5048	California Yellow Free. Emery Food Co., Chicago	2½	15	29	29.0	15.8	54	46	1.0409	10.2	12	1.32	Fair
				29	29.7	16.2	54	46	1.0409	10.2	15	1.08	"
				29	29.2	15.9	54	46	1.0412	10.3	9	1.77	"
5068	Silver Dale Brand California Lemon Cling. Emery Food Co., Chicago	2½	15	29	29.8	20.0	67	33	1.0474	11.8	8	2.50	Fine color and appearance; flavor poor
				29	29.9	22.0	74	26	1.0514	12.7	12	1.67	
				29	29.3	19.4	66	34	1.0468	11.6	9	2.16	
5305	Fiesta Brand Cling, 10% Syrup. Golden Gate Canning Co., Ontario, Cal.	2½	15	28	29.3	20.6	70	30	1.0446	11.1	25	0.82	Good
				28	29.3	21.8	74	26	1.0447	11.1	18	1.21	"
				28	30.0	20.7	69	31	1.0450	11.2	22	0.94	"

TABLE XII:—CANNED FRUIT—*Continued.*

Station No.	Brand.	Can Size.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.	Weight of Drained Fruit.	Drained Fruit.	Liquid.	Spec. Gravity of Liquid @ 15.6° C.	Sugar in Liquid from Spec. Grav.	No. of Pieces of Fruit.	Av. Weight of Pieces of Fruit.	Quality.
			cts.	oz.	oz.	oz.	%	%		%		oz.	
5060	Nysa Brand Yellow Cling, Extra Standard Quality, in Heavy Syrup. Golden Gate Packing Co., San José, Cal.	2½	19	30	31.5	20.0	63	37	1.0874	20.9	10	2.00	Good
				30	30.3	20.0	66	34	1.0792	19.1	11	1.82	"
				30	30.8	19.7	64	36	1.0825	19.8	10	1.97	"
5428	Lawson Pink Brand Lemon Cling. Lawson Pink Food Prod. Co., Boston	2½	22	30	30.8	20.9	68	32	1.0710	17.2	13	1.61	"
				30	30.7	18.6	61	39	1.0835	21.1	9	2.07	"
				30	29.9	22.4	75	25	1.0429	10.7	12	1.87	"
5284	Nabob Yellow Cling. Francis H. Leggett & Co., Dist., New York	2½	20	30	31.5	20.2	64	36	1.0933	22.2	11	1.84	Fine flavor
				30	31.1	19.2	62	38	1.0952	22.7	11	1.75	" "
				30	31.3	18.0	58	42	1.1011	23.9	11	1.64	" "
5120	Libby's Extra Lemon Cling. Libby, McNeill & Libby, Chicago	2½	25	30	31.0	19.4	62	38	1.0952	22.7	10	1.94	Fine taste and appearance
				30	31.2	20.4	65	35	1.0917	21.9	11	1.85	" " " "
				30	31.2	19.8	63	37	1.0884	21.2	11	1.80	" " " "
5427	Tree Brand Lemon Cling, California. Libby, McNeill & Libby, Chicago	2½	15	29	29.8	21.1	71	29	1.0590	14.5	16	1.32	Good
				29	30.4	21.2	70	30	1.0594	14.6	18	1.18	"
				29	30.4	21.6	71	29	1.0620	15.2	18	1.20	"
5433	Pala Brand California Yellow Cling. J. F. Pyle & Son, San José, Cal.	2½	15	29	30.4	20.9	69	31	1.0545	13.4	13	1.61	"
				29	29.4	19.9	70	30	1.0534	13.2	13	1.53	"
				29	30.2	21.5	71	29	1.0505	12.5	17	1.27	"
5449	Hermitage Brand California Lemon Cling, Our Finest Quality. Packed for Stoddard, Gilbert & Co., New Haven	2½	23	30	31.4	20.3	65	35	1.0999	23.7	10	2.03	"
				30	31.3	18.8	60	40	1.1111	26.1	9	2.09	"
				30	31.5	21.2	67	33	1.1037	24.5	9	2.36	"
5182	Polo Brand Yellow Crawford. Packed for Stoddard Gilbert & Co., New Haven	2½	20	30	28.8	18.0	63	37	1.0713	17.3	9	2.00	Soft
				30	30.9	18.6	60	40	1.0850	20.4	9	2.07	Good
				30	30.8	18.4	60	40	1.0754	18.2	6	3.07	"
5448	Brownie Brand Yellow Cling, Choice Extra. R. C. Williams & Co., Dist., New York	2½	20	30	30.7	21.0	68	32	1.0732	17.7	14	1.50	"
				30	30.8	21.6	70	30	1.0724	17.6	13	1.66	"
				30	30.1	19.5	65	35	1.0722	17.5	11	1.77	"
5328	Robin Hood Brand. R. C. Williams & Co., Dist., New York	Odd	15	15	17.5	9.3	53	47	1.0749	18.1	Slices	...	"
				15	17.5	10.6	60	40	1.0705	17.1	"	...	"
				15	17.5	10.7	61	39	1.0711	17.3	"	...	"
5094	White Top Brand, California. Dist. by R. C. Williams & Co., New York	2½	15	30	29.9	22.4	75	25	1.0391	9.8	15	1.49	"
				30	29.2	21.3	73	27	1.0386	9.7	12	1.78	"
				30	29.6	21.8	74	26	1.0321	8.1	14	1.56	"

TABLE XII:—CANNED FRUIT—*Continued.*

Station No.	Brand.	Can Size.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.	Weight of Drained Fruit.	Drained Fruit.	Liquid.	Spec. Gravity of Liquid @ 15.6° C.	Sugar in Liquid from Spec. Grav.	No. of Pieces of Fruit.	Av. Weight of Pieces of Fruit.	Quality.
			cts.	oz.	oz.	oz.	%	%		%		oz.	
	Pears.												
5061	Garland Brand Choice, Extra Heavy Syrup. W. F. Assan Canning Co., Baltimore, Md.	2	10	20	21.5	11.9	55	45	1.0886	21.2	9	1.32	Fair
				20	21.6	12.0	56	44	1.0831	20.0	7	1.71	Some dirt present
				20	21.4	12.8	60	40	1.0873	20.9	11	1.16	Fair
5283	Staple Brand Extra Standard. Austin, Nichols & Co., Dist., New York	3	15	35	37.0	24.7	67	33	1.0739	17.9	15	1.65	Rather hard
				35	36.9	25.2	68	32	1.0674	16.4	18	1.40	" "
				35	37.3	25.6	69	31	1.0805	19.4	15	1.71	" "
5270	Triacan Brand Bartlett. Packed for The F. C. Bushnell Co., New Haven, by The Wm. H. Geer Co., New York	2	15	21	21.2	13.8	65	35	1.0654	16.0	14	0.99	Fair
				21	20.5	13.3	65	35	1.0591	14.5	15	0.89	"
				21	20.6	13.5	66	34	1.0591	14.5	17	0.79	"
5330	Byron Brand Bartlett. No name of manufacturer	2	15	20	20.7	13.8	66	34	1.0558	13.7	15	0.92	Mushy; one bad spot; dirt on pears and in bottom of can
				20	20.1	13.2	66	34	1.0563	13.8	23	0.57	
				20	21.3	13.5	64	36	1.0638	15.6	14	0.96	
5115	Emerald Brand, First Quality. Cherry Creek Canning Co., Cherry Creek, N. Y.	2	15	20	21.1	13.2	63	37	1.0777	18.8	17	0.78	Good
				20	21.0	13.0	62	38	1.0810	19.5	16	0.81	One bad spot
				20	21.1	13.3	63	37	1.0803	19.3	..	...	Good
5049	Prize Winner Brand Bartlett, Fancy Quality. Cherry Creek Canning Co., Cherry Creek, N. Y.	2	13	19	21.3	12.9	60	40	1.0628	15.4	11	1.17	"
				19	20.7	11.2	54	46	1.0638	15.6	11	1.02	"
				19	21.4	12.4	58	42	1.0644	15.7	11	1.13	"
5306	Bridgeton Brand, Extra. Clinton B. Ayars Canning Co., Bridgeton, N. J.	3	15	32	36.2	18.9	53	47	1.0686	16.7	13	1.45	"
				32	36.3	19.1	53	47	1.0658	16.1	13	1.47	"
				32	36.3	19.4	53	47	1.0630	15.4	14	1.39	"
5065	Navy Brand Bartlett, Extra Quality. Cobb Preserving Co., Fairport, N. Y.	2	15	20	21.7	12.9	60	40	1.0705	17.1	16	0.81	One bad spot
				20	21.5	12.4	58	42	1.0664	16.2	15	0.83	Good
				20	21.6	11.5	53	47	1.0786	19.0	13	0.88	"
5112	Bartlett, Extra Quality. Curtice Bros. Co., Rochester, N. Y.	2½	24	31	31.7	23.0	72	28	1.0947	22.5	22	1.05	Rather soft; broken pieces
				31	31.1	22.9	74	26	1.0914	21.8	18	1.27	Fair
				31	31.3	23.1	74	26	1.0880	21.1	21	1.10	"
5300	Compass Brand. D. E. Foote & Co., Baltimore, Md.	2	10	18	21.0	12.6	60	40	1.0676	16.5	16	0.79	"
				18	21.0	13.2	63	37	1.0653	15.9	8(?)	1.65(?)	Many small pieces; 2 bad spots
				18	20.7	13.2	63	37	1.0687	16.7	14	0.94	Fair; some small pieces
5104	Pride of Cedarville Brand. Fruit Farm Pres. Co., Cedarville, N. J.	3	14	32	37.5	18.6	50	50	1.0462	11.5	20	0.93	One bad spot
				32	36.9	18.9	51	49	1.0427	10.6	25	0.76	Three bad spots
				32	37.1	18.8	51	49	1.0446	11.1	28	0.67	Fair
5062	Iona Brand. Dist. by The Great Atl. & Pac. Tea Co., Jersey City, N. J.	2	10	19	21.3	12.5	59	41	1.0551	13.6	23	0.54	Small pieces and trimmings; two seeds and one core; good flavor
				19	21.1	12.5	59	41	1.0605	14.8	17	0.74	
				19	21.2	12.2	58	42	1.0658	16.1	20	0.61	

TABLE XII:—CANNED FRUIT—*Continued.*

Station No.	Brand.	Can Size.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.	Weight of Drained Fruit.	Drained Fruit.	Liquid.	Spec. Gravity of Liquid @ 15.6° C.	Sugar in Liquid from Spec. Grav.	No. of Pieces of Fruit.	Av. Weight of Pieces of Fruit.	Quality.
			cts.	oz.	oz.	oz.	%	%		%		oz.	
5486	Champion Brand. H. J. McGrath Co., Baltimore, Md.	3	10	32	34.3	18.2	53	47	1.0429	10.7	12	1.52	Rather soft
				32	33.9	17.9	53	47	1.0422	10.5	10	1.79	" "
				32	34.5	18.0	52	48	1.0397	9.9	11	1.64	One bad spot
5059	Capital Brand. Thos. J. Myer & Co., Baltimore, Md.	2	8	18	20.5	11.8	58	42	1.0453	11.3	11	1.07	One rotten spot; fishy odor
				18	20.6	10.8	52	48	1.0454	11.3	9	1.20	One rotten spot
				18	20.4	9.9	49	51	1.0440	10.9	9	1.10	Can blown
5057	Huntress Brand Bartlett, Fancy Quality. Oswego Preserving Co., Oswego, N. Y.	2	15	20	20.9	14.0	67	33	1.0702	17.1	20	0.70	Some small and broken pieces
				20	20.7	13.9	67	33	1.0740	17.9	15	0.93	Good
				20	21.0	13.7	65	35	1.0772	18.6	18	0.76	Some small and broken pieces
5488	Monroe Brand Bartlett. Packed for Rochester Pres. Co., Rochester, N. Y.	2	15	0	20.6	14.6	71	29	1.0595	14.6	19	0.77	Some dirt in cans
				0	19.8	12.7	64	36	1.0617	15.1	16	0.79	" " " "
				0	20.4	14.0	69	31	1.0615	15.1	18	0.78	" " " "
5184	White Birch Brand Bartlett. Sodus Canning Co., Sodus, N. Y.	2	15	19	21.1	13.4	63	37	1.0747	18.1	9	1.49	Soft; many raspberry seeds
				19	21.2	14.4	68	32	1.0731	17.7	14	1.03	" " " "
				19	21.1	13.6	65	35	1.0743	18.0	12	1.13	" " " "
5106	Polo Brand Bartlett. Packed for Stoddard, Gilbert & Co., New Haven	2	15	19	21.8	11.5	53	47	1.0904	21.6	12	0.96	Good
				19	21.6	11.8	54	46	1.0892	21.3	14	0.84	"
				19	21.9	11.6	53	47	1.0860	20.6	14	0.83	"
5066	Golden Tip Brand Preserved Bartlett, Extra Selected. A. J. Tanner Co., Oakfield, N. Y.	2	15	20	20.7	14.5	70	30	1.0577	14.2	16	0.91	Mushy
				20	20.7	14.6	72	28	1.0657	16.0	15	0.97	"
				20	20.6	14.9	73	27	1.0555	13.7	19	0.78	Mushy and broken
5185	Big Elm Brand Bartlett, in Syrup. Victor Preserving Co., Victor, N. Y.	2	15	18	21.2	11.8	56	44	1.0667	16.3	13	0.91	Good
				18	21.1	13.0	62	38	1.0574	14.1	14	0.93	"
				18	21.1	13.1	62	38	1.0698	17.0	15	0.87	"
	Pineapple.												
5047	Carmelo Hawaiian Sliced. Austin, Nichols & Co., Dist., New York	2	16	20	21.2	13.8	65	35	1.0886	21.2	8	1.73	Good
				20	21.1	12.7	60	40	1.0981	23.3	7	1.81	"
				20	21.1	13.0	61	39	1.0933	22.2	8	1.63	"
5299	Elite Brand Grated Hawaiian. Packed for Clark, Chapin & Bushnell, New York	2	20	20	21.5	10.2	47	53	1.1011	23.9	grated	...	"
				20	21.1	10.3	49	51	1.1010	23.9	"	...	"
				20	21.2	11.0	52	48	1.1021	24.2		...	"
5063	Hills-Dale Brand Sliced Hawaiian. Emery Food Co., Chicago	2½	15	30	30.7	20.1	65	35	1.0903	21.6	10	2.01	"
				30	29.6	18.8	64	36	1.0854	20.5	8	2.35	"
				30	30.4	18.4	61	39	1.0815	19.6	9	2.04	"
5114	San Marcos Brand, Sliced, Eyeless, Coreless. D. E. Foote & Co., Baltimore, Md.	2	15	18	21.6	10.8	50	50	1.1183	27.6	12	0.90	Small, thin slices
				18	21.5	10.3	48	52	1.1271	29.5	12	0.86	" " "
				18	21.8	11.7	54	46	1.1146	26.8	12	0.98	" " "

TABLE XII:—CANNED FRUIT—*Continued.*

Station No.	Brand.	Can Size.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.	Weight of Drained Fruit.	Drained Fruit.	Liquid.	Spec. Gravity of Liquid @ 15.6° C.	Sugar in Liquid from Spec. Grav.	No. of Pieces of Fruit.	Av. Weight of Pieces of Fruit.	Quality.
			cts.	oz.	oz.	oz.	%	%		%		oz.	
5276	Nabob Sliced Hawaiian Francis H. Leggett & Co., Dist., New York	2	15	19	20.8	15.0	72	28	1.0884	21.2	8	1.88	Good
				19	20.8	15.2	73	27	1.0840	20.2	8	1.90	"
				19	20.6	15.0	73	27	1.0796	19.2	8	1.88	"
5083	Libby's Sliced Hawaiian. Libby, McNeill & Libby, Honolulu, Haw.	2	19	20	22.0	15.2	69	31	1.1265	29.4	8	1.90	"
				20	22.3	14.4	65	35	1.1323	30.6	8	1.80	"
				20	22.2	14.4	64	36	1.1338	30.9	8	1.80	"
5121	Wm. Maxwell Brand Grated, Not Eyeless. D. D. Mallory & Co., Baltimore, Md.	3	10	30	33.3	19.5	59	41	1.0244	6.2	grated	...	Eyes not removed; not sweet
				30	33.7	21.2	63	37	1.0238	6.0	"	...	" " " " "
				30	32.4	21.3	66	34	1.0273	6.9	"	...	" " " " "
5429	J. M. Brand Selected Quality Cubes. J. Menist, Dist., New York. Packed in Singapore, Straits Settlements	Odd	14	18	18.9	10.1	53	47	1.0705	17.1	21	0.48	Cubes
				18	19.6	11.5	59	41	1.0677	16.5	27	0.43	"
				18	18.7	11.5	62	38	1.0629	15.4	31	0.37	" ; some seeds
5105	Crown Brand Hawaiian Sliced. Dist. by Thomas Roberts & Co., Philadelphia	2	15	20	21.3	14.4	68	32	1.0861	20.6	11	1.31	Small fruit
				20	21.3	14.0	66	34	1.0887	21.2	10	1.40	" "
				20	20.6	14.4	70	30	1.0900	21.5	10	1.44	" "
5329	White Rose Brand Grated Hawaiian. Seeman Bros., Dist., New York	2	23	19	21.0	8.6	41	59	1.1034	24.4	grated	...	Good
				19	20.5	8.5	42	58	1.1039	24.5	"	...	"
				19	21.0	7.9	38	62	1.1079	25.4	"	...	"
5278	Hermitage Brand Sliced Hawaiian, Our Finest Quality. Packed for Stoddard, Gilbert & Co., New Haven	2	15	19	22.1	14.9	68	32	1.1148	26.9	8	1.86	"
				19	22.2	14.4	65	35	1.1247	29.0	8	1.80	"
				19	21.9	14.6	67	33	1.1159	27.1	8	1.83	"
5093	Robin Hood Brand Hawaiian Crushed. Dist. by R. C. Williams & Co., New York	2	20	19	20.7	10.2	49	51	1.0867	20.8	crushed	...	"
				19	21.0	10.0	48	52	1.0861	20.7	"	...	"
				20	21.3	8.6	40	60	1.0909	21.7	"	...	"
5274	Robin Hood Brand Hawaiian Sliced. R. C. Williams & Co., Dist., New York	2	20	19	21.1	14.4	68	32	1.0950	22.6	9	1.60	"
				19	21.1	14.2	67	33	1.0956	22.7	9	1.58	"
				19	20.6	12.8	62	38	1.1011	23.9	9	1.42	"
5095	Famous Royal Scarlet Brand Sliced Hawaiian. Dist. by R. C. Williams & Co., New York	2½	25	28	31.9	19.9	62	38	1.1091	25.7	8	2.49	"
				28	30.7	20.0	65	35	1.1047	24.7	8	2.50	"
				28	30.9	20.0	65	35	1.1073	25.3	8	2.50	"
	Plums.												
5322	Monogram Brand. American Fruit Products Co., Rochester, N. Y.	2½	18	29	31.4	17.5	56	44	1.0626	15.3	25	0.70	Soft
				29	31.3	18.0	58	42	1.0602	14.8	26	0.69	Good
				29	31.3	17.5	56	44	1.0633	15.5	23	0.76	"
5275	Mt. Hamilton Brand Green Gage California, Fancy Quality. California Fruit Canners Asso., San Francisco, Cal.	2½	18	30	31.3	15.8	50	50	1.0918	21.9	8	1.98	"
				30	31.0	15.1	49	51	1.0977	23.2	12	1.26	"
				30	31.8	17.6	55	45	1.0937	22.3	9	1.96	"

TABLE XII:—CANNED FRUIT—*Concluded.*

Station No.	Brand.	Can Size.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.	Weight of Drained Fruit.	Drained Fruit.	Liquid.	Spec. Gravity of Liquid @ 15.6° C.	Sugar in Liquid from Spec. Grav.	No. of Pieces of Fruit.	Av. Weight of Pieces of Fruit.	Quality.
			cts.	oz.	oz.	oz.	%	%		%		oz.	
5279	Pride of Egypt Brand Green Gage. Egypt Canning Co., Egypt, N. Y.	2	15	0	21.6	13.3	62	38	1.0620	15.2	19	0.70	Very soft
				0	21.4	11.1	52	48	1.0612	15.0	17	0.65	Soft
				0	21.2	11.0	51	49	1.0636	15.5	16	0.69	"
5432	Clover Orchard Brand Gage, in Syrup. Fruit Belt Pres. Co., East Williamson, N. Y.	2	13	20	21.5	8.8	41	59	1.0824	19.8	21	0.42	"
				20	21.7	9.4	43	57	1.0830	20.0	21	0.45	"
				20	21.5	9.2	43	57	1.0823	19.8	22	0.42	"
5273	Pickwick Club Brand California Egg, Extra Standard Quality. Golden Gate Packing Co., San José, Cal.	2½	22	30	32.2	15.2	47	53	1.0972	23.1	10	1.52	Very soft
				30	32.8	16.3	50	50	1.0964	22.9	10	1.63	" "
				30	33.0	17.1	52	48	1.1136	26.6	9	1.90	" "
5303	Sultana Brand. Put up for The Great Atl. & Pac. Tea Co., Jersey City, N. J.	2½	15	30	30.9	13.3	43	57	1.0843	20.2	20	0.67	Mushy
				30	31.9	15.6	49	51	1.0810	19.5	25	0.62	Good
				30	32.1	16.6	52	48	1.0780	18.8	43	0.39	Small fruit
5472	Bewley Brand Niagara Egg, in Syrup. Lockport Canning Co., Lockport, N. Y.	2	15	20	21.8	11.8	54	46	1.0638	15.6	18	0.66	Good
				20	21.9	12.6	57	43	1.0619	15.1	18	0.70	"
				20	21.7	11.4	52	48	1.0632	15.5	21	0.54	"
5444	Sodus Brand Red. Sodus Canning Co., Sodus, N. Y.	2	15	19	21.7	12.5	57	43	1.0655	15.8	19	0.66	"
				19	21.8	12.5	57	43	1.0667	16.3	22	0.57	"
				19	21.6	11.5	53	47	1.0689	16.8	18	0.64	"
5430	White Birch Brand. Sodus Canning Co., Sodus, N. Y.	2	12	22	21.4	10.5	49	51	1.0688	16.7	19	0.55	"
				22	21.6	12.3	57	43	1.0698	17.0	18	0.68	"
				22	21.6	12.3	57	43	1.0692	16.8	21	0.59	"
5425	Crescent Brand Lombard. The Springville Canning Co., Barker, N. Y.	2	12	20	21.3	11.6	54	46	1.0668	16.3	21	0.55	"
				20	21.5	12.6	58	42	1.0643	15.7	23	0.55	"
				20	21.4	11.8	55	45	1.0656	16.0	21	0.56	"
5110	Robin Brand Lombard. The Springfield Canning Co., Barker, N. Y.	2	10	20	21.7	12.5	58	42	1.0741	17.9	26	0.48	"
				20	21.6	12.4	57	43	1.0736	17.8	26	0.48	"
				20	21.5	12.0	56	44	1.0723	17.5	25	0.48	"
5451	Hermitage Brand. Stoddard, Gilbert & Co., Dist., New Haven	In glass	25	18	23.4	10.9	46	54	1.1456	33.3	19	0.57	Very fine
				18	23.1	12.3	53	47	1.1303	30.1	25	0.49	" "
				18	22.6	12.4	55	45	1.0986	23.4	21	0.59	" "

APPLES.

All of the 18 samples were packed in No. 3 cans. One brand claimed 29 oz. net weight, all the others 30 oz. All the brands satisfied these claims except **5479**, *Social Brand*, the three cans containing 29.5, 29.8 and 28.8 oz., although 30 oz. were claimed. The net weight in the eighteen cans ranged from 29.5 to 33.7 oz.

The drained solids constituted from 50 to 71 per cent, average 63 per cent by weight, of the total contents. Apparently sugar is not added to canned apples in any considerable quantity, the percentages found in the liquid portion being very uniform, ranging from 6.4 to 8.1 per cent.

The size and quality of the fruit packed showed a wide range. In some brands fine large fruit, in others small fruit, practically culls, were used. The number of pieces per can ranged from 11 to 43, while the average weight of the pieces ranged from 0.51 to 1.62 oz. The *Mt. Parnassus* and *Robin Hood* brands contained many small pieces of various sizes and shapes.

The cost per can ranged from 10 to 15 cents.

The following is a summary for the 18 cans of apples:

	Max.	Min.	Av.
Net weight claimed, oz.	30	29	29.8
" " found, oz.	33.7	29.5	31.7
Weight of drained fruit, oz.	22.8	17.0	20.1
Per cent of drained fruit, oz.	71	50	63
Per cent of sugar in liquor	8.1	6.4	7.6
No. of pieces of fruit	43	11	30
Ave. weight of pieces of fruit, oz.	1.62	0.51	0.75
Cost per can, cents	15	10	12

APRICOTS.

One brand was packed in odd-sized cans, containing 17.7 oz. of material. The other 18 samples were in No. 2½ cans. **5426**, *Famous Royal Scarlet Brand,* bore no statement of net weight. Of the other 15 samples all but three satisfied their claims of from 30 to 32 oz., **5473**, *Davisco Brand,* containing only 29.9, 31.3 and 31.6 oz., although 32 oz. were claimed. The net weight of material in the No. 2½ cans ranged from 29.9 to 33.1 oz.

The drained fruit in No. 2½ cans made up from 52 to 63 per cent of the total contents and the sugar in the liquor ranged from 23.2 to 27.1 per cent.

The size and quality of the fruit was much more uniform than in the case of apples. In two brands the fruit was rather soft, and in two the skins had not been removed. The cans contained from 19 to 23 pieces of fruit, weighing from 0.46 to 0.53 oz. per piece.

The cost of No. 2½ cans ranged from 25 to 28 cents.

The following is a summary for the 18 samples packed in No. 2½ cans:

	Max.	Min.	Av.
Net weight claimed, oz.	32	30	30.3
" " found, oz.	33.1	29.9	32.0
Weight of drained fruit, oz.	20.0	16.6	18.2
Per cent of drained fruit	63	52	57
Per cent of sugar in liquor	27.1	23.2	25.0
No. of pieces of fruit	23	19	20
Ave. weight of pieces of fruit, oz.	0.53	0.46	0.49
Cost per can, cents	28	25	25.5

CHERRIES.

Three samples were packed in No. 1 cans, thirty-three in No. 2, twenty-one in No. 2½, and three in odd-sized cans. **5431**, *White Birch Brand Red Cherries,* in No. 1 cans, although claiming 19 oz. net weight, contained only 11.7, 11.9 and 11.7 oz. Probably this shortage was not intentional, but arose from using the wrong labels on this particular lot. The cherries in this brand were of good quality and made up 60 per cent of the total contents of the can.

The 33 samples packed in No. 2 cans claimed from 18 to 21 oz. net weight. Six samples bore no statement of net weight, and one can of **5332**, *Oval Brand,* showed a slight shortage of 0.3 oz. The net weight in all the No. 2 samples ranged from 20.7 to 23.0 oz. The weight of drained fruit in No. 2 cans ranged from 45 to 72 per cent of the total contents. In six samples the drained solids amounted to less than 50 per cent, although in all of these the quality of the fruit was good. The percentage of sugar in the liquor in this size cans showed a wide range from 13.4 to 44.4 per cent, and the cost from 15 to 25 cents per can.

Twenty-one samples were packed in No. 2½ cans. **5334**, *Noreca Brand,* bore no statement of net weight. One can of **5069**, *Red Line,* contained 0.3 oz. less than claimed. The claimed weight ranged from 29.7 to 32.9 oz. The weight of drained solids in cans of this size ranged from 52 to 69 per cent of the total contents; the sugar in the liquor from 7.2 to 28.4 per cent; and the cost of the cherries ranged from 15 to 30 cents per can.

The three cans packed in odd sizes claimed a net weight of 15 oz., and actually averaged 17 oz.

The cherries were not counted, but they ranged from fine large cherries to small, partially rotten fruit. One can of **5277**, *Pride of Egypt Brand,* was blown, and two cans of **5069**, *Red Line,* showed some gas on opening. The three cans of **5084**, *Webster's*

Best Brand, contained several cherries with rotten spots. **5183**, *White Birch Brand White,* showed one can of white cherries, the other two being of a faded lavender color, showing carelessness in picking or branding.

The following is a summary for the 33 samples packed in No. 2 cans and the 21 samples in No. 2½ cans:

	No. 2 Cans. Max.	Min.	Av.	No. 2½ Cans. Max.	Min.	Av.
Net weight claimed, oz.	21	18	19.8	30	30	30
" " found, oz.	23.0	20.7	21.6	32.9	29.7	31.5
Weight of drained fruit, oz.	15.4	9.9	11.9	21.8	16.6	18.7
Per cent of drained fruit	72	45	56	69	52	61
Per cent of sugar in liquor	44.4	13.4	22.6	28.4	7.2	19.1
Cost per can, cents	25	15	17	30	15	24

Peaches.

Six samples of sliced peaches were examined, three being packed in No. 2 cans and three in cans of an odd size. The former, **5055**, *American Club Brand,* bore no statement of net weight, and contained on the average 22.7 oz. In this brand the fruit made up 73 per cent of the contents, while in the other brand of sliced peaches, **5328**, *Robin Hood Brand,* only 58 per cent was fruit. Likewise **5055** contained 31.7 per cent of sugar in the liquor, while **5328** contained only 17.5 per cent. The price of the former was 22 cents per can, that of the latter 15 cents.

Three samples of halved fruit were packed in No. 2 cans. These claimed 20 oz. net weight and contained 21.1 oz. The drained fruit made up 73 per cent of the contents and the percentage of sugar in the liquor was 31.7.

Most of the samples of halved fruit were packed in No. 2½ cans. Of the 57 thus packed, 52 satisfied the claims as to net weight. One can of **5182**, *Polo Brand,* contained 28.8 oz. against 30 oz. claimed; two cans of **5094**, *White Top Brand,* contained 29.2 and 29.6 oz. against 30 oz. claimed; while two cans of **5315**, *Atlas Brand,* bore no statement of weight. The net weight claimed ranged from 28 to 31 oz.; the actual weight from 29 to 32.5 oz. The weight of drained fruit ranged from 54 to 75 per cent and the sugar in the liquor from 8.1 to 30.8 per cent. The number of pieces of fruit in the can ranged from 6 to 25, with a corresponding variation in weight from 0.82 to 3.07 oz. The quality of the fruit likewise was quite variable, in some cases the fruit being overripe, in others of poor appearance but of excellent flavor, while in still others fine appearing fruit was

deficient in flavor. The cost in No. 2½ cans ranged from 15 to 25 cents.

The following is a summary for the 57 samples packed in No. 2½ cans:

	Max.	Min.	Av.
Net weight claimed, oz.	31	28	29.7
" " found, oz.	32.5	29.0	30.5
Weight of drained fruit, oz.	22.4	15.8	19.8
Per cent of drained fruit	75	54	65
Per cent of sugar in liquor	30.8	8.1	17.8
No. of pieces of fruit	25	6	12
Ave. weight of pieces of fruit, oz.	3.07	0.82	1.71
Cost per can, cents	25	15	20

Pears.

Forty-five samples were packed in No. 2 cans. **5488**, *Monroe Brand,* bore no statement of net weight. Two cans of **5270**, *Triacan Brand,* contained 20.5 and 20.6 oz., 21 oz. being claimed. The claimed net weight in 42 samples ranged from 18 to 21 oz., the actual weight from 19.8 to 21.9 oz. The weight of drained solids ranged from 49 to 73 per cent of the can contents. The sugar in the liquor ranged from 10.9 to 21.6 per cent. The number of pieces of fruit from 7 to 23, and the weight of the pieces from 0.54 to 1.71 oz. The cost in No. 2 cans ranged from 8 to 15 cents.

Three samples were packed in No. 2½ cans. These claimed a net weight of 31 oz., 31.4 oz. being found. The drained fruit made up 73 per cent of the sample, and an average of 20 pieces was present, weighing 1.14 oz. These samples cost 24 cents per can.

Twelve samples were packed in No. 3 cans. Nine claimed a net weight of 32 oz., and three 35 oz. All satisfied the claims made, the net weight ranging from 33.9 to 37.5 oz., average 36.2 oz. The drained fruit ranged from 17.9 to 25.6 oz., or from 50 to 69 per cent. The sugar in the liquor ranged from 9.9 to 19.4 per cent, the number of pieces of fruit from 10 to 28, and the weight from 0.67 to 1.79 oz. Pears in cans of this size cost from 10 to 15 cents.

The quality of the pears was not always good. In **5283** the fruit was rather hard; in **5330** the pears were mushy, one piece was partly rotten and there was dirt in the bottom of the cans; in one can each of **5115** and **5065** rotten spots were present; in **5300** many small pieces were present some of which had rotten spots; in **5104** rotten spots were present; **5062** consisted chiefly of small pieces and trimmings, with a core and a few seeds; in **5486** the fruit was quite soft, a piece in one can showing a rotten spot; in **5059** one can was blown (fermented), the other two containing fruit with rotten spots, and the cans having a fishy odor; in **5488** dirt was present; and in **5184** many raspberry seeds.

The following is a summary for the 45 samples in No. 2 cans and the 12 in No. 3 cans:

	No. 2 Cans.			No. 3 Cans.		
	Max.	Min.	Av.	Max.	Min.	Av.
Net weight claimed, oz.	21	18	19.4	35	32	32.8
" " found, oz.	21.9	19.8	21.0	37.5	33.9	36.2
Weight of drained fruit, oz.	14.9	9.9	12.8	25.6	17.9	20.3
Per cent of drained fruit	73	49	62	69	50	56
Per cent of sugar in liquor	21.6	10.9	16.5	19.4	9.9	13.9
No. of pieces of fruit	23	7	14	28	10	16
Ave. weight of pieces of fruit, oz.	1.71	0.54	0.91	1.79	0.67	1.37
Cost per can, cents	15	8	13.5	15	10	13.5

PINEAPPLES.

Twenty-seven samples of sliced pineapple in No. 2 and 2½ cans, 12 of grated pineapple in No. 2 and 3 cans, and three of pineapple cubes in an odd-sized can, were examined.

The samples in cube form claimed a net weight of 18 oz., and an average of 19.1 oz. was found.

All of the samples of sliced pineapple in No. 2 cans satisfied their claimed net weight, which ranged from 18 to 20 oz., while the actual weight ranged from 20.6 to 22.3 oz. The drained fruit ranged from 48 to 73 per cent of the can contents; three samples contained less than 55 per cent of drained fruit, while all of the other samples contained over 60, and most of them over 65 per cent. The number of slices ranged from 7 to 12, depending chiefly on the size of the fruit. The average weight of the slices ranged from 0.86 to 1.86 oz., the samples showing considerable uniformity except **5114**, *San Marcos Brand,* in which small, thin slices were present with an average weight of only 0.91 oz., about one-half that found in the other samples. The sugar in the liquor ranged from 19.2 to 30.9 per cent, and the cost of the No. 2 cans from 15 to 20 cents.

All but one of the six samples of sliced pineapple in No. 2½ cans satisfied their claimed net weight, one can of **5063**, *Hills-Dale Brand,* being 0.4 oz. short weight. The claimed net weight

ranged from 28 to 30 oz., that found from 29.6 to 31.9 oz. The drained fruit ranged from 61 to 65 per cent of the can contents. The number of slices was very uniform, ranging from 8 to 10, the average weight per slice from 2.01 to 2.50 oz., the sugar in the liquor from 19.6 to 25.2 per cent, and the cost of these samples from 15 to 25 cents per can.

All of the 9 samples of grated or crushed pineapple in No. 2 cans satisfied their claimed net weights of 19 or 20 oz. The actual weights ranged from 20.5 to 21.5 oz., and the drained fruit from 7.9 to 11.0 oz., or from 29 to 52 per cent of the can contents. The three different brands averaged 51, 40 and 46 per cent of the drained fruit, the sugar in the liquid ranged from 20.7 to 25.4 per cent, and the cost of the grated fruit in No. 2 cans from 20 to 23 cents.

Three cans of grated pineapple in No. 3 cans claimed 30 oz. net weight, from 32.4 to 33.7 oz. being found. The drained fruit ranged from 19.5 to 21.3 oz., or from 59 to 66 per cent. The sugar in the liquor was very low, ranging from 6.0 to 6.9 per cent, and the eyes had not been removed. This fact was plainly stated on the label, and coupled with the low price of 10 cents per can, indicated that the preparation was not intended by the manufacturer to be a high-grade product.

The following is a summary for the 21 samples of sliced pineapple in No. 2 cans, for 6 samples of sliced in No. 2½ cans, for 9 samples of grated in No. 2 cans, and for 3 samples of grated in No. 3 cans.

	Sliced.					
	No. 2 Cans.			No. 2½ Cans.		
	Max.	Min.	Av.	Max.	Min.	Av.
Net weight claimed, oz.	20	18	19.3	30	28	29
" " found, oz.	22.3	20.6	21.4	31.9	29.6	30.7
Weight of drained fruit, oz.	15.2	10.3	13.8	20.1	18.4	19.5
Per cent of drained fruit	73	48	65	65	61	64
Per cent of sugar in liquor	30.9	19.2	24.6	25.7	19.6	22.9
No. of pieces of fruit	12	7	9	10	8	9
Ave. weight of pieces of fruit, oz.	1.86	0.86	1.63	2.50	2.01	2.31
Cost per can, cents	20	15	16	25	15	22.5
	Grated.					
Net weight claimed, oz.	20	19	19.3	30	30	30
" " found, oz.	21.5	20.5	21.0	33.7	32.4	33.1
Weight of drained fruit, oz.	11.0	7.9	9.5	21.3	19.5	20.7
Per cent of drained fruit	52	38	45	66	59	63
Per cent of sugar in liquor	25.4	20.7	23.3	6.9	6.0	6.4
Cost per can, cents	23	20	21	10	10	10

PLUMS.

Twenty-one samples of plums were packed in No. 2 cans, twelve in No. 2½ cans, and three in glass jars, about equivalent to No. 2 cans.

The three samples in glass claimed a net weight of 18 oz., an average of 23 oz. being found. The drained fruit ranged from 10.9 to 12.4 oz., or from 46 to 55 per cent. The sugar in the liquor was high, ranging from 23.4 to 33.3 per cent, and the number of plums ranged from 19 to 25, weighing from 0.49 to 0.59 oz. These samples were plums of a very fine quality packed in a rather heavy syrup.

Three samples packed in No. 2 cans bore no statement of net weight. The other eighteen samples of this size claimed from 19 to 22 oz., all but the three cans of **5430**, *White Birch Brand,* satisfying their claims; the latter samples showed deficiencies of 0.6, 0.4 and 0.4 oz. The net weight in the 21 samples ranged from 21.2 to 21.9 oz., and the drained fruit from 41 to 62 per cent, four samples containing less than 50 per cent. **5432**, *Clover Orchard Brand,* averaged only 42 per cent, compared with 55 per cent in the other brands. The sugar in the liquor ranged from 15 to 20 per cent; the number of plums from 16 to 26; and the average weight of the fruits from 0.42 to 0.70 oz. The cost of No. 2 cans ranged from 10 to 15 cents.

The twelve samples packed in No. 2½ cans satisfied their claimed net weights of from 29 to 30 oz., the actual weights ranging from 30.7 to 33.0 oz. The drained fruit ranged from 43 to 58 per cent. **5303**, *Sultana Brand,* averaged only 48 per cent of drained fruit, about 5 per cent less than the other brands. The sugar in the liquor ranged from 14.8 to 26.6 per cent, the number of plums from 8 to 43, and the average weight of the fruits from 0.39 to 1.98 oz. The three cans of **5303**, *Sultana Brand,* contained 20, 25 and 43 plums, the last being very small fruit. The cost of cans of this size ranged from 15 to 22 cents.

Aside from the great variations in size, in some of the samples the fruit was very soft and mushy, and by no means of attractive appearance.

The following is a summary for the 21 samples packed in No. 2 cans, and for the 12 packed in No. 2½ cans:

	No. 2 Cans.			No. 2½ Cans.		
	Max.	Min.	Av.	Max.	Min.	Av.
Net weight claimed, oz.	22	19	20.2	30	29	29.8
" " found, oz.	21.9	21.2	21.6	33.0	30.7	31.8
Weight of drained fruit, oz.	13.3	8.8	11.6	18.0	13.3	16.3
Per cent of drained fruit	62	41	53	58	43	51
Per cent of sugar in liquor	20.0	15.0	16.8	26.6	14.8	20.3
No. of pieces of fruit	26	16	21	43	8	18
Average weight of fruits, oz.	0.70	0.42	0.57	1.98	0.39	1.17
Cost per can, cents	15	10	13	22	15	18

GRAHAM FLOUR.

Standard Graham Flour "is made from well cleaned and dusted wheat, but not bolted."

Many of the so-called Graham-flours on the market are imitation products made from various mixtures of bran or middlings with flour. A true Graham flour is characterized by a higher ash and fiber content than ordinary wheat flour. Owing to the variation in composition of the various wheats, mere chemical data are not always sufficient to differentiate between true and imitation Graham flour. A mechanical separation of the bran, shorts and middlings in the flour affords valuable criteria for judgment, but not having the proper appliances for this separation we were obliged to omit it in the present examination, which was concerned more with the food value of the flours than with their genuineness.

Without attempting to judge the ten samples examined too strictly, **5117** appears to contain much lower percentages of ash and fiber than found in genuine Graham flour. The high ash in **5470** is due to the leavening chemicals used.

5116 was not labeled as Graham flour but as "Coarse Flour" "prepared with bran for making coarse bread." However, it was sold by the dealer to our agent in answer to a request for Graham flour.

5293 was similarly sold, although the label frankly declares the removal of a "portion of bran and coarser particles." This brand and the one last referred to showed more protein than any of the other samples.

The samples generally showed a tendency towards short weight.

TABLE XIII:—GRAHAM FLOUR.

Station No.	Brand.	Net Weight. Claimed.	Net Weight. Found.	Price. Per Package.	Price. Per Pound.	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Ether Extract.
		oz.	oz.	cts.	cts.						
5471	Sunbeam Pure Food Hygienic Graham Flour. Austin, Nichols & Co., New York	48	48.1	15	5.0	11.78	1.50	10.56	1.68	72.44	2.04
5470	Obelisk Self-Rising Whole Wheat Graham Flour. Ballard & Ballard Co., Louisville, Ky.	*28	28.7	10	5.6	9.14	6.63	11.25	1.88	69.22	1.88
4470	Banner Graham Flour. Banner Milling Co., Buffalo, N. Y.	80	77.2	25	5.2	11.87	1.96	12.75	2.52	68.92	1.98
5117	Pure Fresh Ground Health Graham Flour. Dayton Milling Co., Towanda, Pa.	..	77.4	18	3.7	10.11	1.13	10.19	1.05	75.96	1.56
5345	Pure Genuine Crescent Graham Flour. Farwell & Rhines, Watertown, N. Y.	*80	73.5	40	8.7	9.45	1.58	10.44	1.85	74.67	2.01
4471	Grandmother's A. & P. Graham Flour. The Great Atl. & Pac. Tea Co., New York	56	55.4	15	4.3	11.86	1.89	13.88	1.83	67.71	2.83
5292	Pure Wheat Graham Flour. The Hecker Cereal Co., New York	*56	55.8	16	4.6	10.12	1.93	13.38	2.18	70.46	1.93
5116	†Big "G" Brand Hygienic Coarse Flour. Potter & Wrightington, Boston, Mass.	*80	79.0	25	5.1	9.42	2.35	16.94	2.13	65.53	3.63
5293	‡Schumacher XXX Graham Flour. The Quaker Oats Co., Chicago	80	78.8	25	5.1	9.92	1.83	16.44	1.88	67.25	2.68
4472	Fancy Graham Flour. Thornton & Chester Mill Co., Buffalo, N. Y.	*80	79.6	18	3.6	12.00	1.79	12.25	2.02	69.53	2.41

† "Prepared with bran for making coarse bread."
‡ "With portion of bran and coarser particles removed."

* Weight when packed.

INFANT FOODS.

In 1908 this station examined all of the special foods for infants for sale in this state. The examination has been repeated this year, first, to determine the uniformity in composition of these foods at widely separated intervals, and second, to determine the changes which the foods as sold undergo in the process of preparation directed by the manufacturer. It is obvious that it is not fair to a manufacturer to condemn his food because ordinary methods of analysis show large percentages of unaltered starch, when if his directions for preparation are carried out most, if not all, of the starches may be converted into soluble forms.

Of the 27 brands examined all except the four *Cereo* preparations, the two barleys, *A. D. S. Malted Milk* and *Lacnut* were also examined in 1908.

DESCRIPTION OF SAMPLES AND CLAIMS MADE FOR THEM.

5290. *A. D. S. Malted Milk.* American Druggists' Syndicate, New York. "A scientifically prepared milk food." "Prepared by adding water only. No cooking required." Price 15 cents per 2 oz.

5437. *"Allenburys" Milk Food No. 1.* Allen & Hanburys, London, Eng. "An efficient substitute for mother's milk." "Specially adapted to the first 3 months of infant life." "Made from carefully tested cows' milk, so modified as to present all the constituents of human milk in their true relative proportions." Price 45 cents for 9.7 oz.

5436. *"Allenburys" Milk Food No. 2.* Allen & Hanburys, London, Eng. "Closely resembling the mother's milk." "Specially adapted to the second 3 months of infant life." "Contains all the elements of human milk in their natural proportions. To these is added a small proportion of the soluble product of the action of malt upon wheat." "Absolutely free from starch in the unaltered conditions." "Also free from an excess of casein." Price 43 cents for 10 oz.

5466. *"Allenburys" Malted Food No. 3.* Allen & Hanburys, London, Eng. "A cooked food, ready for use without either boiling or straining." "An improved form of malted food." Price 30 cents for 12 oz.

5298. *Benger's Food.* Benger's Food, Manchester, Eng. "A farinaceous food containing in itself a natural digestive principle which changes the farinaceous material into soluble substances." Price 21 cents for 4.7 oz.

5434. *Borden's Malted Milk. Eagle Brand.* Borden's Condensed Milk Co., New York. "A perfected Milk Food, wholesome and delicious, prepared by the most improved process whereby all the nutritive elements of the richest cows' milk and strengthening cereals are scientifically combined." Price 39 cents for 8.5 oz.

5469. *Brooks' Baby Barley.* Brooks Barley Co., Boston, Mass. Price 25 cents for 16.4 oz.

5440. *Carnrick's Lacto-Preparata.* Reed and Carnrick, Jersey City, N. J. "A prepared Human Milk for Infants." "Is the nearest approach to Mother's Milk that can ever be produced and remain permanent." "Is prepared from cow's milk so as to perfectly resemble human milk solids in food value and digestibility. It is necessary to mix this food with water only to represent human milk." Price 45 cents for 8.3 oz.

5441. *Carnrick's Soluble Food.* Reed & Carnrick, Jersey City, N. J. "Is rich in flesh, muscle and brain forming elements." "In diabetes, diarrhoea, phthisis and pregnancy it is the food 'par excellence'." Price 90 cents for 20 oz.

5438. *Cereal Milk.* Wells, Richardson & Co., Burlington, Vt. "A predigested food." "Made of whole Vermont dairy milk, pure sugar of milk, the finest wheat gluten flour, so combined with malt diastase that no free starch is present. It is a complete food, thoroughly cooked, and the simple addition of water makes it ready for use." Price 25 cents for 2.3 oz.

5384. *Cereo Gruel Flour, Barley.* Cereo Co., Tappan, N. Y. "Each ounce yields about 3.9 gms. of Protein and 109 Calories and imparts to a quart of gruel or food about 0.48% protein and 2.4% Carbohydrates." Price 25 cents for 16.4 oz.

5382. *Cereo Gruel Flour, Oat.* Cereo Co., Tappan, N. Y. "Each ounce yields about 4.5 gms. of Protein and 115 Calories and imparts to a quart of gruel or food about 0.48% Protein and 2.4% Carbohydrates." Price 25 cents for 16.7 oz.

5383. *Cereo Gruel Flour, Wheat.* Cereo Co., Tappan, N. Y. "Each ounce yields about 3.4 gms. of Protein and 107 Calories and imparts to a quart of gruel or food about 0.40% Protein and 2.5% Carbohydrates." Price 25 cents for 16.3 oz.

5280. *Eskay's Albumenized Food.* Smith, Kline & French Co., Philadelphia, Pa. "Contains egg albumen together with other food principles that upbuild tissues, and when prepared for use with fresh cows' milk forms an invaluable substitute for healthy human milk." Price 20 cents for 4 oz.

5282. *Horlick's Malted Milk.* Horlick's Malted Milk Co., Racine, Wis. "Composed of an extract of selected wheat flour and barley malt and rich pasteurized cows' milk. The starch is converted into soluble dextrin and maltose." Price 39 cents for 6.9 oz.

5295. *Imperial Granum Food.* The Imperial Granum Co., New York. "A pure unsweetened food derived from the finest growths of wheat, rendered by a special process capable of being thoroughly assimilated by the weakest stomach with least tax on the digestive organs." Price 25 cents for 4.4 oz.

5291. *Justfood (Just's Dietetic Cereal Food).* Justfood Co., Syracuse, N. Y. "Intended for use with fresh milk with which it forms a complete and perfect food for all ages." "Prepared from selected barley malt, wheat and corn." "Free from cane sugar, sugar of milk, dried milk and raw starch." Price 50 cents for 10 oz.

5534. *Lacnut.* Lacnut Food Co., Battle Creek, Mich. "The Milk of Nuts." "The Nearest Approach to Mother's Milk." "A preparation of almonds and other nuts especially designed for infants." "The composition is nearly identical with that of mother's milk, which it more clearly resembles in its properties than does any other food." Price one dollar for 23.6 oz.

5442. *Lactated Food for Infants and Invalids.* Wells, Richardson & Co., Burlington, Vt. "Containing the most important elements of mother's milk with the nutritive principles of the cereal grains." Price 25 cents for 5.3 oz.

5489. *Meadow Brand Malted Milk.* Borden's Condensed Milk Co., New York. "Made from full-cream milk and choice cereals, malted." Price 45 cents for 7.4 oz.

5381. *Mellazea.* Cereo Co., Tappan, N. Y. "A cereal product derived from *Zea mays.*" "Is highly nutritious, digests with great ease and is readily assimilated." "Each ounce yields about 2 gms. of Protein and 105 Calories and imparts to a quart of gruel or food about 0.28% Protein and 2.5% Carbohydrates." Price 25 cents for 16.4 oz.

5289. *Mellin's Food for Infants and Invalids.* Mellin's Food Co. of No. America, Boston, Mass. "Carefully and scientifically prepared from barley malt and wheat." "Does not contain starch, dried milk, cane sugar, nor any other element indigestible or undesirable for an infant's food, but, on the contrary, it does contain all the elements which are necessary for the proper nourishment and development of a baby's body." Price 50 cents for 5.4 oz.

5281. *Nestlé's Food.* Henri Nestlé, Vevey, Switz. "A perfect nutriment for infants, children and invalids, the basis of which is the best cows' milk." "A compound of milk, baked flour, barley malt and sugar only." "In its composition shows a close resemblance to mother's milk." Price 19 cents for 6.3 oz.

5467. *Peptogenic Milk Powder.* Fairchild Bros. & Foster, New York. "Modifies Cows' milk so that it become practically identical with mother's milk." "Does not contain starch, glucose, cane sugar or malt sugar." "Contains no digestive ferment, no aid to digestion." Price 50 cents for 7.8 oz.

5297. *Ridge's Food.* Ridge's Food Co., Boston, Mass. "The Milk Modifier." "Made from selected cereals, milk sugar and soluble salts." Price 21 cents for 8.8 oz.

5435. *Robinson's Patent Barley for Infant's Food, Barley Water and Pudding.* Keen, Robinson & Co., London, Eng.

5439. *Wampole's Milk Food.* Henry K. Wampole & Co., Philadelphia, Pa. "Malted cereals, beef and milk with wheat phosphates." Price 45 cents for 7.8 oz.

TABLE XIV:—INFANT FOODS.

Station No.	Brand.	Water.	Fat.	Fiber.	Ash.	Protein (N x 6.25).	Nitrogen-free Extract.	Starch.	Reducing Sugars, as Dextrose. Direct.	After Inversion.	Water-Soluble. Total.	Protein.	Ash.	Carbo-hydrates
5290	A. D. S. Malted Milk	5.93	6.75	0.13	3.08	14.06	70.05	None	30.64	70.12	77.82	7.81	3.04	66.97
5437	"Allenburys" Milk Food No. 1	4.98	13.80	0.00	3.98	9.88	67.36	None	35.56	61.52	73.92	7.19	3.93	62.80
5436	" Milk Food No. 2	4.20	14.20	0.08	3.70	9.75	68.07	None	35.80	64.84	77.32	7.25	3.67	66.40
5466	" Malted Food No. 3	8.58	0.78	0.15	1.18	9.38	79.93	60.92	6.92	14.56	20.96	2.38	1.04	17.54
5298	Benger's Food	10.55	0.83	0.15	1.00	10.75	76.72	57.66	2.68	8.24	19.16	8.50	0.97	9.69
5434	Borden's Malted Milk, Eagle Brand	5.18	7.15	0.05	3.45	15.38	68.79	None	29.64	67.80	77.32	8.88	3.14	65.30
5469	Brooks' Baby Barley	9.88	1.03	0.28	0.88	8.69	79.24	68.51	0.72	3.48	7.36	1.50	0.74	5.12
5440	Carnrick's Lacto-Preparata	2.90	1.60	0.03	3.38	13.63	78.46	None	49.12	74.80	84.44	6.63	3.01	74.80
5441	" Soluble Food	1.87	1.05	0.45	1.30	12.44	82.89	25.99	19.24	49.52	57.58	2.94	1.19	53.45
5438	Cereal Milk	5.10	3.55	0.08	2.38	11.00	77.89	1.74	36.72	73.00	78.72	4.56	2.21	71.95
5384	Cereo Gruel Flour, Barley	9.75	2.03	0.43	1.48	14.88	71.43	58.39	0.76	5.20	10.24	1.56	1.13	7.55
5382	" " " Oat	8.78	6.40	0.88	2.53	16.88	64.53	56.31	0.12	2.36	5.24	0.69	0.77	3.78
5383	" " " Wheat	8.78	1.30	0.10	0.48	12.81	76.53	67.61	0.84	3.32	7.68	2.56	0.24	4.88
5280	Eskay's Albumenized Food	3.08	1.28	0.33	1.58	7.75	85.98	31.95	31.60	48.88	51.12	0.69	1.24	49.19
5282	Horlick's Malted Milk	2.03	8.10	0.15	4.00	15.00	70.72	None	30.28	68.88	77.56	7.88	3.64	66.04
5295	Imperial Granum Food	6.23	0.50	0.18	0.50	13.88	78.71	72.79	0.40	2.12	3.36	0.94	0.42	2.00
5291	Justfood	6.95	0.03	0.10	0.30	0.63	91.99	3.32	14.80	95.84	91.24	0.63	0.31	90.30
5534	Lacnut	3.75	31.30	1.15	2.10	22.19	39.51	2.31	12.04	37.08	41.34	3.88	1.38	36.08
5442	Lactated Food	8.53	0.55	0.10	0.88	8.81	81.13	47.93	16.92	28.52	31.54	1.00	0.67	29.87
5489	Meadow Brand Malted Milk	3.20	5.20	0.30	3.28	14.50	73.52	None	31.52	71.04	79.84	8.50	3.25	68.09
5381	Mellazea	10.48	2.20	0.40	0.60	5.75	80.57	74.36	0.84	1.60	2.50	0.44	0.44	1.62
5289	Mellin's Food	2.98	1.80	0.20	4.45	11.31	79.26	None	34.24	77.64	84.50	5.13	4.10	75.27
5281	Nestlé's Food	3.65	5.70	0.18	1.45	11.94	77.08	20.25	13.88	50.24	61.60	4.88	1.24	55.48
5467	Peptogenic Milk Powder	2.50	0.03	0.10	1.43	0.19	95.75	None	64.48	90.32	92.42	0.19	1.34	90.89
5297	Ridge's Food	9.43	0.33	0.18	0.75	10.31	79.00	70.93	0.80	2.96	5.04	1.44	0.48	3.12
5435	Robinson's "Patent Barley"	10.58	1.40	0.23	0.85	6.75	80.19	70.20	0.92	2.92	5.70	0.81	0.58	4.31
5439	Wampole's Milk Food	1.65	5.25	0.15	4.83	9.19	78.93	None	28.76	66.84	76.56	7.50	3.92	65.14

COMPARATIVE COMPOSITION IN 1908 AND 1915.

The differences in composition shown by the various brands in the two inspections seven years apart as a rule were not great. The main variations shown by the later analyses were as follows:—

Allenburys Malted Food No. 3; 2% less protein, 6% less starch.
Benger's Food; 1.25% less protein.
Borden's Malted Milk; 1% more fat, 2% more protein.
Carnrick's Lacto-Preparata; 2% more protein.
Carnrick's Soluble Food; 10% more starch.
Eskay's Albumenized Food; 1% more protein, 3.5% more starch.
Horlick's Malted Milk; 2% more protein.
Lactated Food; 6% more starch.
Meadow Malted Milk; 1% more each of protein and fat.
Nestlé's Food; 4% more starch.
Ridge's Food; 1% less fat, 1.5% less protein, 2% more starch.
Wampole's Milk Food; 6% less protein.

INSPECTION OF 1915.

The preparations examined may be divided roughly into five classes; first, those prepared from cow's milk with various additions or alterations, and prepared for use simply by the addition of water; second, farinaceous foods, in which the starch has been partly, or wholly, converted into malt sugar or dextrin, and which are fed with cow's milk; third, cereal preparations, to which an enzyme preparation is added at the time of preparation for feeding; fourth, barley products for the preparation of barley water; and fifth, miscellaneous preparations.

The first group, or those which are prepared from cow's milk with various amendments, includes

A. D. S. Malted Milk.	Horlick's Malted Milk
Allenburys' Milk Food No. 1	Lactated Food
" " " No. 2	Meadow Malted Milk
Borden's Malted Milk	Cereal Milk
Carnrick's Lacto-Preparata	Nestlé's Food
" Soluble Food	

In these eleven brands the protein ranges from 8.8 to 15.4 per cent, and the fat from 0.6 to 14.2 per cent, showing the wide difference of opinion among manufacturers as to the proper food for infants. While seven of the brands contain no starch, *Cereal Milk* contains a small amount, and *Nestlé's Food, Carnrick's Soluble Food* and *Lactated Food* contain 20, 26 and 48 per cent of starch, respectively. These last three foods likewise show low water-solubilities, namely, 62, 58 and 32 per cent, while in the other eight brands of this group from 74 to 84 per cent of water-soluble material is present. While the ash in all the brands was almost completely soluble in water, the protein showed a wide range of water-solubility, the extremes being *Lactated Food* with 11 per cent and *Allenburys' Milk Food No. 2* with 74 per cent. The two *Allenburys'* preparations contained much more fat than any of the others.

The second group, farinaceous foods in which the starch had been rendered more or less soluble, includes

Allenburys' Malted Food No. 3	Justfood
Benger's Food	Mellin's Food
Imperial Granum	Ridge's Food

In four of these foods a malting process has been employed, in *Benger's Food* a pancreatic enzyme is claimed to be present, while in *Ridge's Food* dependence for the starch conversion has apparently been placed on simple baking. A characteristic of these foods is their low content of fat, *Mellin's Food* with 1.8 per cent being the only one containing more than 0.8 per cent (it must be remembered, however, that all of these are directed to be used in conjunction with milk). These are essentially carbohydrate foods, the protein in five brands ranging from 9.4 to 13.9 per cent, while in *Justfood* only 0.63 per cent of protein is present, this food consisting almost entirely of soluble carbohydrates and water. *Mellin's Food* contains no starch and *Justfood* about 3 per cent, while the other four brands contain from 58 to 73 per cent. The extent to which this starch is converted into soluble forms at the time of the food's preparation will be discussed on a later page. In the foods as analyzed the starch conversion has been extremely small except in *Justfood* and *Mellin's Food,* in which 90 and 75 per cent, respectively, of the carbohydrates are soluble in water. The soluble carbohydrates in the other brands range from 2 per cent in *Imperial Granum* to 17.5 per cent in *Allenburys' Malted Food No. 3.* The solubility of the protein in *Benger's Food* is 80 per cent, and in *Mellin's Food* 45 per cent, while in the others only from 6 to 26 per cent is soluble in water. *Ridge's Food* claims the presence of milk sugar, but as only 3 per cent of soluble carbohydrate is present, no more than is found in ordinary cereal flours, the amount of this ingredient cannot be large.

The third group includes four foods of the *Cereo Co.,* in the preparation of which for the child's use an enzyme preparation called *Cereo,* supplied by the same company, is directed to be used. These brands are

Cereo Gruel Flour, Barley	Cereo Gruel Flour, Wheat
Cereo Gruel Flour, Oat	Mellazea

The following is our analysis of a sample of *Cereo:*

Water and volatile	34.38	Total reducing sugars as maltose	13.50
Alcohol by volume	4.50	Dextrose	7.80
Solids	65.62	Other non-sugar solids	10.29
Glycerine	37.50	Amylase	present
Protein	3.63		
Ash	0.70		

A later analysis of *Cereo* showed alcohol 2.50, solids 71.75 and glycerine 48.80 per cent.

The four *Cereo* flours show about the usual composition of flours from the respective grains. They are naturally high in starch and their solubility in water is low. For the effect of *Cereo* in converting their starch into soluble carbohydrates see page 337.

The fourth group includes two barley preparations, not intended to be fed as they are, but offered as a means of preparing barley water. The two brands are quite similar in composition. Barley water made from *Brooks' Baby Barley* according to directions we found to have the following composition:

Water	98.40	Carbohydrates	1.42
Protein	0.14	Ash	0.04

The miscellaneous group includes *Eskay's Albumenized Food*, a preparation made from egg albumen and cereals, and directed to be fed with cow's milk; it is rather low in both protein and fat and contains about 32 per cent starch. *Lacnut* is made from almonds and other nuts and its composition is claimed to be "nearly identical with that of mother's milk, which it more clearly resembles in its properties than does any other food." Our analysis does not show this identity. This food is by far the richest in protein and fat of any of the foods listed in our table; it also contains but little starch. *Peptogenic Milk Powder* is chiefly milk sugar and contains no starch. *Wampole's Milk Food* is made from "Malted cereals, beef and milk with wheat phosphates." It contains no starch and 65 per cent of water-soluble carbohydrates. It exceeds in ash all the other foods given in the table.

Composition of Feeding Mixtures made from these Foods as Directed.

The dietitian is not concerned so much with the composition of these foods as the analyst finds them, though that of course is important, as he is with the actual composition of the feeding mixtures made from them when the manufacturer's directions are implicitly followed. Table XV gives this information, in which the three months' old feeding period has been arbitrarily selected for purposes of comparison. *Allenburys' Malted Food No. 3* is not included as it is not intended for infants under six months; nor are the two barley preparations and *Lacnut*, no feeding directions being supplied with our sample of the last named. In preparing this table we have assumed the following average composition for cow's milk, and have analyzed a sample of top milk as follows:

	Cow's Milk.	Top Milk.
Spec. gr. @ 60° Fahr.	1.0300	1.0300
Water	87.40	82.84
Protein	3.80	4.36
Fat	3.60	8.05
Lactose	4.50	4.05
Ash	0.70	0.70

Table XV:—Composition of Day's Feeding, when Foods are Prepared According to Directions for Infants 3 mos. old.

Infant Food.	Formula and Quantities of Food Used.	Total Amount of Mixture Fed.	Cost of Food Mixture per Day.	Grams Supplied in Day's Feeding. Protein.	Fat.	Carbo-hydrates.	Ash.
		oz.	cts.				
A. D. S. Malted Milk	18.08 gms. in 5 oz. water; 126.56 gms. in 7 feedings	35	33	17.79	8.54	88.82	3.90
"Allenburys" Milk Food No. 1	14.18 gms. in 3 oz. water; 99.26 gms. in 7 feedings	21	16	9.81	13.70	66.86	3.95
" " " No. 2	28.35 gms. in 6 oz. water; 99.23 gms. in 7 feedings	21	15	9.67	14.09	67.63	3.67
Benger's Food	7.72 gms. + 140 cc. milk + 160 cc. water; 23.16 gms. food + 420 cc. milk in daily feeding	30	8	18.93	15.74	37.27	3.26
Borden's Malted Milk, Eagle Brand	18.38 gms. in 5 oz. water; 128.66 gms. in 7 feedings	35	21	19.79	9.20	88.57	4.44
Carnrick's Lacto-Preparata	6.09 gms. in 4.5 oz. water; 23.75 gms. in 7 feedings of 2.5 oz.	17.5	5	3.24	0.38	18.64	0.80
" Soluble Food	12.96 gms. in 4.5 oz. water; 69.12 gms. in daily feeding	24	11	8.60	0.73	57.60	0.90
Cereal Milk	16.45 gms. in 4 oz. water; 131.60 gms. in 8 feedings	32	52	14.48	4.67	102.61	3.13
Cereo Gruel Flour, Barley	48.78 gms. + 24 oz. water + 16 oz. top milk + 23 gms. sugar + 5.99 gms. Cereo	40	33	29.01	40.76	79.53	4.22
" " " Oat	48.78 gms. + 24 oz. water + 16 oz. top milk + 23 gms. sugar + 5.99 gms. Cereo	40	33	29.99	42.89	76.39	4.73
" " " Wheat	48.78 gms. + 24 oz. water + 16 oz. top milk + 23 gms. sugar + 5.99 gms. Cereo	40	33	28.01	40.40	81.86	3.73
Eskay's Albumenized Food	27.5 gms. + 16 oz. water + 16 oz. milk	32	10	20.77	18.00	45.81	3.86
Horlick's Malted Milk	16.94 gms. in 4.25 oz. water; 118.58 gms. in 7 feedings	29.75	24	17.79	9.60	84.04	4.74
Imperial Granum Food	21.9 gms. + 22 oz. water + 20 oz. milk	42	10	26.52	22.36	45.09	4.44
Justfood	13.92 gms. + 4 oz. water + 8 oz. milk; 31.32 gms. + 18 oz. milk in 6 feedings	27	11	21.33	20.03	53.87	3.98
Lactated Food	18.3 gms. + 8 oz. water + 8 oz. milk; 40.08 gms. + 525 cc. milk in feedings	35	11	22.13	19.54	39.16	3.94
Meadow Brand Malted Milk	18.98 gms. in 5 oz. water; 132.86 gms. in 7 feedings	35	28	19.26	6.91	98.08	4.36
Mellazea	48.78 gms. + 24 oz. water + 16 oz. top milk + 23 gms. sugar + 5.99 gms. Cereo	40	33	24.56	40.84	83.98	3.79
Mellin's Food	19.53 gms. + 8 oz. water + 8 oz. milk; 34.18 gms. + 14 oz. milk in 7 feedings	28	15	20.31	16.20	46.63	3.18
Nestlé's Food	9.39 gms. in 5 oz. water; 60.1 gms. in 8 feedings (32 oz.)	32	6	7.18	3.43	46.43	0.87
Peptogenic Milk Powder	26.82 gms. + 16 oz. water + 8 oz. milk + 3 oz. top milk	27	10	13.48	16.56	40.58	2.76
Ridge's Food	24.24 gms. + 18 oz. water + 16 oz. milk	34	7	21.29	17.88	41.44	3.64
Wampole's Milk Food	23.22 gms. in 4 oz. water; 185.76 gms. in 8 feedings	32	38	17.07	9.75	146.90	8.97
800 gms. Mother's Milk		..	..	8.00	23.20	53.60	1.60

According to Hutchinson* the average three months' old infant should consume daily about 800 gms. of human milk. Mother's milk at the three months' period contains on the average 1.0 per cent of protein, 2.9 per cent of fat, 6.7 per cent of carbohydrates and 0.2 per cent of ash, so that a daily feeding of 800 gms. would supply to the child 8.0 gms. of protein, 23.2 gms. of fat, 53.6 gms. of carbohydrates and 1.6 gms. of ash. Granting the accuracy of the figures quoted from Hutchinson, Table XV shows very conclusively how little the preparations made from these special infant's foods resemble mother's milk either in the kind or amount of nutriment supplied. It also shows very strikingly the large excess of protein supplied by most of the feeding mixtures, sixteen of them supplying from two to three times as much protein as human milk. In one brand, *Carnrick's Lacto-Preparata,* less than one-half the amount of protein is supplied, one-sixtieth of the fat, one-third of the carbohydrates and one-half of the ash. As a rule there is a great deficiency in fat, the foods prepared with water alone supplying only from one-sixtieth to one-third the proper amount. The four *Cereo* preparations yield a food very rich in fat, due to the use of top milk and not to the food itself. The two *Carnrick* foods, the malted milks, *Cereal Milk and Nestlé's Food* are very deficient in this important ingredient. The carbohydrate content of the feeding mixtures more nearly approximates the amount found in human milk than either the protein or the fat. In *Cereo Milk,* the malted milks and *Wampole's Milk Food* carbohydrates are present in great excess. The ash in the mixtures is generally high, from two or three times the amount supplied by human milk; the two *Carnrick* foods and *Nestlé's Food,* however, contain only about half the normal amount.

There is much difference of opinion among physiologists as to the essentials of a proper artificial infant's food, but we submit these analyses for the information and guidance of physicians and others who may wish to make use of one or the other of these foods in their practice. It is quite likely that the physician or specialist in searching for a diet which will satisfy the peculiar needs of infants deprived of their natural food will find sometimes one of these foods and sometimes

* Food and the Principles of Dietetics, Robt. Hutchinson, M.D., 1906.

another of very different composition best adapted to a particular case and this table with the preceding discussion will be of assistance in making a selection.

TABLE XVI:—COMPOSITION OF FEEDING MIXTURES, PREPARED ACCORDING TO DIRECTIONS FOR INFANTS 3 MOS. OLD.

Infant Food.	Grams per 100 cc.			
	Protein.	Fat.	Carbo-hydrates.	Ash.
A. D. S. Malted Milk	1.69	0.81	8.46	0.34
Allenburys' Milk Food No. 1	1.56	2.17	10.61	0.63
" " " No. 2	1.53	2.24	10.73	0.58
Benger's Food	2.10	1.75	4.14	0.36
Borden's Malted Milk	1.88	0.88	8.44	0.42
Carnrick's Lacto-Preparata	0.62	0.07	3.55	0.15
" Soluble Food	1.19	0.10	8.00	0.13
Cereal Milk	1.51	0.49	10.69	0.33
Cereo Barley Flour	2.42	3.40	6.63	0.35
" Oat Flour	2.50	3.57	6.37	0.39
" Wheat Flour	2.33	3.37	6.82	0.31
Eskay's Albumenized Food	2.16	1.77	4.77	0.40
Horlick's Malted Milk	1.99	1.08	9.42	0.53
Imperial Granum	2.10	1.78	3.58	0.35
Justfood	2.63	2.47	6.65	0.49
Lactated Food	2.11	1.86	3.73	0.38
Meadow Malted Milk	1.83	0.66	9.34	0.42
Mellazea	2.05	3.40	7.00	0.32
Mellin's Food	2.42	1.93	5.55	0.38
Nestlé's Food	0.75	0.36	4.84	0.09
Peptogenic Milk Powder	1.66	2.04	5.01	0.34
Ridge's Food	2.09	1.75	4.06	0.36
Wampole's Milk Food	1.78	1.02	15.30	0.93
Mother's Milk	1.00	2.90	6.70	0.20

It is necessary however to call attention to claims made by three of these foods. *Carnrick's Lacto-Preparata* claims to be "the nearest approach to mother's milk that can ever be produced and remain permanent"; *Lacnut* claims that its "composition is nearly identical with that of mother's milk"; and *Nestlé's Food* claims that it "in its composition shows a close resemblance to mother's milk." The following summary of the analyses of these three preparations shows that if the manufacturers' claims are correct human milk in Jersey City, Battle Creek and in Vevey, Switzerland, must be an exceedingly variable product.

	Carnrick's Lacto-Preparata.	Lacnut.	Nestlé's Food.
Fat	1.60	31.30	5.70
Ash	3.38	2.10	1.45
Protein	13.63	22.19	11.94
Carbohydrates	78.46	39.51	77.08
Starch	none	2.31	20.25

Table XVI has been prepared to show the actual composition of the food mixtures in terms of grams per 100 cc.

Effect of Prescribed Method of Preparation on the Starch of the Foods.

In the following experiments of course those brands containing little or no starch were not included. Twelve of the brands were prepared strictly according to the formulas and directions for infants three months old, except that in the *Cereo* foods the mixtures were not strained. The amount of food recommended was determined in grams and the volume of liquid (water or milk, or both) estimated in cubic centimeters. Four grams of material were then used for the test, the volume of liquid being made proportional.

After preparing the ration the mixture was centrifuged and soluble materials removed by decantation, this operation being repeated three times; no other washing was made. The residue was then treated with malt extract and starch determined in the usual way. It must be recognized that the residual starch in all cases is cooked starch, possessing therefore some advantages over raw starch from the standpoint of digestibility.

There was no actual digestion or conversion of starch to sugars except where enzymes were incorporated in the food (*Benger's Food*) or were mixed with the food at the time of preparation (*Cereo* foods). The action in the other cases must have been due to that of boiling water on starch, rendering it partly soluble or colloidal. The action of any amylase in the milk must have been insignificant since the time consumed in preparation was not great in any case, and usually the milk was boiled. The acidity of the milk likewise would probably not cause any considerable conversion of starch in the time employed.

Attention has already been called to the presence of amylase in *Cereo*. *Benger's Food* likewise contained amylase, together with an esterase and a protease, all enzymes normal to pancreatic

extract which this food is claimed to contain. The effect of these enzymes in the food is clearly apparent from the following table:

	Starch in Original. %	Starch after Preparation. %	Starch Converted. %
Prepared with water only.			
Carnrick's Soluble Food	25.99	22.87	12
Nestlé's Food	20.25	16.92	16
Prepared with water and milk.			
Eskay's Albumenized Food	31.95	23.64	26
Imperial Granum	72.79	41.67	43
Ridge's Food	70.93	44.84	37
Benger's Food	57.66	5.71	90
Lactated Food	47.93	40.49	16
Allenburys' Malted Food No. 3	60.92	27.76	54
Prepared with water, milk and Cereo			
Cereo Gruel Flour, Oat	56.31	7.20	87
Cereo Gruel Flour, Wheat	67.61	1.18	98
Cereo Gruel Flour, Barley	58.39	12.14	79
Mellazea	74.36	5.15	93

In the four *Cereo* preparations and *Benger's Food* from 79 to 98 per cent of the starch was converted into soluble carbohydrates. In the other brands the starch conversion was relatively small, in *Carnrick's Soluble Food* 12 per cent, in *Nestlé's Food* and in *Lactated Food* 16 per cent, in *Eskay's Albumenized Food* 26 per cent, in *Ridge's Food* 37 per cent, in *Imperial Granum* 43 per cent and in *Allenburys' Malted Food No. 3* 54 per cent. In fairness to this last named food it should be said that it is not recommended by the manufacturer for infants under six months.

MAPLE SYRUP.

Twenty-five samples were examined for the Dairy and Food Commissioner.

The present standard for maple syrup requires that it shall contain not more than 35 per cent of water. This is a maximum standard and any excess over that amount is considered as adulteration. The following eleven samples, containing from 35.30 to 37.95 per cent of water, were thus adulterated:

10045, 10215, 10213, 10212, 10047, 10208, 10216, 10048, 10206, 10211 and **10214**. With the exception of this excessive dilution these were of good quality.

TABLE XVII:—MAPLE SYRUP.

Number.	Manufacturer and Brand.	Volume. Claimed.	Volume. Found.	In Original Material. Solids.	Water.	Ash. Total.	Ash. Soluble.	Ash. Insoluble.	*Alkalinity of Ash. Soluble.	*Alkalinity of Ash. Insoluble.	Lead No. (Winton).	Malic Acid.	In Water-free Material. Ash. Total.	Ash. Soluble.	Ash. Insoluble.	*Alkalinity of Ash. Soluble.	*Alkalinity of Ash. Insoluble.	Lead No. (Winton).	Malic Acid.
		fl. oz.	fl. oz.																
10200	Austin, Nichols & Co., New York. Sunbeam Pure Food Maple Syrup	16	14.7	65.50	34.50	0.50	0.26	0.24	39	31	1.41	0.31	0.76	0.39	0.37	60	47	2.15	0.47
10202	" " " " " " " " "	15	15.9	65.50	34.50	0.43	0.24	0.19	34	28	1.28	0.29	0.66	0.37	0.29	52	43	1.95	0.44
10207	" " " " " " " " "	6	5.8	....	....	...	...	...	..	..	...	...	...	...	...	..	..	...	...
10228	Bay State Maple Syrup Co., Boston. Mount Washington Brand Maple Sap Syrup	..	...	66.90	33.10	0.49	0.31	0.18	48	34	1.16	0.24	0.73	0.46	0.27	72	51	1.73	0.36
10045	Lewis DeGroff & Son, New York. Health Brand Maple Syrup	†19	†19.3	64.70	35.30	0.51	0.23	0.28	34	80	1.48	...	0.79	0.36	0.43	53	124	2.27	...
10215	" " " " " " " "	†22	...	63.00	37.00	...	...	...	..	..	...	...	...	...	...	..	..	...	...
10213	F. H. Leggett & Co., New York. Premier Pure Sap Maple Syrup	†22	†22.3	63.90	36.10	0.54	0.36	0.18	44	58	1.28	...	0.85	0.56	0.29	69	91	2.00	...
10212	Leslie, Dunham & Co., Newark, N. J. Maple Twig Brand Maple Syrup	..	20.9	64.35	35.65	0.51	0.32	0.19	46	50	1.19	...	0.79	0.50	0.29	71	78	1.85	...
10204	New England Maple Syrup Co., Boston. New England Brand Vermont Maple Sap Syrup	..	13.2	65.15	34.85	0.48	0.28	0.20	40	46	1.20	0.30	0.74	0.43	0.31	61	71	1.84	0.46
10047	Rigney & Co., Brooklyn, N. Y. Colonial Brand Pure Maple Sap Syrup	7	6.9	63.55	36.45	0.45	0.27	0.18	31	59	1.29	...	0.71	0.43	0.28	49	93	2.03	...
10208	Stoddard, Gilbert & Co., New Haven. Hermitage Brand Pure Sap Maple Syrup	15	15.3	64.30	35.70	0.64	0.35	0.29	48	76	1.47	...	1.00	0.55	0.45	75	118	2.29	...
10217	C. M. Tice & Co., Boston. Sugar Notch Pure Vermont Maple Syrup	..	19.1	65.00	35.00	0.56	0.37	0.19	46	48	1.63	0.31	0.86	0.57	0.29	71	74	2.52	0.48
10043	‡The Towle Maple Products Co., St. Johnsbury, Vt. Green Mountain Brand Syrup	6.5	6.5	64.20	35.80	0.07	0.04	0.03	8	8	0.10	...	0.11	0.06	0.05	12	12	0.16	...
10046	The Towle Maple Products Co., St. Johnsbury, Vt. Vermont Maid Brand Sap Maple Syrup	16	...	65.90	34.10	0.45	0.28	0.17	35	55	0.86	0.06	0.68	0.42	0.26	53	83	1.31	0.09
10049	The Towle Maple Products Co., St. Johnsbury, Vt. Vermont Maid Brand Sap Maple Syrup	8	8.4	66.50	33.50	0.49	0.31	0.18	48	46	1.19	0.29	0.74	0.47	0.27	72	69	1.79	0.44
10216	Vermont Farmer's Co., Springfield, Mass. "Our Finest" Brand Maple Sap Syrup	..	14.6	63.90	36.10	0.52	0.38	0.14	46	44	1.54	...	0.81	0.59	0.22	72	69	2.41	...
10209	§Vermont Farmer's Co., Springfield, Mass. Square Deal Brand Syrup	..	6.5	62.90	37.10	0.20	0.16	0.04	24	22	0.81	...	0.32	0.25	0.07	38	35	1.29	...
10048	Vermont Maple Sugar & Syrup Co., New Haven. Pure Maple Syrup	16	15.9	62.50	37.50	0.53	0.29	0.24	41	71	1.46	...	0.85	0.47	0.38	66	114	2.34	...
10042	‡Vermont Maple Syrup Co., New Haven. Favorite Brand Fancy Syrup	7	6.9	66.95	33.05	0.07	0.06	0.01	14	6	0.09	...	0.10	0.09	0.01	21	9	0.13	...
10210	Welch Bros. Maple Co., Burlington, Vt. Green Mountain Boy Maple Sap Syrup	..	...	67.50	32.50	0.62	0.43	0.19	46	40	1.02	0.06	0.92	0.64	0.28	68	59	1.51	0.09
10206	R. C. Williams & Co., New York. Famous Royal Scarlet Brand Vermont Sap Maple Syrup	16	15.9	62.05	37.95	0.44	0.25	0.19	42	46	1.19	...	0.71	0.40	0.31	68	74	1.92	...
10201	Brand name unknown to us	..	...	65.00	35.00	0.47	0.27	0.20	33	61	1.16	0.29	0.72	0.42	0.30	51	94	1.78	0.45
10205	" " " " "	..	...	64.05	35.95	0.16	0.12	0.04	20	18	0.22	...	0.25	0.19	0.06	31	28	0.34	...
10211	" " " " "	..	...	64.70	35.30	0.44	0.28	0.16	38	48	1.45	...	0.68	0.43	0.25	59	74	2.25	...
10214	" " " " "	..	...	63.90	36.10	0.52	0.30	0.22	42	54	1.33	...	0.81	0.47	0.34	66	85	2.08	...

‡ Made from granulated and maple sugars.
§ Made from maple and granulated sugars.

* cc. $\frac{n}{10}$ acid per 100 gms.
† Avoirdupois oz.

10043 and **10042** were properly labeled compounds of cane and maple syrups, the former containing an excess of water; neither sample contained more than 10 per cent of maple syrup.

10209 was a properly labeled compound maple and cane syrup, containing an excess of water; it contained somewhat more than 50 per cent of maple syrup.

10205 contained cane sugar and an excess of water.

10046 and **10210** we pass, although their low malic acid percentages suggest the presence of cane sugar.

To summarize, 8 samples were genuine, 2 were doubtful, 3 were labeled compounds, 1 was adulterated with water and cane sugar, and 11 were adulterated with water.

Six samples did not come to us in the original containers and we cannot say whether or not they bore the required statement of weight or volume. Samples **10212, 10204, 10217, 10216** and **10209** did not bear the statement required by law. Of the brands bearing a statement of volume only **10200** showed any serious discrepancy; 16 fluid ounces were claimed in this brand but only 14.7 were supplied.

NOODLES.

The following definitions and standards have been adopted recently by the Joint Committee on Definitions and Standards:

"*Noodles, egg noodles,* are dried alimentary pastes made from wheat flour and egg. They contain not less than five per cent by weight of the solids of whole, sound egg exclusive of the shell."

"*Plain noodles, water noodles,* are dried alimentary pastes made from wheat flour without egg, or with less than five per cent by weight of the solids of whole, sound egg exclusive of the shell."

The five per cent of egg of the above standard is equivalent to about one and one-half eggs per pound of flour.

In the past noodles have been very commonly artificially colored, the main purpose having been to conceal a deficiency, or even a complete absence, of eggs, and this abuse has grown so prevalent that the better manufacturers have united in protesting against this practice. It will be seen from the above definition that this product when sold as "noodles" without any other qualification means "egg noodles," and this interpretation is recognized by the trade.

Twelve samples were analyzed, ten bought in package form, and two in bulk. All of the package samples were sold as egg noodles except **5181** and **3545**, which were offered simply as "noodles." The samples show the usual wide variations in composition, partly due to the flour and partly to the amount of egg used. Ash ranged from 0.67 to 2.50 per cent, ether extract

TABLE XVIII:— NOODLES.†

Station No.	Brand.	Net Weight. Claimed.	Net Weight. Found.	Price. Per Package.	Price. Per Pound.	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Ether Extract.	Lecithin Phosphoric Acid.
		oz.	oz.	cts.	cts.							
3536	Babyhead Pure Egg Noodles, Medium. Auger Baking Co., New York	8	7.2	10	22	10.58	0.71	15.81	0.21	70.55	2.14	0.0314
3544	Republic Egg Noodles, Medium, Extra Quality. Austin, Nichols & Co., New York	16	18.1	15	13	10.86	2.07	12.94	0.17	72.03	1.93	0.0352
5485	Golden Egg Brand Noodles, contain egg. Cleveland Macaroni Co., Cleveland, Ohio	7	7.5	10	21	7.76	2.50	14.19	0.20	73.16	2.19	0.0449
3535	Egg Noodles, Medium. Freihofer Baking Co., Philadelphia, Pa.	8	8.4	10	19	10.54	0.67	12.88	0.19	73.83	1.89	0.0373
4457	Pure Egg Noodles, Fine. A. Goodman & Son, New York	8	8.1	12	24	10.85	1.69	15.00	0.18	68.70	3.58	0.0564
4460	A. & P. Brand Egg Noodles, Medium. Great Atl. & Pac. Tea Co., Jersey City, N. J.	8	7.7	10	21	10.57	2.10	13.00	0.23	71.22	2.88	0.0355
5181	Warner's Noodles, Cream of the Wheat. The Hotaling-Warner Co., Syracuse, N. Y.	*7	6.3	10	25	8.36	0.80	13.88	0.25	75.69	1.02	0.0237
5179	Pure Gold Medal Egg Noodles, Brood. Maas Baking Co., New York	3.5	4.1	5	20	8.46	1.00	14.19	0.30	73.01	3.04	0.0624
3545	Superior Quality Mohican Fine Noodles. The Mohican Stores	*7	6.8	9	21	10.98	0.65	14.56	0.15	72.15	1.51	0.0309
3546	Fine Egg Noodles. C. F. Mueller Co., Jersey City, N. J.	8	7.7	10	21	10.56	1.02	14.00	0.14	71.47	2.81	0.0470
5100	In bulk. Said to be Mueller's	8	8.2	5	10	9.34	0.88	13.56	0.03	74.98	1.21	0.0386
5180	In bulk. Marked "Zarega's, New York, Artificially colored"	8	7.3	5	11	8.63	1.65	13.81	0.18	75.32	0.41	0.0281

* When packed.

† No artificial color in any sample except 5180, where Napthol Yellow S was used.

from 0.41 to 3.58 per cent, and lecithin phosphoric acid, as determined by Juckenack's method, from 0.0237 to 0.0624.

Without attempting to judge these brands too critically, it is apparent from our analyses that **5180** contains no egg, and that **5181** and **3545** contain little, if any. The other brands appear to contain from about one to one and one-half eggs per pound of flour.

5180 was the only brand containing artificial color, and it was so labeled.

As is usual with this class of foods there is a tendency towards short-weight in the package goods, ranging from 4 to 10 per cent.

OYSTERS.

A series of samples of shucked, canned oysters from the stock of a prominent Connecticut oyster grower were examined as to their water and salt content. The oysters represented regular stock, and samples of one quart each were taken from five-gallon cans packed ready for shipment. The oysters after shucking had been drained through a coarse sieve, washed with fresh water without "paddling" or "aeration," and were not allowed to stay in contact with the fresh water much over five minutes. In addition to these, two samples were examined which had been aerated somewhat by paddling.

The following results were secured, using essentially the methods employed by the Bureau of Chemistry. A sample of shucked oysters bought in a retail market is included for comparison.

The first eight samples in the table are two lots of four taken on different days and probably represent oysters from different localities. The differences in the amount of ash and salt, in both the oysters and the liquor, in the two groups are striking. In these eight samples the amount of free liquor was small, ranging from 5.7 to 8.2 per cent, and all the samples showed satisfactory amounts of oyster solids, ranging from 17.87 to 18.77 per cent. The two "aerated" samples showed quite clearly the effect of this treatment, the free liquor increasing and the oyster solids decreasing over one per cent. These oysters had been only moderately aerated, and if the process had been more

prolonged the absorption of water by the oysters would have been greatly increased.

TABLE XIX:—SHUCKED OYSTERS.

No.	Drained Oysters. gms.	Liquor. gms.	Liquor. %	In Oysters. Solids. %	Ash. %	Salt. %	In Liquor. Solids. %	Ash. %	Salt. %
Not aerated.									
5564	985	88	8.2	17.87	1.91	0.38	3.94	1.16	0.69
5565	993	85	7.9	18.31	1.74	0.38	4.14	1.32	0.86
5566	968	85	8.1	18.24	1.62	0.38	4.08	1.21	0.84
5567	1010	81	7.4	17.89	1.57	0.35	3.41	1.08	0.74
5568	944	57	5.7	18.38	1.36	0.31	4.29	0.79	0.46
5569	1021	62	5.7	18.77	1.36	0.26	4.34	0.68	0.38
5570	983	79	7.4	18.70	1.43	0.28	4.31	0.79	0.45
5571	1000	66	6.2	17.94	1.26	0.23	3.58	0.69	0.40
Av.	**988**	**75**	**7.1**	**18.26**	**1.53**	**0.43**	**4.01**	**0.97**	**0.60**
Aerated.									
5572	876	82	8.6	16.74	...	...	2.89	...	...
5573	964	99	9.3	17.32	...	...	3.24	...	...
Av.	**920**	**90**	**8.9**	**17.03**	...	...	**3.07**	...	...
Retail sample.									
5490	644	350	35.2	11.77	0.84	0.07	1.66	0.39	0.21

The analysis of the retail sample clearly shows the possibility of abuses in the retail shucked oyster trade. The free liquor amounted to over 35 per cent, and the oyster solids to only 11.77 per cent. The low amounts of salt in both the oysters and the liquor indicates either soaking or excessive washing with fresh water.

RICE.

5557. *Comet Rice Natural Brown.* Seaboard Rice Milling Co., Galveston, Tex.

5556. *Comet Unkoted Rice Head Rice.* "No glucose, no talc." Seaboard Rice Milling Co., Galveston, Tex.

	5557	5556
Water	10.22	11.00
Ash	1.08	0.40
Protein (N x 6.25)	9.00	9.19
Fiber	0.53	0.20
Nitrogen-free extract	77.03	78.85
Ether extract	2.14	0.36
Acid-insoluble ash	0.04	0.004

The second sample is a "polished" rice, but does not contain the usual glucose and talc. Its analysis, however, shows very clearly the effect of polishing on the food value of rice. The ether extract (fat) has been reduced from 2.14 to 0.36 per cent, and the ash from 1.08 to 0.40 per cent. The polishing, in this instance at least, has had little effect on the protein content.

SODA WATER SYRUPS.

Two hundred and nine samples were examined for the Dairy and Food Commissioner, of which 183 were tested for preservatives, saccharin, and artificial color and flavor; 26 were tested only for saccharin, 2 of which contained this artificial sweetener.

The following tabulation shows the results of these tests. The lemon syrups were not tested for added citric acid, nor the vanilla syrups for coumarin. The chocolate syrups were examined for iron oxide and similar mineral coloring matters with negative results.

The results show that of the 183 samples only 74 were not adulterated. If the chocolate and vanilla syrups, which are

TABLE XX:—SODA WATER SYRUPS.

Flavor.	No. of Samples.	Not Found Adulterated.	Legally Labeled Compounds.	Adulterated with					
				Saccharin.	Color.	Benzoic Acid.	Benzoic Acid and Color.	Benzoic Acid, Color and Flavor.	Color and Flavor.
Cherry	12	1	1	1	3	3	3	..	..
Chocolate and Cocoa	29	26	1	1	..	1	..	..	..
*Lemon	28	13	3	4	1	6	1	..	..
Mint	5	..	..	..	4	..	1	..	..
Orange	23	4	3	..	7	4	5	..	..
Peach	1	1	..	..	..	..	..	..	..
Pineapple	2	2	..	..	..	..	..	..	..
Raspberry	29	6	4	..	1	11	6	..	1
Strawberry	36	5	5	1	6	3	11	1	4
†Vanilla	18	16	..	2	..	..	..	..	..
Totals	183	74	17	9	22	28	27	1	5

* Not tested for added citric acid.
† Not tested for coumarin.

seldom adulterated, are omitted from the totals, we find only 32 of 136 samples, or 24 per cent, were free from benzoic acid, saccharin, artificial color or artificial flavor. Soda water syrup continues to be one of the most frequently adulterated of our food products. In 17 instances the consumer had warning of the inferior quality of the syrup by the posting of placards in the store, but it is a question whether many consumers are wise enough to allow this warning to interfere with their purchase.

Summarizing the results we find 74 samples not to be adulterated, 70 contained artificial color, 71 benzoic acid, 9 saccharin and 6 artificial flavor. Salicylic acid was found in none of the samples.

MISCELLANEOUS FOODS.

5537. *Nuttose.* Kellogg Food Co., Battle Creek, Mich. Price 20 cents per can of 8 oz.

5538. *Protose Vegetable Meat.* Kellogg Food Co., Battle Creek, Mich. Price 20 cents per can of 7.7 oz.

5540. *Protose Vegetable Meat, Potted.* Kellogg Food Co., Battle Creek, Mich. Price 30 cents per can of 15.6 oz.

5539. *Protose Vegetable Meat, Roast.* Kellogg Food Co., Battle Creek, Mich. Price 30 cents per can of 16.8 oz.

5547. *Cocoanut Sticks.* Battle Creek Sanitarium Food Co., Battle Creek, Mich. Price 20 cents per package of 15.2 oz.

5294. *Nu-Food Health Flour,* 15% Gluten. Smith and Ashton, Rochester, N. Y. Price $1.25 per bag of 11.6 lbs. (12.25 lbs. claimed.)

5468. *Wheat-A-Laxa Whole Wheat Flour.* Washburn-Crosby Co., Minneapolis, Minn. Price 25 cents per bag of 3 lbs.

6832. *Dairy Maid Brand Milk Hominy.* Marshall Canning Co., Marshalltown, Ia.

	5537	5538	5540	5539	5547	5294	5468	6832
Water	57.25	60.60	56.60	57.45	6.47	8.88	10.58	83.72
Ash	2.30	1.75	2.65	2.18	1.90	0.95	1.90	0.53
Protein (N x 6.25)	16.94	21.94	18.06	23.94	10.06	20.56	14.81	2.54
Fiber	0.85	0.40	0.58	0.45	0.40	0.38	2.13	0.03
Nitrogen-free extract	0.71	8.26	8.78	7.98	73.17	66.95	68.37	12.31
Ether extract	21.95	7.05	13.33	8.00	8.00	2.28	2.21	0.87
Starch	....	....	....	....	....	60.02	....	....

6832 claims to be made from "Pure White Flint Corn and Fresh Sweet Milk." Analysis of the free liquid indicated the claim as to the use of milk was correct, the following data being secured:—Solids 7.12, fat 2.10, refraction of fat 49.5 @ 25° C., casein 1.79 per cent.

II. DRUG PRODUCTS.

ASPIRIN TABLETS.

Samples of these tablets were collected by the Dairy and Food Commissioner from 54 druggists. In each case twelve tablets were sent to this laboratory, each of which was weighed, and six of them then ground and the composite sample analyzed.

The content of aspirin ranged from 2.26 to 5.22 grains per tablet. Excluding five samples notably deficient, the tablets averaged 4.82 grains of aspirin. Eight samples contained from 4.61 to 4.75 grains, 35 from 4.76 to 4.99 grains and 6 over 5 grains per tablet.

The individual tablets in the same sample showed wide variations in weight. In sample **10058** the druggist dispensed tablets of two distinct sizes in the same purchase, the weights ranging from 5.7 to 7.7 grains. Excluding this sample the tablets in the different lots showed variations of from 0.2 to 1.2 grains, with an average variation of 0.5 grain.

The chief excipient used in all samples was starch; in four samples a substance (probably talc) insoluble in dilute hydrochloric acid was present; in one sample calcium sulphate was present in quantity. In only four samples were more than traces of free salicylic acid present.

The following five samples showed too wide variations from the amount of aspirin guaranteed to be present:

9967. Sold by West Side Pharmacy, Ansonia. *Only 45.2 per cent of strength claimed.*

9043. Sold by Kaufmann's Pharmacy, Hartford. *Only 78.6 per cent of strength claimed.*

9800. Sold by S. Kossoff, Hartford. *Only 47.4 per cent of strength claimed; contained much calcium sulphate.*

10017. Sold by Joseph J. Dupre, Putnam. *Only 83.0 per cent of strength claimed.*

10088. Sold by (dealer's name not given), So. Norwalk. *Only 78.4 per cent of strength claimed.*

TABLE XXI:—ASPIRIN TABLETS, 5 GR.

No.	Place of Purchase.	Weight of Tablets. Range.	Weight of Tablets. Average.	Aspirin. Per Cent.	Aspirin. Per Tablet.	Free Salicylic Acid.	Starch.
		mgms.	mgms.		grs.		
9967	Ansonia	360.0–387.0	374.1	38.76	2.26	Trace	Yes
10132	Bethel	427.6–454.9	439.7	73.64	4.98	None	* "
10108	Bridgeport	424.2–448.8	436.3	75.76	5.05	Trace	* "
10109	"	410.0–449.0	430.6	74.20	4.93	"	"
10112	"	345.0–400.3	378.3	84.28	4.83	None	"
10120	"	359.7–394.4	376.1	83.16	4.82	"	"
10123	"	349.5–380.0	365.7	87.82	4.96	Trace	"
10033	Bristol	412.3–429.6	421.5	76.30	4.97	"	"
10037	"	353.3–396.5	382.1	83.16	4.95	"	"
10127	Danbury	371.3–447.4	390.6	81.70	5.02	None	"
10130	"	350.4–366.6	358.6	83.30	4.61	Trace	* "
10012	Danielson	363.1–389.3	376.0	86.50	4.99	None	* "
10095	Darien	376.8–408.8	391.6	77.14	4.68	Trace	"
9985	East Derby	411.0–437.0	426.7	75.06	4.94	"	"
10078	Greenwich	432.5–477.1	457.1	69.42	4.80	None	"
10058	Groton	366.5–496.8	415.8	77.08	4.71	Trace	"
9936	Guilford	383.0–410.0	394.2	79.16	4.83	None	"
9038	Hartford	415.0–433.5	423.9	75.28	4.96	"	...
9043	"	368.5–398.0	381.9	65.26	3.93	"	Yes
9045	"	375.5–386.7	382.5	80.60	4.77	Trace	...
9800	"	369.8–404.0	386.9	39.42	2.37	Yes	†Yes
9963	Meriden	408.7–434.5	417.7	76.20	4.93	"	"
10144	Middletown	422.4–447.5	434.0	71.20	4.81	Trace	"
10145	"	420.7–432.5	428.9	74.44	4.94	"	"
9988	Naugatuck	447.5–485.1	461.2	70.92	4.98	"	"
9950	New Haven	321.0–370.0	357.0	90.58	4.94	"	"
9998	" "	417.2–458.0	430.9	70.76	4.71	"	"
10054	" "	365.0–383.7	370.9	81.30	4.66	"	"
10135	" "	346.4–391.0	369.1	83.16	4.78	None	"
10070	New London	355.7–397.4	379.3	80.20	4.68	Trace	"
10065	Norwich	370.5–422.8	385.0	82.22	4.83	"	"
10096	Norwalk	357.8–387.6	376.9	81.74	4.77	"	"
10098	"	376.5–402.5	391.4	83.96	5.11	"	"
10099	"	406.3–431.0	419.6	77.24	5.02	"	"
10136	Norwich	413.5–432.7	422.4	74.54	4.82	"	"
10015	Putnam	388.0–402.7	395.6	79.18	4.64	"	"
10017	"	391.0–454.2	435.0	63.08	4.15	"	"
10028	Rockville	366.3–399.2	379.2	83.62	4.86	None	"
9973	Shelton	419.0–443.7	436.6	73.40	4.95	Trace	"
10088	So. Norwalk	359.5–401.0	384.8	65.64	3.92	"	"
10089	" "	368.5–398.9	384.0	82.10	4.91	"	"
10092	" "	364.5–403.9	389.1	82.96	4.99	None	"
10080	Stamford	345.8–383.5	362.6	87.70	4.90	"	"
10084	"	391.3–441.9	411.6	77.78	4.98	"	"
10086	"	434.1–466.0	448.4	71.38	4.92	"	"
10003	Torrington	413.5–428.5	420.7	74.60	4.85	Trace	"
10004	"	346.7–379.0	365.2	86.82	4.94	"	"
10008	"	433.0–456.5	443.7	71.28	4.87	"	"
9954	Wallingford	425.5–444.0	434.2	75.22	5.01	Yes	"
9983	Waterbury	375.7–407.0	393.4	76.26	4.62	"	"
10020	Willimantic	422.0–450.7	433.0	73.68	4.88	Trace	"
10022	"	546.4–571.4	556.9	60.84	5.22	"	"
10025	"	361.3–391.1	382.2	80.70	4.77	"	"
10149	Winsted	450.6–487.3	457.6	69.00	4.89	"	"

* Material present, insoluble in dilute HCl (probably talc).
† Much calcium sulphate present.

SPIRIT OF CAMPHOR.

(*Spiritus Camphorae.*)

The U. S. Pharmacopoeia requires that spirit of camphor shall contain 100 grams of camphor in 1000 cc. of alcohol.

Forty-three samples from druggists were examined for the Dairy and Food Commissioner. Three contained abnormally high amounts of camphor, viz., 22.75, 16.56 and 15.00 per cent, respectively. Six samples were more than ten per cent deficient in camphor. The other 35 samples ranged from 9.00 to 11.33 per cent, with an average of 9.49 per cent.

The following is a summary of the results:—

6	samples	from	6.3	to	8.6	per cent
17	"	"	9.0	to	9.5	"
10	"	"	9.51	to	10.0	"
8	"	"	10.01	to	11.3	"
3	"	over	15.0			"

The notably deficient samples were the following:—

No.	Sold by.	Alcohol by Volume. %	Camphor. %
9046	Pigeon Bros., Hartford	87.86	8.00
9935	J. H. Monroe, Guilford	88.14	7.75
9984	Picarelli Pharmacy, Waterbury	85.73	8.55
10008	J. H. Bezner, New Haven	88.80	6.33
10052	Alling's Drug Store, New Haven	72.33	7.12
10093	————, So. Norwalk	85.29	8.39

SYRUP OF FERROUS IODIDE.

(*Syrupus Ferri Iodidi.*)

The U. S. Pharmacopoeia defines this preparation as "a syrupy liquid containing about 5 per cent by weight of ferrous iodide, or about 6.74 gm. in 100 cc."

Among other requirements of the U. S. P. are that it is "a transparent pale green liquid," of "specific gravity, about 1.349 at 25° C., and that it shall contain no free iodine."

The twenty-nine samples examined for the Dairy and Food Commissioner contained from 3.58 to 6.96 per cent of ferrous iodide, or from 4.73 to 9.58 gms. per 100 cc. No free iodine was found in any sample. The color ranged from pale green through yellow to brown; in two samples there was turbidity and in one considerable sediment.

The specific gravity ranged from 1.2862 to 1.3763, the lower gravities indicating the use of insufficient sugar in preparing the syrups.

The following is a summary of the results as regards ferrous iodide:

2	samples	contained	from	3.5	to	4.0	per cent
2	"	"	"	4.1	to	4.3	"
13	"	"	"	4.5	to	5.0	"
12	"	"	over	5.0			"

Ignoring discrepancies as regards specific gravity and color, the following samples were notably deficient in ferrous iodide:

No.	Sold by.	Ferrous iodide. %
9968	West Side Pharmacy, Ansonia	3.79
10077	Finch's Pharmacy, Greenwich	4.30
10066	G. G. Engler, Norwich	4.10
10010	G. E. Dresser, Putnam	3.58

TABLE XXII:—SYRUP OF FERROUS IODIDE.*

No.	Place of Sale.	Spec. Grav. @ 25° C.	Ferrous Iodide. Per Cent.	Ferrous Iodide. Grams per 100 cc.	Color.
9968	Ansonia	1.3307	3.79	5.04	Pale greenish
9941	Branford	1.3627	5.12	6.98	Greenish yellow
10117	Bridgeport	1.3293	4.61	6.13	Yellowish green
10032	Bristol	1.3226	4.51	5.96	Pale greenish
10125	Danbury	1.3443	4.61	6.20	Yellowish green
10013	Danielson	1.3206	4.61	6.09	" "
10077	Greenwich	1.2899	4.30	5.55	Very pale green
9039	Hartford	1.3610	5.19	7.06	Yellowish green
9044	"	1.3300	5.07	6.74	Pale green
9811	"	1.3590	5.02	6.82	" "
9958	Meriden	1.3577	4.71	6.39	Greenish yellow
10139	Middletown	1.3763	6.96	9.58	Greenish
10057	Mystic	1.3668	4.80	6.56	Pale green
9989	Naugatuck	1.3112	4.81	6.31	" "
9951	New Haven	1.2862	4.61	5.93	" "
9994	" "	1.3760	5.32	7.32	" "
10050	" "	1.3435	4.51	6.06	Yellowish green
10063	New London	1.3360	5.22	6.97	Pale green
10097	Norwalk	1.3643	4.71	6.43	" "
10066	Norwich	1.3220	4.10	5.42	" " (sediment)
10010	Putnam	1.3203	3.58	4.73	Yellow
10016	"	1.3366	4.92	6.58	"
10029	Rockville	1.3466	4.51	6.06	Very pale green (turbid)
9975	Shelton	1.3517	4.92	6.65	Brown
10091	So. Norwalk	1.3333	5.02	6.69	Greenish yellow (turbid)
10087	Stamford	1.3430	5.63	7.56	Yellowish green
9979	Waterbury	1.3747	5.02	6.90	Pale greenish
10021	Willimantic	1.3486	5.12	6.90	" "
10146	Winsted	1.3219	5.02	6.64	Yellowish green

* No free iodine in any sample.

TABLE XXIII:—CHLORINATED LIME.

No.	Brand.	Weight. Claimed.	Weight. Found.	Available Chlorine.	Per Cent U. S. P. Strength.
		oz.	oz.	%	
9939	Acme Chloride Lime, High Test. A. Mendelson's Sons, Albany, N. Y.	5.0	5.3	35.71	119.0
10083	" " " " " " " " " "	...	2.2	26.74	89.1
	" " " " " " " " " "	...	2.7	27.46	91.5
10119	* " " " " " " " " " "	...	2.2	14.46	48.2
	* " " " " " " " " " "	...	2.1	24.21	80.7
9961	* " " " " " " " " " "	...	4.1	0.02	0.1
	* " " " " " " " " " "	...	3.9	0.02	0.1
10007	* " " " " " " " " " "	...	2.7	0.23	0.8
	* " " " " " " " " " "	...	2.7	0.26	0.9
10131a	* " " " " " " " " " "	...	...	Trace	0.0
10039	A. D. S. Pure Chloride Lime. American Drug. Syndicate, New York City	12.0	14.6	33.50	111.7
	" " " " " " " " " "	12.0	14.5	33.10	110.3
9977	† " " " " " " " " " "	...	14.3	7.24	24.1
	† " " " " " " " " " "	...	14.9	7.00	23.3
9949	Black Diamond Pure Chloride of Lime. Archibald & Lewis Co., New York City	...	2.2	21.87	72.9
	" " " " " " " " " " " "	...	2.6	23.56	78.5
9956	" " " " " " " " " " " "	...	2.3	21.75	72.5
	" " " " " " " " " " " "	...	2.3	22.07	73.6
9974	" " " " " " " " " " " "	...	2.5	20.80	69.3
	" " " " " " " " " " " "	...	2.4	21.21	70.7
10062	" " " " " " " " " " " "	...	2.6	8.24	27.5
	" " " " " " " " " " " "	...	2.5	8.02	26.7
10140	* " " " " " " " " " " "	...	...	Trace	0.0
	* " " " " " " " " " " "	...	...	Trace	0.0
10131b	* " " " " " " " " " " "	...	...	Trace	0.0

* Patent rotating cover for sifting purposes.
† "Technical use."

CHLORINATED LIME.

(Calx Chlorinata.)

Chlorinated lime, "bleaching powder," of the U. S. P., should contain "not less than 30 per cent of available chlorine. . . . It should be kept in well-closed vessels in a cool and dry place."

This product has a wide use in medicine, both for local application and for general use as a disinfectant. The U. S. Dispensatory recognizes its value in the following words, which it italicizes for emphasis: "For the destruction of disease germs in urine, fecal discharges, sputa, etc., a saturated solution of bleaching powder appears to be in all respects the best disinfectant known."

With this strong recommendation in mind, because of which and similar recommendations the laity put great dependence on the disinfecting powers of this material, it is obvious that it is most important that it shall contain the stipulated amount of its active ingredient. It is easily conceivable that most serious effects might follow the use of chlorinated lime of deficient strength, especially of products, like one-third of our samples, which contain only traces of available chlorine.

Chlorinated lime deteriorates quickly, especially in containers which are not tightly closed, so that when a deficient sample is found it is difficult to place the responsibility. The original material as it came from the manufacturer might be of inferior quality, the sample might represent stock kept too long on the druggists' shelves, or the deterioration might be due to an improper kind of container. Whatever the cause of the inferiority the consumer would have placed dependence on a product that could not secure the desired results. Nine of the samples were packed in cans with a patent rotating cover, which rendered the package far from air-tight. Doubtless this form of cover is used for the convenience of the consumer, but the manufacturer should know that, except when intended for immediate use, such a container causes speedy deterioration of the product. The druggist likewise should know that chlorinated lime packed in this way, and kept on his shelves for an indefinite time, must be inferior, and should not be dispensed.

Of the 25 samples examined for the Dairy and Food Commissioner, only 3 were of full strength, while 2 others were slightly deficient; 7 samples were from 69 to 81 per cent U. S. P. strength, 5 from 23 to 48 per cent, and 8 contained only traces of available chlorine. The deficiencies were confined to no individual brand. Three samples of the *Acme* brand were of standard strength or passable, 1 was 81 per cent U. S. P., another 40 per cent, and 5 contained only traces of available chlorine; all but the first three were packed in cans with the patent covers. Two samples of the *A. D. S.* brand were of full strength; the other two were 23 and 24 per cent U. S. P.; although these last two were labeled "Technical Use" it is questionable whether such a widely used disinfectant as chlorinated lime, and one on which so much dependence is placed at critical times, should be sold of less than standard strength under any conditions whatever. None of the eleven samples of the *Black Diamond* brand was of full strength; 6 ranged from 69 to 79 per cent U. S. P., 2 were 27 and 28 per cent, while 3, with patent covers, contained only traces of available chlorine.

Surely the druggist owes it to the consumer to purchase this useful disinfectant only from reliable firms, who pack it in a way which tends to preserve its valuable properties; stock long kept on the shelf he should not dispense at all.

SOLUTION OF MAGNESIUM CITRATE.

(*Liquor Magnesii Citratis.*)

The U. S. P. formula for this much used preparation yields a product which contains, in 100 cc. of the solution, 1.60 gms. magnesium oxide, 0.33 gm. potassium oxide, 9.28 gms. total citric acid and 3.24 gms. free citric acid.

Sixty-three samples were analyzed for the Dairy and Food Commissioner. In nearly every case two bottles of the preparation from each druggist were analyzed in order to forestall any criticism based on the variability of the product. The samples showed a wide range in composition. They contained from 1.87 to 11.00 gms. total and from 0.60 to 6.02 gms. free citric acid per 100 cc., from 0.59 to 1.95 gms. magnesium oxide and from a trace to 0.41 gm. potassium oxide. All but five of the solutions were clear, these showing a slight turbidity. In 35 samples there was no sediment; in 25 the amount of sediment was slight, while in 3 it was considerable.

This solution is liable to deteriorate in appearance on keeping for even a short time, losing its clear, bright appearance, and a precipitate of potassium bicarbonate frequently settling out. Furthermore, from its composition it is a particularly favorable medium for bacterial and fungus growth. For these reasons, as directed in the U. S. P., "This preparation should be freshly made when wanted." Storage cannot reduce the magnesia and potash in it, but long keeping results in loss of acidity and carbonic acid gas, with an accompanying precipitation of potassium bicarbonate, which seriously affects its appearance, if not its efficiency.

Allowing a variation of ten per cent from the U. S. P. standard, that is, 8.35 total and 2.92 free citric acid, 1.44 magnesia and 0.30 gm. potash per 100 cc., the following table summarizes our analyses:

10 samples within 10 per cent U. S. P.
7 samples low in free citric acid.
2 samples low in magnesia.
11 samples low in total and free citric acid.
8 samples low in total citric acid and magnesia.
17 samples low in total and free citric acid and magnesia.
4 samples low in total and free citric acid and potash.
2 samples low in total citric acid, magnesia and potash.
2 samples low in all four ingredients.

That is, only 10 samples were entirely satisfactory, while 44 were deficient in total citric acid, 41 in free citric acid, 31 in magnesia and 8 in potash.

In certain instances a formula differing from that of the U. S. P. was given on the label, and in others the preparation was stated to be "Not U. S. P.," although the official name of the preparation was used; in 24 samples the word "effervescing" was used in the brand name, apparently redundantly. The statement on the label of the formula used, while possibly technically complying with the rather loose requirements of the law, is of little benefit to the consumer as he is generally in complete ignorance of what the correct formula should be.

Sample **10036**, labeled "Effervescing Solution Aperient Magnesia blended with Lemon" was sold to the inspector on a request for "Solution of Magnesium Citrate." It contained magnesium sulphate (Epsom salt).

TABLE XXIV:—SOLUTION OF MAGNESIUM CITRATE.

(Grams per 100 cc.)

No.	Manufacturer.
9993	Apothecaries Hall Co., Waterbury
10103	[1]Blanding & Blanding, Providence, R. I.
10079	[2]The Boswell Drug Co., Greenwich
10102	Bronson & Pelcher Drug Co., New Haven
10014	[3]Corey Klein Co., Worcester, Mass.
9937	Frank F. Dowden, Guilford
10122	A. Duka, Bridgeport
9943	Fair Haven Drug Shop, New Haven
10137	Lerou's Pharmacies, Norwich
10036	[4]Madden's Drug Store, Bristol
10053	Morris Pharmacy, New Haven
9965	W. W. Mosher, West Meriden
10005	E. F. Nolan, Torrington
10134	J. A. Notkin, New Haven
10113	Park Pharmacy, Bridgeport
9982	Pharmacie Francaise, Waterbury
10069	Geo. M. Rathbone, Norwich
10115	Riker Drug Store, Bridgeport
10075	Riker & Hegeman Co., Hartford
9945	" " " New Haven
10085	" " " Stamford
9978	" " " Waterbury

Volume of Bottle. cc.	Citric Acid. Total.	Citric Acid. Free.	Magnesium Oxide.	Potassium Oxide.	Appearance of Solution.	Character of Sediment.
335	4.06	1.26	0.71	0.35	Clear	None
340	4.06	1.30	0.71	0.33	"	"
325	5.60	0.70	1.33	Trace	"	Considerable
335	5.46	0.60	1.38	"	"	"
335	6.37	2.35	1.06	0.35	"	Slight
315	6.51	2.35	1.09	0.37	"	"
350	8.83	2.21	1.83	0.30	"	"
345	8.61	2.03	1.86	0.31	"	"
350	7.35	3.85	1.01	0.30	"	None
360	4.20	1.40	0.81	0.37	"	"
315	9.88	3.19	1.95	0.30	"	Slight
315	7.70	1.93	1.54	0.24	"	"
300	7.84	2.03	1.60	0.19	"	"
335	6.65	4.02	0.72	0.29	"	None
350	3.29	0.74	0.61	0.33	"	"
350	3.15	0.74	0.59	0.31	"	"
345	2.05	0.63	*0.95	0.31	"	"
345	1.87	0.49	†0.96	0.31	"	"
370	7.91	4.76	0.78	0.30	Sl. turbid	Slight
330	10.08	6.02	0.98	0.35	"	"
325	4.20	0.80	0.88	0.37	Clear	None
335	5.95	0.77	0.90	0.36	"	"
320	7.14	3.61	0.98	0.38	"	"
320	7.56	3.82	0.99	0.38	"	"
325	5.95	1.54	1.21	0.39	"	"
320	6.09	1.65	1.18	0.32	"	"
335	6.30	0.84	1.49	0.35	"	"
330	5.39	0.67	1.37	0.37	"	"
285	8.68	2.94	1.55	0.40	"	Slight
320	9.11	3.33	1.61	0.36	"	"
315	8.82	2.84	1.69	0.29	"	None
330	8.96	2.94	1.67	0.24	"	"
330	9.18	2.66	1.69	0.35	"	Trace
350	9.04	2.73	1.70	0.33	"	"
355	9.94	3.64	1.79	0.34	"	None
350	10.16	3.71	1.87	0.34	"	"
345	8.05	2.61	1.55	0.34	"	"
345	9.76	2.55	1.56	0.36	"	Slight
340	9.10	2.91	1.75	0.34	"	"
345	9.25	2.94	1.78	0.34	"	"
340	6.58	1.19	1.64	0.35	"	"
330	6.72	1.12	1.68	0.37	"	"

[1] "Formula: magnesia carb. 12.2 grs., citric acid 24.6 grs., sodii bicarb. 3 grs., sugar 43 grs., oil lemon to flavor, distilled water to make one ounce."

[2] "Made of pure citric acid and carbonate of magnesia."

[3] Not U. S. P. Each fluidounce contains alcohol 0.25%, benzoic acid 1-5 grs."

[4] "Blended with lemon, contains sodium benzoate 1-10%."

* 1.30% SO_3; Epsom salt present.

† 1.54% SO_3; Epsom salt present.

TABLE XXIV:—SOLUTION OF MAGNESIUM CITRATE.

(Grams per 100 cc.)

No.	Manufacturer.
10110	Ruell's Drug Store, Bridgeport
10061	Sayle's Prescription Pharmacy, New London
10142	The Sisson Drug Co., Hartford
10030	" " " " "
10126	D. F. Stevens, Danbury
10090	Stillson-Powell Corporation, So. Norwalk
10001	[5]The Talcott Co., Hartford. (Wegman Brand.)
9048	G. H. Talcott & Co., Hartford. (Wegman Brand.)
9969	Edward T. Vance, Ansonia
9962	[6]Whitman Chemical Co., Boston
9948	Wooster Pharmacy, New Haven

Volume of Bottle. cc.	Citric Acid. Total.	Citric Acid. Free.	Magnesium Oxide.	Potassium Oxide.	Appearance of Solution.	Character of Sediment.
325	8.47	3.01	1.47	0.34	Clear	None
345	9.11	3.12	1.53	0.33	"	"
325	7.84	2.03	1.60	0.37	Sl. turbid	Slight
325	7.84	1.93	1.61	0.37	"	"
375	7.35	3.50	1.10	0.31	Clear	None
350	7.56	3.50	1.09	0.33	"	"
350	7.42	3.43	1.06	0.31	"	"
350	7.77	3.50	1.07	0.32	"	"
315	8.62	1.79	1.83	0.41	"	"
325	8.06	1.68	1.79	0.48	"	"
360	9.53	3.08	1.77	0.33	"	Slight
355	9.46	3.01	1.80	0.34	"	"
355	6.27	1.68	1.22	0.33	"	None
360	6.16	1.72	1.23	0.33	"	"
...	6.34	1.85	1.20	0.35	"	Slight
325	8.33	2.66	1.69	0.38	Sl. turbid	Considerable
370	8.47	2.80	1.68	0.31	Clear	None
360	8.12	3.59	1.31	0.38	"	Slight
345	11.00	3.99	1.26	0.31	"	None
365	7.56	1.82	1.59	0.32	"	"
365	8.96	1.76	1.56	0.34	"	Slight

The station also inspected this preparation in 1912, when only 4 of 24 samples were of satisfactory quality. This year's inspection shows practically no improvement over the first inspection, and suggests that the leniency then shown the offending druggists was ill advised. The results indicate that as a rule this solution is very carelessly prepared by druggists, especially with respect to the citric acid and magnesia, and that in a number of instances the druggists dispense stock not freshly prepared as is required by the U. S. P. The duplicate samples, representing purchases made at the same time, in many cases further emphasize this carelessness and disregard of pharmacopoeial requirements.

The solution is supposed to be dispensed in 12 oz. (360 cc.) portions, which amount constitutes the official dose. The quantity dispensed by our druggists ranged from 285 to 370 cc., or from 9.5 to 12.2 oz. Nine samples equaled or exceeded the required amount, 20 were less than one-half ounce short, 14 were short from one-half to one ounce, 17 from one to one and one-half ounces, and 2 from two to two and one-half ounces.

[5] "12 fluidounces containing magnesia carb. 180 grs., citric acid 400 grs., syrup 2 oz., extract lemon, bicarb. potash, water."

[6] "Not U. S. P."

MERCURY OINTMENTS.

The mercury ointments of the U. S. P. are often liable to be confused. Although our inspector was instructed to purchase "Mercurial Ointment," which is the official name of the strong ointment, this product was supplied to him in no instance. Two druggists sold products labeled "Mercurial Ointment" which were in reality "Blue Ointment"; while five druggists supplied "Ointment Ammoniated Mercury," the latter, however, being properly labeled.

The necessity for both the strong and dilute ointments has often been questioned. At any rate confusion certainly exists in the minds of many druggists as to the true significance of the names of the three mercury ointments carrying approximately 50, 33.5 and 10 per cent of the metal.

The first two samples in our table are of full strength for "Blue Ointment," but they were sold and labeled as "Mercurial Ointment," and must therefore be considered as substandard. The five samples labeled "Ointment Ammoniated Mercury" more than satisfied the requirement of 10 per cent of metallic mercury.

Mercury ointments are of course dangerous poisons, and yet only three of the seven samples bore a poison label. The sellers of samples **9041, 9944, 9964** and **9980** gave the purchaser no warning as to the poisonous nature of the product. This carelessness on the part of certain druggists in dispensing poisons we have repeatedly noted in former reports.

TABLE XXV:—MERCURY OINTMENT.

No.	Dealer.	Metallic Mercury.	Per Cent U. S. P. Strength.
	Sold as "Mercurial Ointment."		
9041	S. J. Rickman, Hartford	33.67	68.7
9047	*Stoughton Pharmacies, Hartford	33.20	67.8
	Sold as "Ointment Ammoniated Mercury."		
9944	Fair Haven Drug Shop, New Haven	10.69	106.9
9964	Meriden House Drug Store, Meriden	10.15	101.5
9980	———, Waterbury	10.41	104.1
9999	Colburn's York Pharmacy, New Haven	10.37	103.7
10067	Lee & Osgood, Norwich	10.37	103.7

* "Merck's U. S. P., 33⅓%" written on the label.

MINERAL OIL.

(*Liquid Petrolatum.*)

The U. S. P. VIII defines this product as

"A mixture of hydrocarbons, chiefly of the methane series, obtained by distilling off most of the lighter and more volatile portions from petroleum, and purifying the liquid residue."

"A colorless, or very slightly yellowish, oily, transparent liquid, without odor or taste, but giving off, when heated, a faint odor of petroleum."

"Sp. gr. about 0.870 to 0.940 @ 25° C."

According to the proofs of the U. S. P. IX, the definition and gravity of this product are to be changed as follows (*Jour. Amer. Pharm. Assoc., 2, 1913, 1400*):

"A transparent liquid, free from fluorescence, without odor or taste, and giving off when heated not more than a faint odor of petroleum. Spec. grav. 0.845 to 0.940."

The new definition is more stringent as regards color and fluorescence and more lenient respecting gravity.

Liquid Petrolatum as an internal remedy dates back to 1872, and at that time it was exploited "as a cure for coughs, colds, consumption, and a number of other diseases and conditions." It is now known that it is not absorbed from the alimentary tract, and therefore has no food value and has no value as a remedy for consumption and similar wasting diseases.

The chief uses of this product at present are externally as a vehicle for oil sprays and as a base for ointments and salves, and internally for the treatment of constipation (intestinal stasis). As far as is known it exerts no deleterious effect even when used internally.

During the last few years especial attention has been drawn to the product as a remedy for chronic constipation, its value for this purpose having been demonstrated by Lane and Carrel. These authorities cautioned, however, especially against the lighter oils used in spraying mixtures.

Liquid Petrolatum of the highest quality in the past has been produced almost exclusively in Russia. The great European war, however, has closed that source of supply, and most of the product now on the market is of American origin. Usually the American product has not been so free from color and fluorescence as that produced in Russia, and generally is of lower gravity.

Because of the unsettled trade conditions, and because of the suggested changes in the new Pharmacopoeia, the product now sold in this country should be judged with some leniency. Nevertheless, the sale of American as Russian oil is dishonest.

Of the 50 samples examined by us, all of which were purchased in October and November, 1915, 14 were sold under proprietary names, 8 were sold as Russian oil, and 28 were sold without any suggestion as to their origin, and were presumably American oils.

A description of the proprietary samples follows:—

5503. *Liquid Albolene,* McKesson & Robbins, New York. "A Pure Paraffin Oil Refined for Medicinal Use." Price 60 cents for 15.2 fl. oz.

6791. *Blamcoline (Liquid),* Lehn & Fink, New York. "Refined Mineral Oil." Price one dollar for 15.5 fl. oz.

6768. *Calol Liquid Petrolatum Heavy,* Standard Oil Co. (Cal.), San Francisco, Cal. "A pure, heavy, hydrocarbon oil." Price 57 cents for 15.7 fl. oz.

6781. *Colonol Paraffin Oil, Russian Mineral Oil,* Hindle's Drug Stores, Bridgeport. "A pure white hydrocarbon oil of the proper sp. gr. for internal administration." Price 40 cents for 7.6 fl. oz.

5525. *Glymol,* Angier Chemical Co., Boston, Mass. "An Unalterable Hydro-Carbon Oil." Price (wholesale) 40 cents for 16.4 fl. oz.

6767 and 5505. *Interol,* Van Horn & Sawtell, New York. "A particularly fine quality of mineral oil." Price 75 cents for 15.8 and 15.6 fl. oz.

6762. *Moovie Oil,* The Lee & Osgood Co., Norwich, Conn. Price 50 cents for 15.7 fl. oz.

5493. *Nujol,* Standard Oil Co., (N. J.), Bayonne, N. J. "A Pure White Mineral Oil." Price 68 cents for 15.0 fl. oz.

5511. *Solox Mineral Oil,* Solox Chemical Co., New York. "A First Quality American Hydrocarbon Mineral Oil." Price 60 cents for 13.4 fl. oz.

5514. *Terraline, Petrolatum Purificatum Plain,* The Hillside Chemical Co., Newburgh, N. Y. "Indicated in Phthisis, Coughs, Colds, Asthma, La Grippe, Hoarseness and all diseases of the Throat and Lungs, and for General Debility. Free from taste and odor and easily digested. Preferable to Cod Liver Oil." Price 75 cents for 10.5 fl. oz.

5504. *Usoline Oil,* Oil Products Co., New York. "The Original Russian White Mineral Oil." Price 37 cents for 15.0 fl. oz.

5496. *White Liquid Vaseline,* Chesbrough Mfg. Co., New York. "A Pure Hydrocarbon Mineral Oil." Price 25 cents for 4 fl. oz.

6792. *White Mineral Oil,* Eimer & Amend, New York. Price one dollar for 15.3 fl. oz.

TABLE XXVI:—MINERAL OIL (LIQUID PETROLATUM).

Station No.	Brand, or Place of Purchase.	Spec. Grav. @ 25° C.	Color.	Fluorescence.	Sulphuric Acid Test.	
					Color.	Transparency.
	Proprietary Preparations.					
5503	Albolene, Liquid	0.834	None	Slight	Straw	Yes
6791	Blancoline, Liquid	0.855	Straw	None	Black	No
6768	Calol	0.888	None	"	Slight	Yes
6781	Colonol	0.853	"	Strong	Black	No
5525	Glymol	0.860	"	Yes	Light brown	Yes
6767	Interol	0.846	[1] "	None	Slight	"
5505	"	0.847	"	"	Yellow	"
6762	Moovie Oil	0.847	"	"	Straw	"
5493	Nujol	0.846	"	"	Brown	"
5511	Solox	0.849	"	Slight	Dark brown	"
5514	Terraline	0.876	Brown	?	Black	No
5504	Usoline	0.850	None	Slight	Brown	Yes
5496	White Liquid Vaseline	0.852	"	Yes	Black	No
6792	White Mineral Oil	0.849	"	None	Dark brown	Yes
	Sold as Russian Mineral Oil.					
6780	Bridgeport	0.880	Yellowish	Slight	Light brown	Yes
5521	Hartford	0.876	None	None	Yellow	"
5523	New Britain	0.849	"	Slight	Brown	"
5507	New Haven	0.858	"	Yes	"	"
6790	New London	0.850	[2] "	None	Light brown	"
6782	Stamford	0.875	"	Slight	Dark brown	"
6771	Waterbury	0.877	"	None	Yellow	"
6772	"	0.864	"	Slight	Black	No
	Sold as Mineral Oil.					
6775	Bridgeport	0.836	"	None	None	Yes
6776	"	0.837	"	"	"	"
6777	"	0.862	Yellowish	Slight	Brown	"
6778	"	0.836	None	None	Yellow	"
6779	"	0.849	"	"	"	"
5516	Hartford	0.853	"	Yes	Black	No
5517	"	0.860	[1]Yellowish	[3]None	Yellow	Yes
5518	"	0.848	"	"	"	"
5519	"	0.851	None	Yes	Black	No
5520	"	0.853	"	"	"	"
5522	New Britain	0.882	[4] "	Slight	Brown	Yes
5524	" "	0.850	"	None	Yellow	"
5495	New Haven	0.847	"	"	None	"
5506	" "	0.846	"	"	"	"
5508	" "	0.850	"	Yes	Yellow	"
5512	" "	0.836	"	None	None	"
5513	" "	0.840	[5]Yellow	"	"	"
6788	New London	0.864	None	Yes	Black	No
6789	" "	0.845	"	None	Light brown	Yes
6763	Norwich	0.847	"	"	"	"
6764	"	0.850	"	Yes	Brown	"
6765	"	0.854	"	"	Black	No
6783	Stamford	0.850	"	"	"	"
6784	"	0.849	"	Slight	"	"
6769	Waterbury	0.864	[6] "	Yes	"	"
6770	"	0.851	"	"	"	"
6773	"	0.834	"	None	None	Yes
6774	"	0.851	"	Slight	Brown	"

[1] Contained considerable sediment.
[2] Contained some water.
[3] Phenolic odor and taste.
[4] Nutty odor and taste.
[5] Contained water and dirt.
[6] Kerosene odor and taste.

The proposed gravity limits of the U. S. P. IX, 0.845 to 0.940, are so wide as to include practically all available paraffin oils without regard to their origin. The average specific gravity of our 50 samples was 0.853, ranging from 0.834 to 0.888. Six of the samples were lower than the new U. S. P. minimum. None of the oils approaches the maximum limit of the U. S. P. The ten samples sold as Russian oil ranged from 0.850 to 0.880, average 0.863, compared with the others ranging from 0.834 to 0.888, average 0.851.

None of the samples was acid to litmus, none gave a precipitate with sulphuric acid after saponification, and none gave acrid vapors or appreciable residue when heated on platinum foil. Except in the three cases noted in the table the samples were odorless and tasteless; **5517** had a distinct phenolic taste and odor. All the samples were colorless except six, which ranged from a light yellow to brown; **5514** was of a deep brown color and totally unlike any of the other samples in appearance. Strong fluorescence was shown by 14 samples, slight by 11 and none by 25. In the test for readily carbonizable organic impurities 14 samples exceeded "a deeper tint than brown."

Only 15 of the 50 samples complied with the U. S. P. standard in all respects.

The samples bought in bulk were uniformly of a volume of 4 oz., and cost from 15 to 35 cents, with an average of 23.4 cents. The proprietary preparations, usually sold in short-pint bottles, cost from 37 cents to one dollar, average 69 cents, for 15.4 oz. Even making allowance for the relatively lower price of larger sized samples, the unusual result is shown of the proprietary preparations being on the whole rather cheaper than the druggists' samples, which made no claims for special excellence. The fact remains, however, that the proprietary samples ranged in price from 37 cents to one dollar for practically the same amount, certainly a wide range in price.

5493, *Nujol,* and **5504,** *Usoline,* contained only 15 fl. oz., 16 being claimed.

Therapeutic Claims.

The therapeutic claims made for the proprietary preparations are just except in the case of *Terraline.* On the label of this brand we are told that it is "Indicated in Phthisis, Coughs, Colds, Asthma, La Grippe, Hoarseness and all diseases of the Throat and Lungs, and for General Debility," and that it is "Preferable to Cod Liver Oil." The claims as to phthisis, general debility, etc., are false and dangerous and worthy only of a disreputable "patent" medicine. Cod liver oil is a valuable nutrient, *Terraline* has no nutriment value whatever.

PROPRIETARY MEDICINES.

The work reported last year with this class of preparations aroused so much interest and there has been such a demand for our 1914 report that the investigation was continued this year, our attention, as before, being directed chiefly towards medicines widely advertised in the newspapers of this state.

A special study was made of phenolphthalein preparations. The usefulness of this drug as a laxative, and in general its harmlessness, have given it a wide popularity in recent years. In consequence we find on the market a large number of preparations, in which phenolphthalein is the chief active ingredient, sold under fanciful names at greatly increased prices. The greatly advanced price of this drug noted at the present time has no relation to our samples, as most of them were purchased in October, 1914, too early for the market to feel the effect of the European war.

From the standpoint of composition the proprietary remedies show considerable improvement, that is, the presence of dangerous and habit-forming drugs (other than alcohol) is becoming less frequent. Of the 49 samples examined this year only 10 contained dangerous drugs other than alcohol:—

1 acetanilide	1 fusel oil
1 acephenetidine	3 lead acetate
1 arsenic	1 silver nitrate
1 bromides	1 strychnine

The claims on the labels and in the literature accompanying the medicines, though far from perfect, likewise show an improvement. This is largely due to the Sherley amendment of the Federal Food and Drug Act which prohibits false and fraudulent therapeutic claims. The newspaper advertising of many of these preparations, however, is still viciously bad. That the day of honest advertising is fast approaching is obvious to any close observer, and no agency is hastening that day so much as the false and dangerous advertisements of patent nostrums.

A classified list of the brands examined follows:—

Colds
- Grove's Laxative Bromo-Quinine
- Hill's Cascara-Bromide-Quinine

Hair and Scalp
- Am-O-Tone
- Barbo Compound
- Cactico Hair Tonic
- Farr's Gray Hair Restorer
- Hay's Hair Health
- Q-Ban Hair Color Restorer

Obesity
- Fatoff
- Louisenbad Reduction Salt
- Oil of Korein Capsules

Rheumatism and Kidneys
- Neutrone Prescription 99
- Solvax
- Toris Compound
- Uricsol
- Var-ne-sis

Skin and Complexion
- Clearola
- Flowers of Oxzoin
- Gloriol Glowene
- Rose-Kayloin

Phenolphthalein Preparations
- Phenolax Wafers
- Purgen
- Partola
- Prunoids
- Phenaloin Tablets
- Rexall Orderlies
- Veracolate
- Probilin
- Laxaphen

Stomach and Bowels
- Adler-i-ka
- Bad-Em Salz
- Bisurated Magnesia
- Caldwell's Syrup Pepsin
- Mother Gray's Sweet Powders for Children
- Regulin

Tonics
- Cuticura Resolvent
- Manola
- Vin Mariani
- Wincarnis

Miscellaneous
- Cutex
- En-Ar-Co Oil
- Gets-It
- Miles' Restorative Nervine
- Modene
- Mu-Col
- Musterole
- Odo-Ro-No
- Optona
- Mosso's Oil of Salt

REMEDIES FOR COLDS.

GROVE'S LAXATIVE BROMO-QUININE.

4534. *Laxative Bromo-Quinine* (E. W. Grove, Inventor), Paris Medicine Co., St. Louis, Mo. "Each tablet contains 2 grs. phenacetine." Price 19 cents for 24 tablets weighing 104.8 grs.

Grayish-brown tablets with the odor of aloes on powdering, and with a bitter, pungent taste.

Alcohol-soluble matter	75.64	Starch	21.60
Acetphenetidine	46.90	Aloes, resins	present
Caffeine	4.02	Carbonates	small amount
Cinchona alkaloids, anhydr.	8.78		
Ash	6.13	Chlorides, sulphates, phosphates, lime, magnesia, iron, alumina	traces
Ash, insol. in HCl	4.43		
Potassium oxide	0.48		
Sodium oxide	0.52	Phenolphthalein	none
Bromine	0.46		

The active ingredients of the tablets are acetphenetidine, aloes, cinchona alkaloids, caffeine and bromides, each tablet containing about 2.1 grs. acetphenetidine (phenacetine), 0.18 gr. caffeine, 0.4 gr. cinchona alkaloids, and 0.03 gr. bromide calculated as potassium bromide, with aloes.

In the company's circular the claim is made that *Laxative Bromo-Quinine* "relieves a cold in the head in the shortest possible time." In the newspaper advertising, where the honesty of therapeutic claims is not required by law, we are told that "it cures a cold in one day."

HILL'S CASCARA-BROMIDE-QUININE.

4513. *Hill's Cascara-Bromide-Quinine*, W. H. Hill Co., Detroit, Mich. "1.5 grs. acetanilide to a tablet." Price 25 cents for 25 tablets weighing 123.5 grs.

Yellow-brown tablets with a bitter taste.

Alcohol-soluble matter	42.03	Potassium oxide	1.93
Acetanilide	28.32	Sodium oxide	0.32
Cinchona alkaloids, anhydr.	3.60	Magnesium oxide	0.28
Ash	19.85	Bromine	0.82
Ash, insol. in HCl	2.66	Starch	27.72
Calcium oxide	5.34	Cascara, resins	present
Sulphuric anhydride	7.70	Caffeine, phenolphthalein	none

The active ingredients of the tablets are acetanilide, cascara, bromides and cinchona alkaloids, each tablet containing about 1.4 grs. acetanilide, 0.20 gr. cinchona alkaloids, and 0.06 gr. bromides, calculated as potassium bromide, with cascara. Calcium sulphate, starch and talc are used as excipients.

In the company's literature the claim is made "will relieve a cold in 24 hours." In the newspaper advertisements, where at present truth is not required by law, the claim becomes more blatant, and we read: "Cures a cold in 24 hours, cures la-grippe in three days." "Entirely harmless." "Contains no poisonous chemicals." "Always cures." Each of these claims is false.

REMEDIES FOR THE HAIR AND SCALP.

Am-O-Tone.

4711. *Am-O-Tone,* Dry Shampoo, The Am-O-Tone Co., Windsor, Can. Price 67 cents for 3.74 oz.

A cream-colored, perfumed powder.

Loss @ 100° C.	19.77	Acid-insol.-matter (talc)	7.20
Boric acid	59.90	Sodium	present
Starch	3.55	Perfume	present

The material consists of about 90 per cent crystalline borax, 7 per cent talc and 3.5 per cent starch.

A quarter-pound of borax can be bought almost anywheres for 2 or 3 cents, one-twentieth to one-thirtieth the price asked for it when sold under the proprietary name of *Am-O-Tone.*

Barbo Compound.

4524. *Barbo Compound,* for Making a Hair Remedy, Barbo Mfg. Co., Kansas City, Mo. "Gradually darkens faded gray hair." "For external use only." Price 50 cents for 5.75 gms.

A pale-yellow powder without a pronounced odor.

Loss @ 100° C.	1.43	Calcium oxide	10.45
Free sulphur	22.68	Chlorine	14.84
Lead	14.56	Acetates	present
Sulphuric anhydride	12.93	Potassium oxide	none
Sodium oxide	14.77		

The hypothetical composition of the compound, based on the above analytical data, is approximately 23 per cent anhydrous lead acetate, 23 sulphur, 23 sodium sulphate (Glauber's salt), 21 calcium chloride, 3 sodium chloride and 7 per cent water and undetermined. This analysis agrees with those made by the Indiana and North Dakota departments as to ingredients but not as regards proportions. Evidently the mixture is carelessly compounded. The constituent of *Barbo Compound* which gives it the power to darken gray hair is lead acetate, a well-known poison, and dangerous to use.

Appeals to the vanity of women on the part of nostrum manufacturers are common; such appeals as the following, addressed to men, are less frequent:

"The wisdom of concealing gray hair is of no less importance to the man, because anything that robs man of the appearance of youthful vigor is a menace to his success in the business world. With few exceptions none of the big industrial corporations will employ a man for an important position whose hair is tinged with gray. The bid of the commercial world is for youth, because it indicates vigor of mind and body, and the presence of gray hair is a sign that youth is fading and age gaining its mastery."

The person who wishes to ruin his hair can hardly adopt a more certain means of doing so than to use a preparation containing lead acetate.

Cactico Hair Tonic.

5515. *Cactico Hair Tonic,* Mrs. Gervaise Graham, Chicago, Ill. "Alcohol 6%." "Promotes the Growth of Hair." Price one dollar for 6.7 oz.

A yellowish liquid with the odor of oil of rose.

Spec. grav. @ 15.6° C.	1.0123
Alcohol by volume	5.50
Non-volatile solids	6.65 gms. per 100 cc.
Glycerine	6.09 " " "
Ash	0.25 " " "
Boric acid	0.33 " " "
Capsicum, oil of rose	present
Sodium, boron	present
Alkaloids	sl. trace
Salicylates, resorcin, cantharidine, quinine, pilocarpine	none

This tonic is simply a dilute alcohol-glycerine-water solution of borax, containing a little capsicum and oil of rose. The solids, other than glycerine, amount to only 0.56 gm. per 100 cc. and most of that is ordinary borax.

Mrs. Graham's confidence in the efficiency of a small amount of borax and a trace of capsicum is shown in the following:

"For many years I have had my Hair Tonic on the market with excellent results, and I am prepared, after various experiments, to say that a more potent hair tonic, in my opinion, does not exist. I have in Cactico Hair Tonic a tested compound that will stimulate the growth of hair on any scalp where the hair follicles are not dead."

As the cause of baldness is the death of the hair follicles, the speciousness of the above claim is apparent.

On February 25, 1909, a consignment of *Cactico Hair Grower* (now renamed *Cactico Hair Tonic*), having been seized by the U. S. Government on the charge of misbranding because of such false claims as "will produce hair on bald heads," and "stops falling of the hair," Mrs. Graham entered a plea of guilty and was fined $50 and costs (Not. of Judg. 715).

FARR'S GRAY HAIR RESTORER.

4526. *Farr's Gray Hair Restorer, No. 1,* The Brookline Chemical Co., Boston, Mass. "Contains no lead or sulphur," "Absolutely harmless," "Free from sediment." Price one dollar per 6 fl. oz.

A colorless solution with an ammoniacal odor.

It contained 0.518 gm. of metallic silver, equivalent to 0.816 gm. of silver nitrate, per 100 cc; 0.369 gm. of ammonia and 0.87 gm. of solids per 100 cc. It contained no lead, sulphur, mercury, glycerine, alcohol, resorcin, pilocarpine, salicylic acid or boric acid.

The material is a dilute ammoniacal solution of silver nitrate. The silver nitrate of course acts as a dye, the silver being reduced on contact with the organic matter of the hair. It would seem that such a powerful caustic must be injurious to the hair, and yet we are assured by the manufactuer that the preparation is "absolutely harmless."

HAY'S HAIR HEALTH.

4525. *Hay's Hair Health,* Philo Hay Specialties Co., Newark, N. J. "For external use only." Price 50 cents for 3.3 fl. oz.

A colorless liquid, containing a yellow precipitate, and with the odor of oil of bay.

Glycerine	9.23	Alcohol, resorcin, pilocarpine, salicylic acid, boric acid	none
Free sulphur	1.80		
Lead acetate	1.78		
Organic matter (possibly sage)	0.10		

This is simply one of the familiar glycerine-water solutions of lead acetate, with considerable free sulphur. The use of any preparation, even externally, containing such a dangerous poison as lead acetate is unsafe.

Q-BAN HAIR COLOR RESTORER.

5510. *Q-Ban Hair Color Restorer,* Hessig-Ellis Drug Co., Memphis, Tenn. "10% alcohol." "A Hair Dressing producing Soft Luxuriant Hair." Price 50 cents for 6 fl. oz.

A whitish-yellow liquid, with considerable sediment, and with the odor of oil of rose geranium.

Alcohol by volume	10.46
Solids	16.39 gms. per 100 cc.
Glycerine	11.56 " " "
Free sulphur	3.08 " " "
Lead oxide	0.99 " " "
= lead acetate	1.68 " " "
Acetates	present
Oil of rose geranium	present
Salicylates, resorcin, alkaloids	none

This is a perfumed alcohol-glycerine solution of 1.68 gms. per 100 cc. of lead acetate, containing 3.08 gms. of free sulphur in suspension. It is simply one of the many familiar lead acetate-sulphur preparations, and its use is by no means free from danger.

The company's specific claim that it "produces soft luxuriant hair" is considerably weakened by the following reservation also quoted from its literature:

"If you follow directions and the treatment that we recommend, it will in some cases recover the bald spots. This we do not positively assert or guarantee, but that it will restore the color we *do guarantee.*"

REMEDIES FOR OBESITY.

FATOFF.

4698. *Fatoff Obesity Cream,* M. S. Borden Co., New York. Advertised price on the label $1.50; our sample was secured at a cut-rate drug store for 79 cents, the sample weighing 8.82 oz.

A whitish-yellow semisolid mass, with the odor of oil of bitter almonds or nitrobenzol.

Loss @ 100° C.	86.75
Non-volatile solids	13.25
Ash	2.79
Sodium oxide	1.66
Free alkali (in 10 gms.) =	0.2 cc. N/50 acid

Solids sol. in abs. alcohol	13.14
Solids insol. in abs. alcohol	0.11
Nitrobenzol	present
Ether extract	none

The preparation is simply a sodium soap, containing about 86.75 per cent water, with a small amount of nitrobenzol, and with a slightly alkaline reaction.

The label claims that

"*Fatoff Cream* tends to remove fat from any part of the body, invigorates the system and improves the circulation." "A preparation which tends to dissolve fat. A purely hygienic compound of superlative excellence, which contains nothing harmful or poisonous." "This is the only application known to man, by which in a few weeks a large abdomen or any part of the body afflicted with fat may be reduced to a normal size." "One of the charms of the cure is the possibility of removing fat from any part of the body you desire without affecting the adjacent portions. You can take away the double chin, reduce an enlarged waist or overprominent abdomen or bust, the unsightly lump on the back of the neck, or any portions where an overabundance of flesh has settled, without detracting from the other parts which are just about right." "While using *Fatoff* no drugs, no dieting, nor exercise is necessary."

With the above analysis in mind comment on these claims is superfluous.

The sample analyzed was marked one pint, or 1¼ lbs.; it actually weighed slightly over one-half pound. The price stated on the carton was $1.50, but as noted above we bought it for 79 cents, even that being a fairly remunerative price for 1.16 oz. of dry soap.

Louisenbad Reduction Salt.

4699. *Louisenbad Reduction Salt,* Karl Landshut, Importer, Chicago, Ill. Price one dollar for 14.6 oz.

An odorless, white, crystalline product.

Loss @ 100° C.	0.10	Potassium oxide	17.85
Chlorine	19.93	Sulphuric anhydride	34.18
Sodium oxide	31.84		

That is, it contains 60.70 per cent anhydrous sodium sulphate (Glauber's salt), 10.59 per cent sodium chloride (common salt), and 28.44 per cent potassium chloride. That a combination of these well-known salts used in the bath would be in any way effec-

tive as a remedy for obesity taxes one's credulity to the limit. If these salts did possess the qualities claimed for them any druggist could supply equivalent amounts for about five cents instead of the dollar charged by this manufacturer.

And yet the following claims are made for the compound:

"Reduces fat without medicine, drugs or exercising. You need not be fat; you need not dose *with drugs* (which are liable to throw your digestion out of order); you *need not starve yourself;* you need not consume *valuable time* and *tire* yourself with the exertion and monotony of *physical exercises;* you need not inconvenience yourself in any way, only use *Louisenbad Reduction Salt* (for the bath)."

Oil of Korein Capsules.

10733. *Oil of Korein Capsules,* Korein Company, Binghamton, N. Y. "Highly recommended . . . . for the Safe and Speedy Reduction of Superfluous Fat." Price one dollar for 40 capsules weighing 18.56 gms., or 7.16 grs. per capsule.

Gelatin capsules colored red, containing a pale yellow oil with the odor of sassafras and with an aromatic taste. Average weight of capsules 7.16 grs., weight of covering 3.50 grs., weight of contents 3.66 grs., volume of contents from 0.25 to 0.30 cc.

The spec. grav. of the oil was 0.959 @ 20° C., the oil being partly soluble in 95 per cent and in absolute alcohol. It was optically active, 0.2851 gm. dissolved in 20 cc. of absolute alcohol giving a rotation of +0.2° V. in a 200 mm. tube. The portion insoluble in alcohol was not saponified by alcoholic potash. Heated on platinum foil the oil ignited without appreciable residue. No iodine was present and there was no coloration with ferric chloride. Loss @ 100° C. 39.61 per cent. The non-volatile residue had a refractive index @ 20° of 1.4732, and was not saponified by alcoholic potash; it was unaffected by acetic acid anhydride. Concentrated nitric acid gave a color with the original oil followed by the formation of a resinous compound, and the separation of unchanged oil. Concentrated sulphuric acid containing sulphuric anhydride destroyed the oil partially, leaving a clear, unchanged residue.

The above data point to the conclusion that the preparation is a combination of a volatile oil and a non-volatile hydrocarbon oil. The volatile oil is largely or wholly oil of sassafras, recognized by its strong odor and aromatic taste, optical activity, volatility, reaction with nitric acid and its alcohol solubility. The non-volatile oil is a hydrocarbon oil of the nature of paraffin oil, recognized by its stability towards reagents, its index of refraction, and its alcohol insolubility. The mixture, therefore, essentially consists of about 40 per cent of oil of sassafras and 60 per cent of paraffin oil.

The prescribed dose is 4 capsules per day, yielding about 1 cc. of total oil, or 0.6 cc. of paraffin oil. The usual dose of paraffin oil is 4 cc., and some patients require as much as 60 cc. It is apparent, therefore, that the daily dosage supplied by *Oil of Korein Capsules* is only one-seventh of the minimum official dose, scarcely enough to have any effect whatever. The 40 capsules contain 24 cc. of paraffin oil, for which a price of one dollar is asked, whereas paraffin oil (liquid petrolatum) can be purchased at drug stores under its own name for 15 to 25 cents per 4 oz. (120 cc.), or for one-twentieth to one-thirtieth the price.

REMEDIES FOR RHEUMATISM AND KIDNEY DISEASES.

Neutrone Prescription 99.

4692. *Neutrone Prescription 99,* for Rheumatism, The Relief Laboratory, Newburgh, N. Y. "Alcohol not in excess of 20%." Price one dollar for 8.2 fl. oz.

A clear dark-brown liquid with a sweet, bitter, and alkaline after-taste.

Spec. grav. @ 15.6° C.	1.0955	
Alcohol by volume	15.20	
Solids	27.27	gms. per 100 cc.
Glycerine	3.58	" " "
Reducing sugars, as dextrose	14.06	" " "
Salicylic acid	4.79	" " "
= sodium salicylate	5.55	" " "
Ash (chiefly Na_2CO_3 and KI)	3.96	" " "
Sodium oxide	1.10	" " "
Potassium oxide	0.63	" " "
Iodine	1.58	" " "
= potassium iodide	2.07	" " "
Colchicine	present	
Emodin	present	

The material is an alcohol-glycerine-water solution of syrup, containing per 100 cc. 5.55 gms. of sodium salicylate and 2.07

gms. of potassium iodide, with extract of colchicine and an emodin-bearing drug.

That the manufacturers are not overconfident as to the curative powers of *Neutrone* is shown by the following extracts from their literature:

"Remember rheumatism is a deeply rooted disease. It takes a long time to develop and you cannot get rid of it in a day, so don't make the mistake of stopping treatment too soon even though your rheumatic pains have disappeared. After taking *Neutrone Prescription 99* for a short time and experiencing its benefits, do not jump to the conclusion that your rheumatism is cured because the pain has stopped, the chances are that in reality the fight against your rheumatism is just turning in your favor unless your case is a mild one. If you stop treatment too soon you may suffer a return of your rheumatism because it has not been thoroughly driven from your system. . . . Furthermore, if yours is a severe, chronic case of rheumatism, be content to wait a little while for results—your patience will be rewarded. Bear in mind what a stubborn ailment rheumatism is and how its poisons permeate the system and you will realize that in a longstanding case of chronic rheumatism it takes time to accomplish material benefits. Your case may be so severe as to require three or six or even more bottles of *Neutrone Prescription 99*."

In other words if your rheumatism is not cured it is not the fault of the remedy, but because you have not taken enough of it; as long as you continue to pay your dollar for a half pint of the medicine there still is hope.

Solvax.

5509. *Solvax,* Booth's Hyomei Co., Buffalo, N. Y. "A Treatment for Affections Arising from Disorders of the Kidneys and Bladder, etc." Price 50 cents for 50 pills, weighing 22.51 gms., or 6.95 grs. per pill.

Pills coated with sugar, calcium carbonate and gum, and colored with a red dye. Pill mass (3.46 grs.) rather soft, green, with a terpene-like taste, and a balsamic odor similar to oil of juniper.

Ash, total	36.12	Methylene blue, approximately	18.60
Ash, insol. in HCl (talc)	7.29	Total nitrogen	3.00
Sucrose	17.39	Hexamethylene tetramine	present
Invert sugar	trace	Oil of juniper	present
Calcium oxide	18.36	Potassium acetate, nitrates	none
Carbonates	present		

The pills consist essentially of methylene blue, hexamethylene tetramine, oil of juniper and talc, coated with sugar and calcium carbonate, and colored red.

Toris Compound.

4710. *Toris Compound,* Globe Pharmaceutical Co., Chicago, Ill. Price 50 cents for 0.88 oz.

A whitish, granular powder.

Loss @ 100° C.	0.20	Nitric nitrogen	2.10
Reducing sugars, as invert	0.68	= potassium nitrate	16.07
Sucrose	67.88	Salicylic acid	12.78
Potassium oxide	7.49	= sodium salicylate	14.82
		Sodium	present

The compound consists, therefore, of 67.88 per cent cane sugar, 16.07 per cent potassium nitrate (saltpeter) and 14.82 per cent sodium salicylate, with small amounts of invert sugar and volatile matter.

"This formula although apparently simple is well known all over the nation, even in the remotest sections, for its quick and satisfactory effects in controlling rheumatism."

This preparation is one of the prescription fakes, in which well-known drugs are claimed to be endowed with unusual remedial powers, where used with another less familiar drug purporting to be a standard article. In this case, for instance, the famous rheumatism remedy is composed of

Toris Compound	1 oz.
Syrup Sarsaparilla Comp.	1 oz.
Pure Whiskey	8 oz.

The last of these two ingredients are of course well-known, but the first, *Toris Compound,* is sold only by the one manufacturer and has no official standing whatever.

Sodium salicylate is recognized as a valuable drug in the treatment of rheumatism. The same cannot be said for potassium nitrate. The U. S. Dispensatory says

"At one time potassium nitrate was used in very large doses in acute rheumatism, but the practice has passed out of vogue. It is essential always to give the remedy very freely diluted, if at all, and thus avoid its irritant influence upon the gastro-intestinal tract."

The therapeutically useful ingredient in *Toris Compound,* therefore, is the sodium salicylate alone, the current price of which is 45 cents per pound. In this preparation 50 cents is charged for 0.9 oz. of a mixture, only about one-seventh of which is sodium salicylate. It is hard to conceive of a more expensive way to purchase this useful drug.

Uricsol.

4536. *Uricsol,* Uricsol Chemical Co., Boston, Mass. "Alcohol not over 0.5%." "Rheumatic Remedy, Uric Acid Solvent, Kidney and Liver Stimulant." Price 97 cents for 8 fl. oz.

A brown, syrupy liquid with the odor of orange peel, and with a salty, acid, and persistently bitter taste.

Spec. grav. @ 15.6° C.	1.3138	Lithium	0.18
Alcohol by volume	0.16	Citric acid	8.32
Glycerine	15.63	Nitric nitrogen	0.10
Ash	19.46	Bitter principle, probably gentian	present
Sodium oxide	8.51	Salicylates, sucrose, alkaloids, hexamethylene tetramine	none
Phosphoric anhydride	9.74		
Potassium oxide	0.32		
Sulphuric anhydride	0.12		

The preparation is essentially a glycerine-water solution of sodium phosphate with traces of lithium, sodium nitrate and sulphate, acidified with citric acid, and containing a bitter principle, probably gentian.

Sodium phosphate is a mild purgative but can scarcely be said to be "efficacious in all the uric acid diseases including all forms of rheumatism, gout, eczema, asthma and in a large proportion of liver and kidney complaints."

Var-ne-sis.

4522. *Var-ne-sis,* The Var-ne-sis Co., Lynn, Mass. "A Vegetable Remedy for Stomach and Rheumatism. Guaranteed Strictly Vegetable." "18% alcohol." Price one dollar for 14.4 fl. oz.

A brown liquid, with some brown sediment, and with a bitter taste.

Spec. grav. @ 15.6° C.	0.9896	Reducing sugars, as dextrose	0.86
Alcohol by volume	13.62	Capsicum, emodin	present
Non-volatile solids	1.81	Glycerine, alkaloids, salicylic acid	none
Ash	0.16		

The preparation is an alcoholic solution, containing less than one per cent of vegetable drug extracts, chiefly derived from emodin-yielding drugs and capsicum.

Dr. Varney, the sponsor for this "positive stomach and rheumatic remedy," tells us in his literature how his heart, back, head, and whole body ached, how his brain was weary and how he tossed through many a restless night until "a merciful Providence led me to this remedy made of pure roots and herbs, nature's own simples combined with *the most perfect combination of roots and herbs ever put together.*"

"*Var-ne-sis* has cured, and is today curing hundreds." "All forms of Rheumatism Yield to *Var-ne-sis.*" "*Var-ne-sis* makes the stomach sound." "*Var-ne-sis* stimulates, purifies and enriches the blood and soothes the nerves." "Hundreds have been cured, why not you?"

Although on one page of his circular Dr. Varney tells us relief from his terrible rheumatism "came after a few doses," on another page he advises us that rheumatism requires from three to twelve bottles; "in some cases it may require a little longer to produce the desired effect." "Where the disease is of many years' standing there may be no apparent results until from seven to twelve weeks, but in all cases the treatment must be followed consistently to produce the desired result." It is apparent, therefore, according to the good doctor, that if the remedy does not cure, the fault lies with the patient, not the medicine. All the patient has to do is to keep up his faith, which will doubtless be stimulated by the alcohol in the medicine, and continue to pay one dollar per short pint for a remedy containing only a trace of medicament other than alcohol.

REMEDIES FOR THE SKIN AND COMPLEXION.

Clearola.

4712. *Clearola.* Geo. W. Carpenter, East Jaffrey, N. H. "For the removal of Pimples, Blackheads, Blotches and all Eruptions of the Skin." Price 39 cents for 0.44 oz.

A light-yellow powder.

Soluble in carbon bisulphide (sulphur)	99.58
Total ash	0.04
Ash of carbon bisulphide-insoluble	0.28

The preparation is simply sublimed sulphur (flowers of sulphur).

Sublimed sulphur is a specific for scabies (itch) and has distinct therapeutic value. It can be bought, however, at any drug store for ten cents or less per pound; in *Clearola* it costs $14.18 per pound.

Flowers of Oxzoin.

4715. *Flowers of Oxzoin,* To-Kalon Mfg. Co., Syracuse, N. Y. "Absolutely free from pearl white or bismuth in any form. It contains no poisonous ingredients." Price 39 cents for 2 fl. oz.

A colorless liquid, with a heavy pink-white sediment, and having the odor of oil of rose.

Alcohol	none
Non-volatile solids	41.24 gms. per 100 cc.
Glycerine	22.84 " " "
Zinc oxide	18.21 " " "
Ash	18.36 " " "
Cochineal	present

The preparation consists essentially of 18.21 gms. of zinc oxide per 100 cc., suspended in water and glycerine, perfumed with oil of rose and colored with cochineal. The cochineal appeared to be in combination with the zinc oxide, as the filtered liquid was colorless.

Flowers of Oxzoin comes with the recommendation of Mlle. Meta "to-day the most able and widely known Beauty Specialist in the world. . . . Her own marvelous preservation of youth and beauty is a living testimonial to the efficacy of her teachings." Mlle. Meta recommends her *Milk of Roses,* which is compounded from *Flowers of Oxzoin, Tincture of Benzoin, Rose Water* and *To-Kalon Perfume,* as "an invaluable dressing for all cases of rash, irritation, ringworm, salt rheum," etc., and "the indescribable torture, the awful intolerable itching of eczema, the most dreaded of all skin diseases, are almost immediately allayed by a liberal application of *Milk of Roses.*" *Milk of Roses,* or *Flowers of Oxzoin* will relieve the above diseases to the same extent as ordinary zinc oxide, no more, no less, only zinc oxide can be bought at retail for 15 cents per pound, while *Flowers of Oxzoin,* less than one-fifth of which is zinc oxide, costs 39 cents for only two ounces.

Gloriol Glowene.

4701. *Gloriol Glowene,* The Lesslie Co., Dayton, O. Price 25 cents for 1.7 oz.

A yellowish-brown pasty material slightly perfumed.

Loss @ 100° C.	66.90	Insol. in absolute alcohol	0.53
Non-volatile solids	33.10	Sodium, salicylates, phenols	none
Ash	6.94	Free caustic alkali	none
Potassium oxide	4.59		
Sol. in absolute alcohol (soap)	32.51		

The preparation is nothing more than a slightly scented soft soap, consisting of about two-thirds water. The current price of green soap (soft soap) quoted in *The Druggists Circular* is 13 cents per pound, quite different from the $2.25 per pound asked for *Gloriol Glowene.*

Rose-Kayloin.

4714. *Rose-Kayloin Compound,* for Unguentine Mixtures, The Blackburn Products Co., Dayton, O. Price 50 cents for 0.43 oz.

A pink powder, with the odor of oil of rose, and colored with a fluorescent dye.

Loss @ 100° C.	0.81	Sulphuric anhydride	0.29
Sulphur	81.40	Sulphites	present
Potassium oxide	8.48	Calcium oxide	trace
Sodium oxide	0.77	Carbon dioxide	present

The compound consists essentially of sulphur and potassium carbonate, with small amounts of sodium carbonate and sulphur compounds.

"*Rose-Kayloin* is especially preferred to meet the public demand for a remedy for Acne, Pimples, Blackheads, Boils, Ulcers, Cuban Itch, Common Itch and other Skin Diseases. It eliminates skin troubles, soothes the itching and heals the sores."

Although sulphur and potassium carbonate serve a useful purpose in the treatment of cutaneous affections, it is difficult to see why the consumer should buy these very common drugs at the rate of over $18 per pound, simply because they are called *Rose-Kayloin.*

PHENOLPHTHALEIN PREPARATIONS.*

The usefulness of phenolphthalein as a remedy in chronic constipation is well recognized. As a result of the popularity of this relatively new laxative we find certain pharmaceutical houses and a number of proprietary medicine manufacturers offering to the public preparations bearing fanciful names, in which phenolphthalein is often the only active ingredient, for which extravagant prices are asked. We have examined a number of such preparations this year, and while in this examination we have devised no new methods, we have modified certain well-known methods and the analytical details are given herewith as of probable interest to the analyst.

The preparations fell into three general classes:

1. Tablets; mixtures of phenolphthalein with excipients (lactose, sucrose, or both, starch, talc, etc.), with traces of flavoring agents and essential oils (such as peppermint, cinnamon, cassia, etc.).
2. Tablets and pills: mixtures of phenolphthalein with other cathartic drugs, or with compounds of a non-cathartic nature, together with excipients, etc.
3. Liquid preparations: phenolphthalein suspended in a sucrose syrup, flavored with cacao and vanilla, and containing salicylic acid as a preservative.

It is obvious that these various mixtures offer quite diverse problems to the analyst, and the following experimental data may be of interest.

Simple Preparations.

Various solvents, such as ethyl alcohol, acetone, etc., have been proposed for the extraction of phenolphthalein.

Extraction with acetone. A mixture of 2.5 gms. of phenolphthalein and 7.5 gms. of lactose was prepared by trituration. 0.5 gm. of this mixture was extracted on a 5.5 cm. filter with successive portion of acetone to a volume of about 50 cc.; further extraction gave no coloration with NaOH. The excess of solvent was distilled off and the residue of about 100 cc. transferred to a tared beaker with acetone, evaporated and the residue dried at 100° C.

* Credit for the analytical work herewith reported is due to C. B. Morison.

Phenolphthalein Taken. gm.	Weight of Residue. gm.	Apparent Error. gm.	Apparent Error-Blank in Acetone.* gm.	Recovery Per Cent.
.1250	.1316	+.0066	.0050	104.00
.1250	.1334	+.0084	.0068	105.44
.1250	.1267	+.0017	.0001	100.08
.1250	.1277	+.0027	.0011	100.88

The above apparent error was not due to the solubility of the lactose in acetone, as 0.5 gm. of lactose treated with 50 cc. of acetone yielded a residue of only .0017 gm., which minus the correction for acetone, .0016 gm., amounted to but .0001 gm.

The above procedure (extraction with solvent on filter paper) is similar to methods employed by Emery in the extraction of synthetics from headache powders (See *Kebler, The Tablet Industry, Jour. Amer. Pharm. Asso., June, July, August, 1914*).

Solution in alkali, and extraction with ethyl ether from an acidified solution. 0.5 gm. of the mixture used above was transferred to a 100 cc. separatory funnel, 10 cc. of 2N KOH added, and the funnel shaken vigorously to effect solution of the powder. The solution was diluted with water to about 25 cc., acidified strongly with HCl and extracted with successive portions of 15, 10, 10, 10 cc. of ethyl ether. The ether extracts were combined in another separatory and washed free from acid with water. The ethereal solution was then passed through a dry filter into a tared beaker, the solvent evaporated and the residue dried at 100° C. Phenolphthalein after this treatment appears first as a transparent resinous film which gradually becomes white on heating at 100°.

Phenolphthalein Taken. gm.	Weight of Residue. gm.	Error. gm.	Recovery. %
.1250	.1253	.0003	100.24
.1250	.1252	.0002	100.16

Application of above Methods to Proprietary Preparations.

Phenolax. The tablets were declared to contain 1 gr. of phenolphthalein with aromatics and milk sugar to make 5 grs. The average weight of the tablets was 4.76 grs., and according to the claim should contain 20 per cent phenolphthalein. The tablets were finely ground and the following results obtained on 0.5 gm. portions.

Weight Taken. gm.	†Weight of Residue. gm.	Phenolphthalein. Per Cent.	Phenolphthalein. Grs. per Tablet.
Extraction with acetone.			
.5000	.1079	21.58	1.03
.5000	.1074	21.48	1.02
Extraction with ether.			
.5000	.1021	20.42	0.97
.5000	.1029	20.58	0.98
.5000	.1024	20.48	0.98
.5000	.1026	20.52	0.98

* 50 cc. of the acetone gave a residue of .0016 gm.

† The residues were slightly colored.

Extraction with absolute alcohol in a similar manner with the same amounts of material gave residues of .1475 and .1457 gm., or 29.50 and 29.14 per cent; the residues contained considerable sugar and coloring matter. (See *Kebler, The Tablet Industry, Jour. Amer. Pharm. Asso., June, July, August, 1914*).

Extraction with chloroform gave very unsatisfactory results. After using from 160 to 165 cc. of the solvent further washings still gave a strong coloration with NaOH.

Note. The results from the alcohol extraction of *Phenolax* show that the alcohol removes sugar to an extent undesirable for this class of preparations where the residue is to be weighed directly as phenolphthalein. The extraction from an acid solution with ether after dissolving the substance in an alkali yields better results, as the residue is but slightly contaminated. This procedure possesses the advantage of extracting completely all the phenolphthalein which may be occluded by the carbohydrate material present. In the extraction of complex preparations, where starch, dextrin, gums, etc., have been used as excipients, the possibility of loss by occlusion is obvious.

Purgen. Average weight of tablets 3.72 grs.; amount of phenolphthalein not declared.

Weight Taken. gm.	Weight of Residue. gm.	Phenolphthalein. Per Cent.	Phenolphthalein. Grs. per Tablet.
.5000	.2053	41.06	1.53
.5000	.2083	41.66	1.55
.5000	.2040	40.80	1.52
.5000	.2066	41.32	1.54

Partola. Average weight of tablets 14.9 grs.; amount of phenolphthalein not declared.

Weight Taken. gm.	Weight of Residue. gm.	Phenolphthalein. Per Cent.	Phenolphthalein. Grs. per Tablet.
.5000	.0886	17.72	2.64
.5000	.0867	17.34	2.59

Complex Preparations.

Determination of phenolphthalein in this class of preparations is more difficult than in the foregoing class. Simple extraction with solvents and subsequent direct weighing of the residue yields high results. In these complex mixtures the phenolphthalein may be extracted by a suitable solvent and the resulting residue converted into an iodine derivative with reasonably satisfactory results. The determination of phenolphthalein as its tetraiodine derivative was proposed by Kollo (*Apoth. Ztg. 24, 1909, 283*; abst. in *Analyst, 34, 1909, 442*). The abstract in the *Analyst* is incomplete, lacking certain important details of manipulation, and the original paper was inaccessible to us. Tetraiodo phenolphthalein was first described by Classen and Löb (*Ber. deuts. chem. Gesell., 28, 1895, 1603*). It occurs in commerce under the name *Nosophen*.

A solution of 10 gms. iodine and 15 gms. potassium iodide in 200 cc. of water was used. A weighed amount of phenolphthalein was dissolved in about 100 cc. of 2N NaOH and the solution diluted to about 25 cc. The alkaline solution was then treated with an excess of the iodine solution, from 7 to 8 cc., added slowly drop by drop, and allowed to stand at room temperature for about two hours. The iodinized solution was then strongly acidified with HCl and cooled, the precipitate allowed to settle and then collected on a tared Gooch crucible, washed with cold water and dried at 100° C. Practically the same weights of precipitate were obtained when the solution was allowed to stand overnight before acidifying. (It is important to wash free from acid and excess of iodine.)

The following results were obtained using 0.1 gm. of phenolphthalein, and employing the factor .3871.

Weight of Ppt. gm.	Phenolphthalein. Equivalent. gm.	Recovered. %
.2550	.09871	98.71
.2550	.09871	98.71
.2568	.09941	99.41
.2566	.09933	99.33
.2515	.09736	97.36
.2502	.09685	96.85

The following results were obtained using 0.2 gm. of phenolphthalein in the same manner, but doubling the amount of iodine solution used.

.4803	.18592	92.96
.4947	.19149	95.75
.4928	.19076	95.38
.4775	.18484	92.42

Application of above Methods to Proprietary Preparations.

Prunoids. Average weight of tablets 8.15 grs.; 1.5 grs. of phenolphthalein per tablet declared.

	Weight Taken. gm.	Weight of Residue. gm.	Phenolphthalein. Per Cent.	Grs. per Tablet.
Extraction with acetone.				
	.5000	.1082	21.64	1.76
	.5000	.1105	22.10	1.80
Extraction with ether (from acetone residue).				
	.5000	.1024	20.48	1.67
	.5000	.1025	20.50	1.67

Results with Iodine Method.

Weight Taken. gm.	Weight of Ppt. gm.	Weight. gm.	Phenolphthalein. Per Cent.	Grs. per Tablet.
.5000	.2210	.08555	17.11	1.39
.5000	.2202	.08528	17.06	1.39

The residues from acetone and ether were contaminated with coloring matter and extractives. The ether residues were dissolved in 2N NaOH, filtered, and the alkaline solution precipitated with iodine as outlined above.

Phenaloin Tablets. Average weight of tablets 2.58 grs.; amount of phenolphthalein not declared.

	Weight Taken. gm.	Weight of Residue. gm.	Phenolphthalein. Per Cent.	Grs. per Tablet.
Extraction with acetone.				
	.5000	.1574	31.48	0.81
	.5000	.1598	31.96	0.82
Extraction with ether (from acetone residue).				
	.5000	.1032	20.46	0.53
	.5000	.1046	20.92	0.54

The residue from acetone was yellow with a strong odor of aloes and with a bitter taste; that from ether was slightly yellow, but not as badly contaminated as when acetone was used.

Results with Iodine Method.*

Weight Taken. gm.	Weight of Ppt. gm.	Weight. gm.	Phenolphthalein. Per Cent.	Grs. per Tablet.
.5000	.2221	.08597	17.19	0.44
.5000	.2220	.08594	17.19	0.44

Rexall Orderlies. Average weight of tablets 9.0 grs.; amount of phenolphthalein not declared.

	Weight Taken. gm.	Weight of Residue. gm.	Phenolphthalein. Per Cent.	Grs. per Tablet.
Extraction with acetone.				
	.5000	.1226	24.52	2.21
	.5000	.1229	24.58	2.21
Extraction with ether (from acetone residue).				
	.5000	.1174	23.48	2.11
	.5000	.1170	23.40	2.11

Results with Iodine Method.

Weight Taken. gm.	Weight of Ppt. gm.	Weight. gm.	Phenolphthalein. Per Cent.	Grs. per Tablet.
.5000	.2511	.09720	19.44	1.75
.5000	.2510	.09716	19.43	1.75

Veracolate. Average weight of tablets 5.62 grs.; amount of phenolphthalein not declared.

* The yellow residue from the acetone extraction was dissolved in 2N NaOH, acidified and extracted with ether. The iodine compound was prepared from this residue.

Weight Taken. gm.	Weight of Residue. gm.	Phenolphthalein. Per Cent.	Grs. per Tablet.
Extraction with acetone.			
.5000	.0632	12.64	0.71
.5000	.0616	12.32	0.69

Results with Iodine Method.

Weight Taken. gm.	Weight of Ppt. gm.	Phenolphthalein. Weight. gm.	Per Cent.	Grs. per Tablet.
.5000	.1560	.0604	12.08	0.68
.5000	.1552	.0601	12.02	0.68

Probilin. Average weight of pills 3.1 grs.; salicylic acid, acid sodium oleate, phenolphthalein and menthol declared.

2.1626 gms. of the pills were treated with water in a glass mortar and thoroughly disintegrated. The solution was then diluted to about 175 cc. and allowed to stand overnight. The insoluble matter did not settle completely, the supernatant liquid remaining turbid. The solution was finally cleared by centrifuging, the clear liquid filtered through a tared paper and the precipitate washed with water until the filtrate and washings amounted to 300 cc., and dried at 100° C. The above water-insoluble residue treated with acetone yielded as follows

Insol. Residue Representing gm.	Phenolphthalein. Weight. gm.	Per Cent.
2.1626	.1026	4.74
2.1713	.1029	4.74

The residue from the first of the above determinations was subjected to the iodine method and a precipitate of .2563 gm., equal to .0992 gm. of phenolphthalein, or 4.59 per cent, was obtained.

Phenolphthalein is slightly soluble in water, according to McCoy .00318 gm. per 100 cc. (*Amer. Chem. Jour., 21, 1904, 503*), and according to Zotier .0092 gm. per 100 cc. (*Bul. Soc. Chem., 7, 1910, 993*). Assuming the average of these two figures as being the correct value, the loss of phenolphthalein due to solution in the 300 cc. of water used as in the above method would be .0186 gm., increasing our yield to .1178, or 5.45 per cent.

An attempt to extract phenolphthalein from the original material with acetone and determine the iodine compound was unsuccessful as the acetone extracted a dark-brown fatty compound, which absorbed iodine, formed a precipitate before acidification and prevented the precipitation of the iodo compound.

Kellogg's Sanitone Wafers. Average weight of wafers 12.78 grs.; amount of phenolphthalein not declared. Chromium sulphate and a vegetable drug were found to be present.

Weight Taken. gm.	Weight of Residue. gm.	Phenolphthalein. Per Cent.	Grs. per Tablet.
Extraction with acetone.			
.5000	.0111	2.22	0.28
.5000	.0117	2.34	0.30
Extraction with ether (from acetone residue).			
.5000	.0110	2.20	0.28
.5000	.0114	2.28	0.29

Results with Iodine Method.

Weight Taken. gm.	Weight of Ppt. gm.	Phenolphthalein. Weight. gm.	Per Cent.	Grs. per Tablet.
.5000	.0176	.0068	1.36	0.17
.5000	.0186	.0072	1.44	0.18

Liquid Preparations.

Laxaphen. This was claimed to contain phenolphthalein 8 grs., salicylic acid 3/5 gr. to the fl. oz., incorporated in a chocolate base.

Salicylic acid was separated by steam distillation, and the residue evaporated and extracted with 95 per cent alcohol. The alcohol was evaporated and the residue dissolved in 2N NaOH, acidified, and shaken out with ether. The residue, which was contaminated with fat, was redissolved in 2N NaOH and filtered through glass wool, the filtrate being treated with iodine and the phenolphthalein compound precipitated and weighed as follows:

Weight Taken. gm.	Weight of Ppt. gm.	Phenolphthalein. Weight. gm.	Per Cent.
20.0	.6643	.2572	1.29
20.0	.6577	.2546	1.27

To check the above, 10 gms. of the original preparation were evaporated on sand in a porcelain casserole and the residue extracted with alcohol. The alcoholic solution was evaporated and treated with iodine (after treating with KOH, acidifying and extracting with ether), and yielded .3489 gm. of precipitate, equal to .1350 gm. of phenolphthalein, or 1.35 per cent.

Phenolax Wafers.

4529. *Phenolax Wafers,* The Upjohn Co., Kalamazoo, Mich. "Each wafer contains phenolphthalein 1 gr., aromatics, sugar, q. s. ad 5 grs." Price 35 cents for 102 tablets weighing 31.48 gms., or 4.76 grs. per tablet.

Pink tablets with the odor of cassia or cinnamon.

Loss @ 100° C.	0.64	Reducing sugars total, as dextrose	70.40
Ash	6.07	Phenolphthalein	20.58
Ash, insol. in HCl	3.45	Starch, color, oil of cassia or cinnamon	present
Reducing sugars before inv., as dextrose	2.12		

These tablets contain 0.98 gr. phenolphthalein per tablet, with 3.35 grs. sugars, and 0.43 gr. starch, talc and aromatics.

PURGEN.

4528. *Purgen,* D. Bayer, Budapest, Hung. (Dist. by Lehn and Fink, New York.) Price $1.10 for 100 tablets weighing 24.05 gms., or 3.72 grs. per tablet.

Pink tablets with the odor of vanilla.

Loss @ 100° C.	0.94	Reducing sugars total, as dextrose	40.08
Ash	4.71	Phenolphthalein	41.66
Ash, insol. in HCl	4.64	Vanilla flavor, starch, color	present
Reducing sugars before inv., as dextrose	17.84		

These tablets contain 1.55 gr. phenolphthalein per tablet, 1.49 gr. sugars, and 0.68 gr. talc, starch, color and vanilla flavor.

PARTOLA.

5039. *Partola,* Partola Mfg. Co., New York. "The Ideal Peppermint Laxative Candy. Good for Baby, Good for All, a Pleasure to Eat. Best for You. Laxative Blood Purifier and Effective." Price 10 cents for 6 tablets weighing 5.8 gms., or 14.9 grs. per tablet.

Pink tablets with the odor and taste of peppermint.

Loss @ 100° C.	1.45	Reducing sugars total, as dextrose	69.76
Ash	5.83	Phenolphthalein	17.72
Ash, insol. in HCl	5.19	Starch, color, oil of peppermint	present
Reducing sugars before inv., as dextrose	trace		

The tablets contain 2.64 grs. phenolphthalein per tablet, 10.39 grs. sugars, and 1.86 grs. starch, talc, color and oil of peppermint.

PRUNOIDS.

4533. *Prunoids,* Sultan Drug Co., St. Louis, Mo. "An Ideal Laxative, Purgative and Intestinal Tonic." "Are made of phenolphthalein 1.5 grs. in each, cascara sagrada, de-emetinized ipecac and prunes." Price 50 cents for 36 tablets weighing 18.99 gms., or 8.15 grs. per tablet.

Brown tablets with a sweet, slightly bitter, aromatic taste.

Loss @ 100° C.	2.71	Phenolphthalein	17.11
Ash	8.20	Cascara, probably in	small amt.
Ash, insol. in HCl	1.28	*De-emetinized ipecac	?
Reducing sugars before inv., as dextrose	9.88	*Alkaloids	none
Reducing sugars total, as dextrose	39.12	Prunes, probably in	small amt.

Prunes have considerable popular favor as a mild natural laxative food, and the manufacturer of *Prunoids* capitalizes this popularity of prunes in the name of his product. The quantity of prunes in *Prunoids* must indeed be small, the amount of cascara is trifling, and the therapeutic effect of any de-emetinized ipecac present cannot be important. The chief active medicament of *Prunoids,* therefore, is phenolphthalein.

PHENALOIN TABLETS.

4517. *Phenaloin Tablets* (*Wood's*), Wood's Pharmacy, New Haven. "A Chocolate Coated Tablet for the Treatment of Constipation." Price 25 cents for 40 tablets weighing 6.697 gms., or 2.50 grs. per tablet.

Brown, chocolate-coated sugar tablets with the bitter taste of aloes.

* 1 gm. of material was extracted with alcohol and after evaporation of the solvent the residue treated with N sulphuric acid and filtered. The filtrate was made alkaline with ammonia and shaken out with ether. The residue from ether was taken up with N sulphuric acid and tested for alkaloids with negative results. If ipecac is present it is so practically freed of its alkaloids. The following check test for alkaloids was also made. About 2 gms. were triturated with sodium bicarbonate and extracted with a mixture of amyl alcohol, 1, chloroform, 1, and ether, 3 volumes. The solvent was drawn off and extracted with N sulphuric acid, the acid solution made alkaline with ammonia, and extracted with ether-chloroform. The residue after evaporation gave no reaction for alkaloids.

Loss @ 100° C.	3.12	Reducing sugars total, as dextrose	28.16
Ash	21.37	Phenolphthalein	17.19
Ash, insol. in HCl	17.34	Aloin	present
Reducing sugars before inv., as dextrose	trace	Alkaloids	none

The tablets contain 0.44 gr. phenolphthalein per tablet, 0.73 gr. sugars, 0.45 gr. talc, and about 0.96 gr. aloin and chocolate coloring.

This preparation must not be confused with *Phenaloin,* made by the Norwich Pharmacal Co., Norwich, N. Y., which according to the label contains aloin 1-4 grain, strychnine sulphate 1-80 gr., extr. belladonna leaves 1-12 gr., phenolphthalein 1-2 gr., and ipecac 1-15 gr. per pill.

Rexall Orderlies.

4518. *Rexall Orderlies,* United Drug Co., Boston, Mass. "A gentle-acting, pleasant and effective laxative." Price 25 cents for 36 tablets weighing 20.96 gms., or 9 grs. per tablet.

Brown tablets with a vanilla-like odor.

Loss @ 100° C.	0.60	Phenolphthalein	19.44
Ash	7.95	Oxymethylanthraquinones	none
Ash, insol. in HCl	5.73	Alkaloids	none
Reducing sugars before inv., as dextrose	trace	Cacao powder, vanilla flavor	present
Reducing sugars total, as dextrose	60.64		

The tablets contain 1.75 grs. phenolphthalein per tablet, 5.46 grs. sugars, 0.51 gr. talc, and 1.28 grs. cacao powder flavored with vanilla.

Veracolate.

4531. *Veracolate,* The Marcy Co., Boston, Mass. "Rich in cholates." Price one dollar for 100 tablets weighing 36.39 gms., or 5.62 grs. per tablet.

Red, sugar-coated compressed tablets with a peppery taste.

Loss @ 100° C.	4.09	Reducing sugars before inv., as dextrose	trace
Ash (CaO 13.09, MgO 0.87, Na, K, and trace Fe)	28.07	Reducing sugars total, as dextrose	27.64
Carbonates	present		

Phenolphthalein	12.08	*Bile acids	present
Oxymethylanthraquinones	present	Starch, vegetable tissues	small amts.
Cascara, probably	present	Alkaloids	none
Capsicum	considerable		

These tablets contain 0.68 gr. phenolphthalein per tablet, with cascara, capsicum, bile acids and excipients (calcium carbonate and sugars).

Probilin.

4530. *Probilin,* W. Bauermeister (Schering and Glatz, New York, Agents). "A combination of salicylic acid with acid sodium oleate to which sufficient phenolphthalein and menthol have been added to mildly stimulate the gastro-intestinal tract and insure tolerance." Price $1.50 for 60 pills weighing 11.95 gms., or 3.1 gr. per pill.

Black, graphite-covered pills with a strong odor of menthol, and with a mentholic, soapy taste.

Loss @ 100° C.	9.68	Phenolphthalein	5.48
Ash	15.88	‡Salicylic acid	5.82
Ash, insol. in HCl	1.86	Vegetable drug	28.70
Iron and alumina phosphate	3.05	†Sodium oleate	present
Calcium oxide	1.18	Menthol, carbonates	present
Sodium oxide	6.11	Oxymethylanthraquinones	none
Potassium oxide	0.60	Alkaloids	none
Magnesium oxide	trace	Biliary products	?

* The residue from alcoholic or aqueous extracts of *Veracolate* has the odor of preparations of sodium glycocholate and taurocholate, the odor being strong and persistent. A test for bile acids was made as follows: An aqueous extract of the pill mass was shaken with ether to remove phenolphthalein, coloring matter, etc., the ethereal extract being rejected. The aqueous solution was then treated with basic lead acetate, the white precipitate removed by filtration and decomposed with strong soda solution. The alkaline solution was evaporated and extracted with alcohol, and after evaporation of the latter the residue was tested for bile acids by the Pettenkofer test, using a few drops of furfurol solution (1-1000) instead of cane sugar (Mylius and Udransky modification). The reaction was strong and the color persistent.

† An attempt was made to determine oleic acid quantitatively but the residue obtained appeared to be very impure. This residue, however, gave the elaidic acid reaction on treatment with nitrosyl sulphuric acid (Mulliken and Scudder), absorbed bromine and iodine readily, and a barium salt prepared from it had the properties of barium oleate.

‡ The lead precipitate insoluble in ether, obtained in the oleic acid separation, was suspended in water and the lead precipitated by hydrogen

The preparation contains 5.48 per cent phenolphthalein, 5.82 per cent salicylic acid, with sodium oleate, menthol, excipients, and 28.70 per cent of an unidentified vegetable drug.

Laxaphen.

4535. *Laxaphen,* Parke, Davis and Co., Detroit, Mich. "Each fl. oz. contains phenolphthalein 8 grs., salicylic acid 3-5 gr., in a palatable chocolate base." Price 35 cents for 4 fl. oz.

A brown syrup with the taste of chocolate and vanilla.

Spec. gr. @ 15.6° C.	1.2381	Phenolphthalein	1.35
Solids	55.00	Salicylic acid	0.077
Ash	0.19	Ether extract	2.98
Reducing sugars before inv., as dextrose	2.82	Alcohol extract	2.44
		Cacao solids, vanilla	present
Reducing sugars total, as dextrose	34.20		

The preparation contains about 7.74 grs. phenolphthalein and 0.44 gr. salicylic acid per fl. oz., with sugar, cacao solids and vanilla flavor.

REMEDIES FOR THE STOMACH AND BOWELS.

Adler-i-ka.

4516. *Adler-i-ka Treatment,* The Adlerika Co., St. Paul, Minn. "For Bowel and Stomach Diseases." "Composed of twelve medicinal substances. Contains no opium or other narcotics." Price 93 cents for 11.8 fl. oz.

A brown liquid, with some brown sediment, with an aromatic odor, and with a bitter, salty taste.

Spec. grav. @ 15.6° C.	1.1704	Ash	15.21
Alcohol by volume	1.08	Magnesium oxide	5.06
Non-volatile solids	22.68	Sulphuric anhydride	9.97
Glycerine	2.69	Salicylic acid	0.13
Reducing sugars	0.26	Aloes, saccharin	present
Other vegetable extractives	4.52	Alkaloids	none

sulphide. The lead sulphide was removed by filtration and the filtrate extracted with ether. The solvent was evaporated at room temperature spontaneously and the residue dried in vacuo over sulphuric acid. The residue thus obtained was white and crystalline, gave a violet color with ferric chloride, and the odor of methyl salicylate when heated with sulphuric acid and methyl alcohol; its melting point was 159° C.

It is interesting to note that both the oleic acid and the salicylic acid residues showed a slight contamination with phenolphthalein.

While aloes, and possibly some other vegetable drugs, are present to the extent of 4.5 per cent, the 15 per cent of anhydrous magnesium sulphate (Epsom salts) is probably the most active constituent.

The manufacturers of *Adler-i-ka* are very conservative in their claims on the label. Their correspondence with druggists and their advertisements in the local papers, however, show the false pretenses under which the remedy is sold, "The company in a leaflet that it sends around to druggists frankly admits that it is not the people who *have* appendicitis that might be expected to buy this worthless and potentially dangerous fraud, but those who *think* they have it." (*Nostrums and Quackery, 582.*) Furthermore although the remedy has been "made famous by curing appendicitis," a preparation containing 15 per cent of Epsom salts and considerable aloes might involve great danger to a sufferer from appendicitis. And yet prominent druggists in our different communities are willing to lend their names and influence to the exploitation of this dangerous fraud.

Bad-Em Salz.

4519. *Bad-Em Salz,* The American Laboratories, Philadelphia, Pa. "An incomparable remedy for Diseases of Stomach, Intestines, Liver, Kidneys and Bladder." Price 50 cents for 8.7 oz.

An odorless, white, crystalline powder with an alkaline taste.

Loss @ 100° C.	8.10	Sulphuric anhydride	22.16
Chlorine	7.97	Tartaric acid	7.54
Sodium oxide	38.18	Potassium and calcium	traces
Carbon dioxide	19.45	Magnesia	none

The above data indicate that the preparation is a mixture of sodium chloride, sodium sulphate, sodium carbonates and tartaric acid.

The baths at Ems have a wide reputation for their efficiency in certain physical disorders. The manufacturers of this preparation attempt to give by the brand name the false impression that these salts have some close connection with this famous Ems "Bad." In fact the label states that "this powder reproduces the medical properties of the great European springs, famous for centuries for the cure of diseases of the stomach, intestines, liver, kidneys and bladder." The Federal government, however, has successfully maintained a charge of misbranding against this preparation in this connection, and the name has been changed to *Bad-Ex Salts.*

Although consisting only of common well-known salts we are assured by the manufacturers that their preparation is a remedy for Dyspepsia, Gastritis, Catarrh of the Stomach, Vomiting, Heartburn, Nervous Affections of the Stomach, Intestinal Indigestion, Diarrhoea, Constipation, Hemorrhoids, Biliousness, Torpid Liver, Jaundice, Gall Stones, Inflammation of the Kidneys, Gravel, Catarrh of the Bladder, Diseases of Women, Skin Diseases, Gout, Rheumatism, Uric Acid, Obesity, Diabetes, and "Unusual Diseases," "the kind that you yourself and even the doctor are not sure of."

The label claims a net weight of 11 oz., but we find only 8.7 oz.

Bisurated Magnesia.

4704. *Bisurated Magnesia,* International Druggists' and Chemists' Laboratories, Paris, New York, London. "An Antacid, especially prepared for dyspepsia, indigestion and digestive disorders arising from hyper-acidity of the stomach. Corrects heartburn, distress after eating, bad sour breath; relieves belching, gas, bloating, headaches, dizziness and similar disorders attendant upon hyper-acidity." Price 50 cents for 0.7 oz.

An odorless white powder.

Loss @ 100° C.	10.75	Bismuth oxide	1.49
Magnesium oxide	51.90	Sulphuric anhydride	0.41
Calcium oxide	6.30	Carbon dioxide	20.40
Sodium oxide	10.79	Potassium oxide	trace

From the above the following hypothetical composition of the mixture may be calculated:

Loss @ 100° C.	10.75	Calcium carbonate	11.24
Bismuth subcarbonate (Bi_2O_3 $CO_2.H_2O$)	1.69	Magnesium carbonate	10.87
		Magnesium sulphate	0.62
Sodium bicarbonate	18.43	Magnesium oxide	46.49

No doubt these alkaline salts would have a tendency to correct hyper-acidity. All of the drugs the compound contains are cheap

except the bismuth salt, and the amounts supplied in the 0.7 oz. of material are worth in the retail market not over one cent.

Caldwell's Syrup Pepsin.

5500. *Dr. W. B. Caldwell's Syrup Pepsin and Herb Laxative Compound,* Pepsin Syrup Co., Monticello, Ill. "Alcohol 8.5%." Price 50 cents for 5.7 fl. oz.

A brown syrup with the taste and odor of senna, peppermint and cloves or cinnamon.

Spec. grav. @ 15.6° C.	1.1993		
Alcohol by volume	8.16		
Solids	54.83	gms. per	100 cc.
Ash	0.43	"	"
Sucrose	49.45	"	"
Invert sugar	1.42	"	"
Salicylic acid	0.12	"	"
Organic matter, non-sugars	3.53	"	"
Senna	present		
Oil of peppermint	present		
Oil of cinnamon or cloves	present		
Pepsin, if any	very slight		
Phenolphthalein, glycerine	none		

This is an alcoholic sugar solution containing senna and a small amount of salicylate, and flavored with oil of peppermint and aromatics. Pepsin, if any, is present in an inappreciable amount.

The company in its circular tells us

"Having made the science of vegetation a study for many years, discovering and isolating proximate principles of plant drugs containing the most valuable properties and most wholesome substances that may be used to promote human health, separating the inert material with which they are combined, we offer to the world the most convenient, agreeable and acceptable laxative, delicate and effective, having a pleasant flavor, adapted for children, a mild action and soothing effect."

There is no question as to the efficacy of this compound as a laxative but the company's study of "the science of vegetation" apparently stopped with senna, a drug whose value was recognized by the Arabians as early as the ninth century. If pepsin ever was present in the compound, its power as a digestive had been completely lost in the sample which we have analyzed.

Mother Gray's Sweet Powders for Children.

4697. *Mother Gray's Sweet Powders for Children.* Allen S. Olmsted, Le Roy, N. Y. Price 25 cents for 14 powders weighing 8.71 gms., or 9.6 grs. per powder.

Powders with a sweet, licorice taste.

Loss @ 100° C.	1.00	Sulphur	3.18
Ash	1.88	Water-extract	91.38
Reducing sugars before inv., as dextrose	1.96	Licorice powder	present
Reducing sugars total, as dextrose	90.48	Senna	small amt.
		Phenolphthalein	none

This preparation is quite similar to the *Compound Licorice Powder* of the U. S. P. as to ingredients, but the proportions are very different. The U. S. P. product contains 50 per cent sugar, 23.6 licorice powder, 18 powdered senna, 8 sulphur, and 0.4 per cent oil of fennel, while in *Mother Gray's* preparation all of the active therapeutic agents are reduced in quantity and sugar, which is their least desirable ingredient for children suffering from stomach or bowel troubles, is increased from 50 to over 90 per cent.

Regulin.

4514. *Regulin,* The Reinschild Chemical Co., New York. Price 50 cents for 1.62 oz.

A coarsely-shredded substance of a brownish color.

Water	12.35	Cascara	present
Ash	3.95	Agar-agar	present
Galactan	19.53		

The material is agar-agar colored by an aqueous infusion of cascara. The value of agar-agar in the treatment of constipation is well recognized. Cascara also is a drug of known alterative properties, but its use here in connection with agar-agar would appear to be unnecessary and open to the objection stated by the manufacturers themselves that "all laxatives and cathartics impose a tax on the already affected intestinal tract." The really useful ingredient in *Regulin* is the agar-agar, which ordinarily costs about 70 or 80 cents per pound, while in this preparation it costs about five dollars. The use of agar-agar can hardly be called a "New Treatment for Constipation," nor

can cascara be considered "a Harmless Vegetable Addition to Daily Food."

MINERAL OIL PREPARATIONS.

For the analysis of proprietary preparations of liquid petrolatum see page 359.

TONICS.

Cuticura Resolvent.

5494. *Cuticura Resolvent,* Potter Drug and Chemical Corporation, Boston, Mass. "Alcohol 20%." "A gentle alterative tonic, digestive and aperient." Price 39 cents for 6.3 fl. oz.

A dark-brown liquid with an alcoholic aromatic odor, and a sweet, slightly-bitter after-taste.

Spec. grav. @ 15.6° C.	1.0594
Alcohol by volume	18.85
Solids	21.81 gms. per 100 cc.
Sucrose	5.54 " " "
Invert sugar	12.55 " " "
Ash	0.81 " " "
Potassium oxide	0.22 " " "
Iodine	0.58 " " "
= potassium iodide	0.76 " " "
Sodium oxide	0.03 " " "
Yellow coloring matter, extracted by ether	large amount
Alkaloids	slight trace
Glycerine, emodin	none
Strychnine, quinine, morphine, cocaine	none

The *Resolvent* is an alcoholic, syrupy liquid containing 0.76 gm. of potassium iodide and 2.91 gms. of unidentified vegetable extractives per 100 cc. In composition it is not unlike ordinary *Compound Extract of Sarsaparilla.*

Manola.

4706. *Manola,* The Manola Co., St. Louis, Mo. "Alcohol 18%. Price one dollar for 19.3 fl. oz.

A brown, turbid liquid with an aromatic odor, like cinnamon, and a vinous taste.

Spec. grav. @ 15.6° C.	1.0389	
Alcohol by volume	17.35	
Non-volatile solids	17.96	gms. per 100 cc.
Glycerine	2.09	" " "
Reducing sugars, as dextrose	11.77	" " "
Ash	0.28	" " "
Potassium oxide	0.11	" " "
Phosphoric anhydride	0.076	" " "
Nitrogen	0.04	" " "
Cinchona alkaloids	0.0042	" " "
Strychnine	present	
Arsenic	trace	
Calcium, magnesium, iron, sodium	traces	

The label makes the following claim:

"Each 0.5 oz. contains 1 min. each of tr. echinacea, tr. cinchona and phos. acid dilute U. S. P., and 0.5 min. each of Fowler's solution and tr. nux vomica U. S. P. and also the tissue phosphates of Ca, K, Na, Fe, Mg, etc., aromatics, with a nutritious palatable base."

In such a complex preparation as this it is impossible to state the exact proportions in which the numerous ingredients are present. We identified all the claimed ingredients except tincture of echinacea, for which we could find no reliable test. Cinchona alkaloids, phosphoric acid, arsenic (probably due to Fowler's solution) and strychnine (probably due to tincture of nux vomica) were found to be present. Our analysis agrees very closely with one made by the *Journal of the American Medical Association* in 1910, except that we find only 0.28 gm. of ash where the *Journal* found 0.96 gm. Apparently the amount of "tissue phosphates" has been somewhat reduced.

Manola is recommended as "a Powerful Reconstructive Tonic and Alterative, Blood Maker and Tissue Builder."

"*Manola* is indicated wherever Cod Liver Oil would be used. It is especially efficient in Phthisis Pulmonalis on account of its reconstructive and nutritive elements, lessens the muco-purulent expectoration, and arrests night sweats."

"*Manola* is a boon to nursing mothers increasing the quantity and quality of their milk."

"*Manola* possesses a wonderful power as a prompt and reliable restorative in those cases of general and nervous debility peculiar to married women."

"The ideal tonic and reconstructive in all conditions, from the deficient development of childhood to the exhaustion and debility of old age."

"*Manola* embodies the five tissue or cell phosphates in the same relative proportions in which these phosphates are represented in the cells which make up the human organism. . . . They are divided into several groups: *The Cell Constructants,* Calcium Phosphate, Magnesium Phosphate. *The Oxidizing Agent,* Ferrum Phosphate. *The Nutritive Stimulant,* Sodium Phosphate. *The Vitalizing Constituent,* Potassium Phosphate."

The above claims are so palpably false that they need no refutation. The last claim for the cell phosphates, however, might be imposing were it true and were it not for the stubborn facts of our analysis. We found but 0.28 gm. of ash per 100 cc., which would include all the phosphates (only 0.076 gm. of phosphoric acid per 100 cc.), and while a small amount of potash was present, 12.5 cc. of the medicine did not yield enough of either lime, magnesia ("Cell Constructants"), soda ("Nutritive Stimulant") or iron ("Oxidizing Agent") to weigh. The "tissue phosphates" may be desirable ingredients in a medicine, but *Manola* is sadly deficient in them.

Vin Mariani.

5498. *Vin Mariani à la Coca du Pérou,* Mariani and Co., Paris and New York. "Alcohol 17%; free from cocaine." Price 90 cents for 16.7 fl. oz.

A wine with the taste of extract of coca leaves.

Spec. grav. @ 15.6° C.	1.0143	
Alcohol by volume	16.25	
Extract	8.90	gms. per 100 cc.
Ash (containing soda, potash, carbonates and phosphates)	0.23	" " "
Glycerine	0.42	" " "
Sucrose	0.10	" " "
Invert sugar	6.60	" " "
Total acidity, as tartaric	0.495	" " "
Volatile acidity, as acetic	0.072	" " "
Salicylates, benzoates, saccharin, cocaine and other alkaloids	none	

The analysis indicates this is a mixture of Bordeaux wine and an alcoholic extract of decocainized coca leaves, with the addition of 6 to 7 per cent of sugar.

"It is pronounced serviceable in anaemia, debility, indigestion, bronchitis, la grippe, vocal weakness, continued fevers, nervous troubles, malaria, overstrain, melancholia, heart affections, mental and muscular weakness, diseases of the aged, and in protracted convalescence it is employed successfully."

Vin Mariana has simply the tonic properties of ordinary red wine, and, since the cocaine which it formerly contained is now eliminated, its "bracing" effect is probably due to its 16 per cent of alcohol and to nothing else.

WINCARNIS.

4703. *Wincarnis,* Coleman and Co., Norwich, Eng. "Alcohol 18.5%." Made from choice wine, Leibig's extract of meat and extract of malt." Price $1.65 for 25.3 fl. oz.

A clear brown liquid with the odor and taste of port wine.

Spec. grav. @ 15.6° C.	1.0408	
Alcohol by volume	19.61	
Solids	16.33	gms. per 100 cc.
Ash	0.42	" " "
Glycerine	0.49	" " "
Reducing sugars	13.04	" " "
Nitrogen	0.084	" " "
Iron	slight trace	
Salicylates, benzoates, alkaloids	none	

This preparation appears to be a wine to which has been added malt extract and a small amount of meat extract. The amount of the latter is extremely small, as Leibig's extract contains 9.41 per cent of nitrogen, and the total nitrogen in *Wincarnis* amounts to but 0.08 per cent, certainly insufficient to have any appreciable tonic effect.

MISCELLANEOUS REMEDIES.

CUTEX.

4713. *Cutex,* The Special Products Co., New York. "An Ideal Cuticle Remover." Price 25 cents for 0.5 oz., with a stick for application and a small amount of absorbent cotton.

A colorless solution with a faint odor of oil of rose.

Ash	2.35	gms. per 100 cc.
Potassium oxide	1.34	" " "
Sodium oxide	0.16	" " "
Glycerine	12.24	" " "
Carbon dioxide	very small amount	
Oxalic acid	none	
Oil of rose	present	
Suspended gelatinous matter, chiefly silica and aluminum	small amount	
Reaction	strongly alkaline	

Cutex is a water-glycerine solution of 1.50 per cent caustic alkali, perfumed with oil of rose. The normal price of caustic potash is 15 cents per pound, which quantity would make 30 liters of a preparation of the same causticity as *Cutex,* which sells for 25 cents per half ounce.

EN-AR-CO OIL.

4705. *En-Ar-Co Oil* (formerly known as *The Wonderful Japanese Oil*), National Remedy Co., New York. "Alcohol 5%." Price 50 cents for 2 fl. oz.

A dark-brown liquid with a strong odor of fusel oil.

			Fractional Distillation.	
Spec. grav. @ 15.6° C.	0.8545			
Alcohol by volume	3.60		From 85°–90°	6.0
Non-volatile solids	0.85	gm. per 100 cc.	" 90°–100°	7.6
Ash	0.002	" " "	" 100°–120°	22.4
Capsicum	present		" 120°–130°	35.2
Fusel oil	present		" 130°–140°	17.4
Oil of eucalyptus	present		Oily residue	11.4

This preparation is essentially fusel oil (about 85%), tincture of capsicum and oil of eucalyptus.

The manufacturer tells us that *En-Ar-Co Oil* is

"A medicine that is equally valuable for man, beast or fowl, is something outside the general run, and should attract the attention of all classes accordingly." . . . "We do not claim it to be infallible, or to cure everything, but we do believe that it comes nearer to accomplishing all this than any other known remedy; for proof of this read list of diseases printed hereon, which it relieves, and the testimonials published here and elsewhere."

The list of diseases referred to includes among others asthma, cholera morbus, fever sores, gout, headache, snake bites, rheumatism and the itch in human beings, "All diseases common to horses, cattle, fowl, etc.," and "is also excellent for making hens lay."

Fusel oil is an exceedingly dangerous poison, and should not be sold without a poison label. This remedy, however, is not alone recommended for external use, but also for internal medication, "for persons under six years of age five drops, over six years eight to ten drops." In spite of its dangerous character we are assured that

"It is just as necessary to keep a bottle of *En-Ar-Co Oil* in the house as to have a bottle of glue, ink, or any other article which may be required at any moment."

Gets-It.

4523. *Gets-It.* E. Lawrence and Co., Chicago, Ill. "Each ounce contains alcohol 20%, ether 61%." "For Corns, Callouses, Warts and Bruises, Allays Inflammation, Stops Pain at Once." Price 25 cents for 6.5 cc., about one-third of which in our sample had probably been lost by evaporation, although the seal was unbroken.

On account of this partial loss of material by evaporation only qualitative tests were made. The preparation was a brown liquid of ethereal odor, and left a transparent film on evaporation. The presence of alcohol, ether and collodion was demonstrated, as well as a large amount of salicylic acid; no *Cannabis indica* was detected.

Gets-It is simply a collodion preparation of salicylic acid, quite similar to the *Corn Collodion* of the U. S. Dispensatory, except for the omission of *Cannabis indica.*

Dr. Miles' Restorative Nervine.

5499. *Dr. Miles' Restorative Nervine.* Dr. Miles Medical Co.'s Laboratory, Elkhart, Ind. "Non-alcoholic." Price one dollar for 8.7 fl. oz.

A dark-brown, syrupy liquid, with an aromatic odor, and a sweet, saline taste.

Spec. grav. @ 15.6° C.	1.3350
Alcohol	none
Ash	16.51 gms. per 100 cc.
Potassium oxide	3.46 " " "
Sodium oxide	2.40 " " "
Bromine	12.74 " " "
Ammonia (NH_4)	0.183 " " "
Sucrose	46.30 gms. per 100 cc.
Invert sugar	6.14 " " "
Benzoic acid	0.04 " " "
Glycerine	none
Alkaloids, antipyrine, emodin	none
Aromatic volatile oil	slight amount

The preparation is a heavy syrup containing about 17 per cent of bromides, chiefly potassium and sodium, with a smaller amount of ammonium bromide; a small amount of benzoic acid is also present.

We are told by the manufacturers that "all of Dr. Miles' Remedies are Safe," and yet the dosage of this *Nervine,* with its 17 per cent of bromides, for children fourteen years old is one teaspoonful three times a day. The long-continued use of bromides is not without danger.

Modene.

4527. *Modene,* for Removing Objectionable Hair, Modene Mfg. Co., Cincinnati, O. Price one dollar per oz.

A pale yellow powder with a slight odor of hydrogen sulphide.

Ash	97.78	Sodium oxide, water-sol.	0.14
Ash, insol. in HCl	85.38	Sulphur, total	2.40
Barium	10.30	" water-sol.	1.59
Potassium oxide, water-sol.	0.07	" free	none

The preparation appears to be essentially a mixture of about 13 per cent of barium sulphide with 85 per cent of siliceous material. (A small amount of calcium sulphide may also be present.) We are told by the manufacturers that it is "the only preparation known to science that will remove objectionable hair without the slightest injury or discoloration to the most delicate skin," and that it "is of recent scientific discovery."

Barium sulphide, the active ingredient of this product, may be bought at retail for 20 cents per pound; in *Modene* one dollar is asked for about one-eighth of an ounce.

Mu-Col.

4693. *Mu-Col,* for Cleansing Mucous Membranes, The Mu-Col Company, Buffalo, N. Y. Price 25 cents for 2.4 oz.

A white powder with an aromatic odor.

Boric acid	32.85	Thymol, oil of wintergreen, and possibly menthol and eucalyptol	present
Chlorine	28.56		
Sodium	present		

The material consists of 47.12 per cent sodium chloride (common salt) and 50.62 per cent borax ($Na_2B_4O_7$. 10 H_2O) with small amounts of thymol, oil of wintergreen, and possibly menthol and eucalyptol. Whatever virtues the remedy possesses undoubtedly lie chiefly in the two common drugs, table salt and borax, which make up nearly 98 per cent of the mixture.

Musterole.

4696. *Musterole,* The Musterole Co., Cleveland, O. Price 25 cents for 0.78 oz.

An ointment with the odor of mustard oil and menthol.

Loss @ 100° C.	10.83	Menthol	present
Fatty base, by difference	89.17	Camphor	prob. present
Mustard oil	1.67		
Ash	0.02		

As a counter-irritant perhaps *Musterole* has a place among "home remedies." When it is advertised, however, as it is in our local papers, with the claim that it "prevents pneumonia," it of course enters the fraudulent class.

Odo-Ro-No.

4700. *Odo-Ro-No.* Odorono Co., Cincinnati, O. "External use only." Price 25 cents for 1.1 fl. oz.

A red liquid with an aromatic odor.

Aluminum oxide	7.95 gms. per 100 cc.
Chlorine	13.90 " " "
Sodium oxide	0.40 " " "
Sulphuric anhydride	0.19 " " "
Reaction	acid
Borates, nitrates, salicylates, resorcin	none
Aromatics, color	present

The material consists essentially of 37.58 gms. aluminum chloride (Al_2Cl_6. 12 H_2O), 0.72 gm. sodium chloride and 0.19 gm. sulphuric anhydride per 100 cc., with water, aromatics and color.

The free acid in this preparation, and the probability of the production of further free acid from the breaking down of the aluminum chloride militate against the safe use of *Odo-Ro-No.*

Optona.

4702. *Optona,* for the Eyes, Optona Co., Rochester, N. Y. Price one dollar for 37 white compressed tablets weighing 0.4 oz.

Loss @ 100° C.	19.21	Chlorides	trace
Loss on ignition	38.35	Sulphates, phosphates, nitrates, alkaloids	none
Boric acid	84.56	Reaction	alkaline
Sodium oxide	13.99		
Carbon dioxide	3.51		

From the above data *Optona* appears to be a mixture of about 37.50 per cent of borax ($Na_2B_4O_7$), 38.50 per cent of boric acid and 7 per cent of sodium bicarbonate, with water of crystallization. Surely a simple preparation to buy at the rate of one dollar for 0.4 oz., and yet the manufacturers tell us that the first reason for offering *Optona* in tablet form is "because this enables us to give *Optona* users more for their money. It would be impossible for us to make two quarts of this liquid solution, bottle it and offer it at the price we now sell *Optona.*"

Mosso's Oil of Salt.

5674a. *Mosso's Oil of Salt,* C. A. Mosso, Chicago, Ill.

A yellow, oily liquid with an odor resembling turpentine. It had a spec. grav. of 0.9254 @ 15.6° C., and a butyro-refractometer reading of 80.1 @ 25°. It began to distill at about 160°, but this point was very indefinite as the distillation temperature rose very quickly and the liquid decomposed giving off an acrolein-like odor. Under these conditions fractional distillation was difficult, and the distillation was stopped at 300°. The residue was heavy, viscid, of a dark-brown color, and with a fishy odor. The distillate was of a lower gravity, with a fishy odor and refracted at 67.0° at 25°. Tests for phenol derivatives in the original compound and in the distillate were negative; 5 cc. were ignited and gave a residue of 0.0003 gm., equivalent to 0.006 gm. of ash per 100 cc. This gave a faint opalescence when dissolved in water and treated with silver nitrate. The compound contained not more than a trace of chlorides.

The Halphen test for cotton seed oil was negative, and the Hanus number was 150.0. On saponifying with potash, and extracting with ether, a small amount of unsaponifiable matter was found with the odor of oil of sassafras. The saponification residue was acidified and the fatty acids separated; these were liquid at room temperature and resembled fatty acids of the oleic acid series.

Oil of Salt is probably a mixture of volatile terpene compounds and fixed oils of the linseed and marine oil types, and contains but a trace of chlorides.

That this material varies in composition from time to time is shown by the following analysis given in the *Jour. Amer. Med. Asso. Aug. 14, 1915, 640*:—

"A mixture consisting of about two-thirds linseed oil with one-third of a mixture of essential oils, including turpentine, camphor and sassafras, containing total chlorides equivalent to 0.52 per cent HCl, one-third of which is present as free HCl."

We find distinct evidence of a marine oil, only a trace of chlorides and no free HCl.

This preparation is especially exploited among manufacturers as a "First Aid" for injured workmen. It would be an ignorant factory superintendent indeed who would believe that such a mixture as the above could produce the results claimed for *Oil of Salt*:—

"Our Compound promptly relieves pain, stops flow of blood, prevents infection; Causes Wounds to Heal Very Rapidly in all cases of Cuts, Burns, Bruises," etc. "Hayfever, Rheumatism, Neuralgia, Skin Troubles such as Salt-rheum, Eczema, Pimples, etc. Piles of all kinds, Indigestion, Diarrhoea, Nervousness, Female Weakness and prostatic troubles; all of which can be restored to perfect order by the use of Mosso's Oil of Salt."

The manufacturer reveals his ignorance of pathology when he tells us that diabetes is "commonly called Bright's disease."

The preparation is also exploited under the name "First Aid Treatment," and sold by the Pan-Albert Laboratories, Chicago.

TINCTURE OF VANILLA.

(*Tinctura Vanillae.*)

Twenty-seven samples from the stock of druggists were examined for the Dairy and Food Commissioner. Twenty-three of these were genuine tincture of vanilla, containing from 0.11 to 0.36 gm. of vanilla per 100 cc. Two samples were legally labeled compounds.

The two following samples were misbranded:—

9940. *"Ext. Vanilla Compound,"* Hoadley and Hutchinson, Branford. It contained 0.50 gm. of vanillin and 0.0312 gm. of coumarin per 100 cc., and was artificially colored, 85 per cent of the color being insoluble in amyl alcohol.

10059. *"Compound Extract of Vanilla,"* Taylor's Pharmacy, New London. It contained 0.41 gm. of vanillin and 0.0608 gm. of coumarin per 100 cc.

BAR WHISKEY.

Owing to the lax governmental rulings as to what is whiskey, almost any alcoholic beverage may be sold under that name provided it contains from 45 to 50 per cent of alcohol derived from grain. The use of caramel to give alcohol an appearance of age is tolerated, and as a consequence much of our "four-year-old" whiskey is a made-over-night concoction of water, grain alcohol, caramel, prune juice and beading oil. The peculiar aroma and flavor for which whiskey is valued, and which is developed only by the slow maturing of the whiskey over a long period of time are, according to governmental interpretation, no longer essential characters of true whiskey.

It has been suggested that the sudden evil effect of certain bar whiskies on the users indicated that some harmful ingredient other than alcohol might be present, such as wood alcohol, ether or chloral hydrate. The present examination was undertaken, therefore, to determine the alcoholic content of bar whiskey, and the presence or absence of these foreign poisons. In the present state of official opinion it appeared futile to indulge in the niceties of a real whiskey analysis.

One hundred and twenty-three samples were analyzed, in most cases representing the cheapest grades of whiskey sold in our larger cities. In 15 of the samples wood alcohol was suspected from the differences between the actual and theoretical readings of the distillates as shown by the immersion refractometer. The most careful tests, however, failed to demonstrate the presence of wood alcohol in any case, other than possibly mere traces. Likewise neither ether nor chloral was found in any of the samples.

TABLE XXVII:—ANALYSES OF BAR WHISKEY.

Station No.	Dealer.	Price Paid for 8 oz. Requested.	Quantity Delivered.	Alcohol by Volume.	Solids.	Color Insoluble in Amyl Alcohol.
		cts.	oz.	%	%	%
	New Haven.					
4768	Josef Adler, 467 State St.	20	8	45.72	.395	30.5
4789	" " " " "	15	8	39.24	.095	80.5
4759	The Arlington, 152 Meadow St.	25	8	45.67	.100	7.3
4755	The M. J. Beck Co., 398 Grand Ave.	15	8	39.83	.370	72.9
4760	" " " " Grand Ave. & Jefferson St.	15	8	39.84	.313	64.2
4770	" " " " " 562 Grand Ave.	15	8	43.73	.195	65.4
4783	" " " " " 144 Congress Ave.	20	8	46.01	.140	8.6
4786	" " " " " 800 Grand Ave.	25	8	47.07	.614	41.6
4798	" " " " " East St. & Grand Ave.	20	8	46.03	.232	43.7
4802	Jos. Blake, Carlisle St. & Union Ave.	25	8	45.78	.667	63.4
4806	B. Bohan, 46 Putnam St.	25	8	31.72	21.470	68.0
4771	T. E. Cahill, 133 Dixwell Ave. (Harper)	25	8	46.41	.312	59.5
4767	Michele Cappeta, 40 Olive St.	25	8	45.52	.335	65.6
4795	Cedar Hill Café, 1146 State St.	25	8	35.95	.243	77.6
4782	Congress Ave. Café, 250 Congress Ave. (Lalley's Jockey Club)	25	8	43.57	.541	70.1
4807	James Cotiero (?), 128 Commerce St.	25	8	45.10	.390	56.8
4811	G. S. D'Annielo, 21 Collis St.	25	8	44.68	.277	68.8
4792	C. Defelice, 79 Oak St. (Old Bronson)	25	8	45.84	.195	74.6
4804	Alfonso De Maio, 52 Fair St.	25	8	44.41	.819	49.6
4793	Doolittle Inn, 327 State St.	25	8	42.96	.445	73.8
4778	Durant Hotel, 160 State St.	25	8	45.58	.158	5.0
4766	Joseph A. Frye, 121 Broadway	25	8	41.99	.520	56.9
4761	Giuseppe's Café, Water & Warren Sts.	25	8	34.09	.120	97.6
4785	Grenon Bros., 116 Crown St.	25	8	45.80	.151	6.0
4774	Hotel Carrollton, 674 Chapel St.	25	8	43.55	.222	70.7
4757	Hotel Davenport, Orange & Court Sts.	40	8	43.51	.115	32.8
4756	Hotel Freeman, 179 Meadow St.	25	8	45.71	.815	71.1
4763	Hotel Oneco, 14 Church St.	25	8	44.56	.230	71.8
4784	L. P. Ihne, Orange & Crown Sts.	25	8	45.58	.445	58.9
4810	Imperial Café, 12 St. John St.	25	8	44.86	.281	52.9
4776	Fred. Jacob, 113 Water St. (Old Standard)	25	8	46.42	.755	72.6
4772	J. J. Johnson, 636 Congress Ave.	25	8	46.84	.129	6.2
4791	Mrs. John Keehan, 164 Franklin St.	25	8	42.91	.670	57.3
4762	James Kelley, 172 Ashmun St.	25	8	42.53	.105	72.1
4779	Maiorino Bros., 46 Fair St.	15	8	31.93	.098	78.1
4781	" " 173 Wooster St.	30	8	43.46	.471	83.2
4803	Marble Café, 38 St. John St.	25	8	45.88	.470	43.0
4799	A. Maresco, 193 Hamilton St. (Royal XXXX)	25	8	40.01	.197	66.0
4769	——— McCarthy, 316 East St.	25	8	42.69	.290	76.2
4753	Peter McDermott, 294 Ashmun St.	25	8	45.33	.408	68.7
4805	M. F. McNerney, 93 Cedar St.	25	8	33.28	.293	60.3
4797	Victor Mettling, 1280 State St.	25	8	46.45	.528	65.8
4765	[1]Chas. W. Motley, Jr., 153 Dixwell Ave.	25	7	45.26	.617	66.9
4794	John Nolan, 256 Wallace St.	25	8	43.33	.134	7.0

[1] Our 8 oz. bottle kept and 7 oz. given in exchange.

TABLE XXVII:—ANALYSES OF BAR WHISKEY.—*Continued.*

Station No.	Dealer.	Price Paid for 8 oz. Requested.	Quantity Delivered.	Alcohol by Volume.	Solids.	Color Insoluble in Amyl Alcohol.
		cts.	oz.	%	%	%
4752	Thomas Nolan, 443 Grand Ave.	25	8	45.64	.720	74.3
4751	——— Ochenkowski, 770 Grand Ave.	25	8	44.08	.985	75.1
4809	Joe Ornato, 31 Green St.	25	8	52.61	.171	4.8
4777	Oxford Hotel, 132 State St.	25	8	44.71	.454	68.8
4788	Max Price, 123 Oak St.	15	8	42.13	.118	87.5
4750	[2]J. Quint Co., 835 Grand Ave.	20	7	45.73	.395	47.0
4775	Hugh J. Reynolds, 152 Crown St.	25	8	45.63	.931	19.2
4790	Peter Reynolds, 1362 State St.	25	8	46.51	.781	74.8
4780	B. Ruggiero, 709 Congress Ave.	25	8	36.93	.131	95.2
4754	R. Salimeno, 34 Olive St.	25	8	40.47	.095	63.7
4787	H. Salzmann, 53 Congress Ave.	15	8	37.36	.123	67.0
4764	Jacob Strauss, 27 George St. (Cabinet)	15	8	38.37	.090	76.5
4773	" " " " " (Private Stock Reserve)	20	8	45.44	.130	73.2
4758	Herman Taylor, 35 Broadway	25	8	43.89	.871	68.9
4796	Vanacore & Mocci, 194 Wallace St.	25	8	27.38	.771	80.6
4808	M. Weadlick, 166 Bridge St.	25	8	21.91	12.750	79.2
4812	Wooster Café, Wooster & East Sts.	25	8	45.01	.282	71.0
	Hartford.					
4813	[3]J. Bronerwine, 205 Windsor St.	15	7	30.84	.156	79.7
4817	[3]——— Coppelli, 406 Front St.	15	7	42.97	.158	8.4
4823	[3]A. C. Gallucci, 466 Front St.	15	7	37.34	.167	64.1
4816	[3]Julian Glowack, 16 Sheldon St.	25	7	46.35	.240	75.3
4821	Hartford Distillery Co., 83 Windsor St.	15	8	40.19	.113	77.1
4824	[3]Ed. Kacprzinski, 161 State St.	15	7	29.83	.088	77.5
4814	[4]Michael Kolar, 1180 Main St. (Old Cabinet)	25	7	44.82	.342	58.7
4818	[3]People's Café, 283 Front St.	15	7	36.94	.137	73.4
4822	M. S. Sczawinski, 53 Sheldon St.	25	8	45.05	.243	75.1
4815	[5]G. Stovola, 290 Front St.	15	7	37.76	.159	74.4
4820	[3]Synnott Bros., 522 Main St. (Sherwood)	25	7	39.84	.398	73.3
4819	M. Yellin, 177 Windsor St.	25	8	47.96	.364	46.8
	Norwich.					
4826	[6]Henry Allard, 29 No. Main St.	25	7	39.89	.123	71.3
4828	D. J. Driscoll, 157 No. Main St.	25	8	45.49	.144	55.6
4825	H. Jackel & Co., Water & Market Sts.	25	8	45.16	.180	16.3
4831	C. Karpenia, 95 Water St.	25	8	44.79	.112	61.8
4827	Larwiere Bros., 62 Water St.	25	8	45.75	.157	5.7
4833	Levine Bros., 8 No. Thames St.	25	8	50.31	.160	4.8
4830	Lurie & Bendett, 152 W. Main St.	25	8	52.28	.149	4.4
4834	F. Pedace & Co., 9 Bath St.	25	8	44.42	.162	36.1
4832	A. Schauken, 43 W. Main St.	15	8	39.06	.116	66.5
4829	J. Stein, 93 W. Main St.	15	8	37.54	.147	81.7
4836	Tomaino Bros., 174 W. Main St.	25	8	45.52	.420	79.1
4835	L. Wunderlich & Co., 21 Bath St. (Old Empire Straight)	25	8	46.28	.432	46.6

[2] No statement of volume; contained 7 oz.
[3] "7 oz." blown in bottle.
[4] "Full ½ pt." blown in bottle; handstamped "7 oz."
[5] Labeled "This bottle contains 7 oz."

TABLE XXVII:—ANALYSES OF BAR WHISKEY—*Concluded.*

Station No.	Dealer.	Price Paid for 8 oz. Requested.	Quantity Delivered.	Alcohol by Volume.	Solids.	Color Insoluble in Amyl Alcohol.
		cts.	oz.	%	%	%
	New London.					
4847	R. Centinella & Co., 79 Main St.	15	8	34.81	.187	66.2
4839	Michael Doyle, 99 Bradley St.	25	8	49.07	.112	6.0
4848	Phil. Dufresne, 15 Bradley St.	25	8	46.34	.549	23.8
4844	Max R. Einhorn, 23 Bradley St.	15	8	35.02	.254	87.8
4843	J. Hoff (?), Water & Atlantic Sts. (Paul Jones)	25	8	44.50	.180	87.6
4846	Edward Keefe, 489 Bank St.	25	8	39.34	.763	66.6
4838	Thos. J. Kehr, 247 Bank St.	25	8	41.43	.220	71.7
4842	A. Leverone, 15 Golden St.	15	8	35.03	.102	20.0
4837	Samuel Levin & Co., 268 Main St.	25	8	45.77	.356	76.2
4841	M. L. Siegel, John & Potter Sts. (Chimney Corner)	25	8	46.26	.263	33.8
4840	Paul Smilgin, 113 Bradley St.	25	8	52.85	.150	3.6
4845	The Soltz Co., 131 Bradley St. (Oakland Maryland Rye)	15	8	35.11	.131	82.7
	Waterbury.					
5150	Kyran Brophy, 30 Scoville St.	15	8	35.56	.156	84.7
5152	Andrew Byron, 799 Bank St.	25	8	45.24	.438	74.6
5145	Gallabro & Co., 627 So. Main St.	25	8	42.93	.385	72.3
5148	M. Gartz, 2 Sperry St.	25	8	45.73	.206	79.1
5147	Hennessy & Foody, 457 W. Main St.	25	8	45.17	.093	73.6
5144	Nicolo Jacaruso, 606 Bank St.	25	8	45.08	.098	66.3
5151	Kardac & Kaliszewski, 395 So. Main St. ...	25	8	40.39	.110	67.5
5141	Joseph Kudirka, 883 Bank St.	25	8	48.88	.769	74.3
5146	[7]Leonardo Lo Russo, 38 Scoville St.	15	—7	34.92	.148	53.7
5149	Rocco Mancini, 64 Canal St.	25	8	46.59	.883	65.1
5143	Orlando Bros., 38 Union St. (Old Polk) ..	25	8	44.03	.668	54.4
5139	[8]Ike Pasternak, 213 So. Main St.	15	7	42.04	.158	67.0
5142	Perillio Bros., 313 Bank St.	25	8	35.35	.160	66.6
5140	V. Vallerio, 116 Meadow St.	25	8	36.95	.576	84.6
	Bridgeport.					
5153	[8]Jacob Cohen, 758 Pembroke St.	15	7	37.38	.205	68.8
5159	Klematis & Giedratis, 84 Hamilton St.	25	8	38.22	.109	62.0
5156	J. Losanov, 800 Pembroke St. (Royal XXXX)	25	8	40.02	.250	74.8
5160	Ignac Malulewic, 633 Pembroke St.	25	8	45.98	.766	74.8
5163	Julius Nussenfield, 559 Water St.	15	8	36.70	.124	75.2
5162	Jack Reich, 591 Water St.	15	8	37.76	.077	61.7
5155	Edward Rink, 791 E. Main St.		8	41.74	.172	81.3
5158	[2]B. Sachs, 541 Water St. (Monogram)	15	7	40.10	.106	79.4
5154	J. Schine, 701 Pembroke St.	15	8	42.63	.293	83.4
5164	Robt. J. Veit, 777 E. Main St.	25	8	45.63	.924	53.4
5157	Leonard Verrillo, 26 Reilley St.	15	8	34.29	.139	67.4
5161	[8]John Weldon, Water St. & Golden Hill ...	25	—7	38.26	.127	62.1

[6] Labeled "Contents 7 oz."
[7] "Guaranteed full ½ pint" blown in flask; contained less than 7 oz.
[8] "Guaranteed flask" blown in flask; contained less than 7 oz.

Apparently the commonest means employed by the compounders and dealers to cheapen their whiskey is the addition of water. From the standpoint of temperance this practice perhaps may not be without its advantages, but the commercial fraud is none the less real. A liquor dealer has a right to expect whiskey of full alcoholic strength from the compounder, and even the sot is entitled to expect that his "poison" as served over the bar is of full strength and potency. Leaving the question of morality entirely out of the question, the bar keeper has no more right to sell a compound containing 25 per cent of alcohol when whiskey is ordered than the dairyman to sell watered milk for the genuine article.

ALCOHOL CONTENT.

The following is a summary of the alcoholic strength of the whiskies examined:—

4	contained	over	50	per cent
46	"	from	45–50	"
36	"	"	40–45	"
26	"	"	35–40	"
8	"	"	30–35	"
2	"	"	25–30	"
1	"	"	20–25	"

That is, only 50 of the 123 samples were of full alcoholic strength, while 3 contained less than 30 per cent. The range was from 21.91 to 52.85 per cent. One hundred and eight of the samples contained between 35 and 50 per cent of alcohol.

SOLIDS.

With the most liberal interpretation a good whiskey should not contain over 0.5 per cent of non-volatile solids. Our samples showed the following percentages:—

97	with	solids	from	0.08–0.50	per cent
24	"	"	"	0.51–0.99	"
1	"	"	of	12.75	"
1	"	"	"	21.47	"

The extremely high solids in **4806** and **4808** were due almost entirely to added sugar or syrup; **4806** contained 18.90 per cent sucrose and 2.41 per cent invert sugar, **4808** 10.18 and 2.05 per cent, respectively. In **4780** the solids had a distinct peppery taste.

In most of the samples containing over 0.5 per cent of solids, the residue on evaporation had a distinct sweetish taste, indicating the presence of sugar or glycerine. It is worthy of note that in 22 samples the solids showed a slight astringency, suggesting the possibility that at least this number of our samples may have been in an oak cask long enough to extract some of the tannin; these same 22 samples likewise contained from 42.1 to 52.9 per cent of alcohol and were probably the closest approach to genuine whiskies of any of the brands examined.

Added Color.

Freshly distilled whiskey is colorless and the amber color associated with genuine whiskey is a result of long storage in charred casks. In factitious whiskey, however, this appearance of age is simulated by the addition of caramel, prune juice or other coloring matter. The color of genuine whiskey is almost completely soluble in amyl alcohol, while caramel shows only a slight solubility in that reagent. Accordingly a high insolubility of the color in amyl alcohol indicates the presence of artificial color. The following tabulation shows a summary of our data on this point:—

13	with	under 10	per cent	insoluble	color
3	"	10–20	"	"	"
1	"	20–30	"	"	"
4	"	30–40	"	"	"
7	"	40–50	"	"	"
11	"	50–60	"	"	"
30	"	60–70	"	"	"
40	"	70–80	"	"	"
14	"	80–98	"	"	"

That is, 110 of the 123 samples may be considered as having derived their color from some other source than a charred whiskey cask. It is of interest to note that the thirteen samples showing from 3.6 to 8.6 per cent of insoluble color contain from 43.0 to 52.6 per cent of alcohol and only from 0.100 to 0.171 per cent of solids.

On the generous assumption that a genuine whiskey is one showing from 45 to 50 per cent of grain alcohol, not over 0.5 per cent of non-volatile solids, and not over 10 per cent of color insoluble in amyl alcohol, only 13 of our samples can be considered to be above suspicion as to their purity.

Local Conditions.

The following tabulation shows the maximum and minimum percentages found in the samples taken in the various cities. Too definite conclusions should not be drawn from these data, but it is noticeable that none of the 26 samples of cheap bar whiskey taken in Waterbury and Bridgeport was free from added color, and only one in Hartford.

City.	No. of Samples.	No. Genuine.	Alcohol.		Solids.		Insol. Color.	
			Max.	Min.	Max.	Min.	Max.	Min.
New Haven	61	7	52.61	21.91	21.47	0.09	97.6	4.8
Hartford	12	1	47.96	29.83	0.40	0.09	79.7	8.4
Norwich	12	3	52.28	37.54	0.43	0.11	81.7	5.7
New London	12	2	52.85	34.81	0.76	0.10	87.8	3.6
Waterbury	14	0	46.59	34.92	0.88	0.09	84.7	53.7
Bridgeport	12	0	45.98	34.29	0.92	0.08	83.4	53.4

Net Volume of Whiskey.

Our agent was provided with half-pint flasks for his purchases, and in many instances this flask was retained by the dealer and a flask already filled substituted for it. In a number of cases the dealer saved an ounce of whiskey by this exchange. In 17 instances our agent received only 7 ounces when 8 ounces were requested and paid for. In 10 of these the whiskey contained from 29.8 to 39.9 per cent of alcohol, so that the dealer not only sold short volume but diluted whiskey as well. The dealers in Hartford were the chief offenders, 9 out of 12 selling the agent 7 ounces when 8 ounces were called for. These facts have been reported to the state police for action.

The following samples require special notice in this connection:—

4765. Asked for 8 oz.; our 8 oz. bottle kept and a 7 oz. bottle given the agent.

4750 and 5158. No statement of contents on bottle; asked for 8 oz., received 7 oz.

4813, 4817, 4823, 4816, 4824, 4818, 4820, 5139 and 5153. Asked for 8 oz.; received bottle with "7 oz." blown in.

4814. "Full ½ pt." blown in bottle; handstamped "7 oz."; asked for 8 oz., received 7 oz.

4815 and 4826. Labeled "7 oz."

5146. "Guaranteed full ½ pt." blown in bottle; contained less than 7 oz.

5161. "Guaranteed flask" blown in bottle; no volume stated, contained less than 7 oz.

FOOD AND DRUG PRODUCTS EXAMINED FOR THE DAIRY AND FOOD COMMISSIONER.

Thirteen hundred and seven samples were examined for the Dairy and Food Commissioner. Certain of these, such as cheese, maple syrup, soda water syrups and various drug products, have already been discussed. A brief summary of the remaining samples follows. Of the total number examined 761 were not found to be adulterated, 24 were legally labeled compounds, and 522 were adulterated, misbranded or below standard.

Bread. A sample of *Ward's Tip Top Bread* contained 0.06 per cent of sulphuric anhydride, not much greater than is usually found in bread.

Butter and Butter Substitutes. Of 189 samples examined 132 were genuine butter, 34 renovated butter and 23 oleomargarine.

Cheese. In addition to the 86 samples reported on page 269, another sample, suspected of having caused sickness, was examined with negative results.

Cider. Of 25 samples tested 8 contained salicylates, 5 benzoates alone and 2 benzoates with saccharin; only 10 of these samples were free from preservatives.

Confectionery. Two samples of chocolate candies contained alcohol, 1.09 and 1.47 per cent, respectively, in the liquid portion of the candy.

Horse Radish. Two samples were examined microscopically for the presence of ground turnip; none was present.

Maple Sugar. The single sample was not adulterated.

Maple Syrup. Twenty-five samples were analyzed (see page 339.)

Milk. Three hundred and eighty-four samples were analyzed. Of these 182 conformed to the legal standards, while 88 were deficient only in solids-not-fat. Ninety-one were below standard in solids, 66 in fat and 176 in solids-not-fat, 202 samples failing to meet the legal requirements in one or more particulars. Thirteen samples were skimmed, 29 watered and 6 both skimmed and watered.

The skimmed milks were taken in Woodstock, West Hartford, Chaplin, Lebanon, Ellington, North Branford, Rocky Hill and Groton; the watered milks, in Bloomfield, Killingly, Stamford, Shelton, Orange, West Hartford, Coventry, Ellington, Somers, Columbia, Stafford Springs and Manchester; the milks which were both skimmed and watered, in Griswold and Stafford Springs.

Rye Meal. The sample examined contained oat hulls.

Sausage. Sixty-three samples were examined. Of these two were decomposed when received, and 8 contained from 1.35 to 6.46 per cent of starch; sulphites were present only in traces and no boron compounds were detected.

Soda Water Syrups. Two hundred and nine samples were examined (see page 344).

Temperance Drinks. The 63 samples tested were examined chiefly for saccharin. In 19 samples saccharin was present, in 6 instances accompanied with artificial color. Two samples were legally labeled compounds, while 11 contained undeclared artificial color, and one benzoates and color. One sample of strawberry soda contained acid magenta, an unpermitted coal-tar color.

Aspirin Tablets. Fifty-four samples were examined (see page 346).

Spirit of Camphor. Forty-four samples were examined (see page 348).

Chlorinated Lime. Twenty-five samples were examined (see page 351).

Syrup of Ferrous Iodide. Twenty-nine samples were examined (see page 348).

Hydrogen Peroxide. The sample tested contained 2.98 per cent of absolute hydrogen peroxide.

Tincture of Iodine. The sample tested contained no wood alcohol.

Solution of Magnesium Citrate. Sixty-three samples were analyzed (see page 352).

Mercurial Ointments. Seven samples were examined (see page 357).

Proprietary Medicines. A partial analysis of *Fowler's Asthma Cure* (William Fowler, New Haven) showed 14.98 per cent of ethyl alcohol; a small amount of unidentified alkaloid was present, not *Cannabis indica.* The preparation was misbranded "a positive and sure cure for asthma in any form." A sample of *Oil of Korein Capsules* were also examined, the details being given on page 371.

Tincture of Vanilla. Twenty-seven samples were analyzed (see page 404).

Turpentine. The sample examined contained about 40 per cent of mineral oil.

Extract of Witch Hazel. The sample contained 14.48 per cent of ethyl alcohol; no wood alcohol or formaldehyde was present.

MISCELLANEOUS MATERIALS SENT BY PRIVATE INDIVIDUALS.

Butter. Of the 13 samples tested 4 were genuine butter, 1 renovated butter and 8 oleomargarine.

Celery Roots. The sample was analyzed to determine its availability in the diabetic diet. It showed the following composition:—

Water	89.00	Starch	0.09
Ash	1.24	Reducing sugars before inv. as dextrose	0.74
Fiber	1.18		
Protein	1.96	Reducing sugars total, as dextrose	1.39
Nitrogen-free extract	6.27		
Ether extract	0.35		

Cheese. Two samples suspected of having caused sickness were tested with negative results. One of the chemists ate an ounce of one sample with no ill effects. The cheese was fed to three rats, which had been starved for 48 hours before feeding it. The rats showed no bad effects after eating 31, 40 and 55 grams, respectively, in three days, and two of the three rats gained weight on the diet.

Cider. The sample contained 2.34 per cent of alcohol by volume.

Cinnamon. The sample contained 10.70 per cent of alcohol extract and 3.98 per cent of ash, and under the microscope showed no adulteration.

Confectionery. The sample contained 5.97 per cent of paraffin.

Cream. Twenty-seven samples were analyzed; these ranged from 13.5 to 53.5 per cent of fat, all but four meeting the legal standard of 16 per cent. Thirteen samples sold as heavy cream ranged from 29.0 to 53.5 per cent, only 7 exceeding 40 per cent.

Flour. A sample of *Ballard's Self-Rising Flour* was suspected of having caused illness. It contained 3.98 per cent of ash, consisting chiefly of sodium, lime, phosphates and chlorides, none in excessive amount for this sort of flour; no heavy metal was detected.

Honey. The two samples analyzed were not adulterated.

Human Milk. Five samples were analyzed as follows:—

Solids	13.26	13.13	12.38	....	....
Fat	4.20	3.80	3.10	4.50	3.00
Protein	2.05	1.56	....	1.15	....
Lactose	6.61	7.55	....	....	....
Ash	0.40	0.22	....	....	....

Ice Cream. The one sample contained 11.5 per cent of fat.

Malted Milk. Three samples suspected of containing poison were tested with negative results.

Maple Syrup. The single sample was not adulterated.

Meat. Two samples suspected of containing poisonous ingredients were tested with negative results.

Milk. Of the 40 samples examined 27 were of standard quality. One sample was watered, one both skimmed and watered, and 11 were below standard in one or more particulars.

Milk Powder. A sample of skim milk powder contained 32.53 per cent of casein and 0.65 per cent of fat.

Oats. The sample contained 0.0036 per cent of sulphur dioxide; the oats were of poor quality, somewhat musty, and showed no germinating power whatever.

Oleo Color. The color consisted of an oil solution of annatto, with possibly a trace of turmeric.

Olive Oil. The four samples tested were not adulterated.

Peanut Butter. The two samples analyzed were not adulterated; they showed

Protein	28.94	29.06
Fat	47.52	48.25

Salt. The sample was suspected of containing poison; none was found, only the usual impurities of ordinary table salt being present.

Tea. The sample contained 6.26 per cent of ash; no Prussian blue or indigo was present.

Vinegar. Of the 70 samples examined 37 satisfied the legal standards for acidity and solids. Fifteen samples were low in acidity, 11 in solids and 7 in both acidity and solids. Most of the samples were farmers' vinegar and the deficiencies generally were due to incomplete acetification.

Water. A sample of spring water suspected of containing poison showed no heavy metals or alkaloids; a small amount of flowers of sulphur was found as a sediment.

Wine. A sample of Zinfandel wine contained 12.70 per cent of alcohol by volume and 0.20 gm. of reducing sugars per 100 cc.

Aspirin. Two samples of 5 gr. tablets showed 3.84 and 4.98 grs. per tablet, respectively; the former contained free salicylic acid and starch.

Auto-Laks. A partial analysis showed the preparation to consist essentially of about 25 per cent of phenolphthalein in a chocolate base.

Beeswax. The three samples tested showed no adulteration, two being of somewhat superior quality to the third, as indicated by their complete solubility in chloroform and their melting point of 62° C.; the third sample melted at 68° C.

Methylene Blue. The two samples were intended for use in treating contagious abortion in cattle, and were examined for impurities; both samples were found to be the pure dye.

Phosphoric Acid Paste. The sample contained 5 parts per million of arsenic trioxide.

Soap. A sample of liquid soap consisted of a white solid and an olive-green liquid. The solid was of the nature of a wax or paraffin, while the liquid was a solution of soap containing no free alkali.

Stock Medicines. The two samples examined were phenolic products of complex composition.

Whiskey. Three samples were examined. One contained 22.65 per cent of alcohol by volume with considerable black pepper; the other two contained 38.55 and 46.74 per cent of alcohol by volume. No wood alcohol or chloral hydrate was present.

Wool Fat. A sample of *Corona Wool Fat* was tested for salicylates, benzoates, borates, nitrates, phenols and creosote with negative results.

Police Cases. Thirty-nine samples were examined in connection with the police crusade against the sale of habit-forming drugs in New Haven. Fifteen samples were morphine sulphate, 3 cocaine hydrochloride, 1 heroin, 1 strychnine sulphate, 4 gum opium, 7 "yen shi" (partially burned gum opium), 1 a mixture of menthol and opium, 1 roach paste, 1 a bromide preparation for impotency, while 5 samples were milk sugar or other inert drugs.

Poisoning Cases. A sample of vinegar contained 8.93 grs. of corrosive sublimate in 6 fl. oz.; a sample of cooked peas sent at the same time contained no heavy metals. A sample of tablets contained 6.94 grs. of corrosive sublimate per tablet. One sample each of milk and cracked corn contained no metallic poison. An apple, sent by a farmer seven of whose cows had been killed, contained a large amount of arsenic. A sample of candy contained methylene blue, which had been introduced apparently to scare the victim rather than to injure her. A duck and the contents of the stomach of a heifer, thought to have been poisoned, were tested for arsenic and alkaloids with negative results.

Westerly Poisoning (?) Cases. During July, 1915, an epidemic of food poisoning occurred at Westerly, R. I., and in an adjacent township in this state. It is estimated that sixty persons were made seriously ill, four of whom died. The cause of the poisoning seemed to be traced to pies purchased from a certain Westerly bakery. Samples of the various food products used at the bakery were sent to this laboratory; these included cocoanut custard pie, dough, flour, shredded cocoanut, shortening, sugar, nutmeg and vinegar, together with samples of disinfectant and insect powder found on the premises. The disinfectant was of a phenolic character and the insect powder a pyrethrum powder; both of these preparations were shown conclusively to have no connection with the sickness. The food samples were tested for heavy metals and alkaloids with negative results. The stomach contents of one of the victims was also sent to us and in this we found formaldehyde and bismuth; the first of these, we found later, was introduced by the sample having been sent to us carelessly in an embalming fluid bottle; it was stated that bismuth had been administered to the deceased by his physician. No metallic or alkaloidal poison was found in any of the samples. The examination for ptomaines was beyond the facilities of this laboratory and our connection with the case ceased at this point.

It is of interest, however, to note that Bernstein and Fish, in reporting these cases in the *Jour. Amer. Med. Asso.*, Jany. 15, 1916, came to the conclusion that the poisoning was due to the

Bacillus paratyphosus B, that the vehicle of infection was pie, and that the presence of a "disease carrier" in the community had probably been established.

Table XXVIII.—Summary of Results of Examination of Food and Drug Products, 1915.

	Not Found Adulterated.	Adulterated or below Standard.	Compound.	Total Number Examined.
Sampled by Station.				
Cereal Breakfast Foods	11	3	..	14
Cocoa and Chocolate	2	1	2	5
Hygienic Coffee	1	4	..	5
Coffee Substitutes	3	..	..	3
Diabetic Foods	9	..	..	9
Fig Preparations	4	..	..	4
Flavoring Extracts	82	13	26	121
Canned Fruits	..	..	..	303
Graham Flour	7	1	2	10
Infant Foods	..	..	..	27
Noodles	9	3	..	12
Oysters	10	1	..	11
Rice	2	..	..	2
Miscellaneous Foods	8	..	..	8
Mineral Oil	15	35	..	50
Proprietary Medicines	..	..	..	49
Whiskey	10	113	..	123
Total	173	174	30	756
Sampled by Dairy Commissioner.				
Bread	1	..	..	1
Butter	132	57	..	189
Cheese	83	3	1	87
Cider	10	15	..	25
Confectionery	..	2	..	2
Horse Radish	2	..	..	2
Maple Sugar	1	..	..	1
Maple Syrup	11	12	2	25
Milk	182	202*	..	384
Rye Meal	..	1	..	1

* Including 88 below standard in solids-not-fat only.

	Not Found Adulterated.	Adulterated or below Standard.	Compound.	Total Number Examined.
Sausage	53	10	..	63
Soda Water Syrups	98	94	17	209
Temperance Drinks	30	31	2	63
Aspirin Tablets	49	5	..	54
Spirit of Camphor	38	6	..	44
Syrup of Ferrous Iodide	25	4	..	29
Hydrogen Peroxide	1	..	..	1
Tincture of Iodine	1	..	..	1
Chlorinated Lime	5	20	..	25
Solution of Magnesium Citrate	10	53	..	63
Mercurial Ointments	5	2	..	7
Proprietary Medicines	..	2	..	2
Tincture of Vanilla	23	2	2	27
Turpentine	..	1	..	1
Extract of Witch Hazel	1	..	..	1
Total	761	522	24	1,307
Samples by Private Individuals	147	110	..	257
Total from all sources	1,081	806	54	2,220

PART VI.

Report of the Botanist for 1915.

G. P. CLINTON.

NOTES ON PLANT DISEASES OF CONNECTICUT.

G. P. CLINTON.

We have not previously reported on the plant diseases found either in 1914 or 1915 in this state, so we will consider in this article those found in both these years. We will first mention briefly the common troubles that have been previously noted in our reports, and then consider more in detail those that are reported for the first time.

DISEASES, ETC., PREVIOUSLY REPORTED.

Weather, 1914. The winter of 1913-14, following a long mild autumn, was rather severe as a whole on perennial out of door plants. A severe ice storm in December did considerable injury to both fruit and shade trees because of the great weight of the ice supported by some of them during a high wind. Mr. G. A. Drew, writing of this injury in southwestern Connecticut, in Tree Talk (1915:9. Feb.) said: "From the shade trees the tops were literally stripped, the oaks, hickories and elms apparently suffering just as much as the softer wooded trees. Moreover, the forest trees seemed to suffer about as much as the individual ornamental or specimen trees in the open."

Two cold spells, one in January and another in February, without much snow on the ground, also caused considerable winter injury to trees, especially fruit trees, which has continued to show up to the present time. The peach blossom buds were rather severely injured in many orchards.

The spring started early, but in the end was not more advanced than usual. The summer and fall as a whole were of the warmer, drier type, not especially favorable to the development of fungous troubles, September being especially dry. Killing frosts occurred the last of that month.

Diseases, 1914. The following diseases were called to our attention by correspondents during the season, or were noted by us as especially injurious:

Fire blight of apple was reported a number of times; there was considerable scab of apples on susceptible varieties, and also some sooty blotch. Peach leaf curl was unusually prevalent and scab not uncommon. Black knot on cherries and plums was sent to us for identification several times; there was one complaint of anthracnose of cherry, and of downy mildew of grape. Orange rust and fire blight of quince were also reported a few times.

There were a number of reports of injury by potato scab, and Rhizoctonia on the tubers was also common. A few cases of injury by black leg were seen. Tip burn of the vines caused the most trouble, altho near the end of the season there were a few reports of injury by late blight. The anthracnose of bean, rust of asparagus, club root of cabbage, and Phoma rot of Rutabaga were also troubles complained of.

Besides the ice injury and the winter injury to bark, wood and buds of fruit trees, there was complaint of winter injury to the roots of grapes, pæonies, and a few other plants. The white pine blight, due to the severe winter, was also unusually prevalent.

Weather, 1915. The winter of 1914-15 was not so severe as to cause any serious injury of plants, as shown by the very profuse blossoming of peaches in May. The spring was rather cool and dry, and not especially forward. The summer from the middle of June to the middle of August was unusually cool and wet, being an exception in this respect to the rather dry, warm summers for several years past. The cool, wet weather put back plant growth considerably and produced rather unusual troubles, so that crops as a whole did rather poorly, especially muskmelons, late potatoes and tobacco. Warmer and drier weather in late summer and a long fall, due to very late killing frosts, partially compensated for the earlier unfavorable weather.

Diseases, 1915. On the whole the weather conditions favored fungous troubles more than for several years past. Those troubles especially injurious were as follows:

Fire blight and sooty blotch of apple were prevalent, but scab, because of unfavorable spring conditions, was less conspicuous

than the year previous. Leaf curl of peach was common, and in certain unsprayed orchards scab was so injurious on Albertas as to seriously affect their selling value. Brown rot did much injury to the early varieties of peaches, but this in itself did not cause serious financial loss, as over-production and poor quality had made the price so low that some growers left part of the crop to rot rather than market it. The bacterial spot of peach was more conspicuous than for several years. There was some complaint of the anthracnose of cherry, the downy and powdery mildews of grape and the black rot of grape. Some raspberries showed signs of disease, possibly due to winter injury.

The white pine blight also showed again this year, and a leaf spot of Catalpa was reported twice. The sycamore anthracnose was more common than usual. Leaf scorch of maple was also reported a number of times.

The currant rust, *Cronartium ribicola,* was reported on black currants from Canaan by the Massachusetts inspectors, and on red currants from Meriden by Spaulding of the U. S. Department of Agriculture. As this fungus is connected with the white pine blister rust, brought some years ago into this state on stock imported from Europe, this indicated that there were still infected pines in the state, though none had been seen since the last inspection of plantations in 1910. The presence of the rust on one or more of its hosts in Massachusetts, Connecticut, and some other states in 1915 was considered such a menace that the Government threatened to place a quarantine on white pines and currants in the nurseries of these states. This was finally delayed pending a thorough inspection of the pine plantations and nurseries in 1916, to determine the present distribution and amount of the blister rust.

On market garden and special farm crops there were several serious fungous troubles. Root rot of tobacco caused considerable injury to plants in the fields, altho just how much of the poor tobacco crop is to be credited to this and how much to adverse weather conditions in mid-summer is a matter upon which there is some diversity of opinion.

Bacterial spot of beans (see mention elsewhere) was an unusual trouble, and anthracnose of the same host was quite severe. The effect of weather conditions on the development of this latter trouble is shown in Plate XVII e, where seedlings grown from diseased beans (d) developed more or less injury according to whether they were grown under moist or dry conditions. The chief means of combating this trouble seems to be the selection for seed purposes of only those beans that are in pods absolutely free from any signs of anthracnose, and seed should be selected and planted by itself each year as a source of seed for the general crop the next year.

Other important diseases were the mosaic of cucumber and the storage rot of onions, both of which are mentioned elsewhere in this report. "Blast" of seed onions was another serious trouble that caused a loss of one-half to two-thirds of the seed crop. This trouble is still under investigation as to its cause. Late blight of potatoes for the first time in several years caused considerable injury to late potato vines, and in certain fields serious rotting of the tubers. Black leg of potatoes was more common than usual, and there were a few cases of tip burn. Other troubles noted as more prominent than usual were leaf spot of beets and mangels, black rot of cruciferous plants, leaf spot and downy mildew of lettuce, blight of melons, leaf blight of corn, leaf spot of tomatoes, and late leaf blight of celery. Plate XVIII d shows the latter trouble developing in the leaf stalks of celery, spoiling it for market.

A fungus, not of the parasitic type, but yet of considerable economic importance, which was called to our attention in February, was the dry rot, mention of which was made in our Report for 1906, p. 336, as causing injury to woodwork in the basement of a church at Stony Creek. This time the fungus, *Merulius lacrymans,* was found in the factory of the Singer Manufacturing Company of Bridgeport. Complaint of it was made by George M. Eames, as follows:

"We desire to ascertain the cause of a peculiar condition which has arisen under circumstances as follows: On opening up some packing cases containing finished sewing machines, which have lain for a matter of six weeks or two months on a maple floor laid on top of a brick floor with an air space between, we found the inside of the boxes very handsomely decorated with fungi, and the fungi had also climbed around and across the arm and bed of the machines. This would not surprise us if it were in a damp cellar, but it is in a regular working room where the temperature is always dry and warm and the light good, and it seems to have occurred only in one spot in a room 75 feet wide and 350 feet long. This situation is not only interesting, but important for us to ascertain the cause, and we would like to have someone come here and consult with us in the premises."

A visit to the factory showed several of the boxes and the enclosed heads of the sewing machines like those shown in the illustration, Plate XXIV. A considerable number of boxes had stood close together in a pile on the floor. Those showing the fungus had covered a spot about four feet in diameter on the floor which was decayed by the fungus, and apparently the moist air spaces offered by the close placing of the boxes had favored its development upon and into the boxes. The fungus evidently came from the flooring, as the boxes were made of new kiln-dried material and the flooring a short distance away some time before had been replaced on account of rot evidently caused by this fungus. Apparently not all of the fungus had been removed, and the piling of the boxes over an infected part of the floor had favored a rapid and vigorous development above the floor. The fungus had formed a very conspicuous and thick growth, covering the wood of the infected boxes, also the iron of the inclosed machines and the sample cloth attached, and had become slightly tinted as the first step in forming its fruiting stage.

DISEASES NOT PREVIOUSLY REPORTED.

Besides the troubles already mentioned, there were others of more or less economic importance that had not been previously listed from this state. Some of these, however, were only old troubles on new hosts. The following notes, arranged alphabetically by hosts, are upon these new diseases.

ALFALFA, *Medicago sativa.*

White Spot. Plate XVII c. This obscure alfalfa trouble was first called to our attention by Farm Bureau Agent Manchester of Litchfield County, who sent specimens collected at Chapinville early in May, 1915. As shown by the illustration the injury occurs on the leaves as numerous small white spots, usually of an irregular oval or more elongated shape, which are most frequently seen at the upper marginal parts. These spots are generally confined to scattered plants in the field. The disease appears early and is usually rather general on the infected plants, but does not seem to spread to others, so it is not a very important or injurious trouble.

We find the same thing on alfalfa at our Mount Carmel farm, and it appears to be a widespread trouble. Stewart *et al.* (Geneva, N. Y. Agr. Exp. Sta. Bull. 305:402. 1908) were, as far as we know, the first to give a brief description of it. They were not sure as to the cause, but thought it might be a physiological trouble. We understand that it occurs on alfalfa in Wisconsin, and investigators there have some reason for considering it the work of thrips. Recently Crabill (Phytopath. 6:91-3. Fe. 1916) reported that in Virginia this trouble is associated with a fungous crown-rot of the roots and that a similar injury can be produced by mutilating the crown. Such roots as we have examined have shown more or less of a rotting of the tissues in spots near the crown, as if starting from the dead stubs left when the alfalfa is cut. Presumably fungi might enter there and work down somewhat into the crown, or winter injury might be partially responsible, especially in killing the stubs.

Yellow Top. With this trouble the leaves usually show a yellowish band of varying width at the upper end and sides. It has also been reported by Stewart (*loc. cit.*) To us the trouble seems to be physiological, and due to either frost or drought injury. It often shows in spots in the field.

APPLE, *Pyrus Malus.*

In our previous reports we have briefly described various rots of apples caused by *Glomerella rufomaculans* (Bitter Rot), *Sphaeropsis Malorum* (Black Rot), *Penicillium expansum,* reported as *Penicillium glaucum* (Blue-Mold Rot), and *Monilia cinerea* (Brown Rot). During the past few years our assistant, Mr. Stoddard, has been making a special study of all rots of apples. As a result of his studies and our own there have been observed a number of other species of fungi that are primarily or secondarily responsible for rotting of apples, chiefly in storage. A brief mention of these follows.

Alternaria Rot, *Alternaria* sp. We first obtained this fungus some years ago from apples showing a speck rot developing rather abundantly over the fruit, and it has been isolated since then several times from similarly specked apples, but it is likely

to be crowded out later by the more aggressive black-rot fungus. It has also been found causing large rotten areas either on the side or blossom end of the apple. Morse and Lewis (Me. Agr. Exp. Sta. Bull. 185:365. 1910) of Maine and Cook and Martin (Phytopath. 3:119. 1913. *Ibid.* 4:102-5. 1914) of New Jersey, have reported Alternaria rots of the fruit. The latter recognize two types, called by Cook (N. J. Agr. Exp. Sta. Circ. 44:11-12) Blossom End Rot and Jonathan Spot Rot. There has been some difference of opinion as to whether the Jonathan Fruit Spot was due to an Alternaria attack or was a physiological trouble, in most cases following removal of apples from cold storage. Scott and Roberts (U. S. Dept. Agr. Bur. Pl. Ind. Circ. 112:11-16. 1913) hold the latter view. Norton (Phytopath. 3:99-100. 1913) reports that similar injury can be produced by the fumes of formalin and ammonia. Cook and Martin seem to think that there may be both a physiological and an Alternaria Jonathan Fruit Spot.

Fusarium Rot, *Fusarium* sp. Mr. Stoddard has obtained a Fusarium a number of times from stored apples showing a general or core rot. When kept under moist conditions the rotten area is likely to become coated over with a vigorous development of the white mycelium, with more or less development of pink spores, thus distinguishing this from other rots. Lewis (Me. Agr. Exp. Sta. Bull. 219:257. 1913) of Maine reports two species of Fusarium isolated from apples in that state, *F. pirinum* and *F. helianthi.* We have not definitely determined our species, but since it is questionable whether the numerous so-called Fusarium species are all real species or merely physiological strains, the selection of a specific name is largely a matter of personal opinion.

Gray-Mold Rot, *Botrytis vulgaris* Fr. Plate XVII a. Fruit rot caused by a Botrytis has been found occasionally on apple, pear, peach, quince and strawberries in this state. It occurs on the summer varieties of apple, and Mr. Stoddard has obtained it a number of times from stored apples. It causes a general rot of the fruit, and the reproductive stage appears in time as a grayish growth of clustered fruiting threads bearing at their tips bunches of spores, as shown imperfectly in the illustration. It seems to be the same species that occurs on various herbaceous greenhouse plants when kept under unfavorable conditions of moisture. The fungus (said by some authors to be the same as *B. cinerea*) has not been particularly studied with reference to its various hosts or its exact identity, but as it is as much a saprophyte as a parasite, and has the same general appearance in cultures from the various hosts, presumably there is but one species represented by the hosts mentioned here, and this is probably only the conidial stage of the ascomycete *Sclerotinia Fuckeliana,* altho this mature stage has not been seen by us.

Soft Rot, *Rhizopus nigricans* Ehrn. This was found once on summer varieties causing a soft rot of the fruit. In time a vigorous growth of the black fruiting threads overruns the outside. Presumably it occurs more frequently than is indicated by our single collection.

Volutella Rot, *Volutella fructi* S. & H. Plate XVII b. This rot was first called to our attention in 1913, by Professor Osmun of Amherst, who sent us apples (see illustration) from Simsbury from which the fungus was isolated. Mr. Stoddard has also isolated it from one or two other collections. The fungus causes a general rot of the apple, with its fruiting stage showing as small erumpent pustules much like those of black rot, but under the hand lens they show the characteristic setae of Volutella.

CABBAGE, *Brassica oleracea.*

Gray-Mold Fungus, *Botrytis vulgaris* Fr. Plate XVIII a. This fungus, which we have reported (see Apple) on various fruits and greenhouse plants, was found by Mr. Stoddard causing a decay of stored cabbage. A vigorous development of the gray fruiting stage appeared on the outside, as shown in the illustration. Some years ago Professor Graves of Yale separated a somewhat similar fungus from decaying stored cabbage, which he gave us under the name of Sclerotinia, probably *S. Fuckeliana.*

CARNATION, *Dianthus Caryophyllus.*

White Tip. Plate XVIII b. We have given this name to a trouble that was first called to our attention on the Enchantress carnation in the greenhouses of W. H. Burr at Westport in December, 1914. The injury, as indicated by the name, shows on the partially unrolled tips, which assume a white or creamy color for a distance of an inch or so inward. Occasionally similarly colored spots were seen across the leaves a short distance below the tips. No signs of fungus or insect attack showed on these spots. Presumably they appeared rather suddenly; at least they did not seem to increase much in number after their first appearance. This would indicate a physiological rather than a fungous trouble.

The fact that the injury occurred at or near the tips, and on young leaves, points toward a gas rather than a spray injury, and so far as we know, in the case under consideration no injurious spray was used on the plants. Apparently the trouble was due to the fumes of sulphur, or possibly of tobacco, used as a fungicide or an insecticide. We have seen the trouble rarely in other greenhouses, and the only explanation seems to be the one given. The fact that the injury takes place at the tips of the leaves is probably due to their more tender condition, and that it occurs on certain plants rather than on all, to the amount of moisture present on the affected ones at the time of injury. Certain varieties seem much more susceptible than others, and apparently the Enchantress is one of the most susceptible.

CELERY, *Apium graveolens.*

Bunched Roots. Plate XVIII c. Occasionally we have seen celery that after transplanting remained small or became stunted during the season, owing to the lack of sufficient fertilizer in the soil, or of sufficient cultivation to enable the plants to make use of it in a normal growth. In the fall of 1914 we had called to our attention two celery fields, one in Hamden and one in East Haven, where a somewhat similar trouble seemed to be due to excessive fertilization or to improper fertilization, perhaps in part to the character of the season or to the soil in which the celery was transplanted. The plants remained stunted, due to the fact that the roots did not make a normal growth, appearing as if "pot bound," as shown in the illustration. While these roots were massed together and had a reddish, diseased appearance, no signs of a fungous or bacterial cause could be found. Apparently fertilizer burn was responsible. In one field the worst spots showed a red color of the soil, due to the development of an unusual amount of a red unicellular alga, indicating an unusual condition of the soil solutions.

CUCUMBER, *Cucumis sativus.*

Mosaic or *White Pickle.* Plate XIX a-b. This trouble was first noticed by us in this state in 1914, on cucumbers grown by Mr. Hayes for experimental purposes at the Mount Carmel Station farm. The crop was practically ruined by it about the time it came into full bearing. Not much attention was paid to it that year on account of other work. An application of lime to certain plots, however, failed to show any favorable results. In 1915 the disease was even more severe, ruining some of the cucumber seed crops near Milford, where it was mistaken for blight by some of the growers. Specimens were sent to us from other states, and from the reports it seems to have been unusually prevalent and injurious in the northern states east of the Mississippi River. It is apparently the same disease reported some years ago by Selby from Ohio on greenhouse cucumbers.

The most characteristic appearance of the disease and its greatest injury is shown on the fruits. These have a mottled appearance with lighter and darker green areas, the lighter green often fading into white, hence the name "white pickle." The tissues beneath the darker green areas grow more normally and rapidly, due to the greater amount of chlorophyll present, and this causes an irregular knobbing of the fruit, as shown in the illustration. On the leaves the disease shows as mottled areas of light and dark green color, giving a mosaic effect somewhat similar to that of calico of tobacco. This uneven distribution of the chlorophyll sometimes causes irregular growth, resulting in crumpling of the leaves. The disease, however, does not always show prominently on the leaves. As a whole, the vines are more or less stunted.

The writer has made no special study of this disease, but at the recent meeting of the American Phytopathological Society at Columbus, papers were presented by Gilbert, Doolittle and Jagger (see Phytopath. **6**:143-51. Ap. 1916) which show that the disease is contagious, and can be inoculated into healthy plants by rubbing them with bruised diseased tissues or by injection of the infected juice, the same as with calico of tobacco. Their experiments proved likewise that it could be carried from plant to plant by lice. This disease, however, does not seem to be exactly the same as calico of tobacco, since the writer (Rept. **1914**, p. 413 (26)) failed to infect cucumber plants with the juice of calicoed tobacco plants. The chlorosis trouble on muskmelon reported previously by us (Rept. **1907-8**, p. 865) is very similar to this, but we were not sure that that disease was infectious. We noticed this year that some muskmelon vines near the infected cucumbers showed slight indications of a similar disease on certain of the young melons, but we saw no mottling of the leaves. The disease did not become at all prominent on these vines.

As this disease is contagious, and can be carried by lice, it is important that the vines be watched carefully early in the season and all infected vines pulled up and carried from the field, being especially careful not to drop off lice from the diseased onto the healthy vines. Neither should the healthy vines be touched after handling diseased ones, without first washing the hands. We cannot but believe that the type of season is an important factor in this disease, because of its sudden and general appearance the past wet year and the presence of other unusual chlorosis troubles, especially that on the soy bean reported elsewhere.

GRAPE, *Vitis* sp.

Gray-Mold Fungus, *Sclerotinia Fuckeliana* (deBy.) Fckl. Plate XIX c. We have previously reported the conidial stage of this fungus, *Botrytis cinerea,* as causing a rotting of greenhouse grapes. Mr. Zappe, while inspecting imported grape cuttings from Hungary in March, 1914, brought to our attention the sclerotial stage of this fungus (see illustration), which we had not seen before. These sclerotia are small, flattened, oval bodies about one-sixteenth to one-eighth of an inch long, adhering closely to the bark. It is from these that the mature, or sclerotinial stage, is said to develop, altho as yet we have not observed it in this state. From the sclerotia, however, Mr. Stoddard obtained in cultures the Botrytis and sclerotial stages.

KALE, *Brassica oleracea* f. *acephala.*

Black Rot, *Pseudomonas campestris* (Pam.) Smith. Plate XIX d-e. We reported this bacterial disease on cabbage, of which kale is merely a horticultural variety, in our Report for **1911-12**, p. 345. It is characterized by the black discoloration it produces in the veins of the yellowed leaves, and on kale by the blackening and decaying of the stems, as shown by the illustrations. It was found in 1915, late in October, at Mr. Burr's farm at Greens Farms, and evidently had spread to the kale from some nearby infected cabbage. The moist season was favorable for its development.

MANGEL, *Beta vulgaris.*

LEAF BLIGHT, *Cercospora beticola* Sacc. This disease has been reported here previously on beet and chard, which, with the mangel, are merely varieties of the same species. It produces small brownish or later whitish spots with a distinct purplish border, scattered over the surface of the leaves. These spots are usually subcircular and only a few millimeters in diameter, but when numerous they may run together somewhat. Badly infected leaves turn yellowish and die prematurely. Last year was favorable for its vigorous development late in the fall.

Townsend, of the U. S. Department of Agriculture, has published in Farmers' Bulletin No. 618 an account of this fungus as a disease of the sugar beet. Concerning its control, he writes:—"Leaf spot may be controlled on a commercial scale and in a practical and inexpensive manner by a carefully planned and thoroughly executed system of crop rotation, or by deep fall plowing. The best results are obtained by combining these two methods." He also found that the trouble could be controlled by thoro spraying with Bordeaux mixture, and that the proper disposition of beet tops and stable manure are important aids in its control.

CROWN GALL, *Pseudomonas tumefaciens* (Sm. & Towns.) Stev. Plate XX a. In October, 1915, on the Bedford farm at Greens Farms, where the Station had some experiments with mangels, the writer found the specimen shown in the illustration, in which a large gall-like growth had made its appearance on the side of the mangel just above the surface of the ground. No doubt injury to the beet during cultivation had allowed entrance for the bacterial germs that are responsible for the crown gall. The gall has a structure very similar to that of the main root, being an enlargement due to rapid multiplication of the cells caused by the stimulus of the organism. In time the surface becomes more roughened and distorted, and decay may follow.

Townsend (U. S. Dept. Agr. Bull. 203. 1915) has recently published an account of crown gall on sugar beets, and some of his illustrations show specimens with a single large gall, like that shown here. Cooke (Fungoid Pests of Cultivated Plants, p. 245) described some years ago a similar gall observed on beet roots in England. He assigns *Œdomyces leproides* Trab., the canker fungus, as the cause, but he failed to find any signs of this fungus present. As Milburn (Fungoid Diseases of Farm and Garden Crops, p. 107) also illustrates and describes a similar trouble of mangels from England, which Bessey suggests as crown gall, there seems to be little doubt of their identity with the trouble described here.

This trouble, according to Townsend, is likely to increase on land where beets and mangels are grown year after year. When proper rotation of crops is practised, however, the disease does not usually cause much injury.

ROOT ROT, *?Pythium deBaryanum* Hesse. Plate XX b. During the summer of 1915 there was called to the writer's attention a root rot of mangels at the farm of R. F. Beecher of Centerville. Pressure of work prevented an examination of the field until late in September, just after the mangels had been dug. At that time, however, specimens of the diseased roots were found among those harvested and others left in the field as worthless. Apparently the trouble was then at a standstill, since the decayed parts of the roots were very sharply marked off from the healthy, and there was no indication of recent infection of the healthy tissues. A peculiarity of the rot (see illustration) was that it never started at the crown, and usually the part of the root above ground was perfectly healthy even when the part beneath was almost entirely rotted off. Some plants were found which indicated that while the rot was severe, it did not injure the growing crown of leaves as much as one would expect, since plenty of living leaves were found on the badly-rotted roots. A wilting and yellowing of the leaves was noticeable during the growing season, it was said, by which the badly-injured plants could be detected.

Some roots were found that indicated that the trouble started on the side rootlets beneath the ground, and entering the tap root, rotted away the part below so that it was easily broken off when the mangel was pulled from the ground. The rot no doubt progressed upward more slowly, but did not seem to develop very far on the root above the ground. Evidently unusual conditions of moisture were responsible for the starting and continuing of the rot. The past midsummer was very moist, and the land was rather low, so that moisture conditions there at that time were rather favorable for the development of the rot. In the drier fall weather the rot was evidently largely checked even on the infected plants. According to the owner, this same field developed rot badly some years previously.

An examination of the tubers showed in the rotted portions a great variety of low forms of animal life and saprophytic fungi, but no very suspicious species that might account for the trouble. In a few mangels, however, where a slight water-soaked area showed between the perfectly healthy and the rotted tissues, microscopic sections revealed the presence, between the cells, of very distinctive mycelial threads of a fungus that undoubtedly was responsible for the rot. With some difficulty, pure cultures of a phycomycetous fungus were finally obtained from such regions. When the mangels were kept in the laboratory under unusually moist conditions, these water-soaked areas became more pronounced, and cultures of the fungus were then more easily obtained. Grown in test tubes of oatmeal agar, this fungus usually produced a matted submerged surface growth (this may have been due to bacterial impurities), though cultures were finally obtained with an abundant white fluffy aerial growth. All cultures failed to produce a fruiting stage of any kind. However, when a small amount of the mycelium, with the medium, was placed in water in a Van Tieghem cell, oospores with one or more antheridia were readily produced, which seemed to agree well with descriptions of the oospores of *Pythium deBaryanum*.

So far as the writer could determine, the fungus agreed better with *Pythium deBaryanum* than with any other fungus, although there were some things in our imperfect study of it that made us hesitate to name it unquestionably as that species. Unfortunately our assistant let the cultures go too long before renewing, so it was lost before we had a chance to compare it with cultures of *Pythium deBaryanum* obtained from the U. S. Department of Agriculture. The statement of Edson, however (Journ. Agr. Res. **4**:160. 1915) regarding the growth of

Pythium deBaryanum in artificial cultures, seems to agree fairly well with the results we obtained with our fungus. He says:—"It grows especially well, with long-continued vitality, upon string-bean agar. The sexual fruiting bodies are quite common in Petrie-dish cultures upon this medium, but are rarely met with in tube cultures. The asexual conidia, as well as oospores, are formed abundantly when the fungus is grown in water upon sugar beet seedlings in Petrie dishes. * * * Germination by zoospores was not observed, but no special effort was made to induce this type of development."

The only other fungi which seem likely to have caused this root rot are *Aphanomyces laevis* deBy. or *Rheosporangium aphanidermatus* Eds. The former has been rescribed by Barrett (Phytopath. **2**:96. 1912 Abstr.) as causing a root rot of radishes, but we have seen no description of its cultural characteristics, though so far as we can determine from the specific description, it does not agree so well with our fungus as *Pythium deBaryanum*. The second fungus was recently described by Edson (Journ. Agr. Res. **4**:279-91. Jl. 1915) as the cause of a dampening off and a side root disease of sugar beets, which are very closely related to mangels. Edson describes and figures this fungus in detail and states that "in the general character of the disease produced in seedlings and in its appearance in cultures, the organism resembles *Pythium deBaryanum* so closely as to be readily confused with it, except in the asexual fruiting stage." This fungus was at first mistaken by him for *Aphanomyces laevis*. The fact, however, that in water it readily produces a "presporangium," which gives rise to a zoosporangium with zoospores, seems to preclude our fungus from belonging to it, since we saw no signs of such an asexual stage, or of zoospores of any kind in the water cultures in Van Tieghem cells.

While several authors have described *Pythium deBaryanum* as a cause of dampening off and of fibrous root rot of *Beta vulgaris*, we have seen no description of its causing a root rot of the tap root such as we mention here. Edson, who has made a special study of the sugar beet diseases in this country, mentions no such injury, but possibly suggests it in the following statement:—"The fungus was found to be capable of attacking the beet after it was five or six weeks old. Peters' statement that it is able to infect the side roots during the entire vegetative period is probably correct. When the tap root is once attacked by *Pythium deBaryanum,* the ultimate death of the plant seems to be assured."

MAPLE, NORWAY, *Acer platanoides.*

ANTHRACNOSE, *Gleosporium* sp. Plate XX c. This disease was first called to our attention by Mr. Bartlett of Stamford, who sent us specimens of leaves collected in August, 1914, on the Bedford estate at Greens Farms. These leaves showed no signs of the fruiting stage, and at first seemed to indicate not a fungous, but a physiological trouble due to injury from some cause at the base of the petiole. Specimens collected by Dr. Britton the last of September at the same place, however, showed the fruiting stage of a Gleosporium, which was obtained in cultures by Mr. Stoddard.

The peculiarity of the disease is that the injury is confined to a very narrow band running each side of the principal midribs and their large veins. In general, the trouble seemed to start, or at least show most prominently, at the juncture of the midribs at the base of the leaf. From there it appeared to spread up the midribs, though not infrequently the diseased areas were confined to isolated places scattered along them. This may have been due to the restriction of the injury in places to the bundles, while further on it spread out into the parenchyma. So far as could be seen, the veins running off from these ribs always showed the injury first at their juncture with them, and the diseased band was usually widest there. Apparently it progressed from these outward, so that in some cases all of the midribs and their principal veins were injured practically their entire length. The injured tissues were of a reddish-brown color, in rather sharp contrast to the normal green of the rest of the leaf. Under a lens this reddish area was usually seen to be bordered by a faint yellowish, semi-pellucid line. Where the injury to the veins was extensive, the parenchyma tissue between the veins finally lost its green color, turning yellowish, as in maturing leaves, and such leaves were shed prematurely.

While the evidence as a whole seems to point to the Gleosporium as the cause of the trouble, since it was also found on

the fruit, we are not quite sure of its identity. In appearance the trouble approaches nearest to the anthracnose disease of the sycamore, *Gleosporium nervisequum,* which is not infrequently found here on sycamore leaves. In this case, while the injury usually develops along the veins, it is apt to show more in spots, often isolated, running out into the parenchyma, and rarely if ever is confined to such narrow elongated lines. Some botanists have reported the sycamore anthracnose as occurring on maples and oaks, and one would be inclined to consider this the same, were it not for the fact that the spores obtained from these maple leaves were smaller ($5\text{-}8 \times 2\text{-}3\mu$) than those examined from the sycamore ($9\text{-}13 \times 3.5\text{-}5.5\mu$). Curiously enough, the culture we now have on hand, said to have been isolated from these maple leaves, has spores agreeing in size with those from the sycamore. As there is a bare possibility that the culture has been mislabeled, we cannot claim them to be identical.

Besides *G. nervisequum,* Saccardo gives at least eight other species on Acer, but none of these, according to the descriptions, seems to produce an injury similar to that described here, although several of them have spores of approximately the same size, and others have the same host.

Bartlett (Tree Talk 2^2:25. N. 1914) gives a brief description of this disease, and reports its occurrence on Long Island. Further study, especially with cultures and inoculation tests, is needed to prove the exact relationships and identity of the Gleosporium supposed to be its cause. It is barely possible that it is merely an unusual form of attack of *G. saccharini* or some other described species with similar spores.

ONION, *Allium Cepa.*

FUSARIUM ROT, *Fusarium* sp. Plate XX d. In 1915 onions rotted badly after storage. In some instances the growers lost from one-half to three-quarters of the crop. While the Botrytis previously reported was partly responsible for the rot, there were cases where a Fusarium fungus was the chief cause, producing a wetter rot than the former. This fungus is not so apt to fruit on the exposed surface and around the neck of the onion as the Botrytis, but seems to work down between the layers, often rotting one or more so that the inside easily slips out of the outer healthy layers. The wet summer season was apparently the chief factor in the development of this trouble and no doubt most of the bulbs went into storage already infected though showing little or no sign of decay at the time. Selby of Ohio (Ohio. Agr. Exp. Sta. Bull. 214:416) has reported a storage rot of onions caused by Fusarium sp. which seems to be connected with injury by Fusarium (p. 413) in the field.

RUST, *Puccinia Porri* (Sow.) Wint. This fungus was found by the writer on specimens labeled Egyptian perennial onion (which, so far as we can learn, is a horticultural variety of *Allium Cepa*) in Blakeslee's botanical garden at Storrs in July, 1914. Only the uredo stage showed at that time, and specimens sent the first of October by Mr. Shultz, in charge of the garden, also failed to show any other stage. This makes it rather difficult to positively identify the fungus, as there have been a number of rusts reported on Allium in Europe. As we (Conn. Agr. Exp. Sta. Rept. 1909-10:726) have previously reported Puccinia Porri from this state on chives, and as these uredo specimens seem to agree with those of that species somewhat better than with those of *P. Alliorum,* reported in this country on wild species of Allium from the West, we have referred it to the former species, which frequently occurs on cultivated species of Allium in Europe. Dr. Arthur, to whom specimens were sent, also agreed with this determination.

The uredo sori occur as small, scattered or somewhat clustered subcircular to lanceolate pustules, protected by the epidermis, which, cracking lengthwise, exposes the dusty, orange-yellow spore masses. The spores are yellowish to light brown, moderately thin-walled and provided with several germ-pores, minutely and often obscurely verruculate, broadly oblong or oval to ovate or subspherical in shape, and chiefly 24-30μ in length.

PALM, *Phoenix* sp.

FALSE SMUT, *Graphiola Phoenicis* (Moug.) Poit. This fungus occurs on palms in greenhouses, and is not uncommon in tropical regions, especially on the date palm. It was collected here by Inspector Zappe on specimens imported from Ghent, Belgium, by J. N. Champion of New Haven in May, 1914. The fungus, which was originally considered a smut, shows as small black cup-shaped receptacles, light colored where rupturing on top, and elevated above the surface of the leaf about 0.5 mm. When abundant, it causes some injury to the leaves. Stone and Smith briefly describe and figure this in the Mass. Agr. Exp. Sta. Rept. for 1897, p. 67.

PEACH, *Prunus Persica.*

GRAY-MOLD ROT, *Botrytis vulgaris* Fr. This fungus has appeared during the last few years in our young peach orchard at Mount Carmel, causing a rot of the fruit, especially that on the lower branches and on the ground. As yet it has not caused serious injury, but on the other hand, it has been almost as common so far as the brown rot. See Apple, p. 427.

Stripped Buds. Plate XXII a. An unusual injury, due to snow and ice, occurred on some of our nursery peach trees in the winter of 1913-14. The seedlings had been budded rather late the previous summer with yellows buds, and so had in many cases made a rather tender and weak growth to go into the winter. They were so situated that they became rather deeply buried in the snow. When examined in April, they showed the condition indicated in the illustration. Many of the buds had been torn back for two or three inches and were hanging down at the end of a strip of bark. The snow had evidently frozen around the buds, and later, when settling down, had stripped back the buds because of the tender bark, much as if one had slashed them with a knife. The injury was greatest on the most tender trees and those in the lowest part of the rows, where the snow had banked the highest. The buds high above the snow had escaped injury. Although no complaint of such injury has ever been received, it is liable to occur in any nursery to some extent.

PEAR, *Pyrus communis.*

BLUE-MOLD ROT, *Penicillium expansum* Lk. Plate XXII d shows this rot on pear. The specimen was obtained from pears kept in storage for a short time in October, 1915, by Mr. Sears of Elmwood. It forms a general rot of the fruit, and in time the characteristic blue-green fruiting pustules appear, breaking out abundantly on the surface. This rot is not uncommon on both apples and pears in storage, although we have not reported it before on the latter host.

GRAY-MOLD ROT, *Botrytis vulgaris* Fr. This rot was found at the same place as the preceding, on recently stored pears. See Apple, p. 427.

POPLAR, *Populus* sps.

Rusts on poplars and willows have been found on both cultivated and wild species in this state, and are not uncommon on certain of the latter. While several species of Melampsora on these hosts are now recognized in North America, their macroscopic appearance is much the same. The II or uredinial stage shows as small, dusty, yellowish, powdery pustules, breaking out more or less abundantly, usually on the under surface of the leaves, during the early summer. Later, these are followed by the III, or telial stage, which develops its sori as somewhat larger, waxy, orange-red areas firmly imbedded in the leaf tissues. The I or aecial stage occurs as a Caeoma on certain alternate hosts, varying with the different species.

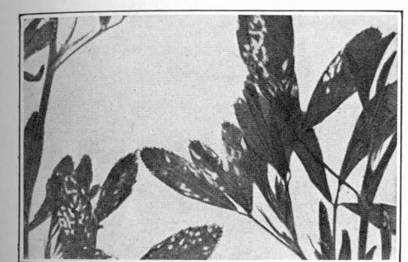
Burrill, in his Uredineae of Illinois, published in 1885, recognized only one species of Melampsora on Salix and another on Populus. Arthur, in his Uredinales of North America, published in 1907, describes two species on Populus and four on Salix, distinguished chiefly by their uredinial spores, but, like Burrill, lists only one species on each of these host-genera for the Eastern United States, both of which are said to have their aecial stage as a Caeoma on Larix. Recently, however, at Arthur's suggestion, Ludwig (Phytopath. 5:279. O. 1915) has made a further study of herbarium material and, profiting by the infection experiments of Fraser (showing the relationship of the hemlock Caeoma to a Melampsora on *Populus grandidentata*), has distinguished besides the species recognized by Burrill and Arthur a new one, which he calls *Melampsora Abietis-canadensis* (Farl.) Ludw. In Switzerland, Fischer (Die Uredineen der Schweiz: 478-506. 1904) described thirteen species on Salix and six on Populus, differing in part by their aecial stages occurring on such widely differing host-genera as Larix, Allium, Galanthus, Orchis, Euonymus, Saxifraga, Ribes, Pinus, Corydalis and Mercurialis. A recent examination of Connecticut herbarium specimens, before seeing

APPLE.

a. Gray-mold Rot, p. 427.

b. Volutella Rot, p. 428.

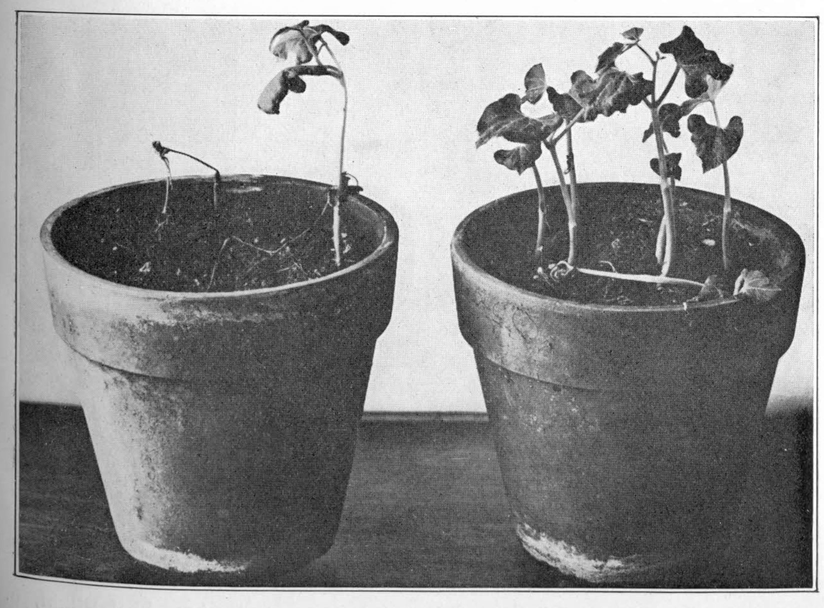
ALFALFA.



c. White Spot, p. 425.

WHITE BEAN.

d. Anthracnose, p. 423.



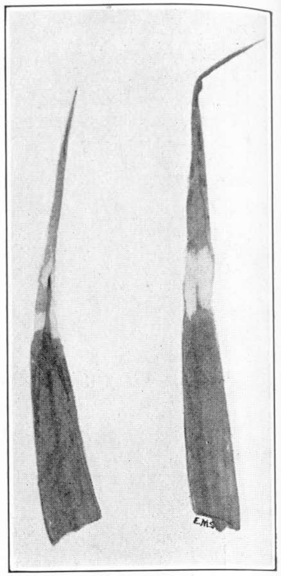
e. Seedlings from Anthracnose Beans kept under moist and dry conditions.

DISEASES OF APPLE, ALFALFA AND BEAN.

CABBAGE.

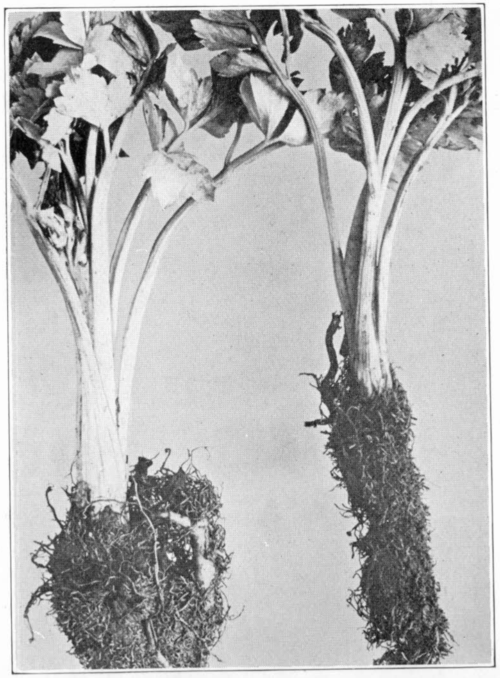
a. Gray-mold Fungus, p. 428.

CARNATION.

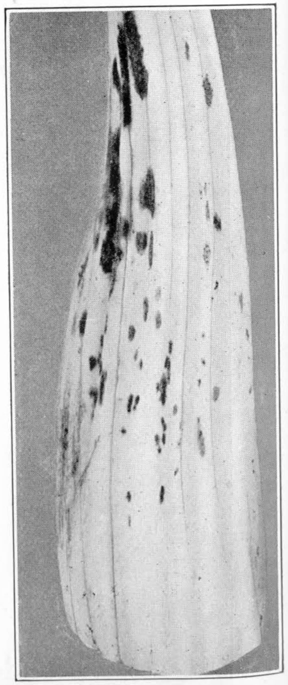


b. White Tip, p. 428.

CELERY.



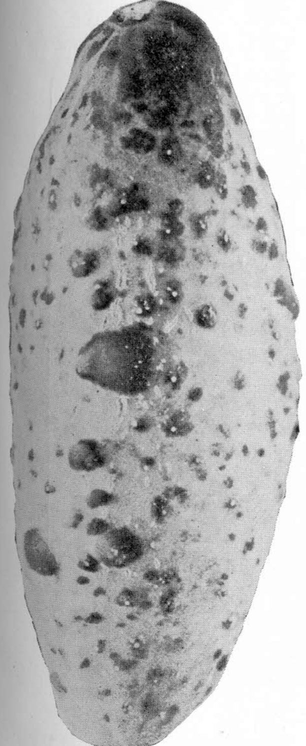
c. Bunched Roots, p. 429.



d. Late Leaf Blight, p. 424.

DISEASES OF CABBAGE, CARNATION AND CELERY.

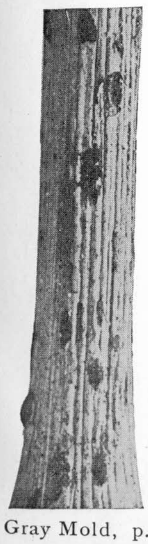
CUCUMBER.



a. White Pickle, p. 430.

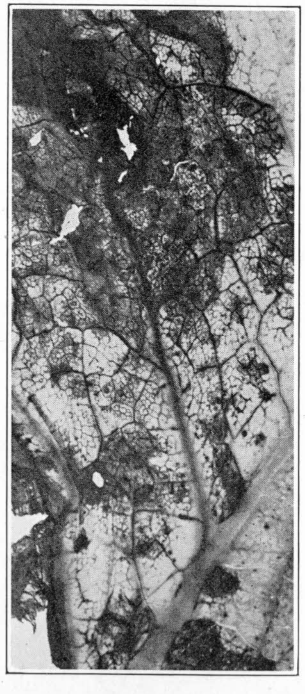
b. Mosaic, p. 430.

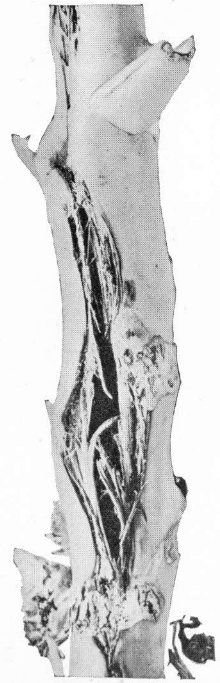
GRAPE.



c. Gray Mold, p. 431.

KALE.

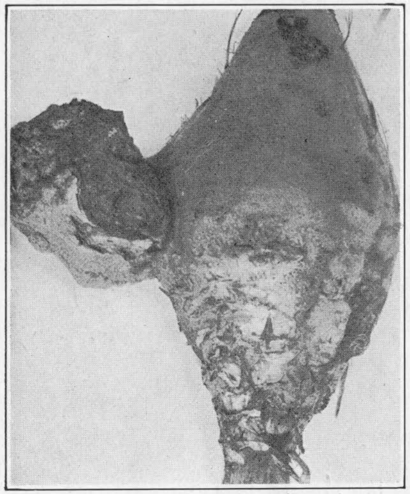




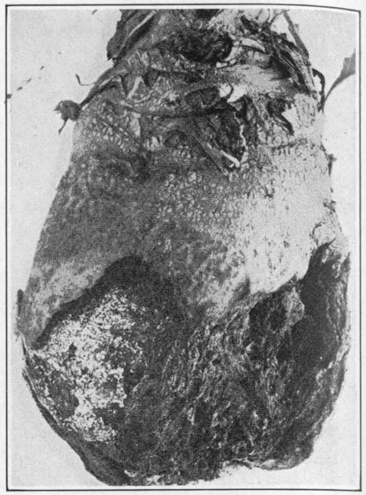
d-e. Black Rot on Leaf and Stem, p. 431.

DISEASES OF CUCUMBER, GRAPE AND KALE.

MANGEL.

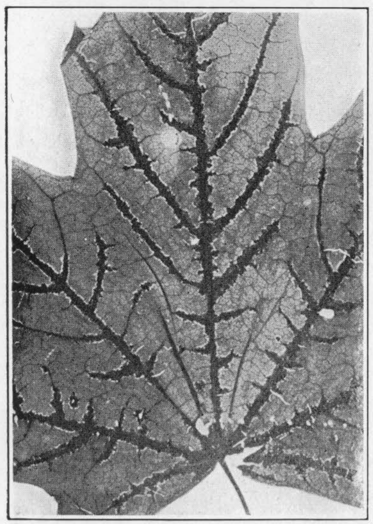


a. Crown Gall, p. 432.



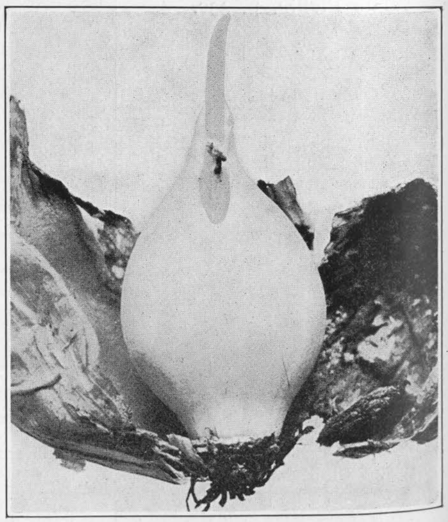
b. Root Rot, p. 433.

MAPLE.



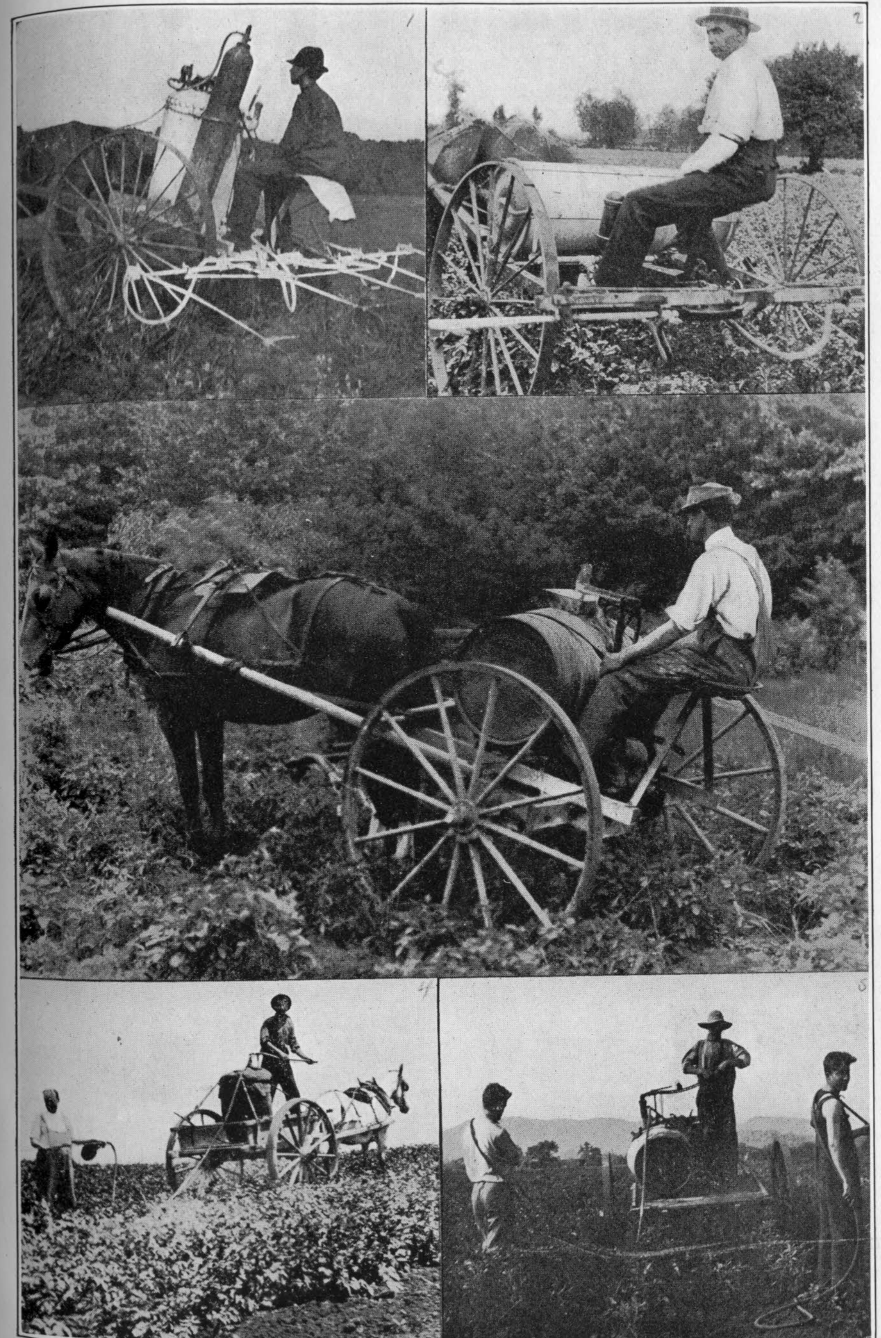
c. Anthracnose, p. 436.

ONION.



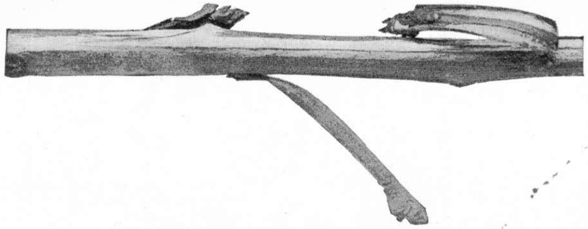
d. Fusarium Rot, p. 437.

DISEASES OF MANGEL, MAPLE AND ONION.

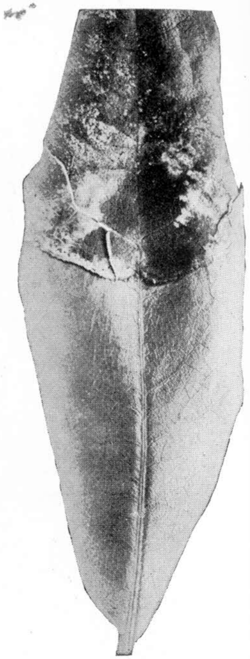


Types of Sprayers used in Experiments, p. 470.

POTATO SPRAYING.



a. Stripped Buds, p. 439.



e. Anthracnose, p. 443.

b. Potato Spraying Experiment, p. 487.

POTATO.

c. Powdery Scab, p. 463.

PEAR.

d. Blue Mold, p. 439.

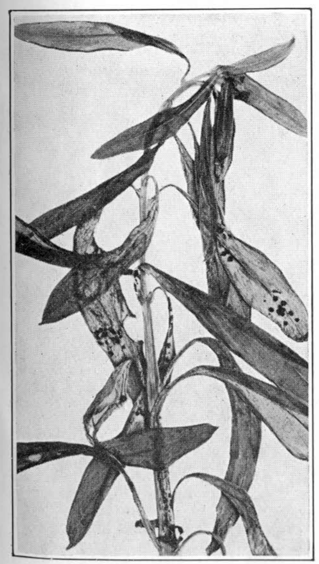
TROUBLES OF PEACH, POTATO, PEAR AND RHODODENDRON.

SOY BEAN.

a. Crinkling Chlorosis, p. 446.

b. Bacterial Leaf-Spot, p. 444.

SNAPDRAGON.



c. Rust, p. 443.

TOBACCO.

d. Lightning Injury, p. 448.

TROUBLES OF SOY BEAN, SNAPDRAGON AND TOBACCO.

rarer here than the form on the cones and twigs, described by Arthur as *Peridermium fructigenum,* and has much smaller sori. Both forms seem to be common in Canada, and the spores of the two are similar, so that the smaller size of the sori on the leaves is probably due merely to the different part of the host attacked.

Ever since finding the Caeoma on hemlock cones, we have tried to trace its telial stage, but could never get any clues from other rusts appearing in the vicinity of infected hemlocks. We therefore attempted to infect a large number of plants noticed growing beneath or near infected hemlocks, but without success. These included such host-genera as Mitchella, Pyrola, Stellaria, Chimaphila, Gaylussacia, Vaccinium, Rubus, Azalea, Kalmia, and Betula. Fraser's success in connecting it with the Melampsora on *Populus grandidentata* clears up the mystery, as we did not try this species. We did, however, try unsuccessfully, as did Fraser, to infect *Populus deltoides.* In view of the fact that Ludwig reports this as one of the hosts of this species in Indiana, the meaning of these failures is not clear.

The uredinial spores of this species are considerably smaller and more subspherical than those of the preceding species, and are without very evident smooth spots. We have made no careful examination of the telia of either species. So far as we can determine from the uredinial stage, which in some cases is not abundant, most of our Connecticut collections belong to this species, and include one or more specimens on the following hosts:—*Populus balsamifera, P. grandidentata, P. heterophylla, P. tremuloides.* Besides these, Ludwig also gives *P. candicans* as a Connecticut host.

POTATO, *Solanum tuberosum.*

Powdery Scab, *Spongospora subterranea* (Wallr.) Johns. Plate XXII c. This disease has been found here so far only on imported seed potatoes. See special article in this Report.

PRIVET, *Ligustrum* sp.

Crown Gall, *Pseudomonas tumefaciens* (Sm. & Towns) Stev. Privet is a host not before reported for the crown gall

in this state. It was found by Inspector Davis on stock imported by Barnes Brothers Nursery Co. from Angers, France, in April, 1915.

QUINCE, *Cydonia vulgaris.*

Gray-Mold Rot, *Botrytis vulgaris* Fr. The gray-mold fungus has been isolated from a decaying quince. See note under Apple.

RHODODENDRON, *Rhododendron* sp.

Anthracnose, *Pestalozzia Guepini* Desm. Plate XXII e. This fungus was found three times during 1915 by Mr. Lowry, of the entomological department, while inspecting imported plants at New Haven, Greenwich, and Stamford, these plants having been received in one case from France and in the other two cases from Holland. Large, dead, brown to reddish-brown areas developed at the tip or sides of the infected leaves, and on these the fruiting stage showed on either surface as minute black pustules beneath the epidermis. From these pustules the spores are exuded on the surface.

RUTABAGA, *Brassica campestris.*

Club Root, *Plasmodiophora Brassicae* Wor. We have previously reported this disease on the common white turnip, but not on the yellow, or Swedish turnip. In 1914 we found it in our experimental garden on the latter, though not nearly so common as on white turnip.

SNAPDRAGON, *Antirrhinum majus.*

Rust, *Puccinia Antirrhini* Diet. & Holw. Plate XXIII c. This fungus was first collected in this state by Mr. Zappe, of the entomological department, while inspecting plants at the greenhouse of Brooks Brothers, at Westbrook, in November, 1915. Apparently the rust was not doing much damage there, or at least it was not nearly as prominent at that time as the anthracnose fungus which we have previously reported on this host. The specimens brought to the writer showed only the uredinial stage. This stage forms small, roundish, reddish-brown pustules, or sori, usually circularly grouped, on the under side of the leaf, causing the tissues above to become yellowish.

On the stem the sori are clustered irregularly, and are often more elongated. The sorus is at first protected by the epidermis, which breaks away, disclosing a rather firmly agglutinated spore mass much like a telial sorus. The spores on the stem seem to retain their pedicels more firmly than those on the leaves, and are as a rule more elongated, being subspherical to oval instead of chiefly subspherical.

This fungus was originally described by Dietel (Hedwigia 36:298) in 1897, from specimens showing both the stages on this same host collected by Blasdale at Berkeley, California, and it has since been collected elsewhere in that state. In the Atlantic States it does not seem to have been collected very frequently, so its importance here as a parasite of this host is yet somewhat doubtful. Peltier and Rees (Phytopath. 4:400. D. 1914), however, reported finding it in 1913 and 1914 in the vicinity of Chicago, Illinois, where it was doing considerable damage. They also reported it from Indiana and Ohio.

SOY BEAN, *Glycine hispida*.

BACTERIAL LEAF-SPOT, *Bacillus* sp. Plate XXIII b. A bacterial disease was found on the Soy bean leaves at the Station farm at Mount Carmel in August, 1915, apparently identical with a somewhat similar appearing bacterial leaf-spot on Lima and wax beans (Round Point Kidney) nearby, though no cultural studies were made to prove their exact identity. Sturgis (Rept. 1898:262) years previously had reported a bacterial disease from this state on Lima beans, and the writer (Rept. 1903:307. *Ibid.* 1904:316) had listed similar troubles on both the common and Lima bean. As observed by both of us, the spots on the Lima beans are light brown, with a dark red-brown or purplish border, subcircular, 1-5 mm. in diameter, sometimes coalescing into larger areas, but not apt to be numerous. Sturgis found similar spots on the pods, and the writer observed what seemed to be the same trouble on the cotyledons of germinating seeds, which indicates how it carries over winter.

The specimens on wax bean collected in 1915 have spots that are reddish-brown, angular, smaller (usually 1-2 mm.), but generally very numerous and coalescing into large areas covering most of the leaf surface. On the other hand, our earlier collections on similar beans usually show a few large spots that by growth have involved most of the leaf tissues. Possibly the size of the spots depends somewhat on the number of infections that have taken place on the same leaf. When moist, these spots have a pellucid or water-soaked appearance.

On the Soy bean the spots (see illustration: less than natural size) vary somewhat, but are generally dark reddish-brown and about 1-2 mm. in diameter, with a somewhat angular outline. Sometimes irregular spots several millimeters in diameter occur, which probably result from the merging of numerous small spots. Very often a yellowing of the tissues outside the spot is seen. Occasionally under a lens the spots show the bundles darker than the parenchyma. The spots are generally well scattered over the leaf blade, but in some cases they occur in areas along the border, as if a general invasion had taken place there. As is the case with the other hosts, the invaded tissues sometimes fall out. The disease was noticed on the following varieties of Soy bean: Medium Yellow, Wilson, Manhattan, Quebec 92, Quebec 537, and Ito San, being especially bad on the last-named variety.

Both Sturgis and the writer considered the bacterial spots previously reported on the Lima and string bean the same as that described by Smith as *Pseudomonas Phaseoli*. Von Oven, according to Stevens, has described a bacterial disease (*Pseudomonas leguminiperdus* (V. Oven) Stev.) on peas and other legumes, but we have not seen a description of this. We have seen no detailed description of a bacterial spot of Soy bean. Smith does not give Glycine as a host of his *P. Phaseoli,* altho he mentions Lima and bush beans as hosts (U. S. Dept. Agr. Div. Veg. Phys. & Path. Bull. 28:149), and later (Ann. Mo. Bot. Gard. 2:381. 1915) gives Vigna (to which genus the cow pea belongs) but not Glycine, as one of several leguminous genera upon which bacterial diseases have been found. Earlier, however, in his "Bacteria in Relation to Plant Diseases" (Vol. II:69), he merely mentioned a leaf spot of Soy bean. The only other references we have been able to find are short ones by Heald in Science (1906:624), where under the title of "New or Little Known Plant Diseases in Nebraska" he mentions Bacterial Blight as serious on Soy beans used as an orchard cover crop (as were ours), and in the Nebraska Ann. Rept. (19:41, 71. 1906), where he names this as Bacillus sp. and gives a short description of its appearance on the leaves, which agrees with what we found on Soy beans here. He does not seem to have made further studies of it.

We believe that the disease collected in 1915 on wax, Lima and Soy beans is the same thing, and presumably *Pseudomonas Phaseoli,* yet because of the small spots as contrasted with the general invasion previously noted on the common bean, and the fact that this species has not to our knowledge yet been reported on Soy bean, we list it here merely provisionally as Bacillus sp. as given by Heald, expecting later to determine its exact identity.

Chlorosis and *Crinkling.* Plate XXIII a. The same year, Soy beans at the Mount Carmel Station farm showed an unusual trouble or troubles which took the form of a yellowish mottling of the leaves, usually accompanied by an irregular wrinkling or puckering of the parenchyma tissues. The former we have called chlorosis, and the latter crinkling. The chlorosis trouble was much like the ordinary chlorosis of plants in appearance, showing as yellowish to yellowish-green irregular areas scattered in the parenchyma between the normally green tissues. This sometimes occurred on certain leaves on plants which had no other peculiarity, but more frequently it was associated with the crinkling trouble. This latter showed wrinkles which were a deep green, while the intervening smooth tissues were a yellowish-green, though not apt to be so yellow as where chlorosis alone showed. Whether these were distinct, or variations of the same trouble, was not determined. Neither were experiments conducted to determine whether they were infectious.

The crinkling chlorosis (see illustration) was in some respects much like the infectious mosaic trouble found on cucumbers, mentioned elsewhere in this report. The crinkling on some of the leaves was very marked, and was most conspicuous in the vicinity of the midrib or larger veins, often showing as a series of small wrinkles on either side of the midrib or veins. This unevenness of development of the parenchymatous tissues was evidently due to the greater amount of chlorophyll in these spots, which caused a more rapid growth of the tissues there, with the pockets or folds always forming with the concavity on the lower side of the leaf. The crinkling chlorosis was found on

the following varieties: Medium Green, Wilson, Swan, Kentucky, Wing's Mikado, and Hollybrook, being especially abundant and prominent on the last-named variety. On the Hollybrook, O'Kute, Wilson, Ito San, and Manhattan, specimens were also obtained that showed only the chlorosis. Whether or not the wet season was partially or wholly responsible for the unusual development of the trouble probably depends on whether or not it is infectious. We have seen no mention of similar trouble on this host, although we have previously reported chlorosis troubles on both string and Lima beans (Rept. 1907-8:859).

SPINACH, *Spinacia oleracea.*

DOWNY MILDEW, *Peronospora effusa* (Grev.) Raben. Although we have looked for this fungus during the past ten years, we did not succeed in finding it until last October. We discovered it then on the W. G. Griswold farm at Wethersfield, on the variety of spinach known as Viroflay, and shortly afterward at the Morgan farm at Cheshire on the Goliath variety. At neither place was the fungus abundant, and apparently it was present only as a result of the favorably moist season. This seems to indicate that this disease is not liable to be very troublesome so far north, tho Reed and others have found it doing considerable damage further south.

This fungus causes indefinite yellow spots, usually of conspicuous size, showing prominently on the upper side of the leaf, while it more or less covers the under surface with a mat of the dirty-white or violet-gray fruiting stage. The winter or oospore stage was not produced within the tissues so far as we could determine from the specimens examined. Magnus, however, found that the mycelium winters over in the late-infected leaves of the spinach. This fungus occurs in the United States also on several of the wild species belonging to the same family, especially on species of Chenopodium, Lamb's Quarters being a common host. Thus far we have found it only once on Chenopodium in this state.

Yellow Leaf. In November, 1915, specimens of spinach were received from S. S. Mills of Stratford, who wished to know what was the matter with his plants, as this trouble was common in his field. An examination of these and other specimens sent later showed that no particular insect or fungus was responsible for the trouble, although on the leaves of a few of the plants the anthracnose fungus, *Colletotrichum Spinaciae* Ell. & Hals., was found. The roots seemed to be healthy. The trouble consisted chiefly of a yellowing of the leaves, either a few or all on a plant, in the latter case presenting the appearance of a golden or aurea variety. This yellowing caused somewhat premature death. Usually, when fresh, the yellowed portion showed a thickening of the tissues, which was also manifested by increased turgor when the leaves were wet. Cross sections under the microscope revealed no fungus mycelium, but the cells and intercellular spaces were enlarged.

The character of the disease and the unusually wet summer indicated that it was probably due to unfavorable seasonal conditions possibly complicated with unfavorable soil conditions. Harter (Va. Truck Exp. Sta. Bull. 4:61. Au. 1910) describes, under the term of malnutrition, a trouble of spinach quite similar, at least, to that mentioned here. He seemed to think that it was the result of unfavorable soil (acid land and excessive use of fertilizers) and seasonal conditions, but in regard to the latter, very dry rather than wet seasons were given as the responsible factor. No doubt excess in either direction might produce somewhat similar effects.

SYRINGA, *Philadelphus* sp.

CROWN GALL, *Pseudomonas tumefaciens* (Sm. & Towns.) Stev. A single specimen of this was found on this new host, imported from Orleans, France, at Burr's Nursery, Manchester, by Inspector Lowry, in January, 1915.

TOBACCO, *Nicotiana Tabacum.*

Lightning Injury. Plate XXIII d. In July, 1914, Mr. P. H. Woodford, of Avon, wrote that he had a disease of tobacco which he would like to have the Station investigate. He said:— "I have a new disease in my tobacco. It has affected a patch about one rod in diameter. A plant will have one leaf shrivel up and soon another on the same side of the plant; then the whole top will wilt and die. It seems to affect the pith of the plant." Mr. Stoddard visited the place and obtained specimens for study, and also made photographs, one of which is shown

in the illustration. No definite explanation of the cause of the trouble was obtained, however, from this investigation, except that it might possibly be a bacterial disease, as cultures were obtained from the injured tissues, and the stem showed blackened longitudinal folds something after the manner of a bacterial canker previously reported by us.

Later, when reading an account by Jones and Gilbert (Phytopath. 5:94-101. Ap. 1915) of somewhat similar injury to potato and cotton plants by lightning, both Mr. Stoddard and the writer came to the conclusion that this was the probable explanation of the trouble. On writing to Mr. Woodford to this effect, he replied:—"I think your diagnosis of this case is probably correct. Mr. Floyd of the Granby Tobacco Corporation told me that it was the effect of lightning. After you were here the disease did not spread, and some of the plants affected improved and lived through the season but did not amount to much for tobacco. * * * Lightning is not very likely to strike in that vicinity, but I have known it to do so. There was a small thunder storm a week or so before I noticed the plants affected, but I did not think that the lightning struck so near me or that it struck in that direction from my house."

TURNIP, *Brassica Rapa.*

BACTERIAL SOFT-ROT, *Bacillus carotovorus* Jones. In the Station Report for 1914, p. 25, we gave a brief description of this soft rot, which is found most frequently in the roots or underground stems of various market plants. The turnip was not included in this list, although it has been reported elsewhere as having the same trouble. Last year Mr. Huber of the Station staff called our attention to its occurrence on white turnips at the Station farm. Undoubtedly the moist season favored its development, especially where the roots had been injured.

WHITE PINE, *Pinus Strobus.*

Fertilizer Burn. In the summer of 1914 the Northeastern Forestry Company had a scorch type of injury appearing suddenly on certain beds of their one-year-old white pines. This developed after some fertilizer had been scattered over the beds one morning, those beds showing the burn where the fertilizer was applied before the dew had evaporated, while other beds similarly fertilized later in the day escaped without injury. The fertilizer was ground bone, which one would not expect to cause injury under ordinary conditions. The injury was different from that described below, in that the tips rather than the base of the leaves first showed it. In some cases the Rhizoctonia fungus seemed to spread where this fertilizer was present, and may have caused some of the injury, but on most of the leaves no sign of it could be found.

Rhizoctonia Blight, *Corticium vagum* var. *Solani* Burt (*Rhizoctonia Solani* Kuhn). We have previously reported (Rept. **1912**:348) the Rhizoctonia stage of this fungus causing dampening off of various coniferous plants. In August, 1914, the Northeastern Forestry Company requested the writer to examine a lot of two-year white pines in their nurseries, whose leaves were dying from some unknown cause. An examination of the plants showed the roots to be perfectly healthy. The mycelium of this Rhizoctonia was found, however, running up from the ground on the stems and developing without injury to the host until it reached the base of the young leaves, where it infected and killed the tender tissues for a short distance. As a result of this basal injury, the leaves eventually died, finally turning a reddish-brown. They sometimes died from the tip downward. In some cases all of the leaves above the original point of infection died as a result of the invasion of the stem from the infected leaves. Spraying with Bordeaux gave beneficial results, as it afforded protection to the exposed tissues in this case. This type of injury is new to us on this host, but is somewhat similar to that caused by the same fungus when it runs up potato stems and produces canker spots, usually beneath the ground.

WILLOW, *Salix sps.*

Larch-Willow Rust, *Melampsora Bigelowii* Thüm. Rust on various species of Salix has been collected a number of times in the past, but we have not reported it before, since all our collections were on wild hosts. Last year it was found on certain species of basket willow grown at our Mount Carmel farm for experimental purposes. Although several species or varieties grew here together, only one showed signs of the rust,

thus suggesting differences in susceptibility to infection, or possibly indicating that different host-species might have different species of rust attacking them. Hedgcock also (Mycol. **4**:147. My. 1912) has reported rust as causing injury to basket willows grown at Washington for experimental purposes.

We are not sure of the identity of our Mount Carmel specimen, as its uredinial sori, spores and paraphyses seemed to differ somewhat from those of our other collections, but it is placed here until further information is gained concerning its possible aecial stage. The other collections seemed certainly to belong under this species, and to have for their aecial stage the Caeoma on Larix, which has been collected twice in this state on *Larix laricina,* once in June, 1910, at Norfolk, with infected willow leaves just beneath the infected larch trees, and again in June, 1913, at West Willington, with infected willows in the vicinity. See Poplar, p. 440.

DISEASES OF PLANTS CAUSED BY NEMATODES.

G. P. CLINTON.

General. Nematodes, or as they are more popularly called, "eel worms," are low, often semi-microscopic, forms of animal life belonging with the true worms to the class known as Vermes. Usually they are characterized, at least in some stage, by a long slender body with tapering ends. Some forms live in decaying vegetable or animal matter, while others are true parasites. Examples are furnished by the eel worm of vinegar, the horse-hair worm, the trichina of pork and the root-knot nematodes parasitic on various plants.

While the investigation of these animals naturally belongs to the zoologist, American botanists have paid considerable attention to those forms which are parasitic on plants, because the problems here are botanical in so far as they relate to the effect of the nematodes on the host plants. It is not the purpose of this article to deal with these animals from a zoological point of view, but merely to call attention briefly and in a general way to two species that have been found in Connecticut, noting the plants upon which they have been found here and the injury caused. The reader who wishes a more comprehensive or a zoological account of the nematodes is referred to the article by Cobb (3) on "Parasites of Stock," published by the Department of Agriculture of New South Wales in 1898, or his more recent article (5) on "Nematodes and Their Relationships," in the United States Department of Agriculture Yearbook for 1914.

ROOT-KNOT NEMATODE, *Heterodera radicicola* (Greef) Müll.

Distribution. This nematode is widely distributed in the United States, and occurs on the roots of a great variety of herbs and trees, both cultivated and wild. It is in the Southern States, however, that it causes the most serious damage. Neal (12), then of Florida, in a bulletin of the United States Department of Agriculture published in 1889, was one of the first in this country to give details concerning the injury caused by this species, which he named provisionally as *Anguillula arenaria.* He also made various experiments with reference to its control. In this same year there also appeared a bulletin of the Alabama Station by Atkinson (1), giving details of the life history, etc., of the same species, which he determined as *Heterodera radicicola* (Greef) Müll., under which name it has since been generally recognized.

In 1897 Selby (16) noted injury caused by this nematode to greenhouse plants in Ohio, and in 1898 Stone and Smith (19) published a bulletin of the Massachusetts Experiment Station dealing with its life history, its injury in Massachusetts, especially as a greenhouse pest, and methods for its control. One of the most complete accounts of the nematode is given in the Bureau of Plant Industry bulletin by Bessey (2), treating of its life history, hosts, literature, etc., and methods of control based on experimental work in Florida. Recently McClintock (10) has published a bulletin giving experiments in its control on ginseng in Michigan.

Injury. The special characteristic of this nematode is that it inhabits the living roots of various plants and by its presence causes a multiplication of the parenchymatous cells of the cortex in its vicinity, giving rise to small swellings or gall-like structures much like those of the club foot of cruciferous plants. This stimulation of tissue formation, however, is succeeded by early death and decay of the tissues, with the liberation of the parasites into the soil for new infections. The root injury frequently results in the yellowing of the foliage, with more or less stunted growth, or premature death, depending upon the severity of the attack. Infected roots of parsnip and snapdragon are shown in Plate XXV a-b.

While in the South this nematode causes considerable injury to a great variety of plants, in the North its hosts seem to be more limited in number, and the injury less. In fact, it is here chiefly a pest of greenhouse plants, or those grown in hot beds, cold frames or protected places.

Hosts in Connecticut. We do not know when this trouble was first noted in Connecticut, tho Sturgis (20) reported it in 1893 as serious on asters, and listed a number of other hosts on which it occurred in New England. Later Jenkins and Britton (7) reported it as bad on tomatoes in certain soils in the Station greenhouse. It has also been seen by the writer in greenhouses on the roots of roses and violets, and occasionally it has been sent in for identification on other cultivated plants. At the Elm

City Nursery it has recently been found on *Pachysandra terminalis.* The writer in 1915 found a few specimens of parsnip, *Pastinaca sativa,* at Farnham's market garden in Westville, showing the trouble (see Plate XXV a). Mr. Lowry, while doing inspection work about the state, has obtained specimens on *Gardenia jasminoides* from the Lewis greenhouse at Ridgefield, and on snapdragon, *Antirrhinum majus* (see Plate XXV b), from the Pierson greenhouses at Cromwell, where on both hosts it was doing more or less injury. Mr. Shepard of the Station has brought us specimens on ginseng, *Panax quinquefolium,* from Mount Carmel, and states that the nematode does considerable harm in his seedbeds. No doubt there are many other hosts, especially among greenhouse plants, upon which it occasionally occurs in this state.

Effect of Winter. One reason why the nematode does not cause more trouble in the North is that it does not readily winter over out of doors in unprotected places, this preventing its culminative development in infected fields. That it can winter over here, especially in protected places, there is little doubt. Mr. Shepard brought the writer specimens of ginseng in early May showing its presence. These were out of door plants, but mulched during the winter. Byars, of the United States Department of Agriculture, who is making a study of this phase of the subject, writes that he has found it wintering over out of doors in protected places as far north as Boston.

Remedies. Numerous remedies have been tried for the prevention of this trouble. Where it is feasible, a change of soil in the greenhouse or hot beds is desirable; or the soil may be left out of doors over the winter and the nematodes largely destroyed by freezing. Thoro drying out of the soil for several months in the summer is helpful. Steam sterilization of the soil (10, 19) is one of the most effective measures. Chemical treatments have not proved very effective, tho some benefit results from the treatment of the soil with formalin (10) or carbon bisulphide (2).

Other species. Besides the root-gall nematodes mentioned here there are other parasitic species found on various parts of their hosts. *Tylenchus devastatrix* Kühn (14, p. 78) is one of the more important of these. Ritzema-Bos (13) has described two species on strawberries from England that are sometimes serious pests. Cobb (4) has recently published an account of one, parasitic on the roots of Citrus trees, that causes considerable injury in California, and has been found in Florida and in other countries. He thinks this species, *Tylenchulus semipenetrans,* to be limited to Citrus as a host. Most of the species parasitic on plants seem to belong to the genera Heterodera, Tylenchus or Aphelenchus.

LEAF-BLIGHT NEMATODE, *Aphelenchus olesistus* Ritzema-Bos.

Cause. A very different type of injury from that of the root-knot is caused by a nematode occurring as a parasite in the leaves of certain plants, and which because of the appearance of the injury, somewhat similar to that caused by bacteria, we have called here the leaf-blight nematode. Apparently not so much has been published concerning this trouble. It was first called to our attention in November, 1914, by a letter and specimens sent to the Station by Mr. John Coombs, the Hartford florist. He wrote as follows:

"By parcel post I am sending you to-day some leaves taken from a lot of five hundred Begonia Cincinnati which show some disease that is a mystery to me. Can you identify it and give any means of prevention or cure? The leaves turn brown in spots which soon spread, affecting the whole leaf, causing it in a short time to wither and drop off, and spreading from leaf to leaf, ruining the entire plant. I saw a very few cases of it last year, but this year it is very prevalent and, unless I can check it in some way, will ruin my entire stock."

A microscopical examination of the diseased tissues of these leaves showed the presence always of slender nematodes, *Aphelenchus olesistus,* which without question were the cause of the injury, as similar injury by them has been reported previously both in Europe and in this country, not only to begonias but to a great variety of plants. The Cincinnati begonia is especially subject to the disease, being badly injured when other varieties show little or no injury. In 1915, in the Sokol greenhouses at Westville, we again found this variety suffering greatly from this trouble, and there was also some injury to the variety Gloire de Chatelaine. The disease has also been reported from the Pierson greenhouses at Cromwell, and no doubt is quite general in the greenhouses of the state, especially where the Cincinnati variety is grown.

Method of Infection, etc. An examination of the leaf structure of the Cincinnati begonia shows that it is especially adapted as a home for this nematode because of the ease with which it can pass thru the stomates to the large intercellular cavities above, which serve as a convenient and protected place where the eggs can be laid. The stomates are confined to the lower surface of the leaves, and usually two or three are grouped together under the large air chambers which under a lens show as small white areas dotting the surface.

The air chambers of the infected tissues, when examined microscopically, were usually found to contain the nematodes or their eggs (Plate XXVI B-D). Thru the epidermis the eggs (chiefly 15-18μ by 50-60μ) could be seen more or less abundantly around the cells lining the air chamber. Sometimes only one or two eggs were seen, but as high as a dozen have been counted in some chambers. Upon hatching, the young larvae can easily pass out thru the stomates and form new colonies elsewhere on the leaf. The mature larvae are also found more or less in the intercellular spaces further within the leaf in the spongy parenchyma, but are apparently prevented from a general invasion of the tissues by the reticulations of the larger veins, which cut off connection with the intercellular spaces of the adjoining areas. Thus the nematodes usually invade new tissues by passing out thru the stomates when the leaves are wet and entering the leaf in a new spot thru the underlying stomates.

Ritzema-Bos (14) held that the nematodes did not gain entrance into the leaf tissues thru the stomates, but worked up thru the tissues of the stem from the soil. Other investigators, as Klebahn (8) and Marcinowski (9), held that they passed into the leaves thru the stomates. Our investigations proved this to be so without a doubt. For instance, the size of the openings between the guard cells of stomates is usually sufficient to admit the passage of even mature nematodes, which we found to be 12-15μ in diameter by 550-800μ in length (see Plate XXVI B, E). Again, their passage thru the stomates could readily be proved by taking fresh leaves and placing a few drops of water over the infected area both on the upper and lower surface. Examination of the water in a few minutes always showed nematodes in it on the lower surface, where the stomates are situated, but not on the upper surface, where they are absent. By watching the stomates of a wet leaf with a microscope of low power we were even able on one occasion to see a nematode emerge thru a stomate into the water.

Infection of two different and less susceptible varieties of begonias was easily accomplished by placing drops of water containing the nematodes on the under surface of the leaves. Infection was also obtained by tying infected leaves of a plant to those of a healthy one, placing the lower surfaces together and keeping them moist for a time. Spots began to show in about ten days, and were conspicuous in two weeks. Microscopic examination later showed the presence of the nematodes and their eggs in the injured tissues.

No root-galls were found on the infected begonias, and we were unable by placing badly infected leaves in the soil to infect seedlings of buckwheat, onions, oats or rye grown in this soil, tho these plants are said to be subject to injury by another species. We were also unable to find the nematodes in the stems of the infected begonias. Infection seemed to be limited to entrance thru the stomates. Of course infection might take place by leaves in contact with infected soil or by the nematodes going up the outside of the stem to the leaves.

Hosts. At the several greenhouses where we have found or heard of this begonia disease, similar injury has also been found on certain species of ferns. We have not noticed it on any other plants, tho many other species have been reported as injured in Europe, and some few others in this country. In our Report for 1907 (p. 349) we reported, with an illustration, a leaf scorch of the Farleyense fern from the Pierson greenhouses that resembles very much the appearance of this nematode leaf blight on certain of the infected ferns. A recent examination of the dried herbarium specimens, however, failed to show the presence of nematodes in the tissues, so apparently a similar appearance may be caused by other agents. We have heard of complaints elsewhere in New England of this nematode causing injury to ferns, etc. On different hosts the appearance and amount of injury is somewhat different, apparently depending in part on the leaf structure, the size and abundance of the stomates, the delicacy of the tissues, etc., and the ability of the nematodes to pass freely thru the intercellular spaces to various parts of the leaf. The following are the hosts upon which we have noticed the trouble, with notes on their appearance:

On the Cincinnati begonia (Plates XXV d, XXVI A) the injury showed as numerous small, at first indistinct, discolorations limited by the small veinlets, but in time merging and causing a large conspicuous reddish-brown spot or spots, as shown in the illustration, so that finally the whole leaf may become so badly injured as to wither and drop off. Sometimes the infection showed as elongated streaks along the main veins, where the nematodes could pass for some distance thru the intercellular spaces unhindered by the juncture of secondary veins. Sometimes small isolated spots occurred in the perfectly green tissues. The species Gloire de Chatelaine usually had single large areas at the base of the blade, following up the veins and out into the tissues, and showed extended dead areas at the margin of the leaf.

On *Asplenium nidus-avis* the injury was quite conspicuous, as it caused a continuous dark brown area from the base of the leaf up the midrib and spreading out into the parenchyma to the margin, killing the entire area as it progressed upward. The small ribs joining the midrib apparently did not cut off the upward progress of the nematodes. Tho they did not seem to be nearly as numerous in the tissues as in the begonia, their action was apparently very severe, as if some poisonous excretion was carried by the sap for some distance thru the tissues.

On *Pteris serrulata aristata* (Plate XXV c) there were very marked reddish-brown bands reaching out from the midrib to the border, limited sidewise by the small parallel cross veins. Sometimes these bands were broad, occupying several parallel spaces, and sometimes narrow, with intervening healthy green bands, giving a striped effect. A somewhat similar appearance showed on *Pteris Wimsetti,* and less so on *Pteris tremula,* where the spots were more irregular and less banded, due to difference in the shape of the pinnae and their venation.

Remedies. As to preventive or remedial treatments for this trouble, it is desirable in the first place to isolate any diseased plants from the healthy, in order to check the spread of the trouble. It may also help to pick off the worst infected leaves and burn them. The rubbish from infected plants and the soil

in which they have grown should not be mixed with soil to be used subsequently for potting purposes. Care in watering the plants, using as little water as possible directly on the foliage, should have some influence in lessening infection, since it is quite evident that the nematodes come out on the surface of the leaves when wet and thereby gain access to new areas in the leaf or are dropped with the water onto other leaves.

The fact that the nematodes are likely to come out on the wet leaf surface suggests their partial control by spraying the plants, especially the under surface, with such irritant solutions as soap and water, etc. What effect Bordeaux mixture would have on them we do not know, but it is possible that they would dislike coming to the surface of leaves coated with this mixture. Marcinowski (9) found that immersing infected ferns five minutes in water at 50° C. (122° Fahr.) did not injure the plants, but helped to destroy the nematodes. Molz (11) states that the nematodes can be killed by immersing infected chrysanthemums for ten minutes in water at a temperature of 43° C. (110° Fahr.). He also recommends steam sterilization of the soil as a preventive measure.

Historical. Smith (17) of England, in 1890, was apparently one of the first to note a nematode disease of begonia similar to that described here. He writes: "A correspondent has forwarded leaves of begonias badly discolored and diseased. The mischief has been caused by colonies of minute eel worms living and breeding between the two membranes of the leaf. * * * Although nematodes are a frequent cause of disease in plants, we cannot remember any former record of their occurrence in begonias, neither can we remember seeing any results identical with the one here described."

In 1891, Klebahn (8) of Germany described a somewhat similar injury that he had known for some time on Asplenium ferns. He concluded that the trouble was caused by an undetermined species of Aphelenchus.

Ritzema-Bos (14) seems to have been the first to determine the species of nematode responsible for these leaf troubles. In 1893 he received specimens of diseased begonias from England and of ferns from Germany, and his investigations led him to the conclusion that the troubles were caused by the same nematode, which he described as a new species, *Aphelenchus olesistus.*

In 1891 the last mentioned investigator had already described the two species of nematodes which caused the diseases of strawberries we have previously mentioned. Marcinowski, in 1908, in studying nematode leaf diseases came to the conclusion that these strawberry diseases were not caused by two different nematodes, but that one of these was merely the immature stage of the other. Infection experiments and a comparison of the mature nematodes also led her to conclude that the strawberry nematode and that of the begonia and fern were the same species. She chose for its name one of the names given by Ritzema-Bos to the strawberry nematode, namely *Aphelenchus Ormerodis*.

Since this trouble was first mentioned by Smith a great variety of plants (Marcinowski gives nearly fifty) have been listed from Europe as having similar injury caused by nematodes. Some authors have used for these the name *Aphelenchus olesistus*, given by Ritzema-Bos to the begonia disease, and some have used the name selected by Marcinowski, *A. Ormerodis*, as being the proper one. Schwartz (15), one of the later writers, uses the name *A. olesistus* for the disease of begonias and ferns, describes the violet trouble as a new variety (*longicollis*) of this, and the chrysanthemum trouble as caused by a new species, *Aphelenchus Ritzema-Bosi*. Ritzema-Bos considered that *A. olesistus* did not cause distortion of its hosts, while the species on strawberry often produces a cauliflower-like head. While it is quite probable that the strawberry disease and that of the begonia are caused by the same nematode, we prefer for the present to use the name *Aphelenchus olesistus* as limited by Ritzema-Bos to the nematodes of the begonia, fern, etc., in which no distortion of the tissues occurs.

In America only two or three botanists have published references to leaf spot diseases of begonia, etc., attributed to nematodes. Halsted (6) of New Jersey figured and described as early as 1892 a nematode leaf disease of begonia, pelargonium, salvia, etc., which was apparently the same as ours. Stewart (18), of New York, also mentioned in 1910 a nematode leaf disease of begonias, but, like Halsted, did not identify the nematode, tho he mentions the similar disease in England caused by *Aphelenchus olesistus*. No doubt other references to such troubles on ferns, etc., have been published in floral magazines.

LITERATURE.

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3. **Cobb, N. A.** Extract from MS. Report on the Parasites of Stock. Dept. Agr. N. S. Wales Miscel. Pub. 215:1-62. 1898. [Reprint from Agr. Gaz. N. S. Wales. Figs. 1-129.]
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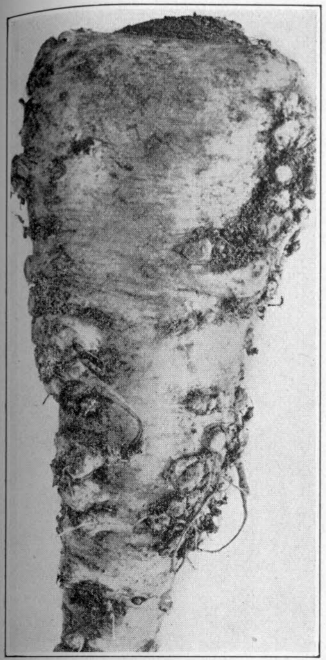
ROOT GALLS.

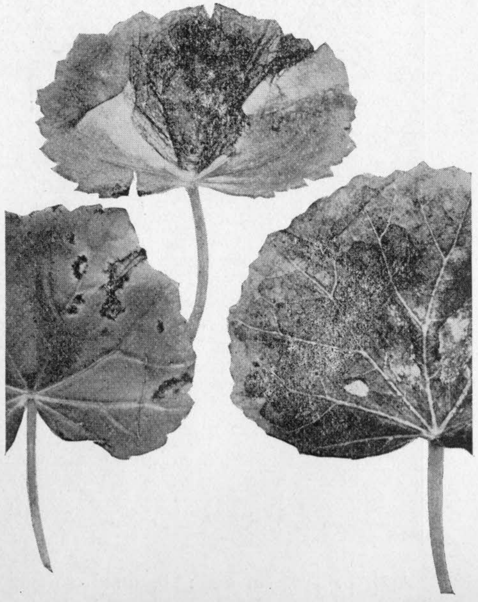


a. On Parsnip, p. 454.

b. On Snapdragon, p. 454.

LEAF INJURIES.

c. Of Fern, p. 458.



d. Of Begonia, p. 458.

DISEASES CAUSED BY NÆMATODES.

In the United States the fungus was first reported by Morse (7) in July, 1913, occurring on potatoes grown in sterilized soil in pots in a greenhouse from tubers received from Massachusetts and Nebraska. Nothing was known about the occurrence of the fungus in either of these states. Later Morse (8) published a general account of the disease. Shortly after the first announcement by Morse, Melhus (4) reported finding the powdery scab on potatoes grown at Presque Isle, Maine, and later he (5) reported the disease not uncommon in Aroostook County, Maine, especially in the northern half. Quite recently the United States Department of Agriculture (1) reported its distribution in the United States as follows:—Northern Maine; Clinton and Franklin Counties, New York; northeastern Minnesota, Carlton, Lake and St. Louis Counties; Washington; Oregon; and a limited area in northern Florida. Although infected potatoes have been planted elsewhere, so far as known the disease has never established itself at these places. Melhus and Rosenbaum (6) have shown that it can infect other hosts beside the potato, since they found it on the roots of six other species of Solanum and on the tomato.

Description. This fungus presents in general two types of injury. The ordinary form, called the powdery scab, somewhat resembles our common potato scab in that the scabby spots are superficial, but can be distinguished from the latter by the deeper and more powdery, olive-brown (darker when wet) pustules, which are generally smaller and more nearly circular in outline, and somewhat protected at the margins by the ruptured skin of the tuber. (See plate showing this form.) The other type is known as the canker form, which involves the tissues more deeply and sometimes causes distortion of the tuber. When the powder from one of the pustules is examined under the microscope, it is found to consist of numerous, definite, subspherical or more elongated masses of small thin-walled cells bound firmly together, but having interstices like those of a sponge. These are the reproductive or spore bodies.

Injury. Where powdery scab becomes established it may, according to various investigators, cause considerable injury, especially in low, wet fields. On the whole, however, it seems to be a trouble of northern regions. So locality, soil conditions and climate are all important factors in its development. Concerning injury by it in Ireland, Pethybridge (12) says:—"This disease was extremely prevalent in the Clifden plots in 1912, its attacks being favored by the wetness of the season. They were particularly disastrous on those portions of the land which for special purposes have now been cropped for four successive seasons with potatoes, the cankerous form of the disease being extremely common. In one or two plots nearly two-thirds of the total crop were practically ruined by it, while the general average loss in the plots on the old land due to it would be about one-third of the crop."

Government Quarantine. After its discovery in Canada, and in view of its possible introduction into the United States, a temporary quarantine (9), prohibiting the importation of potatoes from countries having the powdery scab, was established in December, 1913. On its discovery in Maine and New York, a domestic quarantine (9) was laid, in the fall of 1914, on the shipping of infected potatoes from these two states, and regulations were made concerning inspection of potatoes allowed to be shipped. According to Beattie (2) while this quarantine was in effect the entire crop of the infected region was inspected, and 27,600 cars were allowed shipment, this work requiring as many as 132 inspectors at one time.

Connecticut Inspection. As a result of the discovery of the powdery scab in Maine and the possibility of its introduction from there on seed potatoes into this state, or its occurrence here already, the writer with his assistants, Messrs. Stoddard and Graham, at the suggestion of Mr. Orton, of the Federal Horticultural Board, and with financial aid from the Board, undertook a preliminary inspection of the seed potatoes to be planted in this state in the spring of 1914. The arrangements were not made until the first part of May, so that the time was too limited for a very extensive examination, as many farmers had already begun to plant their potatoes. To facilitate the work, an automobile was hired, and potatoes on farms in various parts of the state were examined during the two weeks from May 12th to 25th. Usually one man was left at a farm while the others were taken to farms near by, and when all had finished they were carried on to the next stop. A certain amount of potatoes of each variety was carefully examined, and any suspicious tubers were taken for subsequent microscopic examination. Records were kept of the varieties, the sources of the seed, the amount to be planted, its condition as regards disease, and whether or not it had been previously inspected.

Results of Inspection. Altogether, potatoes from 130 farms were thus examined, and out of this number the powdery scab was found at only three places; as follows:—(1) At A. N. Farnham's in Westville, on May 13th, in examining a one hundred bushel lot of Irish Cobblers purchased from S. D. Woodruff, from New York but Maine-grown, the writer found a few scabby tubers that upon microscopic examination proved to be infected with the powdery scab. The tags on the bags did not say whether or not these potatoes had been inspected. These potatoes were all treated with formalin before planting. (2) At Andrew Ure's, Highwood, on the same date, the writer also found a couple of Irish Cobblers that on microscopic examination showed the powdery scab. It was not certain whether these were home- or Maine-grown, but they probably came from the same source as those at Farnham's. (3) The third lot was found at the farm of Charles T. Short, Newtown, and consisted of a barrel of Early Bovee purchased of Peter Henderson and grown in Maine. These were advertised as inspected seed, but there was no inspection tag on the barrel. This lot was very badly scabbed, and microscopic examination showed most of it to be the powdery scab. At least half of the tubers showed this scab, some of them badly, of which the one shown in plate XXII c is a fair sample. The scabby potatoes were selected and used by us for experimental purposes, and the others treated with formalin and sulphur before planting.

So far as was shown by the data obtained, 64 of the lots examined were home-grown seed, and 65 were seed grown outside of the state. Of the latter at least 17 had been inspected. The data as to the varieties showed that Green Mountain is the variety most generally grown here. The numbers of each variety inspected were as follows:—Green Mountain, 70; Irish Cobbler, 11; Early Rose, 8; New Queen, 5; Gold Coin, 3; Delaware, 2; and one each of Beauty of Hebron, Long Island Wonder, Early Six Weeks, State of Maine, Carmen, Carmen No. 1, Carmen No. 3, Burpee's Extra Early, Burbank, White Mountain, Bethel Beauty, Early Bovee, Snow, Noxall, Red Bliss, White Bliss, and World's Wonder. On account of the poor yields of the previous few years, due largely to drought, it was found that many growers were cutting down their acreage and some omitting the crop altogether. None of the farmers offered any objection to the examination of the potatoes when our purpose was stated.

Experiments. This inspection seemed to indicate that the disease might already be established in the state, or that there was danger of its being introduced in imported seed. In that case, it was desirable to find means for combating it. Pethybridge (10) had shown that the seed could be fairly well disinfected by treatment with formalin, 1-600, for three hours, or by rolling the wet tubers in flowers of sulphur. Accordingly the infected Early Bovee tubers from the Short farm were divided into three lots and treated as follows: (1) No treatment; (2) Soaked 1½ hours in formalin of strength 1 to 240; (3) Same as 2, but after soaking, thoroughly dusted with fine sulphur. These potatoes were then cut so that every piece had a powdery scab spot on it. They were planted on well-drained land on the Station farm at Mount Carmel, each lot in two rows of about two hundred and thirty feet in length and between young peach trees, so that the exact location would be known in later years. The potatoes were dug on October 2d, and carefully examined for scab of any kind, though little was present. *No powdery scab was surely found* even upon microscopic examination. The results of the experiment as regards ordinary scab were as follows:—

Treatment.	Total Wt. of Tubers. lbs.	Free from Scab. lbs.	Free from Scab. %	Somewhat Scabbed lbs.	Somewhat Scabbed %	Badly Scabbed. lbs.	Badly Scabbed. %
No. 1. No treatment	418	350½	83.9	65.	15.6	2.5	0.6
No. 2. Formalin	388	360	92.8	26.5	6.8	1.5	0.4
No. 3. Formalin and Sulphur ...	461½	432	93.6	28.	6.1	1.5	0.3

These results were so surprising, especially in that no powdery scab appeared on the untreated seed, that other experiments were made in 1915 on the supposition that the soil might have become infected and that at least some powdery scab would develop on the tubers planted where the untreated ones had been the year previous. Through the kindness of Melhus, of the United States Department of Agriculture, badly powdery-scabbed potatoes from Presque Isle, Maine, were received and planted on a fourth space while on the three spaces used in 1914 there were planted potatoes free from powdery scab and treated with formalin. The treatments were as follows: (1) Seed free from powdery scab and treated with formalin was planted where No. 1 (untreated powdery scab) was planted in 1914; (2) Same as No. 1, but planted where No. 2 (powdery scab tubers treated with formalin) was planted in 1914; (3) Same as No. 1, but planted where No. 3 (powdery scab tubers treated with formalin and sulphur) was planted in 1914; (4) Powdery scab potatoes from Presque Isle, untreated, planted on new space.

The potatoes were dug and examined on September 29th, but here again, while they showed ordinary scab more than the previous year, as the mid-season had been quite wet, *there was found absolutely no powdery scab* even after careful microscopic examination of all suspicious tubers. The details of the results as regards ordinary scab are as follows:—

	Total No. of Tubers.	Free from Scab.	Badly Scabbed.	Somewhat Scabbed.	Little Scabbed.	Total Scabbed.	Per Cent Scabbed.
No. 1.	1602	1113	75	219	195	489	30½
No. 2.	1679	1170	65	170	274	509	30⅓
No. 3.	1649	1323	36	147	143	326	19¾
No. 4.	1842	1721	23	59	39	121	6½

Conclusions. Powdery scab of potatoes is not likely to prove a serious disease of potatoes in Connecticut. In fact so far as known, it does not occur here and is not likely to become established. If it ever does occur here, it is likely to be restricted to wet, poorly drained fields. The United States Department of Agriculture has shown that it is largely a question of soil infection, and climatic conditions such as exist in our northern districts, since the disease is confined largely to our northern states; and while soil shipped from Connecticut developed a certain amount of powdery scab when planted with infected tubers in Maine, it did not in our experiments here. As a result of the investigations made, the Federal Horticultural Board has lifted the domestic quarantine (2) on potatoes from the infected districts in Maine and New York, as well as that (1) on foreign potatoes for this disease.

Literature. The following references include only those mentioned in the preceding discussion, and by no means cover all the literature on the subject:

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POTATO SPRAYING EXPERIMENTS, THIRD REPORT.

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In the Station's Reports for 1904, pp. 368-84, and for 1909-10, pp. 739-52, we have published the results of experiments from 1902 to 1909 in spraying potatoes, and in this article we give those obtained since then, together with a general consideration of the results for the entire period of fourteen years during which experiments were carried on in every year except 1905. These experiments had three main objects in view; namely, (1) to determine the value of Bordeaux mixture as a fungicide in wet seasons and its effect on the vines in dry seasons when little or no injury from fungi results; (2) to compare the effect of ridged versus level culture in preventing rot of the tubers, etc.; (3) to determine the value of other fungicides as compared with Bordeaux mixture. We will discuss the results under these three main heads.

SPRAYING EXPERIMENTS WITH BORDEAUX MIXTURE FROM 1902-1915.

Weather Conditions. In the vicinity of New Haven where these experiments were conducted, and no doubt in Connecticut as a whole, the blight of potatoes, *Phytophthora infestans,* rarely appears before the middle of July even in the most favorable seasons, and in seasons not so favorable it may not show until late August or September, or even not at all. The conditions that stimulate its development are frequent rains during July and August, or more especially cool, muggy, or cloudy weather during these months, with sufficient showers to keep the vegetation from drying off rapidly. If after the blight has started there comes a wet or foggy period of some days' duration, it spreads very rapidly; but, on the other hand, if bright, dry weather follows, little development takes place.

The early blight, *Alternaria Solani,* as indicated by the name, develops somewhat earlier than the late blight, and wet weather in June and July favors its development. On the whole, how-

ever, this blight never causes the injury to the vines that the late blight does.

Tip burn is a physiological, not a fungus, trouble, and is due to excessive loss of moisture from the foliage beyond that supplied by the roots, causing the leaves to die from the tip and margins inward. This trouble is often confused with the late blight, but the trained eye can distinguish the latter by the faint whitish growth of the fungus on the under side of the leaves between the dead and living tissues. Tip burn is a serious trouble here, especially in very dry seasons, and is developed under opposite conditions from those of late blight, though it sometimes also occurs in moist seasons when there are sudden changes from wet to bright, hot days.

The weather and blight conditions during the years of the experiments were as follows: In 1902 July and August were unusually cool, and wet, or foggy, so that blight started early in July, and before the end of the month many fields were dead, and by the middle of August practically all of them. There was considerable rot of the tubers. So far as blighted vines were concerned, this was by far the worst of any of the years reported here. Also 1903 was a wet year, favorable for blight, but not as much so as the preceding, so that the disease was not seen before the first week in August. From then on the disease gradually spread until a rainy period the last of August caused the vines to go down rapidly. The decrease in yield caused by the premature death of the vines was not as great as the previous year, but the longer period of gradual spread allowed a better chance for tuber infection, with a resulting greater loss from rot. In 1904 the weather in July and August was warmer and drier than in either of the two years previous, so the blight did not start until after the first of August, and did not do much damage to the foliage until September. The moist weather in September and October, however, favored the general infection of the tubers from the infected vines, so that the rot was even more serious than in the previous years.

The years 1906 to 1914 had on the whole dry periods during July to September that did not favor any extensive development of the blight in the fields in which our experiments were conducted. In fact, in some of these years we failed to find any blight at all on the foliage (1907, 1908, 1911, 1913, 1914), and in others only a little blight was found, not enough to cause any damage. In 1910 a little more developed, but not enough to seriously injure the foliage, and only enough to cause a small amount of rot in the tubers. In these dry years, however, the vines suffered considerably from tip burn, especially in 1908, 1911, 1913, 1914, which killed the vines so prematurely that the yields were exceptionally small.

In 1915 the wet, cold weather of June and July caused the blight to develop and kill most of the late potatoes by the end of August, and there was serious rot in certain places, the worst since 1904. Some injury was caused to vines and tubers at Greens Farms, but at our Mount Carmel farm there was neither blight of the vines nor rot of the tubers, though the vines were killed prematurely, as were some others in similar high, well-drained situations, by a type of tip burn.

Out of the thirteen years, therefore, there were four (1902, 1903, 1904, 1915) in which blight caused considerable injury, one (1910) in which a little injury resulted, chiefly from rotting of the tubers, and eight (1906-1909, 1911-1914) in which blight was entirely absent or so inconspicuous as to cause no injury in the fields under consideration.

Conditions of Experiments. The tests in 1902-04 were conducted on private land not under the control of the Station except as to spraying. The other tests were made at the Station farms at Centerville and Mount Carmel, and one at Greens Farms. In all cases the land was fairly well taken care of as regards fertilization and cultivation, though the land at Centerville and at Mount Carmel was at first run down or not adapted to growing potatoes, so that fair yields were impossible. Furthermore, the dry seasons of 1907-14 seriously cut down the yields for most of these years. The experiments were not undertaken, however, with the idea of trying for large yields, but entirely for studying the effect of spraying. Some of the yields will seem very small to successful growers, and no doubt are when compared with crops that are occasionally harvested here; but considering the object of the experiments, the dry character of the seasons, the run down condition of the land, and the fact that the average potato yield for the state year after year is not far from 100 bushels per acre, the yields are not so low

as they seem at first sight. Green Mountain was the variety largely used, and practically the only one on the Station land.

The treatment of the sprayed and unsprayed plots was the same except for the spraying, and the land used was as nearly uniform as possible. No doubt some of the differences in yield may be due to the unevenness of the land, but in the long run this should affect the sprayed and unsprayed the same. To eliminate this factor as much as possible in determining the yields, test strips of one hundred feet in length were taken in each, parallel and as near together as possible, and usually from several different parts of the plots, depending upon their size. The numbers of these test strips are indicated in each case in the tables, where their combined average yields only are given. Their separate yields, however, usually indicated the same general results, thus serving as additional checks.

In our earlier experiments, in 1902-04, we did not determine the results of the yields as firsts and seconds, but as very large, large, medium, etc. In rearranging these to correspond with the later data obtained only as yields of firsts and seconds (size only considered) no doubt they do not show as relatively large a percentage of firsts as they should in most cases. However, as both sprayed and unsprayed plots were computed on the same basis each year, this makes little difference, as the results of different years should not be compared with each other because of difference in location, weather conditions, etc.

On the sprayed plots home-made Bordeaux mixture of the 4-4-50 strength was always used. The number of treatments varied from one to four, three being given on the average. The time of spraying varied somewhat, but as a rule the first was given about the middle of July and the last at the end of August. With a few exceptions (Table I, Exp. Nos. 4, 6, 9, 11, 20) these sprayings were thoroughly done by hand so that the spray usually coated the vines until they died in the fall. In a few cases, where the spraying was not done often enough to fully protect the vines, the foliage became partially infected and thereby favored the development of rot in the tubers. Our experience shows that with more thorough or frequent treatment this could have been largely avoided. This emphasizes the necessity of thoroughly protecting the foliage in blight years from the last

Table I.—Average Results of Spraying with Bordeaux from 1902 to 1915.

						Aver. Wt. Tubers, 100 ft.			Aver. Rates per Acre.				Gain per Acre.	
Year.	Grower, Locality, etc.	Treatment.	No. Exp.	Times Sprayed.	No. of 100 ft. Tests.	Firsts. lbs.	Seconds. lbs.	Total. lbs.	Firsts. bu.	Seconds. bu.	Total. bu.	Rotten Tubers.	Bushels.	Per Cent.
1902	Ogden, Centerville. Late potatoes	Sprayed	1	3	5	47	32	79	114	77	191	58	101	112
		Unsprayed	2	..	5	21	16	37	51	39	90	145	...	...
1903	Farnham, Westville. No. 4 sprayed imperfectly, dug early before rot started	Sprayed	3	4	4	25	66	91	60	160	220	1,815	97	79
		Sprayed	4	3	2	33	50	83	80	121	201	290	78	63
		Unsprayed	5	..	4	5	46	51	12	111	123	3,920	...	...
1903	Ogden, Centerville. Imper. sprayed. Rye plowed under developed rot	Sprayed	6	3	2	2¼	26	28¼	5	63	68	17,351	17	33
		Unsprayed	7	..	2	½	20½	21	1	50	51	8,712	...	...
1904	Farnham, Westville. Early potatoes, dug early. No blight developed	Sprayed	8	2	4	5½	108½	114	13	263	276	72	32	13
		Sprayed	9	1	4	4	101	105	10	244	254	72	10	4
		Unsprayed	10	..	4	6	95	101	14	230	244	....	...	...
1904	Farnham, Westville. Late potatoes planted late ..	Sprayed	11	4	2	2	34	36	5	82	87	26,862	36	69
		Unsprayed	12	..	2	1¼	20	21¼	3	48	51	3,194	...	...
1904	Clinton, Whitneyville. Early and late garden potatoes	Sprayed	13	2	1	10½	85½	96	25	207	232	1,452	41	21
		Unsprayed	14	..	1	8	71	79	19	172	191	3,339	...	...
1906	Station farm, Centerville. Ridging vs. level expers. ...	Sprayed	15	3	4	45	17	62	109	41	150	145	41	38
		Unsprayed	16	..	4	29	16	45	70	39	109	871	...	...
1907	Station farm, Centerville. Ridging vs. level expers. ...	Sprayed	17	3	4	7	19	26	17	46	63	....	12	24
		Unsprayed	18	..	4	5	16	21	12	39	51	....	...	...
1907	Station farm, Centerville. East's exper. with late potatoes	Sprayed	19	3	1	19¼	15¼	34½	47	37	84	....	28	50
		Sprayed	20	2	1	14½	13¼	27¾	35	32	67	....	11	20
		Unsprayed	21	..	1	9½	13¾	23¼	23	33	56	....	...	...
1908	Station farm, Centerville. East's experiments	Sprayed	22	3	6	19½	19½	39	47	47	94	....	24	34
		Unsprayed	23	..	6	14	15	29	34	36	70	....	...	...
1908	Station farm, Centerville. Ridging vs. level expers. ...	Sprayed	24	3	4	21	18	39	51	43	94	....	14	18
		Unsprayed	25	..	4	17	16	33	41	39	80	....	...	...
1909	Station farm, Centerville. Ridging vs. level expers. ...	Sprayed	26	3	4	23	29	52	56	70	126	....	44	54
		Unsprayed	27	..	4	13	21	34	31	51	82	....	...	...
1910	Station farm, Centerville. Ridging vs. level expers. ...	Sprayed	28	4	41.6	70	13	83	170	31	201	25	33	20
		Unsprayed	29	..	26	57½	12	69½	139	29	168	222	...	...
1911	Station farm, Centerville. Ridging vs. level expers. ...	Sprayed	30	4	72.8	32½	15½	48	79	37	116	....	24	26
		Unsprayed	31	..	72.8	23	15	38	56	36	92	12	...	...

TABLE I.—AVERAGE RESULTS OF SPRAYING WITH BORDEAUX FROM 1902 TO 1915.

Year.	Grower, Locality, etc.	Treatment.	No. Exp.	Times Sprayed.	No. of 100 ft. Tests.	Aver. Wt. Tubers, 100 ft. Firsts. lbs.	Seconds. lbs.	Total. lbs.	Aver. Rates per Acre. Firsts. bu.	Seconds. bu.	Total. bu.	Rotten Tubers.	Gain per Acre. Bushels.	Per Cent.
1912	Station farm, Mt. Carmel. Ridging vs. level expers. ...	Sprayed	32	4	20	53	21	74	128	51	179	29	58	48
		Unsprayed . .	33	..	16	34½	15½	50	83	38	121	18	...	...
1913	Station farm, Mt. Carmel. Ridging vs. level expers. ...	Sprayed	34	3	16	63	10	73	152	24	176	....	32	22
		Unsprayed	35	..	16	50	9½	59½	121	23	144	....	...	...
1914	Station farm, Mt. Carmel. Ridging vs. level expers. ...	Sprayed	36	3	24	66	18	84	160	43	203	....	34	20
		Unsprayed	37	..	16	51	19	70	123	46	169	9	...	...
1915	Station farm, Mt. Carmel. Ridging vs. level expers. ...	Sprayed	38	4	20	52½	16	68½	127	39	166	....	19	13
		Unsprayed	39	..	20	44	17	61	106	41	147	37	...	...
1915	Bedford, Greens Farms. Late potatoes	Sprayed	40	4	34	66½	17½	84	161	42	203	77	50	33
		Unsprayed	41	..	18	47	16	63	114	39	153	944	...	...

of June until the end of the season. In all cases both sprayed and unsprayed plots received the same treatment with an insecticide, in the earlier years with Paris green and in the later with lead arsenate, so such differences as are manifested between the Bordeaux sprayed and the unsprayed are not due to insect injury, except possibly the slight effect the Bordeaux may have had in lessening injury from the flea beetle in some years.

Results of Experiments. The results on the plots sprayed with Bordeaux as compared with those unsprayed are given in Table I. These figures give the results of all the different experiments each year as determined from the average of the 100 foot tests. From 1906 to 1915 they indicate average results obtained in experiments involving both ridged and level culture in both the sprayed and unsprayed plots. As an acre potato field, 16 by 10 rods, with rows running lengthwise, and three feet apart, can contain 145.2 lengths of 100 feet, the yield in bushels per acre for each experiment has been obtained by multiplying the average yield of its 100 foot tests by 145.2 and dividing by 60, the number of pounds in a bushel.

Remembering that the spraying was imperfectly done in some cases and that in others only one or two sprayings were made, the results are striking in the absolute uniformity they show in favor of the sprayed plots. In not a single case in the 22 spraying tests during the thirteen years did the unsprayed plot give a yield equal to the corresponding sprayed plot. This is more remarkable when we consider that in five of these years we failed entirely to find any signs of the late blight fungus on even the unsprayed vines, and that in only four of the thirteen years did it cause any considerable injury in the field! As the early blight did not appreciably harm the vines during these nine years, it can be safely stated, as has been noted previously by others, that outside of its fungicidal value Bordeaux mixture has a beneficial action on the potato vine, as shown by the increased yield. This increased yield is correlated with and apparently directly due to the greater length of life of the sprayed vines. At least the sprayed vines in dry seasons have always remained green longer on the average than the unsprayed vines, the difference being more noticeable some years than others. When this difference was most pronounced the yield was correspondingly greater. Perhaps on the average a difference of one or two weeks was shown, though it is impossible to determine it accurately, as the vines die unevenly in both the sprayed and unsprayed plots.

This greater length of life in the sprayed vines in seasons free from blights has been attributed by us to a lessening or delaying of the tip burn trouble which is so injurious to potatoes in very dry seasons. Apparently the earlier and the more thoroughly the vines are sprayed the better the results obtained. The 4-4-50 Bordeaux also has given better results than the 1-1-50 in a few comparative tests, and the Bordeaux as a whole was better than the less sedimentary sprays, as lime-sulphur, etc. These facts previously led us to the conclusion that the favorable results thus obtained were due to the sediment from the spray on the leaves lessening the loss of moisture in dry seasons and thereby lessening tip burn.

Recent experiments by Duggar and Cooley have shown that certain plants, including potatoes, sprayed with Bordeaux mixture or with certain other substances, really transpire more water than do the unsprayed plants. At first glance this seems contradictory to our theory. These experiments, however, were with potted plants and therefore not under typical field conditions, and they were made at a time of year (May) when tip burn conditions were not a factor in the experiment. May they not then merely explain in part the reason of the increased yield of the sprayed plants, since increased transpiration, if not excessive, is in a sense a measure of the increased chemical activities of the plant? This would still admit of our theory that the sediment on the leaves is a partial protection against sudden and irreparable loss of water during the dry seasons when tip burn occurs, or those occasional wet seasons when it appears because of sudden changes from moist to bright hot weather. For there is no denying the fact that spraying does lessen injury from tip burn and in this way helps to increase the yield. This check to excessive evaporation at a time when it would prove fatal might be due in part, as we suggested, to the mechanical clogging of the stomates and the extra protection to the epidermis, and in part to the reduction of the intensity of sunlight and thereby of the temperature of the leaf and its excessive transpiration in the heat of the day; on the other hand, this coating might by its protection lessen heat radiation at night, thus on the whole securing a greater but a more uniform transpiration and consequent chemical activity. The following statement of Barnes (Text Book Botany 1:330) may serve to illuminate the point made:—

"The temperature of the plant itself tends normally to equal that of the air, since its extended surface permits quick gain or loss of heat toward equilibrium. A rise of temperature in the air, therefore, is quickly followed by a rise of temperature in the plant, and (even with no change in the relative humidity of the air) by increased evaporation. But the temperature of the plant depends also upon the energy absorbed by the green pigment in diffuse light or direct sunlight. In diffuse light the greater part of this energy is used in food making, and only a small portion exerts a heating effect. But in sunlight two-thirds to three-fourths of that absorbed is free to heat the tissues, and as soon as that begins, evaporation is thereby much accelerated."

Sprayed leaf surfaces certainly are not subject to such excessive sunlight on a bright hot day as those uncoated with a film, especially if this film is of a color, such as the blue coating of Bordeaux, that tends to absorb the chemical rather than the heat rays of the light, therefore they should not be so subject to excessive loss of water as the unsprayed.

Returning to a consideration of the actual results of spraying, we find that while the sprayed plants uniformly gave an increased yield, this varied greatly in the different experiments. The increase ranged all the way from 10 bushels to 101 bushels per acre, or from 4 per cent. to 112 per cent. The greatest increased yields were obtained during 1902-04, when the blight did the most injury, but only in those fields where the spraying was most thoroughly done.

We estimate that where several acres are sprayed with home-made Bordeaux it costs, including labor and materials, about ten dollars per acre. This is higher than some estimate, but we believe it costs fully that amount on the average for thorough work. Of course this is based on a cost of copper sulphate at six to eight cents per pound, and not at twenty-four cents, the present war price. Sixty-five cents per bushel seems to be a fair estimate of the price one would have received on the average for both firsts and seconds during the past fourteen years. This means that it would take 16 bushels increase on the average to pay for the cost of spraying. Of the twenty-two experiments reported in Table I, only four failed to give this increase. Even in drought years, on the average, the spraying has much more than paid for itself, giving an increase of 29 bushels (Exp. Nos. 15-38). The average increase for all the spraying experiments is about 38 bushels, and deducting 16 bushels as cost, this allows a net gain of 22 bushels, or about $15.00 per acre. The greatest gain (Exp. No. 1) at this rate was about $55.00 per acre. These gains do not take into consideration the extra cost of digging, marketing, etc., which would reduce them somewhat. Upon the whole, the experiments show that just as it is a wise policy to give attention to selection of good seed, thorough fertilization and cultivation, it is equally wise to add thorough spraying to these as one of the necessary operations in the most successful potato culture.

RIDGED VERSUS LEVEL CULTURE, WITH AND WITHOUT BORDEAUX.

It is well known that the late blight produces an infection of the tubers as well as the foliage, and this tuber infection comes about by spores from the foliage being washed down into the soil. These infected tubers open the way for secondary bacterial infection, which is the cause of the ill-smelling soft rot. Seasonal conditions that tend to develop the blight gradually over a long period favor greater infection of the tubers than if the blight appears only at the end of the season or even appears early and suddenly blights all the vines. Years ago it was advocated in England and some other European countries that the tubers be protected by ridging up the ground and burying them deeper; and especially if the vines were leaned so that the spores were washed into the trenches, fewer spores or their zoospores would eventually reach the tubers and less rot would therefore result.

As a result of a considerable development of rot in potatoes during the years 1902 to 1905, we began in 1906 comparative experiments with ridged and level culture on both sprayed and unsprayed potatoes to determine the effect, if any, of the former cultural method in lessening the rot. These experiments have been conducted every year since, or ten years altogether. The results of the first four years were reported in the Station Report for 1909-10, p. 743.

The method of treatment of the plots each year was exactly the same except for the planting and cultivation, and as part of each was sprayed we have two ways of comparing the ridged with the level culture each year. With the ridged potatoes the seed pieces were planted on the average five to six inches deep, while with the level, only three to four inches. The cultivation of both was the same until about the first of July, when the deeper planted half was gradually ridged up as high as possible with wings attached to the cultivator during the next two or three cultivations, the center of the ridged rows being cultivated at this time and later whenever the level half was cultivated. This method gave the ridged rows the advantage of level cultivation early in the season, and both had the same number of cultivations, averaging about one a week.

Unfortunately for the experiment, not once during the ten years did any very serious rot develop on either the ridged or level cultivated potatoes. This was largely because these years were not blight years, but also because during the last four years the potatoes were grown on high, well drained land, where rot was not so likely to develop, as shown by its absence in 1915, when it developed considerably elsewhere. So, after ten years of experimenting, we are still without any very extensive data to show the value of ridging in preventing rot. An examination of Table II, however, shows that what little rot did appear was always greater in the level than in the ridged plots. The year 1910 was the only one of the six in which a noticeable amount of rot developed, and the evidence here was clearly in favor of the ridging lessening the rot both in the sprayed and unsprayed plots, as no rotten tubers were found as compared with 44 in the sprayed and 504 in the unsprayed level plots, per acre. In two other unsprayed plots in the same field, not reported in the table, we found at the rate of 17 rotten tubers per acre in the ridged as against 973 in the level. The evidence then, as far as it goes, shows that the deeper planting and ridging have at least some influence in lessening rot.

Aside from the question of rot, the method of ridging and deep planting shows advantages over that of the level and shallower planting. In the first place, the ridging of the vines keeps them off the ground more, and so allows a better circulation of air through them, with consequent quicker drying off

TABLE II.—RIDGING VS. LEVEL CULTURE, WITH AND WITHOUT BORDEAUX MIXTURE.

Year.	Cultivation.	Spraying.	No. of Sprayings.	No. of 100 ft. Tests.	Aver. Yields per Acre. Firsts. bu.	Seconds. bu.	Total. bu.	Rotten Tubers.	Rank of Yield for Year
1910	Ridged	Sprayed	4	18.2	182	21	203	...	1
		Unsprayed ..	..	15.6	154	21	175	...	3
		Average	..	...	168	21	189	...	1
	Level	Sprayed	4	23.4	158	42	200	44	2
		Unsprayed ..	..	10.4	125	36	161	504	4
		Average	..	...	141½	39	180½	274	2
1911	Ridged	Sprayed	4	36.4	82	33	115	...	2
		Unsprayed ..	..	36.4	65	33	98	8	3
		Average	..	...	73½	33	106½	4	1
	Level	Sprayed	4	36.4	75	43	118	...	1
		Unsprayed ..	..	36.4	48	39	87	16	4
		Average	..	...	61½	41	102½	8	2
1912	Ridged	Sprayed	4	10	127	57	184	44	1
		Unsprayed ..	..	8	81	33	114	...	4
		Average	..	...	104	45	151	22	2
	Level	Sprayed	4	10	131	44	175	14	2
		Unsprayed ..	..	8	85	43	128	36	3
		Average	..	...	108	43½	151½	25	1
1913	Ridged	Sprayed	3	8	153	20	173	...	2
		Unsprayed ..	..	8	114	28	142	...	4
		Average	..	...	133½	24	157½	...	2
	Level	Sprayed	3	8	153	27	180	...	1
		Unsprayed ..	..	8	126	19	145	...	3
		Average	..	...	139½	23	162½	...	1
1914	Ridged	Sprayed	3	12	161	38	199	...	2
		Unsprayed ..	..	8	138	38	176	...	3
		Average	..	...	149½	38	187½	...	2
	Level	Sprayed	3	12	159	50	209	...	1
		Unsprayed ..	..	8	110	61	171	18	4
		Average	..	...	134½	55½	190	9	1
1915	Ridged	Sprayed	4	10	129	41	170	...	1
		Unsprayed ..	..	10	117	33	150	...	3
		Average	..	...	123	37	160	...	1
	Level	Sprayed	4	10	125	38	163	...	2
		Unsprayed ..	..	10	98	47	145	73	4
		Average	..	...	111½	42½	154	37	2

of the foliage, thereby lessening opportunity for rapid blight infection. Also, this method allows the spray cart to be more easily driven through the rows without running over the vines, and permits a more general distribution of the spray on the vines. In the third place, the deeper planting and ridging prevents tubers from being formed so superficially that they

are exposed to the sun and so become green or sun-burned, a not uncommon occurrence with potatoes in level culture if not planted deeply.

Aside from the blight, level culture has been advocated by certain investigators as possessing considerable advantage over ridged culture because of supposed greater yield, due in part to better conservation of soil moisture, especially in dry seasons. In our experiments we have aimed to preserve as much as possible the supposed advantages of level culture. Inasmuch as most of these years have been unusually dry, it is of interest to see if the level culture has possessed any particular value over the ridged. If it did, this might more than offset any occasional lessening of rot. In the experiments previously reported (1906-09) the level culture gave better yields three out of four years. However, this increase was quite small, amounting to only 6 per cent on the average, or 12 bushels per acre yield of 200 bushels. During the last six years, in the tests reported here, the results, obtained more in detail, show on the whole more in favor of the ridged rather than the level, though they run close together. The chief advantage seems to be that the ridged gave a better percentage of firsts both in the sprayed and unsprayed plots. A summary of these points made from Table II is given below. Taking everything into consideration, ridging would seem to be preferable to level culture as a general practice in this state.

CONDENSED DATA OF SIX YEARS TEST WITH RIDGED VS. LEVEL CULTURE.

	Ridged.	Level.
No. years aver. for both sprayed and unspr. was best	3	3
No. times sprayed gave best total yield	3	3
No. times unsprayed gave best total yield	4	2
No. times 1sts, each, of sprayed and unspr. were best	8*	3*
No. times 2ds, each, of sprayed and unspr. were best	3	9
Aver. total bu. per acre, both sprayed and unspr.	158¼	157
Aver. total bu. per acre, sprayed	174	174
Aver. total bu. per acre, unsprayed	142½	140
Aver. total bu. per acre, sprayed, 1sts	139	133½
Aver. total bu. per acre, sprayed, 2ds	35	40½
Aver. total bu. per acre, unsprayed, 1sts	111½	99
Aver. total bu. per acre, unsprayed, 2ds	31	41
Aver. total bu. per acre, both sprayed and unspr., 1sts	125¼	116¼
Aver. total bu. per acre, both sprayed and unspr., 2ds	33	40¾

* One tie not counted.

year there was a fair increase in yield, and the other two years not enough difference one way or the other to indicate any benefit.

Miscellaneous Sprays. In 1907 and 1908 we tried, at the suggestion of the Dow Chemical Company, the use of Sodium Benzoate on potatoes. They claimed this had fungicidal value and might be used with weak Bordeaux, making it as effective as the strong. We used, as advocated by them, one-half pound in 1-1-50 Bordeaux. Of course its real fungicidal value was not tested in these dry years, but its practical value under such conditions was not any greater than the weak Bordeaux alone. In fact, there was one year a very slight increase over the check, and the next year an even greater decrease, while the 4-4-50 Bordeaux gave good results both years.

Sulfocide, 1-200, was tried in 1910, with absolutely no advantage over the check either in keeping the vines alive longer or in increasing the yield. Indeed, the yield was slightly smaller, and there was possibly a slight injury to the foliage. Niagara Lime-sulphur, 1-50, used the same year, gave similar unsatisfactory results. Home-made Bordeaux and, to a less extent, Pyrox, gave fair yield increases in adjacent rows in the same field.

Lieberam's Secret Treatment. In 1906 Mr. August Lieberam of Deep River appeared before the State Board of Agriculture and requested payment for a secret potato blight treatment that he proposed to reveal to them. He was referred to the writer, with the assurance that if his method possessed decided merit his request would receive consideration. Mr. Lieberam revealed his method to the writer, who tried it out in 1906 and 1907. In neither of these years, however, did the blight develop in the experimental plants, either the treated or the checks. This makes it impossible to state definitely that the treatment has no merit, but from our acquaintance with its nature and our experience these two years, also from an examination of some potatoes similarly treated by Mr. Lieberam the past season, we confidently believe that it has little or no merit so far as preventing blight of the vines is concerned. Whether or not it will lessen rot of the tubers is not quite so certain, for there is a possibility that, under certain conditions, it might have this effect, not so much by preventing blight of the tubers as by lessening the soft bacterial rot that generally follows such infection. While this treatment may or may not have an influence on blight, the experiments certainly show that the yields under ordinary conditions are decreased rather than increased, since in all five of the experiments the treated plots gave a decidedly lower yield than the check, or untreated plots, and this decreased yield was not accidental, but apparently directly due to the treatment. The effect of this treatment on the vines is shown by comparison in Plate XXII b. The first row received three treatments with dust Bordeaux; the second, three with liquid home-made Bordeaux; the third, no treatment; the fourth, Lieberam's secret treatment.

SUMMARY OF RESULTS AND CONCLUSIONS.

(1) Experiments with home-made 4-4-50 Bordeaux mixture uniformly gave higher yields than the unsprayed parts of the potato fields during the thirteen years the tests were carried on, the increase ranging from 10 to 101 bushels, or an average increase of 38 bushels per acre.

(2) The Bordeaux not only gave increased yields by controlling blight, but also gave an increase in dry years, when there was no trouble of this sort, by lessening injury from tip burn, and also possibly by its stimulating effect, as shown by an average increase of 29 bushels per acre during these blight-free years.

(3) The increased yields in all but four of the twenty-two tests more than paid for the extra cost of spraying, and the average increase was considerably above this cost, which, estimated at $10.00 per acre, gave a net gain of about $15.00 per acre.

(4) Ridged versus level culture experiments with both sprayed and unsprayed vines indicate that the ridging and deeper planting help to lessen rot of the tubers in blight seasons.

(5) Aside from this advantage, ridging permits of better spraying and easier access to do it.

(6) Ridging potatoes also gave on an average as high total yields as the level culture, and a higher yield of firsts; also they were not subject to sunburn.

(7) The increases in yield obtained in experiments with some of the other fungicides tried in no case equaled those obtained with home-made Bordeaux.

CUTTING OUT CHESTNUT BLIGHTED TIMBER.*

E. M. Stoddard, *Asst. Botanist,*
A. E. Moss, *Asst. Forester.*

This experiment was undertaken in the State forest at Portland to determine whether the spread of the chestnut blight within the limits of a woodlot or small forest area could be retarded or checked by the removal each year of all infected trees, and if so, whether such work was economically possible. The plan followed was to select certain areas in the forest, amounting to about 130 acres, and on them to count, mark and remove every winter all infected chestnut trees. In other "check" areas on adjoining land, amounting to 190 acres, the infected trees were counted and marked, but not removed. By this means the progress of the disease in successive years could be determined under the two conditions of cutting out and letting go, assuming that the distribution and number of the trees were comparable in the two cases.

DESCRIPTION OF PLOTS.

The forest conditions were typical of the forests of Connecticut, consisting of various-aged cut-over stands and reverting old fields. The species varied from a hardwoods mixture to pure chestnut on the best sites, pure oak on the ridges, and pure maple in the swamps. The original purchase was by "lots," and these have been used as the plots in this experiment.

The cut-out plots on state land are designated by letters in the text and on the accompanying map, while the check plots on private land are represented by numerals.

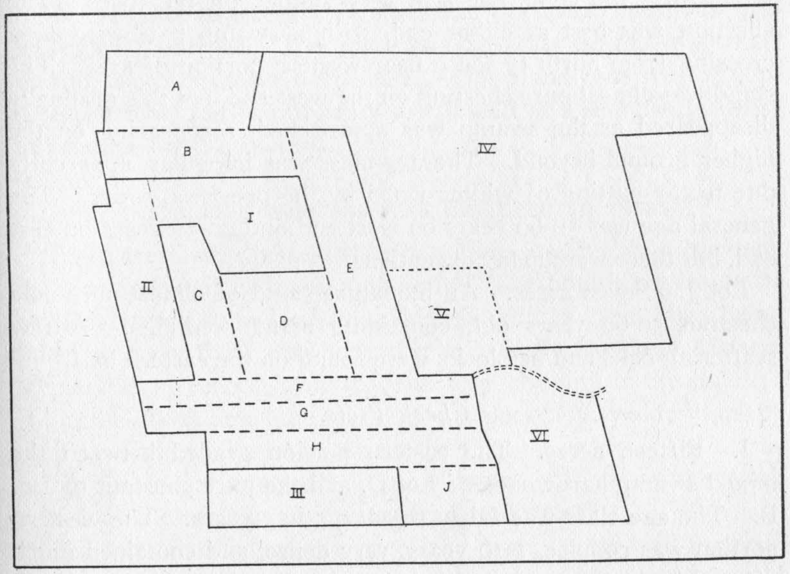
Cut-Out Plots.

Lot A. Twenty acres. Irregular age classes due to some portions having been culled while other portions were clear cut, consisting of chestnut, more or less shaded and in rather poor

* This experiment was started by the former state forester, S. N. Spring, and the botanist. It has been continued under the direction of the latter and the present state forester. As Messrs. Stoddard and Moss have been largely responsible for the work done, they have been requested to write up the results of the experiment.

condition, with much suppressed material left at the time of cutting, and a great deal of slash on the ground at the present time. The older age classes prevail toward the east, while the younger are found in the southwest part of the area.

Lot B. Twelve acres. There are two distinct age classes, 11-20 year scarlet oak to the west and 40-60 year chestnut to the east. The chestnut was in poor condition, being over-mature. In the chestnut coppice a noticeable percentage of trees were dying without signs of disease.



Lot C. Sixteen acres. The greater portion was coppice, 11-20 years, in which probably 75 per cent was oak, the remainder being chestnut, with percentage of oak increasing toward the north. Fairly good growing conditions prevailed, but with a tendency to crowding. North end of area was 30-40 year chestnut and oak, which had been thinned and suppressed, and from which cordwood had been removed.

Lot D. Twenty acres. This is largely a stony swamp, with yellow birch and maple as predominant species. Chestnut and oak appear along the west and northeast sides of the tract. The age was probably 40-50 years, and the stand has been somewhat thinned in places.

Lot E. Seventeen acres. The entire area was clear cut fifteen or twenty years ago. The southern portion was more or less swampy, with much inferior growth coming in and very little chestnut. To the north the conditions improved, with more or less dense coppice of chestnut and oak, and a dense laurel undergrowth. The north end approached old field conditions, with open turf areas and exposed ledges. The chestnut in this section of the lot was not in a vigorous growing condition.

Lots F., G. and H., a total of 39 acres, may be described as one lot because the conditions are very similar on the three. The chestnut was best at either end, with a swamp hardwood area crossing from north to south near western portion of area. The stand was almost pure chestnut on the west end, but this gradually disappeared as the swamp was approached, reappearing on the higher ground beyond. The age class was irregular, apparently due to the cutting of winter wood by the previous owner. The general age was 50-60 years on west end and 20-30 years on east end, but there were many exceptions.

Lot J. Seven acres. An immature stand of almost pure pole chestnut 50-60 years old, containing many seedlings. A few scattering oaks and hemlocks were found on the eastern half.

Check Plots.

I. Fifteen acres. The eastern portion graded between the mixed swamp hardwoods of Lot D. and the pure chestnut of Lot B. The age class was fairly regular, 50-75 years. The western portion was coppice, 1-10 years, very dense, and contained much oak, with chestnut more or less in groups. The growing conditions were not suitable for chestnut in this portion of the lot.

II. Fifteen acres. The north end was a 40-60 year stand of chestnut and oak, the percentage of oak increasing on the hilltop. To the south there were two classes,—1-20 year clear cut, with open coppice, and 50-60 year poles. The percentage of chestnut was much greater in this plot.

III. Fourteen acres. This region was similar to H. and J., with swamp to the west, grading into pure chestnut on the east. Age classes were also irregular, but tended to be 1-20 years, with dense coppice, on the west, and 50-60 years on the east, with much pure chestnut of pole size.

IV. One hundred and fifteen acres. This large area contained many very diverse conditions. As a whole, the area was one of old field birch and cedar, developing into more or less uniform chestnut stands, especially to the north and east. Very irregular cuttings have been made on this area.

V. Thirteen acres. This area was largely swamp, but the southeast portion was chestnut 50-70 years old, with a large percentage of seedlings. The stand was relatively poor form, but good forest conditions prevailed.

VI. Eighteen acres. More or less uniform conditions prevailed on this tract. The age was 1-10 years on the south half and 11-20 years on the north half. This stand consisted of coppice chestnut, fairly uniformly distributed and sufficiently dense to produce rapid growth.

INSPECTION AND REMOVAL OF INFECTED TREES.

These areas were inspected by two men, running strips through them approximately three rods wide. The blighted trees to be removed from state land were blazed with an axe, care being taken to make them easy to find later. Tally was kept of trees so marked, no record being made of total chestnut in the stand.

On the check areas the marking was done with yellow lumberman's crayon, which was found to be very satisfactory, the marks being visible for 2-3 years in most cases. Otherwise the work was done the same as on the experimental areas.

The trees marked on the state land were cut and all material removed during the winter months. Merchantable wood was sold and the rest was gathered and burned as brush in a suitable opening during the winter.

In describing the inspection we propose to take up the work by years and by plots, using to designate the latter the numbers and letters found on the accompanying map. The work of inspection was done by W. O. Filley, R. L. Stevenson, A. E. Moss and E. M. Stoddard, and the work of removal was supervised by J. C. Reeves, warden of the forest.

First Inspection.

The first inspection was made in November, 1911, and March, 1912, 27 days being required to complete the work, which consisted in locating the boundary lines of the plots, laying out the work, counting and marking diseased trees. The following notes on the different plots represent their condition at the beginning of the experiment.

Plot A. On this plot 63 diseased trees were found, of which the greater number were young sprouts.

Plot B. One hundred and two infected trees were found, mostly in small stuff scattered over the area, with perhaps the least on the east end.

Plot C. A total of 64 blighted trees was found, 10 of which were large trees and the remainder smaller trees and sprouts. The blight was found most often on the south side of the trees, a condition which might indicate that the disease had followed a winter injury. Many of the small trees were in an unhealthy condition, but did not show any apparent signs of blight.

Plot D. This plot showed 14 trees infected with the blight, most of which were on the drier portions of the lot, there being none in the swampy part of the piece.

Plot E. This lot had 76 blighted trees, all of which were sprouts four inches or less in diameter. Disease was very scarce in and near a swamp on the east end of the lot. No particular side of the tree seemed to be attacked.

Plots F and G. Owing to the similarity of these two plots they will be considered collectively, the two having 59 blighted trees, mostly in the drier portions of the lot. Many trees in the swamp appeared to have suffered severely from winter injury, but diseased trees were exceedingly scarce.

Plot H. In the sprout growth on either end of this lot were most of the 26 infected trees, very few occurring in the larger growth.

Plot J. Twenty-nine infected trees were found on this plot, most of them on the higher ground.

Check Plot I. On this plot were 36 blighted trees, the larger number being on the east side, which was dry and rocky.

Check Plot II. On this plot 41 trees had been attacked by blight, the larger number on the east end, which was largely small sprouts.

Check Plot III. Scattered throughout the piece were 46 diseased trees.

Check Plot IV. This plot was a large area with a variety of conditions and sizes of trees, 423 of which were infected. The greater part of these were in a small area near the northeast corner of the lot, where the disease had probably been present for about ten years, as near as could be determined by the age of the sprouts grown since the death of many of the trees.

Check Plot V. A considerable part of this plot was swamp containing no chestnut, and consequently was not inspected; but on the slope at the south side were found 22 infected trees.

Check Plot VI. This plot consisted of recently cut-over land coming into sprouts, of which 76 were diseased, and older sprout growth, of which 58 were diseased.

Second Inspection.

The second inspection was made in 1912 during October and November. The details of the work were identical with the previous year, and the stand of timber was the same except for a small thinning in Plot H, which removed diseased trees. The notes concerning the prevalence and location of the disease in 1911 apply equally well to the condition found in each plot in 1912. The number of infected trees by plots follows, and it will be noted that as the infected trees were not removed on the check plots, the counts for them for this and succeeding years include trees counted previously.

Cut-out Plots.

	Number of Blighted Trees.
Plot A	102
B	64
C	57 sprouts 10 larger trees
D	23
E	117
F, G, H	109
J	9
Total	491

Check Plots.

	Number of Blighted Trees.
Plot I	55
II	101
III	60
IV	699
V	39
VI	100 sprouts 103 larger trees
Total	1,157

Plots F, G and H were combined on this and subsequent inspections, as they were adjoining and similar, thus facilitating the work of inspection.

Third Inspection.

The inspection for 1913 was made October 23d to November 6th inclusive. The work was carried out as formerly on the same plots. All plots showed a marked increase over previous years, and, as formerly, the sprout growth was attacked more severely, although this inspection showed that the disease was attacking the larger trees more than formerly. High or low land seemed to show no difference in the prevalence of the blight. The number of blighted trees in the respective plots follows.

Cut-out Plots.

Plot	Number of Blighted Trees.
Plot A	339
B	219
C	15 larger trees; 202 sprouts
D	43
E	195
F, G, H	422
J	65
Total	1,500

Check Plots.

Plot	Number of Blighted Trees.
Plot I, II	492
III	231
IV	1,941
V, VI	417 large trees; 603 small "
Total	3,684

Check Plots I and II, also V and VI, were inspected as one plot in 1913, in order to get the work done in shorter time.

Fourth Inspection.

In 1914 the inspection was made from November 9th to 30th inclusive, and was conducted in every respect as the previous work had been. The diseased trees were found in moist and dry areas in equal proportion, and also large and small stuff showed practically an equal amount of infection. It was estimated at this inspection that about two-thirds of the total stand of chestnut was infected. The trees cut after the 1913 inspection had not been entirely removed, but it is doubted if this fact appreciably influenced the results. Tabulated results of this inspection follow.

Cut-out Plots.

Plot	Number of Blighted Trees.
Plot A	1,028
B	1,325
C	800
D	200
E	1,375
F, G, H	1,159
J	197
Total	6,084

Check Plots.

Plot	Number of Blighted Trees.
Plot I, II	1,865
III	800
IV	7,575
V, VI	3,925
Total	14,165

The trees marked in 1914 were not removed, as it was decided to discontinue the work at that time.

In November, 1915, a hasty survey of the whole area was made in which no accurate counts were made; however, it was very evident that the disease was still progressing, although possibly not as rapidly as between 1913 and 1914.

SUMMARY.

In the following table is shown the count of infected trees by years, giving totals in cut-out plots and in check plots, also cost of inspection, cutting and removal, and receipts for product. In estimating the cost of inspection, $2.50 per day per man is allowed for two men working.

As is shown by the table, the total cost of inspection, cutting and removal was $741.25, while the total receipts were $52.23, giving a net loss of $689.02. The small amount received for product is due to the large percentage of small sprouts, which had to be burned as brush.

Cut-out Plots.	1911	1912	1913	1914	Totals.
Plot A	63	102	339	1,028	1,532
B	102	64	219	1,325	1,710
C	64	67	217	800	1,148
D	14	23	43	200	280
E	76	117	195	1,375	1,763
*F, G, H	112	109	422	1,159	1,802
J	29	9	65	197	300
Check Plots.					
Plot *I, II	77	79	336	1,373	1,865
III	46	14	171	569	800
IV	423	276	1,242	5,634	7,575
*V, VI	156	86	778	2,905	3,925
Total number of trees infected on cut-out plots					8,535
" " " " on check plots					14,165
Cost of inspection	$110.00	$30.00	$ 70.00	$106.00	$316.00
Cost of Cutting and Removal	193.26	90.12	141.87	†	425.25
Amount received for Product	35.23	3.72	13.28	†	52.23

* Plots inspected together to facilitate the work.

† Not cut and removed in 1914.

N. B. Counts in checks for 1912-13-14 represent new infections for those years, as counts for previous years have been subtracted from those of succeeding years.

CONCLUSIONS.

Study of the table shows that the number of infected trees increased year by year, and very rapidly in 1913 and 1914. The total number of infected trees for the check plots the last year was noticeably greater than for the cut-out plots, yet the proportional increase, as estimated by comparison of the number of infected trees in each the first year, was about the same, namely, twenty and nineteen times as many respectively. Whether the greater total for the check plots at the end of the experiment was due to the greater number of diseased trees to begin with, or to differences in soil conditions, density of stand, or total number of trees involved, cannot be determined. In any case it is fair to conclude that

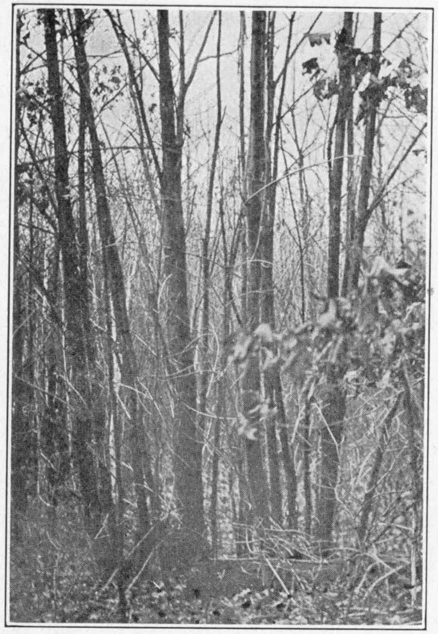
(1) In Connecticut, the cutting and removal from woodlots of trees infected with chestnut blight (*Endothia gyrosa* var. *parasitica*) does not prevent the spread of that disease.

(2) The cost of inspection, cutting and removal is too high in comparison with the results obtained to warrant its adoption from a commercial standpoint.

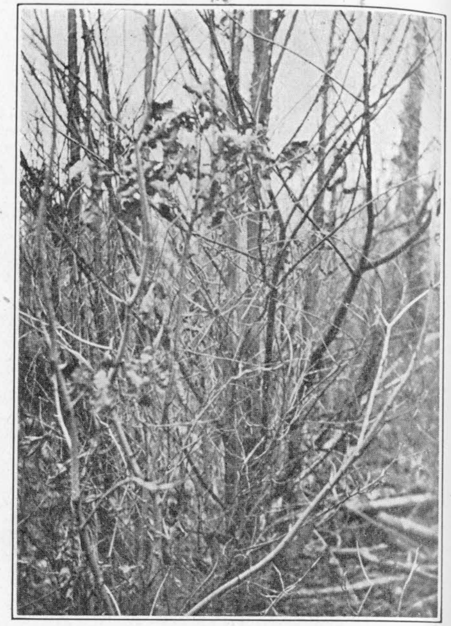
a. Type of growth on Plots A and B, p. 488.

b. Type of growth on Plot J, p. 490.

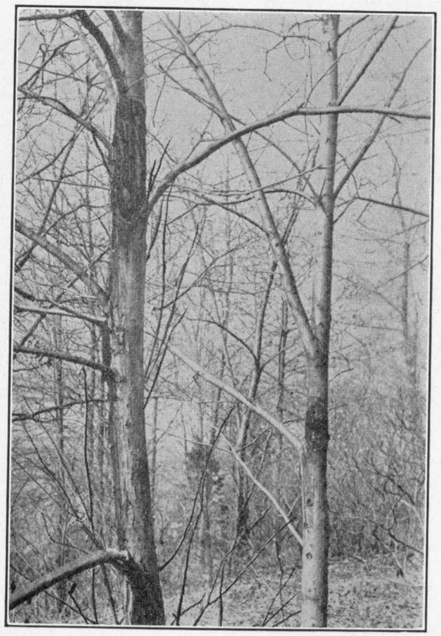
CHESTNUT BLIGHT EXPERIMENT.



a. Type of growth on Plots F, G, H, p. 490.



b. Type of growth on Plot III, p. 490.



c. Cankers on the trees.

d. Summer Fruiting Stage.

CHESTNUT BLIGHT EXPERIMENT.

SEED ANALYSES MADE DURING 1912–1915.

Mary H. Jagger,* *Seed Analyst.*
E. M. Stoddard, *Assistant Botanist.*

Owing to changes in the personnel of the seed analysis division and to changes in the policies and lines of work undertaken, it has not been thought desirable to issue a report on the work during the past four years. The work previous to 1914 was conducted entirely by Miss Jagger, to whom full credit should be given for analyses made and the preparation of the material for this report. Since and including the year 1914 the work has been done in the Botanical Department by the assistant botanist and G. E. Graham, laboratory assistant.

On account of the large number of samples to be reported, it has been thought best not to make a detailed report on all samples, but to condense the data as much as possible; also it would not be fair to dealers and growers to report samples under their names which at present do not represent the stock being offered for sale. It is planned, however, for the future to issue a report every year or two giving in detail as far as possible all tests made during the period. By so doing we think that we can help the purchaser to know the dealers who are giving a "square deal," and it will also give the dealers in reputable seeds a chance to show the purchaser where such seeds can be secured. We believe more can be accomplished by educating the purchaser to the realization of the value of high quality seed, demanding it irrespective of higher cost, than can ever be accomplished by legislation.

At present the work of the seed analyst consists of making, free of charge, purity or germination tests, or both, of all samples of seed submitted by growers, dealers or purchasers. It is essential that the person sending a sample for test should send a large one which fairly represents the stock from which it is taken. By so doing the sender gets a more accurate report and we get more accurate data for our records, thus giving to each a larger measure of satisfaction for time spent. Our reports to dealers are not

* Resigned May 1, 1914.

intended for an advertisement for the particular seed tested, but rather for information which will enable him to secure better stock to place on the market. The larger part of the samples received are from dealers, a fact to which we have no objection, but we believe the department should be more largely patronized by the users of the seed than it is at present.

In this report the work of 1912-13 will be presented first, followed by the analyses made in 1914-15.

GRASS AND FORAGE CROP SEEDS, 1912–13.

Most of the samples received for examination were too small to justify the making of a weighed test, and the time is wasted if the seed does not fairly represent the stock from which it is taken. Therefore in most cases the seeds were looked over, notes taken, and a germination test conducted.

Red Clover.

The red clover samples have averaged fair to good, less than one-fifth containing dodder and the average germination being 90.9 per cent. Plantain, the usual red clover weed, was found in less than one-half the samples. In 1913 seven samples of red clover seed were bought by the Station agent in different parts of the state. Purity and germination of these are shown in Table I. The weed seeds were very plentiful, there being in one sample over 40,000 to the pound, or in other words, 7 pounds of weed seeds in every hundred pounds of clover. Green foxtail, narrow-leaved and Rugel's plantain, dock, sorrel, pigweed and catchfly were the most numerous. None of the samples contained dodder.

TABLE I.—RED CLOVER SEED BOUGHT IN 1913.

Station No.	8073	8074	8075	8076	8078	8082	8083
1,000 seeds weigh, grams	1.93	1.70	1.53	1.50	1.71	1.69	1.54
Pure seed, per cent	91.7	95.6	94.5	89.9	94.0	93.8	96.5
Inert material, per cent	3.8	1.7	1.2	2.1	2.9	2.9	1.2
Weed seeds, per cent	2.3	.1	3.4	7.1*	1.7	2.2	1.6
Foreign seeds other than weeds	2.2	.8	.9	.9	1.4	1.1	.7
Pure seed germination, per cent	87.0	89.5	87.5	91.0	89.5	89.5	88.5
Viability, per cent	79.7	85.5	82.6	81.8	84.1	83.9	85.4
Number of noxious weed seeds, per pound							
Green foxtail	2,260	75	7,600	28,000	3,000	4,500	810
Narrow leaved plantain	1,921	...	800	5,950	150	1,500	...
Rugel's plantain	1,356	...	...	2,660	150	660	630
Dock	1,017	75	900	140	1,425	120	...
Pigweed	113	...	1,200	...	450	960	90
Sorrel	...	...	1,000	140	...	420	90
Finger grass	...	...	...	2,100	...	...	270
Catchfly	...	...	100	...	150	...	...
Witch grass	...	...	700	...	...	720	...
Black medic	452	75	...	...	75	...	...
Lady's finger	...	...	200	210	...	120	...
Yellow foxtail	...	...	...	350	...	60	90
Pepper grass	...	...	200	...	...	...	...
Crab grass	...	...	...	630	75	...	...
Wild carrot	...	...	100	490	...	...	...
Heal-all	452	...	100	...	...	...	...
Canada thistle	226	...	...	...	...	60	...
Ragweed	...	...	...	140	...	60	...
Mint, species	...	...	...	140	...	60	...
Mustard, species	113	...	...	...	...	60	...
Spurge	...	...	...	70	...	60	...
Shepherd's purse	...	...	...	...	...	...	...
Common plantain	...	...	...	...	...	...	...
Chicory	...	...	...	350	...	...	...
Hare's ear mustard	...	...	...	140	...	...	...
Wild geranium	...	...	...	...	...	120	...
Dog's fennel	...	...	...	...	...	...	...
Barnyard grass	...	...	100	...	...	...	90
Bird's foot trefoil	...	75	...	...	...	...	...
Unidentified weed seeds	339	...	1,400	...	...	...	...
Total number weed seeds, per pound	9,605	300	14,400	41,510	5,475	9,480	2,070
Foreign seed, other than weeds, per pound							
Timothy	1,695	75	400	4,200	600	1,440	...
Alsike clover	3,503	...	2,700	560	6,450	3,420	...
Alfalfa	3,164	825	100	280	...	...	...
White clover	...	...	200	...	975	1,320	...
Redtop	15,820	...	...	1,470	...	...	...
Bluegrass	...	...	...	...	...	...	...

* Of this 7.1 per cent, 4.5 per cent were seeds of green foxtail, 1.4 per cent were seeds of narrow leaved plantain and 1.2 per cent included other weed seeds.

White Clover.

Of the few samples of white clover, only one was considered of excellent quality. A purchased sample contained 4.2 per cent weed seeds, of which 2 per cent were seeds of peppergrass. This seed is admirably adapted in color, size and shape for use as an adulterant of white clover.

Alsike Clover.

The quality of these samples, with one exception, was good.

Crimson Clover.

Two of the crimson clovers were of low value both in purity and germination, two were good, and two were fair. Adulteration of this seed has been confined chiefly to the use of old seed. Fresh seed is pinkish and bright, while old seed is dull and brown. The viability should be 98 or 99 per cent. The samples averaged 79.6 per cent, 95 per cent being the highest.

Alfalfa.

Seven, or one-sixth of the samples, contained alfalfa dodder, and one, seeds of field dodder. The latter species has not been found before; but there is little doubt of its growing on alfalfa, as it is a decidedly prolific grower on red clover.

The average germination of the 42 samples was 89.6 per cent, which is above the standard for germination. Three samples contained over 40 per cent of hard seed which did not germinate in the test. In the case of leguminous seeds, as clovers and alfalfa, there are always more or less hard seeds, but it is assumed that at least one-third of these will sprout during the season; however, the use of seed which is 40 per cent hard, is not wise. Soaking in concentrated sulphuric acid has caused hard seed to germinate, but the resistance offered by different lots of seed varies so much, that the duration of the treatment would necessarily be variable, and definite rules cannot be given for its use.

The chalcid insect found in two samples was probably identical with that found in red clover seed.

The average weight per thousand alfalfa seeds in 95 samples tested was 2.04 grams, the average number of seeds to the pound 222,000.

Timothy.

As a rule the timothy seed was of good quality. Pepper grass and plantain were the most common weeds. The germination was good, only two samples sprouting below 80 per cent. For 100 samples the average weight per thousand seeds was .37 grams, the number of seeds to the pound 1,224,000.

Red Top.

Several lots of Red Top were dirty, chaffy or weedy. The average germination was 89.6 per cent. The average weight per thousand seeds in 60 samples was 0.8 grams, the average number of seeds to the pound 5,662,000.

Kentucky Blue Grass.

The methods of cleaning Kentucky Blue Grass usually leave from 10 to 20 per cent of chaff with the seed. Canada Blue Grass is an inferior species which costs only from one-third to one-half as much as Kentucky Blue Grass, and is often found in samples of the latter. As it matures seed later than the Kentucky species, only immature seeds would naturally occur with the seed, and the fact that well-formed mature seeds are found in Kentucky Blue Grass indicates the use of the Canadian species for adulteration. The resemblance between the seeds of the two species allows complete substitution of one for the other without arousing the suspicion of the purchaser.

In a sample bought in Connecticut the actual amount of pure seed that sprouted was 7 pounds to the hundred. This lot of seed was made up of 0.3 per cent pure Kentucky Blue Grass, 73.1 per cent Canadian Blue Grass, 21.5 per cent chaff and inert material, 5.1 per cent foreign seeds, and was labeled Kentucky Blue Grass!

Canadian Blue Grass.

These samples, all of which were bought in the state, were of fair quality.

Rhode Island Bent and Orchard Grass.

Of these seeds only a few samples were examined. The bent grass was found chaffy, as is usually the case, and germinated only fairly well.

TABLE II.—GRASS AND FORAGE CROP SEED TESTED IN 1912–13.

Kind of Seed.	No. of Samples.	Per cent of Samples Giving Germination Test of 55-60%	60-65%	65-70%	70-75%	75-80%	80-85%	85-90%	90-95%	95-100%	Per cent of Samples Good Quality.	Per cent of Samples Fair Quality.	Per cent of Samples Poor Quality.
Red Clover	23	...	...	...	...	...	8.7	21.7	60.9	8.7	30.4	30.4	39.2
White Clover	12	...	8.4	...	...	8.4	24.9	16.6	33.3	8.4	30.8	30.8	38.4
Crimson Clover	6	16.7	16.7	...	...	16.7	...	...	49.9	...	50.0	33.3	16.7
Alfalfa	42	...	...	7.1	...	3.5	9.7	12.0	46.0	21.7	36.4	25.8	37.8
Timothy	32	...	...	3.1	...	3.1	3.1	18.8	21.9	50.0	53.1	43.7	3.2
Red Top	15	...	...	...	...	...	13.2	33.4	40.2	13.2	40.0	33.3	26.7
Ky. Blue Grass	8	Ranged from 15.5–64.0% germination. Fair to poor quality.											
Oats	6	" " 19.0*–96.5% " Good to fair "											

* Had been bleached with sulphurous acid.

The purchased samples of orchard grass were all low in viability, and one showed very low vitality, bringing the viability down to 2.9 per cent, which means that there were actually less than three pounds of good live orchard grass seen in every hundred pounds. The large amounts of chaff and inert material signified adulteration, as good seed should be at least 90 per cent pure.

The samples sent in for examination were of fair quality.

MISCELLANEOUS SEEDS, 1912-13.

There were a number of miscellaneous seeds tested, among them samples of grasses, vetches, millet, oats and tobacco.

One sample of oats which was sold for seed had been bleached, with the result that only 19 per cent sprouted (see Table No. II). The bleaching of inferior grain with sulphurous acid is done to make it appear bright, fresh and plump, and bring the price of a higher grade seed. Not only is profit made by the improved appearance of the grain, but also by the increase in weight due to the additional moisture. Bleached oats are usually readily eaten by horses, but if used for seed it is advisable to make a germination test, for it is apparent that the vitality is greatly decreased.

THE VITALITY TEST OF VEGETABLE SEEDS, 1912-13.

Nine hundred and forty-five samples of vegetable seeds were tested for germination during the year 1912-13. These were sent to the Station by growers, dealers and purchasers. All of the common field and garden vegetables are included. The results reported to those interested cannot be given in detail here.

As usual, the deterioration of most seeds with age is shown and also the great difference in the vitality of seeds of the same year, caused by accidents of weather, improper harvesting, curing and storing, or neglect to separate and reject the light and imperfectly matured seed. Thus there were exhibited at some of the agricultural fairs held in the state a sample of California-grown onion seed of which 97.5 per cent sprouted and another grown in the same state and year of which only 40 per cent sprouted. A like comparison of seed grown in the same year showed celery seed with 90.3 per cent and another with only 26.3 per cent germination, cucumber seed with 100 and with 55 per cent respectively, and beets with 140 sprouts and with only 16 sprouts from 100 seed balls.

Onion Seed.

Table III shows the average vitality of Connecticut-grown onion seed less than one year old, as far as were shown by our tests in the years named.

TABLE III.—VITALITY OF CROPS OF ONION SEED.

	No. of Samples Tested.	Average Percentage Sprouted.
In 1894	25	82.9
1895	13	85.5
1896	44	72.4
1897	39	77.9
1898	68	69.3
1899	62	89.0
1900	77	88.5
1901	60	71.0
1902	60	80.6
1903	59	62.0
1904	42	80.4
1905	37	78.6
1906	62	77.2
1907	24	88.8
1908	119	74.5
1909	89	72.5
1910	57	64.3
1911	11	84.0
1912	18	89.5

Average for 19 consecutive years, 75.5 per cent.

The exceptionally low vitality of the 1910 seed was due to the blasting of the crop in the field.

The Sprouting Capacity of Different Varieties of Onions.

The average sprouting capacity of five varieties, of which a considerable number of samples were tested, was as follows. Only those samples were included which were stated to be less than one year old at the time of testing and were grown in Connecticut.

TABLE IV.—SPROUTING CAPACITY OF DIFFERENT VARIETIES OF ONION SEED.

	No. of Samples Tested.	Average Percentage of Sprouting Seed.
Yellow Globe	407	74.30
Red Globe	291	77.90
White Globe	212	78.33
White Portugal	34	70.82
Wethersfield Red	15	79.07

Vitality of Onion Seed as Affected by the Age of the Seed.

From 1896 to 1912 the Station examined 1,793 samples of onion seed of succeeding crops. The results are summarized in the following table:

TABLE V.—VITALITY OF ONION SEED.

	Connecticut Grown.		California Grown.	
	No. of Samples.	Per cent Sprouted.	No. of Samples.	Per cent Sprouted.
Seed stated to be less than one year old	890	75.13	424	88.29
Seed stated to be between one and two years old	168	65.63	257	78.85
Seed stated to be between two and three years old	24	21.90	28	60.55
Seed stated to be between three and four years old	1	59.50	1	10.00

In general, onion seed loses in vitality the second year, but it often happens that seed more than one year old from a crop grown and harvested under favorable conditions will sprout better than seed less than a year old which grew or was gathered under unfavorable conditions.

We believe that with sufficient skill in separating seed after threshing and winnowing, Connecticut seed can be put on the market which will have as high germinating power as the California seed. The following tests are instructive on this point, all seed used in the tests being less than one year old at the time of separating and testing:

TABLE VI.—CONNECTICUT ONION SEED SEPARATION.

Number.	Original Test.		Separation Tests.				Per cent of Increase in Germination of Heavy Seed over Light Seed.
			Heavy Seed.		Light Seed.		
	Weight 100 Seeds, Grams.	Germination, Per cent.	Weight 100 Seeds, Grams.	Germination, Per cent.	Weight 100 Seeds, Grams.	Germination, Per cent.	
5604	.351	87.5	.380	88.0	.267	64.0	24.0
5607	.295	43.3	.352	58.0	.198	25.5	32.5
5608	.345	80.0	.391	80.0	.260	53.5	26.5
5609	.371	89.5	.423	94.0	.295	66.0	28.0
5611	.349	70.5	.386	83.0	.258	55.0	28.0
5613	.344	84.0	.381	87.5	.289	79.5	8.0
5614	.363	90.5	.397	95.5	.298	87.0	8.5
5615	.270	49.0	.327	68.5	.222	44.3	24.2
5626	.366	87.0	.371	89.5	.276	59.5	30.0
5627	.306	71.5	.317	72.5	.223	36.5	36.0
5628	.314	56.5	.320	61.5	.220	31.0	30.5
5629	.355	60.0	.360	65.5	.273	47.0	18.5
5630	.380	79.5	.400	89.0	.276	66.5	22.5
5631	.327	51.5	.392	73.0	.239	39.0	34.0
5634	.356	83.5	.365	88.0	.253	68.0	20.0
5635	.352	76.5	.374	80.5	.268	50.0	30.5
5636	.351	58.5	.373	64.5	.267	42.0	22.5
5640	.362	84.5	.381	90.0	.299	87.5	2.5
5641	.290	25.0	.327	32.0	.203	9.0	23.0

Corn.

The quality of the seed corn raised in the state would doubtless be much improved if more care were given to its proper curing and storing. Mature seed corn when harvested still contains a considerable amount of moisture, and sweet corn, especially, if kept in a warm place with insufficient ventilation, will mold badly, the fungi greatly reducing the vitality and very often killing the seed. A sample of corn received for examination during the past year contained about 70 per cent of moldy seed. The fungus *Penicillium* had penetrated the kernels, and in some the embryos were entirely destroyed. Lack of ventilation also often causes premature germination.

After corn is thoroughly cured it should be kept in a dry, cool place with a free circulation of air around it. With our very sudden changes from snow to rain and from moderate to zero weather, even well-cured seed, if not kept dry, will absorb moisture and thus be liable to injury from freezing.

Soil and climate give this state an exceptional chance to be the center of sweet corn seed production. It is about the northern limit for the safe maturing of most varieties of sweet corn seed, and the quality of varieties grown here is generally believed to be better than those grown in a warmer climate.

Vitality of Sweet Corn Seed.

The following table gives the average, the maximum and the minimum vitality of Connecticut-grown sweet corn less than one year old, unless otherwise stated, tested during the years 1904 to 1912:

	No. of Samples Tested.	Average Percentage of Seed Sprouting.	Maximum.	Minimum.
Country Gentleman	20	88.4	100.0	59.0
Early Crosby less than one year old	12	93.5	100.0	77.0
Early Crosby one to two years old	4	63.6	85.0	42.0
Early Evergreen less than one year old	3	87.8	96.0	82.0
Early Evergreen one to two years old	1	91.0	....	....
"Evergreen" less than one year old	12	88.0	....	....
"Evergreen" one to two years old	3	80.7	92.0	73.0
Acme Evergreen one to two years old	1	80.0	....	....
Hickox	4	83.2	96.0	65.0
Metropolitan	4	91.7	99.0	85.0
Old Colony less than one year old	5	84.6	100.0	57.0
Old Colony one to two years old	1	80.0	....	....
Old Colony two to three years old	1	45.0	....	....
Stowell's Evergreen less than one year old	29	87.0	100.0	48.0
Stowell's Evergreen one to two years old	8	81.7	99.0	62.5
Early Dawn	1	96.0	....	....
Ne Plus Ultra	1	72.5	....	....

VEGETABLE AND FIELD CROP SEEDS, 1914-15.

The germination tests of seed received in sufficient quantity to warrant reporting average percentages are given in the following table. Peas and onion seed head the list for number of samples submitted for test, with sweet corn and tomatoes following as close seconds. Of field crops, corn and soy beans are first in number, followed by tobacco and vetch. Samples of nearly all the common vegetable seeds have been submitted in varying quantities, but not in large enough quantity to report, except to note that the quality ran uniformly good in most cases.

TABLE VII.—GERMINATION OF VEGETABLE SEEDS, ETC.

Kind of Seed.	No. Samples.	Minimum Germination.	Maximum Germination.	Average Germination.
Peas	36	51.5	100.0	89.6
Onion (white)	21	43.0	95.5	77.6
" (yellow)	21	49.5	95.0	81.1
" (red)	10	59.5	92.5	80.5
Sweet Corn	18	82.4	100.0	94.1
Tomatoes	13	76.0	97.5	89.1
Field Corn	20	84.0	100.0	97.3
Soy Beans	19	27.5	99.5	89.7
Tobacco	8	11.5	89.5	67.1
Vetch	5	61.0	71.5	65.9

GRASS AND FORAGE CROP SEEDS, 1914-15.

As in previous years, many of the samples of grass and forage crop seeds were too small to warrant making an accurate purity test; however, it has been possible to estimate the quality very closely from the samples at hand. From our records it appears that the larger percentage of the samples have given a lower percentage of germination than during 1912-13, but the proportion of good quality seed has increased considerably. We believe the improvement in quality has been due in part to a demand of the trade for a higher grade seed than formerly and the response to this demand on the part of the grower or dealer. Besides the samples recorded in the accompanying table, a few samples each of Kentucky blue grass, sweet vernal, Rhode Island bent, sweet and alsike clover and millet have been tested for germination and purity.

In a test of different grades of timothy and red top it is shown that the higher the grade of seed the higher the percentage of germination, the strictly prime timothy germinating 93 per cent while the grade designated as choice gave a germination of only 70 per cent, and the fancy recleaned red top germinating 75.5 per cent while the unhulled gave only 25.3 per cent. It is at once apparent that the lower grades of these seeds are much more expensive considering the resulting stand than the high grade seed.

TABLE VIII.—GRASS AND FORAGE CROP SEED TESTED IN 1914-15.

Kind of Seed.	No. of Samples.	Per cent of Samples Giving Germination Test of: Less than 65%.	65-70%.	70-75%.	75-80%.	80-85%.	85-90%.	90-95%.	95-100%.	Per cent of Samples, Good Quality.	Per cent of Samples, Poor Quality.
Red Clover	11	*18.2	...	...	18.2	27.3	18.2	9.05	9.05	81.8	18.2
Alfalfa	25	...	...	8.0	16.0	16.0	24.0	20.0	16.0	†	...
Timothy	5	...	...	...	...	40.0	40.0	20.0	...	85.8	14.2
Red Top	8	25.0	25.0	...	25.0	...	25.0	...	...	25.0	75.0
Oats	11	18.2	...	...	...	...	45.4	9.2	27.2	81.8	18.2

TREE SEEDS.

During the period covered by this report we have made several tests of tree seeds and while we realize that the number has been too small to warrant drawing any very definite conclusions there have been some interesting points brought out which are worthy of notice. Of course it is a question whether the testing of tree seed will enable the planter to determine accurately the amount of seed to plant from the results of the test, as these have to be made under conditions which are largely artificial. Yet from the results obtained in our tests it would seem that it would be perfectly possible to tell the extremes of quality even if the gradations between could not be so readily determined, that is to say one could tell fair to good seed from poor to very poor.

There are three methods of testing which have been used, namely, a cutting test, which determines quickly the per cent of seed which are filled but in no wise tells the per cent which have

* Experimental tests of samples of hard seed.
† Quality in general good.

vitality enough to sprout; a germinator test, in which the seeds are kept under the most ideal conditions for germination, which usually gives the per cent of germination in a shorter time than the third test, which is a soil test. In the soil test the seeds are sown broadcast in boxes of sand and leaf mold in the greenhouse and of all the tests it most closely approaches actual field conditions. This test gives usually a larger per cent of germination than the germinator test but the seeds sprout much slower. The temperature for the germinator tests averaged 68° F. for eighteen hours and 86° F. for six hours of each day and the soil tests were carried at an average minimum temperature of 55° F. and an average maximum of 85° F. with many intermediate variations.

Judging from the results of our tests the cutting test is the least reliable as the seed tested in this way uniformly showed a high per cent of what was apparently good seed while the actual germination of the same sample sometimes was very poor. Between the soil (S.) and germinator (G.) tests there does not seem to be so great a difference in the final result and frequently the difference is in favor of the former.

In Table IX it will be noted that the samples of white pine show considerable differences in vitality, and the results do not warrant making any summary of the behavior which may be expected of white pine seed under any given condition. Samples No. 8323 and 8324 were of the same age and tested under exactly the same conditions, the former being collected by a nursery company and the latter by a private party, but as we do not know the conditions of curing and storing it is impossible to tell the cause for the variation in per cent of germination. On the other hand we find that the samples of red pine show a marked uniformity in results. Five samples of the seven tested vary only 3 per cent, and it will also be noted that nearly all of the samples germinated in a comparatively short time as compared with the germination of the white pine. Sample No. 8390 gave 81.0 per cent of germination after being kept for five years at ordinary room temperature.

Sample No. 8387 was taken from the same lot of seed as sample No. 7759 and shows that this sample of Japanese Black Pine completely lost its vitality in five years. The samples of hemlock show uniformly poor germination, a condition which seems to be common in hemlock seed in the field. Sample No.

TABLE IX.—GERMINATION OF TREE SEEDS.

Test No.	Seed.	Age. Yrs.	Number of Days to First Sprouting. S.	G.	Per cent Five Weeks. S.	G.	Total Per cent. S.	G.	Number of Weeks to Final Count. S.	G.
6451	White Pine	1	14	8	56.0	54.5	58.0	64.0	10	10
6793	“ “	1	21	11	20.0	42.0	96.5	79.5	25	25
6794	“ “	1	21	1	19.0	44.0	84.5	78.5	25	25
8323	“ “	#	..	21	...	46.5	...	57.5	..	10
8324	“ “	#	..	30	...	11.5	...	25.5	..	10
8391	“ “	3	..	..	...	...	...	00.0	..	10
8435	“ “	3	..	21	...	18.0	...	27.5	..	10
7993	“ “	2	..	11	...	20.5	...	37.0	..	10
7861	Red Pine	?	..	10	...	81.0	...	88.0	..	8
6452	“ “	1	14	14	...	94.2	82.5	94.2	10	5
6792	“ “	1	21	11	96.5	91.5	96.5	93.5	5	10
7992	“ “	1	..	14	...	...	...	92.0	..	2
8325	“ “	1	..	6	...	...	...	94.0	..	3
8326	“ “	1	..	18	...	...	...	95.0	..	4
8390	“ “	5	..	19	...	69.0	...	81.0	..	6
7367	Scotch Pine	1	18	7	68.0	56.5	68.0	62.0	5	10
7660	“ “	?	..	8	...	28.0	...	31.0	..	10
8327	“ “	?	..	11	...	23.0	...	25.5	..	10
7760	Mt. Pine	1	12	5	12.0	2.5	12.0	2.5	5	5
6796	Pitch Pine	#	21	8	51.5	33.0	67.5	64.0	20	20
7860	Jack Pine	?	18	8	53.0	47.0	84.0	80.0	20	10
7759	Japanese Black Pine	1	12	7	32.0	22.5	32.0	25.5	5	10
8387	“ “ “	5	..	..	...	...	...	00.0	..	10
7863	Hemlock	#	..	..	...	...	...	00.0	..	36
7355	“	#	35	..	1.0	...	18.0	00.0	20	24
7757	“	?	35	63	7.5	...	22.0	1.0	10	10
8389	“	..	..	..	...	...	...	00.0	..	10
7368	Norway Spruce	1	18	7	41.0	42.0	44.5	42.0	10	5
8321	Siberian Larch	2	..	11	...	50.0	...	50.0	..	5
6538	European Spruce	?	..	6	...	76.0	...	76.0	..	2
7366	European Larch	1	17	7	17.0	29.0	29.5	29.0	15	5
7752	Japanese Larch	1	12	9	85.0	39.5	86.5	44.0	10	15
8388	“ “	4	..	..	...	...	...	00.0	..	10
6795	Arbor Vitae	?	21	8	74.0	75.5	75.5	76.0	10	10
7753	Japanese Yew	1	..	..	...	...	00.0	00.0	..	..
7755	Japanese Cedar	?	..	..	...	...	00.0	00.0	..	..
7999	Douglas Fir	1	..	4	...	...	...	65.0	..	2½
8322	“ “	1	..	11	...	...	...	56.5	..	2
8209	“ “	1	..	6	...	...	...	72.5	..	3
8000	White Fir	1	..	9	...	...	...	27.5	..	2
8328	“ “	2	..	11	...	57.5	...	57.5	..	5
7656	Sycamore	1	14	2	...	...	41.0	40.0	6	2
7758	Beech	?	7	..	60.0	...	70.0	...	6	..
6550	Catalpa	1	12	5	...	...	84.0	60.0	5	3
6798	White Ash	#	287	511	...	...	6.0	2.0	77	73
7356	“ “	1	105	105	...	...	38.0	3.0	73	73
7754	Chinese Redbud	1	14	..	...	...	12.0	...	3	..
7751	Chinese Privet	1	56	..	...	...	84.0	...	23	..
7862	Sweet Gum	?	..	..	...	...	...	00.0	..	..
8494	Paper Birch	?	..	9	...	...	...	9.5	..	3
8502	White Birch	?	..	..	...	...	...	00.0	..	12
8263	Locust	?	..	19	...	...	...	1.5	..	10

Seed less than year old.

8388, taken from the same lot of seed as was Sample No. 7752, shows complete deterioration of Japanese Larch seed in four years. White ash seed took a long time to germinate and did not give a very high per cent at the best. White and paper birch, also locust, gave very poor results with the conditions under which they have been tested at this laboratory.

TABLE X.—CUTTING VERSUS GERMINATION TESTS OF TREE SEEDS.

Test No.	Seed.	Cutting Test.	Germination Test.	Variation.
6794	White Pine	96.0	84.5	11.5
6451	" "	96.0	71.0	25.0
6452	Red Pine	99.0	82.5	16.5
6792	" "	100.0	96.5	3.5
7760	Mt. Pine	91.0	12.0	79.0
6796	Pitch Pine	90.0	67.5	22.5
7860	Jack Pine	99.0	84.0	15.0
7759	Japanese Black Pine	93.0	32.0	61.0
7863	Hemlock	60.0	00.0	60.0
7757	"	67.0	22.0	45.0
7366	European Larch	66.0	29.5	36.5
7752	Japanese Larch	97.0	86.5	10.5

From Table X it will be seen that while nine of the samples on which cutting tests were tried showed a uniformly high per cent of good seed the corresponding germination tests showed a considerable variation. The soil tests were used for comparison as it was thought that these approximated more closely the results which could be expected under field conditions. Of course there is considerable variation between the soil and germinator tests but for the most part they do not show as gross a difference as is shown in the above table between cutting and germination tests which were conducted under conditions as near as possible to field practices. We believe that the cutting test will tell in a very general way what may be expected of a sample of seed and could be used in case of lack of time for any other test but that it is not reliable and should only be used in case of necessity where facilities or time for other tests are not to be had.

GERMINATION TESTS OF RADISH SEED BOUGHT IN 1915.

It was planned in the spring of 1915 to undertake some coöperative experiments with the vegetable department on the comparison of laboratory tests on germination with tests of the same samples under actual field conditions. Thirty-three samples of radish seed of the same variety were consequently collected from as many dealers throughout the state and germination tests were made in a standard germinating chamber and later field tests were made of the same samples. It has been decided that the results are not conclusive enough to warrant any publication at this time in regard to the comparison of the two tests so we will only present the data concerning the laboratory tests.

The samples showed variation of from 23.5 per cent to 99 per cent of germination with 25 samples or 62.5 per cent of the whole germinating over 80 per cent; 11 samples or 27.5 per cent germinating between 50 and 80 per cent, and 4 samples or 10 per cent germinating under 50 per cent. These results seem to indicate that the radish seed offered for sale in the state last year was for the most part of good quality. Our results also show that the appearance of the seed is not necessarily any criterion of its quality, as the sample that germinated only 23.5 per cent was the brightest looking lot of seed collected.

INDEX.

ERRATA.

Page 54, sample No. 6172, Mapes Tobacco Manure, Wrapper Brand. In the fifth column of the table the figure for "Average retail cost of like amounts," etc., should be $49.34 and not $36.63, as there given.

Page 93, line twenty-seven from top: for *Pestalozzi* read *Pestalozzia.*

Page 455, line six from top: for Ritzena read Ritzema.

Page 458, fourteenth line from bottom: for *aristata* read *cristata.*