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Fortieth Annual Report

OF

The Connecticut Agricultural Experiment Station

Being the annual report for the year ended October 31

1916

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THE BOARD OF CONTROL

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF.

SEPTEMBER 30, 1916.

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

Vegetable Growing.

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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:

As required by law, the Board of Control of The Connecticut Agricultural Experiment Station herewith respectfully makes its annual report for the year ending October 31, 1916.

A full discussion of the Station work and its results is presented year by year in printed reports and bulletins. It is therefore only necessary here to give a general sketch of the Station's activities, sufficient in detail to show what it does and whether the service rendered pays for its cost to the State. This cost to the State for the year has been approximately $38,750.

This includes the State Forester's expenses, except for land purchase, and those of the State Entomologist and of the gipsy and brown-tail moth work in his charge.

This is equivalent to an expense per capita of the entire population of the State of about 3.5 cents.

We wish here to show in brief outline what service the Station has rendered in return. It will be seen, in the sketch which follows, that this service is not in the interest of farmers alone but that in several directions it has a distinct bearing on the public welfare, as in the protection from insect pests, the examination of foods and drugs, etc.

The object of the Station, as set forth in its act of incorporation, is to promote agriculture by scientific investigation and experiment.

Nevertheless, the one project which was most prominently in the mind and speech of those who urged its establishment was the control of the quality of commercial fertilizers, because this seemed to them their greatest need at the time.

Since then other forms of inspection and control work have been by statute delegated to this Station. Some of them have

a not very obvious connection with agricultural investigation, but the reasons for placing them under the management of this Station and of leaving them there are nevertheless very clear and convincing.

This is the only State institution which owns its laboratories, library, collections and grounds, with ample room for further expansion and equipped for investigation in the various departments required for control work.

Its entire staff give their whole time and attention to the Station work, its personnel is not affected by the vicissitudes of politics, and for forty years it has commanded the confidence of the public.

The Botanical Department.

Dr. Clinton in Charge.

The work of this department in finding and destroying the pine blister rust will be referred to with the work of the Forestry Department.

The experimental work has been in the study of plant diseases and the means for their prevention and control. Many of these experiments have to be continued from year to year until sufficient data have been secured for a comprehensive discussion of them. Thus, Dr. Clinton's last report gives the conclusions of fourteen years' study of means of preventing potato blight. The results of this work are now being tested and demonstrated by the county agents, a part of them in coöperation with Dr. Clinton.

A continued study of the channels of infection and method of spread of peach yellows, both on a commercial orchard of 900 trees and also in a small experimental orchard at our experiment field, promises helpful results.

The studies of fungicides and of the nature of various plant diseases need not be catalogued here.

The management and records of the Station experimental orchards are also largely in the botanist's care, as well as the tests of vitality and purity of agricultural seeds.

Considerable time and attention are given by the department to the identification of fungous diseases, weeds, cultivated and wild plants, varieties of fruits, etc., which are sent in from all parts of the State. Advice is given concerning the control of

diseases, and personal inspections of fruit, garden and greenhouse crops are frequently made for this purpose.

Particular attention is given to various troubles as they become especially prominent, as blast of onions, root-rot of tobacco, apple spot, etc. Purely scientific studies are made of certain fungi or groups of fungi.

Effort is made to gather in the herbarium specimens and notes on every disease, whether fungous or physiological, found on cultivated plants within the State.

The aim of the department is to combine research work with practical help in the control of plant diseases.

The Chemical Department.

Mr. Street in Charge.

Seven hundred and thirteen samples of fertilizing materials have been examined and the results published, calling attention to inferior or worthless articles.

The value of this work may be illustrated by the cottonseed meal situation. Very large amounts of this meal are used as a fertilizer, though it also finds use as a feed. Not less than $180,000 yearly are paid for meal used as a fertilizer.

Most of the car-lots brought into the State are analyzed at this Station, and if a shipment is not as guaranteed the buyer receives a rebate from the agent or shipper and a loss to the farmer is thus prevented.

Two hundred and seventy-three samples of feeds have likewise been examined. As a result of these yearly tests, many feeds of inferior value have been kept out of the State and the composition of the valuable feeds has been more correctly stated in their guaranties.

The number of food products and drugs tested has been 2,220. These include the samples referred to us by the State Dairy and Food Commissioner, who depends on the Station for the chemical evidence necessary in prosecution. In fifteen cases expert evidence was required in court.

Aside from the work done for the Dairy and Food Commissioner, the examination of foods for the general information of the public has been very extensive. Thus, in the last twenty years over 28,000 samples have been tested, various frauds

detected, in many cases the nutritive value determined, untruthful claims exposed, and the results given to the public so far as our publishing facilities permitted.

This educational work we believe has benefited the producer as well as the consumer both within and without the State and has resulted in a great improvement in the quality of food and also in the truthfulness of the labels under which it is sold. As an example may be cited a summary of purity tests gathered from two inspections.

	Per cent. of Samples Found Pure	
	1896-8	1914-6
Ground coffee	9	100
Honey	22	96
Molasses	68	93
Spices	65	90
Lard	54	90
Olive Oil	68	86
Average of 20 foods	59	90

The work which the Station began in 1906 on the examination of foods for diabetic patients and which has been carried on ever since has met with remarkable popularity and success. It has exposed the fraudulent and misleading claims of certain manufacturers who recommended their special foods, which in fact were dangerous or deadly for this class of patients, and has given, chiefly for the guidance of physicians, the essential chemical data on every brand of diabetic food which has been found in the American market. The results of the work are naturally in great demand, for an authority on the subject* states that it is probably an underestimate to consider that one per cent of all individuals in the country have or may have diabetes.

The accuracy and value of the Station work on foods and medicines have been widely recognized. As one evidence of this appreciation it may be noted that the chief chemist of the Station is one of the Federal Committee on Food Definitions and Standards, which determines these important matters for the guidance of the United States and state officials. He is also a member of the Committee on Revision of Analytical Methods, which are the standards for the American agricultural stations

* Joslin: Treatment of Diabetes Mellitus, p. 22.

and for analysts generally, and is referee on diabetic foods for the Council of the American Medical Association.

The laboratory has also done an important work in the exposure of the fallacious, misleading and dangerous claims made by manufacturers of many of the proprietary medicines widely advertised in this State. During the last four years 280 of these remedies have been analyzed and the analyses published in the annual reports. The economic loss arising from the use of these medicines is large, and the danger in their unrestricted and unintelligent use is a menace to the public health.

Twelve hundred and fifty-two pieces of Babcock glassware used in the State for determining the quality or market price of milk and cream have been tested and certified since our last report on this work.

These inspections, all required by law, have been made by this department.

Other work of the department has been as follows:

Chemical examinations for the Police Department and State Board of Pharmacy in efforts to abate the illegal traffic in narcotic drugs; many analyses for the departments of botany and agronomy; examination of many soil samples for farmers to determine their lime requirement; and study of methods of determining the availability of nitrogen in fertilizers, and of various other methods for the Association of Official Agricultural Chemists.

The Entomological Department.

Dr. Britton in Charge.

The work of this department has included a determination of the life history and habits of a destructive imported pine sawfly and a study of its parasites.

Methods of combating the striped beetle, the squash borer and the pine weevil have been studied with success.

Too little time has been left for such studies because both time and funds have of necessity been spent in the various kinds of inspection and control work required by law and made necessary by the invasions of dangerous insects pests. A brief outline of this work follows:

The eighty-eight nurseries in the State have been examined, and insects and fungous pests destroyed in the few cases where they were found.

More arduous has been the inspection of 291 shipments containing 2,102 parcels of imported nursery stock. Nearly a third of the shipments were infested with insects or fungi, some of which are dangerous and these were destroyed.

Four hundred and sixty-seven apiaries with 3,698 colonies were inspected, and about twenty per cent of the apiaries were found infected with foul brood.

The most important and expensive work has been directed to the detection and suppression of the gipsy moth, which is now present in twenty-one towns on our eastern border, having apparently been blown into the State almost at the same time by an easterly storm soon after the caterpillars hatched in 1913.

A gang of scouts under the direct supervision of Mr. Davis has searched the four worst infested towns, federal scouts working in the other towns. The number of infestations in the four towns this year was 169 as against 252 in 1915. Four other towns infested last year were found free in 1916, and in general most of the towns this year showed fewer infestations than last. This indicates that the work is really reducing the extent of the plague.

The work of the year may be indicated by these figures:

Number of infestations	210
Egg clusters destroyed	3,135
Trees banded and examined	13,165
Areas sprayed	60
Larvae destroyed	31,671
Fruit trees examined by scouts	205,579
Shade trees* examined by scouts	42,272

The fact that by the prompt and vigorous action of the State Entomologist two previous invasions of gipsy moth have been entirely blotted out gives ground for hope that the present much more extensive invasion may be kept from devastating woodland and finally be destroyed.

It should be stated that the Bureau of Entomology of the United States Department of Agriculture has most efficiently

* Only trees within 100 feet of a building.

coöperated with the State Entomologist during the past year and has spent nearly $15,000 in the work in this State.

Some scouting for brown-tail moths was done by our men at a cost of $186.61, and the towns of Putnam, Thomaston, Pomfret, and Woodstock were asked to cut and burn the winter nests. This was done, as provided by law, at an expense of $457, one-half of which was paid out of the appropriation for this work by the State.

Under the law passed by the last General Assembly a large mosquito ditching contract involving 2,668 acres, lying between the Branford and Hammonasset Rivers, has been executed, and according to universal testimony the mosquito plague has been very largely reduced.

The Forestry Department.

Mr. Filley in Charge.

The work required by law of the State Forester, Mr. Filley, who is also the Station forester, is the care of the State Forests and the management of the State Forest Fire Service.

There are four State Forests:

1. The Union forest of about 287 acres, which is in the heart of a rather extensive white pine region, where the only work done has been the removal of weeviled pine tops from plantations of previous years.

2. The Simsbury plantation of 130 acres, where 27,000 trees of four different species of pine have been set out and necessary renewal of fire lines done.

3. The Cornwall forest of 1,100 acres, on which no work has been done.

4. The Portland forest of about 1,200 acres. Here considerable work is done in improving the present stands, replanting land with various species, partly for experimental purposes and for making observations on the rate of tree growth. This is both the largest and the oldest of the State Forests, and here permanent plots have been established for studying forest growth.

All work in the State Forests has been greatly hindered this year by the impossibility of getting necessary labor.

No serious fires have occurred on the State land.

The Forest Fire Control is gradually increasing in efficiency. In the last year there has been less destruction than in other recent years. This is of course largely explained by weather conditions. Until the public realizes the danger in the careless setting and watching of fires great damage will be done in the critical periods of fall and spring—however efficient the fire service is—if rain or snow does not add its protection.

There were 327 forest fires last spring (46 per cent of them caused by the railroads), which burned over 17,000 acres, with estimated damage of over $68,800, as compared with 1,325 fires covering an estimated area of 100,000 acres, and damage of $291,000, in the spring of 1915.

Unquestionably the loss would have been much larger if there were not in every town a forest fire warden to call help and direct the work of fire-fighting intelligently.

The experimental forestry work is largely carried on in the Station's experimental forest of 150 acres at Rainbow and at the smaller white-pine field of 5 acres in Enfield.

But little work of this kind could be done this year because of the emergency caused by the white-pine blister rust, an imported disease, which destroys the young trees on which it fastens. It had been found some years ago by the entomologist's department on imported stock and destroyed. But its appearance in Massachusetts and the public apprehension of the destruction of our extensive white-pine plantations made necessary a careful scouting of this State.

This was done by the coöperation of this Station through the botanical department (Dr. Clinton), the forestry department (Mr. Filley), and the entomological department (Dr. Britton), with the Bureau of Plant Industry of the United States Department of Agriculture. The Bureau met nearly one-half of the expense.

Eighty plantations were inspected, and infected trees found and destroyed in ten of them and in one nursery.

The fungus has two hosts. Part of its life cycle is passed on the five-leaved pines; the rest of it is passed on currant or gooseberry leaves. It cannot spread directly from pine to pine, but its course must be: pine to currant, currant to pine.

The disease on pine is therefore self-limiting unless currants or gooseberries are in the neighborhood.

A very serious situation was found in Norfolk and vicinity, where the disease was found in an imported pine plantation set in 1909 and where wild and native currants and gooseberries were very abundant and abundantly infected. A camp was established with a crew of six men, directed by Messrs. Moss and Stoddard, and two months were spent in destroying all wild currants near the roadsides for several miles around. The infected area was found to cover about forty square miles. Later a hurried scouting showed the disease on currants to be very prevalent east of the Connecticut River, but on the west side it appears to be sporadic rather than general.

The Department of Vegetable Growing.

Mr. Huber in Charge.

This department has carried through its first year elaborate tests of the time and methods of seeding, greenhouse management and field culture of tomatoes in their effect on earliness and amount of crop.

A second test of Southport White Globe onion seed grown in different parts of the country has been made.

A hybrid sweet corn, a cross between Golden Bantam and Stowell's Evergreen, has been further selected and established and, in the opinion of market gardeners who have tested it, is a promising extra early white sweet corn.

Studies on methods of growing and storing potatoes to preserve vigor and productive capacity are also in progress, and a comparative test of twenty varieties of lettuce for summer growing, besides less extensive tests of other vegetables.

Complete data have been gathered on cost and income from a half-acre vegetable garden under average conditions.

Research Work Supported by the Adams Fund.

It remains to briefly allude to two departments of Station work supported by the Adams Fund, which is received from the federal government and which the law requires to be spent in scientific investigation on subjects approved by the Office of Experiment Stations and preferably on projects requiring continuation through a term of years.

One of these Adams projects is: studies in inheritance in plants, in charge of Mr. Jones. In some parts of this work

he has had the coöperation of Dr. E. M. East of the Bussey Institution of Harvard University, and of the Bureau of Plant Industry of the United States Department of Agriculture.

The studies have been chiefly on inheritance in corn and tobacco. Less elaborate studies of tomatoes and selection experiments with rye have also been made.

The discussion of the results in relation to the laws of heredity are published mainly in scientific journals. Their bearing on practical problems of improving yield and quality of the crops mentioned is discussed in our reports.

To know what can and what cannot be done by crossing strains or varieties and how it may be possible to fix any apparently improved qualities in a cross requires patient investigation and must be preliminary to any successful practical undertaking.

In this connection and in coöperation with the Storrs Station, but not on the Adams Fund, a corn survey of the whole State has been carried out, and the most promising varieties are being grown for three years both at the Storrs Station and on our own field to test their vigor and yield, with the object of finding the best and in the end encouraging the using of home-grown seed instead of depending on seed brought from outside.

The other department of distinctive research work is that under Dr. Osborne's direction, on the constitution of the protein bodies and their relative value in nutrition. This work, begun with very limited support about twenty-six years ago, has become recognized here and abroad as epoch making. It has helped to revolutionize our conception of nutrition and the problems of cattle feeding and has furnished a starting point for other investigators and practical experimenters.

The work now receives substantial support from the Carnegie Institution.

From this brief and incomplete summary of the Station work one may get a general idea of its scope. Some further idea of its amount may be gained from the following additional statistics:

Number of letters written	11,956
Public addresses	97
Papers in scientific journals	23
Specimens of insects and fungi determined for inquirers	524
Specimens added to herbarium	1,677
Samples of seed tested	335

During the year a small insectary has been built for the entomological department.

A section of the greenhouse which had become useless was taken down and a new one built in its place wholly by the workmen on the place under Mr. Veitch's direction. They have also built a garage for the Station motors.

The annual field meeting at the Mount Carmel Farm on August 16th brought together about 400 farmers and their wives, who lunched together, listened to short talks and discussions on the Station work, and inspected the various field experiments which were in progress.

This experiment field, most efficiently managed by Mr. Hubbell, has been a great help in the experiment work of the Station. The results of laboratory work may here be tested under our control before they are passed on to the county agents for tests in all parts of the State. Every department of the Station is represented in these field tests at Mount Carmel.

Changes in the Station Staff.

Miss E. B. Whittlesey, who has served efficiently as herbarium assistant and stenographer for some years, resigned September 30, 1916.

In June, 1916, G. L. Davis terminated his work as assistant chemist.

Publications.

During the year the Station has issued its annual report containing 555 pages, 28 plates and 2 maps, and three bulletins aggregating 80 pages and 19 plates.

The Needs of the Station.

A larger appropriation for the support of the Station is urgently needed to permit its growth in response to the demands on it.

It is universally acknowledged that the work of the Stations is the basis for any sound advance in agriculture and in agricultural education.

The Extension Service, which has been so remarkably advanced of late, is designed wholly to carry to the individual

farms and farmers of the State a knowledge of what has been established by the work of the Stations. It may be likened to a means of transportation, absolutely necessary as a means, but absolutely dependent for its usefulness on abundant production. If crops fail, if manufacturing interests decline, the railroads must either lay off their cars or run them empty.

Efficient and well-supported Stations are the first need of the Extension Service. Otherwise, it must curtail its traffic or, what is worse, run empty.

All of which is respectfully submitted.

GEORGE A. HOPSON,
Secretary.

NEW HAVEN, CONN., October 31, 1916.

REPORT OF THE TREASURER, 1916

E. H. JENKINS, in account with THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION for the fiscal year ending September 30, 1916.

RECEIPTS.

Balance on hand, October 1, 1915 (Analysis Fees)		$ 1,476.18
State Appropriation, Agriculture	$17,500.00	
State Appropriation, Food	2,500.00	
State Appropriation, Insect Pest	3,750.00	
United States Appropriation, Hatch	7,500.00	
United States Appropriation, Adams	7,500.00	
Analysis Fees	8,135.00	
Sale of Station Produce	8.04	
Miscellaneous Receipts	1,037.34	
From Lockwood Trust Income (including sale of tree seedlings and Mt. Carmel Farm Produce)	9,609.68	
		57,540.06
		$59,016.24

DISBURSEMENTS

E. H. Jenkins, director, salary	$2,800.00
E. H. Jenkins, treasurer, "	400.00
V. E. Cole, salary	969.99
L. M. Brautlecht, "	870.00
J. P. Street, "	2,500.00
T. B. Osborne, "	2,400.00
E. M. Bailey, "	1,800.00
C. B. Morison, "	1,400.00
C. E. Shepard, "	1,025.00
G. L. Davis, "	666.66
W. E. Britton, "	2,500.00
G. P. Clinton, "	2,500.00
E. M. Stoddard, "	1,300.00
W. O. Filley, "	2,200.00
A. E. Moss, "	1,700.00
E. L. Ferry, "	1,320.00
H. F. Huber, "	1,291.67
D. F. Jones, "	1,500.00
H. Lange, "	925.00
V. L. Churchill, "	900.00
W. Veitch, "	700.00
E. L. Avery, "	480.00
E. B. Whittlesey, "	720.00
C. D. Hubbell, "	800.00
C. D. Hubbell	9.33
H. Kiley	748.00
W. Pokrob	231.00

G. Graham	$ 809.33
F. Sheldon	748.00
O. Welch	678.00
J. Leschke	530.00
Labor	4,369.91
Publications	953.58
Postage	274.53
Stationery	402.28
Telephone and Telegraph	187.88
Freight and Express	165.80
Gas, Kerosene and Electricity	791.97
Coal	1,704.60
Water	134.75
Chemicals and Laboratory Supplies	862.95
Agricultural and Horticultural Supplies	182.29
Miscellaneous Supplies	764.19
Fertilizers	674.01
Feeding Stuffs	310.78
Library and Periodicals	501.55
Tools, Machinery and Appliances	704.76
Furniture and Fixtures	680.84
Scientific Apparatus	65.46
Live Stock	2.10
Traveling by the Board	172.50
Traveling by the Staff	1,245.71
Gasoline for Automobiles	280.59
Traveling in connection with Adams Fund Investigations	126.93
Insurance	560.27
Insect Pest Appropriation to State Entomologist	3,750.00
Contingent	213.93
Lockwood Expense	400.00
New Buildings	533.19
Betterments	7.55
Repairs	370.09
Total Disbursements	$58,816.97
Balance on hand, Sept. 30, 1916 (Analysis Fees)	199.27
	$59,016.24

NEW HAVEN, CONN., Oct. 19, 1916.

THIS IS TO CERTIFY that we have audited the accounts of E. H. Jenkins, Treasurer of Connecticut Agricultural Experiment Station, for the fiscal year ending September 30, 1916, and have found them correct.

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

PART I.

Report on Commercial Fertilizers, 1916.

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

During 1916 forty-eight individuals and firms have entered for sale in this state 389 brands of fertilizers classified as follows:

Nitrogenous superphosphates with potash	181
Nitrogenous superphosphates without potash	125
Bone manures and tankage	33
Fish, blood, castor pomace and chemicals	50
Total	389

During the spring months V. L. Churchill, the sampling agent, visited 100 towns and villages of the state and gathered 537 samples of commercial fertilizers. These represented all the brands registered with the exception of the following:

American Agricultural Chemical Co.'s Dissolved Acid Phosphate, Dissolved Animal Bone, H. G. Ground Bone, H. G. Dried Blood, *Complete Tobacco Manure 1916, Bradley's Tobacco Manure 1916 (carbonate), East India Economizer Phosphate 1916, East India Roanoke Phosphate 1916, Williams and Clark's Royal Phosphate 1916, Williams and Clark's Matchless Fertilizer 1916, Williams and Clark's Utility Brand 1916; *Armour's* 4-8-1, Brewer's Special No. 2; *Coe-Mortimer's* 6-30 Tankage, Original Ammoniated Dissolved Phosphate 1916; *International* Buffalo Ammoniated Phosphate; †*James'* Ground Bone; *Lister's* Buyer's Choice Acid Phosphate, U. S. Superphosphate 1916, H. G. Special for Spring Crops 1916; *National* Nitrogen Phosphate Mixture No. 3; *Nitrate Agencies Co.'s* H. G. Acid Phosphate 14%, Dried Blood; *Olds and Whipple's* †Wood Ashes; *Royster's* Valley Tobacco Compound; *Spencer Bros.* †Castor Pomace; *Tennessee Coal*

*A purchaser's sample was analyzed.
†A manufacturer's sample was analyzed.

and Iron R. R.'s Duplex Basic Phosphate "AA"; *Worcester Rendering Co.'s* Royal Worcester Corn and Grain Fertilizer, Royal Worcester Potato and Vegetable Fertilizer; *Whitman and Pratt's* 2½-10, 3-8-1, 4-8-1, and 5-10. Of these it was therefore impossible to make analyses, except where the manufacturer had deposited a sample of the brand with the station, or where individuals 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	11
Dried blood	1
Horn and hoof wastes	3
Cotton seed meal	177
Castor pomace	19
2. Containing phosphoric acid as the chief active ingredient.	
Ground phosphate rock	4
Basic lime phosphate	2
Precipitated bone phosphate	14
Precipitated phosphate	1
Acid phosphate	18
3. Containing potash as the chief active ingredient:	
Muriate of potash	7
Sulphate of potash	1
Cotton hull ashes	2
Wood ash carbonate	1
4. Raw materials chiefly valuable for nitrogen and phosphoric acid:	
Fish manures	20
Tankage	16
Bone manures	29
5. Mixed fertilizers:	
Nitrogenous superphosphates with potash	202
Nitrogenous superphosphates without potash	128
Home-mixed fertilizers	2
6. Miscellaneous fertilizers and waste products:	
Sheep and goat manures	4
Wood ashes	29
Limestones and limes	13
Miscellaneous	42
Soils	82
Total	828

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 15.47 per cent of nitrogen, equivalent to 93.8 per cent of pure sodium nitrate.

The following eleven samples were analyzed:

7319. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Sampled at factory.

7367. Sold by Apothecaries Hall Co., Waterbury. Stock of C. A. Templeton, Waterbury.

7876. Sold by Coe-Mortimer Co., New York. Stock of W. R. Markham, Middletown.

7371. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of W. H. Burr, Westport.

7262. Sold by Nitrate Agencies Co., New York. Stock of C. R. Treat, Orange.

7292. Sold by Nitrate Agencies Co., New York. Stock of Spencer Bros., Suffield.

7375. Sold by Wilcox Fertilizer Co., Mystic. Stock of G. F. Stannard, Branford.

7287. Sold by American Agricultural Chemical Co., New York. Stock of Geo. S. Phelps and Co., Thompsonville.

7384. Sold by L. T. Frisbie Co., New Haven. Stock of Lightbourn and Pond Co., New Haven.

7267. Sold by L. T. Frisbie Co., New Haven. Sampled at Station Farm, Mt. Carmel.

7700. Old stock of Station.

ANALYSES OF NITRATE OF SODA.

Station No.	7319	7367	7876	7371	7262	7292
Per cent of						
Nitrogen guaranteed	15.00	15.00	15.00	14.80	15.00	15.00
Nitrogen found	15.64	15.28	15.64	15.52	15.40	15.44
Cost per ton	$72.50	72.00	75.00	75.00	75.00	79.00
Nitrogen costs cents per pound	**23.2**	**23.6**	**24.0**	**24.2**	**24.4**	**25.6**

Station No.	7375	7287	7384	7267	7700
Per cent of					
Nitrogen guaranteed	15.00	15.00	15.00	15.00	.....
Nitrogen found	15.04	15.52	15.52	15.68	15.52
Cost per ton	$78.00	85.00	90.00	.....	.....
Nitrogen costs cents per pound	**25.9**	**27.4**	**29.0**	.....	.....

The cost of nitrogen in nitrate of soda in small lots at retail has been about 24 1-2 cents per pound, 8 or 9 cents more than in the previous year. This is a rise of more than 50 per cent.

DRIED BLOOD.

Only one sample was analyzed.

7316. Sold by L. T. Frisbie Co., New Haven. Sampled at factory. Guaranteed 9.85, contained 9.78 per cent of nitrogen. It cost $60.00 per ton, the nitrogen costing 30.7 cents per pound.

HORN AND HOOF WASTES.

3000. Horn and Hoof Meal, sold by H. J. Baker and Bro., New York, contained 14.21 per cent of nitrogen.

7229. Horn Waste, sampled and sent by Mr. Warren, New Haven, contained 15.25 per cent of nitrogen.

7239. Horn Shavings, sold by Kane Button Co., Newtown, and sampled and sent by J. L. Mitchell, South Britain, contained 15.13 per cent of nitrogen.

Steamed Horn and Hoof Meal, like sample **3000**, is a fairly active form of nitrogen. The nitrogen in that sample is divided as follows:

As ammonia	0.41
Organic, water soluble	2.52
active insoluble	8.86
inactive insoluble	2.42
	14.21

The nitrogen of raw horn on the other hand is much less available.

COTTON SEED MEAL.

(*Analyses on pages 6 and 7.*)

One hundred and seventy-seven samples of this material, bought for use as a fertilizer, have been tested. Most of the samples represented car lots and in the aggregate indicate a cash outlay by Connecticut purchasers of about $170,000.

One hundred and four of the samples contained the full amount of nitrogen guaranteed and require no detailed report here. But seventy-three lots of meal, or 41 per cent of all the car lots brought into the state, of which we have record, did not contain as much nitrogen as was guaranteed.

The amount of deficiency was:

		Average Deficiency in Money Value per Ton.*
In 2 samples	One per cent or more	$4.59
" 5 "	0.75 to 1.00 per cent	3.44
" 17 "	0.50 " 0.75 "	2.30
" 30 "	0.25 " 0.50 "	1.44
" 18 "	0.10 " 0.25 "	0.62

In case the buyer, to whom the analyses are reported wherever this is possible, made a claim for rebate because the meal delivered was not what was guaranteed, an adjustment has not been refused to our knowledge and thus a good deal of money has been saved.

The following statement shows the number of samples failing to meet their guaranty which each of the firms named shipped into this state:

	Above Guaranty.	Below Guaranty.	Total.
Humphreys-Godwin Co.	51	28	79
Empire Cotton Oil Co.	15	8	23
Southern Cotton Oil Co.	5	5	10
Texas Cake and Linter Co.	11	10	21
F. M. Brode & Co.	0	12	12
Terrell Cotton Oil Co.	7	0	7

On the 89 samples which met their guaranty and of which the prices are given the average per cent of nitrogen is 6.65, ranging from 5.30, the only one below 6.07, to 7.11 and the average cost is $39.52.

Of the 62 samples which did not meet their guaranty and of which the prices are given the average per cent of nitrogen is 6.03, ranging from 4.97 to 7.30 and the average cost is $37.59.

Assuming 2.9 and 1.9 as the respective percentages of phosphoric acid and potash in cotton seed meal, if they are valued at 4 cents and 25 cents per pound respectively, the nitrogen of cotton seed meal would cost about 20.9 cents per pound.

* Reckoning nitrogen at 20.9 cents per pound.

COTTON SEED MEALS BELOW GUARANTY.

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled, or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	F. W. Brode & Co.				
7560	852	E. N. Austin	5.21	5.76	$34.00
7385		L. T. Frisbie Co.	6.12	6.50	.....
7575		C. K. Hale	5.74	6.50	38.00
7275		C. H. Hatheway	5.83	6.50	41.50
7442	No. 1	W. J. Hayes	5.74	6.17	37.00
7443	No. 2	" "	5.39	6.17	35.50
7006	38200	Holmes, Keeler & Kent Co.	6.11	6.50	.....
7597	93790	K. C. Kulle	6.57	7.00	33.00
7825	15994	" "	6.71	7.00	33.00
7826	24252	" "	6.84	7.00	33.00
7824	108894	" "	6.70	7.00	33.00
7574		W. J. Norton	5.68	6.50	37.50
	Empire Cotton Oil Co.				
6893	95519	American Sumatra Tobacco Co.	5.66	6.17	.....
6974	5946	" " " "	6.06	6.17	.....
6975	33193	" " " "	5.66	6.17	.....
6976	32674	" " " "	6.03	6.17	.....
6977	60477	" " " "	6.02	6.17	.....
7187	88884	" " " "	5.90	6.17	.....
7188	61786	" " " "	6.06	6.17	.....
7191	578560	" " " "	6.03	6.17	.....
	Humphreys-Godwin Co.				
7432		Berkshire Fertilizer Co.	4.97	6.50	36.00
7519	75184	A. W. Higgins	6.01	6.50	36.00
7572		S. H. Neelans	5.10	6.50	36.00
7311	65404	Geo. S. Phelps & Co.	5.56	6.50	39.50
7394	120570	" " "	5.55	6.50	38.00
7444	65404	" " "	5.49	6.50	39.50
7541	9355	E. S. Seymour	5.98	6.18	35.00
7399	48079	Spencer Bros.	5.26	6.50	38.00
7400	60167 x 11840	" "	5.96	6.18	37.75
7401	12856 x 14372	" "	5.95	6.18	37.75
7402	6868	" "	5.95	6.50	38.00
7404	19102 x 40429	" "	6.03	6.18	37.75
7406	142495	" "	5.95	6.18	37.75
7408	173444	" "	5.80	6.18	37.75
7411	132492	" "	5.15	6.50	36.00
7602	37132	" "	6.13	6.50	38.00
7608	145637	" "	5.78	6.18	35.00
7609	87212	" "	6.00	6.50	40.00
7610	108947	" "	5.84	6.18	35.00
7611	6896	" "	5.30	6.50	36.50
7613	120464	" "	6.05	6.18	37.75
7614	109947	" "	6.02	6.18	38.00
7615	96181	" "	6.14	6.50	38.00
7620	40218	" "	5.99	6.50	38.00
7621	22724	" "	5.80	6.18	35.00

COTTON SEED MEALS BELOW GUARANTY.—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled, or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co. *(Continued.)*				
7622	118024	Spencer Bros.	6.14	6.50	$40.00
7699	533876	James Sullivan	5.95	6.18	37.25
7754	7798	Griffin-Neuberger Tob. Co.	6.80	7.00	36.00
	Lanier Bros.				
7573		J. N. Lasbury	5.70	6.00	35.75
	Meech & Stoddard.				
7459		E. H. Rollins	6.11	6.50	37.00
7461		J. S. Dewey	6.08	6.50	37.00
	C. L. Montgomery & Co.				
7524	31654 x 18551 x 27802 x 87008 x 102771	L. T. Frisbie Co.	5.68	6.50	40.00
	W. C. Northern.				
7431		M. E. Thompson	5.88	6.24	38.00
	Olds & Whipple.				
7213	17448	L. B. Haas & Co.	7.29	7.82	46.08
7252	13394	" " "	7.28	7.82	42.92
7253	24398	" " "	7.30	7.82	42.97
	W. Newton Smith.				
6971		E. N. Austin	5.88	6.50	35.00
	J. E. Soper Co.				
6980		J. M. Bahr	6.01	6.50	40.00
	Southern Cotton Oil Co.				
7589	72226	Conn. Tobacco Corp.	6.01	6.18	34.25
7591	3701	" " "	5.82	6.18	34.25
7593	29444	" " "	6.07	6.18	34.25
7544	37638,	" " "	5.94	6.18	34.25
7546	151151	" " "	6.01	6.18	34.25
	Texas Cake and Linter Co.				
7418	54518	A. W. Camp	5.93	6.50	38.50
7261	504533	Conn. Tobacco Corp.	6.26	7.00	41.00
7260	3491	" " "	6.34	7.00	41.00
7596	104652	" " "	6.82	7.00	41.00
7268	16311	Griffin-Neuberger Tob. Co.	6.59	7.00	41.00
7395	123310	" " "	6.87	7.00	41.00
7753	1206	" " "	6.68	7.00	41.00
7276	29232	Geo. S. Phelps & Co.	6.12	6.50	38.00
7439	54518	Geo. T. Soule	5.80	6.50	40.00
7440	60072	" " "	6.06	6.50	39.00

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 nineteen samples were analyzed:

7013, 7019, 7021, 7022, 7028, 7029 and **7194.** Sold by G. S. Alexander and Co., New York. Sampled and sent by Connecticut Tobacco Corporation, Tariffville and Silver Lane. The respective car numbers were 64298, 10002, 46176, 210368, 67663, 112275 and 8606.

7289, 7330 and **7366.** Sold by Apothecaries Hall Co., Waterbury. Stock of Patrick McCue, Windsor Locks, K. C. Kulle, Suffield, and J. A. Marston, Wallingford, respectively.

7370, 7580 and **7582.** Sold by Baker Castor Oil Co., New York. Stock of Fred Thrall, Windsor, American Sumatra Tobacco Co. (Tariffville plant), and American Sumatra Tobacco Co. (So. Windsor plant), respectively.

7465. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of W. N. Pinney, Rockville.

7471. Sold by A. L. Koster, Suffield. Stock of S. B. Warner, Windsor.

7317 and **7579.** Sold by Olds and Whipple, Hartford. Sampled at factory and from stock of American Sumatra Tobacco Co. (Poquonock plant), respectively.

7243. English Castor Pomace. Sold, sampled and sent by Spencer Bros., Suffield.

7873. Sold by Wilcox Fertilizer Co., Mystic. Stock of C. B. Sikes, Jr., Ellington.

ANALYSES OF CASTOR POMACE.

Station No.	7013	7019	7021	7022	7028	7029	7194
Per cent of							
Nitrogen guaranteed	.....	.....	.....	.....	.....	.....	.....
Nitrogen found	6.62	6.01	6.55	6.14	6.42	6.00	5.87
Cost per ton	.....	.....	.....	.....	.....	.....	.....

Station No.	7289	7330	7366	7370	7580	7582	7465
Per cent of							
Nitrogen guaranteed	4.52	4.52	4.52	4.50	4.50	4.50	5.00
Nitrogen found	4.99	5.15	5.04	4.40	4.59	4.53	4.90
Cost per ton	$31.00	28.00	32.00	.....	26.00	26.00	30.00

Station No.	7471	7317	7579	7243	7873
Per cent of					
Nitrogen guaranteed	4.94	5.00	5.00	5.59	4.53
Nitrogen found	4.82	5.50	5.13	5.64	4.81
Cost per ton	$31.00	30.00	32.00	33.00	27.00

In sample **7370** one per cent of phosphoric acid and potash was also guaranteed; the sample contained 1.73 and 0.97 per cent, respectively.

There are two grades of castor pomace, one guaranteed 6.0 per cent, the other 4 1-2 per cent of nitrogen. If 4 cents per pound for phosphoric acid and 25 cents per pound for potash were assumed in valuation, the average cost of nitrogen in the higher grade pomace would be about 19.8 cents, in the lower grade 23.5 cents.

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

GROUND PHOSPHATE ROCK.

For the mixed farming which is most common in this state and on light soils containing little humus which constitute the larger part of our agricultural land, experiments indicate that soluble forms of phosphoric acid, acid phosphate, basic phosphate, ground bone, etc., are much more profitable to use than the much less soluble and available raw phosphates. This has been quite definitely settled by careful and long continued tests.

Whether on such of our soils as are relatively deficient in phosphoric acid and with short rotations the abundant use of lime with stable manure and green manures, which greatly increase the vegetable matter in the land, may make raw phosphates more profitable than the soluble phosphates in supplementing the phosphoric acid in the manure, is still an open question and can only be definitely determined by well-planned and long continued tests. The Connecticut stations are engaged in this work.

Three samples of finely ground phosphate rock ("floats") have been analyzed:

7415. Stock of Thomas Holt, Southington. Cost $9.00 per ton. It contained 29.80 per cent of phosphoric acid.

7433. Sold by Federal Chemical Co., Columbia, Tenn. Stock of C. M. Griffin, East Granby. Cost $9.00 per ton. It was guaranteed 29.75 and contained 31.48 per cent of phosphoric acid.

7874. Sold by American Agricultural Chemical Co., New York. Stock of Thomas Martin, Bridgeport. Cost $12.00 per ton. It was guaranteed 31.12 and contained 30.50 per cent of phosphoric acid.

SPURIOUS PHOSPHATE ROCK.

6841. This sample of alleged phosphate rock was sent by C. A. Peabody, Vernon. It was agriculturally worthless material containing only 0.22 per cent of phosphoric acid and 94.75 per cent of matter insoluble in acid (sand).

BASIC LIME PHOSPHATE.

Shipments of basic phosphate from abroad have been almost cut off on account of the European war. As a substitute for basic phosphate a product called "basic lime phosphate" has been put on the market, of which we have analyzed two samples.

7880. Basic Lime Phosphate. Sold by American Agricultural Chemical Co., New York. Stock of C. R. Main, Norwich. Cost $17.50 per ton. Guaranteed 13 per cent of "available" phosphoric acid. It contained 14.32 per cent total and 10.94 per cent "available" phosphoric acid, the latter costing 8.0 cents per pound.

7883. Basic Fruit and Legume Phosphate. Sold by Coe-Mortimer Co., New York. Stock of August Preli, So. Glastonbury. Cost $18.25 per ton. Guaranteed 13 per cent of "available" phosphoric acid. It contained 15.10 per cent total and 13.05 per cent "available" phosphoric acid, the latter costing 7 cents per pound.

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 solution and is quickly available to crops. It is at present chiefly used as a tobacco fertilizer.

Fourteen samples were analyzed, all of which were sold by Olds and Whipple, Hartford, and all but one of which were sampled and sent by the above firm; **7374** was sampled by the station agent from the jobber's stock. The samples were uniformly guaranteed 36 per cent "available" phosphoric acid.

The respective car numbers were as follows: 254639, 213797, none, 75653, 7393, 92416, 73930, 53525, 26006, 65605, 112, 4513, 9672 and 7222.

ANALYSES OF PRECIPITATED BONE.

Station No.	7217	7312	7374	7416	7434	7538	7655
Per cent of							
Water-soluble phosphoric acid	1.44	1.30	1.25	1.01	1.01	1.18	1.32
Citrate-soluble phosphoric acid	28.67	27.71	31.26	29.37	33.05	29.53	32.09
Citrate-insoluble phosphoric acid	9.81	11.17	8.05	4.86	8.80	10.57	8.49
Total phosphoric acid	39.92	40.18	40.56	35.24	42.86	41.28	41.90
"Available" phosphoric acid	30.11	29.01	32.51	30.38	34.06	30.71	33.41

Station No.	7714	7715	7808	7867	8210	8232	8242
Per cent of							
Water-soluble phosphoric acid	0.76	1.23	1.30	1.08	1.03	0.87	0.87
Citrate-soluble phosphoric acid	28.30	31.48	30.71	28.72	28.60	28.94	29.34
Citrate-insoluble phosphoric acid	4.62	7.25	9.57	7.20	11.81	8.15	8.89
Total phosphoric acid	33.68	39.96	41.58	37.00	41.44	37.96	39.10
"Available" phosphoric acid	29.06	32.71	32.01	29.80	29.63	29.81	30.21

The above samples sold for a uniform price of $1.33 1-3 per unit of "available" phosphoric acid, or 6.7 cents per pound.

PRECIPITATED PHOSPHATE.

7463. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of W. N. Pinney, Rockville. Cost $30.00 per ton. Guaranteed 22 per cent "available" phosphoric acid. It contained:

Water-soluble phosphoric acid	8.86
Citrate-soluble phosphoric acid	16.52
Citrate-insoluble phosphoric acid	0.72
Total phosphoric acid	26.10
"Available" phosphoric acid	25.38

Available phosphoric acid cost 5.9 cents per pound.

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 of lime 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 eighteen samples were analyzed:

7263. Sold by Nitrate Agencies Co., New York. Stock of C. R. Treat, Orange.

7373. Sold by Nitrate Agencies Co., New York. Stock of S. R. Macdonald, Wallingford.

7562. Sold by American Agricultural Chemical Co., New York. Stock of C. W. Hudson, Warehouse Point.

7462. Sold by American Agricultural Chemical Co., New York. Stock of F. O. Burr, Branford.

7294. Sold by Nitrate Agencies Co., New York. Stock of Spencer Bros., Suffield.

7565. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Sampled at factory.

7900. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of D. L. Clark and Sons, Milford.

7466. Soluble Phosphate. Sold by Bowker Fertilizer Co., New York. Stock of W. D. Grant, Willimantic.

7295. Sold by Nitrate Agencies Co., New York. Stock of The F. S. Platt Co., New Haven.

7467. High Grade Soluble Phosphate. Sold by Coe-Mortimer Co., New York. Stock of J. E. Stoddard, Abington.

7286. Sold by American Agricultural Chemical Co., New York. Stock of Blish Hardware Co., So. Manchester.

7266. Sold by L. T. Frisbie Co., New Haven. Stock of Station Farm, Mt. Carmel.

7288. Sold by Apothecaries Hall Co., Waterbury. Stock of Patrick McCue, Windsor Locks.

7318. Plain Superphosphate. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Stock of H. O. Chatfield, Seymour.

7468. Sold by Coe-Mortimer Co., New York. Stock of J. E. Stoddard, Abington.

7561. Sold by American Agricultural Chemical Co., New York. Stock of Fred Thrall, Windsor.

7570. Sold by Wilcox Fertilizer Co., Mystic. Sampled at factory.

7879. Sold by American Agricultural Chemical Co., New York. Stock of D. A. Doolittle, Bethany.

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.
7263	13.92	2.04	0.65	16.61	15.96	16.00	$18.00	*5.6
7373	14.74	1.79	0.23	16.76	16.53	16.00	18.50	5.6
7562	11.90	4.38	1.09	17.37	16.28	16.00	21.25	6.5
7462	16.64	1.65	0.37	18.66	18.29	18.00	24.50	6.7
7294	13.92	3.02	0.27	17.21	16.94	16.00	23.00	6.8
7565	14.20	2.67	0.43	17.30	16.87	16.00	23.00	6.8
7900	13.22	3.04	1.06	17.32	16.26	16.00	22.50	6.9
7466	9.05	5.21	0.61	14.87	14.26	14.00	20.50	7.2
7295	13.68	3.03	0.37	17.08	16.71	16.00	25.00	7.5
7467	9.64	4.92	0.52	15.08	14.56	14.00	22.00	7.6
7286	11.71	4.82	1.06	17.59	16.53	16.00	25.50	7.7
7266	15.68	1.14	0.13	16.95	16.82	16.00	.....	..
7288	12.72	2.34	0.61	15.67	15.06	14.00	.....	..
7318	13.44	2.76	0.49	16.69	16.20	14.00	.....	..
7468	11.66	4.65	0.74	17.05	16.31	16.00	22.50	6.9
7561	9.53	4.66	1.19	15.38	14.19	14.00	.....	..
7570	12.33	3.97	1.87	18.17	16.30	16.00	.....	..
7879	12.02	4.26	1.07	17.35	16.28	16.00	27.50	8.4

One of the above samples was of the highest grade, 18 per cent "available," twelve were guaranteed 16 per cent and five 14 per cent.

The average cost of available phosphoric acid in the samples here reported was 6.94 cents per pound.

* Mixed car lot.

III. RAW MATERIALS OF HIGH GRADE CONTAINING POTASH.

Owing to the European war very little, if any, potash has been shipped to this country during the past two years. All but two of the eight samples of potash salts analyzed during the past season represented stock in the hands of certain farmers of the state, who were tempted by the abnormally high prices to dispose of their surplus stock.

MURIATE OF POTASH.

7377. Stock of R. E. Banks, Fairfield; contained 61.08 per cent of potash.

7196. Stock of A. N. Farnham, Westville; contained 53.36 per cent of potash.

6866. Stock of C. E. Billin, Southbury; contained 49.32 per cent of potash.

6794. Stock of E. J. Wallace, Wallingford; contained 43.88 per cent of potash.

6827, 6829 and **6831.** Stock of W. A. Henry and Son, Wallingford; contained 50.80, 51.76 and 52.68 per cent of potash, respectively.

SULPHATE OF POTASH.

6830. Stock of W. A. Henry and Son, Wallingford, contained 51.56 per cent of potash.

COTTON HULL ASHES.

6843. Sampled and sent by Griffin-Neuberger Tobacco Co., North Bloomfield; contained 14.48 per cent of water-soluble potash.

6840. Sampled and sent by Olds and Whipple, Hartford; contained 20.34 per cent of moisture and 10.08 per cent of water-soluble potash.

WOOD ASH CARBONATE.

7313. Sampled and sent by Olds and Whipple, Hartford. Stock of Nich. Schug, Burnside. This is apparently the evaporated leachings of wood ashes.

Water	15.85
Ash	78.39
Organic matter	5.76
	100.00
Nitrogen	0.29
Phosphoric acid	0.10
Potash, total	45.58
" as muriate	9.39
" as sulphate	18.34
" as carbonate	17.85
Sulphuric anhydrid	15.59
Chlorin	7.07
Lime	0.77
Insoluble in acid	0.34

Wood ashes, another source of potash and lime, are discussed later in this report.

SECURITY POTASH TREATER DUST.

A sample of this material, **8250,** was sent by the Security Cement and Lime Co., Hagerstown, Md.

It is stated to be a by-product in the manufacture of cement. It is a fine powder and contains 7.56 per cent of water-soluble potash.

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

FISH MANURES.

(*Analyses on pp. 16 and 17.*)

In the table are given analyses of twenty samples of this material. There are two quite distinct products: one, and the most common, is dry ground fish with a guarantee of 8.24 per cent nitrogen and of 5.50 to 6.00 per cent of phosphoric acid, the other with a guaranty of 7.4 and 14 per cent of nitrogen and phosphoric acid, respectively. The latter is made, in part at least, from the waste of factories where edible fish are prepared for market. Samples **7315, 7877** and **7563** are of this class.

Only two samples failed to meet their guaranty: **7563,** sold by Apothecaries Hall Co., and **7502,** sold by the E. D. Chittenden Co. **7502** and **7501** were both certified as drawn from stock of R. C. Lasbury, Broad Brook, by W. H. Cook. One was sent

ANALYSES OF

Station.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station :	
7881	American Agr. Chem. Co.	H. S. Davis, New Haven.
7290	Apothecaries Hall Co.	P. McCue, Windsor Locks.
7563	Apothecaries Hall Co.	W. J. Norton, Broad Brook.
7291	Armour Fertilizer Works.	F. S. Bidwell & Co., Windsor Locks
7464	Berkshire Fertilizer Co.	W. N. Pinney, Rockville.
7875	E. D. Chittenden Co.	R. C. Lasbury, Broad Brook.
7564	E. D. Chittenden Co.	J. N. Lasbury, Broad Brook.
7315	L. T. Frisbie Co.	Factory
7469	A. L. Koster.	F. J. Hartz, Burnside.
7470	A. L. Koster.	S. B. Warner, Windsor.
7581	A. L. Koster.	Amer. Sum. Tob. Co., So. Windsor.
7877	Lowell Fertilizer Co.	T. J. Coleman, Warehouse Point.
7273	Olds & Whipple.	James Gamble, Thompsonville.
7296	Wilcox Fertilizer Co.	Spencer Bros., Suffield.
7567	Wilcox Fertilizer Co.	C. B. Sikes, Jr., Ellington.
7568	Wilcox Fertilizer Co.	C. K. Hale, Gildersleeve.
7569	Wilcox Fertilizer Co.	W. J. Norton, Broad Brook.
	Sampled by Purchaser :	
7502	E. D. Chittenden Co.	R. C. Lasbury, Broad Brook,
7501	E. D. Chittenden Co.	R. C. Lasbury, Broad Brook.
7331	Olds & Whipple.	K. C. Kulle, Suffield.

with a letter from E. P. Brewer, Silver Lane, and the other with a letter from R. C. Lasbury. Later two samples of the same brand, **7875** and **7564**, were drawn by the station agent, one from stock of R. C. Lasbury, the other from stock of J. N. Lasbury, both of which fully met the guaranty.

The average of all the analyses is 8.50 per cent of nitrogen and 8.24 per cent of phosphoric acid.

The average cost was $51.39 per ton. If the phosphoric acid were valued at 4 cents per pound, the nitrogen would cost 26.3 cents per pound.

If phosphoric acid were valued at 6 cents, the nitrogen would cost 24.4 cents.

TANKAGE.

(*Analyses on pp. 18 and 19.*)

This material, made from the waste of slaughter houses and meat markets, naturally shows considerable differences in composition, the nitrogen in the 16 samples here reported ranging from 2.68 to 7.46 per cent.

FISH MANURES.

Nitrogen.				Phosphoric Acid.			Total Phosphoric Acid.		Cost per ton.
As Ammonia.	As Organic.	Total found.	Total guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	
0.38	8.21	8.59	8.23	0.83	4.97	1.27	7.07	6.00	$55.31
0.20	9.40	9.60	8.20	0.58	6.10	1.28	7.96	5.50	52.00
0.15	7.47	7.62	8.20	0.53	7.57	3.66	11.76	5.50	52.00
0.35	8.05	8.40	8.22	0.29	6.19	2.60	9.08	6.87	49.00
0.22	8.03	8.25	8.23	0.45	5.13	1.01	6.59	6.00	52.00
0.24	8.06	8.30	8.23	0.58	3.52	1.25	5.35	6.00	50.00
0.28	8.04	8.32	8.23	0.51	3.82	1.00	5.33	6.00	50.00
0.14	7.56	7.70	7.41	0.48	9.91	4.32	14.71	14.00	50.00
0.31	8.28	8.59	8.23	0.44	7.83	0.24	8.51	6.00	52.00
0.32	8.23	8.55	8.23	0.23	7.92	0.29	8.44	6.00	54.00
0.34	8.23	8.57	8.23	1.11	6.86	0.59	8.56	6.00	50.00
0.16	7.36	7.52	7.41	0.66	8.53	5.23	14.42	14.00	54.00
0.15	8.48	8.63	7.40	0.48	5.13	1.55	7.16	5.50	52.00
0.22	8.84	9.06	8.24	0.58	5.61	1.61	7.80	6.00	52.00
0.21	8.88	9.09	8.24	2.34	3.96	1.70	8.00	6.00	50.50
0.22	9.03	9.25	8.24	0.82	5.61	1.27	7.70	6.00	50.00
0.22	8.64	8.86	8.24	0.77	6.46	1.39	8.62	6.00	52.00
0.54	6.76	7.30	8.23	0.48	2.96	0.95	4.39	6.00	50.00
0.14	8.95	9.09	8.23	0.48	4.03	1.77	6.28	6.00	50.00
...	...	9.36	7.40	0.72	4.89	1.55	7.16	5.50	51.00

Four samples fail to meet their nitrogen guaranty: **7365**, from American Agricultural Chemical Co., **7293** and **7372**, from Nitrate Agencies Co., and **7878**, from the F. S. Platt Co.

The Nitrate Agencies Co. made prompt reduction in the price, to cover the shortage in composition.

The average percentages of nitrogen and phosphoric acid in these samples were 5.38 and 12.92 respectively, and the average cost was $35.98.

Only four of these samples could be called fine, having 50 per cent or more of their weight in particles smaller than $\frac{1}{50}$ inch.

BONE MANURES.

(*Table of Analyses, pp. 20 and 21.*)

The analyses of twenty-nine samples of bone are given in the table, nineteen of them drawn by the station agent. "Bone,"

ANALYSES OF

Station No.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station:	
7365	American Agr. Chem. Co. (6–30)	Jos. Adams, Westport
7882	American Agr. Chem. Co. (9–20)	H. S. Davis, New Haven
7368	Apothecaries Hall Co.	Factory
7314	Conn. Fat Rendering Co.	Factory
7265	L. T. Frisbie Co.	Station Farm at Mt. Carmel
7884	L. T. Frisbie Co.	Factory
7472	Lister's Agr. Chem. Works (Celebrated Ground Bone and Tankage).	Paul Lauz, Rockville
7264	Nitrate Agencies Co.	C. R. Treat, Orange
7293	Nitrate Agencies Co.	Spencer Bros., Suffield
7372	Nitrate Agencies Co.	S. R. Macdonald, Wallingford
7878	F. S. Platt Co.	Factory
7566	C. M. Shay Fertilizer Co.	Knowles Lombard Co., Guilford
7571	Wilcox Fertilizer Co.	Factory
	Sampled by Purchaser:	
7417	Apothecaries Hall Co.	A. I. Fonda, Kensington
7506	Apothecaries Hall Co.	Keiser & Boasberg Plant., E. Windsor Hill
6842		E. N. Austin, Suffield

like tankage, has a wide range of composition, some samples being from raw bone with or without much adhering meat and cartilage, others representing bone which has been cooked, grease and nitrogenous matter being partially removed.

The average per cent of nitrogen in these samples is 3.09 and of phosphoric acid 23.71.

All the samples taken by the Station meet their guaranties of nitrogen. Two are deficient in phosphoric acid but the deficiency is more than made good in money value by an overrun in nitrogen.

APPROXIMATE COST OF NITROGEN, PHOSPHORIC ACID AND POTASH, SPRING OF 1916.

A review of the preceding analyses of raw materials and fertilizer chemicals shows the following approximate costs of

TANKAGE.

Nitrogen.				Phosphoric Acid.		Mechanical Analyses.		
As Ammonia.	As Organic.	Total found.	Total guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.
0.47	3.67	4.14	4.94	18.36	13.73	50	50	$36.00
0.26	7.11	7.37	7.41	13.50	9.15	47	53	48.31
0.34	4.80	5.14	4.94	10.94	7.00	45	55	36.00
0.04	3.73	3.77	3.00	21.17	20.00	61	39	26.00
0.17	7.59	7.76	7.41	10.23	9.15	43	57	.....
0.28	4.70	4.98	4.94	16.09	15.00	24	76	40.00
0.22	2.46	2.68	2.67	14.14	12.00	49	51	32.50
0.15	5.57	5.72	5.75	9.68	6.86	32	68	35.00*
0.18	5.02	5.20	5.75	8.12	6.86	40	60	39.00
0.25	5.12	5.37	5.75	8.76	6.86	53	47	35.00
0.38	6.61	6.99	7.28	11.39	9.80	49	51	42.00
0.14	4.02	4.16	....	9.12	.....	47	53	38.00
0.08	6.26	6.34	6.00	16.52	15.00	75	25	.....
....	....	5.52	4.94	7.48	7.00	45	55	35.00
....	....	4.63	2.47	19.83	22.88	42	58	30.00
....	....	6.32	....	10.84	.....	30	70	26.00

* Mixed car lot.

nitrogen, phosphoric acid and potash during the season of 1916 when bought in ton lots or less:

		Cents per pound.
Nitrogen in	nitrate of soda	24.5
	cotton seed meal	20.9
	castor pomace, 6 per cent	19.8
	castor pomace, 4½ per cent	23.5
	fish manures	24.4–26.3
Phosphoric acid, total, in	"floats"	1.5
	available "basic lime phosphate"	7.5
	" precipitated bone	6.7
	" acid phosphate	6.9

Potash. No potash salts have been on the market at prices which admitted of profitable use on the farm. Potash in ashes and in mixed fertilizers has been sold at $5.00 per unit or 25 cents per pound, nearly six times the price which prevailed just before the European war.

ANALYSES OF

Station No.	Manufacturer and Brand.	Dealer or Purchaser.
	Sampled by Station:	
7885	American Agr. Chem. Co., Fine Ground Bone.	Holmes, Keeler & Kent Co....
7369	Apothecaries Hall Co., Bone Meal	J. A. Martin .....
7886	Armour Fertilizer Works, Bone Meal.....	Kennedy Corporation .....
7887	Bowker Fertilizer Co., Fresh Ground Bone	Chas. Greenbacker.....
7888	Coe-Mortimer Co., Fine Ground Bone.....	J. P. Barstow & Co.....
7889	John C. Dow & Co., Pure Ground Bone.....	Norwich Grain Co.....
7890	L. T. Frisbie Co., Fine Bone Meal	Hitchcock Hardware Co.....
7891	International Agr. Corp., Buffalo Bone Meal...	Ansonia Flour & Grain Co.....
7893	Lister's Agr. Chem. Works, Bone Meal	Paul Lanz.....
7894	Lowell Fertilizer Co., Ground Steamed Bone ..	Geo. S. Phelps & Co. .....
7895	Nitrate Agencies Co., Ground Bone.....	M. C. Griffin .....
7896	Rogers & Hubbard Co., Hubbard's Knuckle Bone Flour.....	Factory .....
7897	Rogers & Hubbard Co., Hubbard's Strictly Pure Fine Bone.....	R. H. Hall .....
7898	Rogers & Hubbard Co., Rogers' Pure Raw Knuckle Bone Flour.....	Cadwell & Jones.....
7899	Rogers & Hubbard Co., Rogers' Strictly Pure Fine Bone.....	Factory .....
7901	Sanderson Fert. & Chem. Co., Fine Ground Bone.....	G. W. Thorpe .....
7903	C. M. Shay Fertilizer Co., Pure Ground Bone..	Factory .....
7902	M. L. Shoemaker & Co., Swift-Sure Bone Meal	Spencer Bros. .....
7904	Van Iderstine Co., Pure Ground Bone.....	E. B. Clark Co.....
	Sampled by Purchaser:	
6809	Florence Bone Mills, Bone Dust.....	J. B. Stewart .....
7010	L. T. Frisbie Co., Ground Bone (Car 65178)....	Connecticut Tobacco Corp.....
7011	L. T. Frisbie Co., Ground Bone (Car 71516)....	Connecticut Tobacco Corp.....
7012	L. T. Frisbie Co., Ground Bone (Car 90520)....	Connecticut Tobacco Corp.....
7018	L. T. Frisibe Co., Ground Bone (Car 62241)....	Connecticut Tobacco Corp.....
7020	L. T. Frisbie Co., Ground Bone (Car 504363)...	Connecticut Tobacco Corp.....
7023	L. T. Frisbie Co., Ground Bone (Car 218164)...	Connecticut Tobacco Corp.....
7892	E. L. James, Ground Bone	Factory .....
7437	Rogers & Hubbard Co., Hubbard's Strictly Pure Fine Bone.....	John Gotta .....
7032	Rogers & Hubbard Co., Steamed Bone	Factory .....

V. MIXED FERTILIZERS.

NITROGENOUS SUPERPHOSPHATES.

(*Analyses on pages 30 to 49.*)

The analyses of these fertilizers have been tabulated in two classes: those in which potash has been guaranteed, 202 in number, Table I, and those in which potash has not been guaranteed, of which there are 128, Table II.

In a considerable number of cases two or more analyses of a single brand have been made. This was done where the first

BONE MANURES.

Nitrogen.		Phosphoric Acid.		Mechanical Analysis.		
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.
2.85	2.47	25.56	22.82	52	48	$41.00
2.73	2.26	21.36	22.88	64	36	32.00
3.02	2.47	22.69	22.00	56	44	38.00
3.14	2.47	19.29	22.88	54	46	.....
2.55	2.47	24.72	22.88	65	35	38.00
2.04	2.00	23.90	24.00	58	42	37.00
3.59	2.46	23.00	23.00	63	37	38.00
2.52	2.50	22.69	22.00	55	45	37.00
3.15	2.47	24.33	23.00	48	52	39.00
2.64	2.46	25.92	23.00	66	34	36.00
2.57	2.46	23.51	22.88	50	50	37.00
3.93	3.82	25.94	24.70	91	9	43.00
3.90	3.50	23.33	20.00	39	61	35.00
3.88	3.82	26.66	24.70	71	29	46.00
3.70	3.50	21.44	20.00	58	42	34.00
2.54	2.47	24.66	20.00	59	41	38.00
2.50	2.06	27.33	20.00	66	34	35.00
5.53	4.53	23.56	20.00	70	30	41.00
2.05	2.00	29.55	27.00	39	61	35.00
4.06	....	23.53	.....	78	22	35.00
3.39	....	24.82	.....	53	47	.....
3.06	....	26.22	.....	60	40	.....
3.48	....	24.82	.....	43	57	.....
3.09	....	25.48	.....	55	45	.....
3.55	....	23.82	.....	41	59	.....
3.38	....	24.36	.....	53	47	.....
3.96	3.00	20.39	20.00	4	96	37.00
3.88	3.50	22.77	20.00	52	48	34.00
*	....	†28.03	.....	..	..	.....

* Not determined.
† 15.76% citrate-insoluble phosphoric acid.

analysis failed to show the guaranteed composition and the manufacturer requested that another sample be drawn and examined.

In a good many cases the manufacturer has asked for a portion of our sample to check our results, but in no case has there been essential disagreement between our results and those obtained elsewhere on the same samples.

Regarding Guaranties.

Of the 121 samples of nitrogenous superphosphates without potash sampled by the Station, 30, or 25 per cent, failed to meet their minimum guaranty of nitrogen or phosphoric acid. Nine were deficient in nitrogen and 21 in phosphoric acid. We are advised that the failure of the Rogers & Hubbard goods to meet their available phosphoric acid guaranty was due to a miscalculation of the solubility of the bone which was used. Of the 186 samples of nitrogenous superphosphates with potash, 62, or 33 per cent, failed in some particular to meet the minimum guaranteed composition. Fifteen were deficient in nitrogen, 5 in phosphoric acid, 30 in potash and 12 in both nitrogen and potash. Potash seemed to offer the greatest difficulty, some manufacturers apparently guaranteeing more potash than they were able, or cared, to furnish. Of 186 brands guaranteeing potash, 42, or 23 per cent, were deficient.

The following summaries show the firms whose brands failed to meet their guaranties in the ingredients indicated, deficiencies of not more than 0.10 per cent nitrogen, 0.30 per cent phosphoric acid and 0.15 per cent potash being disregarded in this connection.

A slight deficiency in one ingredient, if compensated by an excess of another, is of no great significance to the purchaser, though a large deficiency in one element may disarrange a calculation of the plant food to be supplied to a crop, which is vexatious and may result in loss.

More important therefore is the question whether these mixed fertilizers which fail in one or more particulars to meet their guaranty, do nevertheless supply an excess of the other ingredients sufficient to balance this failure.

It is not possible, in this year of high and quickly shifting prices of raw materials, when the prices which prevailed at the

	Number of brands analyzed.	Possible deficiencies.	No. of brands deficient in: Nitrogen.	Phosphoric acid.	Potash.	Nitrogen and potash.
Nitrogenous superphosphates with potash.						
Amer. Agr. Chem. Co.	58	174	1	1	14	5
Apothecaries Hall Co.	5	15	1	..	..	..
Armour	6	18	2	1	..	1
Bowker	16	48	1	..	4	3
Chittenden	5	15	1	..	..	..
Clark	1	3	..	..	..	1
Coe-Mortimer	9	27	2	..	1	..
International Agr. Corp.	5	15	1	..	2	..
Kirke	1	3	..	..	1	..
Lister	8	24	..	1	1	..
Mapes	8	24	1	..	..	..
National	14	42	..	1	7	2
Rogers & Hubbard	4	12	1	..	..	..
Royster	8	24	4	..	..	..
Virginia-Carolina Chem. Co.	9	27	..	1	..	..
Woodruff	1	3	..	..	1	..
Other manufacturers	28	84	..	..	..	..
Totals	186	558	15	5	31	12
Nitrogenous superphosphates without potash.						
Atlantic Packing Co.	5	10	1	..	..	..
Bowker	7	14	1	1	..	..
Chittenden	2	4	..	1	..	..
Clark	2	4	..	1	..	..
Essex	4	8	2	..	..	..
Mapes	2	4	..	1	..	..
Parmenter & Polsey	5	10	..	1	..	..
Rogers & Hubbard*	12	23	..	8	..	..
Royster	6	12	2	1	..	..
Sanderson	3	6	1	1	..	..
Shay	3	6	..	3	..	..
Virginia-Carolina Chem. Co.	4	8	1	1	..	..
Wilcox	7	14	1	2	..	..
Other manufacturers	59	118	..	..	..	..
Totals	121	242	9	21	0	0
Totals for all nitrogenous superphosphates	307	800	24	26	31	12

* See notice on page 22.

time of manufacture may have been very different from those quoted at the time of sale to farmers, to establish any very accurate schedule of valuations.

We have assumed for the following comparison 25 cents per pound for both nitrogen and potash and 6 cents per pound for phosphoric acid.

The following statement includes those brands in which the deficiency of one or more ingredients was not made up in money value by an overrun of others.

NITROGENOUS SUPERPHOSPHATES CONTAINING POTASH IN WHICH A FAILURE TO MEET THE GUARANTY IN ONE INGREDIENT WAS NOT MADE GOOD BY AN OVERRUN IN OTHER INGREDIENTS.

No.	Brand.	Relation to Guaranty. Available Nitrogen.	Phos. Acid.	Potash.
	American Agr. Chem. Co.:			
*7346	Sure Growth Phosphate, 1916	—0.56	+1.74	—0.38
*7449	Top Dresser, 1916	—0.28	+1.10	—0.34
7760	East India Corn King, 1916	—0.11	+1.80	—0.65
*7761	" " Potato and Garden Manure	—0.91	+1.92	—0.87
*7457	Great Eastern Garden Special	—0.29	+0.86	—0.14
7827	" " Potato Manure	—0.04	+0.48	—0.15
7762	Packers' Union Potato Manure, 1916	—0.14	+0.95	—0.21
7771	Williams & Clark's Elk Brand	+0.08	+0.32	—0.22
	Armour Fertilizer Works:			
7780	Wheat, Corn and Oats Special	—0.12	—0.23	—0.20
7306	3-8-1	—0.15	—0.10	+0.02
	Bowker Fertilizer Co.:			
*7636	Complete Alkaline Tobacco Grower	—0.47	+1.46	—0.17
	E. B. Clark Seed Co.:			
7483	Special Mixture	—0.19	+0.39	—0.29
	The Coe-Mortimer Co.:			
*7790	Universal Fertilizer, 1916	—0.37	+1.52	—0.13
	International Agricultural Corporation:			
7830	Buffalo Economy	+0.16	—0.26	—0.76
8218	" "	+0.22	+0.90	—0.83
	National Fertilizer Co.:			
*7685	Complete Root and Grain Fertilizer, 1916	—0.75	+2.59	—0.22
*7686	Eureka Potato Fertilizer, 1916	—0.11	+0.93	—0.19

* A second analysis on stock from another place had no deficiency in money value.

No.	Brand.	Relation to Guaranty. Available Nitrogen.	Phos. Acid.	Potash.
	Royster Guano Co.:			
7720	Defender Fertilizer	—0.31	+0.32	+0.12
7721	Pipe of Peace Tobacco Fertilizer	—0.52	+0.22	+0.20

NITROGENOUS SUPERPHOSPHATES WITHOUT POTASH.

	Bowker Fertilizer Co.:			
7426	Superphosphate with 5% Ammonia	—0.31	+0.53	
	Rogers & Hubbard Co.:			
7656	Hubbard's Bone Base Corn and General Crops	+0.02	—0.62	
7659	Rogers H. G. Oats & Top Dressing	+0.02	—1.32	
7660	" " Corn and Onion	—0.07	—0.94	
7661	" " Soluble Tobacco	+0.24	—2.85	
	F. S. Royster Guano Co.:			
7664	Curfew Ammoniated Superphosphates	—0.31	+0.56	
7857	" " "	—0.15	+0.24	
	Virginia-Carolina Chemical Co.:			
8213	H. G. Corn and Vegetable Compound	—0.20	—0.04	

QUALITY OF THE PLANT FOOD IN NITROGENOUS SUPERPHOSPHATES.

The potash reported in the table of analyses is all water-soluble and doubtless readily available to crops.

The amounts of phosphoric acid soluble in water and in ammonium citrate solution, as well as the total amount present in each fertilizer, are given in the table. The water-soluble phosphoric acid speedily becomes insoluble in water after it goes into the soil, but it probably is distributed somewhat more widely in the soil than insoluble forms and is more readily available to crops. The sum of the "citrate-soluble" and the water-soluble phosphoric acid is called in the trade "available." It must be remembered, however, that "available" in the trade is not necessarily "available" on the land. Doubtless the water-soluble and citrate-soluble are in general much more quickly used by crops than the phosphoric acid which is insoluble in these media, but there are probably very considerable differences in the agricultural value of citrate-soluble phosphoric acid from various sources.

The same is true of the "insoluble" phosphoric acid. Where bone is used as the chief or only source of phosphoric acid, from 30 to 60 per cent of it may be classed as "insoluble," but experiments show that the phosphoric acid of bone is much more readily available to crops than that of phosphate rock. In buying mixed fertilizers, however, it is safest to give preference to those in which the amount of insoluble phosphoric acid is relatively small.

In 307 samples tested this year the average per cent of the total phosphoric acid which was insoluble was 14.6. In 24 cases more than 30 per cent was insoluble and in one or two cases 60 per cent. No evidence has been found of the presence of raw rock phosphate in significant amount.

Of more importance is the quality of the organic nitrogen. Its solubility has been tested and where it proved to be low by one method, a second method has been used to confirm the finding.

The detail and merits of the alkaline permanganate and neutral permanganate methods have been explained in previous reports. By the former, any form of organic nitrogen is considered inferior in which less than 50 per cent of the water-insoluble organic nitrogen is soluble in permanganate, by the latter any solubility less than 85 is suspicious.

This year only six fertilizers have been found in which a part of the organic nitrogen appears to be inferior. The detail of the nitrogen examination appears in the table on page 27.

In certain fertilizers peat or some other "conditioner" which contains inactive nitrogen is used to keep the mixture in soft, drillable condition and prevent caking in the bags. Such a practice is not objectionable if the *guaranteed* amount of nitrogen is present in available form; that is, without counting the inferior nitrogen of the "conditioner."

	Required.	Found.
In Armour's Wheat, Corn & Oats the corresponding figures are	0.74	0.37
" " 2-8-1 " " " "	1.47	0.94
" Mapes' Cereal Brand " " " "	0.45	0.43
" " General Crop " " " "	0.63	0.37
" " Corn Manure " " " "	0.80	0.60
" Woodruff's Home Mixture " " " "	1.90	1.53

The amounts of soluble nitrogen required to meet the guaranty and the amounts actually found in the samples are given below.

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.
7779	Armour's 2-8-1.....	1.37	0.65	0.29	0.43	40.0	0.56	0.16	78.0
7780	Armour's Wheat, Corn and Oats Special.....	0.62	0.22	0.15	0.25	38.0	0.24	0.16	59.0
7512	Mapes' Cereal Brand	0.83	0.15	0.28	0.40	41.2	0.45	0.23	66.0
7513	Mapes' General Crop.....	0.79	0.09	0.28	0.42	40.4	0.45	0.25	64.0
7309	Mapes' Corn Manure	1.10	0.23	0.37	0.50	42.6	0.64	0.23	73.0
7849	Woodruff's Home Mixture	2.27	1.07	0.46	0.74	38.0	1.00	0.20	83.0

Samples Needing Special Notice.

Four samples were sent, labeled "Complete Tobacco Fertilizer," with no certificate as to where or how the samples were taken and how much stock was represented.

Through an oversight they were given to the chemist for analysis. The Station will not examine samples until it has assurance that they fairly represent the stock from which they are taken, and that in the public interest full information has been given regarding them. If the sender cannot trust the Station with these facts, which are necessary to make the analyses of any general interest and value, he certainly should not trust the accuracy of its analyses.

	8235	8236	8237	8238
Nitrogen	5.42	6.13	6.00	5.34
Phosphoric acid	5.50	1.56	1.51	5.51
Potash	0.70	1.22	1.24	0.62

Regarding Prices of Nitrogenous Superphosphates.

The prices given are those quoted by the retailer to the Station agent as the cash ton prices.

The manufacturer has little if any control over these prices. The retail dealer naturally fixes a price which he believes will yield him the largest profit on the season's sales. In a few cases less is charged than the manufacturer deems should be, but in many cases the price quoted to the Station is considerably higher than what the manufacturer thinks would yield a fair profit to the retail seller. The following table illustrates these differences in prices quoted for goods which have the same guaranty. The first figure in the guaranty is the per cent. of ammonia, the second available phosphoric acid and the third potash.

Guaranty	Average	Highest	Lowest
1 – 8–1	30.18	38	28
1 –10–1	32.00	36	30
2 – 9–1	31.90	35	29
2 –10–1	32.77	36	30
2½– 8–1	33.00	33	32
2½–10–1	34.93	37	32
3 – 8–1	36.33	39	34
3 – 9–1	35.91	39	32.50

Guaranty	Average	Highest	Lowest
4 – 9–1	37.50	42	37
5 – 4–1	38.53	41	35.50
5 – 8–1	41.42	50	37
5½– 3–1	38.20	41	36

In many cases the guaranties of a considerable number of brands differ only in the percentage of phosphoric acid or of potash. From these it is therefore possible to calculate the retail cost of a pound of potash or of available phosphoric acid.

A considerable number of such calculations show that *at the prices quoted by retailers of* fertilizers, a pound of available phosphoric acid has cost 4.75 cents on the average with extremes of 1.55 and 8.9 cents. The average cost of a pound of potash has been 27.7 cents and the extremes 16 and 51.5 cents.

HOME MIXTURES.

Only two samples of home mixed fertilizers were sent for analysis this year, as follows:

7332. Potato Fertilizer. Mixed, sampled and sent by Charles R. Treat, Orange. The formula called for 4 per cent ammonia, 10 per cent phosphoric acid and 4 per cent potash.

7364. Mixed by J. G. Schwink, Meriden. Sampled by station agent.

Station No.	7332	7364
Per cent of		
Nitrogen as nitrates	1.66	4.93
" as ammonia	0.06	0.17
" as organic	1.75	0.36
" total	3.47	5.46
Phosphoric acid, water-soluble	8.11	8.41
" " citrate-soluble	2.64	2.33
" " citrate-insoluble	0.96	0.33
" " total	11.71	11.07
Potash as muriate	4.89	.....

TABLE I.—NITROGENOUS SUPERPHOSPHATES WITH POTASH.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-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. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent:																			
	American Agricultural Chemical Co., New York City.																			
7448	Complete Manure for Top Dressing 1916	Branford	$40.00	....	2.12	0.83	1.38	4.33	4.11	4.75	3.28	2.28	10.31	9.0	8.03	8.0	1.00	1.00	1.0	7448
7447	Odorless Grass and Lawn Top Dressing 1916	Norwalk	40.00	2.15	0.86	0.04	0.98	4.03	3.70	5.09	3.74	0.51	9.34	9.0	8.83	8.0	0.78	0.78	1.0	7447
7346	Sure Growth Phosphate 1916	Glastonbury	35.00	....	0.79	0.51	0.61	1.91	2.47	7.10	3.64	1.16	11.90	10.0	10.74	9.0	0.35	0.62	1.0	7346
7702	Sure Growth Phosphate 1916	Thompsonville	36.00	0.06	1.01	0.58	1.05	2.70	2.47	6.94	2.63	0.69	10.26	10.0	9.57	9.0	0.95	0.95	1.0	7702
7449	Top Dresser 1916	Stamford	42.00	2.01	1.00	0.04	0.78	3.83	4.11	3.98	5.12	0.69	9.79	9.0	9.10	8.0	0.35	0.66	1.0	7449
7810	Top Dresser 1916	Forestville	42.00	2.27	1.21	0.17	0.85	4.50	4.11	3.70	4.92	0.92	9.54	9.0	8.62	8.0	0.33	0.68	1.0	7810
7757	5½-3-1 for Tobacco	East Granby	40.75	0.60	0.16	0.51	3.44	4.71	4.53	1.71	2.52	0.64	4.87	4.0	4.23	3.0	0.31	0.99	1.0	7757
7816	Bradley's B. D. Sea Fowl Guano 1916	Avon	30.00	0.16	0.20	0.24	0.71	1.31	0.82	6.89	4.60	1.25	12.74	11.0	11.49	10.0	0.87	0.87	1.0	7816
7453	Bradley's Complete Manure for Potatoes and Vegetables 1916	Norwalk	40.00	0.13	1.49	0.85	0.95	3.42	3.29	6.62	2.95	0.79	10.36	10.0	9.57	9.0	0.96	0.96	1.0	7453
7454	Bradley's Complete Manure for Top Dressing, Grass and Grain 1916	Norwich	40.00	1.02	1.70	0.37	0.95	4.04	4.11	3.94	5.04	1.32	10.30	9.0	8.98	8.0	1.01	1.01	1.0	7454
7528	Bradley's Corn Phosphate 1916	Sterling	33.00	0.70	0.54	0.12	0.60	1.96	1.65	5.08	4.81	1.07	10.96	11.0	9.89	10.0	0.98	0.98	1.0	7528
7451	Bradley's Eclipse Phosphate 1916	Sterling	33.00	0.43	0.45	0.10	0.43	1.41	1.23	4.66	5.22	0.74	10.62	11.0	9.88	10.0	0.98	0.98	1.0	7451
7759	Bradley's Half Century Fertilizer 1916	Canaan	35.00	0.76	0.84	0.36	0.58	2.54	2.06	4.62	4.59	0.87	10.08	11.0	9.21	10.0	0.71	1.00	1.0	7759
8215	Bradley's Half Century Fertilizer 1916	East Granby	32.50	0.18	0.80	0.22	0.88	2.08	2.06	7.91	3.77	0.93	12.61	11.0	11.68	10.0	0.20	1.26	1.0	8215
7758	Bradley's New Method Fertilizer 1916	Wallingford	25.00	0.20	0.22	0.37	0.29	1.08	0.82	3.46	5.71	0.87	10.04	9.0	9.17	8.0	0.99	0.99	1.0	7758
7305	Bradley's Patent Superphosphate 1916	Thompsonville	34.00	....	0.61	0.59	0.91	2.11	2.06	6.10	3.03	1.23	10.36	9.0	9.13	8.0	0.56	0.89	1.0	7305
7452	Bradley's Potato Fertilizer 1916	South Coventry	33.00	0.77	0.61	0.33	0.57	2.28	2.06	4.27	4.34	0.79	9.40	9.0	8.61	8.0	1.09	1.09	1.0	7452
7348	Bradley's Potato Manure 1916	Suffield	36.00	0.60	0.24	1.08	0.70	2.62	2.47	5.90	4.27	0.90	11.07	10.0	10.17	9.0	0.87	0.87	1.0	7348
7450	Bradley's Special Niagara Phosphate	Danielson	31.00	0.21	0.26	0.41	0.25	1.13	0.82	3.55	5.85	0.96	10.36	9.0	9.40	8.0	0.85	0.85	1.0	7450
7347	Bradley's Unicorn 1916	Glastonbury	35.00	0.35	0.11	0.74	0.62	1.82	1.65	5.95	4.16	1.15	11.26	10.0	10.11	9.0	0.88	0.88	1.0	7347
7630	Bradley's Tobacco Manure 1916	Glastonbury	38.50	0.89	0.06	0.14	3.36	4.45	4.53	1.42	2.47	0.29	4.18	4.0	3.89	3.0	0.23	0.91	1.0	7630
7760	East India Corn King 1916	Burnside	32.50	0.13	1.07	0.40	0.76	2.36	2.47	7.47	3.33	1.11	11.91	10.0	10.80	9.0	0.05	0.35	1.0	7760
7455	East India Mayflower 1916	Burnside	30.50	0.40	0.11	0.70	0.58	1.79	1.65	6.00	3.90	1.04	10.94	10.0	9.90	9.0	0.85	0.85	1.0	7455
7868	East India Pilgrim Fertilizer 1916	Branford	30.00	0.08	0.04	0.46	0.40	0.98	0.82	7.49	3.60	1.47	12.56	11.0	11.09	10.0	0.16	0.64	1.0	7868
7761	East India Potato and Garden Manure	Burnside	37.50	....	1.04	0.53	0.81	2.38	3.29	7.63	3.29	1.09	12.01	10.0	10.92	9.0	0.13	0.13	1.0	7761
7869	East India Potato and Garden Manure	Ansonia	42.00	1.54	0.17	0.86	0.91	3.48	3.29	5.92	3.38	0.81	10.11	10.0	9.30	9.0	0.93	0.93	1.0	7869
7631	East India Tobacco Special 1916	Burnside	36.75	0.86	0.06	0.11	3.48	4.51	4.53	1.58	2.19	0.26	4.03	4.0	3.77	3.0	0.24	0.91	1.0	7631
7349	East India Unexcelled Fertilizer 1916	Southport	32.00	....	0.66	0.53	0.86	2.05	2.06	5.52	3.90	1.01	10.43	9.0	9.42	8.0	0.91	0.91	1.0	7349
7457	Great Eastern Garden Special 1916	Bloomfield	37.00	...	1.36	0.54	1.10	3.00	3.29	5.81	4.05	1.14	11.00	10.0	9.86	9.0	0.86	0.86	1.0	7457
7703	Great Eastern Garden Special 1916	Granby	38.00	0.18	1.64	0.37	1.16	3.35	3.29	5.87	3.86	1.16	10.89	10.0	9.73	9.0	0.95	0.95	1.0	7703
7456	Great Eastern General 1916	East Hampton	31.00	0.70	0.33	0.10	0.87	2.00	0.82	3.41	5.79	1.10	10.30	9.0	9.20	8.0	0.74	0.74	1.0	7456
7814	Great Eastern General 1916	Bloomfield	38.00	....	0.14	0.22	0.63	0.99	0.82	4.82	4.75	1.47	11.04	9.0	9.57	8.0	0.64	0.64	1.0	7814
7828	Great Eastern Northern Corn Special 1916	Hotchkissville	33.00	....	1.03	0.64	1.08	2.75	2.06	5.81	3.20	1.28	10.29	9.0	9.01	8.0	0.91	0.91	1.0	7828
7827	Great Eastern Potato Manure 1916	Hotchkissville	34.00	....	0.76	0.47	0.79	2.02	2.06	6.79	3.69	1.14	11.62	11.0	10.48	10.0	0.85	0.85	1.0	7827
7529	Packers' Union Animal Corn Fertilizer	Forestville	31.00	0.13	0.44	0.32	0.78	1.67	1.65	6.92	3.32	1.13	11.37	11.0	10.24	10.0	0.90	0.90	1.0	7529
7762	Packers' Union Potato Manure 1916	Forestville	32.00	0.62	0.15	0.47	0.68	1.92	2.06	7.68	3.27	1.56	12.51	11.0	10.95	10.0	0.16	0.79	1.0	7762
7530	Quinnipiac Ammoniated Dissolved Bone 1916	Branford	31.00	0.24	0.22	0.88	0.60	1.94	1.65	5.41	4.50	1.71	11.62	10.0	9.91	9.0	0.74	0.74	1.0	7530
7764	Quinnipiac "B" Fertilizer 1916	Terryville	33.00	....	0.76	0.37	0.83	1.96	1.23	6.96	3.73	0.87	11.56	11.0	10.69	10.0	0.78	0.78	1.0	7764
7763	Quinnipiac Climax Phosphate 1916	Milford	31.00	....	0.10	0.16	0.58	0.84	0.82	4.90	4.45	1.32	10.67	9.0	9.35	8.0	0.71	0.71	1.0	7763
8225	Quinnipiac Climax Phosphate 1916	Shelton	34.00	0.18	0.24	0.83		1.25	0.82	3.29	5.56	0.87	9.72	9.0	8.85	8.0	0.51	0.78	1.0	8225
7531	Quinnipiac Corn Manure 1916	New London	36.00	0.63	0.47	0.26	0.52	1.88	1.65	4.14	5.83	1.25	11.22	11.0	9.97	10.0	1.33	1.33	1.0	7531
7767	Quinnipiac Fish and Potash Mixture 1916	Hazardville	33.75	....	0.70	1.02	0.96	2.68	2.47	5.40	4.31	1.23	10.94	10.0	9.71	9.0	0.80	0.80	1.0	7767

TABLE I.—NITROGENOUS SUPERPHOSPHATES WITH POTASH—(*Continued*).

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-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. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent:																			
	American Agricultural Chemical Co., New York City. (*Continued.*)																			
7532	Quinnipiac Market Garden Manure 1916	North Stonington	$38.50	2.22	0.20	0.31	0.77	3.50	3.29	4.92	4.17	1.14	10.23	10.0	9.09	9.0	0.94	0.94	1.0	7532
7766	Quinnipiac Phosphate 1916	New London	39.00	0.82	0.76	0.27	0.77	2.62	2.47	4.39	4.97	1.27	10.63	10.0	9.36	9.0	1.03	1.03	1.0	7766
7765	Quinnipiac Potato Phosphate 1916	Branford	32.00	....	0.66	0.64	0.76	2.06	2.06	5.37	3.94	1.56	10.87	9.0	9.31	8.0	0.48	0.75	1.0	7765
8226	Quinnipiac Potato Phosphate 1916	Shelton	35.00	0.76	0.62	0.84		2.22	2.06	4.07	4.47	1.00	9.54	9.0	8.54	8.0	0.85	0.85	1.0	8226
7632	Quinnipiac Wrapper Leaf Brand Tobacco Manure 1916	Windsor	36.75	0.91	0.06	0.07	3.50	4.54	4.53	1.65	2.51	0.56	4.72	4.0	4.16	3.0	0.20	1.06	1.0	7632
7533	Wheeler's Corn Fertilizer 1916	Bloomfield	30.00	....	0.74	0.38	0.71	1.83	1.65	6.99	4.62	1.43	13.04	11.0	11.61	10.0	0.45	0.82	1.0	7533
7769	Wheeler's Corn Fertilizer 1916	Hartford	30.00	....	0.82	0.35	0.87	2.04	1.65	6.65	3.77	1.11	11.53	11.0	10.42	10.0	1.07	1.07	1.0	7769
7770	Wheeler's Cuban Tobacco Grower 1916	Hartford	37.00	1.15	0.09	0.35	3.37	4.96	4.53	1.24	2.66	0.41	4.31	4.0	3.90	3.0	0.31	1.22	1.0	7770
7768	Wheeler's Potato Manure 1916	Bloomfield	32.00	0.72	0.18	0.44	0.71	2.05	2.06	7.56	3.07	1.37	12.00	11.0	10.63	10.0	0.31	0.86	1.0	7768
7535	Williams and Clark's Americus Corn Phosphate 1916	Ellington	33.50	0.69	0.36	0.30	0.51	1.86	1.65	5.40	4.94	1.51	11.85	11.0	10.34	10.0	1.05	1.05	1.0	7535
7772	Williams and Clark's Americus H. G. Special for Potatoes and Root Crops 1916	Milford	40.00	....	1.36	1.04	1.18	3.58	3.29	6.70	2.70	1.10	10.50	10.0	9.40	9.0	1.00	1.00	1.0	7772
7536	Williams and Clark's Americus Potato Manure 1916.	Clark's Corner	.....	0.74	0.65	0.29	0.64	2.32	2.06	4.41	4.58	0.96	9.95	9.0	8.99	8.0	0.95	0.95	1.0	7536
7771	Williams and Clark's Elk Brand 1916	Waterbury	36.00	....	0.05	0.47	0.38	0.90	0.82	7.05	3.27	1.85	12.17	11.0	10.32	10.0	0.31	0.78	1.0	7771
7773	Williams and Clark's Meadow Queen Fertilizer 1916.	Milford	37.00	....	0.62	1.12	0.90	2.64	2.47	6.22	3.69	1.16	11.07	10.0	9.91	9.0	0.88	0.88	1.0	7773
7774	Williams and Clark's Seed Leaf Tobacco Manure 1916	South Manchester	39.00	0.86	0.06	0.03	3.83	4.78	4.53	1.59	2.66	0.55	4.80	4.0	4.25	3.0	0.16	1.09	1.0	7774
7534	Williams and Clark's Special Prolific Crop Producer	Milford	30.00	....	0.04	0.49	0.39	0.92	0.82	5.09	3.72	1.82	10.63	9.0	8.81	8.0	0.36	0.72	1.0	7534
	Apothecaries Hall Co., Waterbury, Conn.																			
7777	Victor Fish and Potash for Corn	Windsorville	34.00	0.05	0.27	0.19	1.15	1.66	1.65	6.60	2.81	1.20	10.61	9.0	9.41	8.0	0.35	1.05	1.0	7777
7633	Victor Potato and Vegetable Special, 1% Potash	Plantsville	36.00	0.75	0.10	0.45	1.32	2.62	2.47	5.21	3.76	1.64	10.61	9.0	8.97	8.0	0.27	1.11	1.0	7633
7775	Victor Potato and Vegetable Special, 2% Potash	Waterbury	38.00	0.90	0.12	0.43	1.12	2.57	2.47	4.73	4.70	1.02	10.45	9.0	9.43	8.0	0.71	2.10	2.0	7775
7634	Victor Tobacco Special	Windsorville	40.00	0.92	1.92	0.08	1.11	4.03	4.12	4.54	0.88	0.59	6.01	5.0	5.42	4.0	0.23	1.00	1.0	7634
7776	Victor Top Dresser for Grass and Grain	Waterbury	45.60	3.22	0.10	0.59	1.61	5.52	5.76	3.56	3.29	1.61	8.46	6.0	6.85	5.0	0.48	2.12	1.0	7776
	Armour Fertilizer Works, Baltimore, Md.																			
7307	Bidwell's 3-8-1	Windsor Locks	34.00	0.99	0.03	0.13	1.31	2.46	2.47	6.77	1.94	0.37	9.08	8.5	8.71	8.0	0.36	0.87	1.0	7307
7778	Fish and Potash No. 2	Danielson	33.00	0.19	0.65	0.17	1.07	2.08	2.06	6.16	1.96	0.81	8.93	8.5	8.12	8.0	1.01	1.01	1.0	7778
7635	Special Tobacco Grower No. 1	Hazardville	40.00	0.89	0.11	0.11	2.87	3.98	4.11	3.55	1.84	0.43	5.82	4.5	5.39	4.0	0.11	1.12	1.0	7635
7780	Wheat, Corn and Oats Special	Danielson	28.00	0.06	0.02	0.22	0.40	0.70	0.82	5.07	1.70	0.47	7.24	7.5	6.77	7.0	0.80	0.80	1.0	7780
7779	2-8-1	Hazardville	33.00	0.05	0.13	0.65	0.72	1.55	1.65	4.58	3.04	0.81	8.43	8.5	7.62	8.0	0.99	0.99	1.0	7779
7306	3-8-1	Thompsonville	35.00	....	1.05	0.27	1.00	2.32	2.47	4.99	2.91	0.54	8.44	8.5	7.90	8.0	1.02	1.02	1.0	7306
	Berkshire Fertilizer Co., Bridgeport, Conn.																			
7474	Complete Fertilizer	Granby	42.50	0.96	0.05	0.25	1.62	2.88	2.50	7.41	1.97	0.47	9.85	9.0	9.38	8.0	0.89	2.97	2.0	7474
7781	Tobacco Special	Suffield	50.00	1.16	0.02	1.47	2.53	5.18	4.50	0.69	3.11	0.29	4.09	4.0	3.80	3.0	0.40	2.06	2.0	7781
	Bowker Fertilizer Co., New York City.																			
7475	All Round Fertilizer 1916	Yalesville	37.00	1.11	0.13	0.27	0.59	2.10	2.06	7.08	3.36	0.87	11.31	11.0	10.44	10.0	0.88	0.88	1.0	7475
7782	Ammoniated Food for Flowers	Waterbury	.....	2.70	0.00	0.18	0.12	3.00	2.47	0.84	5.53	1.22	7.59	7.0	6.37	6.0	2.10	2.69	2.0	7782
7482	Brighton Phosphate	New Haven	29.00	....	0.11	0.18	0.50	0.79	0.82	5.77	3.38	1.39	10.54	9.0	9.15	8.0	0.78	0.78	1.0	7482
7636	Complete Alkaline Tobacco Grower 1916	Rockville	41.00	0.79	0.10	0.14	2.61	3.64	4.11	2.18	3.28	0.41	5.87	5.0	5.46	4.0	0.17	0.83	1.0	7636
7811	Complete Alkaline Tobacco Grower 1916	Suffield	38.75	0.96	0.14	0.05	2.67	3.82	4.11	1.99	3.01	0.56	5.56	5.0	5.00	4.0	0.20	1.03	1.0	7811
7478	Corn Phosphate 1916	Willimantic	31.00	0.63	0.35	0.29	0.50	1.77	1.65	5.13	5.47	1.14	11.74	11.0	10.60	10.0	1.14	1.14	1.0	7478

TABLE I.—NITROGENOUS SUPERPHOSPHATES WITH POTASH—(*Continued*).

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-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. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent:																			
	Bowker Fertilizer Co., New York City. (*Continued.*)																			
7308	Farm and Garden Phosphate 1916	New Haven	$33.00	....	0.36	0.40	0.92	1.68	1.65	7.25	3.78	0.74	11.77	11.0	11.03	10.0	0.87	0.87	1.0	7308
7481	High Nitrogen Mixture 1916	Bloomfield	56.00	3.68	3.32	0.20	1.46	8.66	8.23	3.75	1.91	0.56	6.22	6.0	5.66	5.0	0.88	0.88	1.0	7481
7476	Hill and Drill Phosphate 1916	Waterbury	37.00	....	1.01	0.48	1.08	2.57	2.47	0.43	3.70	0.81	10.94	10.0	10.13	9.0	0.70	0.70	1.0	7476
7813	Hill and Drill Phosphate 1916	New Canaan	37.00	....	1.04	0.41	1.15	2.60	2.47	6.39	3.49	0.88	10.76	10.0	9.88	9.0	0.62	0.62	1.0	7813
7458	Lawn and Garden Dressing 1916	New Haven	50.00	2.66	0.17	0.20	0.96	3.99	4.11	5.28	4.38	0.77	10.43	9.0	9.66	8.0	0.51	0.82	1.0	7458
7477	Potato Phosphate 1916	Rockville	34.00	0.60	0.50	0.30	0.39	1.79	1.65	5.80	4.81	0.83	11.44	11.0	10.61	10.0	0.94	0.94	1.0	7477
7480	Stockbridge Early Crop Manure 1916	Rockville	41.00	....	2.07	0.80	1.33	4.20	4.11	5.07	3.07	2.20	10.34	9.0	8.14	8.0	1.06	1.06	1.0	7480
7479	Stockbridge General Crop Manure 1916	Waterbury	40.00	0.14	1.41	0.47	1.05	3.07	3.29	7.77	2.90	0.82	11.49	10.0	10.67	9.0	0.83	0.83	1.0	7479
7812	Stockbridge General Crop Manure 1916	Yalesville	42.00	....	1.62	0.54	1.10	3.26	3.29	7.79	2.67	1.05	11.51	10.0	10.46	9.0	0.82	0.82	1.0	7812
7783	Sure Crop Phosphate 1916	Yalesville	32.00	0.15	0.08	0.21	0.66	1.10	0.82	7.95	3.04	1.36	12.35	11.0	10.99	10.0	0.91	0.91	1.0	7783
	E. D. Chittenden Co., Bridgeport, Conn.																			
7786	Complete Tobacco and Onion Grower, 1% Potash	Suffield	38.00	1.04	0.30	0.74	1.10	3.18	3.29	1.20	6.78	3.75	11.73	9.0	7.98	8.0	0.20	1.00	1.0	7786
7785	Complete Tobacco and Onion Grower, 2% Potash	Suffield	41.50	0.82	1.58	0.09	0.95	3.44	3.29	6.77	2.32	1.82	10.91	9.0	9.09	8.0	1.00	2.39	2.0	7785
7787	Connecticut Tobacco Grower, 2% Potash	Broad Brook	49.00	0.15	3.64	0.26	1.23	5.28	4.94	4.00	0.83	0.35	5.18	5.0	4.83	4.0	0.40	2.05	2.0	7787
7784	Tobacco Special with 1% Potash	Suffield	41.00	2.05	0.93	0.09	1.55	4.62	4.50	4.20	0.76	0.40	5.36	4.0	4.96	3.0	0.60	2.06	1.0	7784
7788	Tobacco Special with 2% Potash	Suffield	50.00	0.23	2.52	0.47	1.63	4.85	4.50	2.16	1.06	0.37	3.59	4.0	3.22	3.0	0.71	2.24	2.0	7788
	The Everett B. Clark Seed Co., Milford, Conn.																			
7483	Special Mixture	Milford	34.00	0.64	1.33	0 19	0.94	3.10	3.29	6.30	2.09	0.97	9.36	9.0	8.39	8.0	0.71	0.71	1.0	7483
	The Coe-Mortimer Co., New York City.																			
7792	Columbian Corn and Potato Fertilizer 1916	Brooklyn	33.00	0.69	0.43	0.28	0.42	1.82	1.23	5.52	5.29	0.92	11.73	11.0	10.81	10.0	0.96	0.96	1.0	7792
7484	Gold Brand Excelsior Guano 1916	Brooklyn	36.00	0.97	0.78	0.24	0.90	2.89	2.47	4.79	4.67	1.09	10.55	10.0	9.46	9.0	1.00	1.00	1.0	7484
7789	Ideal Tobacco Fertilizer 1916	Windsor	.....	0.95	0.06	0.05	3.28	4.34	4.53	1.53	2.49	0.46	4.48	4.0	4.02	3.0	0.20	1.01	1.0	7789
7818	Morco Top Dresser 1916	Poquonock	56.00	3.24	2.38	1.10	1.58	8.30	8.23	3.70	1.92	0.61	6.23	6.0	5.62	5.0	0.77	0.77	1.0	7818
7791	New Englander Special 1916	Abington	28.00	0.40	0.30	0.10	0.30	1.10	0.82	4.32	4.38	0.74	9.44	9.0	8.70	8.0	1.06	1.06	1.0	7791
7817	Red Brand Excelsior Guano 1916	Poquonock	43.00	0.21	1.95	0.67	1.39	4.22	4.11	5.16	2.93	2.34	10.43	9.0	8.09	8.0	1.02	1.02	1.0	7817
7485	Standard Potato Fertilizer 1916	Abington	39.00	1.33	1.19	0.31	0.70	3.53	3.29	5.01	4.29	1.09	10.39	10.0	9.30	9.0	0.99	0.99	1.0	7485
7790	Universal Fertilizer 1916	Killingly	34.00	0.36	0.26	0.46	0.20	1.28	1.65	7.06	3.46	1.65	12.17	10.0	10.52	9.0	0.11	0.87	1.0	7790
8231	Universal Fertilizer 1916	Winsted	34.00	0.12	0.12	1.54		1.78	1.65	5.47	4.73	1.38	11.58	10.0	10.20	9.0	0.63	0.63	1.0	8231
	T. H. Eldredge, Norwich, Conn.																			
7638	Fish and Potash	Norwich	30.00	1.00	0.18	0.18	2.08	3.44	2.40	5.83	2.38	0.72	8.93	9.0	8.21	8.0	0.20	0.49	0.25	7638
	Essex Fertilizer Co., Boston, Mass.																			
7820	High Grade Special	Warehouse Point	.....	0.28	1.52	0.88	1.41	4.09	3.69	5.97	4.12	1.64	11.73	10.0	10.09	9.0	1.28	1.28	1.0	7820
7819	New Tobacco Fertilizer	Glastonbury	39.00	0.60	0.08	1.11	2.60	4.39	4.10	3.17	3.80	1.47	8.44	6.0	6.97	5.0	0.31	1.15	1.0	7819
	The L. T. Frisbie Co., New Haven, Conn.																			
7829	Complete Manure for Roots, Fruits and Vines	New Haven	39.00	0.24	1.28	0.96	1.04	3.52	3.29	6.77	4.60	1.41	12.78	11.0	11.37	10.0	1.27	1.27	1.0	7829
	International Agricultural Corporation, Buffalo, N. Y.																			
7830	Buffalo Economy	Ansonia	35.00	....	0.41	0.52	0.83	1.76	1.60	4.51	5.23	2.30	12.04	11.0	9.74	10.0	0.24	0.24	1.0	7830
8218	Buffalo Economy	West Suffield	35.00	0.28	0.90	0.64		1.82	1.60	7.66	3.24	1.37	12.27	11.0	10.90	10.0	0.11	0.17	1.0	8218
7831	Buffalo General Favorite	West Suffield	31.00	....	0.42	0.18	0.39	0.99	0.80	5.33	3.46	0.70	9.49	9.0	8.79	8.0	0.20	0.99	1.0	7831
7832	Buffalo High Grade Manure	Watertown	39.50	0.45	0.81	0.58	1.59	3.43	3.30	5.85	2.29	0.38	8.52	9.0	8.14	8.0	1.02	1.02	1.0	7832
7905	Buffalo Tobacco Producer	West Suffield	37.50	....	0.96	0.36	2.50	3.82	4.10	1.62	2.44	1.30	5.36	5.0	4.06	4.0	0.00	1.43	1.0	7905

TABLE I.—NITROGENOUS SUPERPHOSPHATES

WITH POTASH—(*Continued*).

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-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. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent:																			
	Kirke Chemical Co., Brooklyn, N. Y.																			
7833	Kirke Fertilizer	Hartford	.....	5.12	0.04		0.03	5.19	5.0	8.73	1.83	0.52	11.08	8.25	10.56	7.5	1.79	2.89	3.15	7833
	Lister's Agricultural Chemical Works, Newark, N. J.																			
7677	Ammoniated Dissolved Superphosphate 1916	North Branford	$32.00	0.84	0.81	0.22	0.35	2.22	2.06	4.48	3.71	1.34	9.53	9.0	8.19	8.0	0.91	0.91	1.0	7677
7680	Complete Tobacco Manure 1916	Burnside	39.00	2.03	0.15	0.24	1.60	4.02	4.11	1.92	2.94	1.68	6.54	5.0	4.86	4.0	0.40	0.97	1.0	7680
7676	Corn and Potato Fertilizer 1916	Stratford	.....	0.21	1.20	0.39	0.46	2.26	2.06	2.28	4.53	2.30	9.11	9.0	6.81	8.0	0.92	0.92	1.0	7676
7679	Potato Manure 1916	Warehouse Point	39.50	0.21	2.15	0.23	1.48	4.07	4.11	6.17	3.27	0.95	10.39	9.0	9.44	8.0	0.20	0.97	1.0	7679
7834	Special Tobacco Fertilizer 1916	Brookfield	36.00	1.11	0.08	0.49	0.47	2.15	2.06	6.92	3.51	1.80	12.23	11.0	10.43	10.0	0.20	0.97	1.0	7834
7678	Standard Pure Superphosphate of Lime 1916	Rockville	36.00	0.83	1.09	0.15	0.45	2.52	2.47	6.62	2.90	0.73	10.25	10.0	9.52	9.0	0.82	0.82	1.0	7678
7675	Success Fertilizer 1916	Warehouse Point	28.00	0.10	0.58	0.08	0.61	1.46	1.23	7.89	3.78	0.73	12.40	11.0	11.67	10.0	1.01	1.01	1.0	7675
7681	Valley Brand Fertilizer 1916	Hamden	.....	0.12	0.19	0.16	0.66	1.13	0.82	7.77	3.34	1.09	12.20	11.0	11.11	10.0	0.96	0.96	1.0	7681
	Lowell Fertilizer Co., Boston, Mass.																			
7836	Special Tobacco	Rockville	40.00	0.40	0.10	1.21	2.41	4.12	4.10	4.03	2.96	0.61	7.60	6.0	6.99	5.0	0.40	1.30	1.0	7836
7835	Superior Fertilizer	Derby	35.00	0.25	1.25	1.48	1.59	4.57	3.69	4.99	4.85	1.69	11.53	10.0	9.84	9.0	1.12	1.12	1.0	7835
	The Mapes Formula and Peruvian Guano Co., New York City.																			
7309	Corn Manure (War Brand)	Suffield	36.00	1.62	0.05	0.23	0.87	2.77	2.47	0.53	7.75	3.30	11.58	10.0	8.28	8.0	0.64	0.85	1.0	7309
7688	General Special (War Brand)	Southington	49.00	5.04	0.06	0.10	1.22	6.42	5.76	0.94	5.43	2.84	9.21	8.0	6.37	6.0	0.80	1.35	1.0	7688
7689	Potato Manure (War Brand)	Windsor Locks	41.00	2.92	0.10	0.07	0.96	4.05	3.71	0.77	7.61	2.28	10.66	8.0	8.38	8.0	0.54	1.06	1.0	7689
7639	Tobacco Manure (War Brand)	East Windsor Hill	.....	4.55	0.13	0.44	3.18	8.30	8.23	0.50	6.32	2.17	8.99	8.0	6.82	5.0	0.45	1.44	1.0	7639
7640	Tobacco Manure (War Brand)	East Windsor Hill	.....	3.79	0.09	0.45	3.48	7.81	8.23	0.36	7.19	2.39	9.94	8.0	7.55	5.0	0.52	1.20	1.0	7640
7690	Tobacco Starter Improved	Windsor Locks	41.00	2.26	0.10	0.34	1.95	4.65	4.12	0.44	5.67	3.47	9 58	8.0	6.11	6.0	0.54	1.07	1.0	7690
7691	Top Dresser Full Strength (War Brand)	Rockville	65.00	8.12	0.12	0.56	1.26	10.06	9.88	0.53	5.85	2.46	8.84	8.0	6.38	5.0	0.91	1.84	1.0	7691
7692	Top Dresser Half Strength (War Brand)	Hartford	41.00	4.24	0.08	0.35	0.46	5.13	4.94	1.57	2.24	0.91	4.72	4.0	3.81	2.5	0.40	0.59	0.5	7692
	National Fertilizer Co., New York City.																			
7694	Ammoniated Phosphate 1916	Wallingford	.....	....	0.40	0.42	0.82	1.64	1.65	7.12	3.73	0.95	11.80	11.0	10.85	10.0	0.87	0.87	1.0	7694
7685	Complete Root and Grain Fertilizer 1916	Meriden	.....	0.08	1.02	0.30	1.14	2.54	3.29	8.56	3.03	1.02	12.61	10.0	11.59	9.0	0.33	0.78	1.0	7685
7906	Complete Root and Grain Fertilizer 1916	Greenwich	40.00	0.28	1.22	1.03	1.00	3.53	3.29	6.48	3.50	1.38	11.36	10.0	9.98	9.0	0.97	0.97	1.0	7906
7686	Eureka Potato Fertilizer 1916	South Manchester	38.25	0.15	1.02	0.44	0.75	2.36	2.47	6.24	3.69	1.05	10.98	10.0	9.93	9.0	0.81	0.81	1.0	7686
7907	Eureka Potato Fertilizer 1916	Broad Brook	38.75	0.36	1.12	0.35	1.07	2.90	2.47	5.94	3.82	1.14	10.90	10.0	9.76	9.0	0.78	0.78	1.0	7907
7684	Extra High Grade Manure 1916	Greenwich	44.65	0.33	1.93	0.62	1.50	4.38	4.11	4.78	2.57	2.48	9.83	9.0	7.35	8.0	1.05	1.05	1.0	7684
7863	Extra High Grade Manure 1916	Warehouse Point	37.00	2.62	1.18	0.00	0.84	4.64	4.11	3.89	4.51	0.82	9.22	9.0	8.40	8.0	0.31	0.72	1.0	7863
7683	High Grade Top Dressing 1916	Granby	60.00	3.34	3.51	0.18	1.67	8.70	8.23	4.03	1.96	0.68	6.67	6.0	5.99	5.0	0.40	0.97	1.0	7683
7693	Potato Phosphate 1916	Meriden	.....	....	0.55	0.51	1.02	2.08	2.06	5.88	3.66	1.10	10.64	9.0	9.54	8.0	0.78	0.78	1.0	7693
7862	Potato Phosphate 1916	Wallingford	.....	....	0.55	0.53	0.92	2.00	2.06	5.77	3.84	1.10	10.71	9.0	9.61	8.0	0.80	0.80	1.0	7862
7682	Tobacco Special 1916	Warehouse Point	38.00	1.10	0.18	0.13	3.51	4.92	4.53	1.44	2.19	0.58	4.21	4.0	3.63	3.0	0.16	1.03	1.0	7682
7695	Universal Phosphate 1916	Wallingford	.....	....	0.12	0.27	0.65	1.04	0.82	6.75	4.64	1.43	12.82	11.0	11.39	10.0	0.70	0.70	1.0	7695
7861	Universal Phosphate 1916	South Manchester	32.00	....	0.13	0.30	0.59	1.02	0.82	6.34	4.47	1.48	12.29	11.0	10.81	10.0	0.82	0.82	1.0	7861
7310	XXX Fish and Potash 1916	South Manchester	36.50	....	0.52	0.38	1.08	1.98	2.06	7.20	3.77	0.93	11.90	11.0	10.97	10.0	0.82	0.82	1.0	7310
	Nitrate Agencies Co., New York City.																			
7696	H. G. Genuine Peruvian Guano	Middletown	75.00	0.27	3.47	0.71	6.20	10.65	10.69	2.38	8.62	1.45	12.45	11.0	11.00	10.0	2.45	2.64	2.5	7696
7837	Pescadores H. G. Genuine Peruvian Guano	Bridgeport	.....	0.14	4.26	0.00	7.42	11.82	11.51	3.03	8.80	0.84	12.67	13.0	11.83	10.0	2.19	2.74	2.5	7837

TABLE I.—NITROGENOUS SUPERPHOSPHATES WITH POTASH—(*Continued*).

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-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. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent:																			
	Olds and Whipple, Hartford, Conn.																			
7697	Complete Corn, Potato and Onion Fertilizer	Silver Lane	$40.75	2.00	0.10	0.48	1.03	3.61	3.30	1.53	4.51	1.92	7.96	6.0	6.04	6.0	2.57	2.57	2.0	7697
7583	Complete Tobacco Fertilizer	Weatogue	48.00	1.09	0.02	0.80	3.05	4.96	4.50	0.53	2.95	1.22	4.70	3.0	3.48	3.0	0.71	2.46	2.0	7583
7584	Complete Tobacco Fertilizer	Windsor Locks	48.00	....	....	....	....	4.92	4.50	....	....	....	4.34	3.0	....	....	0.40	2.64	2.0	7584
7585	Complete Tobacco Fertilizer	Southwick, Mass.	48.00	....	....	....	....	4.88	4.50	....	....	....	4.40	3.0	....	....	0.20	2.28	2.0	7585
7698	Fish and Potash	Hartford	37.50	0.55	0.15	0.22	1.98	2.90	2.45	3.34	4.41	2.19	9.94	6.0	7.75	6.0	2.67	2.67	2.0	7698
	The Rogers and Hubbard Co., Middletown, Conn.																			
7852	Hubbard's Bone Base Soluble Potato Manure	Branford	49.00	2.02	0.31	0.68	1.45	4.46	4.25	0.70	10.68	5.97	17.35	16.0	11.38	10.0	1.00	1.00	1.0	7852
7843	Hubbard's Tobacco Special	Glastonbury	44.00	1.08	0.06	0.48	3.09	4.71	5.00	0.11	5.23	2.90	8.24	7.0	5.34	4.0	0.16	1.01	0.5	7843
7842	Rogers' H. G. Soluble Tobacco and Potato Manure	Somerville	49.00	2.02	0.28	0.59	1.42	4.31	4.25	0.94	10.16	6.46	17.56	16.0	11.10	10.0	1.00	1.00	1.0	7842
7838	Rogers' Tobacco Grower, Vegetable Formula	Suffield	43.50	0.69	0.21	0.68	3.68	5.26	5.00	0.32	6.01	1.00	7.33	7.0	6.33	4.0	0.40	0.78	0.5	7838
	F. S. Royster Guano Co., Baltimore, Md.																			
7722	Arrow Head Tobacco Fertilizer	Glastonbury	42.75	0.08	0.56	0.28	3.08	4.00	4.11	2.87	2.31	0.33	5.51	4.5	5.18	4.0	1.20	1.92	2.0	7722
7717	Cuckoo Crop Grower	Branford	30.00	....	0.40	0.19	0.43	1.02	0.82	4.11	4.93	0.82	9.86	8.5	9.04	8.0	1.03	1.03	1.0	7717
7720	Defender Fertilizer	Plainville	38.00	....	0.92	0.69	1.37	2.98	3.29	4.01	4.31	1.66	9.98	8.5	8.32	8.0	1.12	1.12	1.0	7720
7719	Drillwell Phosphate	Waterbury	39.00	....	0.54	0.62	1.00	2.16	2.47	4.11	4.14	1.37	9.62	8.5	8.25	8.0	1.30	1.30	1.0	7719
7844	Log Cabin Guano	Darien	39.75	....	2.00	0.87	1.51	4.38	4.11	4.08	4.24	1.94	10.26	8.5	8.32	8.0	1.03	1.03	1.0	7844
7718	Logical Compound	Plainville	35.00	....	0.21	0.77	0.98	1.96	1.65	3.24	5.18	0.96	9.38	8.5	8.42	8.0	0.88	0.88	1.0	7718
7721	Pipe of Peace Tobacco Fertilizer	Glastonbury	.....	0.18	0.72	0.21	2.48	3.59	4.11	1.89	1.33	0.20	3.42	3.5	3.22	3.0	0.20	1.20	1.0	7721
7723	Vim Top Dresser	Milford	38.75	1.23	2.62	0.00	0.23	4.08	4.11	7.18	0.95	0.03	8.16	6.5	8.13	6.0	0.11	1.06	1.0	7723
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.																			
7726	Atlantic Coast Bone, Fish and Potash 1916	Guilford	29.00	....	0.12	1.12	0.71	1.95	1.65	1.76	7.73	1.56	11.05	10.0	9.49	9.0	1.26	1.26	1.0	7726
7846	Complete Tobacco Grower 1916	Glastonbury	....	0.25	0.26	0.23	3.95	4.69	4.53	1.43	2.83	0.69	4.95	4.0	4.26	3.0	0.31	1.07	1.0	7846
7727	Corn Superphosphate 1916	Seymour	34.00	0.38	0.18	0.49	0.67	1.72	1.65	2.31	8.77	0.86	11.94	11.0	11.08	10.0	0.60	0.96	1.0	7727
7724	Formula A 1916	Shelton	37.50	0.71	0.71	0.72	1.22	3.36	3.29	3.22	6.46	1.68	11.36	10.0	9.68	9.0	1.41	1.41	1.0	7724
7815	Formula B 1916	Southport	37.00	1.20	0.56	0.34	1.41	3.51	3.29	4.52	5.43	4.67	14.62	10.0	9.95	9.0	0.50	1.16	1.0	7815
7847	Kelsey's Bone, Fish and Potash 1916	Branford	33.25	0.57	0.24	0.58	1.49	2.88	2.47	4.08	5.25	1.42	10.75	10.0	9.33	9.0	1.29	1.29	1.0	7847
7728	Potato Manure 1916	Shelton	33.00	....	0.34	0.93	1.23	2.50	2.06	1.15	7.51	2.78	11.44	9.0	8.66	8.0	0.80	1.12	1.0	7728
7845	Top Dressing for Grass and Grain 1916	East Hampton	42.00	1.68	0.10	1.02	1.48	4.28	4.11	2.96	5.68	1.85	10.49	9.0	8.64	8.0	1.01	1.01	1.0	7845
	Virginia-Carolina Chemical Co., New York City.																			
7737	H. G. Corn and Vegetable Compound	Glastonbury	.....	0.69	0.11	0.45	1.28	2.53	2.47	4.96	3.70	1.51	10.17	9.0	8.66	8.0	0.20	1 09	1.0	7737
7729	Indian Brand for Tobacco No. 1	Glastonbury	41.75	0.27	1.92	0.25	1.58	4.02	4.12	4.08	1.56	0.46	6.10	5.0	5.64	4.0	0.90	2.80	2.0	7729
7730	Indian Brand for Tobacco No. 2	Suffield	35.50	0.04	3.28	0.04	1.16	4.52	4.12	3.83	0.75	0.55	5.13	5.0	4.58	4.0	0.16	1.20	1.0	7730
7732	National Corn, Grain and Grass Top Dresser	Glastonbury	....	0.04	2.38	0.31	0.55	3.28	3.29	6.84	1.75	1.77	10.36	9.0	8.59	8.0	0.51	1.14	1.0	7732
7735	Owl Brand Potato Fertilizer	Shelton	34.00	0.07	0.39	0.20	1.30	1.96	1.65	6.23	2.67	1.62	10.52	9.0	8.90	8.0	0.31	1.09	1.0	7735
7736	Star Brand Potato and Vegetable Compound	Jewett City	42.00	0.31	1.83	0.18	1.12	3.44	3.29	6.68	2.52	1.55	10.75	9.0	9.20	8.0	0.60	1.94	2.0	7736
7731	Tobacco and Onion Special	Glastonbury	35.50	0.64	0.36	0.83	1.47	3.30	3.29	1.05	5.50	4.08	10.63	9.0	6.55	8.0	0.31	0.95	1.0	7731
7734	20th Century Potato Manure with 1% Potash	Milford	38.00	2.02	0.32	0.62	1.23	4.19	4.12	3.63	4.76	2.38	10.77	9.0	8.39	8.0	0.31	1.34	1.0	7734
7733	XXX Fish and Potash Mixture	Glastonbury	30.00	0.34	0.84	0.63	0.44	2.25	1.65	7.08	2.00	1.51	10.59	9.0	9.08	8.0	0.25	0.93	1.0	7733
	Wilcox Fertilizer Co., Mystic, Conn.																			
7704	Fish and Potash	Meriden	26.50	0.14	0.16	0.35	2.20	2.85	2.40	6.36	2.27	0.49	9.12	9.0	8.63	8.0	0.15	0.52	0.5	7704
7738	High Grade Vegetable Fertilizer	Ellington	41.00	2.40	0.10	0.06	1.64	4.20	4.12	6.75	2.11	0.26	9.12	9.0	8.86	8.0	0.97	0.97	1.0	7738

TABLE I.—NITROGENOUS SUPERPHOSPHATES WITH POTASH—(*Concludea*).

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-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. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
	Sampled by Station Agent:																			
	Wilcox Fertilizer Co., Mystic, Conn. (*Continued.*)																			
7740	Potato Fertilizer	Suffield	$33.00	0.58	0.20	0.09	1.75	2.62	2.46	3.58	2.44	5.10	11.12	7.0	6.02	6.0	0.15	0.45	0.5	7740
7586	Potato, Onion and Vegetable Phosphate	Gildersleeve	34.00	0.95	0.05	0.21	2.79	4.00	3.72	6.17	2.99	1.50	10.66	9.0	9.16	8.0	0.24	0.49	0.5	7586
7739	Tobacco Special	Ellington	40.00	0.92	0.10	0.08	3.95	5.05	4.95	0.65	5.46	0.58	6.69	6.0	6.11	5.0	0.16	1.02	0.5	7739
	S. D. Woodruff and Sons, Orange, Conn.																			
7849	Home Mixture	Orange	36.00	1.30	0.10	1.07	1.20	3.67	3.30	0.51	6.34	1.71	8.56	8.0	6.85	....	0.62	0.62	1.0	7849
	Sampled by Purchasers and Others:																			
7223	A. A. C. Co.'s Complete Tobacco Manure 1916	*West Suffield:*—H. C. Nelson	38.75	1.07	0.04	3.55		4.66	4.53	1.60	2.29	0.24	4.13	4.0	3.89	3.0	0.25	0.97	1.0	7223
7224	A. A. C. Co.'s Complete Tobacco Manure 1916	*West Suffield:*—H. C. Nelson	38.75	1.07	0.03	3.63		4.73	4.53	1.52	2.37	0.19	4.08	4.0	3.89	3.0	0.18	0.93	1.0	7224
7230	A. A. C. Co.'s Complete Tobacco Manure 1916	*West Suffield:*—H. C. Nelson	38.75	....	....	....	....	4.73	4.53	1.44	2.14	0.18	3.76	4.0	3.58	3.0	....	0.92	1.0	7230
7809	Quinnipiac Complete Tobacco	*Suffield:*—G. H. Harmon	36.00	0.86	0.14	0.09	3.45	4.54	4.50	1.65	2.24	0.54	3.89	4.0	4.43	3.0	0.50	1.03	1.0	7809
7242	Quinnipiac Tobacco Fertilizer	*Suffield:*—H. F. Russell	38.75	....	....	....	....	4.51	4.50	.....	....	....	4.21	4.0	....	3.0	....	1.09	1.0	7242
7247	Quinnipiac Tobacco Manure	*West Suffield:*—W. H. Nelson	36.00	1.11	0.04	3.60		4.75	4.50	1.44	2.56	0.13	4.13	4.0	4.00	3.0	0.23	0.94	1.0	7247
8211	Bowker's Alkaline Tobacco Grower	*West Suffield:*—S. Viets	36.50	0.80	0.05	3.17		4.02	4.11	1.75	2.90	0.33	4.98	5.0	4.65	4.0	0.20	0.97	1.0	8211
7333	Chittenden's Connecticut Tobacco Grower	*Suffield:*—Bissell-Graves Co.	52.00	0.09	3.49	1.39		4.97	4.94	3.94	0.95	0.23	5.12	....	4.89	4.0	0.43	2.19	2.0	7333
7334	Chittenden's Connecticut Tobacco Grower	*Suffield:*—Bissell-Graves Co.	52.00	0.13	3.53	1.45		5.11	4.94	3.65	0.95	0.26	4.86	....	4.60	4.0	0.41	2.10	2.0	7334
6810	Clark's Special Mixture for General Use (1915 stock)	*Woodmont:*—R. M. Treat	.....	....	....	....	....	3.06	3.29	....	....	....	10.17	9.0	....	....	....	3.62	4.0	6810
8221	Lister's Complete Tobacco Fertilizer	*Tariffville:*—Ketchen Tob. Corp.	37.75	2.06	0.08	1.84		3.98	5.00	1.89	2.56	1.79	6.24	.....	4.45	4.0	0.40	0.86	1.0	8221
7212	Mapes' Tobacco Starter Improved	*Jewett City:*—A. A. Young	42.00	1.75	0.05	2.83		4.63	4.11	0.21	6.20	2.46	8.87	8.0	6.41	6.0	0.41	1.16	1.0	7212
6444	Rogers and Hubbard's Oats and Top Dressing (1915 stock)	*Middletown:*—Manufacturer.	....	....	....	....	....	7.86	8.50	.....	.....	.....	9.83	8.0	....	4.5	....	3.58	4.0	6444
7908	Royster's Pipe of Peace Tobacco Fertilizer	*Glastonbury:*—R. Kraiger	36.75	0.18	0.80	2.57		3.55	4.11	2.11	1.33	0.36	3.80	3.5	3.44	3.0	0.20	0.82	1.0	7908
8219	Royster's Pipe of Peace Tobacco Fertilizer	*Glastonbury:*—John Bantle	36.75	0.69	0.19	2.82		3.70	4.11	1.94	1.60	0.27	3.81	3.5	3.54	3.0	0.11	1.09	1.0	8219
7526	Sanderson's Kelsey's Bone, Fish and Potash	*Branford:*—A. E. Plant Sons Co.	33.25	0.58	0.22	1.93		2.73	2.47	4.46	5.20	1.60	11.26	10.0	9.66	9.0	1.30	1.30	1.0	7526

TABLE II.—NITROGENOUS SUPERPHOSPHATES WITHOUT POTASH.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-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. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Station No.
	Sampled by Station Agent:																
	American Agricultural Chemical Co., New York City.																
7338	Ammoniated Fertilizer A	Southport	$23.50	....	0.06	0.26	0.50	0.82	0.82	6.91	3.48	0.93	11.32	11.0	10.39	10.0	7338
7419	Ammoniated Fertilizer AA	East Hampton	28.00	0.41	0.45	0.37	0.55	1.78	1.65	6.67	3.95	1.02	11.64	11.0	10.62	10.0	7419
7420	Ammoniated Fertilizer AAA	Southport	28.50	....	1.34	0.44	0.81	2.59	2.47	7.20	3.75	1.52	12.47	11.0	10.95	10.0	7420
7285	Ammoniated Fertilizer AAAA	New Haven	40.00	1.17	1.21	0.57	0.64	3.59	3.29	9.27	0.85	1.27	11.39	11.0	10.12	10.0	7285
7797	5½–3 for Tobacco	Avon	35.00	0.92	0.16	0.23	3.38	4.69	4.53	1.73	2.21	0.63	4.57	4.0	3.94	3.0	7797
7706	Bradley's Tobacco Manure without Potash	Burnside	.....	0.97	0.09	0.04	3.70	4.80	4.53	1.56	2.74	0.51	4.81	4.0	4.30	3.0	7706
	Armour Fertilizer Works, Baltimore, Md.																
7707	Special Tobacco Grower No. 2	East Hartford	34.75	0.02	0.18	1.09	2.72	4.01	4.11	3.19	1.74	0.49	5.42	4.5	4.93	4.0	7707
7641	2–11–0	Hazardville	30.00	0.18	0.86	0.20	0.54	1.78	1.65	7.49	3.49	0.73	11.71	11.5	10.98	11.0	7641
7798	4–10	East Granby	.....	0.13	1.54	0.30	1.42	3.39	3.29	7.70	2.34	1.33	11.37	10.5	10.04	10.0	7798
	Atlantic Packing Co., New Haven, Conn.																
7421	Atlantic Grain Fertilizer	Norwich	34.00	....	0.35	0.62	0.70	1.67	1.64	6.84	4.69	0.50	12.03	11.0	11.53	10.0	7421
7558	Atlantic Potato Phosphate	Norwich	37.00	0.33	0.50	0.70	0.77	2.30	2.46	7.12	4.13	0.63	11.88	11.0	11.25	10.0	7558
7547	Atlantic Special Vegetable	Norwich	39.00	....	1.26	1.04	1.20	3.50	3.29	7.51	4.01	0.99	12.51	11.0	11.52	10.0	7547
7799	Atlantic Tobacco Special (C. S. Meal)	Silver Lane	32.00	0.50	0.14	1.03	2.47	4.14	4.10	4.27	2.88	1.01	8.16	7.0	7.15	6.0	7799
7548	Atlantic Top Dresser for Grass and Market Gardens	Norwich	42.00	....	2.23	1.11	1.26	4.60	4.10	8.16	3.62	0.99	12.77	11.0	11.78	10.0	7548
	Berkshire Fertilizer Co., Bridgeport, Conn.																
7422	Ammoniated Bone Phosphate	Norwich Town	24.00	....	0.01	0.05	1.21	1.27	0.80	7.01	1.70	0.37	9.08	9.0	8.71	8.0	7422
7549	Economical Grass Fertilizer	Granby	54.00	6.10	0.21	1.20	0.36	7.87	7.40	0.60	8.21	0.52	9.33	8.0	8.81	4.0	7549
7550	Grass Special	Norwich Town	39.00	3.51	0.08	0.11	2.02	5.72	5.00	4.47	1.18	0.40	6.05	6.0	5.65	5.0	7550
7423	Market Garden Fertilizer	Plantsville	34.00	....	0.95	0.52	2.03	3.50	3.30	5.23	3.49	0.55	9.27	9.0	8.72	8.0	7423
7551	Potato and Vegetable Phosphate	South Coventry	30.00	...	0.10	0.54	1.40	2.04	1.70	4.75	4.54	0.43	9.72	9.0	9.29	8.0	7551
7552	Root Fertilizer	Norwich Town	30.00	0.27	1.07	0.37	1.40	3.11	2.50	4.95	3.55	0.51	9.01	9.0	8.50	8.0	7552
7553	Tobacco Grower	Windsor	39.50	1.09	0.06	1.52	2.35	5.02	4.50	1.44	4.52	0.26	6.22	6.0	5.96	5.0	7553
	F. E. Boardman, Middletown, Conn.																
7800	Fertilizer for Potatoes and General Crops	Cromwell	.....	....	1.76	0.50	1.62	3.88	3.29	6.81	1.31	0.45	8.57	....	8.12	7.0	7800
7801	Tobacco Fertilizer	Middletown	34.00	0.16	1.52	0.62	1.35	3.65	3.29	4.46	3.42	0.29	8.17	....	7.88	7.0	7801
	Bowker Fertilizer Co., New York City.																
7642	High Nitrogen Mixture without Potash	Meriden	47.50	3.58	3.98	0.10	1.57	9.23	8.23	4.10	1.18	0.27	5.55	6.0	5.28	5.0	7642
7425	Superphosphate with Ammonia 1%	Jewett City	24.00	0.32	0.15	0.22	0.30	0.99	0.82	5.23	5.07	1.60	11.90	11.0	10.30	10.0	7425
7339	Superphosphate with Ammonia 2%	Westport	28.00	0.90	0.82	0.34	0.60	2.66	1.65	7.25	3.27	1.38	11.90	11.0	10.52	10.0	7339
7555	Superphosphate with Ammonia 3%	Westport	30.00	0.83	0.75	0.27	0.63	2.48	2.47	7.34	3.19	1.38	11.91	11.0	10.53	10.0	7555
7424	Superphosphate with Ammonia 4%	New Canaan	.....	....	1.27	0.49	1.69	3.45	3.29	7.73	3.30	0.79	11.82	11.0	11.03	10.0	7424
7426	Superphosphate with Ammonia 5%	Meriden	30.50	....	1.89	0.61	1.30	3.80	4.11	6.62	1.91	1.13	9.66	9.0	8.53	8.0	7426
7554	Tobacco Grower 1916	Windsor	.....	0.97	0.10	0.04	3.17	4.28	4.11	2.11	2.49	0.52	5.12	5.0	4.60	4.0	7554
	E. D. Chittenden Co., Bridgeport, Conn.																
7299	Complete Tobacco and Onion Grower (no Potash)	Suffield	32.50	2.30	0.39	0.52	0.59	3.80	3.29	5.66	4.52	2.29	12.47	11.0	10.18	10.0	7299
7708	Vegetable and Onion Grower without Potash	Westport	29.00	0.50	0.32	0.86	0.86	2.54	2.47	2.95	6.70	2.98	12.63	11.0	9.65	10.0	7708
	The Everett B. Clark Seed Co., Milford, Conn.																
7320	Ammoniated Bone Phosphate	Milford	32.00	2.51	0.37	0.57	0.66	4.11	3.29	5.18	4.47	2.46	12.11	11.0	9.65	10.0	7320
7507	Ammoniated Bone Phosphate	Milford	32.00	....	2.41	0.26	0.80	3.47	3.29	7.33	2.54	1.93	11.80	11.0	9.87	10.0	7507

TABLE II.—NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station Agent:		
	The Coe-Mortimer Co., New York City.		
7427	H. G. Ammoniated Superphosphate 1916	Abington	$31.00
7709	Ideal Tobacco Fertilizer without Potash 1916	Windsor	.....
7803	Morco Top Dresser without Potash	Poquonock	45.00
7556	Prolific Crop Producer 1916	Simsbury	33.00
7802	XXV Ammoniated Phosphate 1916	Canaan	26.00
	Essex Fertilizer Co., Boston, Mass.		
7804	Corn and Vegetable	Willimantic	36.00
7805	Market Garden and Potato Manure	Poquonock	34.00
7643	Tobacco Manure	Hazardville	40.00
7300	XXX Fish Fertilizer	Suffield	33.00
	The L. T. Frisbie Co., New Haven, Conn.		
7428	Connecticut Special for All Crops	New Britain	34.00
7321	Corn and Grain Fertilizer	New Haven	28.00
7340	Market Garden and Top Dresser	New Britain	39.00
7429	Potato and Vegetable Grower	Highwood	.....
7341	Tobacco Special	Glastonbury	34.00
	International Agricultural Corporation, Buffalo, N.Y.		
7342	Buffalo Farmers Choice	Watertown	27.50
7322	Buffalo New England Special	Ansonia	31.00
7806	Buffalo Standard	Winsted	35.00
7508	Buffalo Top Dresser	West Cheshire	44.00
7430	Buffalo Vegetable and Potato	Watertown	33.50
	Lister's Agricultural Chemical Works, Newark, N. J.		
7850	Plant Food 1916	Danbury	28.00
	Lowell Fertilizer Co., Boston, Mass.		
7302	Animal Brand	Suffield	34.00
7323	Bone Fertilizer	Wallingford	30.00
7510	Corn and Vegetable	Warehouse Point	40.00
7509	Empress Brand	Simsbury	30.00
7511	Market Garden, Special Grass and Lawn Dressing	Rockville	38.00
7301	Potato Phosphate	Suffield	36.00
7557	Tobacco Grower	Warehouse Point	37.00
	E. Manchester and Sons, Winsted, Conn.		
7644	1916 Formula	Ellington	28.00
7645	1916 Special	Ellington	34.00
	The Mapes Formula and Peruvian Guano Co., New York City.		
7512	Cereal Brand (War Special)	Hartford	29.00
7513	General Crop (War Special)	Danielson	26.00

WITHOUT POTASH—(*Continued*).

Nitrogen.						Phosphoric Acid.							
				Total.					Total.		So-called "Available."		
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	Station No.
0.93	0.96	0.43	0.54	2.86	2.47	6.19	4.20	1.00	11.39	11.0	10.39	10.0	7427
1.06	0.06	0.20	3.54	4.86	4.53	1.71	2.27	0.24	4.22	4.0	3.98	3.0	7709
3.14	3.58	0.27	1.63	8.62	8.23	4.50	1.27	0.36	6.13	6.0	5.77	5.0	7803
0.41	1.02	0.91	1.16	3.50	3.29	7.78	2.88	1.07	11.73	11.0	10.66	10.0	7556
....	0.14	0.40	0.66	1.20	0.82	6.95	3.33	0.81	11.09	11.0	10.28	10.0	7802
....	1.68	0.93	1.08	3.69	4.10	9.10	3.52	0.72	13.34	11.0	12.62	10.0	7804
0.38	0.68	0.69	1.13	2.88	2.87	7.28	3.02	1.48	11.78	11.0	10.30	10.0	7805
0.52	0.10	0.95	2.39	3.96	4.10	4.35	3.08	0.81	8.24	7.0	7.43	6.0	7643
0.36	0.51	0.92	0.90	2.69	2.46	6.91	4.28	0.90	12.09	11.0	11.19	10.0	7300
0.35	0.51	0.89	0.83	2.58	2.46	7.33	4.24	0.52	12.09	11.0	11.57	10.0	7428
....	0.36	0.69	0.73	1.78	1.64	6.43	4.32	0.51	11.26	11.0	10.75	10.0	7321
....	2.29	0.96	1.20	4.45	4.10	7.54	4.02	1.04	12.60	11.0	11.56	10.0	7340
....	1.41	1.06	1.12	3.59	3.29	8.02	3.31	0.63	11.96	11.0	11.33	10.0	7429
0.48	0.08	1.02	2.65	4.23	4.10	3.84	3.42	1.06	8.32	7.0	7.26	6.0	7341
....	0.34	0.12	0.53	0.99	0.80	5.95	3.90	0.17	10.02	11.0	9.85	10.0	7342
....	0.57	0.56	0.80	1.93	1.60	5.57	5.18	1.98	12.73	11.0	10.75	10.0	7322
....	1.40	0.94	0.97	3.31	3.30	7.31	3.82	2.11	13.24	11.0	11.13	10.0	7806
2.46	0.56	0.57	2.14	5.73	5.80	2.48	4.48	2.47	9.43	7.0	6.96	6.0	7508
0.15	0.83	0.28	1.28	2.54	2.50	7.35	2.66	0.20	10.21	11.0	10.01	10.0	7430
0.09	0.10	0.35	0.52	1.06	0.82	6.99	3.69	1.04	11.72	11.0	10.68	10.0	7850
0.39	0.69	0.87	1.04	2.99	2.87	6.82	4.53	1.32	12.67	11.0	11.35	10.0	7302
....	0.36	0.92	0.80	2.08	2.05	5.81	4.05	1.51	11.37	11.0	9.86	10.0	7323
0.51	1.51	0.93	1.15	4.10	4.10	6.62	4.11	2.34	13.07	11.0	10.73	10.0	7510
0.08	0.40	0.47	0.66	1.61	1.25	7.70	3.12	0.46	11.28	11.0	10.82	10.0	7509
0.13	1.88	1.74	2.00	5.75	4.92	3.39	4.90	2.56	10.85	9.0	8.29	8.0	7511
0.35	0.96	0.90	1.19	3.40	3.28	6.46	4.76	1.45	12.67	11.0	11.22	10.0	7301
0.61	0.10	1.33	2.48	4.52	4.10	3.98	3.21	0.61	7.80	7.0	7.19	6.0	7557
0.35	0.07	1.06	1.10	2.58	2.46	6.65	4.79	1.43	12.87	....	11.44	10.0	7644
0.15	2.30	0.97	1.20	4.62	4.11	8.20	3.42	0.65	12.27	....	11.62	10.0	7645
2.02	0.00	0.15	0.68	2.85	2.47	0.70	5.35	3.62	9.67	8.0	6.05	6.0	7512
1.02	0.00	0.09	0.70	1.81	1.65	1.45	6.04	4.16	11.65	8.0	7.49	8.0	7513

TABLE II.—NITROGENOUS SUPERPHOSPHATES WITHOUT POTASH—(*Continued*).

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-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. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Station No.
	Sampled by Station Agent:																
	National Fertilizer Co., New York City.																
7324	Nitrogen Phosphate Mixture No. 2	Meriden	.....	0.24	0.56	0.28	0.74	1.82	1.65	7.34	3.29	1.46	12.09	11.0	10.63	10.0	7324
7343	Nitrogen Phosphate Mixture No. 4	Silver Lane	$34.00	0.53	1.43	0.50	0.95	3.41	3.29	7.25	3.31	1.34	11.90	11.0	10.56	10.0	7343
7646	Tobacco Special without Potash	Windsor Locks	.....	1.36	0.00	0.09	3.43	4.88	4.53	1.54	2.12	0.70	4.36	4.0	3.66	3.0	7646
	New England Fertilizer Co., Boston, Mass.																
7515	Corn and Grain Fertilizer	South Manchester	30.00	....	0.37	0.37	0.53	1.27	1.23	9.00	2.36	0.26	11.62	11.0	11.36	10.0	7515
7514	Corn Phosphate	Unionville	32.00	0.09	0.42	0.86	0.93	2.30	2.06	6.18	4.52	2.00	12.70	11.0	10.70	10.0	7514
7851	High Grade Potato Fertilizer	East Granby	36.00	0.31	1.01	0.59	1.46	3.37	3.28	7.87	2.12	1.61	11.60	11.0	9.99	10.0	7851
7648	Potato Fertilizer	Rockville	32.00	0.46	0.06	0.87	1.10	2.49	2.46	7.03	4.51	1.41	12.95	11.0	11.54	10.0	7648
7649	Special Tobacco	Warehouse Point	36.00	0.58	0.06	0.87	2.51	4.02	4.10	4.39	2.93	0.96	8.28	7.0	7.32	6.0	7649
7647	Superphosphate	Unionville	34.00	....	0.94	1.12	1.23	3.29	2.88	7.73	3.77	0.61	12.11	11.0	11.50	10.0	7647
	Olds and Whipple, Hartford, Conn.																
7516	High Grade Tobacco Starter	Cromwell	53.00	3.54	0.14	0.45	6.58	10.71	10.70	1.65	2.52	0.87	5.04	3.0	4.17	3.0	7516
7795	Special Grass Fertilizer	Hartford	36.75	2.28	0.10	0.45	2.85	5.68	4.95	1.08	3.02	3.01	7.11	4.0	4.10	4.0	7795
7517	Special Phosphate	Silver Lane	32.00	1.32	0.06	0.31	3.22	4.91	4.18	2.84	2.24	2.33	7.41	4.0	5.08	4.0	7517
7344	Tobacco Special	Silver Lane	37.50	0.85	0.11	0.56	3.48	5.00	4.50	2.06	3.71	0.18	5.95	5.0	5.77	5.0	7344
	Parmenter and Polsey Fertilizer Co., Boston, Mass.																
7651	P. & P. Grain Grower	North Stonington	26.50	0.13	0.05	0.67	0.52	1.37	1.23	6.31	3.30	1.24	10.85	11.0	9.61	10.0	7651
7518	P. & P. Plymouth Rock Fertilizer	Plantsville	30.00	0.42	0.10	1.23	1.32	3.07	2.88	6.96	4.09	2.06	13.11	11.0	11.05	10.0	7518
7710	P. & P. Potato Fertilizer	Plantsville	.....	0.15	0.36	0.79	0.93	2.23	2.05	6.38	4.93	1.52	12.83	11.0	11.31	10.0	7710
7711	P. & P. Special Tobacco	Cromwell	.....	0.57	0.07	0.92	2.79	4.35	4.10	4.57	3.04	1.33	8.94	7.0	7.61	6.0	7711
7650	P. & P. Star Brand Superphosphate	Cromwell	.....	0.47	0.46	0.23	1.31	2.47	2.46	6.88	4.43	0.74	12.05	11.0	11.31	10.0	7650
	The Rogers and Hubbard Co., Middletown, Conn.																
7652	Hubbard's Bone Base Oats and Top Dressing	Branford	48.00	5.10	0.09	0.28	0.55	6.02	6.00	0.00	6.38	6.43	12.81	12.0	6.38	6.0	7652
7656	Hubbard's Bone Base Soluble Corn and General Crops Manure	Branford	37.00	1.26	0.10	0.64	0.52	2.52	2.50	2.88	6.50	3.71	13.09	12.0	9.38	10.0	7656
7856	Hubbard's Bone Base Soluble Tobacco Manure	Middletown	.....	3.12	0.48	0.06	1.42	5.08	5.00	0.13	11.38	5.07	16.58	13.0	11.51	10.0	7856
7657	Rogers' All Soils-All Crops Phosphate	Meriden	38.00	1.60	0.04	0.38	1.58	3.60	3.30	3.69	3.48	1.98	9.15	9.0	7.17	7.0	7657
7658	Rogers' Complete Phosphate	Meriden	38.00	0.18	0.04	0.43	0.52	1.17	1.00	5.15	3.62	2.53	11.30	11.0	8.77	9.0	7658
7659	Rogers' H. G. Oats and Top Dressing	Meriden	55.00	4.80	0.10	0.50	0.62	6.02	6.00	0.12	4.56	7.82	12.50	12.0	4.68	6.0	7659
7660	Rogers' H. G. Soluble Corn and Onion Manure	Somersville	.....	1.11	0.08	0.37	0.87	2.43	2.50	2.88	6.18	3.43	12.49	12.0	9.06	10.0	7660
7661	Rogers' H. G. Soluble Tobacco Manure	Glastonbury	43.00	3.02	0.18	0.84	1.20	5.24	5.00	0.12	7.03	5.91	13.06	13.0	7.15	10.0	7661
7662	Rogers' Potato Phosphate	Meriden	38.00	0.76	0.16	0.78	0.63	2.33	2.00	5.57	6.74	3.49	15.80	15.0	12.31	13.0	7662
7855	Rogers and Hubbard's All Soils-All Crops Phosphate	Middletown	36.00	2.25	0.10	0.50	0.88	3.73	3.30	2.48	3.48	3.48	9.44	9.0	5.96	7.0	7855
7854	Rogers and Hubbard's Complete Phosphate	Middletown	29.00	0.10	0.10	0.45	0.54	1.19	1.00	5.20	3.49	2.99	11.68	11.0	8.69	9.0	7854
7853	Rogers and Hubbard's Potato Phosphate	East Hampton	34.00	0.61	0.14	0.78	0.57	2.10	2.00	5.86	6.53	3.70	16.09	15.0	12.39	13.0	7853
	F. S. Royster Guano Co., Baltimore, Md.																
7664	Curfew Ammoniated Superphosphate	Milford	31.50	....	1.02	0.63	1.33	2.98	3.29	5.49	3.07	1.80	10.36	8.5	8.56	8.0	7664
7857	Curfew Ammoniated Superphosphate	Northford	33.50	....	1.56	0.22	1.36	3.14	3.29	5.17	3.07	0.88	9.12	8.5	8.24	8.0	7857
7665	Good Will Ammoniated Superphosphate	Plainville	38.00	....	1.66	0.83	1.69	4.18	4.11	5.55	3.60	2.12	11.27	8.5	9.15	8.0	7665
7858	Innovation Ammoniated Superphosphate	Northford	30.50	0.17	1.55	0.14	1.03	2.89	2.47	5.23	2.21	0.56	8.00	8.5	7.44	8.0	7858
7666	Penguin Ammoniated Superphosphate	Milford	26.00	....	0.53	0.65	0.64	1.82	1.65	7.32	3.54	1.27	12.13	10.5	10.86	10.0	7666
7663	Stevens' Formula	Glastonbury	35.00	0.22	0.86	0.13	3.07	4.28	4.11	4.96	1.54	0.38	6.88	6.5	6.50	6.0	7663

TABLE II.—NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station Agent:		
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.		
7725	Formula B 1916 without Potash	Wallingford	$35.00
7325	H. G. Ammoniated Phosphate	Highwood	.....
7345	Special without Potash	Highwood	26.00
	C. M. Shay Fertilizer Co., Groton, Conn.		
7667	Brown's Complete Fertilizer	Groton	28.50
7712	Brown's Formula	Guilford	34.50
7713	Brown's Oats and Top Dressing	Guilford	42.00
7859	Shay's Formula	Guilford	.....
	M. L. Shoemaker and Co., Philadelphia. Pa.		
7303	Swift-Sure Superphosphate for Tobacco and General Use	Windsor Locks	36.00
	Springfield Rendering Co., Springfield, Mass.		
7860	Animal Fertilizer, Complete Manure for All Crops	Thompsonville	32.00
	Virginia-Carolina Chemical Co., New York City.		
7870	Ammoniated Bone Phosphate for All Crops	North Haven	27.00
8212	Beef, Blood and Bone "BBB" (without Potash)	Winsted	35.00
8213	H. G. Corn and Vegetable Compound (without Potash)	Milford	26.00
8214	20th Century Potato Manure (without Potash)	Winsted	37.00
	Wilcox Fertilizer Co., Mystic, Conn.		
7871	Wilcox Complete Bone Phosphate	Ellington	27.50
7587	Wilcox Corn Special	Gildersleeve	31.00
7588	Wilcox Corn Special	Gildersleeve	30.50
7304	Wilcox Grass Fertilizer	Suffield	39.00
7705	Wilcox Grass Fertilizer	Meriden	31.50
7872	Wilcox Special Superphosphate	Branford	27.50
7796	Wilcox 6–8 Mixture	Ellington	38.50
	Sampled by Purchasers and Others:		
7540	Bowker's Alkaline Tobacco Grower	*West Suffield:*—S. Viets.	31.50
7687	Bowker's Alkaline Tobacco Grower	*West Suffield:*—S. Viets.	31.50
7436	Bowker's High Nitrogen Mixture	*Portland:*—J. Gotta	49.50
7435	Bowker's Superphosphate	*Portland:*—J. Gotta	32.50
7527	Sanderson's High Grade Ammoniated Phosphate	*Branford:*—A. E. Plant Sons Co.	32.50
7629	Shay's Brown's Special for Oats and Top Dressing	*East Haddam:*—E. E. Smith	40.00
7525	Wilcox Corn Special	*Branford:*—A. E. Plant Sons Co.	33.50

WITHOUT POTASH—(*Concluded.*)

Nitrogen.						Phosphoric Acid.							Station No.
				Total.					Total.		So-called "Available."		
In Nitrates.	In Ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	
0.91	0.65	0.38	1.21	3.15	3.29	8.54	2.70	0.84	12.08	11.0	11.24	10.0	7725
0.60	0.89	0.61	1.21	3.31	3.29	3.46	6.26	1.54	11.26	11.0	9.72	10.0	7325
0.57	0.29	0.74	1.08	2.68	2.47	2.06	7.33	1.45	10.84	11.0	9.39	10.0	7345
0.25	0.12	0.65	1.47	2.49	2.06	1.21	3.79	2.77	7.77	8.0	5.00	....	7667
0.50	0.24	1.07	1.64	3.45	3.30	0.94	5.71	2.57	9.22	10.0	6.65	....	7712
3.15	0.10	0.98	1.11	5.34	4.94	0.04	4.94	4.44	9.42	10.0	4.98	....	7713
0.46	0.18	1.00	1.72	3.36	3.30	1.75	5.52	2.15	9.42	10.0	7.27	....	7859
1.14	0.00	1.05	1.44	3.63	3.29	7.01	3.96	1.25	12.22	12.0	10.97	9.0	7303
0.40	0.55	0.87	0.81	2.63	2.46	7.80	3.70	0.46	11.96	11.0	11.50	10.0	7860
0.22	0.12	0.71	0.81	1.86	1.65	4.35	5.46	2.11	11.92	11.0	9.81	10.0	7870
0.17	0.19	0.69	2.23	3.28	3.29	5.30	5.21	1.87	12.38	11.0	10.51	10.0	8212
0.53	0.19	0.79	0.76	2.27	2.47	4.65	5.31	2.01	11.97	11.0	9.96	10.0	8213
0.29	0.33	0.80	2.95	4.37	4.12	4.67	4.73	3.84	13.24	11.0	9.40	10.0	8214
0.24	0.11	0.65	1.07	2.07	1.65	4.16	6.68	4.59	15.43	13.0	10.84	12.0	7871
....	....	....	....	3.26	3.30	7.26	2.87	1.61	11.74	11.0	10.13	10.0	7587
0.40	0.08	1.05	2.11	3.64	3.30	3.77	5.09	3.11	11.97	11.0	8.86	10.0	7588
1.77	0.07	0.68	1.86	4.38	4.12	3.25	5.39	2.75	11.39	9.0	8.64	8.0	7304
0.89	0.11	0.43	2.58	4.01	4.12	4.22	4.80	2.06	11.08	9.0	9.02	8.0	7705
0.22	0.12	0.22	1.36	1.92	1.23	5.54	3.24	5.01	13.79	11.0	8.78	10.0	7872
0.93	0.40	0.67	2.99	4.99	4.95	2.58	5.15	4.26	11.99	9.0	7.73	8.0	7796
0.84	0.02	3.35		4.21	4.11	2.55	2.44	0.69	5.68	5.0	4.99	4.0	7540
1.11	0.05	0.09	3.21	4.46	4.11	2.31	2.59	0.35	5.25	5.0	4.90	4.0	7687
3.97	3.23	1.80		9.00	8.24	4.56	1.45	0.32	6.33	6.0	6.01	5.0	7436
0.17	1.05	2.27		3.49	3.30	7.44	3.11	1.16	11.71	11.0	10.55	10.0	7435
1.12	1.18	1.23		3.53	3.29	8.17	2.76	1.01	11.94	11.0	10.93	10.0	7527
1.88	0.16	3.24		5.28	5.36	1.05	6.62	3.28	10.95	10.0	7.67	....	7629
0.91	0.06	2.65		3.62	3.30	3.72	5.65	2.83	12.20	11.0	9.37	10.0	7525

VI. MISCELLANEOUS FERTILIZERS, LIME, ASHES, ETC.

SHEEP AND GOAT MANURE.

7637. Excelsior Brand Pulverized Sheep Manure. Sold by A. H. Case and Co., Buffalo. Stock of J. J. Cahill, Warehouse Point.

7840. Sheep's Head Brand Pulverized Sheep Manure. Sold by Natural Guano Co., Aurora, Ill. Stock of Frank S. Platt Co., New Haven.

7841. Wizard Brand Manure. Sold by Pulverized Manure Co., Chicago. Stock of Brower and Malone, Norwalk.

7848. South American Sheep and Goat Manure. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Sampled at factory.

Station No.	7637	7840	7841	7848
Per cent of				
Nitrogen as nitrates	0.06	0.11	0.06	0.14
" as ammonia	0.04	0.55	0.10	0.02
" as organic	1.51	1.92	1.84	1.23
" total found	1.76	2.58	2.00	1.39
" total guaranteed	1.00	2.25	1.80	1.23
Phosphoric acid, water-soluble	0.41	1.35	0.50	0.17
" " citrate-soluble	0.73	0.43	0.55	0.70
" " citrate-insoluble	0.20	0.18	0.19	0.12
" " total found	1.34	1.96	1.24	0.99
" " total guaranteed	*0.87	1.25	1.00	1.00
Potash found	1.29	2.05	2.59	3.80
" guaranteed	1.00	1.50	1.00	2.00
Chlorin	0.23	0.90	0.45	1.65
Cost per ton	$30.00	30.00	37.00	30.00

These dried manures are chiefly of interest to florists and to greenhouse or lawn owners. As we have said in previous reports, they are out of the question for general farm use, because horse manure supplies three or four times as much plant food for the same money and the extra vegetable matter should be supplied in farm crops and residues.

WOOD ASHES.

Twenty-nine samples called "wood ashes" have been examined. **6966** from The Grangers' Lime Co., and **7387** from Pennsylvania are probably lime-kiln ashes. **6965, 6991, 7807, 7378** are of

* "Available" phosphoric acid guaranty.

ANALYSES OF WOOD ASHES.

Station No.	Car No. and Purchaser or Dealer.	Water.	Insoluble in acid (sand).	Water-soluble Potash.	Lime.	Magnesia.	Phosphoric Acid.	Cost per ton.
7259	F. S. Bidwell & Co., Windsor Locks. Fairview Farm, Hartford	....	....	3.71	.....	....	....	$21.15
7386	T. H. Framley, Newport, R. I. F. H. Rolf, Guilford	15.03	11.80	5.54	26.20	4.02	2.34	18.00
6966	Grangers' Lime Co., West Stockbridge, Mass.	....	12.90	0.22	51.00	....	0.38	.....
7017	L. B. Haas & Co., Hartford	....	10.00	5.24	29.58	3.88	2.00	.....
7387	W. F. Leidy, Swarthmore, Pa. S. D. Woodruff & Sons, Orange	3.30	9.85	0.16	56.14	trace	0.19	18.00
6983	Geo. D. Nichols, Shelton (Soft wood ashes)	....	31.00	2.90	20.14	6.48	1.09	.....
6839	Olds & Whipple, Hartford. 65540 Michael Driscoll, Poquonock	....	....	4.22	.....	....	....	*21.10
6965	Olds & Whipple, Hartford. 48872 Michael Driscoll, Poquonock	....	....	1.47	.....	....	....	*7.35
6990	Olds & Whipple, Hartford. 7496 E. O. Gates, New Hartford	....	....	5.61	.....	....	....	*28.05
6991	Olds & Whipple, Hartford. 44776 W. S. Pinney, Suffield	....	....	2.19	.....	....	....	*10.95
7004	Olds & Whipple, Hartford. 203729 James Conroy, East Windsor	....	....	4.75	.....	....	....	*23.75
7005	Olds & Whipple, Hartford. 87294 R. M. Thompson, South Manchester	....	....	4.57	.....	....	....	*22.85
7258	Olds & Whipple, Hartford. 65089 J. B. Stewart, Windsor	....	....	7.71	.....	....	....	*38.55
7279	Olds & Whipple, Hartford. 35660 O. J. Thrall, Windsor	....	....	6.57	.....	....	....	36.13
7493	Olds & Whipple, Hartford. 90237 R. M. Thompson, South Manchester	....	4.93	6.89	32.34	3.50	2.97	*34.45
7537	Olds & Whipple, Hartford. 65125 Geo. M. Grant, Melrose	....	8.80	6.20	32.82	3.24	2.25	34.10
7539	Olds & Whipple, Hartford. 65050 James Conroy, Warehouse Point	....	7.75	6.23	31.16	2.90	1.94	34.27
7500	Olds & Whipple, Hartford. 9152 R. L. Thrall, Hartford	....	2.34	4.34	44.16	3.84	2.47	23.87
7750	Olds & Whipple, Hartford. 61741 John Wolf, Windsor	....	9.96	5.91	34.74	2.96	2.01	*29.55
7751	Olds & Whipple, Hartford. 101769 Geo. M. Grant, Melrose	....	7.06	6.55	34.98	3.46	1.97	*32.75
7793	Olds & Whipple, Hartford. 12267 Howard Kirbell, Silver Lane	....	8.17	5.37	35.36	2.82	2.17	26.85
7807	Olds & Whipple, Hartford. 8283 Olin Wheeler, Burnside	....	5.53	2.53	41.38	3.34	2.10	*12.65
7866	Olds & Whipple, Hartford. 8034 E. O. Gates, New Hartford	....	7.22	6.46	31.10	3.85	2.34	*32.30
8220	Olds & Whipple, Hartford. 18262 J. C. Eddy, Simsbury	....	7.24	4.47	28.60	3.68	2.03	*22.35
7378	Geo. S. Phelps & Co., Thompsonville	1.43	51.55	0.77	18.80	3.30	1.24	.....
6999	Geo. Stevens, Peterboro, Ont. 55478 H. A. Henshaw, Suffield	....	13.25	3.28	.....	....	1.42	15.50
7460	Geo. Stevens, Peterboro, Ont. .... J. C. Thompson, Unionville	13.03	11.01	4.76	31.48	2.48	1.56	18.50
7335	Chas. Stevens, Napanee, Ont. .... John B. Cannon, Granby	4.03	10.45	5.24	38.30	....	1.73	.....
7749	Swift & Co. .... Julius Reck, Bridgeport	....	5.34	6.91	36.70	5.76	1.75	15.00

* $5.00 per unit of water-soluble potash.

very poor quality, the last named being more than half sand and soil. The others are of fair to good quality.

All the samples sold by Olds & Whipple are stated to be not Canadian but domestic ashes and show decided superiority to the so-called Canadian Hard Wood Ashes sold in previous years. With the exceptions above noted the average per cent of potash in 23 samples is 5.36, the average per cent of phosphoric acid in the 16 samples in which it was determined was 2.00.

This shows, what we have constantly maintained, that the very inferior quality of ashes sold in this state in late years is to be explained by the carelessness or fraud of makers or dealers. The quality of the pure ashes from hard wood is as good as ever.

Ashes should never be bought without a guaranty of water-soluble potash. No other kind of potash is wanted. There should also be a full understanding that a rebate is to be given by the seller for any potash deficiency and the terms of the rebate agreed upon in advance. "Ashes" and "Canada hard-wood ashes" as offered in market have no definite composition and much money has been lost by farmers in the purchase of inferior ashes.

GROUND LIMESTONE, OTHER LIMES AND OYSTER SHELLS.

6970. Ground Limestone. Sold by The Grangers' Lime Co., West Stockbridge, Mass.

7653. Ground Limestone. Sold by The Grangers' Lime Co., West Stockbridge, Mass., to L. H. Healey, North Woodstock.

7672. Ground Limestone. Sold by The Grangers' Lime Co., West Stockbridge, Mass., to Rogers and Hubbard Co., Middletown.

7673. Ground Limestone. Sold by The Grangers' Lime Co., West Stockbridge, Mass., to Apothecaries Hall Co., Waterbury.

All of the above samples were drawn and sent by the manufacturer.

7197. Ground Limestone. Sold by Stearns Lime Co., Danbury. Sampled by station agent at factory.

7282. Ground Limestone. Sold by Stearns Lime Co., Danbury. Sampled and sent by J. A. Sherwood, Long Hill.

6982. Lime sampled and sent by H. A. Smith, Newtown.

7284. Lime from "Yellow Factory," Chester. Sampled and sent by John H. Fay, county agent, Middletown.

7283. Lime from acetylene gas plant. Sampled and sent by John H. Fay, county agent, Middletown. May be taken from the factory without charge.

7007. Limeoid. Sampled and sent by The Burns Co., Bridgeport.

7337. Burnt Lime. Sold by Gault Bros., Westport. Stock of W. H. Burr, Westport. Sampled by station agent.

7009. Ground Oyster Shells. Sent by F. E. Rogers, county agent, New Haven.

7383. Sampled and sent by Jas. O. Wooster, Fairfield. Qualitative tests showed this to be a ground limestone containing a large amount of moisture.

The first six samples are quite pure calcitic limestones containing little magnesia. **6982** is a ground magnesian limestone, representative of the larger part of the deposits in western Connecticut. **7283** and **7284** are factory wastes, the one from the acetylene plant containing more than half its weight of water. We find nothing likely to injure crops in either product and acetylene lime has been used on land with success.

ANALYSES OF LIMES AND OYSTER SHELLS.

Station No.	6970	7653	7672	7673	7197	7282
Per cent of						
Lime	48.60	51.24	49.68	49.26	43.70	43.44
Magnesia	small	*	*	*	*	*
Insoluble in acid	6.65	6.60	6.37	6.25	10.80	10.95

Station No.	6982	7284	7283	7007	7337	7009
Per cent of						
Lime	36.00	61.56	31.89	43.20	40.90	39.90
Magnesia	22.93	*	*	much	*	*
Insoluble in acid	2.25	†2.15	‡0.40	0.50	1.55	§

MUCK, PEAT, HUMUS, ETC.

Fourteen samples were analyzed as follows:

6452. Swamp muck from swamp west of Beaver Brook reservoir near Bridgeport Ave., Milford. Sent by Eli Whitney, New Haven.

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* Not determined.

† Contains 0.75 per cent moisture and 0.47 per cent organic matter.

‡ Contains 52.40 per cent moisture.

§ Contains 16.56 per cent moisture.

ANALYSES OF PEAT, MUCK, 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.
6452	Swamp Muck	71.62	13.44	14.94	0.40	0.06	0.06	52.65	47.35	1.41	0.21	0.20
6870	Humus No. 1	10.72	24.90	64.38	2.23	.....	.....	27.88	72.12	2.49	....	....
6871	Humus No. 2	16.50	23.38	60.12	2.14	.....	.....	27.99	72.01	2.55	....	....
6872	Humus No. 3	14.13	16.05	69.82	3.02	.....	.....	18.69	81.31	3.51	....	....
6878	Beard Swamp Muck	79.14	11.91	8.95	0.25	0.03	0.04	57.09	42.91	1.20	0.14	0.19
6879	Pump House Swamp Muck	84.32	0.91	14.77	0.28	0.02	0.01	5.80	94.20	1.79	0.13	0.06
7388	Peat, four feet from surface	41.85	9.64	48.51	1.45	.....	.....	16.58	83.42	2.49	....	....
7389	Peat, eight feet from surface	49.99	4.47	45.54	1.16	.....	.....	8.94	91.06	2.32	....	....
7390	Dried and ground peat	12.13	45.25	42.62	1.15	.....	.....	51.50	48.50	1.31	....	....
6455	Pasture muck	.....	80.80	.....	.....	.....	.....	.....	.....	.....	....	....
8227	Beaver Brook	85.99	1.84	12.17	0.31	0.01	0.02	13.13	86.87	2.21	0.07	0.14
8228	Beaver Brook	82.41	3.47	14.12	0.33	0.01	0.02	19.73	80.27	1.88	0.06	0.11
8229	Beaver Brook	83.47	3.93	12.60	0.29	0.01	0.01	23.77	76.23	1.75	0.06	0.06
8252	Muck from a wet "hollow"	72.39	14.13	13.48	0.33	.....	.....	51.15	48.85	1.19	....	....

6870, 6871 and **6872.** Humus sent by Branford Farms, Groton.

6878. Beard Swamp muck. Sent by Eli Whitney, New Haven.

6879. Pump House Swamp muck. Sent by Eli Whitney, New Haven.

7388. Peat taken from four feet below surface. Sent by Lansing Lewis, New Haven.

7389. Peat taken from eight feet below surface, many roots present. Sent by Lansing Lewis, New Haven.

7390. Dried and ground peat. Sent by Lansing Lewis, New Haven.

6455. Pasture muck. Sent by H. E. Russell, Brookfield.

8227, 8228, 8229. Muck from Beaver Brook, Milford. Sampled and sent by Prof. W. L. Slate, Jr., Storrs.

8252. Vegetable matter from a low, wet hollow. Sent by R. B. Kelly, New Canaan.

Of the above samples, concerning which we have no further information, **6879, 7389, 7388, 6872, 8227** and **8228** are quite pure vegetable matter, the largest amount of mineral matter in the dry substance of any of them being less than 20 per cent. All of them, when partly dry, would make admirable absorbents for liquid manure and a valuable adjunct to manure because of their water-holding capacity in sandy soils. The nitrogen being in form quite resistant to decay is of little immediate farm value.

COMPOSITION OF SHADE-GROWN TOBACCO STALKS.

A sample containing seven stalks of shade-grown tobacco, from which the leaves had been primed, was sent by W. H. Olcott, South Manchester, with a request for analysis.

The stalks as received weighed 10 lbs. 7½ oz., and contained

Water	82.44
Dry matter	17.56
	100.00
Nitrogen	0.366
Phosphoric acid	0.084
Potash	0.565

There are contained in

	One ton stalks	*10,000 stalks*
Water	1,649 lbs.	12,338 lbs.
Dry matter	351 "	2,632 "
Nitrogen	7.3 "	55 "
Phosphoric acid	1.7 "	13 "
Potash	11.3 "	85 "

Green stalks would not pay for cartage but if turned under in the fall would supply very considerable amounts of nitrogen and potash, as the analysis shows.

MISCELLANEOUS MATERIALS.

6972. "Davidge's Special Phosphorus." Made by Hudson Carbon Co., Ballston Spa, N. Y. Cost $40.00 per ton. Guaranteed 5 per cent phosphoric acid. Sampled and sent by A. A. Young, Jewett City. This material is advertised for florists' use.

Moisture	1.85
Mineral matter	73.78
Organic matter	24.37
Nitrogen	0.98
Phosphoric acid, water-soluble	0.05
" " citrate-soluble	1.68
" " citrate-insoluble	15.39
" " total	17.12
Potash	0.45

2999. Rape Meal. Contained 5.96 per cent of nitrogen, which by the permanganate methods showed a high solubility.

7198. Waste Powder. This is understood to be sweepings from a factory and to consist chiefly of gunpowder. Sent by S. W. Eddy, Avon. It contained 10.28 per cent of nitrate nitrogen and 34.50 per cent of potash, equivalent to 74.04 per cent potassium nitrate (saltpeter). This waste powder, composed of sulphur, charcoal and nitrate of potash, would be valuable in a special potato mixture, but the risks attending its transport and storage are of course great.

7199. Soot from chimney flues. Sent by S. W. Eddy, Avon. It contained about 98.5 per cent of mineral matter with 1.05 per cent of phosphoric acid, 0.35 per cent of potash and no nitrogen.

6969. Lint refuse. Sent by F. A. Wheeler, Norwich. It contained 0.94 per cent of nitrogen and 42.38 per cent of mineral matter (mostly sand). It was suggested that it might be used as a mulch if got without other cost than cartage.

7254. Dirt from under cotton carding machines. Sent by The Palmer Bros. Co., Fitchville. It contained 1.24 per cent of nitrogen, 0.17 per cent of phosphoric acid and 1.24 per cent of potash.

7336. Harbor Mud. Sent by Prof. A. G. Gulley, Storrs. It contained

Water	3.55
Insoluble in acid (sand)	75.60
Nitrogen	0.99
Phosphoric acid	0.77
Potash	0.05
Lime	1.24

On light land some kinds of marine mud, after partial drying and freezing, have proved valuable as a dressing.

7742. Finely powdered material sent by G. L. Howe, Rocky Hill. It contained 0.10 per cent of nitrogen, 0.74 per cent of phosphoric acid, no potash, 2.60 per cent of lime and 83.24 per cent of insoluble mineral matter. There was some carbonaceous matter present and the substance had the general characters of flue dust.

6992. Rock. **6993.** Sand. Sent by C. C. Hewitt, Uncasville. These samples contained 96.15 and 94.70 per cent, respectively, of matter insoluble in acid (sand) and are without value as fertilizers.

6994 and **6995.** Ground charred corn cobs. Sent by C. C. Hewitt, Uncasville. They contained 1.95 and 2.01 per cent of potash, respectively.

7222. Sent by North-Eastern Forestry Co., Cheshire. Fertilizer which had been in storage for four years, originally claimed to contain 14 per cent of potash. It contained 3.36 per cent of nitrogen, 10.20 per cent of phosphoric acid and 7.05 per cent of potash.

7382. Mixture of odds and ends, including a mixed fertilizer, tankage, acid phosphate and blood. Sent by L. M. Benham, Highwood. It contained 2.75 per cent of nitrogen, partly in form of nitrates, 11.71 per cent of phosphoric acid and 2.06 per cent of potash.

7008. Stone Dust. Sent by The Burns Co., Bridgeport. It contained 91.85 per cent of matter insoluble in acid (sand) and was without agricultural value.

7379. Refuse sent by E. E. Burwell with request for a test for potash was found to contain 0.37 per cent.

6225. Fertilizer sold by Oleum Products Co., Scranton, Pa. Sent by Benj. Fenn, Milford. It contained 0.27 per cent of nitrogen, 3.43 per cent of phosphoric acid and 0.31 per cent of potash.

6989. Sent by Lilian C. Alderson, Greenwich, with the question whether it was a superphosphate. It contained 0.35 per cent of nitrogen, 0.41 per cent of potash and no phosphoric acid.

6824 and **6825.** Mixed fertilizers sent by Henry Dryhurst, Jr., Meriden, with a request for a test for potash, of which they were found to contain 1.79 and 3.03 per cent, respectively.

7701. Waste odds and ends of fertilizer from stock of Station. It contained 5.50 per cent of nitrate nitrogen.

7195. Material thought to be nitrate of soda. Sent by A. N. Farnham, Westville. It contained no nitrate nitrogen, 0.45 per cent of potash and chlorin equivalent to about 93 per cent of common salt.

6887, Coarse Salt, and **6888,** Fine Salt. Sent by L. T. Frisbie Co., New Haven. These were thought to contain considerable nitrogen but analysis showed only 0.04 and 0.12 per cent, respectively.

6828. A mixture of nitrate of soda and muriate of potash. Sent by W. A. Henry and Son, Wallingford; contained 15.46 per cent of potash, with much soda and nitrate nitrogen.

8241. A fertilizer sent by Joseph Carson, Hazardville, with the inquiry whether it contained corn meal, contained no corn meal or other starchy matter.

8246. "Special Potash Ash" from the Chemical Products Co. of Pennsylvania. Sent by E. K. Dean, Amenia Union; contained only 0.51 per cent of water-soluble potash.

MISCELLANEOUS SOIL TESTS.

These tests are here noticed because they have relation to the use of fertilizers and amendments.

More than 60 samples of soil have been tested for acidity by the Jones method in answer to requests from their owners. The test is designed to give the number of pounds of actual lime, CaO, required per acre to make the soil neutral in reaction.

Soils will, however, often produce good crops with considerably less than this amount.

The highest lime requirement indicated in any of the soils examined was 7020 pounds. One sample (soil from alfalfa land which had been very heavily limed for some years) was found to be alkaline and the lowest lime requirement in any other was 630 pounds.

EXAMINATION OF SOILS FROM TOBACCO FIELDS.

Very general complaint has been made in the last few years that the yield of old tobacco lands was in many cases growing less. More striking has been the appearance in tobacco fields of areas of varying size where the crop either failed entirely or was stunted and sickly.

In order to see if the reaction of the soil on these spots showed any difference from that of parts of the field where growth was normal, samples both of the normal and the "sick soil" were drawn from twelve different fields and the acidity tested by the Jones method.

The average lime requirement of the normal soils was 1190 pounds, that of the "sick" spots 1242 pounds. In seven cases the lime requirement on the soil of the normal part of the field was less than that on the "sick" portion and in four cases it was more. These differences are certainly too small to be significant.

FURTHER CHEMICAL EXAMINATIONS OF SOIL FROM TOBACCO FIELDS.

The object in making these analyses was to find whether the failure of tobacco to grow satisfactorily on certain fields or parts of fields could possibly be attributed to a difference in the composition of the soil. The samples were drawn either by members of the Station staff or by the owners of the land who were fully instructed as to the method and precautions in sampling.

The data regarding the samples are as follows:

4738 and **4739,** soils to the depth of 9 inches from farm of Edgar E. Woodbury, Warehouse Point.

4739. Tobacco has been grown on this land almost constantly for 80-100 years. As good tobacco is grown here as anywhere in

the field though the yield of the whole field is not entirely satisfactory.

4738, from a portion of the same field, under the same treatment, where the plants are obviously stunted and not nearly so large or productive as on the rest of the field. The sample was taken from the east end where growth is poorest.

4740 and **4741**. Soils to a depth of 9 inches from tobacco land of H. E. Ellsworth, Simsbury. Tobacco has been grown here for many years, for the last 2 or 3 years under shade.

4741 from land where tobacco grows satisfactorily.

4740 from spots where the growth is stunted and poor.

The official method of soil analysis was followed, those elements only being determined which are soluble in acid.

	E. E. Woodbury.		H. E. Ellsworth.	
	Good.	Poor.	Good.	Poor.
	4739	**4738**	**4741**	**4740**
Fine soil	89.87	89.09	90.64	87.58
Gravel	10.13	10.91	9.36	12.42
	100.00	100.00	100.00	100.00
ANALYSIS OF FINE SOIL.				
Water	0.26	0.28	0.84	0.70
Other volatile matter	4.51	3.72	7.06	5.44
Insoluble in acid	88.93	90.62	88.45	87.90
Potash	0.15	0.16	0.15	0.19
Soda	0.08	0.10	0.09	0.08
Lime	0.35	0.44	0.34	0.48
Magnesia	0.49	0.51	0.31	0.38
Oxide of iron and alumina	5.00	4.36	3.32	4.85
Phosphoric acid	0.36	0.29	0.10	0.30
	100.13	100.48	100.66	100.32
Nitrogen	0.11	0.09	0.19	0.16

A comparison of each good soil with the poor soil from the same field shows no significant difference in composition, to which a difference in crop production could be attributed. The only striking difference is that the analysis of the poor soil from Ellsworth showed three times as much phosphoric acid as the good soil.

This field was visited by Dr. Clinton after harvest when most of the roots were dead. Examinations in both parts of the field showed slight infection with the root rot fungus, *Thielavia basicola*, but not in an amount which would be likely to interfere seriously with crop production.

As it has been suggested that an accumulation of water-soluble salts in the surface soil was the cause of the poor spots where tobacco did not grow normally, the following tests were made.

The tests consisted in shaking a weighed portion of soil for some time with water, filtering and determining in the clear solution the elements named.

In one case, the method of extraction by percolation used by the Massachusetts station was tried for comparison:

3008 and **3301** were sampled and sent by S. W. Bristol, Collinsville, **3301** from land yielding good tobacco, **3008** from spots where the yield was very inferior. **3007** was sampled by W. A. Hamlin, Suffield. For the last three years quality and yield of leaf have steadily grown poorer. His statement shows that it has been well fertilized, 2500 to 3000 of a mixed tobacco fertilizer per acre each year, 300 lbs. of lime in 1910 and 1911, and 1000 lbs. of lime in 1912. No lime was added in 1913, the year in which the sample was taken.

3719 East field and **3720** West field were sampled and sent by E. G. Beinhart of the U. S. Bureau of Plant Industry. These are from land of Henry Adams, Suffield, which yearly for the last ten years has had 1200 lbs. per acre of a standard tobacco fertilizer, together with one ton of cotton seed meal and 200 lbs. of lime.

The tobacco on the areas represented by the samples was inferior as compared with other parts of the field.

The samples were taken from slight depressions in the field, ranging from 100 to 3000 sq. ft. in area and the owner states that in dry periods the surface of these depressions is covered with a thin gray crust.

Following are the analyses of the solid matter in the aqueous extracts. The figures are percentages in the fine soil.

The extracts, where not otherwise stated, were prepared by the method described by Haskins, shaking a given weight of soil with water and making determinations in an aliquot part of the filtered solution.

A percolation method was used in some cases, 200 grams of soil being washed on a filter till 1000 cc. of filtrate were collected.

	Collinsville S. M. Bristol. Poor.	Collinsville S. M. Bristol. Good.	Suffield. W. A. Hamlin. Poor.	Suffield. W. A. Hamlin. Poor.	Suffield. Henry Adams. Poor.	Suffield. Henry Adams. Poor.
	3008*	3301*	3007*	3007†	3719†	3720‡
Total residue containing	.082	.040	.186	.205	.407	.473
Potash	.016	.009	.016	.012	.010	.010
Soda	.008	.007	.009	.012	.010	.012
Lime	.021	.002	.060	.055	.035	.050
Magnesia	.003	trace	.016	.013	.015	.012
Phosphoric acid	trace	trace	trace	trace	trace	trace
Iron oxide	....	....	....	....	.013	.011

Calculated on 2 million lbs. of soil:

§ *Total residue*	1,640	800	3,720	4,100	8,140	9,460
Potash	320	180	320	240	200	200
Soda	160	140	180	240	200	240
Lime	420	40	1,200	1,100	700	1,000
Magnesia	60	..	320	260	300	240
Oxide iron	..	..	..	..	260	220

In the last two samples the residue was largely organic.

In the one sample of soil producing good tobacco the amount of soluble lime was very much smaller than in any of the others and this seems to be the only significant feature. The sum of the four ingredients, soluble potash, soda, lime, and magnesia, is in the single good soil .018, in the four "sick" soils .087. It is unfortunate that we have not more comparisons of good and poor spots from the same field. The average of Haskins' tests in Massachusetts was .0435 on good soils and .0808 on sick soils.

In the two analyses of the acid-soluble part of the soil the sum of percentages of the four ingredients named above in good soils was 0.98, in poor soils 1.17.

A single analysis of soil from the farm of W. A. Henry & Son, Wallingford, may here be given though not a tobacco soil. The history of the soil is not known. It had not been cultivated recently and was in meadow.

* Soil extracts neutral to litmus.
† This extract prepared by percolation.
‡ Soil extracts acid to litmus.
§ Largely organic.

The analysis was made on the acid-soluble portion of the water-free, fine soil by the official method.

Insoluble and silica	84.20
Loss on ignition	5.20
Potash	0.24
Soda	0.13
Lime	0.31
Magnesia	0.54
Oxide of iron and alumina	8.36
Phosphoric acid	0.10
Sulphuric acid (SO_3)	0.09
	99.17
Nitrogen	0.16

PART II.

SIXTEENTH 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 the following as my sixteenth report as State Entomologist of Connecticut for the fiscal year ending September 30, 1916. The inspection of the nurseries was not completed before that date, but as it is desirable to have them all in one list, they are included here. The presence of the white-pine-currant blister rust has necessitated extra inspection work, though, as this is a fungous disease, both the botanical and forestry departments have aided in its eradication. The chief entomological features of the year as well as accounts of the routine work of the department, and a few special articles, will be found in the following pages.

Respectfully submitted,

W. E. Britton,
State Entomologist.

Report of the Receipts and Expenditures of the State Entomologist from October 1st, 1915, to September 30th, 1916.

Receipts.

From E. H. Jenkins, Treasurer	$3,750.00	
Account of 1915, balance	761.54	
State Comptroller, Apiary Inspection Account	10.70	
" " Gipsy Moth Control Account	713.00	
Miscellaneous sources for lantern slides	2.85	
		$5,238.09

EXPENDITURES.

For Field, office and laboratory assistance:		
B. H. Walden, salary	$1,500.00	
Q. S. Lowry, salary	1,041.65	
M. P. Zappe, salary*	787.49	
Grace A. Foote, salary†	489.86	
Other assistance	41.00	
		$3,860.00
Printing and illustrations		15.64
Postage		25.01
Stationery		13.56
Telegraph and telephone		4.44
Office supplies		8.43
Library		50.53
Laboratory supplies		49.63
Express, freight and cartage		3.59
Tools and supplies		34.25
Traveling expenses		198.91
Balance, cash on hand		974.10
		$5,238.09

Memorandum:—This account of the State Entomologist has been duly audited by the State Auditors of Public Accounts. By provision of the Legislature at its 1915 session, all expenses for the work of suppressing gipsy and brown-tail moths and of inspecting imported nursery stock are paid by order of the Comptroller on receipt of duly approved, receipted, and certified vouchers, and the accounts may be found in the Comptroller's office in the State Capitol at Hartford. The items of $10.70 and $713.00 credited above as having been received from the State Comptroller, are not real receipts, but are virtually transfers from other appropriations to cover time expended on work for which such appropriations were made.

SUMMARY OF INSPECTION AND OFFICE WORK.

325 samples of insects received for identification.
88 nurseries inspected.
79 regular nursery certificates issued.
19 parcels of nursery stock inspected and certified.
23 orchards and gardens examined.
291 shipments, containing 2,102 cases, 1,998,178 plants imported nursery stock inspected.
94 shipments, or 32.3 per cent. found infested with insects or fungi.
467 apiaries, containing 3,898 colonies, inspected.
88 apiaries, containing 275 colonies found infested with European foul brood.
5 apiaries, containing 6 colonies found infested with American foul brood.

* For ten months. † For thirty-five weeks.

2 apiaries, containing 2 colonies found infested with pickled or sacbrood.
2037 letters written on official work.
768 post cards written on official work.
300 reports of inspection to Federal Horticultural Board.
1230 bulletins, etc., mailed on request or to answer inquiries.
99 packages sent by mail or express.
28 lectures and addresses made at institutes, granges, etc.

PUBLICATIONS OF ENTOMOLOGICAL DEPARTMENT, 1916.

By W. E. Britton:

Fifteenth Report of the State Entomologist (Part II. of Station Report for 1915): 112 pages, 6 figures, 16 plates; 10,000 copies distributed in April.

Report of the Committee on Injurious Insects, Proceedings Connecticut Pomological Society, page 35, 5 pages, 1916.

Report of the Committee on Injurious Insects, Proceedings Connecticut Vegetable Growers Association, page 9, 2 pages; page 82, 3 pages; also page 17 "Insects Attacking the Potato," 4 pages, 1915-1916.

Further Notes on *Diprion simile* Hartig, Journal of Economic Entomology, Volume 9, page 281, 2 pages, 1916.

The House Fly as a Disease Carrier and How Controlled (New and revised edition of a paper issued in 1912), Connecticut State Board of Health, 12 pages, 1916.

Report of the Anti-Mosquito Committee of the New Haven County Public Health Association, Monthly Bulletin, Connecticut State Board of Health, 3 pages, September, 1916.

A Dangerous Pine Sawfly (*Diprion simile* Hartig), Tree Talk, Volume 3, page 45, 2 pages, November, 1915.

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

Bulletin 190, Insects Attacking Cabbage and Allied Crops in Connecticut, 23 pages, 17 figures; 10,000 copies distributed in April.

By B. H. Walden:

Anti-Mosquito Work in Connecticut, Proceedings Second Annual Meeting New Jersey Mosquito Extermination Association, page 81, 3 pages, 1915.

By P. L. Buttrick:

Bulletin 189, A Mosquito Survey at the Mouth of the Connecticut River, 32 pages, 1 map in colors; 2,000 copies distributed in March and April.

Department 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 Grace A. Foote, B.A. .....*Clerk and Stenographer.*

H. W. Coley, Westport
A. W. Yates, Hartford } .....*Apiary Inspectors.*

Messrs. Walden, Lowry, Davis, and Zappe have continued as assistants and have aided in the general work of the department, particularly the inspection of nurseries and of imported nursery stock.

Mr. Walden has been in charge of all work during the absence of the Entomologist and has done most of the photographic work of the department which includes the making of negatives, prints, enlargements and lantern slides. He has also devised and made certain pieces of special apparatus for photographic work. He was assigned the inspection of the mosquito drainage work in Branford, Guilford, and Madison, and this occupied most of his time during the summer. He was, however, able to continue certain experiments on the control of the white pine weevil at Rainbow.

Mr. Davis has been in charge of the field work in suppressing the gipsy moth and the brown-tail moth, and has resided in Danielson throughout the entire year, except from August 15 to September 15, when he was in New Haven assisting in the annual inspection of the nurseries of the State. Mr. Davis' salary has been paid by the Comptroller out of the gipsy moth appropriation.

Mr. Lowry has conducted some field experiments in controlling the insects attacking cucumber, squash, and pumpkin at the Station farm at Mt. Carmel. He also investigated an outbreak of the eight-spotted forester, *Alypia octomaculata* Fabr., which occurred in the city of New Haven. Mr. Lowry has done a large portion of the work of inspecting nursery stock, both that growing in the nurseries of the State and that coming in from foreign countries.

Mr. Zappe was employed during May and June in inspecting pine trees for the white-pine-currant blister rust, under the direction of the State Forester, and for these two months was on the Federal payroll. Under the direction of the Entomologist, he has carried on some detailed studies on the life history, distribution, habits, and food plants of the imported pine sawfly, *Diprion simile*. He has also made the laboratory and insectary records, inspected much nursery stock and has done considerable work on the insect collection.

Miss Foote has done the stenographic and clerical work of the office, which consists of keeping all the records of inspection of apiaries and of imported nursery stock, indexing literature and insect collections, writing letters, typing manuscripts, filing letters and pamphlets, etc. During her vacation and for a short time when she was called home on account of sickness, Miss Alice C. Heath acted as substitute.

Messrs. Coley and Yates have inspected apiaries, as in former years, on a *per diem* basis, their wages and expenses being paid by order of the Comptroller, on duly accredited vouchers, out of an appropriation for the purpose.

All the members of the staff and others mentioned above have worked faithfully and conscientiously, and each deserves credit for whatever degree of success has been reached in the work of the department.

New Equipment.

During the early summer an out-door insectary about 10x16 feet in size was erected near the laboratory. It was built of a wood frame covered with a strong galvanized wire netting having a fine mesh. At first a removable and adjustable canvas roof was constructed, but in the fall this was replaced by a more permanent and stronger roof of boards and shingles. It was feared that the canvas would not carry the weight of snow which sometimes accumulates during the winter. This building is shown on plate 1, a.

A microscope slide cabinet holding 1,500 slides, a No. 4402 micro-Tessar photographic lens, and a second hand No. 3 special Kodak, fitted with Bausch and Lomb No. 11B Tessar lens and compound shutter, have been purchased during the year.

The insect collection has been enriched by a gift of 28 species of beetles of the family Dytiscidæ, from Mr. F. Waldo Dodge of Melrose Highlands, Mass. The specimens are correctly named and neatly mounted, and supplement the other species of this family in the collection.

Chief Lines of Work.

The routine and control work required by law continue to occupy a major portion of the time and efforts of members of the department staff. This includes the inspection of nurseries, inspection of orchards, gardens, greenhouses, etc., on request, the suppression of gipsy and brown-tail moths, and the inspection of apiaries. Since 1909, when nests of the brown-tail moth were found on stock imported into New York State, we have endeavored to examine all nursery stock entering Connecticut coming from outside the United States, and this inspection has been fairly complete since the establishment of the Federal Horticultural Board with its excellent system of permits and notices, in 1912.

The gipsy and brown-tail moth suppression work has been in immediate charge of Mr. Davis and has required much thought and attention. As provided by law, the work was placed upon a different basis beginning October 1, 1916. All bills are now paid by order of the Comptroller on vouchers which have been receipted and certified, and duly approved by the State Entomologist. The State Entomologist still has general charge of the work, is authorized to make rules and regulations, and must approve all accounts before they can be paid.

Under the new mosquito drainage law, the Director of the Station is authorized to make rules and orders concerning the drainage of swamp lands to eliminate mosquito breeding, and may order any marsh ditched, whenever suitable funds have been raised for the purpose. The Director is also charged with the approval of the work, after which the towns are obliged to maintain it.

As a large drainage project was under way involving all the salt marsh areas in the towns of Madison, Guilford, and the eastern part of Branford, the Director called upon the entomological department to inspect the work and Mr. Walden was

assigned the task. This work required the most of his time from April 1 to September 1. Mr. Walden has also inspected about 32,000 feet of ditches cut in salt marshes in Saybrook and about 15,000 feet in the lower part of the West River marsh in the town of Orange near New Haven.

Experiments in controlling the white pine weevil have been in progress for several years, and during 1916 were continued at Rainbow by Mr. Walden. The study of the imported pine sawfly, *Diprion simile* Hartig, commenced last year, has been continued by Mr. Zappe under the writer's supervision. A number of interesting observations were made on habits and food plants, and some new parasites were reared. This work was carried on in the new out-door insectary.

Experiments in controlling the insects attacking squash, pumpkin, and cucumber, and particularly the striped cucumber beetle and the squash borer, were conducted by Mr. Lowry under the writer's supervision, at the Station farm at Mt. Carmel. One-half acre of ground was devoted to this work and especially with the squash borer the treated rows gave a good crop of squashes, while the untreated rows had many of the vines killed, resulting in a small crop. This work will probably be continued next year.

The Entomologist has kept under observation during the season a scale-insect on silver maple.

The entomological supervision of the Station orchards at Mt. Carmel has been continued, and Messrs. Lowry and Zappe have examined the young apple and peach trees for borers, as in preceding years.

The Entomologist has given considerable time to forthcoming bulletins on insects to be published by the Connecticut Geological and Natural History Survey. Bulletin No. 22, "The Hymenoptera of Connecticut," which is about to be issued, has required reading and correcting of proof. He has also written a portion, and edited the remainder of a series of papers on the "Hemiptera of Connecticut," which will appear as an early bulletin of the Survey.

The following pages give a more detailed account of the work of the department for the year.

INSPECTION OF NURSERIES.

This work was commenced on August 8, and finished October 11, and was done by Messrs. Lowry, Davis, Zappe, Walden, and Britton. Dr. Clinton, Botanist, accompanied the party occasionally and visited a few of the larger nurseries, giving particular attention to the white-pine-currant blister rust, which has been found in two nurseries.

As was the case last year, the Ford car was used to transport the men, especially to the larger nurseries. The car was thus available for about a month, but was needed on the gipsy moth work by Mr. Davis after September 15.

On account of the outbreak of the white-pine-currant blister rust, an inspection of all white-pine plantations, where imported stock was used, was made in May and June by Station men in coöperation with the U. S. Department of Agriculture. This work was in charge of Mr. W. O. Filley, State Forester, but members of the botanical and entomological departments assisted. Some of the larger nurseries had previously imported pines from Europe and these were, therefore, inspected early in the summer. All nurseries were inspected for this as well as other pests in late summer, when the regular annual inspection was made. In August and September this disease was found on currants in a few nurseries and all diseased stock destroyed.

On the whole the nurseries were found to be in unusually good condition, though the inspection was uncommonly rigid. In 37 nurseries no pests were found; in 23 there were traces of San José scale. Oyster-shell scale was noted in 30; scurfy scale, 5; euonymus scale, 2; pine leaf scale, 2; spruce gall louse, 10; white pine weevil, 3; sawfly larvae on pine, 7; chestnut blight, 5; fire blight, 2; black knot, 6; white-pine-currant blister rust, 2; tulip tree scale, West Indian peach scale, *Kermes, Lina scripta,* linden borer and leopard moth, 1 each.

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 unless these instructions had been carried out.

Besides the regular inspection and certification of nurseries, six inspection trips have been made, and 19 parcel certificates issued to persons who are not regular nurserymen, but who wish to ship woody plants, and are unable to do so without certificates.

Four nurseries have been inspected twice, in addition to the blister-rust inspection of pines in May and June which included practically all nurseries having pines.

Of the 83 names on the nurserymen's list, 15 are new since the publication of the list for 1915. Three have discontinued the business in Connecticut. The area now devoted to growing nursery stock in Connecticut is 1,526 acres. The list for 1916, together with date and number of certificate and acreage of each, is as follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1916.

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate.
Alderson & Dell, The Misses	Greenwich	1	Nov. 23,	802
Barnes Bros. Nursery Co.	Yalesville	155	Sept. 27,	749
Beattie, Wm. H.	New Haven	1	Sept. 27,	759
Bowditch, J. H.	Pomfret Center	4	Sept. 8,	734
Brainard Nursery & Seed Co.	Thompsonville	6	Sept. 18,	741
Bradley, H. M.	Derby	1	Sept. 27,	758
Bradley, Smith T.	New Haven	1	Sept. 13,	740
Braley & Co., S. A.	Burnside	1	Aug. 28,	729
Bretschneider, A.	Danielson	1	Oct. 2,	771
Brooks Bros.	Westbrook	2	Oct. 11,	790
Burroughs, Thos. E.	Deep River	2	Oct. 16,	795
Burr & Co., C. R.	Manchester	300	Sept. 5,	730
Chapman, C. B.	Groton	1	Oct. 9,	788
Chapman, C. E.	North Stonington	2	Oct. 9,	787
Comstock & Lyon	Norwalk	60	Nov. 9,	800
Conine Nursery Co., The F. E.	Stratford	50	Sept. 29,	763
Conley, L. D.	Ridgefield	3	Oct. 2,	765
Conn. Agricultural College (Prof. A. G. Gulley)	Storrs	2	Oct. 2,	769
Conn. Agri. Experiment Station (W. O. Filley, State Forester)	New Haven	1	Sept. 27,	761
Conway, W. B.	New Haven	1	Sept. 18,	742
Cross Highway Nurseries	Westport	6	Oct. 18,	796
Dallas, Inc., Alexander	Waterbury	3	Sept. 20,	743
Dehn & Bertolf	Greenwich	25	Oct. 6,	781
Dowd, Frank C.	Madison	3	Oct. 4,	777
Elm City Nursery Co., Woodmont Nurseries, Inc.	Woodmont & New Haven	155	Oct. 4,	772
Fairfield Landscape & Nurseries Co.	Cannon Station	5	Nov. 29,	807
Gardner's Nurseries	Cromwell	10	Aug. 28,	727
Geduldig, G., Estate of	Norwich	1	Oct. 2,	770

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate.
Goodwin Associates, Inc., The James L.	Hartford	1	Oct. 11,	792
Hartford Park Commissioners (G. A. Parker, Supt.)	Hartford	3	Sept. 27,	752
Heath & Co., H. S.	Manchester	50	Sept. 5,	732
Hilliard, H. J.	Sound View	1	Oct. 11,	791
Holcomb, Irving (2)	Simsbury	1	Oct. 4,	778
Horan & Son, Jas.	Bridgeport	1	Sept. 27,	753
Houston & Sons, J. R.	Mansfield	4	Oct. 4,	776
Hoyt's Sons Co., The Stephen	New Canaan	300	Oct. 2,	764
Hubbard & Co., Paul M.	Bristol	12	Oct. 30,	798
Hunt & Co., W. W.	Hartford	12	Oct. 6,	779
Isselee, Charles	Stamford & Greenwich	3	Oct. 4,	774
Kelley, James	New Canaan	1	Sept. 9,	736
Kellner, Herman H.	Danbury	1	Oct. 2,	767
Laurel Park Farm & Nurseries	Burnside	90	Oct. 6,	782
Long, J. A.	East Haven	1	Sept. 13,	739
Mallett & Co., G. A.	Bridgeport	1	Oct. 9,	785
Maplewood Nursery Co. (T. A. Peabody, Mgr.)	Norwich	1	Oct. 16,	794
Marigold Farm	New Canaan	1	Sept. 11,	737
McDermott, E. F.	Windsor	1	Oct. 4,	773
Meier & Gillette	West Hartford	2	Sept. 25,	748
Munro, Charles	New Haven	1	Sept. 13,	738
New Haven Nurseries Co.	New Haven	10	Dec. 1,	808
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Oct. 9,	786
New London Cemetery Ass'n. (F. S. Newcomb, Pres.)	New London	1	Nov. 27,	804
Northeastern Forestry Co.	Cheshire	20	Sept. 9,	735
Oakland Nurseries	Manchester	50	Sept. 5,	731
Palmer, L. M.	Stamford	5	Oct. 4,	775
Park Gardens	Bridgeport	1	Sept. 27,	762
Pequod Nursery Co. (2)	Meriden	15	Sept. 27,	750
Phelps, J. Wesson	Bolton	1	Nov. 28,	805
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Nov. 28,	806
Pierson, Inc., A. N.	Cromwell	35	Aug. 28,	728
Platt Co., The Frank S.	New Haven	1	Nov. 9,	799
Pomeroy, Edwin C.	Northville	1	Oct. 2,	768
Purington, C. O.	Hartford	1	Oct. 20,	797
Raab, Joseph O.	Ansonia	1	Sept. 27,	755
Reck, Julius	Bridgeport	1	Sept. 27,	757
Roehrich, W. G.	Stratford	1	Sept. 27,	754

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate.
Rowe, Henry C.	Groton	2	Nov. 25,	803
Saxe & Floto	Waterbury	1	Sept. 20,	744
Schleichert, F. C.	Bridgeport	2	Sept. 22,	746
Scott, J. W.	Hartford	5	Jan. 10,	809
Sierman, C. H.	Hartford	3	Sept. 25,	747
South Wilton Nurseries	South Wilton	5	Oct. 9,	784
Stamford Seed & Nursery Co.	Stamford	1	Oct. 6,	783
Steck, Charles A.	Bethel	2	Oct. 2,	766
Stratfield Nursery Co.	Bridgeport	4	Sept. 27,	756
Traendly & Schenck	Rowayton	2	Oct. 11,	793
Upson, R. E. (2)	Marion	3	Sept. 20,	745
Vidbourne & Co., J.	Hartford	7	Oct. 6,	780
Wallace, Arthur T.	Wallingford	1	Nov. 20,	801
Wallingford Nurseries (2)	Wallingford	10	Sept. 27,	751
Wilson & Co., C. E.	Manchester	7	Sept. 5,	733
Yale University Forest School	New Haven	2	Sept. 27,	760
Young, Mrs. Nellie A.	Pine Orchard	1	Oct. 11,	789
Total		1,526 acres		

INSPECTION OF IMPORTED NURSERY STOCK.

The quantity of woody, field-grown nursery stock entering Connecticut from Europe has not shown a material falling off, as might be expected on account of the war. During the fiscal year just ended, we have inspected 291 shipments, containing 2,102 cases and 1,998,178 plants, as against 264 shipments, 1,349 cases and 2,102,222 plants the preceding year.

The same system of notices and permits arranged by the Federal Horticultural Board as was used last year still remains in force, and seems to be satisfactory. Altogether 300 reports of inspection have been made to the Federal Horticultural Board. During the past year this inspection work has required the equivalent time of one man working 197 days of 7½ hours each or about two-thirds of the working time of an entire year. The cost of this work including time and traveling expenses, has amounted to about $1,120.00 and has been paid from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock, by the State Comptroller on duly accredited vouchers.

The sources of this stock are about the same as last year, except that none was received from Germany or Italy, and the quantity from Holland shows an increase, and that from Belgium a decrease. These differences are probably more apparent than real, as it is understood that considerable stock is transported from Belgium into Holland and then shipped to America. The figures appear in the following table:

SOURCES OF IMPORTED NURSERY, 1915-1916.

Country	No. of Shipments	No. of Cases.
Holland	154	1,432
Belgium	75	380
France	27	168
England	20	82
Ireland	3	3
Scotland	8	9
Japan	4	28
Total	291	2,102

In addition to the figures given above, notice was received of 12 other shipments containing 42 cases. Of these, two shipments were refused, two consisted of orchids and were examined at the port of entry by Federal inspectors, five contained herbaceous plants, and one, seeds, and these were not inspected. One never reached its destination, and one was retained in New York.

Of the 291 shipments examined, 94, or 32.3 per cent, were found infested with various insects or plant diseases, some of which may be considered pests. Some of the plant diseases were identified by Dr. G. P. Clinton, Botanist of this Station, and others and some of the insects were determined by specialists of the U. S. Department of Agriculture at Washington. These infestations are given in the following list:

INFESTATIONS FOUND, 1915-1916.

Plant Diseases.

Exobasidium on Azalea. (48 shipments.)
M. Debaerdemaeker, Evergem, Belgium (3); J. De Duysseleyr (5), O. De Vuyst (5), K. J. Kuyk (2), Arthur De Meyer (4), Societe Anonyme Horticole, Mont St. Amand (2), Ghent, Belgium; Bier & Ankersmit (6), De Coster Bros. (2), Melle, Belgium; August Toeffaert (4), Alphonse Colle, Destelbergen, Belgium; Haerens Co. (August Haerens) (2), Somergem, Belgium; De Bruyne Bros. (3),

L. Ch. Vander Linden Bros., P. T. Vander Sypt, Loochristy, Belgium; De Bruycker & B. Droesbeke, Wyncket St. Croix, Belgium (2); De Bruycke & L. Driesbeke, Gand, Belgium; Van Dillewyn & Thiel, Meirelbeke, Belgium (4).

Crown gall.
On rose. King's Acre Nurseries, Hereford, England; Vincent Lebreton's Nursery, La Pyramide-Trelaze, France; Levavasseur & Fils, Ussy, France.

Phyllosticta sp. on Rhododendron.
Schaum & Van Tol, Boskoop, Holland.

Phyllosticta aucubicola Sacc. on Aucuba.
D. Nieuwenhuis & Zonen, Lisse, Holland.

Fungus on Palm.
P. T. Vander Sypt, Loochristy, Belgium.

Sterile mycelium of fungus.
Ant. Roogen & Son, Hagerswoude, Holland.

Ascomycete, Immature, on apple.
Franco-American Seedling Co., Angers, France.

Sclerotinia stage of *Botrytis* on Golden Privet.
W. Fromow & Sons, Windlesham, Surrey, England.

Pestalozzia guepini on Rhododendron. (3 shipments.)
Schaum & Van Tol (2), H. den Ouden & Son, Boskoop, Holland.

Insects.

Oyster Shell Scale. On *Buxus.*
Ebbinge & Van Groos, Boskoop, Holland (3); J. Blaauw & Co., Schaum & Van Tol, K. Rosbergen & Son, L. D. Endtz & Co., W. Van Kleef & Son., Jac. Akerboom & Sons, H. M. Hardyzer, D. Nieuwenhuis & Zonen, Lisse, Holland; Verkade Van Kleef, Waddinxveen, Holland.

Diaspine Scale.
On Palms. Societe Anonyme Horticole de Mont St. Amand, Ghent, Belgium.
On Aspidistras. K. J. Kuyk, Ghent, Belgium; Bier & Ankersmit, Melle, Belgium.
On Bay Trees. Aug. Toeffaert, Destelbergen, Belgium.

Scale on Rose stock. L. Renault, Orleans, France.

Chionaspis salicis Linn. (egg stage) Green Ash cross stick. W. Fromow & Sons, Windlesham, England.

Coccus hesperidum. Societe Anonyme Horticole de Mont St. Amand, Ghent, Belgium.

Pseudaonidia paeoniae Ckll. Rhododendron. Yokohama Nursery Co., Ltd., Yokohama, Japan.

Emphytus cinctus on Manetti stock. Franco-American Seedling Co., Angers, France; Hemeray-Aubert, Orleans, France.
On (?). G. Bernard (or Benard), Olivet, France; Levavasseur & Fils, Ussy, France.
Larvae on Manetti stock. Levavasseur & Fils, Ussy, France.

Capsid. On Myrobolan plums. Doorne Bosch & Zoon, Veenham, Holland.
Psyllids on *Buxus*. Schaum & Van Tol, Boskoop, Holland; Jac. Akerboom & Sons, Boskoop, Holland.
Agelastica alni Linn. (3).
H. den Ouden & Son, Van Gelderen & Co., Schaum & Van Tol, Boskoop, Holland.
Aleyrodes on Azalea. Van Dillewyn & Thiel, Meirelbeke, Belgium (2); Aug. Haerens, Somergem, Belgium.
Woolly Aphis. Roots of Spruce Trees. Franco-American Seedling Co.
Apple. Franco-American Seedling Co., Angers, France.
Rhodites sp. gall. *Rosa rubiginosa*. G. Bernard, Orleans, France.
Cynipid gall on oak. Union Nurseries, Oudenbosch, Holland.
Coccinellid beetle. Vincent Lebreton's Nursery, La Pyramide-Trelaze, France.
2 Staphylinid beetles. Jac. Smits & Co., Naarden, Holland.
Tussock moth egg mass. On Maple. Ebbinge & Van Gross, Boskoop, Holland (2). Union Nurseries, Oudenbosch, Holland.
On (?) Vincent Lebreton's Nursery, La Pyramide-Trelaze, France.
Dead Lepidoptera. Arthur De Meyer, Mont St. Amand, Ghent, Belgium.
Lepidopterous cocoon. On Evergreen. Koster & Co., Boskoop, Holland.
On (?). Vincent Lebreton's Nursery, La Pyramide-Trelaze, France; De Bruyne Bros., Loochristy, Belgium; 2 parasitized. Ebbinge & Van Groos, Boskoop, Holland.
Lepidopterous larva, probably Pyralid. On Azalea. Van Dillewyn & Thiel, Meirelbeke, Belgium.
Empty cocoon and larval skin of Gipsy Moth. On Apple. Franco-American Seedling Co., Angers, France.
Dipterous pupa. On Rhododendron. C. Van Kleef & Co., Boskoop, Holland.
Coleopterous larva. On Rhododendron. C. Van Kleef & Co., Boskoop, Holland.
Empty Sawfly cocoon. Levavasseur & Fils, Ussy, France; De Bruyne Bros., Loochristy, Belgium.
Sawfly larvae and pupae. Vincent Lebreton's Nursery, La Pyramide-Trelaze, France.
Work of borers in roots of oak. Louis Leroy's Nursery Co., Angers, France.
Spider's eggs on *Buxus*. Ebbinge & Van Gross, Boskoop, Holland.
Centipede in packing material. Schaum & Van Tol, Boskoop, Holland.

INSPECTION OF APIARIES.

The total number of apiaries inspected in 1916 is 467, as against 494 for the preceding year. The cost per apiary and per colony averaged slightly more than in 1915. As in former years Mr. H. W. Coley of Westport has made the inspections in Fairfield, New Haven, Middlesex, and New London counties, and Mr. A. W. Yates of Hartford has covered Litchfield, Hartford, Tolland, and Windham counties.

Some inspections were made in each county, but, of course, not in each town. In all 96 towns, as against 90 last year, were visited by the inspectors, and apiaries were examined in each town. This is a larger number than has even been visited before in a single season since the advent of apiary inspection in Connecticut in 1909. Of this number the towns of Ashford, Ansonia, Bethany, Brookfield, Brooklyn, Canaan, East Haddam, Greenwich, Guilford, Hampton, Huntington, Kent, Mansfield, Monroe, New Milford, Newtown, North Haven, Norfolk, Orange, Plainfield, Prospect, Salem, Salisbury, Scotland, Sharon, Simsbury, Southbury, Southington, Stafford, Suffield, Tolland, Willington, Windham, Wolcott, and Woodbridge were not covered in the work last year, and apiaries in the towns of Ansonia, Ashford, Bethany, Brookfield, Canaan, Guilford, Kent, Monroe, New Milford, Orange, Plainfield, Salem, Salisbury, Simsbury, Tolland, Wolcott, and Woodbridge have never before been officially inspected. In Fairfield county 117 apiaries were inspected, in Hartford county 98, and in New Haven county 71. In each of Fairfield and New Haven counties, 21 towns were visited by the inspector, and in Hartford county 18 towns.

Foul brood was found in all the counties of the State, European foul brood occurring in seven towns in Fairfield county, 10 towns in New Haven county, two towns in Middlesex county, seven towns in New London county, four towns in Litchfield county, five towns in Hartford county, six towns in Tolland County, and six towns in Windham county. Both European and American foul brood were found in one town in New London county, one town in Middlesex county, and in three towns in Fairfield county. The percentage of diseased apiaries and colonies is somewhat less than last year for European foul brood, but slightly greater for American foul brood.

The statistics regarding the apiaries inspected in each town in each county are given in the following tables, the summary appearing on page 82.

APIARIES INSPECTED, 1916.

	No. Apiaries			No. Colonies	
	Inspected	Diseased*	Quarantined	Inspected	Diseased*
FAIRFIELD COUNTY.					
Bethel	18	2	0	54	2
Bridgeport	1	0	0	58	0
Brookfield	4	0	0	32	0
Danbury	13	0	0	141	0
Darien	2	0	0	56	0
Easton	2	0	0	83	0
Fairfield	9	0	0	94	0
Greenwich	4	0	0	60	0
Huntington	1	1†	0	7	5¶
Monroe	5	2	0	81	3
New Canaan	6	0‖	0	28	0
Newtown	4	3†	1	60	8¶
Norwalk	4	0	0	33	0
Redding	5	0	0	34	0
Ridgefield	5	3¶	0	64	7¶
Stamford	5	3§	0	51	8††
Stratford	2	0	0	45	0
Trumbull	3	0	0	69	0
Weston	3	0	0	20	0
Westport	6	0	0	66	0
Wilton	15	1	0	197	2
	117	15	1	1,333	35
NEW HAVEN COUNTY.					
Ansonia	2	1	0	15	2
Beacon Falls	1	0	0	4	0
Bethany	1	0	0	5	0
Cheshire	6	0	0	76	0
Derby	6	0	0	74	0
Guilford	2	1	0	9	3
Hamden	2	0	0	9	0
Madison	1	1	0	29	1
Meriden	12	2	1	129	4
Middlebury	2	1	0	43	35
Milford	3	0	0	26	0
Naugatuck	4	1	1	37	12
New Haven	3	1	0	8	2
North Haven	2	0	0	79	0
Orange	1	0	0	1	0
Prospect	9	1	0	88	8
Seymour	2	0	0	16	0
Southbury	4	1	0	12	1
Waterbury	5	0	0	37	0
Wolcott	1	1	1	18	18
Woodbridge	2	0	0	3	0
	71	11	3	718	86

	No. Apiaries			No. Colonies	
	Inspected	Diseased*	Quarantined	Inspected	Diseased*
MIDDLESEX COUNTY.					
Chatham	7	3†	0	67	7¶
East Haddam	9	4	0	83	6
	16	7	0	150	13
NEW LONDON COUNTY.					
Bozrah	2	2	0	10	3
Lisbon	1	1	0	4	1
Montville	10	6	0	36	9
New London	1	1	0	10	2
Norwich	3	0	0	133	0
Old Lyme	2	1†	0	52	3**
Salem	6	5	0	13	10
Waterford	3	1	0	59	2
	28	17	0	317	30
LITCHFIELD COUNTY.					
Canaan	10	1	0	67	3
Harwinton	1	0	0	1	0
Kent	5	1	0	40	1
New Milford	3	0	0	3	0
Norfolk	3	1	0	9	2
Salisbury	6	0	0	27	0
Sharon	8	0	0	30	0
Torrington	11	6	0	58	7
	47	9	0	235	13
HARTFORD COUNTY.					
Berlin	6	0	0	66	0
Bloomfield	9	5	1	133	11
Bristol	2	2	0	6	4
East Hartford	1	0	0	3	0
East Windsor	4	0	0	14	0
Enfield	5	0	0	9	0
Farmington	3	0	0	35	0
Glastonbury	15	1	0	67	4
Hartford	11	0	0	61	0
Manchester	1	0	0	4	0
Plainville	4	3	0	14	7
Simsbury	3	0	0	10	0
Southington	6	0	0	54	0
South Windsor	2	0	0	31	0
Suffield	9	0	0	27	0
West Hartford	11	1	0	65	3
Windsor	1	0	0	4	0
Windsor Locks	5	0	0	28	0
	98	12	1	631	29

	No. Apiaries Inspected	Diseased*	Quarantined	No. Colonies Inspected	Diseased*
TOLLAND COUNTY.					
Andover	3	1	0	9	6
Bolton	4	0	0	7	0
Coventry	11	3	0	88	27
Ellington	2	0	0	12	0
Mansfield	5	1	0	62	4
Stafford	2	1	0	18	1
Tolland	2	1	0	18	1
Vernon	8	0	0	74	0
Willington	11	6	0	49	22
	48	13	0	337	61
WINDHAM COUNTY.					
Ashford	1	0	0	10	0
Brooklyn	3	1‡	0	27	1‡‡
Hampton	3	2‡	0	10	4‡‡
Killingly	7	1	0	20	2
Plainfield	4	1	0	15	1
Pomfret	8	1	0	34	1
Putnam	9	1	0	22	2
Scotland	4	0	0	25	0
Windham	3	2	0	14	11
	42	9	0	177	22

SUMMARY OF APIARY INSPECTION.

County	No. Towns	No. Apiaries Inspected	Diseased	No. Colonies Inspected	Diseased
Fairfield	21	117	15	1,333	35
New Haven	21	71	11	718	86
Middlesex	2	16	7	150	13
New London	8	28	17	317	30
Litchfield	8	47	9	235	13
Hartford	18	98	12	631	29
Tolland	9	48	13	337	61
Windham	9	42	9	177	22
	96	467	93	3,898	289

* European foul brood unless otherwise indicated.
† An apiary with both American and European foul brood.
‡ One apiary infested with sacbrood.
§ Two apiaries with disease of adult bees.
‖ One apiary killed by European foul brood.
¶ One colony has American foul brood.
** Two colonies with American foul brood.
†† Six colonies with disease of adult bees.
‡‡ One colony with sacbrood.

	Apiaries	Colonies
Number inspected	467	3,898
Infested European foul brood	88	275
Per cent infested	18.8	7.05
Infested American foul brood	5	6
Per cent infested	1.07	.15
Pickled or sacbrood	2	2
Average number of colonies per apiary		8.34
Cost of inspection		$750.34
Average cost per apiary		1.61
Average cost per colony		.19

CONTROLLING THE GIPSY AND BROWN-TAIL MOTHS.*

By W. E. BRITTON and IRVING W. DAVIS.

Notwithstanding the fact that the law provides that towns shall, when ordered by and under the direction of, the State Entomologist, suppress the gipsy and brown-tail moths, it was thought best, for the present at least, to keep the gipsy moth work in the hands of trained men. It would be very difficult, if not impossible, for the several towns to secure trained and experienced men for this work, and consequently the results which they might accomplish would not be of maximum effectiveness. Plans to this effect were, therefore, prepared, and these plans, together with the more important purchases of supplies and equipment, have been duly approved by the Station Board of Control, as provided in Section 3, Chapter 267, Public Acts of 1915. The following pages give a brief account of the work accomplished under the act.

GIPSY MOTH WORK.

AREA INFESTED AND CHARACTER OF INFESTATIONS.

At the beginning of the fiscal year 20 towns were thought to be infested by the gipsy moth, but during the winter Ashford was found infested by the Federal scouts, making 21 in all. These towns have a total area of about 730 square miles and are as follows:

* This paper was included in the report, which the law requires the State Entomologist to make to the General Assembly. It is here given with slight emendations.

Thompson	Brooklyn	Voluntown
Putnam	Hampton	Griswold
Pomfret	Chaplin	Sprague
Woodstock	Sterling	Lisbon
Eastford	Plainfield	North Stonington
Ashford	Canterbury	Stonington
Killingly	Scotland	Groton

Since the manuscript of this paper was prepared, the Federal scouts have found an infestation in Mansfield near the eastern boundary. As Mansfield contains 46 square miles, the total infested area must now be regarded as 776 square miles.

All of these towns are shown on the accompanying map, figure 1.

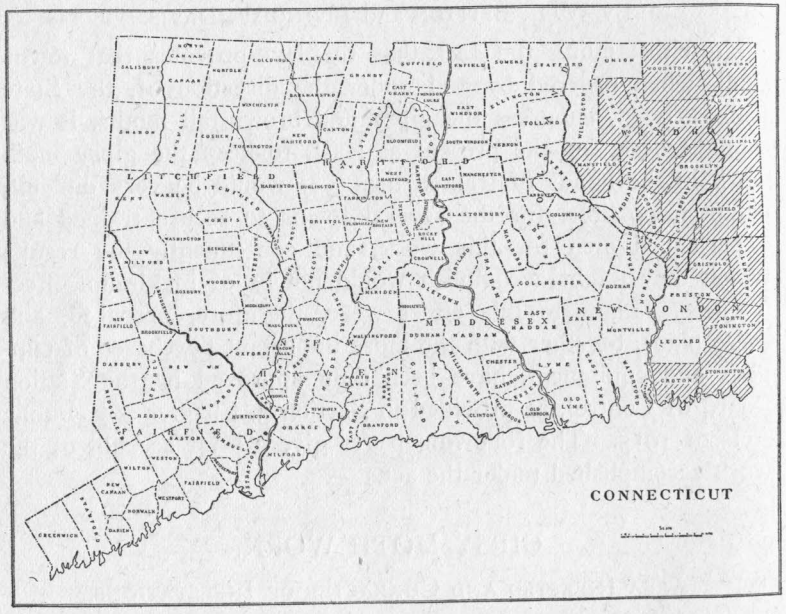

FIG. 1. Map of Connecticut, shaded portion showing area now infested by the gipsy moth.

The worst infested towns are Thompson, Putnam, Woodstock, and Pomfret, having an area of about 172 square miles. The number of infestations in each of these towns was found to be somewhat less than during the preceding year, as the following table will show:

Town	Number of Infestations 1915	1916
Thompson	166	100
Putnam	24	21
Woodstock	40	21
Pomfret	22	27
Total	252	169

Mr. Davis employed scouts from about November 1 to May 1, and during this time they searched the towns of Thompson, Putnam, Woodstock, Pomfret, Killingly, and Brooklyn, and destroyed all egg clusters found. All other towns were searched by the Federal scouts. No gipsy moths were found in the towns of Sterling, Voluntown, Sprague, and Lisbon, and none were found in Killingly by State or Federal scouts, though one caterpillar was reported by Mr. Woodward from East Killingly, near the Rhode Island line. Fewer infestations were also found in Hampton, Griswold, and Groton, though more were found in Eastford, Scotland, Canterbury, Chaplin, Stonington, and North Stonington. The same number occurred in Brooklyn and Plainfield, and the additional town of Ashford was found by the Federal scouts to be slightly infested in four places.

ORGANIZATION.

Irving W. Davis, B.Sc., a graduate of the Massachusetts Agricultural College, class of 1911, was already in charge of this work at the time the law was enacted, and on my recommendation, he was formally appointed Assistant and Deputy in Charge of Moth Work by the Board of Control of the Connecticut Agricultural Experiment Station, as provided in Section 3 of the act. Throughout the year Mr. Davis has resided in Danielson, where he may be reached by telephone, 28-3, or by mail. He has also employed men for the necessary work of scouting, cutting brush, spraying, applying tanglefoot, and examining the sticky bands. Trained scouts have been paid the same wages as is paid by the Federal Bureau of Entomology for this work, viz., from $2.56 to $3.20 per day, the latter being paid only to foremen who have had much experience. As our appropriations have never been adequate to cover the entire work, we have been obliged to depend on the coöperation of the Bureau of Entomology, and it frequently happens that both State and Federal men may be

employed in the same vicinity, or perhaps board at the same place. Consequently it seemed desirable to make hours and wages correspond as nearly as possible.

Untrained men have been employed temporarily for cutting brush and handling hose for $2.00 per day.

In general the men are not allowed their expenses, except in special cases where moved from one town to another or where sent on trips involving an actual outlay.

The number of men employed has varied from 8 to 25 as the exigencies of the work required.

Coöperation with Federal Agents.

From the start there has been the most cordial coöperation between the Federal and State forces seeking to control these dangerous insect pests. As a rule, each year the territory has been divided, each covering a portion and being responsible for it. As a Federal problem, perhaps the most important phase of this work is to prevent the further spread of the gipsy moth to other states; hence many towns not known to be infested have been examined by Federal men. On the other hand it seemed to us a better use of State funds to expend them in eradicating known infestations, rather than in hunting for new ones. Consequently during the year just closed, the Federal men have scouted the outside towns or those on the border of the infestations, while the State forces have endeavored to suppress the pest in the area most thickly infested. Even the Federal scouts have often been placed under the general supervision of Mr. Davis, and have reported all infestations to him. Likewise he has reported to the Federal agents all infestations found by the State scouts. Our thanks are due to Messrs. A. F. Burgess, L. H. Worthley, and other members of the Bureau of Entomology for this coöperation.

Equipment.

No extensive equipment has been added during the fiscal year, but free use has been made of the power sprayer, the Ford touring car, and the motor cycle and bicycles purchased during the preceding year. Four sets of tools and four tool boxes were purchased for the scouting crews at a total cost of $85.38.

Supplies.

For spraying the trees in and around the principal infestations, two tons of arsenate of lead were purchased at a cost of $295.76, and for banding the trees in and around the infestations, one ton of tanglefoot was purchased at a cost of $375.00. A portion of each kind of material was not used and is available for the coming season.

Methods of Scouting for Egg-Clusters.

Since the gipsy moth passes the winter in the egg stage, locating and destroying the egg-clusters has proven one of the best methods of controlling this pest.

The scouting for these egg-clusters, as it has been carried on in Connecticut, is commonly known as "roadside scouting." By this is meant the examination of all trees outside of woodland, and in wooded areas to examine or "scout" the trees for a distance of from 50-200 feet from the clearing, the distance depending on the species of trees and type of growth. Recent work by the United States Department of Agriculture has shown that this insect is spread principally by means of wind, and, therefore, it is necessary to scout carefully all windswept areas, paying particular attention to the apple and oak trees, which are the favorite food of the gipsy moth.

The organization has consisted of from one to four crews, each group or crew having at least four men and a foreman. The men or "scouts," as they are termed, are each equipped with a small mirror and a knife, the end of the blade of which is curved. The former is used to examine the under side of rocks, cavities in old trees, etc., while the latter is used to pull off pieces of dead bark, and for the man to mark his tree. Each man is given a special mark when he begins work, and it is equivalent to his writing his name on each tree that he examines. For example:—Scout J. J. Fitzgerald while scouting in the town of Killingly uses the mark —L, and all trees in that town which bear that mark show that he has examined them and is, therefore, responsible for them. Should any egg-clusters of the moth be found on that tree later, the man who examined it could be ascertained immediately. The foreman of the crew is not allowed to mark a tree until after a scout has done so, and

when the foreman's mark appears it places the responsibility on him. This also has the additional advantage of keeping the foreman behind his men so that he can follow their work better.

Besides the equipment that each man carries, each crew is required to have with it at all times, a can of creosote, a can of white paint, and a small hatchet. Each crew has a box of tools which is left at the boarding-house. This box contains axes, saws, etc., to be used in chopping out around the infestations.

The men are required to work eight hours a day. They leave their boarding-house at 7 o'clock and their time begins at 7.30. The working period is from 7.30 to 12.00 and from 12.30 to 4.00, after which they walk home in their own time. In the case of stormy or inclement weather, the men chop or burn brush around the infested localities, but if the day proves too stormy they are allowed to return to the boarding house, but are subject to the foreman's call up to 3 o'clock in the afternoon.

In order to make the work as simple and as efficient as possible, blue-print maps are made of the roads in each town, and each road is lettered, the main roads being lettered as A, B, C, D, etc., while the side roads are designated according to their location as A1, A4, B14, C9, etc. One of these maps is given to the foreman, and on this he designates the infestations found; another copy is filed in the office of the State Entomologist at New Haven, and a third is retained by the deputy.

Gummed paper arrows are used to enable anyone familiar with the work to find the crews. The foreman leaves one of these in front of the boarding-house each morning, with the arrow pointing in the direction that the crew is working. On this arrow is written the date, time the arrow was placed there, where the crew will work that day, and the foreman's initials. One of these arrows is also placed at each crossroad that is passed, and bears a legend similar to the first.

Reports are made by the foreman twice each week, and contain the name of the town being scouted, the date, the foreman's name, the name of the road worked, the number of miles scouted each day, the miles of wooded growth, the time lost and the reason, the number of trees examined (apple and shade), and if any infestations are found, the owner of the land, his address, the location of the infestation and the number of egg-clusters.

When the work has been completed in a town a similar report is sent in, which covers all of the infestations in that town.

Applying and Inspecting Bands.

During the first part of May the trees in and about the infested localities are scraped so as to smooth the bark, but not enough to injure the cambium or inner bark, and the tree is banded with a sticky substance known as "tree tangle-foot." This prevents the gipsy moth caterpillars from crawling up the trees, and as these localities are visited every day or so during the caterpillar season, the young caterpillars may be easily destroyed. The caterpillar season lasts from the middle of May until the middle or last of July.

When the infestations are plentiful, the men are able to use bicycles in the work, but in the outlying districts where the infestations are far apart, motorcycles have been used in visiting them.

Spraying.

In case any of the infestations assume a serious nature, we try to spray them during the month of June. At this time the caterpillars are rather small and it does not require as much poison to kill them, and the leaves have grown enough to have plenty of surface to hold the poison. The mixture used is arsenate of lead, 6 pounds in 50 gallons of water. The spraying is accomplished by the use of a Fitzhenry-Guptill power sprayer. This has a 10-12 horse-power gasoline engine, and a 400 gallon tank to hold the mixture. In spraying these localities, 1,500 feet of hose is used, and in the running of the sprayer a crew of about four men besides the engineer and nozzleman are required. This past season this machine was used to spray 60 of the worst infestations in the State.

Details of Gipsy Moth Work by Towns.

The details of the infestations and of the suppression work in each town have been prepared by Mr. Davis, and are described briefly in the following pages:

Thompson—100 infestations—1,359 egg-clusters.

Thompson, covering an area of 49 square miles, and situated as it is on the border of Rhode Island and Massachusetts, has

always been the most seriously infested of any of the Connecticut towns, and this past year has proved no exception.

The number of infestations (100) showed a decrease from the previous year when 166 were located. These infestations, however, were well distributed throughout the entire town, although a large number were situated in the vicinity of the road leading from Brandy Hill to Webster, Mass. In this group was located the largest infestation found during last winter, numbering 398 egg-clusters. Large infestations were also found near the village of Grosvenordale, on the State road about a mile south of Wilsonville, and on the road from Brandy Hill to the Quaddick reservoir.

During the early part of the summer work, several of these infestations showed a large number of larvae, and 39 of the most serious infestations were sprayed. The work closed on the 22d of July, but this town with the rest of the infested area will be thoroughly scouted this coming winter.

Woodstock—21 infestations—127 egg-clusters.

The finding of only 21 infestations in the town of Woodstock during the winter of 1915-16, reduced the number of colonies almost half from the previous year when 40 were located.

The majority of the infestations found were in the vicinity of the villages of East Woodstock and West Woodstock, with scattering ones in various parts of the town. One infestation, which was found about a mile and a half south of West Woodstock, was perhaps the worst one in the town this season. Here several large larvae were found outside of the banded area, but by doing extra scouting in that locality the number was greatly diminished before the end of the season.

None of the gipsy moth colonies in Woodstock were sprayed, as they were not deemed serious enough to warrant it, and on July 22d the work of patrolling the banded area closed for the season.

Putnam—21 infestations—141 egg-clusters.

The gipsy moth infestations in the town of Putnam numbered 21, and while 10 of these contained only a single egg-cluster each, there were several comparatively large ones. The largest in the town was one of 52 egg-clusters, which was located near

the Woodstock line on land owned by Mr. Henry Maynard. Early in the season a number of larvae were found here feeding on small oak growth, and this infestation together with 8 others in the town was sprayed.

Among other infestations of importance in Putnam, were those located on the State road about two miles east of the city of Putnam, one in the south part near the grounds of the Putnam Country Club, and one on a cross-road a mile to the east of the city. This last mentioned infestation was located on a roadside apple-tree, and during the early part of June a large number of gipsy moth caterpillars were found feeding on low brush on the opposite side of the road. This brush was cut and burned, and the remaining foliage on either side of the road was sprayed. The last few visits to this infestation failed to reveal any larvae, and it is believed that this infestation together with the others in this town have been exterminated.

Pomfret—27 infestations—686 egg-clusters.

The first part of the scouting done in Pomfret last winter was in the eastern section of the town, and as there were but few infestations located, it was believed that this town was comparatively free from the pest. As the work was carried to the western portion of the town, however, a number of infestations were located on a thickly wooded ridge which extends north and south along the western border of Pomfret.

Here the most serious infestation in the State was found, consisting of 304 egg-clusters and covering approximately ten acres of woodland. This growth was thinned and the remaining trees banded with tanglefoot, and the entire area sprayed. During the woodland scouting in August this section was again covered, and 20 egg-clusters found. (See plate II, b.)

Just previous to the spraying work a number of egg-clusters and larvae were found close to an infestation in the northern part of the town near the Putnam and Woodstock lines. This was thoroughly sprayed, and by the end of the season we were unable to find any more larvae in this vicinity.

Eastford—5 infestations—93 egg-clusters.

Of the five infestations found in Eastford, four were located in the eastern part of the town near the Pomfret line, while the

fifth, a pupa case, was found on the road leading from Phoenixville to Ashford.

The work of patrolling the infestations was carried on here as in the other infested towns, but none of the colonies in this town assumed serious nature.

Ashford—49 infestations—20 egg-clusters.

The scouting during the winter of 1915-16 found the town of Ashford infested by the gipsy moth for the first time. Four infestations were located, the largest consisting of 12 egg-clusters and situated about two miles south of the village of Warrenville.

During the summer work only eight gipsy moth caterpillars were found in this town. (See plate II, a.)

Killingly—0 infestations—0 egg-clusters.

Although this town has been infested for the past two years, a thorough scouting, and later a careful trailing, failed to reveal any egg-clusters of the gipsy moth.

Toward the latter part of the caterpillar season it was reported that a gipsy moth caterpillar had been taken in East Killingly near the Rhode Island line, but an examination of the nearby trees failed to show any evidence of the pest.

Brooklyn—2 infestations—13 egg-clusters.

The two infestations found in the town of Brooklyn were widely separated, one being in the southwestern corner, and the other in the northeastern corner of the town. At the former no larvae were found, but at the latter several appeared early in the season and this infestation was sprayed. No caterpillars were found after the middle of July, and at the time the summer work closed this infestation appeared free from the pest.

Hampton—6 infestations—151 egg-clusters.

Six infestations of the gipsy moth were found in the town of Hampton during the last winter, and all of them were grouped in the northwestern corner of the town. The largest of these contained 127 egg-clusters, and was located in an old orchard owned by Mr. Fowler. This infestation assumed a serious nature early in the season, and that together with the neighboring growth was sprayed with arsenate of lead.

The other infestations, while showing a number of caterpillars in the early part of the work, were apparently free from the pest before the season closed.

Chaplin—2 infestations—16 egg-clusters.

During the scouting in the town of Chaplin two colonies of gipsy moths were found within its limits. Both of these were in the eastern part of the town near the Hampton line, and contained 4 and 12 egg-clusters respectively. The latter was on the State road just below Clark's Corner. Here a few caterpillars were taken early in the summer, but nothing was found the latter part of the season.

Sterling—0 infestations—0 egg-clusters.

During the winter of 1915-16 this town was thoroughly scouted, but no signs of the gipsy moth were found.

Plainfield—1 infestation—160 egg-clusters.

The only gipsy moth infestation found in the town of Plainfield during last winter was located in the western part of the town near the Quinebaug River. This numbered approximately 160 egg-clusters, and while a large proportion of these were found in the trunk of a large apple tree, there were several scattered in the nearby undergrowth. During the month of June a number of larvae were taken here, but none were found during the later visits to this infestation.

Canterbury—10 infestations—211 egg-clusters.

Though six of the 10 infestations in the town of Canterbury were of but a single egg-cluster each, two rather large colonies were located. One of these was situated on the land of Mr. Charles Hyde near the road leading from Brooklyn to Canterbury, and the other a little to the west of the village of Westminster on land owned by Mr. Davis. The former contained 80, and the latter 115 egg-clusters.

These two infestations were the most serious in Canterbury, and in each case the underbrush was cut and the trees pruned. As several larvae were taken early in the season and none later, it is believed that both of these colonies were exterminated before the summer work finished.

Scotland—4 infestations—24 egg-clusters.

Of the four infestations located in the town last winter, one found in the woods close to the Hampton line was the largest. This consisted of 18 egg-clusters and was the only colony in the town where any larvae were taken during the summer. Thirteen caterpillars were taken early in the season, but during the later visits none were found.

Voluntown—0 infestations—0 egg-clusters.

No egg-clusters were found in this town during the past winter's scouting.

Griswold—2 infestations—6 egg-clusters.

There were two gipsy moth colonies found in this town during the winter scouting of 1915-16. One of these colonies consisted of one egg-cluster and was found near the banks of the Quinebaug River, while the other, a colony of five egg-clusters, was located in the southeastern corner of the town near the Preston line. Several larvae were found at the latter infestation early in the season, but during the last few weeks of the work none were taken, and it is hoped that both of these colonies have been exterminated.

Lisbon—0 infestations—0 egg-clusters.

The town was scouted last winter, but no evidence of the gipsy moth was found.

Sprague—0 infestations—0 egg-clusters.

No signs of the gipsy moth were found in Sprague during the past winter.

North Stonington—2 infestations—71 egg-clusters.

Two infestations were found in this town, one a pupa case and the other a colony of 71 egg-clusters. The latter was located in an orchard about a mile to the west of the North Stonington post office. This infestation was rather serious and was not sprayed, owing to the need of the sprayer in the northern towns. Extra scouting work was done in this locality, and when the season closed over 900 caterpillars had been destroyed.

Stonington—2 infestations—55 egg-clusters.

Only two colonies of gipsy moths were found in Stonington during the scouting of 1915-16. One of these was found near Wequetequock and the other in Pawcatuck near the city of Westerly, R. I. Neither of these colonies showed many larvae during the summer work, and during the later visits none were found.

Groton—1 infestation—1 egg-cluster.

The result of the scouting in the town of Groton during last winter was the finding of a small egg-cluster on Pearl Street in the village of Mystic. This infestation was watched during the summer, but no larvae were found.

Statistics of Infestations.

The statistics of the infestations for each town are given in the following table:

Town	No. of Infestations	No. Egg-clusters Destroyed	No. of Bands Applied	No. of Infestations Sprayed	No. of Larvae Destroyed
Thompson	100	1,359	5,665	39	11,906
Woodstock	21	127	615	0	562
Putnam	21	141	1,243	9	7,007
Pomfret	27	686	3,749	10	5,700
Eastford	5	93	371	0	42
Ashford	4	20	264	0	8
Killingly	0	0	0	0	1*
Brooklyn	2	13	43	1	65
Hampton	6	151	129	1	4,176
Chaplin	2	16	49	0	42
Sterling	0	0	0	0	0
Plainfield	1	160	17	0	785
Canterbury	10	211	501	0	135
Scotland	4	25	289	0	130
Voluntown	0	0	0	0	0
Griswold	2	6	113	0	53
Lisbon	0	0	0	0	0
Sprague	0	0	0	0	0
North Stonington	2	71	63	0	989
Stonington	2	55	38	0	70
Groton	1	1	16	0	0
Totals	210	3,135	13,165†	60	31,671

* Reported to the office by Mr. Woodward of East Killingly.

† In addition to this number of bands, 349 bands of Raupeleim were used in Thompson and Stonington.

Apple trees examined by State scouts during the winter 1915-16:

Thompson	38,277
Woodstock	53,583
Putnam	14,861
Pomfret	49,256
Killingly	22,960
Brooklyn	26,642
Total	205,579

Shade trees examined by State scouts during the winter 1915-16 (Shade trees counted are only those which stand within 100 feet of a building. No record was kept of roadside trees examined):

Thompson	8,290
Woodstock	9,356
Putnam	4,429
Pomfret	9,702
Killingly	5,481
Brooklyn	5,014
Total	42,272

Total expended by the State in gipsy moth work for the year ending September 30, 1916, $11,491.42.

BROWN-TAIL MOTH WORK.

The last two years ending September 30, 1915, saw such an increase of the gipsy moth in Connecticut, that it seemed best to use the most of our available funds in the control of this serious pest. The brown-tail moth work done during this period had, therefore, not been in the eastern towns of the State, which were known to be infested with this pest.

Upon examination of this section last fall it was deemed advisable to have the four towns in the northeastern corner of the State, namely,—Thompson, Woodstock, Putnam, and Pomfret, take measures to destroy this pest within their respective limits, as provided by law. Accordingly Mr. J. H. Osgood of Putnam, who has had much experience in this particular line of work, was appointed agent in each of these towns and whenever possible trained local men to help him in the work. Through this same means these four towns were scouted and the following

table shows the number of webs destroyed and the amount expended:

Town	Webs destroyed	Cost	Reimbursed by State
Thompson	1,652	$ 72.51	$ 36.25
Woodstock	7,518	212.50	106.25
Putnam	3,008	81.00	41.50
Pomfret	2,272	91.00	45.50
Total	14,450	$457.01	$229.50

During the month of March when there were several heavy snow storms, the gipsy moth crews were located in Killingly, and on days when they were unable to scout, they spent their time in destroying brown-tail webs. Through this means about 1,650 webs were cut and burned, the most of them being taken in the town of Killingly, although some 500 were found in the town of Brooklyn.

It has been our custom to have a few trained men scout the towns just west of those known to be infested with this pest and under the Federal quarantine, and during last winter Mr. John H. Osgood took charge of these men. No new towns were found to be infested, and a decrease was noted in those towns near the border, a few of which Mr. Osgood examined for the purpose of determining the spread of parasites. The cost of this work of scouting along the border of the quarantined area was $186.61. The total cost to the State for brown-tail work was $416.11.

Present Appropriation.

Out of the biennial appropriation of $21,000.00 for suppressing gipsy and brown-tail moths, and inspecting imported nursery stock, we have expended $13,026.20 distributed about as follows:

Gipsy moth work	$11,491.42
Brown-tail moth work, including 50 per cent rebate to towns of $229.50	416.11
Inspecting imported nursery stock	1,119.67
	$13,027.20

This leaves only $7,972.80 for the coming year.

Federal Expenditures in Connecticut.

In addition to the total amounts expended by the State, Federal agents in hearty coöperation with us have expended nearly $15,000.00 in gipsy moth work during the year just closed.

State Appropriation for Next Biennial Period.

It will be seen from the foregoing that during the past year about $28,000.00 has been expended in this work in Connecticut by the State and Federal Government. In case large additional infestations should be discovered, our funds would be wholly inadequate; consequently, we have asked for an appropriation of $60,000.00 for this purpose for the two fiscal years ending September 30, 1919.

Future Work and Recommendations.

In future moth work it will be necessary to employ more crews and to start trailing. By "trailers" we mean the men who examine the towns and check the work of the scouting crews. These are very important, as they furnish the main office with data of the exact results accomplished by each crew. I would also recommend the purchase of more spraying equipment, because our present outfit is inadequate and will not enable us to spray many infestations in the short time when spraying can be done. More bicycles are also needed; though we have purchased some bicycles, the majority that we use have been borrowed from the Federal Government. More motor vehicles will soon be needed. Judging from our experience with motorcycles, apparently Ford automobiles are about as cheap to operate and can be used on the work throughout the winter. If the infestations increase to any alarming extent, it will probably be advisable to establish a parasite laboratory within the State. This could be maintained in conjunction with the Federal work, and the cost would be insignificant in comparison with the results obtained, as parasites help control both the gipsy moth and the brown-tail moth.

A DESTRUCTIVE APHID ON TURNIPS.

Aphis pseudobrassicæ Davis.

On September 19, Mr. A. N. Farnham telephoned to the Station regarding serious injury to his turnips and kale by aphids, and requested an inspection. In company with Mr. Farnham I visited the farm that day, and saw several fields where damage had been done. One of these fields, which is situated just west or northwest of Pine Rock, contained two or three acres of turnips. A

portion (perhaps a half acre) had been planted to white egg turnips and the plants had been killed. These plants were of good size but had at first turned yellow, then brown, and now they were entirely dead and lay flat upon the ground. This had all happened within a few days, and the plants went down very quickly after the presence of the aphids was noticed. The other portion of the field was covered with rutabagas or Swedish turnips, which were attacked and injured though not as yet killed. There were patches here and there where the leaves were turning yellow. Plate V, a shows the edge of the field, and where the rows of white egg turnips had been killed. In another field south of Pine Rock eight rows of white egg turnips were rapidly being destroyed by the aphids, though at this time the leaves were still green and turning yellow. When visited October 2 the plants were nearly all dead. Swedish turnips on either side of the egg turnips had not as yet been greatly injured, though infested.

We also examined a newly-set field of kale on the top of the hill along Osborn Avenue. The plants were already infested.

Identity.

Considerable material was gathered and taken to the laboratory. Some of the leaves were photographed and are shown on plate IV, b. Some of the aphids were mounted on slides, and were identified as the turnip aphis, *Aphis pseudobrassicæ* Davis, a species described in 1914, by Mr. John J. Davis of the Bureau of Entomology. In order to verify the identification, some of the slides were sent to Dr. Edith M. Patch, of Orono, Me., who reported that the determination was correct for most of the specimens, but that on two of the slides, another species, the green peach aphis, *Myzus persicæ* Sulzer, was present. After this we examined much material and mounted a good series of specimens, and can state with certainty that the turnip aphis was by far the most abundant, and was evidently the one chiefly responsible for the damage.

Distribution.

Apparently this aphis was widely destructive in 1916, as complaints were received from A. N. Farnham and W. L. Mitchell, New Haven; Charles M. Jarvis, Berlin, and D. L. Clarke &

Sons, Milford. Mr. Huber, vegetable grower, also reports considerable damage around East Hartford, and at Green's Farms. We examined specimens, however, only from Mr. Farnham's field, though we understood that the insect was destructive throughout Highwood. Presumably the same species is also responsible for the injury elsewhere.

Distribution in Other States.

According to Paddock*, the turnip aphis has been recorded from New York, Indiana, Minnesota, Oklahoma, Louisiana, Florida, and Texas, and probably occurs throughout the United States. In general it has probably been mistaken for *Aphis brassicæ*, as it feeds upon the same kind of plants.

Life History.

No life history studies of the turnip aphis have been made in Connecticut and most of the observations on record are from Texas. It is not known where the aphids pass the entire season, but they appeared on the turnips in August and September and were found there until the following May. In the spring the infestations are heavy in Texas and continue until the crops are harvested or otherwise disposed of.

The species reproduces asexually in Texas where 19 generations were recorded between January and the following August. The sexual forms are unknown.

Description.

The original description† of the turnip aphis is as follows:

"Wingless viviparous female:—Entire body pale whitish green, head slightly dusky. Abdomen with a longitudinal row of impressed dots along each side in line with the cornicles; also on each side of the median dorsal line is a row of transverse shining areas with a reticulated surface, those on the last four or five segments usually united; and a similar row of smaller areas on each side. These shining reticulated areas contrast with the rest of the body which is dull and very slightly pulverulent. Thoracic segments with similar transverse areas. In specimens just molted the entire body appears shining and reticulated.

* Bull. 180, Texas Agricultural Experiment Station, 1915.

† Canadian Entomologist, Vol. xlvi, page 232, 1914.

"Eyes black. Antennae blackish excepting segments I, II, and basal half of III which are pale; reaching a little beyond the middle of the body; segment III longest, it being half to three-fourths longer than VI filament; segments V and VI base with the usual distal sensoria. Beak reaching to coxae of second pair of legs. Legs pale with dusky joints, the tips of the tibiae and all of the tarsi black. Cornicles pale with the tip dusky, slightly swollen towards the tip and constricted just before the apex, and noticeably longer than the cornicles of *A. brassicæ*. Cauda conical, and dusky to blackish.

"Measurements, as follows (averages from six individuals): Length of body 1.66 mm.; width 1.00 mm.; cornicle 0.226 mm.; cauda 0.140 mm.; antenna I, 0.080; II, 0.061; III, 0.399; IV, 0.202; V, 0.160; VI, base 0.122; VI, filament 0.287; total average length 1.311 mm.

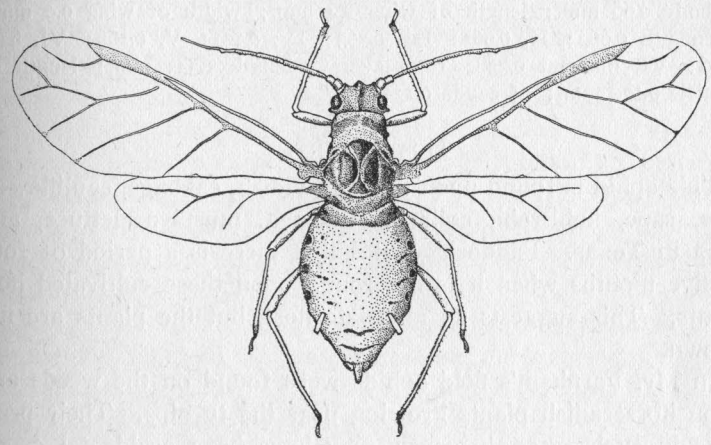

Fig. 2. The turnip aphid, *Aphis pseudobrassicæ*, winged female, greatly enlarged.

"Pupa. Head dusky, remainder of body cream color or with a faint greenish tint, and covered with a slight whitish pulverulence, excepting the shining areas which are covered with a noticeable reticulation, and which are placed as follows:—a row of oval or transverse areas on each side of the median dorsal line and a row of smaller and more circular ones laterad of these on each side, about in line with the cornicles.

"Eyes black. Antennae pale dusky, the distal ends of segments being more so, relative lengths of segments as in the winged female. Wing pads blackish. Legs pale dusky with the joints, distal end of tibiae, and tarsus blackish. Cornicles dusky, paler at middle, blackish at tips, and similar in shape to those of the wingless female.

"Winged viviparous female:—Head and thorax black. Abdomen pale apple green with a tint of nile green and a row of three black spots on each side anterior to the cornicles; a row of small impressed dots on

each side dorsad of the larger spots; and in addition a few scattered inconspicuous dusky markings on the dorsum, and the last three segments with black transverse, dorsal median markings.

"Eyes black. Antennae black; almost reaching to base of cornicles; segments III and VI filament subequal; segment III with 19 to 26 moderately tuberculate circular sensoria irregularly placed, IV with 6 to 10, often more or less in a row, V and VI base with the usual distal sensoria and not infrequently segment V bears one or two near the base. Wings with black and rather conspicuous veins, and the terminal branch of the media nearer the apex of wing than where it first branches. Legs with femur pale brownish to blackish, tibia pale brownish with tip black and tarsus black. Cornicles dusky, paler at tips, and shaped as in the wingless form. Cauda concolorous with the abdomen or paler. Measurements as follows (averages from six individuals): Length of body 1.4 mm.; width of body 0.66 mm.; length of wing 2.4 mm.; width of wing 0.9 mm.; antenna I, 0.069; II, 0.061; III, 0.363; IV, 0.191; V, 0.165; VI, base 0.126; VI, filament 0.358; total average length 1.333 mm.; length of cornicle 0.172 mm.; of cauda 0.134 mm."

Host Plants.

This aphid is found upon turnip, raddish, cabbage, cauliflower, kale, rape, kohl-rabi, collard, rutabaga, mustard, lettuce, and bean in Texas. Paddock* states that there is a period of four or five months when it is not found upon these cultivated host plants. This suggests an alternate host, but the plants are not known.

In Mr. Farnham's field aphids were found on the weeds and upon horseradish plants growing near the turnips. Their presence in such cases, however, may have been accidental or on account of their great abundance, and does not necessarily mean that these plants are real hosts.

Injury to Crops.

The injury is due to the large number of aphids sucking out the sap. When the infestation is severe, the leaves turn yellow and later brown, and soon wither and die. In regions of extensive areas devoted to truck crops, especially cruciferous plants, serious damage may result.

At Mr. Farnham's the infested turnips and kale were entirely killed. As there were many other fields in the same locality and nearly all similarly affected, it must have caused thousands of dollars of damage in the State in 1916.

* Bull. 180, Texas Agricultural Experiment Station, 1915.

Natural Checks.

In Mr. Farnham's three fields, two of which were perhaps half a mile apart, lady beetles were abundant in both the larval and adult stages and many pupae were fastened to the under sides of the leaves. The commonest species observed were the nine-spotted lady beetle, *Coccinella ix-notata* Hbst., and the five-spotted lady beetle, *Coccinella transversoguttata* Fabr. (*V-notata*). Many leaves were found which were entirely cleaned of the aphids by the lady beetles, though there were plenty of cast skins showing that aphids had been present and abundant. In Texas *Aphis pseudobrassicæ* is strongly parasitized by two Hymenopterous parasites, *Dieretus rapæ* Curt. and *Lysiphlebus testaceipes* Cress. These were not observed by us in connection with this aphid in Connecticut in 1916.

When examining this aphid material in the laboratory, it was noticed that a few individuals had been killed by a fungous disease. These were shown to Dr. G. P. Clinton, Botanist of the Station, and at his request sent to Dr. A. T. Speare of the Bureau of Entomology at Washington, who is at work on this group of fungi. Dr. Speare identified it as *Entomopthora aphidis* Hoff.

On October 2, this fungus was far more noticeable than on the previous visit and the under surface of the leaves was covered with aphids which had been killed by it, and giving the leaf a brownish color. Many of the wingless aphids showed a pinkish color, which, as Dr. Clinton pointed out, is an indication that they are infected. He examined several and found mycelium in their bodies. These fungous-killed aphids are shown on plate V, b.

These natural checks did not combine to save the crops at Mr. Farnham's in 1916, bright as the outlook appeared for them to do so. They were too late. Conditions for their rapid multiplication were favorable only after the aphids had increased to such an extent that the plants had died from their attacks.

Remedies.

At the start it seemed doubtful if artificial remedies could be employed to advantage in control of this pest, particularly after the whole field became infested. Mr. Huber suggested that

where colonies first started here and there in a field, straw be burned over the infested plants in order to kill the aphids and prevent their further spread.

In Texas many tests were conducted to control this aphis by spraying and by fumigating. One of the most successful was spraying the under leaf surface by means of an elbow tube and nozzle, using common laundry soap, 1 lb. in 7 gals. of water. Even though this treatment could not be applied to the whole field, it might well be employed to kill the first colonies as they appear in spots over the field.

LITERATURE.

Davis, John J., Canadian Entomologist, Vol. xlvi, page 231, 1914 (original description, with figures).

Paddock, F. B., Texas Agricultural Experiment Station, Bull. 180, 1915 (full account).

THE CONTROL OF APHIDS IN FIELDS OF SEED BEETS.

In the Report of this Station for 1915, page 191, is a brief account of damage in Milford to fields of seed beets owned by the Everett B. Clark Seed Company. Three species, *Aphis rumicis* Linn., *Macrosiphum solanifolii* Ashm., and *Myzus persicæ* Sulz., were present on the plants as well as on lambs' quarters and pigweed growing about the field, though the first species, being much the most abundant, was probably responsible for most of the damage.

On June 20, 1916, the writer visited the fields of the Clark Seed Company with Mr. F. E. Rogers, of the New Haven County Farm Bureau. At this time the brown species, *A. rumicis,* had just commenced to form colonies around the succulent stem and leaves near the tops of the taller plants, especially around the margins of the field. Only a few individuals were present in each colony and the plants had not yet been injured. We examined several fields, none of which were exempt, as small colonies were detected here and there, usually occurring on the upper portion of the tallest stalks and being more numerous around the edges of the field.

Mr. Clark was advised to send a careful man through the fields with a small knapsack spray outfit and to spray thoroughly that portion of each plant seen to be infested. "Black Leaf 40," one teaspoonful in a gallon of water with a little soap added, was the material used. A second visit was made in company with Mr. Rogers, July 11. We saw innumerable places where the spray had hit the aphid colonies and there were many dead aphids on the stalks and leaves. On the whole the treatment had been effective. A few living aphids were found here and there, and Mr. Clark promised to go over the fields again, and it surely would pay to do it. At this time there was promise of a heavy crop of beet seed, and by checking the aphids so as to protect the plants for another month, the crop would be sufficiently mature to be safe from injury.

This treatment is far less expensive than to spray all the plants in the field, even with a power outfit, and by taking it in season the aphids can be controlled by killing them when the colonies are small though conspicuous and before they spread to all the plants. The writer believes this to be an important point in the treatment of other kinds of aphids also, though some crops do not lend themselves so well to it as does the beet seed crop.

THE WHITE-MARKED TUSSOCK MOTH.

Hemerocampa leucostigma, S. & A.

From time to time serious damage is done to shade trees in the larger towns and cities on account of the attacks of the white-marked tussock moth, the larvae of which feed upon the leaves. Thus, in various times outbreaks have occurred in Washington, Baltimore, Philadelphia, New York, Albany, New Haven, Providence, Boston, and probably in many other cities. This insect is usually a greater pest in towns and cities than in the open country, yet in 1908* it caused serious damage in the apple orchards of western New York, one grower estimating his loss as high as 25 per cent of the total value of the crop. It has been taken repeatedly in Connecticut on both orchard

* Bulletin No. 312, New York (Geneva) Agricultural Experiment Station, 1909.

and shade trees. In 1905* it was abundant in New Haven and Hartford and defoliated many shade trees including elm, chestnut, horse chestnut, and poplar, and again in 1916 it was noticeable in many towns of the State. In Albany and Troy, N. Y., more than thirty years ago Dr. Lintner observed a different form of injury by the caterpillars of this insect. They ate the tender bark of new shoots of the elm, thus girdling them and causing them to break off and drop to the ground. In a paper read in 1895 Dr. Lintner† states that this girdling has been observed each year since 1883.

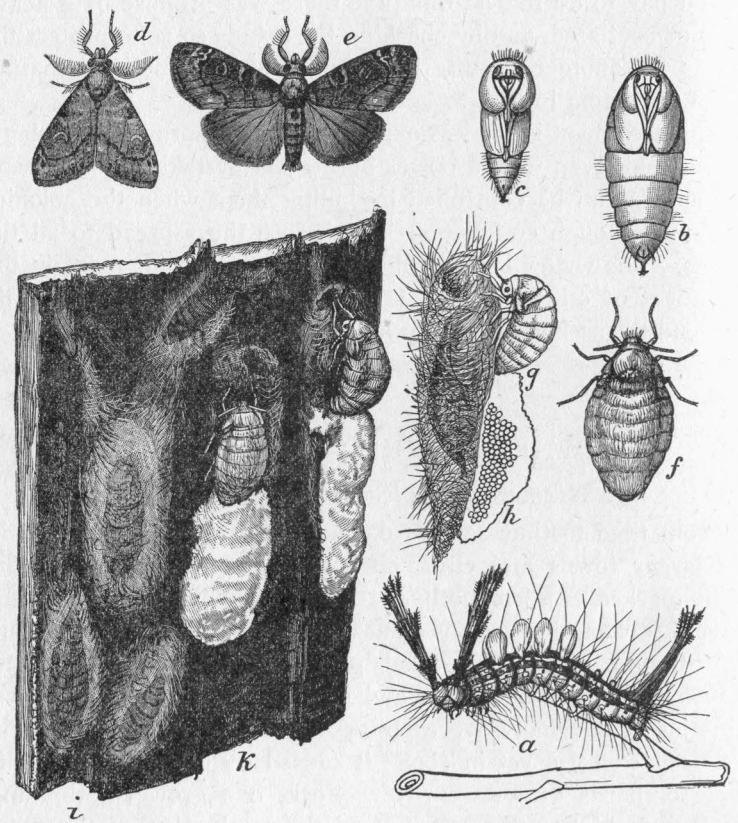

FIG. 3. White-marked tussock moth. a, larva: b, female pupa: c, male pupa: d, e, male moth: f, female moth: g, female laying eggs: h, egg-mass: i, k, cocoons—all slightly enlarged. (After Howard, Bur. Ent., U. S. Dept. Agr.)

* Report Conn. Agr. Expt. Station, page 230, 1905.

† Report, New York State Entomologist, II, page 124, 1895.

During the season just closed, the white-marked tussock moth has been received at the Station 17 times, including three times from points in New York State. In most cases it was reported from shade trees, but in one instance the caterpillars were feeding on peach and in another on quince.

In September specimens were sent us from New London with a request for an inspection, as it was feared that the gipsy moth was present there. Consequently Mr. Davis visited New London on September 22, and found the insect in question to be the white-marked tussock moth, which was abundant there.

The egg-clusters are conspicuous on the trunks and larger branches of trees during the winter months, where they appear as white foamy masses, characteristically shown on plates VI, and VII, a and c.

LIFE HISTORY AND HABITS.

Along the coast and up the river valleys and in fact over most of the area of Connecticut, there are two generations each year of the white-marked tussock moth. Felt* reports that only one generation occurs normally in Albany, and there are at least three annual broods in the vicinity of Washington, D. C.

The insect passes the winter in the egg stage. These eggs hatch in May in Connecticut, and the young caterpillars feed upon the under side of the leaves eating at first only the green portion and leaving the veins and upper epidermis. As the caterpillars increase in size, they eat holes entirely through the leaves, and when nearly full grown are voracious feeders and devour the whole leaf except perhaps the largest veins. The larval or caterpillar stage lasts about five weeks, during which time the caterpillars molt or cast their skins five times. When nearly mature the caterpillars have the habit of crawling considerable distances, and are able to go over the ground from one tree to another. If numerous, they migrate from the defoliated trees, and may be seen crawling over fences, sidewalks, or upon vehicles, and in this way they spread to other trees.

It is usually about the first week in July in Connecticut when the mature larva transforms. It spins some silken threads and with them mixes some of the long hairs from its own body,

* Insects Affecting Park and Woodland Trees, Vol. 1, page 135, 1905.

forming a gray cocoon, which is usually placed on the rough bark of the trunk or larger branches, though sometimes on the small twigs or leaves, and on buildings, fences, and monuments. The insect remains in the cocoon about two weeks. The male on emerging flies about and is attracted to lights. The female, having no wings, cannot fly, and though she may crawl short distances, usually deposits her cluster of eggs on the old cocoon. The egg-mass is pure white, of a frothy texture, and contains from 100 to 500 eggs. It is shown on plate VII, a. The eggs laid in July soon hatch and the caterpillars feed through August and into September, when they become full grown and pupate. In 1905, the adults emerged from many of these cocoons. Normally the winter is passed in the egg state, though Packard, quoting Riley,* states that occasionally a living pupa may be found in the winter.

Food Plants.

The white-marked tussock moth has a long *menu,* including nearly all kinds of fruit trees, most of the forest and shade trees except conifers, as well as many common shrubs. Among the shade trees, poplar, elm, horse chestnut, linden, and soft maple seem to be preferred.

Distribution.

The white-marked tussock moth is found from Florida to Nova Scotia and as far west as Nebraska. It is probably the most abundant in southern New England and the Middle Atlantic States.

Description.

The caterpillars are distinguished by the four yellow or white brush-like tufts of hair standing upright in a row on the back. A broad black band extends longitudinally along the back, bordered by yellowish subdorsal stripes. Laterally the caterpillar is dark gray with yellow tubercles. Head bright red. There are two long pencils or plumes of black hairs projecting forward over the head and one similar plume extending backward at the tail. This is one of the most striking and beautiful caterpillars found in Connecticut, and may often be seen crawling on the

* Fifth Report, U. S. Entomological Commission, page 264, 1890.

sidewalk, trunks of trees, fences, etc. When fully grown the caterpillar is about one and three-fourths inches long, and its general appearance is shown on plate VII, d.

The female is about five-eighths of an inch long, gray, and wingless, and resembles the female canker worm only larger. The male has a wing-spread of about one and one-fourth inches and is dull gray with rather inconspicuous marking on the fore wings, with slender body, and large and feathery attennae as shown on plate VII, b. The cocoons are dark gray or slate-color, and about three-fourths of an inch long.

The egg-masses are usually about one-half inch in diameter though irregular in shape and size. They are usually laid upon the old cocoon and are pure white and very conspicuous.

Parasites and Natural Checks.

It is known that certain species of birds feed upon the caterpillars, especially in their younger stages. Unfortunately native birds are not sufficiently abundant in cities to hold the moth in check. The robin, the Baltimore oriole, the yellow-billed cuckoo, the whip-poor-will, the phoebe, the chimney swift, the blue jay, and the English sparrow have been observed feeding upon the caterpillars. Several insect parasites have been recorded. In New York State in 1908, the ichneumon flies (*Pimpla*) *Scambus inquisitoriellus* Dalla Torre (= *inquisitor*) and (*P.*) *S. conquisitor* Say, were abundant, the former being the more numerous. These two species infested about 95 per cent. of all the parasitized cocoons in the vicinity of Geneva and Lockport. Around Geneva about 60 per cent of all cocoons were parasitized, and in some orchards around Lockport the parasitism reached 80 per cent.

Dr. L. O. Howard* states that in Washington in 1895 about 90 per cent of the larvae were killed by parasites. Of these *Scambus inquisitoriellus* D. T. (*Pimpla inquisitor* Say) and *Chalcis ovata* Say were the most effective. He also records the following as primary parasites of the white-marked tussock moth: *Scambus marginatus* Provancher, (*Pimpla annulipes* Say) *Amorphota orgyiæ* How, *Meteorus communis* Cress., *M. hyphantriæ*

* Technical Series, No. 5, Division of Entomology, U. S. Department of Agriculture, 1897.

Riley, *Limneria valida* Cress., *Limneria* sp., *Theronia fulvescens* Brullé., *Apanteles delicatus* How., *A. hyphantriæ* Riley, *A. parorgyiæ* Ashm., *Pteromalus cuproideus* How, *Cratotechus orgyiæ* Fitch, and *Telenomous orgyiæ* Fitch. In addition to these primary parasites Howard lists a large number of hyperparasites which often counteract the good done by the primary parasites in checking the white-marked tussock moth. Several two-winged or dipterous parasites have been reared from the cocoons, as follows:—*Frontina aletiæ* Riley, *F. frenchii* Williston, *Tachina mella* Walker, *T. clisiocampæ* Townsend, *Euphorocera claripennis* Macquart, *Exorista griseomicans* Van der Wulp, *Winthemia quadripustulata* Fabricius, *Sisyropa* sp.

Control Measures.

There are two chief methods of controlling this insect: (1) by poisoning the foliage, and (2) by destroying the egg-clusters.

Spraying. A thorough spraying of the foliage in June will destroy the larvae of the first brood. Lead arsenate (3 lbs. of the paste in 50 gallons of water) is probably the best poison for this purpose. As it adheres well to the foliage it may not be necessary to repeat the application, unless the second brood caterpillars are very abundant and migrate from adjacent unsprayed trees. In such cases they will be able to find sustenance on foliage which has formed subsequent to the application of the poison, and a second spraying in August may be advisable.

Destroying the Egg-clusters. The destruction of the eggs is often the most economical method of destroying the pest, and this can be accomplished in two ways; (1) by scraping off and burning the egg-masses, or (2) by treating them on the tree with something that will prevent their hatching. The former method is practiced in New York and some other large cities, where men employed for the purpose become very expert in the use of a specially made tool, consisting of a small hoe blade mounted on the end of a long pole. By means of this tool many of the egg-clusters can be reached from the ground and dislodged. But if left upon the ground and not destroyed, these eggs will hatch. Hence they should be gathered and burned or saturated with creosote to prevent hatching.

A simpler method is to soak the egg-masses *in situ* with crude creosote by means of a brush or sponge mounted on a long pole. This can be dipped in the creosote and pressed against the egg-masses. As the creosote discolors the pure white eggs, it is easy to distinguish the treated from the untreated eggs. This creosote has long been used to kill gipsy moth eggs and is effective if a sufficient amount of the liquid is used to thoroughly soak through the mass. Otherwise some of the eggs may survive.

It should be borne in mind that the treated and discolored egg-clusters will remain for a time on the bark, and render the trees more or less unsightly. In case of choice shade trees near the home, it may be advisable to remove them, just for the sake of appearance.

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THE ROSE CHAFER.

Macrodactylus subspinosus Fabr.

For many years this insect has caused much damage to growing fruit and garden crops in Connecticut, and it was particularly troublesome in 1916.

In the Report of this Station for 1905, page 259, is a brief note regarding damage to young peach fruits by rose chafers and the injury is shown on plate XII, b, of the same Report. Aside from a mere mention this is the only place in the reports

of the State Entomologist where any information is given regarding the rose chafer. A brief account of its injury, life history, and the control methods to be used against it is given here for the information of the many orchard and garden owners who suffer from its ravages throughout the State.

It is generally considered that the rose chafer is a much more serious pest on sandy soils, for it breeds chiefly on such soils. The soil is sufficiently sandy in Connecticut for it to be present in destructive numbers all over the State, but it is especially abundant along the coast.

Distribution.

The rose chafer occurs from Canada southward to Virginia and Tennessee and as far west as Colorado and Oklahoma. The region of its greatest abundance and, therefore, of its greatest destructiveness, is in Southern New England and the Middle Atlantic States. Though it has been reported as especially destructive in certain sections of Maryland, Virginia, West Virginia, Pennsylvania, New York, Ohio, Indiana, Illinois, Nebraska, Kansas, Michigan, Vermont, Massachusetts, and Rhode Island, it is not uniformly destructive throughout these states, and does little damage on the larger areas where the soil is a heavy clay. As has already been stated, the insect breeds in sandy soils and may be expected to cause its greatest devastation over sandy areas.

Injury Caused by the Rose Chafer.

Injury to Plants. Grapevines were injured by the rose chafer as early as 1810, and always have been a favorite food of the beetles, which emerge in this latitude just before the middle of June and begin their attack at the blossoming time of the grapes. They eat away the blossoms and newly set fruit, often entirely destroying the crop. They also feed upon the leaves, riddling them and sometimes almost defoliating the vines.

Though grape vines have long been a preferred food, the rose chafer is by no means confined to them, but attacks all kinds of trees and shrubs. Fruit trees are often seriously damaged, and the work of the adult beetles is common on shade trees. Plate IX, d, shows some small peaches which have been eaten by the

beetles. The writer recalls that in 1906, in Stonington nearly all of the native vegetation was attacked and many of the cultivated trees and shrubs had their leaves riddled. Even the greenbrier, *Smilax sp.* was defoliated. In fact when these beetles are exceptionally abundant, almost all forms of vegetation are attacked and devoured. Plate VIII, b, shows the characteristic injury on a birch leaf.

One of the most disgusting forms of injury caused by the rose chafer is that which this insect inflicts upon choice flowers, such as roses, paeonies, and late blooming iris in the garden. Plate VIII, a, shows the chafers feeding upon a rose. White roses and white paeonies are especially sought by the beetles, which eat holes in the petals, and soil the flowers so that they are worthless. They also attack pink and other light-tinted varieties, but seldom molest the dark ones. As the light-colored flowers are usually the most effective in the ornamental garden, they cannot well be eliminated in favor of the dark colors. The beetles are usually on hand in time to attack roses and paeonies.

Injury to Chickens. It is not wholly as a pest of plants that we must consider the rose chafer an injurious insect. It has often been stated that chickens would die soon after eating the beetles. This was first called to the writer's attention by Professor G. H. Lamson, Jr., of the Connecticut Agricultural College at Storrs, who has recently published a short account of his investigations.* From 15-20 rose chafers are enough to kill a week-old chicken that eats them. It takes from 25-45 rose chafers to kill a chicken three weeks old. Mature fowls and chickens ten weeks old and upwards are seldom killed. An extract was made from rose chafers and this, when injected into rabbits, killed them in a few minutes. These results lead Professor Lamson to believe that rose chafers contain a neuro toxin which affects the heart action of both chickens and rabbits, and renders them a dangerous food for young chickens. Chickens, therefore, should be kept in a mowed field away from grapes, flowering shrubs, or herbaceous plants during rose chafer time and especially when rose chafers are abundant.

* Journal of Economic Entomology, Vol. 8, page 547, 1915.

Life History.

The beetles emerge from the ground and attack plants usually about June 10-12 in New Haven. The earliest record in the Station collection is June 9. Of course, this date varies somewhat each year according to climatic conditions, yet it is fairly constant for a given locality. I well remember hearing a fruit grower state that the beetles had not failed for many years to appear on June 12 at his place in North Windham. The beetles are usually feeding for about four weeks, and are present for about six weeks, though diminishing in numbers toward the end of this period, then they disappear entirely. There is only one generation or brood each year. Soon after emerging the beetles mate, and they are usually found in pairs on the foliage. The female lays her eggs singly, a few inches below the surface of the ground, usually depositing from 24 to 36 eggs. The eggs soon hatch and the young larvae feed upon the succulent roots of grass and other plants, becoming full grown by late autumn when they descend deeper into the ground below the frost line. The following spring in April or May they ascend, transform to pupae in earthern cells, and from two to four weeks later the beetles dig their way out into the open air and attack the plants. The adult lives, on the average, about three weeks.

Description.

The adult beetle is yellowish-brown with head, thorax, and body together about one-third of an inch long, and with long sprawling legs. There is usually a greenish tint on the thorax and the legs are deep honey-yellow with black spines. The beetle is shown on plate IX, c.

The larva is yellowish-white with pale brown head. The egg is smooth, oval, about 1.5 mm. in length, white, and semitransparent. Two eggs as laid in the soil are shown on plate IX, b, about two and one-half times enlarged.

Control Measures.

The rose chafer is an exceedingly difficult insect to control by ordinary measures, and though many practices have been advised, most of them have proved unsatisfactory when the beetles are present in large numbers.

Spraying with Arsenical Poisons. Grapes in the vineyard should be sprayed heavily and thoroughly just before the blossoms appear and again after the blossoms fall, using lead arsenate (paste) 5 lbs. in 50 gallons of water. This spray may also be applied to the foliage of any shade trees or ornamental shrubs around the place, and also to fruit trees unless the fruit is nearly ready to harvest. Even when covered with this poison, the leaves and fruit will often be somewhat injured, because the beetles are obliged to do considerable feeding before they obtain enough poison to kill them.

Covering with Bags or Netting. The newly-set clusters of grapes are often enclosed in a paper or cloth bag which is pinned tightly around the stem. This will protect the fruit from being injured by the rose chafer as well as several other insect pests, and is a practice that may well be adopted on a small scale, as in the home garden. It is hardly practicable in the vineyard. Likewise choice shrubs and small trees may be protected by covering them with mosquito netting to keep away the beetles.

Hand Picking. When the beetles are on flowers, like roses, paeonies, etc., which cannot well be protected, hand picking is about the only remedy. A good way to destroy them is to drop them into a tin can containing kerosene.

Cultivation. It has been found that the pupa is easily destroyed, while the larvae and adults are hard to kill. This suggests plowing and harrowing the ground, or deep cultivation, at the time the insect is in the pupa stage, say during the last week in May.

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EXPERIMENTS IN CONTROLLING THE STRIPED CUCUMBER BEETLE AND THE SQUASH BORER.

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

At the Station farm, Mt. Carmel, in 1916, one-half acre of ground was assigned to this department for use in field experiments in the control of certain insects attacking cucurbits. Chief among these insects are the striped cucumber beetle, *Diabrotica vittata* Fabr., and the squash borer, *Melittia satyriniformis* Hübn., though observations were made on the squash bug, *Anasa tristis* Degeer, and some other species. All plants were grown from seed planted May 25. The following varieties were grown: Cucumbers—Davis Perfect, White Spine, and Long Green; Squashes — Fordhook, Delicata, Boston Marrow, Hubbard; Pumpkin—Small Sugar. These tests do not show satisfactory results, and we expect to continue them. Nevertheless, they indicate certain possible lines of treatment, and the uselessness of others, so we mention them here.

Striped Cucumber Beetle.

Striped beetles were more abundant than the writers have ever seen elsewhere. They attacked both cucumbers and squashes before they appeared above ground and nearly all plants were ruined, notwithstanding the various treatments applied. Consequently it was necessary on June 23 and 24 to replant the whole field. The plants in some of the rows were covered with protectors as shown on plate I, b, and if applied early enough, these protectors will probably prove as effective as any treatment. In most cases, however, beetles were already at work on the stems of the plants below the surface of the ground before the protectors were placed over the plants. Probably there were also some beetles that emerged from the ground under each frame. Undoubtedly these protectors will keep off the beetles which fly to the field.

In using arsenical poisons, the dry or powdered form seemed to be rather more effective than the same amount of poison applied as a spray.

We hope to continue this work next season, and will test the protectors placed over the hills when the seeds are planted.

Squash Borer.

After the attack of the striped beetle had subsided, there were enough squash and pumpkin plants left for a fair crop, except for the injury caused by the squash borer. Few adults were noticed on the field, yet when the plants were carefully examined on August 1, several were found to be infested with young borers. It was intended that plants of each variety be given the same treatment, but through some oversight this was not done. We have, therefore, no good basis for comparing yields, yet it was certain that more plants were saved where the young borers were cut out than was the case with the check plants, or where only the vines were covered with soil.

Rows 21-26 were examined closely for borers. Their presence is indicated by the "sawdust" thrown out of the stem. With a small sharp knife, a longitudinal incision was made in the stem and the larva killed by cutting with the knife. If taken in season the vines are not much injured and the wound soon heals.

The first cutting out was done August 4, though the two rows of pumpkins were not examined until August 7, when 45 borers were found in row 25, and 55 in row 26.

On August 16, the check rows had lost a greater number of plants than the adjoining rows, where the vines were covered with soil, but finally did not give any better yield. The best results were obtained where the borers were cut out.

The following table shows the varieties, treatment, and also the yield based upon a count of the mature squashes and pumpkins October 11:

Results of Treatment on Squashes and Pumpkins.

Variety	No. of Row	Yield	Treatment
Boston Marrow	17	13 squashes	Check. No treatment.
	18	15 "	
	19	5 "	Vines covered with soil.
	20	9 "	
Hubbard	21	58 "	Borers cut out.
	22	45 "	
	23	44 "	
	24	59 "	
Small Sugar	25	96 pumpkins	
	26	54 "	

It is planned to continue the trials, using different treatments of the same variety the coming year. Probably the greatest benefit will follow the combined treatments of cutting out the borers and covering the vines with soil.

OUTBREAK OF THE EIGHT-SPOTTED FORESTER.

Alypia octomaculata Fabr.

Order *Lepidoptera*, Family ZYGAENIDAE.

By QUINCY S. LOWRY.

During the past summer the eight-spotted forester occurred in large numbers in the neighborhood of Howard Avenue, New Haven. Though present each year, it seldom attracts attention, and there are no records, at least since the office of State Entomologist was established in 1901, which indicate that the eight-spotted forester has been anything like as abundant in Connecticut as during this outbreak.

The writer was sent to the home of Mr. E. A. Prince at 498 Howard Avenue, New Haven, to investigate a complaint made by him that his grape arbors and Virginia creepers were being rapidly defoliated by "worms." At this date, July 22, 1916, the Virginia creepers were entirely stripped (see place X, a) and the grape arbors nearly so; even the young clusters of fruit were badly eaten by the caterpillars, which were present by the thousands. These proved to be the larvae of the eight-spotted forester, *Alypia octomaculata* Fabr.

Mr. Prince was advised to spray at once with arsenate of lead all the foliage remaining on his premises. This was done, and when the arbors were inspected again on July 28, it was difficult to find any living larvae to collect for rearing purposes in the laboratory. However, there were quantities present in adjoining yards.

Only brief accounts of this insect have been recently published, and these do not figure this insect as being of any economic importance. If the eight-spotted forester should appear in abundance in commercial vineyards a great amount of damage would be caused, considering the number of caterpillars in this outbreak in the city yards of New Haven.

LOCALITY INFESTED.

The locality infested was within the radius of a mile from the junction of Howard and Kimberly Avenues, where any grape vines or Virginia creepers were present, and great numbers of these caterpillars were found to be completely destroying the foliage by the twenty-eighth of July. There is no doubt that this pest is very local in its habits, as it did not appear in any other section of the city, neither was it reported from any of the commercial vineyards of the State.

FOOD PLANTS.

These caterpillars cause the greatest amount of damage to the grape, both the wild and cultivated varieties. However, the Virginia creeper, *Ampelopsis quinquefolia* Michx., is another favorite food plant, and the common barberry, *Berberis vulgaris* Linn., and varieties of rose were found to be readily eaten by these larvae on the estate of Mr. Prince, which may have been due to the fact that the foliage of the grape and Virginia creeper at this date had been nearly destroyed, and they were forced to feed on what foliage remained.

In 1891 an article was published by C. V. Riley* who says, "*Alypia octomaculata* is one of the most troublesome caterpillars; the great abundance of Ampelopsis vines in the parks and especially around it covering 'squatter sovereignty' houses, affords congenial food for its rapid propagation. In the parks the vines are twice annually treated with a solution of London purple applied with a spraying machine. This has proved most effective, and the vines do not seem to be injured as easily as most plants by the arsenates."

DISTRIBUTION.

Morris† reports that the eight-spotted forester is common in the northern states, while Dr. John B. Smith‡ lists it as being common through the eastern and central United States. Saunders§ states that it is very generally found throughout the United States and Canada, while Dyar‖ gives its distribution as being

* Insect Life, Vol. iv, p. 61.

† Morris, Lepidoptera of North America, page 132, 1860.

‡ Smith, Economic Entomology, page 263, 1896.

§ Saunders, Insects Injurious to Fruits, page 262, 1900.

‖ Dyar's List of North American Lepidoptera, page 97, 1902.

the Atlantic States. The station collection shows that adults were collected from New Haven, Stonington, and Watertown, Connecticut, also from Savoy, Massachusetts, a majority of these specimens being collected in May and June.

Habits.

It seems to be a well known fact that this pest occurs only in cities and towns, and has never been reported from this State as causing damage to vineyards or arbors located in the country.

As the caterpillars feed in the day time and are exposed, it makes it a rather easy pest to control; they are also very local in their injury, this outbreak being confined to a very small area. Inasmuch as the adult is a day-flyer and because of its local habits, it should be effectually controlled if proper treatment be given when the larvae are first found feeding. They are very voracious leaf feeders, and if the foliage has been sprayed with arsenical poisons it will prove very destructive to them.

Life History.

The adult, or moth, generally appears in Connecticut during the months of May and June, and probably lays its eggs soon after it emerges from the ground.

The young caterpillars are whitish in appearance and feed beneath the leaves, growing very rapidly. The caterpillar when full grown goes into the ground to pupate about the first of August. This year a majority had pupated on August 2. It changes into a chrysalis within a slight cocoon, just below the surface of the ground. In Connecticut the insect passes the winter in the chrysalis stage, the adult appearing the next spring and having one brood. In Missouri, however, Riley* reports that the adult issues soon after it changes from the larva to the chrysalis form, also that there are two broods annually in Missouri, and that a third brood was obtained in Illinois in 1870. J. B. Smith† reports but one brood in New Jersey, and Lugger‡ also reports that this species is single brooded in Minnesota and passes the winter in the pupal stage.

* Riley, Sixth Annual Report of State Ent. of Mo., 1874, page 95.
† Smith, Economic Ent., page 263, 1896.
‡ Lugger, Minnesota Insects, Bull. 61, page 121, 1898.

Description.

Egg. The egg of this pest has never been observed by the writer and consequently cannot be figured or described here.

Larva. The average length of the full grown larvae is 35 mm. The general color of the larvae is brown with a bluish cast. The head and cervical shield are of a shiny bright deep orange, covered with several black dots. The segments are transversely banded with narrow black and whitish bands, each segment having a broader band of orange. This orange band is sometimes lacking on the second and third segments, and is interrupted in the center of the seventh, eighth, and ninth segments. The orange band is dotted with small black dots; even when the bands are not present on the second and third segments, the black dots are present. Each dot produces a short white hair, and they are arranged in two rows, alternating in the rows. Between the orange bands, the black and white transverse lines appear. The eleventh segment has a prominent hump, and laterally between the tenth and eleventh segments appears a whitish spot, which is larger than the white markings that appear between the other segments just below the spiracles. These markings give the appearance of a wavy whitish line, which is only broken by the interruption of the orange bands. The legs are black; the false legs have two black spots near the bases which are orange.

Chrysalis. The larva changes to its chrysalis within a slight cocoon, which is made of particles of soil or sand and measures about three-fourths of an inch in length. The chrysalis is dark brown in color and measures one-half inch in length.

Adult. The female moth is of a deep velvety blue-black color. The forewings have two large circular pale yellow spots, and the hind wings two smaller white spots. The shoulder-covers are yellow, and the first and second pairs of legs are tufted with orange. The male moth differs slightly from the female, having larger wing spots in proportion to its size, and it also has a white mark on the tip of its abdomen. The abdomen of the female is entirely black. Females in the station collection have a wing-expanse of one and three-eighths inches; the males average one and one-fourth inches.

The larvae, pupae, adults and parasite are shown on plate XI.

Parasites.

Undoubtedly many different species of birds feed upon these caterpillars and help largely to keep this pest in check. In the laboratory two Tachinid parasites emerged August 15, and were identified by Mr. Harrison E. Smith as *Winthemia quadripustulata* Fabr. Whether this is an important parasite that will keep the insect in check another year remains a question.

Control Methods.

Hand picking has been recommended as a control method where the caterpillars appear in small numbers and when arsenical sprays cannot be used to advantage. Spraying with arsenate of lead, three pounds in 50 gallons of water, is very effective, one spraying being sufficient in most cases. Pyrethrum in the form of a spray, two ounces to a gallon of water, will prove effective, especially if applied when the caterpillars are small. London purple is an old remedy which was much used in New York City about 1890, being recommended by E. B. Southwick, who had charge of the trees and shrubs in Central Park.

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THE PINE TIP MOTH.

Pinipestis zimmermani Grote.

During the course of the work of inspecting the white pine plantations by the botanical and forestry departments, on account of the blister rust, early in the summer of 1916, many infested pines were found and destroyed. Sections of the trees containing the fungus were placed in heavy paper bags and brought to the Station. These were stored in the botanical laboratory, where a few weeks afterward several small moths were observed on the windows. These were collected and examined and were found to be two species, *Pinipestis* (*Nephopteryx*) *zimmermani* Grote and *Dioryctria abietella* D. & S. As they were suspected of having emerged from some of the pine wood, subsequent material was placed in cages and several adults obtained. These emerged from sections of the trunk often three inches or more in diameter. This moth was reared from material gathered in Bantam, Litchfield County; New Canaan, Cannon Station, and Bridgeport, in Fairfield County; Middlebury, New Haven County; Groton, New London County; and Woodstock, Windham County. These records indicate that this insect occurs throughout the State.

Injury.

This insect is supposed to attack the base of the new growth, causing a brown pitch mass to form, and later the tip shrivels and finally turns brown. According to both Grote and Kellicott, q. v., it also attacks the bark of the trunk and larger branches, especially in the vicinity of wounds, often killing small trees. The former expressed the opinion that this insect caused more injury to young white pines than any other species.

Though this insect is known as the pine tip moth, Professor Kellicott* observed it breeding in the vicinity of wounds on the trunks of trees from six to twelve inches in diameter. He also found the larvae near galleries made by other borers and found their galleries in both trunk and branches above and below the whorls, sometimes completely girdling the stem and killing the upper portion. Particularly was the injury of this moth apparent in connection with the tunnels of the white pine weevil, *Pissodes strobi* Peck.

Life History.

There has been no opportunity for us to work out the life history of this insect, but Kellicott* states that he took many larvae on April 12, varying from .25 to .7 of an inch in length, so apparently the insect winters in the larval stage, and trans-

* Canadian Entomologist, Vol. xi, page 114, 1879.

forms to the pupal stage in early summer. The first of our adults emerged June 27, but others came out later up to August 5. Probably there is only one brood each year.

Food Plants.

This moth is known to infest the following species of pines:— white pine, *Pinus strobus; P. rubra;* red or Norway pine, *P. resinosa;* Scotch pine, *P. sylvestris;* stone pine, *P. cembra;* Bhotan or Japanese white pine, *P. excelsa;* and the Austrian, Corsican, and Russian pines.

Description.

Adult. Wing-expanse, 1.-1.25 inches; forewings less than one-fourth of an inch wide at widest part, ground color gray sometimes brownish, marked transversely with zigzag lighter and darker lines, as shown on plate XII, b. Rear wings nearly unicolorous, light brown, darker along the veins and near the margins. Body gray, rear margin of each abdominal segment bordered with whitish scales. Antennae brown, filiform; legs black and white.

Larva. The larval stage was not observed as we did not know that this insect was present until the moths emerged. Grote* states that the larva when full grown is from 16 to 18 mm. long and "livid or blackish green" with shining chestnut brown head and black mandibles. Its body is naked with series of black dots, each dot giving rise to a single rather stout bristle. Prothoracic shield blackish. Kellicott,† on the other hand, states that the larvae were dull white instead of "livid or blackish green," and that the hairs arise from brown instead of blackish dots.

Treatment.

So far as known there is no practicable method of control. It is always advisable to destroy, during the winter or early spring, trees or portions of trees which are known to be infested.

Literature.

Felt, E. P., Insects Affecting Park and Woodland Trees, Vol. 2, page 403, 1906.
Grote, A. R., Canadian Entomologist, Vol. ix, page 161, 1877.

* Canadian Entomologist, Vol. ix, page 161, 1877.
† Ibid., Vol. xi, page 114, 1879.

Hulst, G. D., Transactions American Entomological Society, Vol. xvii, page 136, 1890.
Kellicott, D. S., Canadian Entomologist, Vol. xi, page 114, 1879.
Packard, A. S., Fifth Report, U. S. Entomological Commission, page 731, 1890.
Zimmerman, C. D., Canadian Entomologist, Vol. x, page 20, 1878.

THE PARALLEL SPITTLE-INSECT ON PINE.

By B. H. Walden.

The parallel spittle-insect, *Aphrophora parallela* Say, has been quite abundant on pines in the forest plantation at Rainbow during the past two or three seasons. The presence of this insect is indicated by conspicuous masses of white froth one-half to three-fourths of an inch long on the twigs usually near the tips.

The spittle-insects belong to the order Hemiptera, family Cercopidae. The immature stages are passed in these froth masses and the injury to the plants is caused by sucking out the juices or sap. At least two species are very abundant during certain seasons on grasses, and probably cause considerable damage. Other species, like the parallel spittle-insect which attacks pines, cause more or less injury to various trees and shrubs, though usually much less abundant than those attacking grasses.

In 1915, the froth masses of the parallel spittle-insect were first observed on May 28; the insects at this time were a little over 4 mm. in length, which would indicate that they were in the second stage or instar. On June 30, two adults were collected on pitch pine trees and several pupa skins were observed. The insects in a number of the froth masses at this time were about 6 mm. long and were probably only in the fourth instar.

From froth masses collected on the station grounds on June 19, adults emerged on June 22 and 26. Adults in the station collection have been taken in the field from June 30 until August 10.

At Rainbow this insect was most abundant on pitch pine, but many froth masses were found on white pine and Scotch pine, and a few were observed on Norway spruce planted among the pines. No froth masses were found on Austrian pine, red pine, or Jack pine.

While these insects have often been very abundant, and their injury has been observed for years, very little has been published

regarding their habits and life histories until Professor Osborn published the results of his recent studies in 1916.* The different stages of *A. parallela* are described and figured in this publication but the only food plant mentioned is Scotch pine. Packard† and Felt‡ mention pitch pine or hard pine, and Smith§ records the species in New Jersey as occurring throughout the state (June to September) on the white pine and pitch pine, and probably it infests other species.

The adult of the parallel spittle-insect and the froth masses caused by the nymph are shown on plate XIII.

ANTI-MOSQUITO WORK IN CONNECTICUT IN 1916.

By W. E. Britton and B. H. Walden.

During 1916 considerable interest has been shown in mosquito elimination work, and the largest single contract ever awarded for this kind of work in Connecticut was executed in Branford, Guilford, and Madison, and now the salt marshes between Branford River and Hammonasset River, about 2,668 acres, are wholly ditched. Other salt marshes near New Haven and in Saybrook were also ditched, making a total of about 2,900 acres of salt marsh in the State which was ditched in 1916, making this the banner year since anti-mosquito work was started in 1912.

All ditches cut in 1912 and subsequently have been maintained in good working condition. Several improvements have been made affecting fresh swamps where malaria mosquitoes breed. These operations are described in detail in the following pages:

Work of the Connecticut Shore Mosquito Extermination Association, Inc., Branford, Guilford, Madison.

Approximately 2,668 acres of salt marsh along the Connecticut coast were ditched in 1916 to eliminate mosquito breeding. This area extends from the Branford River on the west to the Hammonasset River on the east, including the salt marsh east of the

* Maine Agr. Exp. Station, Bull. 254, page 279, 1916.
† U. S. Ent. Commission, Fifth Report, page 741, 1890.
‡ Insects Affecting Park and Woodland Trees, Vol. ii, page 686.
§ Insects of New Jersey, page 98, 1909.

Branford River in the town of Branford and all of the salt marsh in the towns of Guilford and Madison. The acreage of marshes drained in these towns is approximately as follows:

Branford	578	acres
Guilford	1,085	"
Madison	1,005	"
	2,668	"

The money to do this work was furnished by the Connecticut Shore Mosquito Extermination Association, Incorporated. This association was formed during the early part of the year and the money was raised by private subscription.

The association was desirous of having the work maintained by the towns as provided in the law passed at the last session of the Legislature. In order to take advantage of this provision it was necessary that the ditching work be done under the direction of the Director of the Agricultural Experiment Station and approved by him. Under the above law it is necessary for the Director to publish an order for such work in a newspaper having a circulation in the locality where the work is to be done. The order must be published three times, the first publication to be at least ten days before work is started. This is in order that the property owners may apply for relief from any damage that they may consider will be done to their property by the ditching. The appeal, according to the law, shall be made within ten days after the order for the work is first published. Consequently the order for this work was first published on March 16, 1916, in the Shore Line Times of Guilford, and the areas to be drained were indicated on maps, which were filed in the Town Clerk's office of each town where the work was to be done.

No appeals were filed by any of the property owners in the territory to be drained.

Owing to late snows and the general condition of the marshes at that time, it was not practicable to make a preliminary survey of the area at that time. The association was anxious to have the work started immediately without waiting for any survey to be made, and furthermore did not care to provide funds for such a survey.

The contract for the work was awarded to the U. S. Drainage and Irrigation Company, 17 Battery Place, New York, and the

work was started on March 28, 1916, twelve days after the publication of the first notice or order concerning the work. The task of inspecting the ditches was assigned to Mr. B. H. Walden.

The ditching was started in Branford at the west end of the territory, and the association immediately requested the contractor to start work in each town, so as to facilitate the collection of pledges from the residents. The contractor, therefore, placed men at Stony Creek and others on the Hammonasset marsh in Madison at the extreme eastern end of the section. This was done without consulting the Director of the Station or the inspector, and proved to be a serious handicap in the matter of inspecting and approving the work.

The Skinner spade, which makes a ditch ten inches wide and twenty-four inches deep, was used for cutting all the new ditches.

Soon after the work started objections were made by many of the marsh owners regarding the ditching. The boundaries between the various pieces of marsh property were frequently marked only by ditches. In a majority of cases these ditches had become filled with mud or clogged with vegetation. Some were so grown up that the exact location could be determined only with difficulty. There was no way to distinguish these boundary ditches from the others, and the contractor preferred to cut new ditches a few feet from the old ones. This arrangement was not only to his advantage, but the new ditches are usually more satisfactory from the mosquito elimination standpoint. New ditches drain more readily, keep their shape much better, and the cost of maintenance is much less than where old ditches are cleaned.

The owners also objected to having the marshes cut up into small sections, which interferes considerably in harvesting the salt hay. As this was the first mosquito drainage work under the present law, it seemed advisable to proceed with as little opposition from the marsh owners as possible. Therefore, considerable time was spent by the inspector and the contractor's foreman in meeting the farmers and locating the ditches as far as possible to their satisfaction. Thus many old boundary ditches were cleaned instead of digging new ones.

The work was considerably delayed owing to the contractor not being able to obtain more laborers, and a number of marsh

owners in Guilford objected to having their marshes ditched in June after the grass was well started. As some of these marshes were fairly dry with few mosquito-breeding areas, it was agreed to postpone the ditching until after the hay had been cut.

These excepted marshes were situated in three places: the upper part of the West River marsh above the Sachem's Head road, the East Creek marsh above the railroad tracks, and the upper end of the East River marsh above the main highway.

Branford Marshes.

The most important problem in Branford was the marsh east of the road to Indian Neck. The marsh extends eastward back of Hotchkiss Grove and another portion extends to the north. The surface is lower than the outer marsh towards the outlet. Just below the road was an old tide gate, which had not been repaired for several years and which failed to keep the water out. On the east side of the road a gate had previously been built in the trolley embankment to replace the old one. Though this gate was in good repair, the trolley embankment was built of rocks and gravel, and the water seeped through it for a distance of fifty or more feet, so that the water level on the marsh was not under these conditions materially lowered.

This marsh was extremely soggy with large shallow pools and much standing water in the grass areas, and was a prolific salt marsh breeding area furnishing a mosquito nuisance for the entire section from Indian Neck to Pine Orchard. The marsh was ditched in April, the contractor putting in as many ditches as were practicable owing to the soft condition of the marsh. After this, while the water did not flow in and out of the ditches freely, most of the surface water was concentrated in the ditches. Frequent inspections of the marsh were made during the season and but very little mosquito breeding was found. A tide gate was apparently necessary to lower the water in order thoroughly to drain the marsh. It was decided that the best place for a tide gate was south of the road where the old gate was located. Therefore, a pair of new gates were built and hung on the old frames, which appeared to be in fairly good shape. After placing the new gates it was soon found that they would not close tightly against this frame. The abutments on either side of the gate

also leaked considerably. Later a new frame was made of four by six inch lumber to support the gates, and fastened to the outside of the old frame. Sheet piling was placed from the edges of the frame and in front of the abutments and the space between packed with clay. After this the gates worked satisfactorily excepting when blocked with eel-grass and weeds. Owing to lack of maintenance this was removed several times either by the contractor's foreman or by the inspector.

Towards the end of the season additional ditches were cut in the marsh and many of those cut earlier in the season were cleaned. The marshes in the eastern part of Branford were well supplied with natural creeks and were, therefore, readily drained by the ditching.

Guilford Marshes.

West of Leete's Island Station and north of the railroad and highway there is a marsh of about twelve acres, which was low and soggy, breeding many mosquitoes. The outlet is through a long, crooked culvert under the highway, where it passes under the railroad. After the marsh was ditched it was found that the water did not drain out readily, and owing to the soft texture of the marsh some of the ditches were partially closed up. On August 1 additional ditches were dug, and the outlet and opening of the culvert cleaned and deepened. After this was done the water drained out and the condition of the marsh was much improved, no breeding being found there after August 1.

North of Island Bay (or Joshua Cove as it is locally known) is a marsh of about 50 acres. Between the marsh and the water on the southwest side is a large sand bar and a strip of high land over which the Stony Creek and Guilford trolley line passes. At one time the outlet of this marsh was probably near the eastern end of this sand bar, but for years the only outlet has been a ditch to the north across the highway and for several hundred feet along the southern side of the railroad embankment and then through a twenty-four-inch pipe under the railroad into the marsh northward, where a ditch was indirectly connected with the creek draining the Great Harbor meadows, a distance from the upper end of the Island Bay to the mouth of the Great Harbor Creek of about a mile and a quarter. This marsh was found to be a serious mosquito-breeding area in 1904, when a preliminary mosquito survey of the Connecticut coast was made.

A photograph showing haystacks standing in water on this marsh taken in August, 1904, was published in the Report of this Station for 1904, plate XIV, a.

It was found that an outlet could be made into Island Bay east of the sand bar where it would be protected by the rocky shore. The contractor and the owners of the marsh agreed with us that the most practicable way to drain the marsh was by opening an outlet at this point. After the ditch had been cut here, the tides flooded the upper end of the marsh which was six to eight inches lower than the southern portion. The owners felt that the water would ruin the salt hay and demanded that a gate be placed at the outlet. The contractor held that it was not a part of his contract to build tide gates, but finally agreed to build one. It was later found necessary to enlarge and lower the culvert under the trolley tracks. Considerable work was done in cleaning and deepening the outlet to the north. A new twenty-inch ditch was dug from the upper end of the railroad culvert eastward to the main creek in order to obtain more direct drainage.

Madison Marshes.

On the lower part of the large East River marsh the ditching was inspected early in July. At this time the marsh had dried out and was considered in good shape. When any breeding was found, the places were eliminated by filling or by cutting spur ditches. At the time of the August perigee the tides were unusually high each day for over two weeks. Every depression in the marsh was filled with water, and mosquito larvae were very abundant. While much of the water drained away before adults emerged, it was found necessary to do considerable more work filling and tapping pools. The same condition occurred on some of the other large marshes. In fact during this same period similar trouble was experienced on certain marshes which were drained in 1912, and which had been practically free from breeding for four years.

Within this section are a number of small marshes just back of the Madison beach, which had no adequate outlets. To carry off the water it was necessary to put in eight box culverts varying from fifteen to one hundred and fifty feet in length.

The provision for a permanent outlet for the marsh of about sixteen acres west of the West Wharf road is an engineering problem requiring the expenditure of several hundred dollars. The only place for an outlet was through the exposed sandy beach where the waves break with much force, shifting large quantities of sand during the spring and fall. The culvert put in during the past season is adequate to drain the water from the marsh, but it is a question whether it will stay in place during the winter storms.

The portion of the large Hammonasset marsh west of the Hammonasset River in the town of Madison forms the eastern boundry of the area included in the contract. This marsh was ditched during May and the early part of June. The work was inspected, and after a certain amount of perfecting work was done, practically no breeding occurred during July. Following the rains and high tides of August considerable breeding, especially on the lower portion, developed, and a large amount of additional perfecting work was done, including filling pools and cutting spur ditches.

Results of the Work.

When the height of the mosquito breeding season arrived, there were still many areas to be ditched and a large proportion of perfecting work yet remained to be done. But in spite of these facts the number of mosquitoes was greatly reduced, and the results of the work were apparent over the entire area. This fact was admitted by many of the residents and summer boarders, who were familiar with the mosquito conditions of past seasons. That the summer hotels were better patronized is indicated by the conditions of one house that was brought to the attention of the writers. During 1915 this hotel was practically empty twice during the mosquito-breeding season, and the management offered special inducements to the guests. During 1916 this hotel was filled during the whole season and was obliged to turn away many applicants.

Summary of the Work.

Approximately 2,668 acres of salt marsh in the towns of Branford, Guilford, and Madison were ditched during 1916 to eliminate mosquito breeding. The work was started March 28 and completed November 20. About 1,200,000 feet of new ditches were dug and old ditches cleaned. One new tide gate was built and one old tide gate was repaired. Twelve box culverts from 15 feet to 175 feet long were built. The whole or larger part of 81 days were spent by the inspector interviewing the marsh owners, inspecting the work, etc.

New Haven and Orange.

Maintenance work.

The Anti-Mosquito Committee of the Civic Federation of New Haven has each year raised money for the maintenance of the ditches cut during the past few years. This committee engaged Mr. P. L. Buttrick to start the cleaning of the ditches early in the season, but as Mr. Buttrick was later given a more important position as inspector of a large ditching contract at Lawrence, Long Island, Mr. J. W. Draper of West Haven was employed for the remainder of the season (June 15 to September 15) in and around New Haven, on maintenance and inspection work.

New Ditching Work.

In 1916 the funds of this committee were sufficient to maintain the old ditches and leave some money available for new ones. In ditching additional areas it seemed best to expend the money where it would do the most good. As the amount available was small, it was not sufficient to ditch the lower portion of the Quinnipiac marsh nor the marsh on the east side of the New Haven harbor north of Fort Hale Park. On the other hand there still remained an undrained area in the West River marsh which we considered as one of the most prolific sources of salt marsh mosquitoes near New Haven. This area was situated on the west side of the river in the town of Orange, between Spring Street and Congress Avenue. In West Haven some interest had been aroused and a committee appointed to raise funds and promote anti-mosquito work. Dr. Charles D. Phelps was chairman of this committee. Thus by the coöperation between these two committees, sufficient money was available to ditch this area which contained about 90 acres. The West Haven committee raised $150.00, and the remainder was

supplied by the New Haven committee, the total cost being $396.75 for cutting 15,870 lineal feet of ditches at 2½ cents per foot. The necessary legal notice was published by the Director of this Station in the New Haven Journal-Courier under date of August 29, 1916. The work was done by the United States Drainage and Irrigation Company of New York, N. Y., and on account of the scarcity of labor was considerably delayed. It was finally started on November 23 and finished on December 6. It was inspected and the ditches measured by Mr. Walden. Thus all salt marsh is now ditched south of the Congress Avenue bridge in the West River meadows.

Dr. Phelps and his committee also raised money and arranged to ditch the lower portion of the Old Field Creek marsh. The Director's order and notice was first published in the New Haven Sunday Register, December 10, 1916. There were no protests or appeals, but at the time of this writing the work had not been done. It was planned to cut 9,000 to 10,000 feet of ditches between Beach Street and Blohm Street.

Dredging of Morris Creek.

Some of the ditches at Morris Cove, cut in 1912, did not perform their work properly on account of a defective tide gate. A new tide gate was finished in 1915, but even then the water did not drain out of the ditches satisfactorily, and it was decided that the main outlet, Morris Creek, should be dredged below the tide gate. The money was, therefore, raised, the contract awarded, and it was expected that the work would be done in September, but for some reason it was delayed and the writers are informed that the dredging will be done early in the spring. After the main channel has been deepened, it will be necessary to clean out the old ditches above the tide gate. These ditches were cut in 1912 and have been cleaned somewhat and examined many times, but as they have been filled with water much of the time, it was impossible to clean them thoroughly, and, if possible, would do little good. Still there has not been much mosquito breeding in this locality. With the creek deepened sufficiently to allow the ditches to empty at low tide, they can be put in first class condition and properly maintained.

Appropriation by City of New Haven.

In the estimates of 1917, which were allowed by the Board of Finance and later adopted by the Board of Aldermen, is an item of $10,000.00 for mosquito extermination. This was asked for in the estimates of the preceding year, but was disallowed.

Ten thousand dollars will probably be sufficient to ditch all the remaining unditched salt marsh areas now existing in New Haven, and may provide for some ditching in the West River meadows north of the Congress Avenue bridge, where the marsh is of a fresh character. Some malarial mosquitoes doubtless breed in this section, which at any rate should be given some attention.

The principal sources of mosquitoes for New Haven are as follows:

Quinnipiac Marsh. The lower part lies in New Haven, and is an intensive breeding place for salt marsh mosquitoes, especially along both sides of the Middletown turnpike.

Mill River Marsh. This is a small marsh lying between the State Street bridge and East Rock. It has never been an important mosquito-breeding place, though many people seemed to regard it as such. Now the land has all been acquired by the city for park purposes, and is rapidly being filled. The Park Department will see that this area is cared for, and if additional ditches are needed, will cut them, so that none of this appropriation is needed in the Mill River marsh.

Harbor Marsh. On the east side of the harbor there is a salt marsh area of 120 acres or more, situated north of Fort Hale Park, which has never been adequately ditched. Most of this land is owned by Mr. G. H. Townshend, who has cut ditches from time to time for the purpose of increasing the yield and improving the quality of salt hay. Nevertheless, more ditches are needed, and at present this is one of the most serious breeding places of salt marsh mosquitoes existing in the southerly part of the city. Relief can be obtained only by a treatment of this area.

Beaver Swamp. Though many improvements have been made in this vicinity by the Park Department, this still remains the most constant source of malarial mosquitoes around New Haven. They breed in the grassy edges of the clear water

streams and springs. Some of the surface is oiled each year, but it is still not difficult to find the larvae during the latter part of summer. Some of the land is still in the hands of private owners, and before any comprehensive plan can be carried out it will be necessary for the city to purchase considerable property. This $10,000.00 appropriation would be entirely inadequate here, and moreover whatever is done should be along the lines of permanent park development. It is much more than a simple ditching problem.

West River Meadows. These meadows have now all been ditched below Congress Avenue, but above Congress Avenue as far north as Derby Avenue, and even to Chapel Street on the eastern side of the stream, there are lagoons and springs with clogged outlets. As this water is largely fresh, these places are doubtless furnishing some malarial mosquitoes each year. Adequate ditches should be cut connecting these places with the main stream, and the old lagoons cleaned of weeds and rubbish.

Saybrook.

During the latter part of the summer Honorable M. G. Bulkeley let a contract for ditching two areas of salt marsh at Fenwick in the town of Saybrook. About 32,000 lineal feet of ditches were cut and the total area probably amounts to over 50 acres. Much more salt marsh in the vicinity needs ditching, but a start has been made, and it is to be hoped that the work will not end here.

Hamden.

Through the efforts of the Health Officer, Dr. George H. Joslin, the town appropriated $300.00 for anti-mosquito work. Several pools and swamps in the Highwood section were filled with factory waste without expense to the owners or to the town. A fresh water swamp near Mill Rock and adjoining Lake Whitney has for years been a breeding ground for malarial mosquitoes, and malaria has been prevalent in the vicinity. Through the coöperation of the New Haven Water Company and the Winchester Repeating Arms Company, owners of the land, mosquito breeding will soon be abolished. By raising the dam of Lake Whitney about 18 inches the Water Company will flood about 50 acres of its own swamp land. The Winchester Repeating Arms Company is building a dam and pumping station by means of which the water will be pumped into Lake Whitney from a swamp of about 50 acres. Thus the two projects together will abolish mosquito breeding in a swamp of about 100 acres, formerly a prolific source of malaria mosquitoes.

ENTOMOLOGICAL FEATURES OF 1916.

The first part of the preceding winter was mild followed by severe weather and low temperature in February, which killed the peach buds on trees in the orchards back a few miles from the coast. During the spring and early summer, it was cool with heavy rainfall, so that crops were backward. On account of the rainy weather and scarcity of labor, work was behind on farms and in many cases the crops were not given attention at the right time. Up to July 1, the rainfall was greatly in excess of that of 1915 and was also above the normal, but for the remainder of the season, it was somewhat below normal.

There were complaints of wireworm injury to the roots of crops in some parts of the State. There was a certain amount of white grub injury, though less than in 1915. Cutworms were generally common and caused the usual amount of damage.

The striped cucumber beetle, *Diabrotica vittata* Fabr., was more abundant and caused more damage at the Station farm at Mt. Carmel than the writer has ever seen elsewhere.

Certain kinds of aphids were prevalent. The rosy apple aphis caused considerable injury in orchards here and there, but the green aphis seemed to be less prevalent than in 1915. The aphids on seed beets mentioned in the Report of this Station for 1915, page 191, were also present in 1916, and a brief account of the control measures, which were given a successful trial, will be found in the pages of this Report. The most notable aphid outbreak of the year was that of the turnip aphid, *Aphis pseudobrassicæ*, Davis, which seemed to cover nearly the whole State and caused damage to the turnip crop probably amounting to thousands of dollars. For a more comprehensive account of this insect and how to control it, see page 98 of this Report.

Rose chafers were also abundant and caused the usual amount of damage to grapes and other fruits, as well as to ornamental trees, shrubs, and flowers.

One of the features of the season was the great amount of injury to apples caused by the false or-lined red bug, *Lygidea mendax* Reuter, which has heretofore been noticeable only in the southwestern corner of the State. In 1916, however, it was much more widespread and destructive. It was reported from Litchfield, Glastonbury, and Mansfield, and no doubt could be found all over the State. The writer saw rather severe injury from it in Milford.

The apple maggot, *Rhagoletis pomonella* Walsh, was also very abundant and caused serious damage.

The brown-tail moth has failed to spread its usual distance during the year and winter webs are now rather scarce. Nowhere have they been found abundant.

The gipsy moth has not spread perceptibly from the infestations known to exist in the summer, but since the fall scouting began a large number of small infestations consisting mostly of single egg-clusters have been found along the eastern border of Thompson and some occur in Putnam and Killingly.

The first portion of the season was favorable, as regards rainfall, for the development of mosquitoes and they were abundant. Considerable ditching was done on the salt marsh during the year, amounting to about one and a quarter million lineal feet, thus effectively draining about 2,900 acres. This is the most ever done in a single year in Connecticut. More work is planned for next season.

More detailed information regarding these insects will be found in the pages of this Report.

MISCELLANEOUS INSECT NOTES.

Scale Insect on Azalea. On July 26, we received from Hartford a rhododendron twig infested with a few large, light-gray scales occurring on the bark. These were identified by the Bureau of Entomology at Washington, D. C., as *Eriococcus azaleæ* Comstock.

Moths in Sap Bucket. On April 6, we received from Mr. George W. Best, Higganum, specimens of moths, with a statement that they were present in large numbers in maple sap. Thirty-five were found in one bucket. The specimens were too

badly crushed for accurate specific identification, but evidently belonged to the genera *Xylina* and *Scopelosoma.*

A Rare Long-Horned Beetle. Another addition to the Connecticut collection of beetles was made at Middlebury on June 2, 1916, in a specimen of *Anthophilax malachiticus* Hald. This large, metallic, bluish-green, long-horned beetle, about one-half inch long, was found walking across the road in a damp place. It is probably a wood-boring species and has been taken in Canada, Maine, New York, and Connecticut.—M. P. Zappe.

European Elm Case Bearer. On June 16, leaves of Camperdown elm were received from Fairfield, which showed several holes and also several peculiar larvae in their brown cases, known as case bearers. This is apparently the European elm case bearer, *Coleophora limosipennella* Dup., which has previously been recorded in Brooklyn and New York City by Slingerland* and Felt.† It is said that this insect is spreading and the injury increasing. Spraying with lead arsenate, as is usually practiced to control the elm leaf beetle, ought to prevent serious injury by this case bearer.

Another Spruce Gall Aphid in Connecticut. While making the annual inspection of nurseries, in two nurseries in Hartford, September 20-22, large galls were noticed on specimen trees of the Colorado blue spruce. These galls are caused by *Chermes cooleyi* Gillette, a species not hitherto recorded from the State. Plate XV, b, shows the shape of the gall. If remedial measures are necessary, probably a contact spray early in spring, as is used against the common spruce gall aphid, *Chermes abietis* Linn., would be effective.

Injury by Silver Fish. Specimens of a species of silver fish, *Thermobia domestica* Pack, were brought to the office on September 14, from Hartford where they caused much damage by gnawing paper, book bindings, etc. It is often necessary to try different remedies before success is reached. Boiled starch paste poisoned with arsenic and distributed on cloth or bits of cardboard placed around in the crevices where the silver fish

* Bulletin 233, Cornell Agr. Expt. Station, page 49, 1905.

† Insects Affecting Park and Woodland Trees, Vol. 1, p. 167, 1905.

occur, will sometimes prove effective. Pyrethrum or insect powder can also be used where it can be applied.

A Scolytid Beetle in Sugar Maple. On July 10, a section of the trunk of a small sugar maple tree was received from Pomfret with a number of small, deep tunnels in the wood. In these tunnels were several beetles which were identified as *Xyleborus dispar* Fabr. The accompanying letter stated that for several years this beetle has been at work in one part of one maple tree. The species is known to attack many different kinds of trees including fruit trees, but remedial measures, other than destroying the infested tree, are of questionable value.

The Eyed Elater. The largest click beetle occurring in Connecticut, known as the eyed elater, *Alaus oculatus* Linn., on account of the two large eye spots on the thorax, was seemingly more common than usual in 1916, and was sent to the office several times between June and November from New Haven, Hamden, Orange, and Hartford. The correspondent usually asks if this is a pest. We are obliged to answer, No. The larvae are found in decayed wood such as old logs, stumps, etc., and it can scarcely be called an injurious insect. The adult is shown on plate IX, a, photographed from a living specimen.

Abundance of Walnut Caterpillar. The walnut caterpillar, *Datana integerrima* G. & R., which has been mentioned in former reports (see Reports of this Station for 1901, page 275; 1914, page 191), was also prevalent in 1916. Specimens were received several times from New Haven, West Haven, Wallingford, Meriden, Chester, and New Canaan. The caterpillars feed in clusters upon butternut, black walnut, and hickory, and have the habit of gathering in large numbers on the trunks and larger branches at molting time. Consequently the large gray masses of cast skins are noticeable on the bark. Spraying the tree or destroying the clusters of larvae by hand are remedies.

Tarnished Plant Bug Injuring Tobacco. During July a complaint was received from Mr. R. H. Gardner, Cromwell, regarding a form of injury to tobacco caused by a small sucking bug, which was doing much damage. In order to make sure of the identity of the insect responsible, specimens were requested. It proved to be the tarnished plant bug, *Lygus pratensis* Linn., an old offender, which has caused much injury in past years to various fruit, flower, and vegetable crops. It is a difficult pest to control, but if taken in season a thorough spray of "Black Leaf 40," one pint in 50 gallons of water, to which has been added two pounds of laundry soap, should prove effective. Mr. Gardner claimed that in 1916 this insect caused damage in his tobacco fields to the amount of $500.00.

The Greenhouse Leaf-Tyer. Larvae of the greenhouse leaftyer, *Phlyctænia ferrugalis* Hübn., were received from Norwalk, January 4, 1916, where they were doing much damage to snapdragon, geranium, and cineraria by devouring the leaves. A note about this insect occurs in the Report of this Station for 1909, page 369. The larva is shown in figure 7, and the adult on plate XVI, b, of that report. The food plants include nearly all of the common vegetables, many native weeds, and a large number of ornamental herbaceous plants growing both under glass and out of doors. A good remedy is to apply paste lead arsenate at the rate of one pound in ten gallons of water. Small potted plants can be dipped in this mixture, but in spraying it is necessary to coat the under side as well as the upper surface of the leaves.

Flea Beetle on Ash. During the spring inspection of white pines for white pine blister rust, a flea beetle, *Œdionychis sexmaculata* Ill., not previously reported from Connecticut, was found at Middlebury feeding on ash (*Fraxinus*). These beetles are oblong-oval in shape, in color reddish or brownish yellow. They have the last joints of the hind tarsi globosely swollen and the hind thighs thickened for leaping. Size, about one-eighth of an inch long. On June 7, 1916, there were many beetles feeding on the ash sprouts which were growing between the rows of pine, almost defoliating some of them. There was much ash growing among the pines, but it was considered worthless because the pines would soon outgrow and kill it. Where ash is used as a shade tree or is grown for lumber, these beetles may become of some economic importance.—M. P. Zappe.

California Privet Injured Supposedly by White Grubs. On April 8, specimens of white grubs, *Lachnosterna* sp., were

brought to the office from Wallingford, with the statement that they were causing considerable injury in a small nursery by eating the bark of California privet just below the surface of the ground. Some plants had been killed, many had been girdled, and others had been eaten on one side and a callus had formed around the wound. The owner had about 35,000 plants which he had grown from cuttings. He transplanted 5,000, and found that almost every plant had been attacked. Mr. Zappe visited this nursery April 10, and found many injured plants and but few white grubs. The owner was advised to throw the soil up around the stems of the plants to induce them to make roots above the girdled areas. When the nursery was again inspected in the fall there was a good stand of plants.

Sucking Dog Louse. On May 9, several specimens of the sucking dog louse, *Hæmatopinus piliferus* Burm., were received from Fairfield, where one of several pet dogs, a beagle hound, was infested. All of the dogs slept in the same barn, but the others seemed to be free from lice. Several remedies such as flea powder, creolin, and whale oil soap were tried, but were not very effective. Kerosene and water and a thorough combing kept them down for a week or so, when they appeared again. The owner was advised to obtain some paraffine oil about 28° gravity, and to saturate thoroughly the hair and skin of the dog, and then to wash it off with soap and water an hour or so later. A subsequent letter from the owner stated that this proved a perfect success, and two such treatments a month apart completely routed the pest.

The Grape-Vine Sawfly. Larvae were received on July 15 from Wilton, and on August 26 from Bridgeport, where they were feeding on the under side of grape leaves. This insect is known as the grape-vine sawfly, *Erythraspides pygmæus* Say. It is not much of a pest in Connecticut. The larvae when mature are about a half-inch in length, greenish yellow, with head and tip of the body black, and with two transverse rows of black spots on each segment. The larvae feed in colonies, and are shown on plate XVI, b. There are two broods each season. The adult is a small, four-winged fly. Though this insect seldom causes much injury in Connecticut, it can be controlled when

abundant by spraying the grape leaves with lead arsenate, using three pounds of the paste in fifty gallons of water.

Euclemensia bassettella Clem., a Micro-Lepidopteron Bred from Scale Insects. Specimens of a *Kermes* probably *K. sassceri* King., were collected on an oak at Yalesville, April 13, 1916, by B. H. Walden. On examining this material during the summer four specimens of a small moth were found in the box, and in the scales were holes from which the moth emerged. See plate XII, c. The moth proved to be *Euclemensia bassettella* Clem. This species was described by Dr. Clemens* from Connecticut material sent to him by Mr. H. F. Bassett, of Waterbury. The original description is as follows:

> "*H. bassettella.* Fore wings bright reddish-orange, sometimes tinted with yellowish-orange, with a black spot at base above the fold of the wing, and a broad black stripe, showing bluish or greenish reflections, along the inner margin, extending from the middle of the fold to the tip of the wing and occupying nearly one-half of the breadth of it. Along the costa, about the middle of it, is a shining black stripe, which becomes narrower as it approaches the apical third of the wing. Cilia blackish. Hind wings shining, dark greenish black. Head and thorax black. Antennae black. Labial palpi, yellowish-orange."—B. H. WALDEN.

Shot-Gun Cartridges Injured by White Ants. Some paper shot-gun cartridges were sent to the laboratory, September 28, by the Winchester Repeating Arms Company of New Haven. These shells had been eaten, evidently by some insect, in much the same manner as another lot received in 1910 which had been injured by ants. (See Report of this Station for 1909-1910, page 698.) The present shipment was returned from a dealer in Wichita, Kansas. In some cases the shells were eaten so that the powder and shot rattled out into the box. An examination of this material revealed the presence of a few dead and immature white ants, probably *Leucotermes flavipes* Kollar, a common and destructive species in the more northern latitudes where white ants are found. This species is native to the United States and often breeds in old logs, stumps, posts, or any timber near the ground. It frequently tunnels in the construction timbers of trestles, bridges and buildings, sometimes seriously weakening

* Proceedings Entomological Society of Philadelphia, Vol. ii, page 423, 1864.

them. The termites probably were tunneling where the cartridges were stored and, not realizing their dangerous character, ate into the shells.

A Worm Reported from Milk. A Hartford dairyman brought to the office on March 18 a whitish larva which was alleged to have been found in milk by one of his customers. This proved to be a full grown larva of the cadelle, *Tenebrioides mauritanicus* Linn. It is about three-fourths of an inch long, whitish, with head and anal segment dark brown; there are also brown dorsal markings on the three thoracic segments. This insect feeds upon all kinds of stored vegetable foods and has even been reported from milk,* but may have occurred there accidentally. Its presence should not necessarily be considered as evidence that the milk was adulterated with farinaceous material. In the Hartford case, however, the customer admitted that the bottle had been opened and that milk, sugar, and barley flour had been used in the preparation for a patient. In straining, the larva was found upon the strainer. The flour was sifted, and no more worms were found. It was thought that this one came from the milk. The habits of this species lead us to believe that, though the larva may have fallen into the milk, it is even more probable that it was in the barley flour or the sugar.

Twigs Girdled by the Giant Hornet. On June 17, some small hard wood twigs, which had been girdled, were received from Stamford. This appeared to be the work of the giant hornet, *Vespa crabro* Linn., and our opinion was later confirmed by Dr. E. P. Felt, to whom the sample was submitted. On November 7, apple twigs which had been similarly injured were received from Greenwich, and this injury had been followed by the woolly aphis. Dr. Felt† states that this insect has attracted considerable attention during the last few years by gnawing the bark from the living twigs of various trees, birch being attacked oftener perhaps than other kinds. This hornet is a native of Europe, but has been collected many times in Connecticut in recent years at New Haven, Hamden, Darien, and Plantsville. It was first noticed in the vicinity of New York City more than twenty years ago,

* Insect Life, Vol. i, page 112, 1888.

† Thirtieth Report of New York State Entomologist, page 71, 1915.

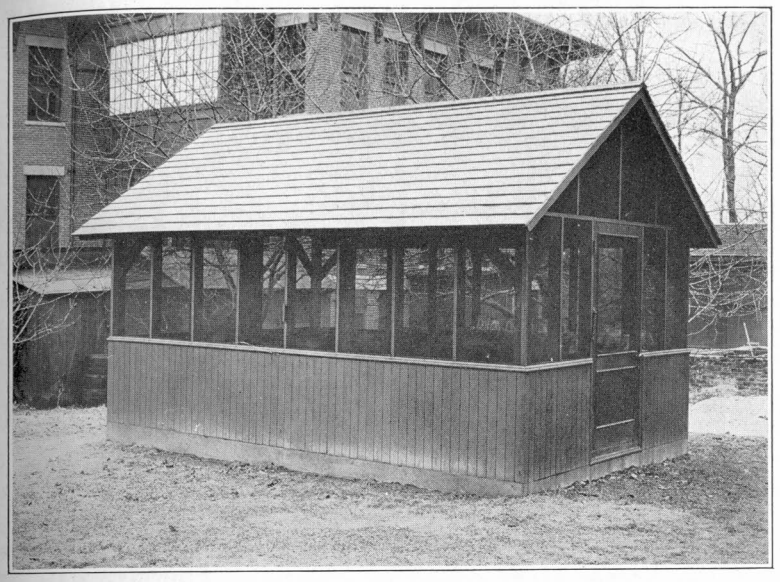
and has now spread into southern Connecticut and throughout New Jersey. In Europe this hornet is recorded as stripping the bark from the twigs of ash, alder, elm, linden, lilac, oak, larch, horse chestnut, willows, and poplars. Though this injury is usually slight and needs no control measures, in case of choice specimen trees and shrubs grown for ornament it may be advisable to coat the bark with lead arsenate, using one pound in ten gallons of water.

The Hickory Gall Aphid. Each year the compound leaves of various species of hickory begin to fall in June. If the stems are covered with galls, as shown on plate XV, a, it is an indication that the cause of dropping is due to the hickory gall aphid, *Phylloxera caryæcaulis* Fitch. The work of this insect is always evident in New Haven, and during the past season it was also received from Middlebury and Darien. The galls occur on the new shoots and leaf stems in June, and are bullet-shaped or pointed-globular and are sessile on the stems, which are usually more or less deformed. The galls vary from less than one-fourth to an inch or more in diameter, though usually between one-fourth and one-half inch. Those growing singly are the largest, but when crowded they are often confluent and are much smaller. At the time the leaves fall the galls are open at the point and blackened inside. Earlier these galls are nearly filled with immature aphids. Apparently the winter is passed in the egg stage, and there is only one gall-producing brood each season. These galls can form only when the tree is making its season's growth. Several varieties have been described, but these varieties are at least in part due to the particular species of hickory on which they occur and not to the insects responsible for the galls. Sometimes many leaves fall, and it seems as though much injury must result, but certain trees on the Station grounds are attacked each year, and though a portion of the leaves and some of the new shoots drop, some are not infested, and some only slightly infested, and these remain upon the trees. The vigor of these trees does not seem to be greatly impaired. Requests for remedies are constantly received, and though not supported by any records of evidence, it is possible that if sprayed with kerosene emulsion or nicotine solution just as the buds are breaking open in the spring, choice shade trees may be protected from attack.

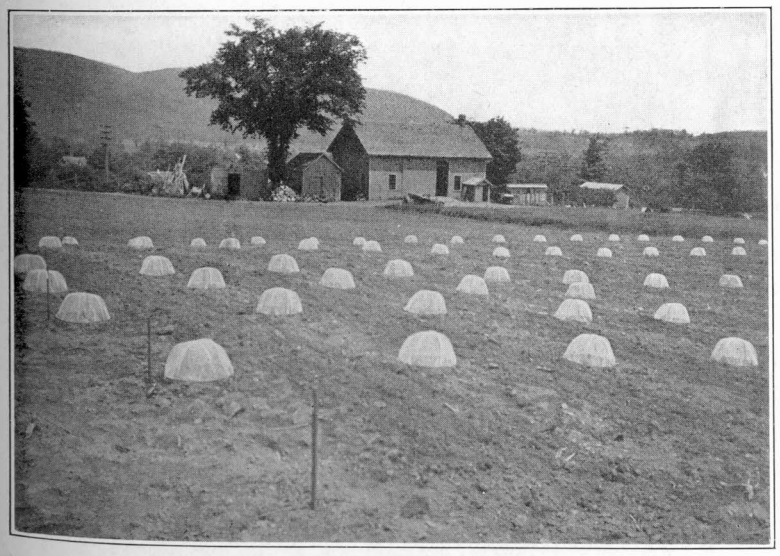
Curious Galls on Grape-Vines. Each year we receive a number of specimens of galls from grape vines with a request for information about the cause and seriousness of the trouble. The commonest gall on grape is known as the grape vine tomato gall, *Lasioptera vitis* Osten Sacken, and several specimens were sent to the office during the summer from New Haven, North Haven, and Meriden. This gall is an irregular, watery thickening or swelling, usually occurring on the new shoots, sometimes involving the stem and often the leaves, petioles, and the tendrils. These swellings are usually red, sometimes green, and they are often confluent. Their appearance is shown on plate XVI, a. Of course, these galls are conspicuous and affect the growth of the shoot on which they occur. But usually only part of the shoots are affected and the vine makes ample growth in spite of them.

A similar, though more regular, and usually larger, gall is found on the stems of wild grapes. This is the grape vine apple gall, *Schizomyia pomum* Walsh and Riley, formerly known as *Lasioptera vitis-pomum*. On August 16, a specimen of this gall was received from Meriden. This gall is formed from a bud and is borne sessile on the side of the stem. In shape it resembles a small peach, the end being pointed, and it is about five-eighths of an inch in length. It is usually green or reddish, and is much more common on wild grapes than upon the cultivated varieties.

There is no treatment which can be recommended to prevent the formation of these galls. The parent two-winged flies lay the eggs on or in the succulent tissues, the galls grow and contain cells in which the larvae develop. The only known means of control is to clip off and burn the infested tips.



a. New out-door insectary.

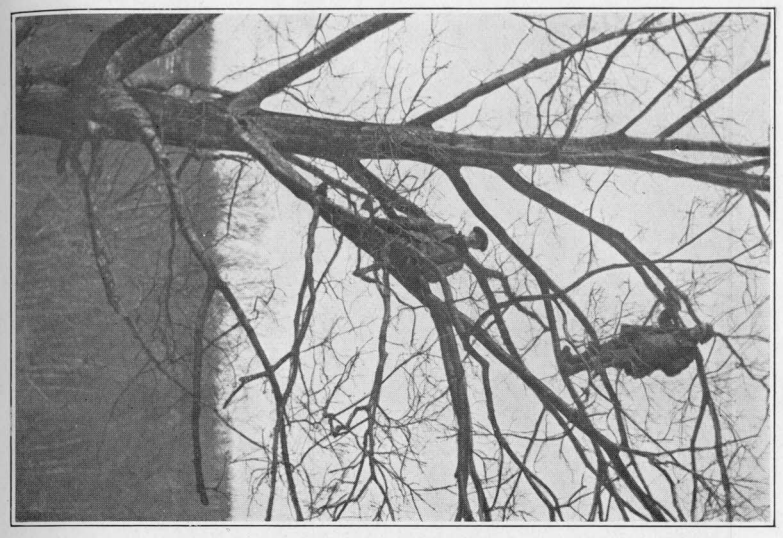


b. View at farm showing protectors over cucumber plants.

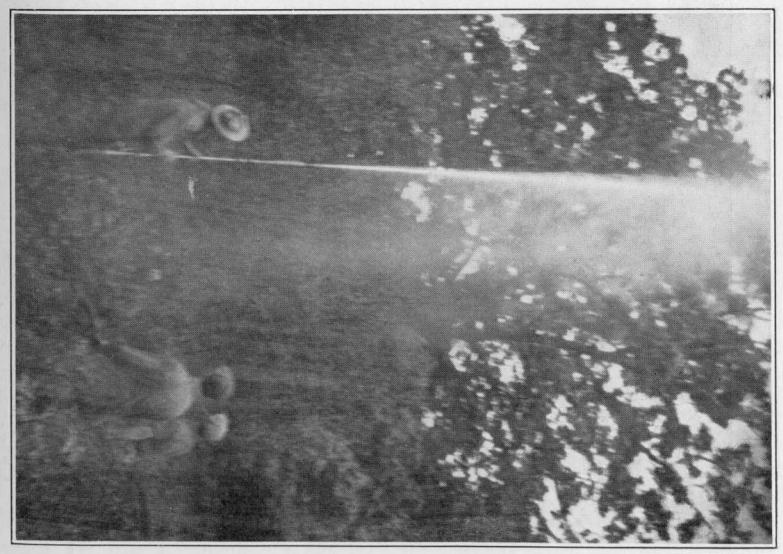
NEW INSECTARY, AND VEGETABLE INSECT EXPERIMENTS.

a. The westernmost infestation, Ashford.

b. Woodland infestation, No. 18, Pomfret; 304 egg-clusters were found here, and 4000 gallons of spray mixture used.

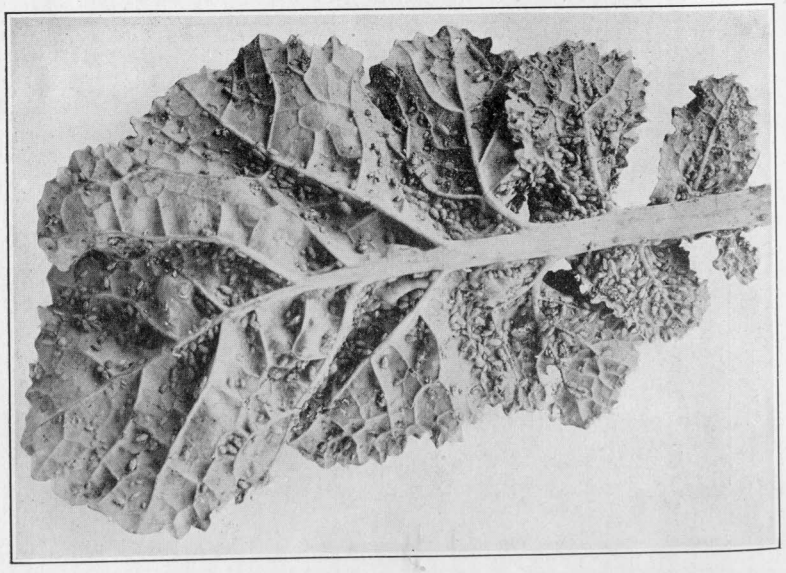


a. Creosoting egg-masses, infestation No. 1, Brooklyn.



b. Spraying woodland trees, Thompson.

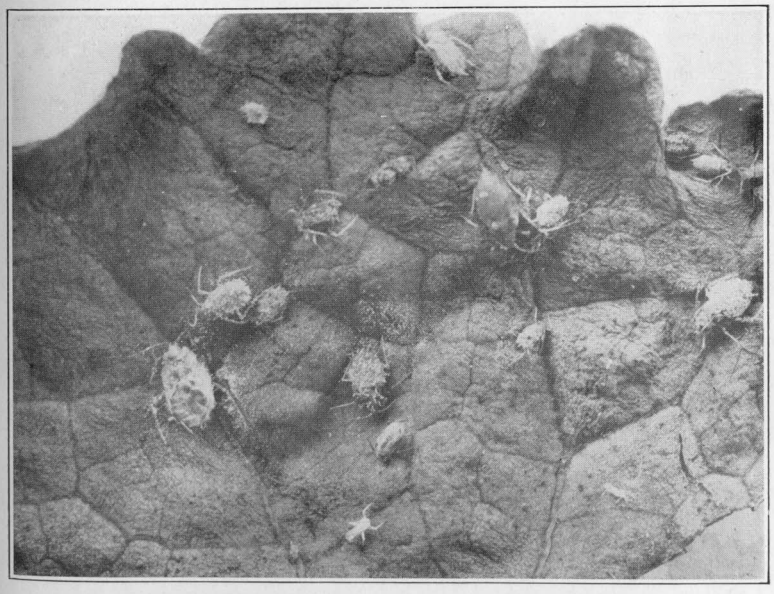
a. Spraying woodland trees, gipsy moth work, Thompson.



b. Turnip leaf infested with aphids, natural size.

GIPSY MOTH WORK AND TURNIP APHID.

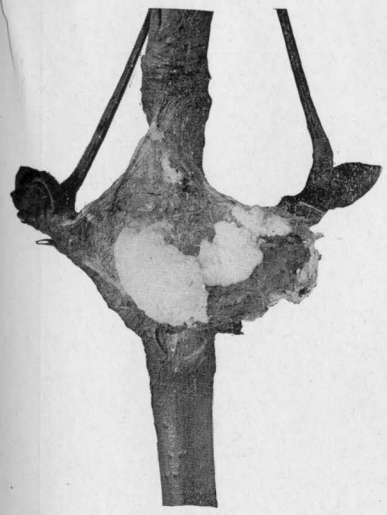
a. Turnip field. White egg turnips at right had been killed by aphids; rutabagas at left were beginning to show injury.



b. Aphids killed by fungus, enlarged six times.

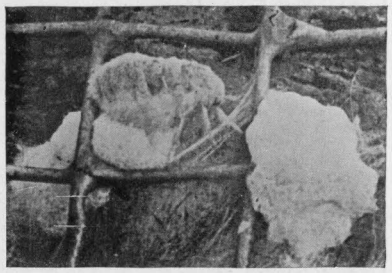
TURNIP APHID.

White-marked tussock moth. Cocoons and egg-masses.

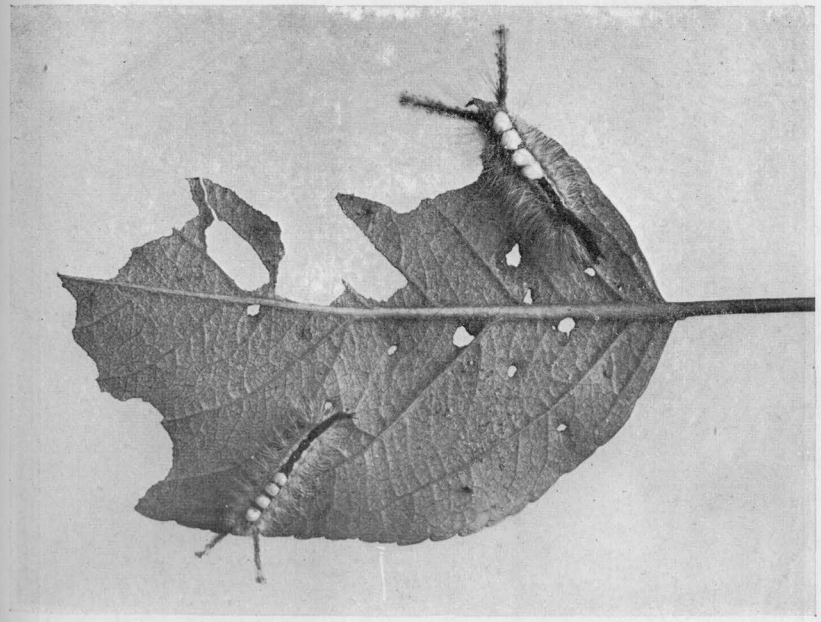


a. Egg-masses.

b. Male moth.



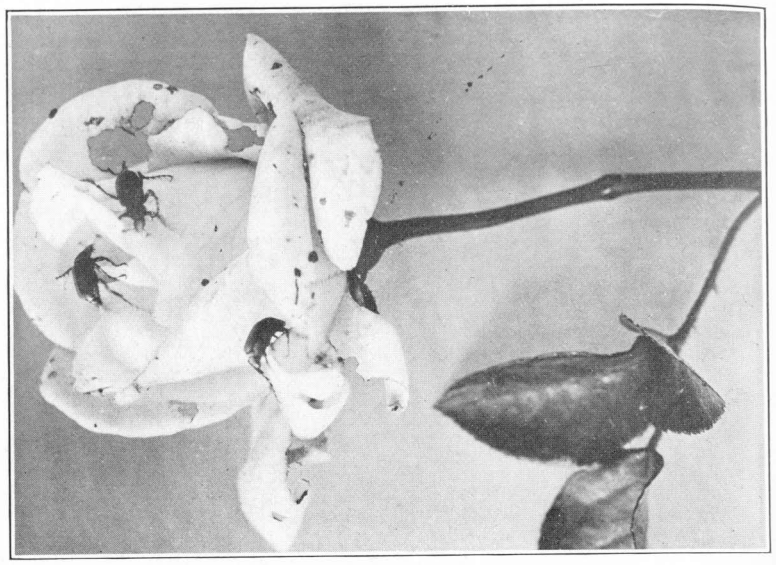
c. Female moth and egg-masses.



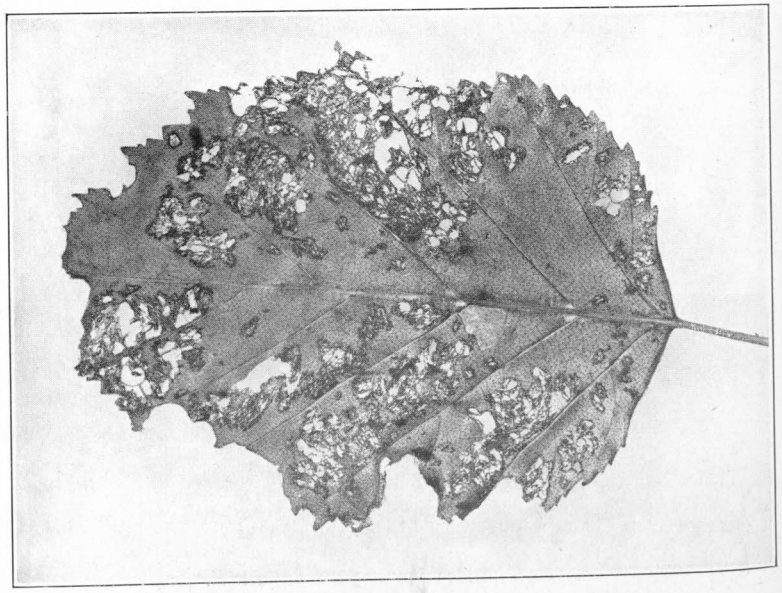
d. Caterpillars feeding on apple leaf.

WHITE-MARKED TUSSOCK MOTH, ALL NATURAL SIZE.

PLATE VIII.

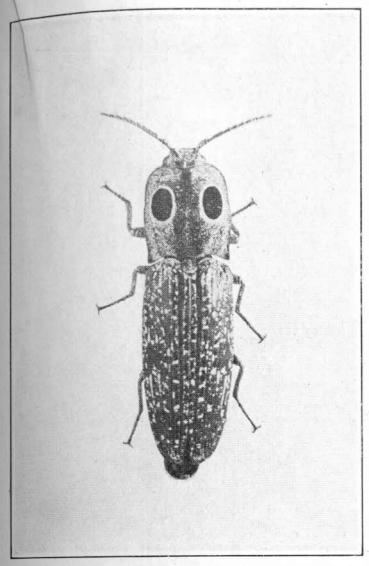


a. Adult beetles injuring rose, natural size.

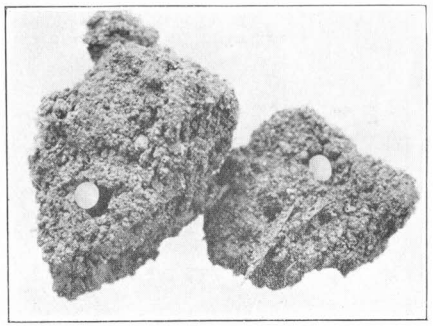


b. Birch leaf eaten by beetles.

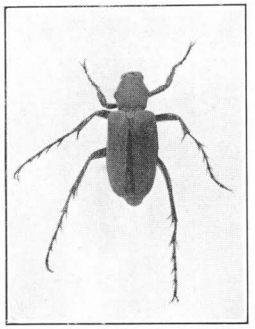
WORK OF THE ROSE CHAFER



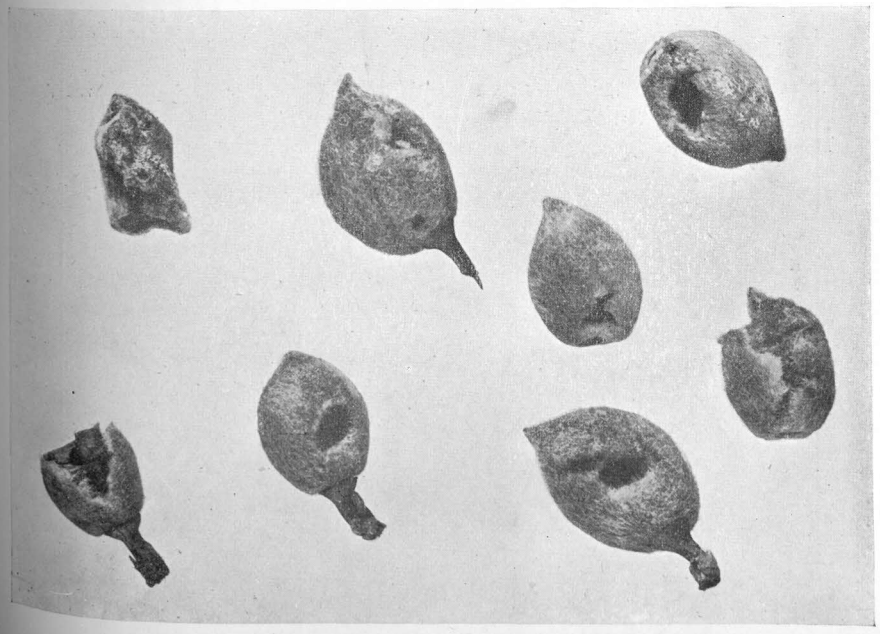
a. Eyed elater, *Alaus oculatus* Linn., natural size.



b. Eggs of rose chafer, two and one-half times enlarged.

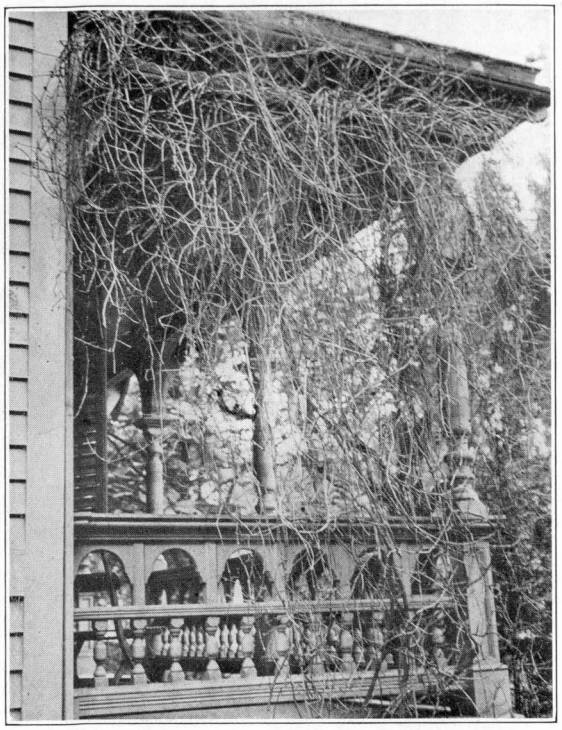


c. Rose chafer, twice natural size.

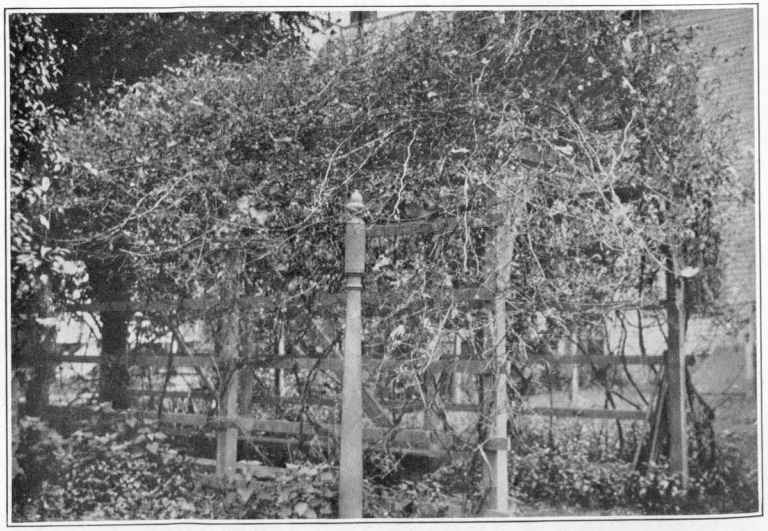


d. Peaches eaten by the rose chafer.

WORK OF ROSE CHAFER, AND EYED ELATER.

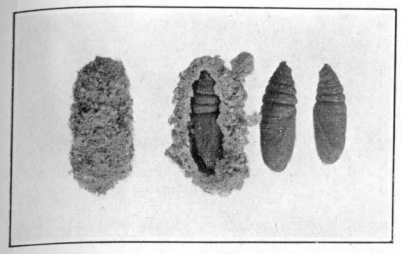


a. Virginia creeper stripped by larvae.

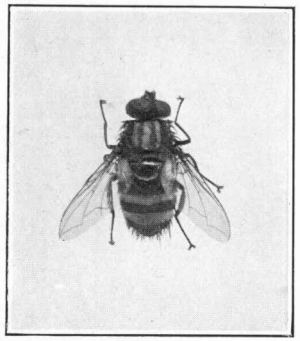


b. Grape-vines defoliated by the larvae.

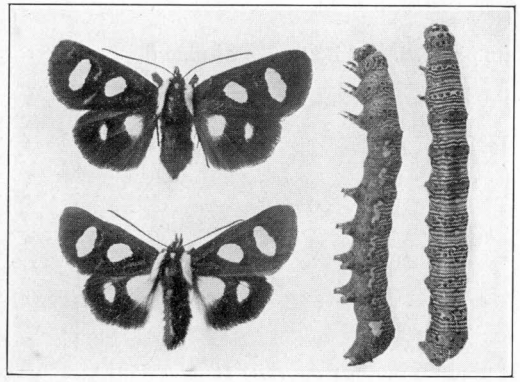
WORK OF THE EIGHT-SPOTTED FORESTER.



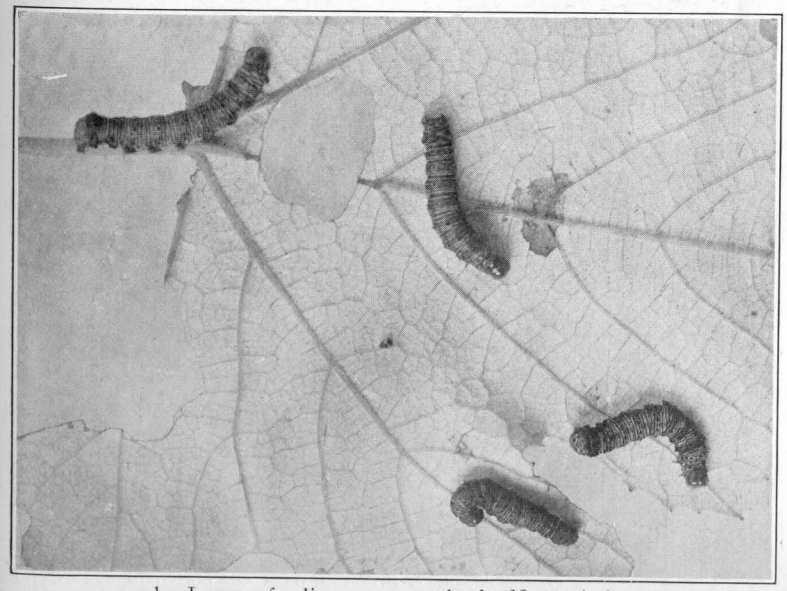
a. Pupae, natural size.



b. Tachinid fly, *Winthemia quadripustulata* Fabr. Twice natural size.

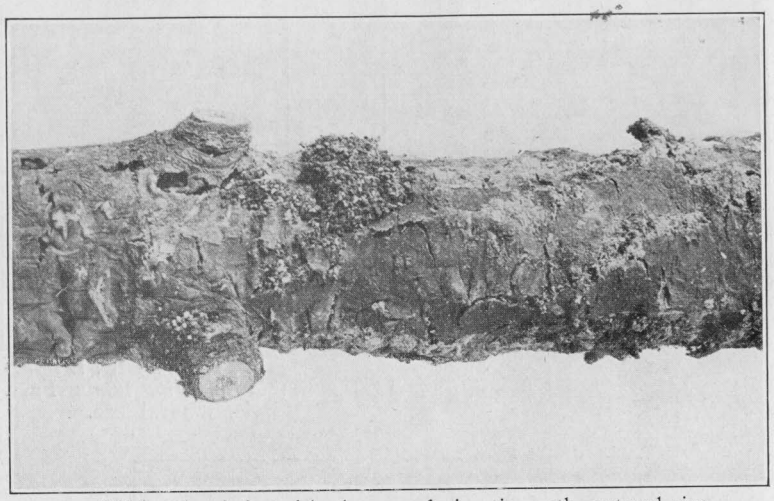


c. Adults and larvae, natural size. Female at top.

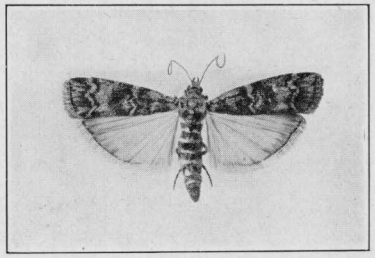


d. Larvae feeding on grape leaf. Natural size.

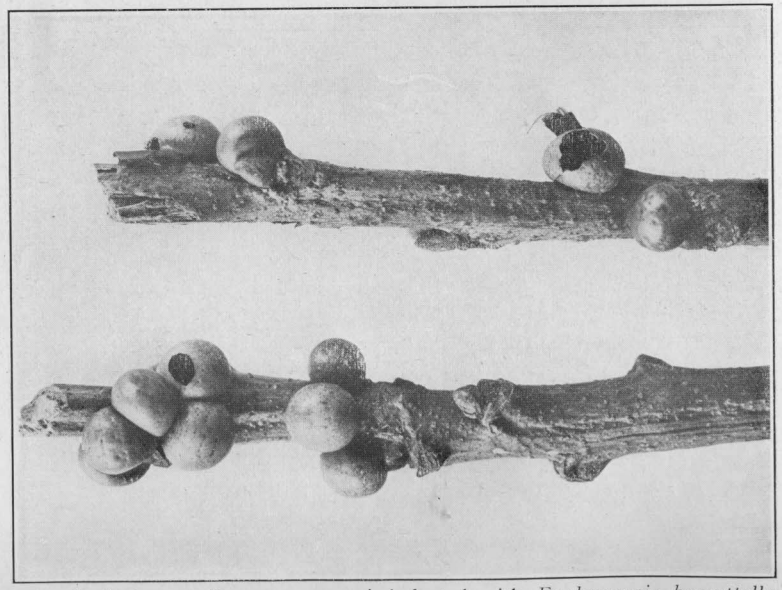
EIGHT-SPOTTED FORESTER.



a. White pine infested by larvae of pine tip moth, natural size.

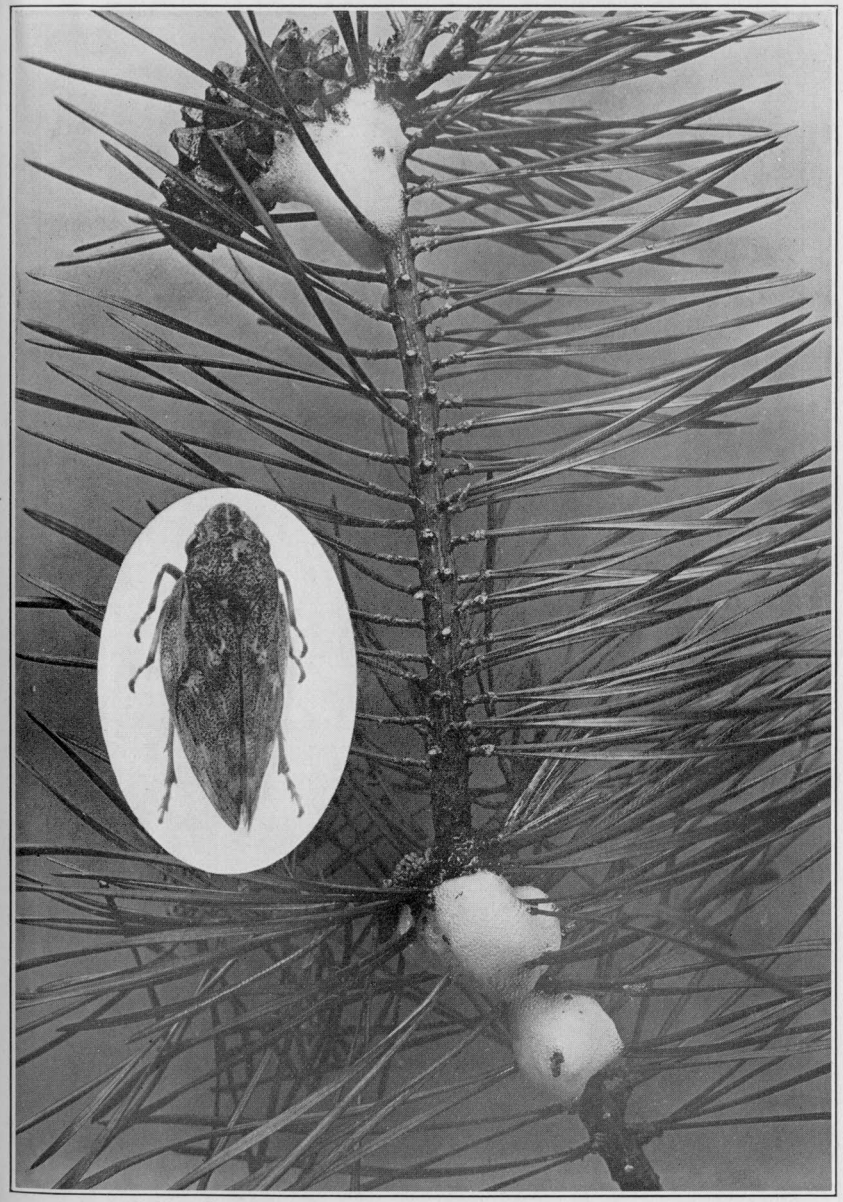


b. Adult of pine tip moth, *Pinipestis zimmermani* Grote. Natural size.



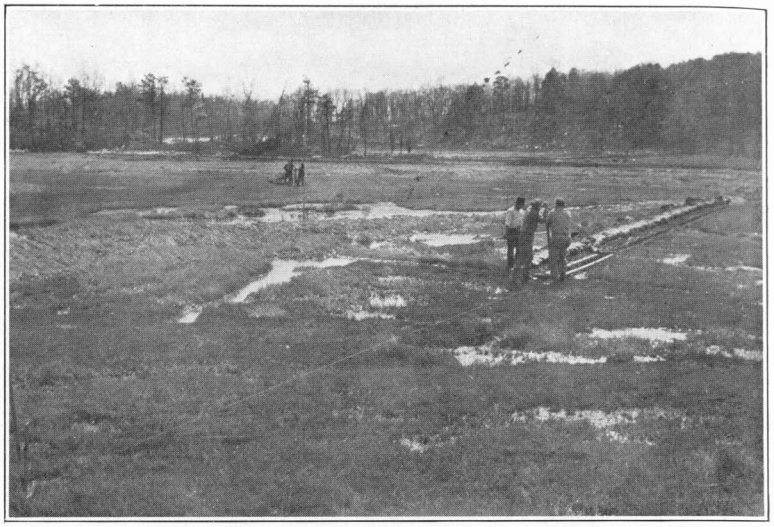
c. Scale-insect, *Kermes sassceri,* infested with *Euclemensia bassettella* Clem. Twice natural size.

PINE TIP MOTH, AND INFESTED SCALE-INSECT.

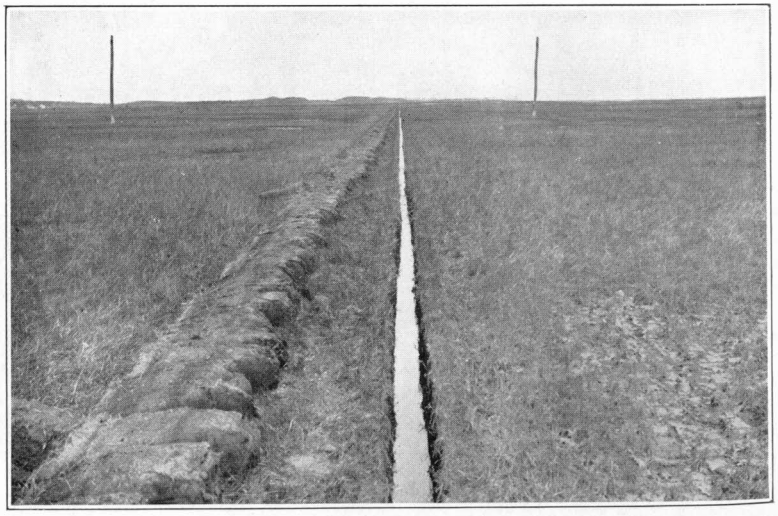


The froth masses on Scotch pine are natural size. The insert shows the adult insect, four times enlarged.

PARALLEL SPITTLE INSECT.

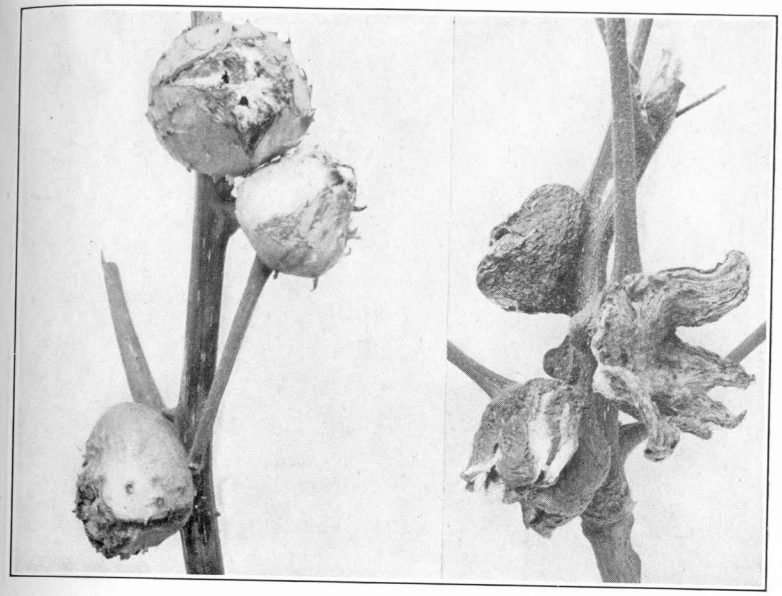


a. Ditching gangs at work, near Stony Creek.

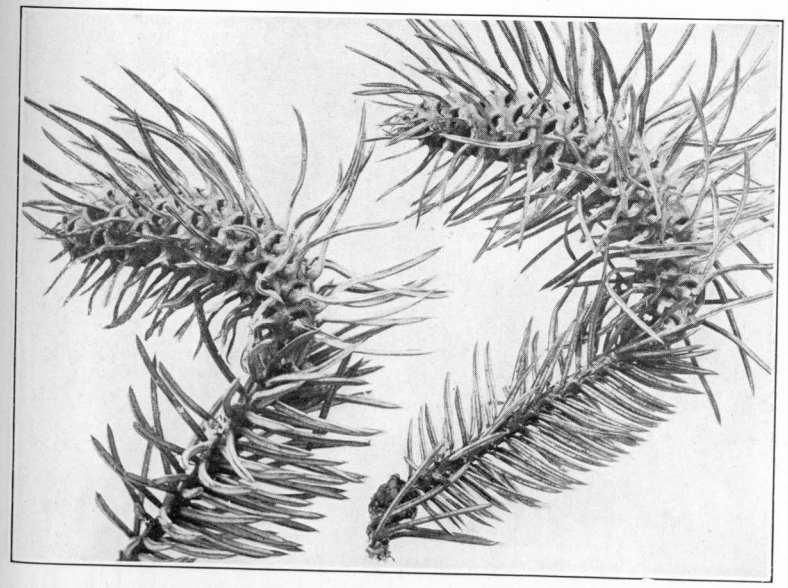


b. View on Hammonasset Marsh, Madison, showing ditch.

ANTI-MOSQUITO WORK.

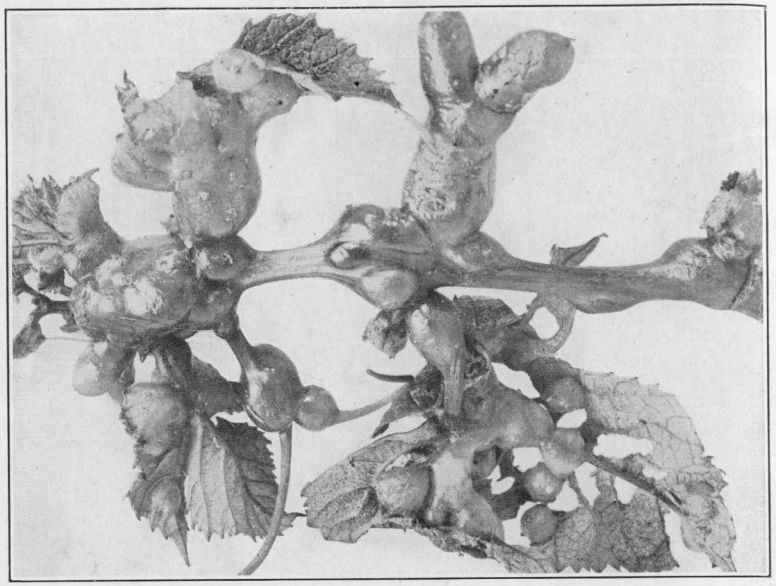


a. Galls of hickory gall aphid, natural size. Typical *Phylloxera caryæcaulis* at right, var. *spinosa* at left.

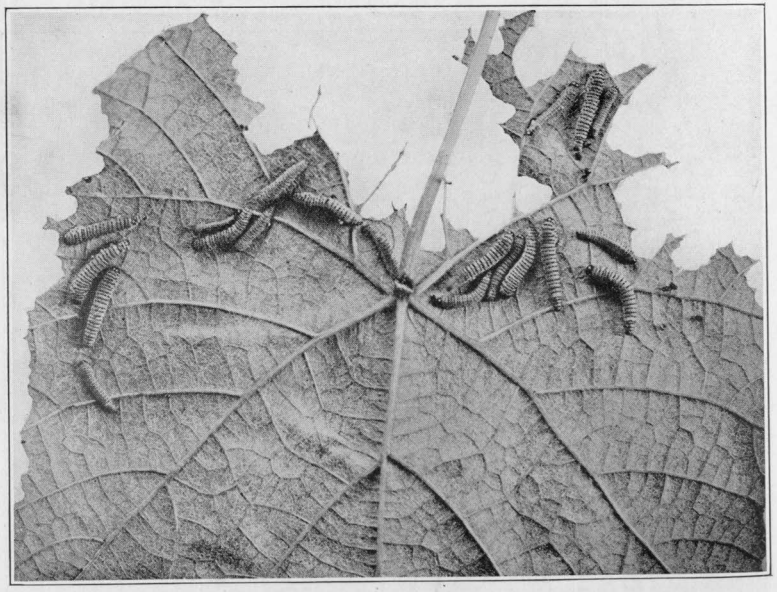


b. Galls of aphid, *Chermes cooleyi* Gillette, natural size.

HICKORY AND SPRUCE GALLS



a. Grape-vine tomato gall, *Lasioptera vitis* O. S. Natural size.



b. Larvae of the grape-vine sawfly, *Erythraspides pygmæus* Say. Natural size.

GRAPE GALLS AND GRAPE SAWFLY.

PART III.

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 the 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.

No registration of feeds or payment of analysis 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 1916.

In compliance with the above requirements the following report has been prepared. During the fall of 1916 the station sampling agent visited 54 towns and villages of this state and collected 203 sample of feeds. The results of the examination of these sam-

* The chemical analyses here reported were made by E. M. Bailey, C. B. Morison and C. H. Shepard.

ples are here discussed and the chemical analyses are given in Table V.

The analyses of 56 samples sent by individuals are also separately reported. The analyses of 676 samples of ensilage corn, soy bean fodder, and corn grain grown in connection with experimental work will be reported in another place.

The official samples may be grouped as follows:

19	Cotton seed meal
7	Linseed meal, old process
15	Wheat bran
16	Wheat mixed feed
10	Wheat middlings
1	Red dog flour
2	Rye feed
3	Rye middlings
2	Buckwheat middlings
1	Corn gluten meal
8	Corn gluten feed
17	Hominy feed
3	Dried brewers' grains
1	Malt sprouts
7	Dried distillers' grains
4	Dried beet pulp
1	Wheat bran and corn cob feed
2	Corn and oat feeds
64	Horse, dairy and stock feeds
20	Poultry feeds
203	Total

Comments on Analyses.

The only brand offered for sale without the guaranties required by law was **8557**, *Hardy's Hominy Feed*; this, however, was of average quality.

Of the 203 official samples 33 did not meet their guaranties in some particular; 9 in protein, 19 in fat and 5 in both protein and fat. Sixteen per cent of the brands showed deficiencies this year as compared with 20 per cent in 1915 and 10 per cent in 1914.

Table I shows the individual brands which failed to satisfy their guaranties.

Table I.—Feeds Below Guaranty.*

		Deficiency in Protein. %	Deficiency in Fat. %
8445	Bull Brand Cotton Seed Meal	3.37	....
8597	Danish Brand Cotton Seed Meal	1.00	....
8577	National Feed Co.'s Cotton Seed Meal	3.50	....
8617	Puritan Cotton Seed Meal	4.25	....
8529	American Red Tag Cotton Seed Meal	....	1.42
8544	American Red Tag Cotton Seed Meal	1.70	1.51
8556	American Red Tag Cotton Seed Meal	1.30	....
8574	Number 7 Cotton Seed Meal	1.25	....

		Deficiency in Protein. %	Deficiency in Fat. %
8581	Moon's Mixed Feed	....	1.22
8488	Winona Wheat Middlings	....	0.50
8607	Quinebaug Buckwheat Middlings	8.81	1.91
8485	Bufceco Hominy Feed	....	0.42
8531	Plymouth Hominy Feed	....	2.10
8628	American Malt. Co.'s Malt Sprouts	....	0.86
8565	Korn-Oato Feed	....	0.94
8589	Pennant Stock Feed	....	1.10
8564	Blatchford's Pig Meal	....	0.51
8468	Bufceco Horse Feed	....	0.35
8502	Iroquois Dairy Feed	....	0.92
8493	Anchor Dairy Feed	4.44	0.99
8480	Bonnie Horse Feed	1.44	0.46
8455	Badger Stock Feed	1.31	....
8442	Peerless Horse Feed	....	0.52
8499	Park and Pollard's Calf Meal	....	0.97
8452	Tom Boy Horse Feed	....	0.62
8467	Mogol Molasses Feed	1.25	....
8592	Ryde's Cream Calf Meal	....	0.36
8464	Biles Ready Dairy Ration	....	0.67
8500	Iroquois Poultry Mash	....	0.40
8608	Wirthmore Growing Feed	1.00	0.88
8461	Wirthmore Poultry Mash	....	1.14
8491	Blue Ribbon Laying Mash	1.12	....
8466	Vincent Bros. XXXX Mash	....	0.32

* Deficiencies of less than 1.00 per cent protein and 0.25 per cent fat are ignored in this tabulation.

Cotton seed meal averaged over 1.5 per cent less protein than in 1915 with the price $8 per ton higher. Compared with 1914 we find a decrease of 2.5 per cent protein with the price $14 higher. The quality of this feed in our markets is growing poorer year by year, due chiefly to a greater admixture of hulls. The average crude fiber, an index of the amount of hulls present, found in this product since 1910 has been as follows:

1910	8.28	1914	9.73
1911	8.56	1915	10.69
1912	8.23	1916	12.42
1913	9.97		

In fact, five of the samples examined this year, and sold as Cotton Seed Meal, are in reality Cotton Seed Feed, mixtures of cotton seed meal and cotton seed hulls with less than 36 per

cent of protein. Two samples of the *Danish* brand, one of the *National Feed Co.'s,* one of the *Puritan* brand and the *Union Seed and Fertilizer Co.'s Number 7* fall into this classification.

Seven of the 19 samples were below guaranty in protein and two in fat, the protein shortage ranging from 1.00 to 4.25 per cent. The samples deficient in protein were as follows:

8445	Bull Brand	3.37
8597	Danish Brand	1.00
8577	National Feed Co.	3.50
8617	Puritan Brand	4.25
8544	American Red Tag Brand	1.70
8556	American Red Tag Brand	1.30
8557	Union Seed and Fert. Co.'s Number 7	1.25

We have frequently called attention in the past to the discrepancies in the prices of feeds. This is well illustrated this year by these meals. The brand containing the highest protein, 44.25 per cent, sold for $46 per ton, while that containing the least protein, 31.75, sold for $47 per ton, or $1 per ton higher.

Linseed Meal, Old Process. The seven samples satisfied their guaranties. The protein in these averaged over one per cent less than last year with the price $4.50 higher. Compared with 1914 we find that feed of about the same quality this year sold on the average for $10.50 higher.

Wheat Products. Aside from *Moon's Mixed Feed* and *Winona Wheat Middlings,* which showed respective deficiencies in fat of 1.22 and 0.50 per cent, these samples require no special comment.

Rye Products. The five samples satisfied their guaranties.

Buckwheat Middlings. The two products sold under this name differed greatly in composition. The one contained 25.00 per cent protein and 3.66 per cent fiber, the other 20.94 and 21.74 per cent, respectively.

Corn Gluten Meal. The single sample satisfied its guaranty. However, it contained 4.32 per cent less protein than last year and cost $12.80 more per ton.

Corn Gluten Feed. The eight samples ranged in protein from 22.44 to 28.94 per cent, the selling price of the lower-grade product being one dollar higher than that of the high-grade. Like most of the feeds gluten feed shows a much higher

selling price than in previous years. In 1914 the average ton price was $33.54, in 1915 $30.17, while this year it was $41.63.

Hominy Feed. Two of the 17 samples failed to satisfy their guaranties, the *Bufceco* and *Plymouth* brands being deficient in fat by 0.42 and 2.10 per cent, respectively. On the average the samples showed about the same protein as last year with over one per cent less fat, while the selling price was $13 higher per ton.

Dried Brewers' Grains. The three samples examined satisfied their guaranties and were high-grade products. They contained 2.50 per cent less protein than last year with the price $1.20 per ton higher. High prices do not appear to have attacked this feed, and it continues to be the cheapest protein feed on the market.

Malt Sprouts. The single sample was deficient in fat. A price of $37 per ton is high for this feed with dried brewers' grains selling at $31.

Dried Distillers' Grains. The seven samples satisfied their guaranties. They showed a wide range in composition, as usual, protein from 13.25 to 32.38 per cent and fat from 5.98 to 13.26 per cent. While the higher grades of this feed are relatively cheap they are more expensive feeds as a rule than dried brewers' grains. A rye distillers' grains with 13.25 per cent protein at $30 does not appear to be an economical purchase with dried brewers' grains containing 27.36 per cent protein selling at $31.

Dried Beet Pulp. The five samples satisfied their guaranties. The cost was $6.50 per ton higher than in 1915.

Wheat Bran and Corn Cob Meal. This sample contained 6.14 per cent less protein, 1.90 per cent less fat and 6.70 per cent more fiber than average wheat bran, and the price was 87 cents per ton higher. No feeder is warranted in paying such a price for a feed of this character.

Corn and Oat Feeds. One of the two samples failed to meet its fat guaranty by 0.94 per cent. The composition of this sample shows the use of excessive oat hulls.

Proprietary Horse, Dairy and Stock Feeds. Of the 64 samples of this class of feeds, 18 failed to meet their guaranties; 2 were deficient in protein, 14 in fat and 2 in both protein and fat. *Anchor Dairy Feed, Bonnie Horse Feed, Badger Stock*

and *Mogol Molasses Feed* showed protein deficiencies of 4.44, 1.44, 1.31 and 1.25 per cent, respectively.

Again we call attention to the fact that the official method for determining ether extract (fat) does not always give correct results in feeds of this class when molasses is present. As we are obliged by law to use the official method, the results in Table V were obtained by that method. 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.—FAT IN MOLASSES FEEDS.

	Official Method.	Modified Method.
Arcady Dairy Feed	3.45	3.12
Iroquois Dairy Feed	3.08	2.67
Clover Leaf Dairy Feed	4.28	4.08
Corno Sweet Feed	1.75	2.34
Hobby Horse Feed	1.17	1.76
Anchor Dairy Feed	1.68	2.51
Anchor Horse Feed	4.00	3.47
Hamlin's Horse, Mule and Dairy Feed	3.17	3.40
Algrane Horse Feed	4.00	3.37
New England Stock Feed	4.73	3.97
Badger Horse Feed	2.39	2.19
Badger Stock Feed	4.45	3.90
Badger Stock Feed	4.97	4.38
Blue Top Horse Feed	1.64	1.77
Cream City Horse Feed	1.84	1.97
Cream-O-Lene Dairy Ration	5.35	4.89
Domino Horse Feed	2.75	2.23
Domino Justice Creamery Feed	5.73	4.82
Fidelity Stock Feed	3.93	3.24
Peerless Horse Feed	1.08	1.48
Park and Pollard's Horse Feed	1.21	1.80
Peters King Corn	1.23	1.34
Tom Boy Horse Feed	0.74	1.38
Green Cross Horse Feed	2.30	2.28
Mogol Molasses Feed	2.34	2.09
Purina Feed with Molasses	2.24	2.16
Purina Feed with Molasses	2.20	2.15
Colonel's Ration	3.14	2.79
Ti-O-Ga Dairy Feed	7.35	6.89
Ti-O-Ga Dairy Feed	7.13	6.54
Xtra Vim Feed	0.45	0.76

The differences between the two methods are not as striking this year as usual, only 11 of the 31 samples showing higher results by the modified method, ranging from 0.11 to 0.85 per cent. The higher results secured by the official method are doubtless due to contamination of the ether extract with substances soluble in ether but not of a fatty nature. Apparently these substances are soluble in water as well as ether and do not appear in the results secured by the modified method. It is believed that the latter more truly represent the actual fat content of the feeds.

Many of these proprietary feeds are sold at excessive prices when their composition is considered, and furthermore there is little relation between cost and feeding value. We find brands containing from 9.25 to 24.69 per cent protein selling for $36 per ton, brands with 7.50 to 25.25 protein at $38, brands with 4.38 to 13.81 protein at $40, and brands with 9.38 to 27.31 protein at $42; one brand containing 11.88 protein sold at $45 and another containing 9.25 per cent at $48 per ton.

There is no mystery as to the components of these feeds (see below). The higher-grade feeds contain excellent feeding stuffs, but those of low-grade, against which our criticism is chiefly directed, are usually made up of very ordinary material indeed. But even with the high-grade mixtures of this class it is believed that the feeder could purchase staple feeds and mix his own rations for considerably less than he must pay for these ready mixed rations.

Proprietary Poultry Feeds. Of the 20 samples 2 were deficient in protein and 3 in fat. *Wirthmore Growing Feed* was 1.00 per cent deficient in protein, and 0.88 per cent in fat, *Wirthmore Poultry Mash* 1.14 per cent in fat and *Blue Ribbon Laying Mash* 1.12 per cent in protein.

CERTIFIED COMPOSITION OF PROPRIETARY FEEDS.

This state requires no statement of the components of the feeds sold in our markets. Many of them, however, bear such information on the tags, and the following is a summary of these statements:

Portage Stock Feed. Either white or yellow shelled corn, barley, oat shorts, oat hulls, oat middlings and ½ per cent of salt.

Arcady Dairy Feed. Malt sprouts, dried brewers' grains, cotton seed meal, molasses, clipped oat by-products, ground grain screenings and salt.

Pennant Stock Feed. White hominy and oat by-products.

Blatchford's Calf Meal. Locust bean meal, unpressed flax seed, wheat flour, barley meal, ground beans and peas, rice polish, old process oil meal, cocoa shell meal, cocoanut meal, recleaned cotton seed meal, fenugreek, dried milk, anise and salt.

Blatchford's Pig Meal. Oil meal, oat meal, wheat flour, barley meal, cotton seed meal, cocoa shell meal, bean meal, crushed flax seed, fenugreek and salt.

Bufceco Chop Feed. Ground corn, oats and barley, hominy feed, oat shorts and oat hulls.

Bufceco Creamery Feed. Ground corn, wheat bran and middlings, hominy feed, corn gluten feed, cotton seed meal, oat by-products and ½ per cent of salt.

Bufceco Horse Feed. Ground oats, corn and barley, wheat middlings, hominy feed, oat shorts, oat middlings, oat hulls, linseed meal and corn gluten feed.

Iroquois Dairy Feed. Ground corn, corn gluten feed, cotton seed meal, ground grain screenings, molasses and ½ per cent of salt.

Unicorn Dairy Ration. Corn distillers' grains, cotton seed meal, linseed meal, hominy meal, malt sprouts, gluten feed, corn starch by-products with corn bran, barley feed, brewers' grains and wheat bran.

Clover Leaf Dairy Feed. Cotton seed meal, corn gluten feed, mixed broken grains (wheat, corn, barley, flax, speltz), ground grain screenings, cocoa shells, clipped oat by-products, molasses and ½ per cent of salt.

Corno Stock Feed. Oat feed and hominy feed.

Corno Sweet Feed. Whole oats, ground alfalfa, cracked corn, cotton seed meal and molasses.

Wirthmore Stock Feed. Ground barley, ground oats, ground hominy, ground corn, oat meal mill by-products and ½ per cent of salt.

Crosby's Quality Feed Ready Ration. Distillers' grains, cotton seed meal, oil meal, malt sprouts, wheat bran, wheat middlings, hominy feed and ½ per cent of salt.

Hobby Horse Feed. Corn, oats, barley, alfalfa meal and molasses.

White Cross Stock Feed. Ground oats, ground barley, corn feed meal, wheat meal, ground corn bran, cotton seed meal and ¼ per cent of salt.

Anchor Dairy Feed. Cotton seed meal, corn gluten feed, oil meal, malt sprouts, dried brewers' grains, corn meal, corn bran, ground grain screenings, clipped oat by-products, wheat middlings, molasses and ¾ per cent of salt.

Anchor Horse Feed. Crushed and ground oats, ground and cracked corn, corn bran, wheat bran, crushed barley and molasses.

Globe No. 1 Chop Feed. Ground corn, kaffir and oats, oat hulls, flour middlings and ½ per cent of salt.

Grandin's Stock Feed. Hominy feed, oat meal mill by-products and salt.

Hamlin's Horse, Mule and Dairy Feed. Crushed flaxseed meal, old process oil meal, alfalfa meal, dried brewers' grains, dried distillers' grains, cane syrup and ½ per cent of salt.

Haskell's Stock Feed. Ground corn, ground oats, hominy feed, oat hulls, oat shorts and salt.

Algrane Horse Feed. Oat hulls, crushed oats, wheat middlings, molasses, oat shorts, hominy feed, ground grain screenings, ground corn, corn gluten feed and ½ per cent of salt.

New England Stock Feed. Ground corn, ground oats, ground grain screenings, hominy feed, oat hulls, wheat middlings, oat shorts, molasses and ½ per cent of salt.

Badger Horse Feed. Corn, oats, alfalfa, molasses and salt.

Badger Stock Feed. Hominy feed, maizo corn oil meal, maizo red dog flour, oat meal mill by-products and salt.

Blue Top Horse Feed. Corn, oats, alfalfa meal, salt and molasses.

Cream City Horse Feed. Alfalfa meal, molasses, corn, oats and salt.

Larro Feed. Cotton seed meal, corn gluten feed, dried distillers' grains, dried beet pulp, wheat bran and middlings and ¾ per cent of salt.

Palmo Meal. Peanut meats and hulls and palm oil.

M. and S. Stock Feed. Ground oat hulls and white hominy feed.

Cream-O-Lene Dairy Ration. Cotton seed meal, corn gluten feed, oil meal, wheat middlings, corn distillers' grains, corn feed meal, clipped oat by-products, malt sprouts, brewers' grains, ground wheat screenings, molasses and ¾ per cent of salt.

Domino Justice Creamery Feed. Cotton seed meal, corn gluten feed, oil meal, wheat middlings, corn distillers' grains, corn feed meal, clipped oat by-products, malt sprouts, dried brewers' grains, ground wheat screenings and ¾ per cent of salt.

Peerless Horse Feed. Corn, oats, alfalfa meal and molasses.

Stevens 44 Dairy Ration. Linseed meal, cotton seed meal, wheat bran, corn gluten feed, cocoanut oil meal, pea meal, distillers' grains, dried brewers' grains, ground barley, wheat middlings, hominy meal, buckwheat middlings, corn meal and salt.

Park and Pollard's Calf Meal. Flax seed, beans, lentils, wheat flour, cotton seed meal, locust beans, cocoa meal, anise, fenugreek and a trace of salt.

Park and Pollard's Horse Feed. Alfalfa, corn, oats, molasses and salt.

Park and Pollard's Stock Feed. Corn meal, hominy feed and oat feed.

Peters King Corn. Corn, oats, alfalfa and molasses.

Iowa Stock Feed. Wheat middlings, corn meal, hominy feed, dried brewers' grains, oat meal mill by-products, and 1 per cent of table salt.

Tom Boy Horse Feed. Cracked corn, whole oats, alfalfa meal, oat meal mill by-products, cotton seed meal and molasses.

Boss Feed. Ground corn, hominy feed, oat meal by-products and ½ per cent of salt.

Green Cross Horse Feed with Molasses. Alfalfa meal, ground corn, crushed oats, cotton seed meal, oat meal mill by-products and molasses.

Mogol Mixed Molasses Feed. Corn, oats, alfalfa meal, cotton seed meal, oat middlings, oat hulls and molasses.

Schumacher's Calf Meal. Ground corn, hominy feed, ground barley, wheat flour, wheat middlings, cotton seed meal, oat meal mill by-products, ground puffed rice and wheat, and ½ per cent of salt.

Schumacher's Special Horse Feed. Ground corn, crushed oats, oat meal mill by-products and ½ per cent of salt.

Victor Feed. Ground corn, hominy feed, oat meal mill by-products and ½ per cent of salt.

Purina Feed with Molasses. Corn, oats, alfalfa, molasses and 1 per cent of salt.

Ryde's Cream Calf Meal. Carob bean, flaxseed, wheat flour, cotton seed meal, beans, lentils, fenugreek, anise, cocoa meal and salt.

Yellow Tag Stock Feed. Ground barley, ground hominy, ground corn, oat meal mill by-products and ½ per cent of salt.

Colonel's Ration. Alfalfa meal, cane molasses, wheat middlings, corn feed meal, dried brewers' grains, wheat bran, oil meal, hominy feed and salt.

Biles Ready Ration (Union Grains). Distillers' grains, cotton seed meal, old processes oil meal, wheat middlings and bran, hominy meal, dried brewers' grains, malt sprouts and ½ per cent of salt.

Xtra Vim Feed. Cane molasses and sphagnum moss.

Bufceco Poultry Mash. Ground corn, wheat bran and middlings, hominy feed, corn gluten feed, oat middlings and rolled oats.

Iroquois Poultry Mash. Ground corn, wheat bran, wheat middlings, corn gluten feed and alfalfa meal.

Wirthmore Poultry Mash. Ground oats and barley, gluten feed, alfalfa meal, wheat bran, ground corn, beef scrap, fish meal, wheat middlings and ¾ per cent of salt.

Globe Egg Mash. Alfalfa meal, bran, middlings, wheat meal, corn feed meal, ground corn bran, oil cake, meat scrap and ½ per cent of salt.

Queen Poultry Mash. Alfalfa meal, wheat bran, wheat feed meal, corn bran, corn feed meal, beef scrap, linseed cake and salt.

Blue Ribbon Laying Mash. Wheat bran and middlings, wheat flour, ground oats, corn meal, gluten feed, pea meal, alfalfa, linseed meal, fish scrap, meat meal and ground bone.

H. O. Dry Poultry Mash. Oat middlings, corn gluten feed, wheat middlings, rolled oats, alfalfa meal, ground corn, hominy feed, cracked wheat and wheat bran.

H. O. Poultry Feed. Ground corn, corn gluten feed, wheat middlings, oat middlings, wheat bran, hominy feed, rolled oats, ground peas, ground grain screenings and molasses.

M. and S. Dry Mash Feed. Bran, middlings, gluten, corn meal, beef scrap, alfalfa meal and hominy.

Domino Laying Mash. Linseed meal, ground oats, wheat flour, wheat bran and middlings, corn feed meal, corn gluten feed, alfalfa meal, ground bone and meat scrap.

Park and Pollard's Growing Feed. Ground corn, wheat, barley, oats, meat, bone, alfalfa, kaffir corn, wheat bran and middlings, buckwheat, beet pulp, calcium carbonate and salt.

Park and Pollard's Lay or Bust Dry Mash. Wheat bran and middlings, ground corn, wheat, oats, barley, kaffir corn, buckwheat, alfalfa, fish, meat, bone, beet pulp, calcium carbonate and salt.

Schumacher's Poultry Mash. Meat scraps, oat meal, wheat bran, alfalfa, corn feed meal, corn gluten feed, ground grain screenings.

Purina Chicken Chowder Feed. Wheat middlings, wheat bran, corn meal, salt, alfalfa meal, linseed meal, granulated meat.

Crude Fiber Guaranties.

While this state requires no guaranty of crude fiber in feeding stuffs, the general Food and Drug Law, which also applies to this class of material, requires that any statement made on the label must not be false or misleading. If, therefore, a manufacturer makes a claim as to the amount of fiber present this claim must be correct or the feeding stuff is misbranded under the law.

Of the 82 brands in which fiber was guaranteed, 25, or 30 per cent, exceeded the guaranty by more than one per cent. These brands were as follows:

Table III.—Fiber Guaranty Exceeded by More Than One Per Cent.

No.	*Brand.*	*Excess.*	*No.*	*Brand.*	*Excess.*
8445	Bull Cotton Seed Meal ..	3.49	8463	Portage Stock Feed	2.16
8568	Bull Cotton Seed Meal ..	2.12	8441	Bufceco Chop Feed	1.78
8465	Danish Cotton Seed Meal	1.60	8501	Bufceco Creamery Feed..	3.87
8597	Danish Cotton Seed Meal	1.28	8468	Bufceco Horse Feed	1.11
8550	Dixie Cotton Seed Meal..	2.75	8502	Iroquois Dairy Feed	2.29
8510	Forfat Cotton Seed Meal	5.88	8620	Corno Stock Feed	2.82
8583	Canary Cotton Seed Meal	3.87	8426	Crosby's Ready Ration ..	1.52
8529	American Red Tag Cotton Seed Meal	3.09	8493	Anchor Dairy Feed	1.37
			8442	Peerless Horse Feed	1.75
8544	American Red Tag Cotton Seed Meal	3.29	8585	Yellow Tag Stock Feed..	2.54
			8440	Bufceco Poultry Mash ..	1.20
8528	Continental Gluten Feed..	3.19	8484	H. D. Poultry Mash	2.13
8542	Eagle E D Distillers' Grains	3.75	8610	Dove Cotton Seed Meal..	1.21
			8613	Sunset Cotton Seed Meal	2.21

The Costs of the Feeds.

The selling prices of most classes of feeding stuffs have made great advances during recent years, and unfortunately in certain feeds, especially cotton seed meal, this increase in price has been accompanied by a decided falling off in quality. The following tabulation shows the average retail selling prices of certain standard feeds during the past five years compared with the average of the five years preceding. These prices in all cases represent the retail prices per ton quoted to our agent in the fall months of the respective years, and are therefore fairly comparable.

Table IV.—Retail Prices of Feeding Stuffs, 1907-1916.

Feed	1907–11	1912	1913	1914	1915	1916	Per cent Increase 1916 over 1907–11
Cotton Seed Meal	$33.40	$33.12	$35.45	$32.81	$38.83	$46.95	41
Linseed Meal, o. p.	38.02	39.00	36.80	37.06	43.17	47.86	26
Wheat Bran	28.73	27.85	.....	.....	26.92	34.13	19
Wheat Feed	30.38	30.23	.....	.....	29.95	37.72	24
Wheat Middlings	31.23	31.48	.....	.....	30.18	37.95	22
Gluten Meal	.....	.....	38.00	38.00	37.20	50.00	33
Gluten Feed	31.53	30.75	31.78	33.54	30.18	41.63	32
Hominy Feed	33.28	30.33	32.78	32.20	31.50	44.48	34
Dried Brewers' Grains ..	28.77	29.75	28.57	29.60	29.80	31.00	8
Malt Sprouts	25.74	28.00	26.00	27.00	.....	37.00	36
Dried Distillers' Grains, h. g.	32.12	34.67	34.75	35.60	35.47	39.60	23
Dried Distillers' Grains, l. g.	29.33	.....	25.00	.....	27.00	32.50	11
Dried Beet Pulp	28.00	29.00	29.60	29.71	28.30	34.75	23
Corn and Oats	33.86	32.50	35.00	35.67	31.33	49.00	45

The conditions shown by the above table are startling indeed. The fourteen feeds listed show increases in price, compared with the five years preceding 1912, of from 8 to 45 per cent, or an average increase of 27 per cent. In view of these inflated prices no feeder of farm animals can afford to buy his feeds in the usual haphazard manner. He must give the most careful consideration not only to the composition of the feed but to its price as well. Just as in the case of commercial fertilizers during the past two seasons no farmer was justified in buying potash salts at the ruling war prices, so to-day the prices of certain feeds exclude those feeds from use by feeders who wish to make a success of the dairying business.

The table clearly shows that in spite of its high feeding value and general desirability as an ingredient of the ration, dried brewers' grains has shown the effect of high prices less than any other of the standard feeds, its increase in price over 1907-11 being only 8 per cent, compared, for instance, with 41 per cent for cotton seed meal, 32 per cent for gluten feed, 34 per cent for hominy feed and 45 per cent for provender. Here certainly is an opportunity for the feeder to practice economy in his purchase of feeds, as many feeding experiments have shown that dried brewers' grains may well be substituted for at least a part of the grain in the dairy ration, and for a part of the oats in a ration for horses. Just so long as the feeder will pay $47 for cotton seed meal, $42 for gluten feed, $45 for hominy feed or $49 for corn and oats, when dried brewers' grains, containing 27 per cent protein, 7 per cent fat and 42 per cent carbohydrates, may be secured for $31, just so long will failure in the dairy business cease to be a mystery.

The absurdities in the prices of many of the proprietary stock feeds are even more striking and have been referred to on an earlier page.

Unofficial Samples.

Fifty-six samples sent by individuals have been analyzed. The station is responsible for the accuracy of the analysis, but not for the sampling, of these feeds:

Cotton Seed Meal. Fifteen samples were analyzed, the descriptions following:

American Red Tag, Union Seed and Fertilizer Co., Clarksdale, Miss.; **7350,** sent by S. J. Orr, West Suffield.

Bull Brand, Humphreys, Godwin Co., Memphis, Tenn.; **7214,** sent by Rockville Milling Co., Rockville.

Dixie Brand, Humphreys, Godwin Co., Memphis, Tenn.; **7486, 7487, 7351** and **7352,** sent by S. J. Orr, West Suffield; **7015,** sent by C. H. Fairty Co., New Canaan.

Unknown brands, Humphreys, Godwin Co., Memphis, Tenn.; **7671,** sent by R. E. Hyde, Ellington; **7218,** sent by Samuel Roodner, South Norwalk; **7193,** sent by The Coles Co., Middletown.

Dove Brand, F. W. Brode & Co., Memphis, Tenn.; **8710,** sent by Thomas Holt, Southington.

Good Luck Brand, S. P. Davis, Little Rock, Ark.; **7488,** sent by S. J. Orr, West Suffield.

Milko Brand, H. F. H. Eberts, Little Rock, Ark.; **8718,** sent by Meech and Stoddard, Middletown.

Cyclone Cattle Feed, **8701,** sold by Willimantic Grain Co., Willimantic, sent by Saul Wachtel, Chestnut Hill. Sold by dealer for cotton seed meal with guaranty of 36 per cent protein, but tags on bags guaranteed 20 per cent protein. The material is in reality cotton seed feed.

7240, sold by C. L. Montgomery & Son, Memphis, Tenn.; sent by The Coles Co., Middletown.

Four of the 15 samples were deficient in protein from 2.25 to 4.94 per cent, and another sample without guaranty, **7193,** was a low-grade product.

PROTEIN CONTENT OF COTTON SEED MEALS.

No.	Found.	Guaranteed.	No.	Found.	Guaranteed.	No.	Found.	Guaranteed.
7350	38.69	38.55	7352	40.81	38.62	8710	39.44	38.63
7214	38.75	41.00	7015	38.19	38.62	7488	40.69	41.00
7486	41.06	38.62	7671	42.13	38.62	8718	38.88	38.62
7487	42.25	38.62	7218	38.25	41.00	8701	31.06	36.00
7351	41.13	38.62	7193	36.69	.....	7240	36.13	38.50

Cocoanut Meal. **6997,** sent by W. J. Southey, Bridgeport, contained 26.50 per cent protein; another sample, **8234,** sent by C. M. Jarvis, Berlin, had the following composition:

Water	11.88	Fiber	7.76
Ash	6.23	Nitrogen-free extract	40.53
Protein (N x 6.25)	23.75	Fat	9.85

Wheat Bran. **7210** and **7211,** sent by W. J. Prann, Centerbrook, contained 13.94 and 14.19 per cent protein, respectively.

Salvage Wheat. **7221,** sent by C. M. Jarvis, Berlin; cost 90 cents per bushel. It had the following composition:

Water	9.34	Fiber	2.60
Ash	2.55	Nitrogen-free extract	67.81
Protein (N x 6.25)	15.94	Fat	1.76

Cracked Corn. **7756** (coarse) and **7755** (fine) contained 9.44 and 10.38 per cent protein, respectively.

Gluten Feed. **7839,** sent by E. M. Tomlinson, Oronoque, **8239,** sent by Carl Johnson, Bethany, and **8233,** sent by Abner Hendee Co., New Haven, contained 26.18, 24.56 and 25.59 per cent protein, respectively.

Hominy Feed. **7227** and **7228,** sent by R. F. Porter, Amston, contained 10.25 and 12.12 per cent protein, respectively.

Distillers' Grains. **7216,** *Hector's Distillers' Grains,* sent by G. C. White, Storrs, and guaranteed 46.5 protein and fat (on the bags 30 per cent protein and 10 per cent fat) contained 31.25 per cent protein and 12.83 per cent fat. This is a high-grade product. *3D Distillers' Grains,* **7257,** sent by J. G. French, Vernon, contained 26.50 per cent protein; it likewise is a high-grade grains.

Proprietary Stock Feeds. Holstein Feed, **8696,** sent by S. C. Ingersoll, Stamford, contained 11.06 per cent protein. **8254,** sent by C. A. Cowles, Plantsville, and claimed to be three-fifths hominy and two-fifths oat feed, contained 8.23 per cent water, 8.69 protein, 12.93 fiber and 5.40 fat.

Tioga Feed. **8717,** sent by F. E. Fowler, Guilford, had the following composition:

Water	6.83	Fiber	9.61
Ash	5.04	Nitrogen-free extract	51.78
Protein (N x 6.25)	19.81	Fat	6.93

Proprietary Poultry Feed. Chicken Chowder Feed, **7668,** sent by C. B. Raub, New London. The purchaser suspected the feed to have caused the death of a number of his chicks. A partial analysis showed 7.46 per cent ash containing 0.99 per cent common salt.

Alfalfa Meal. **7255** and **7256**, sent by Hartford Hay and Grain Co., Hartford, contained 15.31 and 17.00 per cent protein, respectively.

Meat Muscle. **7559** and **7559a** contained 76.13 and 80.00 per cent protein, respectively.

Meat Scrap, etc. **8708**, *Shay's Beef Scrap,* sent by C. C. Hewitt, Uncasville; **7232**, *Meat Scraps,* **7233**, *Bone and Meat Meal,* **7234**, *Cracked Bone,* **7235**, *Digester Tankage* and **7231**, *Ground Bone,* all sold by Springfield Rendering Co., Springfield, Mass., and sent by C. M. Jarvis, Berlin. These had the following composition:

	8708	7232	7233	7234	7235	7231
Protein (N x 6.25)	46.56	49.31	44.44	26.56	43.31	17.63
Phosphoric acid	12.93	12.15	15.19	24.54	15.47	25.26
Fat	.....	10.13	8.98	.....	7.85	.....

Beans. **8255** (marketable) and **8256** (culls) sent by C. M. Jarvis, Berlin, had the following composition:

	8255	8256
Water	10.74	10.85
Ash	3.32	3.84
Protein (N x 6.25)	24.00	24.50
Fiber	3.08	3.52
Nitrogen-free extract	57.39	55.77
Fat	1.47	1.52

Cracker Food. **7248**, sent by F. E. Rogers, New Haven, and suspected of having caused the death of a number of pigs and chickens. No poison was detected.

Bread Crumbs. **7220**, sent by F. M. Peasley, Cheshire, contained 11.00 per cent protein and 0.25 per cent fat.

Miscellaneous Feeds. **7272** and **8681**, sent by C. M. Jarvis, Berlin, had the following composition:

	7272	8681
Water	6.16	5.82
Ash	5.13	5.39
Protein (N x 6.25)	12.38	6.63
Fiber	15.93	23.53
Nitrogen-free extract	54.73	55.55
Fat	5.67	3.08

7031, sent by F. C. Bushnell, New Haven, contained 9.63 per cent protein: **6996**, sent by W. J. Southey, Bridgeport, contained 12.81 per cent protein; **7441**, sent by L. W. Robinson, Columbia, contained 12.47 per cent protein; **8734** and **8735**, sent by A. W. Close, Stamford, contained 18.13 and 18.44 per cent protein, respectively.

7238, sent by O. T. Adams, Seymour and **8411**, sent by M. J. Trowbridge, Bethel, were suspected of having caused the death of calves and chickens respectively. No poison, smut or mould was found in the samples.

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	OIL SEED PRODUCTS.	
	Cotton Seed Meal.	
8427	Prime. Ames-Burns Co., Jamestown, N. Y.	*East Haven:* F. A. Forbes
8610	Dove. F. W. Brode & Co., Memphis, Tenn.	*Danielson:* Young Bros. Co.
8624	Buckeye. Buckeye Cotton Oil Co., Cincinnati, O.	*Granby:* E. H. Rollins
8445	Bull. Humphreys, Godwin Co., Memphis, Tenn.	*No. Haven:* Coöperative Feed Co.
8568	Bull. Humphreys, Godwin Co., Memphis, Tenn.	*New Haven:* Crittenden-Benham Co.
8465	Danish. Humphreys, Godwin Co., Memphis, Tenn.	*Plantsville:* C. A. Cowles
8524	Danish. Humphreys, Godwin Co., Memphis, Tenn.	*Torrington:* F. L. Wadhams & Sons
8597	Danish. Humphreys, Godwin Co., Memphis, Tenn.	*Yantic:* A. R. Manning
8550	Dixie. Humphreys, Godwin Co., Memphis, Tenn.	*Thompsonville:* Geo. S. Phelps & Co.
8510	Forfat. Humphreys, Godwin Co., Memphis, Tenn.	*Plainville:* Eaton Bros.
8583	Canary. C. L. Montgomery & Co., Memphis, Tenn.	*New London:* I. N. Bragaw
8577	Prime. National Feed Co., St. Louis, Mo.	*Hartford:* Loydon, Northam & Loydon
8617	Puritan. J. E. Soper Co., Boston, Mass.	*Willimantic:* Willimantic Grain Co.
8613	Sunset. Texas Cake & Linter Co., Dallas, Tex.	*Putnam:* Bosworth Bros.
8529	American Red Tag. Union Seed & Fert. Co., Argenta, Ark.	*Winsted:* Leonard Grain Co.
8534	American Red Tag. Union Seed & Fert. Co., Grenada, Miss.	*Winsted:* E. Manchester & Sons
8544	American Red Tag. Union Seed & Fert. Co., Argenta, Ark.	*Rockville:* Edward White
8556	American Red Tag. Union Seed & Fert. Co., Memphis, Tenn.	*Middlefield:* Middlefield Grain & Coal Co.
8574	Number 7. Union Seed & Fert. Co., New York	*Hartford:* G. M. White & Co.
		Average guaranty
		Average of these 19 analyses
		Average digestible
	Linseed Meal, Old Process.	
8555	American Linseed Co., Buffalo, N. Y.	*Middlefield:* Middlefield Grain & Coal Co.
8536	Amco. American Milling Co., Peoria, Ill.	*Canaan:* Ives & Pierce
8436	Archer Daniels Linseed Co., Buffalo, N. Y.	*Hamden:* I. W. Beers
8449	Midland Linseed Products Co., Minneapolis, Minn.	*Wallingford:* E. E. Hall
8474	Spencer Kellogg & Sons, Buffalo, N. Y.	*New Canaan:* C. H. Fairty Co.
8527	Toledo Seed & Oil Co., Toledo, O.	*Torrington:* F. L. Wadhams & Sons
8511	Bonnie. Traders & Producers Supply Co., Buffalo, N. Y.	*Bristol:* Eaton Bros.
		Average guaranty
		Average of these 7 analyses
		Average digestible

SAMPLED IN 1916.

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8427	8.51	6.11	39.25	9.78	29.25	7.10	$48.00
8610	7.88	6.07	37.63	11.21	30.26	6.95	48.00
8624	7.91	5.58	44.25	11.89	24.43	5.94	46.00
8445	8.75	5.69	37.63	11.49	29.16	7.28	48.00
8568	7.60	6.42	41.13	10.12	27.91	6.82	50.00
8465	7.94	5.91	35.63	13.60	31.82	5.10	47.00
8524	8.10	5.43	36.75	12.85	29.63	7.24	45.00
8597	8.33	6.03	35.00	13.28	31.41	5.95	45.00
8550	7.60	5.97	40.13	10.75	28.31	7.24	48.00
8510	6.07	5.78	38.25	13.88	29.19	6.83	48.00
8583	8.71	5.98	37.44	11.87	28.87	7.13	49.00
8577	7.27	5.79	35.00	13.02	32.24	6.68	46.00
8617	7.22	5.29	31.75	15.26	33.79	6.69	47.00
8613	7.74	5.21	41.38	12.21	27.48	5.98	52.00
8529	7.80	5.10	38.25	14.59	28.68	5.58	42.00
8534	9.18	5.89	38.56	12.11	27.92	6.34	43.00
8544	7.87	5.11	36.88	14.79	29.86	5.49	45.00
8556	7.11	6.29	37.25	11.47	29.77	8.11	48.00
8574	8.20	5.94	34.75	11.73	31.53	7.85	47.00
....	....	....	**38.16**	....	....	**6.00**	....
....	**7.88**	**5.77**	**37.73**	**12.42**	**29.55**	**6.65**	**46.95**
....	....	....	**31.7**	**4.6**	**22.2**	**6.3**	....
8555	8.81	5.15	37.44	7.24	35.36	6.00	48.00
8536	9.10	5.76	30.19	9.48	38.31	7.16	48.00
8436	10.00	5.08	36.50	7.35	34.09	6.98	48.00
8449	9.60	4.81	34.25	7.10	35.73	8.51	48.00
8474	8.52	4.96	37.19	7.08	36.01	6.24	48.00
8527	9.43	6.10	29.31	8.88	40.59	5.69	48.00
8511	8.20	5.45	34.06	7.45	36.95	7.89	47.00
....	....	....	**32.29**	....	....	**5.29**	....
....	**9.09**	**5.33**	**34.13**	**7.80**	**36.72**	**6.92**	**47.86**
....	....	....	**30.4**	**4.4**	**28.6**	**6.2**	....

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	WHEAT PRODUCTS.	
	Wheat Bran.	
8554	Dudley. Chas. M. Cox Co., Boston, Mass.	*Suffield:* Spencer Bros.
8507	Monogram. Chas. M. Cox Co., Boston, Mass.	*West Cheshire:* G. W. Thorpe
8443	Monogram. Chas. M. Cox Co., Boston, Mass.	*No. Haven:* Coöperative Feed Co.
8478	Choice. Hecker-Jones-Jewell Mill. Co., Buffalo, N. Y.	*Stamford:* W. L. Crabb
8458	Anchor. Kemfer Mill & Elev. Co., Kansas City, Mo.	*Meriden:* A. Grulich
8612	Lucky. Federal Milling Co., Lockport, N. Y.	*Putnam:* Bosworth Bros.
8504	Maple Leaf. Maple Leaf Milling Co., Toronto, Can.	*West Cheshire:* G. W. Thorpe
8447	Choice. Niagara Falls Mill. Co., Niagara Falls, N. Y.	*Wallingford:* E. E. Hall
8432	Pillsbury Co., Minneapolis, Minn.	*Guilford:* Morse & Landon
8626	Quaker City. Quaker City Flour Mills Co., Philadelphia, Pa.	*New Haven:* R. G. Davis & Sons
8548	Bell Cow. Quaker Oats Co., Chicago, Ill.	*Somers:* W. C. Pease
8552	Pure. Southwestern Mill. Co., Kansas City, Mo.	*Thompsonville:* Geo. S. Phelps & Co.
8532	David Stott Flour Mills, Detroit, Mich.	*Winsted:* E. Manchester & Sons
8519	Angelus. Thompson Milling Co., Lockport, N. Y.	*Torrington:* D. L. Talcott
8598	George Urban Mill Co., Buffalo, N. Y.	*Yantic:* A. R. Manning
		Average guaranty
		Average of these 15 analyses
		Average digestible
	Wheat Feed (Mixed Feed).	
8603	Bailey Fancy. E. W. Bailey Co., Montpelier, Vt.	*Norwich:* Chas. Slosberg
8535	White Satin. Barber Mill. Co., Minneapolis, Minn.	*Canaan:* Ives & Pierce
8490	Winona. Bay State Milling Co., Winona, Minn.	*Danbury:* F. C. Benjamin
8517	Boston. Duluth Superior Mills, Duluth, Minn.	*Torrington:* D. L. Talcott
8495	Globe Dairy Feed. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* Geo. E. Ackley Co.
8525	Mainspring. Harter Milling Co., Toledo, O.	*Torrington:* F. L. Wadhams & Sons
8541	Hecker-Jones-Jewell Mill. Co., Buffalo, N. Y.	*New Hartford:* Wallace Case
8581	Geo. O. Moon & Co., Binghamton, N. Y.	*Hartford:* Loydon, Northam & Loydon
8486	Fancy. Pillsbury Co., Minneapolis, Minn.	*Danbury:* H. E. Meeker
8591	Buckeye. Quaker Oats Co., Chicago, Ill.	*Westerly, R. I.:* C. W. Campbell Co.
8437	Occident. Russell Miller Mill. Co., Minneapolis, Minn.	*Hamden:* I. W. Beers
8438	Gold Mine. Sheffield King Mill. Co., Minneapolis, Minn.	*Ansonia:* Ansonia Flour & Grain Co.
8558	Try-Me. Sparks Milling Co., Alton, Ill.	*Middletown:* Meech & Stoddard
8526	Honest. David Stott Flour Mills, Detroit, Mich.	*Torrington:* F. L. Wadhams & Sons

SAMPLED IN 1916—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8554	8.88	5.87	15.06	11.00	53.59	5.60	$36.00
8507	8.46	5.78	15.06	10.71	54.44	5.55	38.00
8443	9.33	6.21	15.13	10.88	52.97	5.48	34.00
8478	8.57	6.69	15.13	9.78	54.75	5.08	33.00
8458	8.94	7.02	17.44	9.64	52.87	4.09	35.00
8612	9.25	6.85	14.88	9.55	55.01	4.46	35.00
8504	9.05	4.48	15.31	8.81	57.31	5.04	36.00
8447	8.40	6.97	15.63	9.79	54.29	4.92	33.00
8432	9.69	5.89	14.50	10.61	54.37	4.94	34.00
8626	8.50	6.40	14.63	8.89	56.89	4.69	36.00
8548	9.09	4.88	16.50	8.56	55.32	5.65	34.00
8552	8.61	7.07	17.00	9.15	53.70	4.47	34.00
8532	8.15	5.83	15.13	9.82	56.30	4.77	34.00
8519	8.45	6.47	13.75	10.05	56.46	4.82	34.00
8598	8.30	5.73	15.63	8.95	55.84	5.55	36.00
....	....	....	**14.22**	....	....	**3.82**	....
....	**8.78**	**6.14**	**15.39**	**9.75**	**54.94**	**5.01**	**34.80**
....	....	....	**11.7**	**4.2**	**40.7**	**4.2**	....
8603	8.85	5.77	15.13	7.87	57.50	4.88	38.00
8535	9.61	4.55	16.25	7.51	57.10	4.98	40.00
8490	10.40	4.08	16.25	6.02	58.90	4.35	37.50
8517	9.13	4.79	15.13	8.51	56.79	5.65	37.00
8495	8.90	4.87	15.25	7.94	58.27	4.77	36.00
8525	9.50	4.86	15.94	8.33	55.97	5.40	38.00
8541	9.77	5.39	16.56	7.68	55.21	5.39	36.00
8581	8.90	5.14	15.50	7.96	57.72	4.78	37.00
8486	9.55	4.11	15.94	6.15	60.01	4.24	36.00
8591	9.16	4.94	16.13	7.49	56.98	5.30	37.00
8437	9.70	4.60	14.75	8.25	57.28	5.42	39.00
8438	9.74	5.14	15.75	8.07	56.25	5.05	38.00
8558	9.25	5.74	18.44	7.10	55.25	4.22	38.00
8526	9.63	4.96	14.88	7.90	57.60	5.03	38.00

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	WHEAT PRODUCTS—*Continued.*	
	Wheat Feed (Mixed Feed)—Continued.	
8496	Farmers Favorite. Valley City Mill. Co., Grand Rapids, Mich.	*Newtown:* Newtown Coal & Grain Co.
8619	Waggoner-Gates Mill. Co., Independence, Mo.	*Willimantic:* Willimantic Grain Co.
		Average guaranty
		Average of these 16 analyses
		Average digestible
	Wheat Middlings.	
8488	Winona. Bay State Milling Co., Winona, Minn.	*Danbury:* F. C. Benjamin
8433	Best of All. Great Northern Flour Mills Co., St. Cloud, Minn.	*Branford:* S. V. Osborn
8546	Flour. Madelia Roller Mills, Madelia, Minn.	*Rockville:* Edward White
8543	Choice. Niagara Falls Mill. Co., Niagara Falls, N. Y.	*Rockville:* Edward White
8513	Standard. Northwestern Cons. Mill. Co., Minneapolis, Minn.	*Bristol:* Eaton Bros.
8600	B. Pillsbury Co., Minneapolis, Minn.	*Colchester:* M. Klingon
8515	Thompson Milling Co., Lockport, N. Y.	*Bristol:* Goodsell Bros.
8609	Geo. Urban Milling Co., Buffalo, N. Y.	*Danielson:* Young Bros. Co.
8508	Standard. Washburn-Crosby Co., Minneapolis, Minn.	*Southington:* Southington Lumber & Feed Co.
8584	Western Canada Flour Mills Co.	*New London:* I. N. Bragaw
		Average guaranty
		Average of these 10 analyses
		Average digestible
	Red Dog Flour.	
8602	Choice. Rush City Mill. Co., Rush City, Minn.	*Colchester:* M. Klingon
		Guaranty
		Digestible
	RYE PRODUCTS.	
8518	Middlings. Bay State Milling Co., Winona, Minn.	*Torrington:* D. L. Talcott
8428	Feed. Boutwell Mill. & Grain Co., Troy, N. Y.	*East Haven:* F. A. Forbes
8448	Irving Mills Feed. Van Vechten Mill. Co., Rochester, N. Y.	*Wallingford:* E. E. Hall
8575	Choice Middlings. Miner-Hillard Mill. Co., Wilkes Barre, Pa.	*Hartford:* G. M. White & Co.
8616	Choice Middlings. Miner-Hillard Mill. Co., Wilkes Barre, Pa.	*Willimantic:* Willimantic Grain Co.
	BUCKWHEAT PRODUCTS.	
8615	Middlings. C. G. Lawton, Brooklyn	Miller
8607	Middlings. Quinebaug Grist Mill, Danielson	Miller
	MAIZE PRODUCTS.	
	Corn Gluten Meal.	
8593	Diamond. Corn Products Ref. Co., New York	*Westerly, R. I.:* C. W. Campbell Co.
		Guaranty
		Digestible

SAMPLED IN 1916—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8496	8.76	5.40	15.63	7.19	58.02	5.00	$40.00
8619	8.33	5.58	16.81	6.79	57.78	4.71	37.00
....	....	....	14.94	....	....	4.37	....
....	9.32	4.99	15.90	7.55	57.29	4.95	37.66
....	....	....	12.2	2.8	43.5	4.3	....
8488	9.48	3.82	16.50	6.34	59.36	4.50	35.50
8433	10.47	4.77	16.81	7.05	55.82	5.08	38.00
8546	10.25	4.13	16.94	5.60	57.94	5.14	37.00
8543	9.25	5.08	16.75	8.02	55.42	5.48	37.00
8513	9.18	4.71	15.63	8.37	55.76	6.35	40.00
8600	9.82	5.08	15.94	9.21	54.30	5.65	37.00
8515	9.14	4.50	13.75	6.72	60.99	4.90	44.00
8609	9.36	4.58	16.25	8.06	56.05	5.70	37.00
8508	10.03	4.58	17.00	6.88	56.50	5.01	36.00
8584	10.20	3.97	17.19	5.97	56.81	5.86	38.00
....	....	....	14.58	....	....	4.20	....
....	9.72	4.52	16.28	7.22	56.90	5.37	37.95
....	....	....	12.5	2.2	44.4	4.7	....
8602	12.18	2.27	14.56	2.09	65.60	3.30	45.00
....	....	....	15.00	....	....	3.50	....
....	....	....	12.8	0.8	57.7	2.8	....
8518	9.10	3.66	17.13	4.17	62.63	3.31	37.00
8428	10.86	3.80	15.13	4.47	62.49	3.25	34.00
8448	10.23	3.75	15.13	4.11	63.39	3.39	34.00
8575	10.44	3.42	15.88	3.58	63.64	3.04	38.00
8616	10.08	3.50	18.44	3.68	61.25	3.05	40.00
8615	11.70	4.23	25.00	3.66	49.39	6.02	40.00
8607	10.96	3.93	20.94	21.74	36.84	5.59	40.00
8593	9.35	0.65	40.06	1.08	47.21	1.65	50.00
....	....	....	40.00	....	....	1.50	....
....	....	....	34.1	5.94	42.5	1.5	....

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	MAIZE PRODUCTS—*Continued.*	
	Corn Gluten Feed.	
8435	Buffalo. Corn Products Ref. Co., New York ...	*Branford:* S. V. Osborn .....
8505	Buffalo. Corn Products Ref. Co., New York ...	*West Cheshire:* G. W. Thorpe
		Average guaranty .....
		Average of these 2 analyses ..
		Average digestible .....
8596	Clinton. Clinton Sugar Ref. Co., Clinton, Ia. ..	*Yantic:* A. R. Manning .....
		Guaranty .....
		Digestible .....
8430	*Crescent. Corn Products Ref. Co., New York	*Guilford:* Morse & Landon ..
		Guaranty .....
		Digestible .....
8439	Globe. Corn Products Ref. Co., New York	*Ansonia:* Flour & Grain Co...
8497	Globe. Corn Products Ref. Co., New York	*Derby:* Peterson & Hendee ..
		Average guaranty .....
		Average of these 2 analyses ..
		Average digestible .....
8571	K. K. K. J. C. Hubinger Bros. Co., Keokuk, Ia.	*New Haven:* Crittenden-Benham Co. .....
		Guaranty .....
		Digestible .....
8582	Union. Union Starch & Ref. Co., Edinburg, Ind	*New London:* I. N. Bragaw..
		Guaranty .....
		Digestible .....
	Hominy Feed.	
8621	Homco. American Hominy Co., Indianapolis Ind.	*So. Coventry:* E. W. Latimer
		Guaranty .....
8599	Cooked. Baltimore Pearl Hominy Co., Baltimore, Md.	*Colchester:* M. Klingon .....
		Guaranty .....
8549	Spring Garden. Baltimore Pearl Hominy Co. Baltimore, Md.	*Thompsonville:* Geo. S. Phelps & Co. .....
8446	Spring Garden. Baltimore Pearl Hominy Co. Baltimore, Md.	*No. Haven:* Coöperative Feed Co. .....
		Guaranty .....
8434	Bufceco. Buffalo Cereal Co., Buffalo, N. Y. ...	*Branford:* S. V. Osborn .....
8485	Bufceco. Buffalo Cereal Co., Buffalo, N. Y. ...	*Danbury:* H. E. Meeker .....
		Guaranty .....
8553	Paragon. Chas. M. Cox Co., Boston, Mass.	*Thompsonville:* Geo. S. Phelps & Co. .....
		Guaranty .....
8545	Emco. Evans Milling Co., Indianapolis, Ind. ...	*Rockville:* Edward White ...
		Guaranty .....
8557	*R. J. Hardy, Boston, Mass.	*Middlefield:* Grain & Coal Co.
8512	Badger. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Bristol:* Eaton Bros. .....
		Guaranty .....
8503	Steam Cooked. Miner-Hillard Mill. Co., Wilkes Barre, Pa.	*West Cheshire:* G. W. Thorpe
8588	Steam Cooked. Miner-Hillard Mill. Co., Wilkes Barre. Pa.	*Mystic:* Mystic Grain Co. ....

* Statement of dealer.

SAMPLED IN 1916—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8435	8.30	3.79	25.31	7.29	52.71	2.60	$40.00
8505	8.28	3.80	27.19	7.97	50.81	1.95	43.00
....	....	....	23.00	....	....	1.00	....
....	8.29	3.80	26.25	7.63	51.76	2.27	41.50
....	....	....	22.3	5.8	45.5	1.9	....
8596	8.15	1.88	26.31	7.11	52.50	4.05	43.00
....	....	....	23.00	....	....	3.00	....
....	....	....	22.4	5.4	46.2	3.4	....
8430	9.16	4.90	26.38	7.43	47.63	4.50	38.00
....	....	....	23.00	....	....	1.00	....
....	....	....	22.4	5.6	41.9	3.8	....
8439	7.13	3.53	27.38	6.89	53.69	1.38	42.00
8497	9.80	3.37	28.94	6.84	49.50	1.55	42.00
....	....	....	23.00	....	....	1.00	....
....	8.46	3.45	28.16	6.87	51.59	1.47	42.00
....	....	....	23.9	5.2	45.4	1.3	....
8571	9.81	1.28	22.44	6.30	57.07	3.10	43.00
....	....	....	23.00	....	....	2.40	....
....	....	....	19.1	4.8	50.2	2.6	....
8582	10.07	2.16	24.38	6.14	53.90	3.35	42.00
....	....	....	23.00	....	....	3.00	....
....	....	....	20.7	4.7	47.4	2.9	....
8621	8.10	2.35	10.94	4.84	66.77	7.00	46.00
....	....	....	10.00	....	....	6.00	....
8599	9.28	7.11	16.81	3.84	55.36	7.60	44.00
....	....	....	14.00	....	....	7.00	....
8549	10.14	2.85	11.25	5.08	64.42	6.26	46.00
8446	9.12	3.16	11.69	4.80	64.79	6.44	44.00
....	....	....	10.00	....	....	6.00	....
8434	11.16	2.70	11.25	4.79	64.27	5.83	42.00
8485	9.10	2.65	11.25	4.69	66.73	5.58	46.00
....	....	....	10.00	....	....	6.00	....
8553	8.35	2.72	11.38	5.24	64.28	8.03	46.00
....	....	....	9.50	....	....	7.50	....
8545	8.35	2.66	11.56	5.23	64.20	8.00	44.00
....	....	....	10.00	....	....	7.50	....
8557	8.25	2.67	11.25	5.40	66.16	6.27	46.00
8512	8.33	3.45	12.00	3.94	65.55	6.73	46.00
....	....	....	10.00	....	....	6.00	....
8503	9.09	2.42	10.75	4.53	67.73	5.48	46.00
8588	10.13	2.55	10.63	3.98	67.12	5.59	46.00

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	MAIZE PRODUCTS—*Continued.*	
	Hominy Feed—Continued.	
8606	Steam Cooked. Miner-Hillard Mill. Co., Wilkes Barre, Pa.	*Moosup:* T. E. Main & Sons
		Average guaranty
8578	Mystic Milling Co., Sioux City, Ia.	*Hartford:* Loydon, Northam & Loydon
		Guaranty
8531	Plymouth. Plymouth Milling Co., Lemars, Ia.	*Winsted:* E. Manchester & Sons
		Guaranty
8431	Blue Ribbon. J. E. Soper Co., Boston, Mass.	*Guilford:* Morse & Landon
		Guaranty
8476	Acme. Suffern-Hunt Mills, Decatur, Ill.	*Stamford:* W. L. Crabb
		Guaranty
		Average guaranty of all
		Average of these 17 analyses
		Average digestible
	BREWERY AND DISTILLERY PRODUCTS.	
	Dried Brewers' Grains.	
8479	M. F. Baringer, Philadelphia, Pa.	*Stamford:* W. L. Crabb
		Guaranty
8462	Bull. Farmers Feed Co., New York	*Plantsville:* C. A. Cowles
		Guaranty
8444	Crown. Milwaukee Grain & Feed Co., Milwaukee, Wis.	*No. Haven:* Coöperative Feed Co.
		Guaranty
		Average of these 3 analyses
		Average digestible
	Malt Sprouts.	
8628	Standard. American Malting Co., Buffalo, N. Y.	*New Haven:* R. G. Davis & Sons
		Guaranty
		Digestible
	Dried Distillers' Grains.	
8450	Ajax Flakes. Ajax Mill. & Feed Co., New York	*Wallingford:* E. E. Hall
		Guaranty
		Digestible
8528	Continental Gluten Feed. Continental Cereal Co., Peoria, Ill.	*Winsted:* Leonard Grain Co.
		Guaranty
		Digestible
8542	Eagle 3 D. The Dewey Bros. Co., Blanchester, O.	*Rockville:* Edward White
		Guaranty
		Digestible
8481	Dried Grains. The Fleischman Co., Peekskill, N. Y.	*So. Norwalk:* S. Roodner
		Guaranty
		Digestible
8604	Rye. Dwight E. Hamlin, Pittsburgh, Pa.	*Norwich:* Chas. Slosberg
		Guaranty
		Digestible
8521	Brownie. Larrowe Milling Co., Detroit, Mich.	*Torrington:* F. U. Wadhams
		Guaranty
		Digestible

SAMPLED IN 1916—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8606	9.50	2.36	11.06	4.31	67.59	5.18	$43.00
....	....	....	10.00	....	....	4.33	....
8578	9.91	2.52	11.38	4.03	64.48	7.68	48.00
....	....	....	11.00	....	....	6.50	....
8531	8.88	2.20	9.88	5.09	67.55	6.40	44.00
....	....	....	10.00	....	....	8.50	....
8431	9.21	2.22	10.63	4.89	66.52	6.53	43.00
....	....	....	10.00	....	....	6.00	....
8476	8.68	2.62	10.63	4.63	65.42	8.02	45.00
....	....	....	10.00	....	....	7.00	....
....	....	....	10.28	....	....	6.19	....
....	9.15	2.89	11.43	4.67	65.23	6.62	45.00
....	....	....	7.5	3.5	58.8	6.0	....
8479	6.72	3.18	27.38	12.19	43.74	6.79	31.00
....	....	....	25.00	....	....	6.00	....
8462	6.40	3.19	28.31	12.90	42.00	7.20	30.00
....	....	....	27.00	....	....	6.00	....
8444	7.95	3.18	26.38	14.26	41.11	7.12	32.00
....	....	....	26.00	....	....	6.00	....
....	7.02	3.18	27.36	13.12	42.28	7.04	31.00
....	....	....	22.2	6.4	24.1	6.3	....
8628	9.38	5.22	26.25	11.64	46.21	1.30	37.00
....	....	....	23.80	....	....	2.16	....
....	....	....	20.2	1.0	37.0	1.1	....
8450	5.53	2.81	29.38	11.29	39.69	11.30	41.00
....	....	....	30.00	....	....	10.00	....
....	....	....	21.4	10.7	32.1	10.7	....
8528	6.41	3.10	28.88	10.19	41.54	9.88	42.00
....	....	....	29.00	....	....	10.00	....
....	....	....	21.1	9.7	33.6	9.4	....
8542	6.49	1.53	32.38	11.75	34.59	13.26	37.00
....	....	....	30.00	....	....	10.00	....
....	....	....	23.6	11.2	28.0	12.6	....
8481	6.15	2.26	21.31	15.45	47.14	7.69	35.00
....	....	....	20.00	....	....	7.00	....
....	....	....	15.6	14.7	38.2	7.3	....
8604	7.93	2.14	13.25	15.28	55.42	5.98	30.00
....	....	....	14.00	....	....	6.00	....
....	....	....	9.7	14.5	44.9	5.7	....
8521	7.30	4.38	28.38	7.23	40.24	12.47	43.00
....	....	....	26.00	....	....	7.00	....
....	....	....	20.7	6.9	32.6	11.9	....

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	BREWERY AND DISTILLERY PRODUCTS—*Continued.*	
	Dried Distillers' Grains—Continued.	
8472	Fourex. Ubiko Milling Co., Cincinnati, O.	*Norwalk:* Holmes, Keeler & Kent Co. .....
		Guaranty .....
		Digestible .....
	MISCELLANEOUS FEEDS.	
	Dried Beet Pulp.	
8522	*Michigan Sugar Co., Alma, Mich.	*Torrington:* F. U. Wadhams
8567	*Michigan Sugar Co., Caro, Mich.	*New Britain:* C. W. Lines Co.
8625	Charles Pope, Chicago, Ill.	*New Haven:* R. G. Davis & Sons .....
8530	*West Bay City Sugar Co., Bay City, Mich.	*Winsted:* E. Manchester & Sons .....
		Guaranty .....
		Average of these 4 analyses ..
		Average digestible .....
	PROPRIETARY MIXED FEEDS.	
	Wheat Bran and Corn Cob Feed.	
8563	Sterling Feed. Indiana Mill. Co., Terre Haute, Ind.	*Middletown:* Meech & Stoddard .....
		Guaranty .....
		Digestible .....
	Corn and Oats.	
8586	Nobotheration Provender. C. W. Campbell Co., Westerly, R. I.	*Mystic:* J. L. Manning & Co.
		Guaranty .....
8565	Korn-Oato Feed. Meech & Stoddard, Middletown	Manufacturer .....
		Guaranty .....
	Horse, Dairy and Stock Feeds.	
8463	Portage Stock Feed. Akron Feed & Mill. Co., Akron, O.	*Plantsville:* C. A. Cowles ....
		Guaranty .....
8456	Arcady Dairy Feed. Arcady Farms Mill. Co., Rondout, Ill.	*Meriden:* A. Grulich .....
		Guaranty .....
8589	Pennant Stock Feed. E. W. Bailey & Co., Swanton, Vt.	*Mystic:* Mystic Grain Co. ...
		Guaranty .....
8560	Blatchford's Calf Meal. Blatchford's Calf Meal Factory, Waukegan, Ill.	*Middletown:* Meech & Stoddard .....
		Guaranty .....
8564	Blatchford's Pig Meal. Blatchford's Calf Meal Factory, Waukegan, Ill.	*Middletown:* Meech & Stoddard .....
		Guaranty .....
8441	Bufceco Chop Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Shelton:* Ansonia Flour & Grain Co. .....
		Guaranty .....
8501	Bufceco Creamery Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer..
		Guaranty .....
8468	Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Norwalk:* Brower & Malone..
		Guaranty .....
8502	Iroquois Dairy Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer..
		Guaranty .....

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

SAMPLED IN 1916—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8472	7.01	1.99	30.25	10.44	38.54	11.77	$35.00
....	....	....	**31.00**	....	....	**12.00**	....
....	....	....	**22.1**	**9.9**	**31.2**	**11.2**	....
8522	6.97	3.52	9.00	18.95	60.88	0.68	35.00
8567	5.80	3.10	9.94	19.14	61.45	0.57	34.00
8625	6.17	5.66	9.50	20.71	57.17	0.79	37.00
8530	5.93	3.97	9.38	19.32	61.00	0.40	33.00
....	....	....	**8.00**	....	....	**0.50**	....
....	**6.22**	**4.06**	**9.46**	**19.53**	**60.12**	**0.61**	**34.75**
....	....	....	**4.9**	**16.2**	**49.9**	....	....
8563	7.55	3.78	9.25	16.45	59.86	3.11	35.00
....	....	....	**10.00**	....	....	**3.00**	....
....	....	....	**5.8**	**4.6**	**42.5**	**2.9**	....
8586	10.38	2.06	10.00	4.07	69.49	4.00	49.00
....	....	....	**8.00**	....	....	**3.00**	....
8565	7.93	5.44	7.44	12.55	64.58	2.06	38.00
....	....	....	**7.00**	....	....	**3.00**	....
8463	7.44	5.51	8.44	12.16	61.45	5.00	37.00
....	....	....	**10.00**	....	....	**4.00**	....
8456	11.44	9.20	15.50	13.65	46.76	3.45	37.00
....	....	....	**16.00**	....	....	**3.50**	....
8589	8.29	2.98	9.38	9.32	64.63	5.40	42.00
....	....	....	**10.00**	....	....	**6.50**	....
8560	9.85	5.79	25.00	7.17	45.33	6.86	70.00
....	....	....	**24.00**	....	....	**5.00**	....
8564	9.13	4.95	18.56	6.77	56.10	4.49	65.00
....	....	....	**18.00**	....	....	**5.00**	....
8441	8.35	3.64	8.75	11.78	62.48	5.00	38.00
....	....	....	**8.00**	....	....	**4.00**	....
8501	7.90	5.24	19.69	11.87	50.63	4.67	43.00
....	....	....	**18.00**	....	....	**4.00**	....
8468	8.84	3.46	11.06	9.11	63.88	3.65	40.00
....	....	....	**11.00**	....	....	**4.00**	....
8502	9.56	8.67	18.44	11.29	48.96	3.08	38.00
....	....	....	**17.00**	....	....	**4.00**	....

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
8594	Nobotheration Dairy Feed. C. W. Campbell Co., Westerly, R. I.	Manufacturer Guaranty
8489	Unicorn Dairy Ration. Chapin & Co., Hammond, Ind.	*Danbury:* F. C. Benjamin Guaranty
8547	Clover Leaf Dairy Feed. Clover Leaf Mill. Co., Buffalo, N. Y.	*Somers:* W. C. Pease Guaranty
8620	Corno Stock Feed. Corno Mills Co., St. Louis, Mo.	*Willimantic:* Willimantic Grain Co. Guaranty
8618	Corno Sweet Feed. Corno Mills Co., St. Louis, Mo.	*Willimantic:* Willimantic Grain Co. Guaranty
8551	Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass.	*Thompsonville:* Geo. S. Phelps & Co. Guaranty
8426	Crosby's Quality Feed Ready Ration. E. Crosby & Co., Brattleboro, Vt.	*East Haven:* F. A. Forbes Guaranty
8580	Hobby Horse Feed. Albert Dickinson Co., Chicago, Ill.	*Hartford:* Loydon, Northam & Loydon Guaranty
8579	White Cross Stock Feed. Albert Dickinson Co., Chicago, Ill.	*Hartford:* Loydon, Northam & Loydon Guaranty
8493	Anchor Dairy Feed. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* Geo. T. Soule Guaranty
8494	Anchor Horse Feed. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* Geo. T. Soule Guaranty
8492	No. 1 Chop Feed. Globe Elevator Co., Buffalo, N. Y.	*New Milford:* Geo. T. Soule Guaranty
8470	Grandin's Stock Feed. D. H. Grandin Milling Co., Jamestown, N. Y.	*Norwalk:* Holmes, Keeler & Kent Co. Guaranty
8506	Horse, Mule & Dairy Feed. Dwight Hamlin & Co., Pittsburgh, Pa.	*West Cheshire:* G. W. Thorpe Guaranty
8601	Haskell's Stock Feed. W. H. Haskell, Toledo, O.	*Colchester:* M. Klingon Guaranty
8566	Algrane Horse Feed. H. O. Co., Buffalo, N. Y.	*New Britain:* C. W. Lines Co. Guaranty
8590	New England Stock Feed. H. O. Co., Buffalo, N. Y.	*Westerly, R. I.:* C. W. Campbell Co. Guaranty
8480	Bonnie Horse Feed. Holmes, Keeler & Kent Co., So. Norwalk	Manufacturer Guaranty
8523	Badger Horse Feed. C. A. Krause Mill. Co., Milwaukee, Wis.	*Torrington:* F. U. Wadhams Guaranty
8455	Badger Stock Feed. C. A. Krause Mill. Co., Milwaukee, Wis.	*Meriden:* A. Grulich
8520	Badger Stock Feed. C. A. Krause Mill. Co., Milwaukee, Wis.	*Torrington:* F. U. Wadhams Guaranty

SAMPLED IN 1916—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8594	8.59	3.72	22.94	8.23	50.54	5.98	$44.00
....	....	....	**22.00**	....	....	**5.50**	....
8489	7.28	5.55	27.31	10.76	41.91	7.19	41.50
....	....	....	**26.00**	....	....	**5.00**	....
8547	9.65	8.15	16.50	12.86	48.56	4.28	30.00
....	....	....	**13.50**	....	....	**4.00**	....
8620	7.18	3.75	10.81	12.82	59.50	5.94	40.00
....	....	....	**9.90**	....	....	**3.50**	....
8618	8.65	4.92	13.81	15.37	55.50	1.75	40.00
....	....	....	**10.00**	....	....	**2.50**	....
8551	7.73	3.48	10.50	9.56	62.05	6.68	42.00
....	....	....	**9.00**	....	....	**4.00**	....
8426	7.55	3.99	25.75	10.52	44.37	7.82	42.00
....	....	....	**25.00**	....	....	**7.00**	....
8580	8.75	7.34	12.75	15.80	54.19	1.17	44.00
....	....	....	**9.00**	....	....	**1.50**	....
8579	9.19	2.40	10.25	5.06	68.03	5.07	42.00
....	....	....	**10.00**	....	....	**3.50**	....
8493	9.05	6.69	11.56	10.37	60.65	1.68	35.00
....	....	....	**16.00**	....	....	**3.50**	....
8494	9.72	3.24	9.25	7.01	66.78	4.00	48.00
....	....	....	**9.00**	....	....	**3.00**	....
8492	7.24	4.36	10.75	9.81	61.51	6.33	40.00
....	....	....	**7.00**	....	....	**3.00**	....
8470	8.38	3.63	9.63	8.65	63.36	6.35	40.00
....	....	....	**8.50**	....	....	**4.00**	....
8506	8.52	5.71	14.44	12.33	55.83	3.17	41.00
....	....	....	**14.00**	....	....	**3.50**	....
8601	8.66	3.21	9.69	7.30	64.29	6.85	40.00
....	....	....	**9.00**	....	....	**6.00**	....
8566	8.12	5.76	11.38	11.46	59.28	4.00	29.00
....	....	....	**11.00**	....	....	**4.00**	....
8590	7.59	4.96	10.31	10.46	61.95	4.73	41.00
....	....	....	**9.00**	....	....	**4.00**	....
8480	8.59	3.44	11.56	10.49	62.38	3.54	40.00
....	....	....	**13.00**	....	....	**4.00**	....
8523	10.08	7.07	11.44	12.87	56.15	2.39	42.00
....	....	....	**10.00**	....	....	**2.00**	....
8455	8.44	4.53	8.69	13.67	60.22	4.45	40.00
8520	9.21	4.24	9.38	12.48	59.72	4.97	40.00
....	....	....	**10.00**	....	....	**4.25**	....

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
8457	Blue Top Horse Feed. C. A. Krause Mill. Co., Milwaukee, Wis.	*Meriden:* A. Grulich Guaranty
8595	Cream City Horse Feed. C. A. Krause Mill. Co., Milwaukee, Wis.	*Yantic:* A. R. Manning Guaranty
8460	Larro Feed. Larrowe Milling Co., Detroit, Mich.	*Meriden:* Grain & Feed Co. Guaranty
8429	Palmo Meal. The Meader Atlas Co., New York	*East Haven:* F. A. Forbes Guaranty
8559	M. & S. Stock Feed. Meech & Stoddard, Middletown	Manufacturer Guaranty
8538	Cream-O-Lene Dairy Ration. Nowak Mfg. Corp., Buffalo, N. Y.	*Norfolk:* A. P. Curtis Guaranty
8540	Domino Horse Feed. Nowak Mfg. Corp., Buffalo, N. Y.	*Norfolk:* A. P. Curtis Guaranty
8539	Domino Justice Creamery Feed. Nowak Mfg. Corp., Buffalo, N. Y.	*Norfolk:* A. P. Curtis Guaranty
8537	Fidelity Stock Feed. Nowak Mfg. Corp., Buffalo, N. Y.	*Norfolk:* A. P. Curtis Guaranty
8442	Peerless Horse Feed. Omaha Alfalfa Mill. Co., Omaha, Neb.	*Bridgeport:* Berkshire Mills Guaranty
8451	Stevens 44 Dairy Ration. Oswego Milling Co., Oswego, N. Y.	*Wallingford:* Gallagher Bros.
8622	Stevens 44 Dairy Ration. Oswego Milling Co., Oswego, N. Y. Park & Pollard Co., Boston	*Granby:* E. H. Rollins Guaranty
8499	Calf Meal. Park & Pollard Co., Boston, Mass.	*Waterbury:* Spencer Grain Co. Guaranty
8498	Horse Feed. Park & Pollard Co., Boston, Mass.	*Waterbury:* H. S. Coe & Co. Guaranty
8561	Stock Feed. Park & Pollard Co., Boston, Mass.	*Bridgeport:* Standard Feed Co. Guaranty
8487	Peters King Corn. Peters Mill. Co., Omaha, Neb.	*Danbury:* H. E. Meeker Guaranty
8453	Iowa Stock Feed. Purity Oats Co., Davenport, Ia.	*Wallingford:* Gallagher Bros. Guaranty
8452	Tom Boy Horse Feed. Purity Oats Co., Davenport, Ia.	*Wallingford:* Gallagher Bros. Guaranty
8569	Boss Feed. Quaker Oats Co., Chicago, Ill.	*New Haven:* Crittenden-Benham Co. Guaranty
8477	Green Cross Horse Feed. Quaker Oats Co., Chicago, Ill.	*Stamford:* W. L. Crabb Guaranty
8467	Mogol Molasses Feed. Quaker Oats Co., Chicago, Ill.	Guaranty
8454	Schumacher's Calf Meal. Quaker Oats Co., Chicago, Ill.	*Wallingford:* Gallagher Bros. Guaranty
8475	Schumacher's Feed. Quaker Oats Co., Chicago, Ill.	*New Canaan:* C. H. Fairty Co. Guaranty
8623	Schumacher's Special Horse Feed. Quaker Oats Co., Chicago, Ill.	*Granby:* E. H. Rollins Guaranty

SAMPLED IN 1916—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8457	11.37	7.62	11.38	14.48	53.51	1.64	$38.00
....	....	....	10.00	....	....	1.00	....
8595	9.23	7.25	11.00	14.81	55.87	1.84	40.00
....	....	....	10.00	....	....	1.50	....
8460	8.23	5.11	19.81	11.76	50.94	4.15	42.00
....	....	....	20.00	....	....	3.00	....
8429	7.68	10.07	6.63	49.65	17.59	8.38	23.00
....	....	....	7.00	....	....	7.00	....
8559	8.27	4.78	9.06	10.33	63.30	4.26	40.00
....	....	....	9.00	....	....	3.00	....
8538	9.09	7.02	21.81	11.13	45.60	5.35	38.00
....	....	....	20.00	....	....	4.00	....
8540	8.66	7.48	10.00	17.65	53.46	2.75	41.00
....	....	....	9.00	....	....	2.00	....
8539	7.67	7.43	22.63	11.54	45.00	5.73	39.00
....	....	....	22.00	....	....	4.00	....
8537	6.99	6.08	7.50	14.42	61.08	3.93	38.00
....	....	....	8.00	....	....	3.00	....
8442	10.83	7.12	11.44	13.75	55.78	1.08	37.00
....	....	....	10.00	....	....	2.00	....
8451	8.38	4.78	24.69	11.13	44.37	6.65	36.00
8622	6.57	4.15	24.44	11.54	46.88	6.42	43.00
....	....	....	24.00	....	....	5.00	....
8499	10.25	5.58	25.00	6.52	48.62	4.03	70.00
....	....	....	25.00	....	....	5.00	....
8498	10.00	7.18	11.25	12.48	57.88	1.21	42.00
....	....	....	9.00	....	....	1.50	....
8561	8.84	4.02	10.50	10.02	60.62	6.00	44.00
....	....	....	9.00	....	....	1.50	....
8487	8.81	8.04	11.88	19.26	50.78	1.23	45.00
....	....	....	9.00	....	....	1.50	....
8453	9.44	4.44	9.63	10.70	61.33	4.46	38.00
....	....	....	10.00	....	....	4.00	....
8452	9.63	6.72	10.88	16.04	55.99	0.74	38.00
....	....	....	9.00	....	....	2.00	....
8569	8.34	3.84	9.00	10.64	64.53	3.65	40.00
....	....	....	8.00	....	....	3.00	....
8477	8.78	5.41	9.25	13.93	60.33	2.30	36.00
....	....	....	10.00	....	....	2.50	....
8467	8.75	5.87	8.75	15.73	58.56	2.34	44.00
....	....	....	10.00	....	....	2.50	....
8454	9.06	4.45	18.44	2.86	56.37	8.82	60.00
....	....	....	19.00	....	....	8.00	....
8475	7.89	3.87	11.56	9.75	63.20	3.73	40.00
....	....	....	10.00	....	....	3.25	....
8623	9.08	2.40	9.75	6.68	68.31	3.78	43.00
....	....	....	9.25	....	....	3.25	....

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS—*Continued.*	
	Horse, Dairy and Stock Feeds—Continued.	
8570	Victor Feed. Quaker Oats Co., Chicago, Ill.	*New Haven:* Crittenden-Benham Co. .....
		Guaranty .....
8483	Purina Feed with Molasses. Ralston Purina Co., St. Louis, Mo.	*So. Norwalk:* S. Roodner ...
8572	Purina Feed with Molasses. Ralston Purina Co., St. Louis, Mo.	*New Haven:* Crittenden-Benham Co. .....
		Guaranty .....
8592	Ryde's Cream Calf Meal. Ryde & Co., Chicago, Ill.	*Westerly, R. I.:* C. W. Campbell Co. .....
		Guaranty .....
8585	Yellow Tag Stock Food. P. Schwartz Co., New London	Manufacturer .....
		Guaranty .....
8605	Colonel's Ration. Tioga Mill & Elev. Co., Waverly, N. Y.	*Jewett City:* Jewett City Grain Co. .....
		Guaranty .....
8471	Ti-O-Ga Dairy Feed, Red Brand. Tioga Mill & Elev. Co., Waverly, N. Y.	*Norwalk:* Holmes, Keeler & Kent Co. .....
8614	Ti-O-Ga Dairy Feed, Red Brand. Tioga Mill & Elev. Co., Waverly, N. Y.	*Putnam:* F. M. Cole .....
		Guaranty .....
8464	Biles Ready Ration (Union Grains). The Ubiko Mill Co., Cincinnati, O.	*Plantsville:* C. A. Cowles ....
		Guaranty .....
8533	Xtra-Vim Feed. Xtravim Molasses Feed Co., Boston, Mass.	*Winsted:* E. Manchester & Sons .....
		Guaranty .....
	POULTRY FEEDS.	
8440	Bufceco Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y.	*Shelton:* Ansonia Flour & Grain Co. .....
		Guaranty .....
8500	Iroquois Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer..
		Guaranty .....
8608	Wirthmore Growing Feed. Chas. M. Cox Co., Boston, Mass.	*Danielson:* Quinebaug Mills..
		Guaranty .....
8461	Wirthmore Poultry Mash. Chas. M. Cox Co., Boston, Mass.	*Meriden:* Grain & Feed Co...
		Guaranty .....
8627	Globe Egg Mash. Albert Dickinson Co., Chicago, Ill.	*New Haven:* R. G. Davis & Sons .....
		Guaranty .....
8576	Queen Poultry Mash. Albert Dickinson Co., Chicago, Ill.	*Hartford:* Loydon, Northam & Loydon .....
		Guaranty .....
8491	Blue Ribbon Laying Mash. Globe Elevator Co., Buffalo, N. Y.	*Brookfield:* C. R. Dubia .....
		Guaranty .....
8484	H. O. Dry Poultry Mash. The H. O. Co., Buffalo, N. Y.	*Ridgefield:* S. D. Keeler ....
		Guaranty .....
8473	Bonnie Dry Mash. Holmes, Keeler & Kent Co., Norwalk	Manufacturer .....
		Guaranty .....
8509	H. O. Poultry Feed. The H. O. Co., Buffalo, N. Y.	*Plainville:* Eaton Bros. .....
		Guaranty .....

SAMPLED IN 1916—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8570	8.20	3.95	9.06	11.12	64.24	3.43	$40.00
....	....	....	**8.00**	....	....	**3.00**	....
8483	10.48	6.37	9.69	12.12	59.10	2.24	40.00
8572	10.49	6.21	9.25	10.86	60.99	2.20	45.00
....	....	....	**9.30**	....	....	**1.70**	....
8592	10.13	5.20	25.69	5.27	49.07	4.64	70.00
....	....	....	**25.00**	....	....	**5.00**	....
8585	6.80	5.70	9.00	12.04	61.35	5.11	40.00
....	....	....	**9.00**	....	....	**4.00**	....
8605	9.38	5.99	14.13	12.31	55.05	3.14	36.00
....	....	....	**12.00**	....	....	**2.50**	....
8471	6.98	4.56	27.00	10.81	43.30	7.35	42.00
8614	7.79	4.45	24.75	10.73	45.15	7.13	42.00
....	....	....	**23.00**	....	....	**3.25**	....
8464	8.06	5.28	25.25	9.32	45.76	6.33	38.00
....	....	....	**24.00**	....	....	**7.00**	....
8533	23.67	5.16	4.38	5.66	60.68	0.45	40.00
....	....	....	**4.50**	....	....	**0.60**	....
8440	9.14	3.80	16.19	6.20	59.77	4.90	51.00
....	....	....	**15.00**	....	....	**4.00**	....
8500	9.25	3.99	15.25	8.76	59.15	3.60	55.00
....	....	....	**14.00**	....	....	**4.00**	....
8608	10.83	4.86	14.00	4.31	62.38	3.62	51.00
....	....	....	**15.00**	....	....	**4.50**	....
8461	9.59	6.47	19.50	7.50	54.08	2.86	50.00
....	....	....	**17.00**	....	....	**4.00**	....
8627	8.90	5.45	16.75	7.01	57.29	4.60	51.00
....	....	....	**15.00**	....	....	**3.00**	....
8576	9.43	6.58	12.44	6.00	62.11	3.44	54.00
....	....	....	**11.00**	....	....	**2.50**	....
8491	9.35	7.10	18.88	7.65	53.22	3.80	46.00
....	....	....	**20.00**	....	....	**3.00**	....
8484	8.51	4.99	18.75	11.13	53.08	3.54	46.00
....	....	....	**18.00**	....	....	**3.50**	....
8473	9.29	8.80	18.75	9.13	49.99	4.04	48.00
....	....	....	**16.00**	....	....	**4.00**	....
8509	8.73	4.06	16.69	6.44	59.55	4.53	44.00
....	....	....	**17.00**	....	....	**4.50**	....

TABLE V.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	POULTRY FEEDS—*Continued.*	
8562	M. & S. Dry Mash Feed. Meech & Stoddard, Middletown	Manufacturer Guaranty
8459	Mystic Laying Mash. Mystic Mill. & Feed Co., Rochester, N. Y.	*Meriden:* Grain & Feed Co. Guaranty
8516	Domino Laying Mash. Nowak Milling Corp., Buffalo, N. Y.	*Torrington:* D. L. Talcott Guaranty
8587	Growing Feed. Park & Pollard Co., Boston, Mass.	*Mystic:* J. L. Manning & Co. Guaranty
8514	Lay or Bust Dry Mash. Park & Pollard Co., Boston, Mass.	*Bristol:* Goodsell Bros. Guaranty
8573	Platco Laying Mash. Frank S. Platt Co., New Haven	Manufacturer Guaranty
8611	Schumacher's Poultry Mash. Quaker Oats Co., Chicago, Ill.	*Putnam:* F. M. Cole Guaranty
8482	Purina Chicken Chowder Feed. Ralston Purina Co., St. Louis, Mo.	*So. Norwalk:* S. Roodner Guaranty
8469	Ti-O-Ga Dry Mash. Tioga Mill & Elev. Co., Waverly, N. Y.	*Norwalk:* Holmes, Keeler & Kent Co. Guaranty
8466	V-B XXXX Mash. Vincent Bros. Co., Bridgeport	*Bridgeport:* Vincent Bros. Co. Guaranty

SAMPLED IN 1916—*Concluded.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
8562	9.18	6.62	16.31	7.03	57.14	3.72	$50.00
....	....	....	**12.00**	....	....	**3.00**	....
8459	9.37	5.40	24.38	6.62	49.96	4.27	50.00
....	....	....	**23.00**	....	....	**4.00**	....
8516	8.15	13.16	20.50	7.74	45.02	5.43	50.00
....	....	....	**20.00**	....	....	**3.00**	....
8587	9.33	8.92	16.50	6.07	54.98	4.20	52.00
....	....	....	**10.00**	....	....	**1.50**	....
8514	8.15	9.77	18.00	10.64	49.51	3.93	51.00
....	....	....	**18.00**	....	....	**1.50**	....
8573	8.38	17.60	19.51	5.39	43.69	5.43	50.00
....	....	....	**20.30**	....	....	**5.54**	....
8611	9.05	4.86	21.38	7.71	51.92	5.08	48.00
....	....	....	**17.50**	....	....	**4.00**	....
8482	9.02	7.36	19.50	7.84	52.18	4.10	50.00
....	....	....	**17.00**	....	....	**3.00**	....
8469	8.93	16.37	13.75	5.35	51.60	4.00	50.00
....	....	....	**12.00**	....	....	**2.00**	....
8466	8.93	7.83	20.75	11.04	46.87	4.58	50.00
....	....	....	**21.50**	....	....	**4.90**	....

Digestibility of Feeding Stuffs by Ruminants.

Table VI shows the digestion coefficients, or percentages of the food elements which are digestible by neat cattle (Feeds and Feeding, by Henry and Morrison, 1915, page 647 *et seq.*).

Some of these figures are the result of only a very few tests, and all of them represent short periods of feeding and must be regarded as showing comparative digestibility of the feeds only very roughly. Like chemical composition, statement of the digestibility of a feed is only a single "pointer" to the feeder; helpful, if it is not over-valued.

Table VI.—Digestion Coefficients.

	Protein.	Fiber.	Carbohydrates.	Fat.
Cotton Seed Meal	84	37	75	95
Linseed Meal (old process)	89	57	78	89
Wheat Bran	76	43	74	62
Wheat Feed	77	36	76	87
Wheat Middlings	77	30	78	88
Red Dog Flour	88	36	88	86
Corn Gluten Meal	85	55	90	93
Corn Gluten Feed	85	76	88	85
Hominy Feed	66	76	90	91
Dried Brewers' Grains	81	49	57	89
Malt Sprouts	77	87	80	85
Dried Distillers' Grains	73	95	81	95
Dried Beet Pulp	52	83	83	..
Wheat Bran and Corn Cob Feed	63	28	71	92

PART IV.

Twenty-first Report on Food Products and Ninth Report on Drug Products, 1916.

By John Phillips Street.*

Of the 401 samples collected by the station agent, 55 were adulterated, misbranded or below standard, exclusive of the 38 proprietary medicines; one-half of these adulterations were found in the ground peppers. The Dairy and Food Commissioner submitted to the laboratory 886 samples, chiefly butter, milk, coffee, ketchup and drug products. Of these 311 were adulterated, misbranded or below standard, and 42 were legally labeled compounds. Besides the above, 82 samples have been examined for city and health officials and private individuals. In all 1,369 samples were analyzed, of which 392 were adulterated, misbranded or below standard (exclusive of proprietary medicines).

The Station's own examinations of foods and drugs have been somewhat limited because of the work required for the Dairy and Food Commissioner. Because of these interruptions the analyses of nearly 150 foods and drugs, which had been collected by the Station, remain unexamined. The number of samples analyzed is no measure of the amount of work performed; for instance, the 53 samples of drugs taken from the stocks of physicians have required more time for their analysis than would 1,500 samples of milk or 2,400 samples of butter. The inspection of food products to-day requires more than a simple routine

* The analytical work herein reported was done mainly by the writer's assistants, E. M. Bailey, C. B. Morison and C. E. Shepard. Especial credit is due to Messrs. Bailey and Morison for their very excellent work in connection with the difficult analysis of the drugs from physicians' stocks.

examination, and each year we find the analysis of these products more difficult, more exacting, and naturally more time-consuming.

Since 1896 the Station has struggled along on the meager annual appropriation of $2,500 for food and drug analysis (a sum probably smaller than is appropriated in any other state where any real attempt is made to inspect these products). An increased force of chemists and increased revenue are absolutely essential if the Station is to continue in a satisfactory manner the important work it has done in this connection for the past twenty-one years.

I. FOOD PRODUCTS.

HYGIENIC COFFEE.

Last year four brands of so-called hygienic coffees were examined, and this year five additional brands were analyzed. All of these analyses, together with that of a sample of commercial Java coffee, are given in Table I for purposes of comparison.

The new brands were as follows:

8004. *Dekofa,* Merck and Co.; New York (Dist.) "A genuine coffee from which the stimulating drug caffeine has been

TABLE I:—

Station No.	Brand.	Water.	Solids soluble in cold water.	Petroleum ether extract.	Ash.			
					Total.	Water-soluble.	Water-insoluble.	Acid-insoluble.
6334	Commercial Java Coffee,.....	5.62	23.01	16.57	4.27	3.29	0.98	0.03
5040	Kaffee Hag,.....	5.42	22.60	16.38	4.57	3.65	0.92	0.02
6333	G. Washington Prepared Coffee,.....	8.58	90.30	0.26	16.68	13.36	3.32	0.02
6335	Café des Invalides,.....	5.03	27.53	13.68	5.04	4.03	1.01	0.09
6336	Richelieu Vacuum Improved Coffee,.	4.57	22.41	16.43	4.21	3.31	0.90	0.03
8004	Dekofa,.....	6.25	20.55	13.10	4.38	3.60	0.78	0.02
8261	Cafab Certified Coffee, 25	6.65	16.90	16.32	3.42	2.47	0.95	0.03
8262	" " " 30	6.46	16.48	16.04	2.95	2.10	0.85	0.01
8260	" " " 35	6.62	17.80	16.04	3.27	2.42	0.85	0.03
8259	Hübner's Health Coffee,.....	6.17	13.58	16.60	1.65	1.05	0.60	0.03
8258	Pura Café Presque sans Caffeine,....	6.95	16.55	15.01	3.10	2.23	0.87	0.01

largely removed." "Is the H. A. G. Kaffee of the European market."

8261. *Cafab Certified Coffee 25,* Cafab Products Co.; New York. "From which large per cent of the caffein has been removed." On the label the words "about 90" have been partially obliterated and the word "large" substituted.

8262. *Cafab Certified Coffee 30,* Cafab Products Co.; New York. Same labeling as 8261.

8260. *Cafab Certified Coffee 35,* Cafab Products Co.; New York. Same labeling as 8261.

8259. *Hübner's Health Coffee,* Hübner's Health Coffee Co.; New York. "Between 80 and 90 per cent of caffeine is extracted. A small percentage of caffetannic acid and other ingredients are also removed."

8258. *Pura Café Presque sans Caffeine,* Acker, Merrall and Condit Co.; New York. "Coffee from which the greatest part of the caffeine and tanic (*sic*) acid has been extracted."

The analyses show a very diverse series of products containing from 0.03 to 4.96 per cent caffein and from 6.52 to 48.04 per cent of caffetannic acid. The brands may be classified into five quite distinct groups:

HYGIENIC COFFEES.

*Alkalinity of ash.		Phosphoric acid.		Potash.	Chlorin.	Nitrogen.	Caffein.		Caffetannic acid.	Reducing sugars, as dextrose.	Sucrose, from increase after inversion.	Carbohydrates insoluble in 95% alcohol and convertible by diastase.
Water-soluble.	Water-insoluble.	Water-soluble.	Water-insoluble.				From residue.	From nitrogen in residue.				
4.09	2.08	0.12	0.32	2.01	0.01	2.22	1.22	1.20	11.37	0.98	0.73	6.75
4.55	2.26	0.06	0.32	2.29	0.06	1.92	0.04	0.03	11.47	0.72	1.01	6.56
18.34	7.40	0.40	1.23	8.92	0.09	3.42	5.11	4.96	48.04	4.04	2.06	13.50
3.90	2.30	0.17	0.29	2.09	0.49	2.31	1.00	0.97	11.56	2.70	2.57	7.25
4.07	2.10	0.15	0.29	2.07	0.01	2.32	1.18	1.15	11.82	1.11	0.80	5.00
4.25	1.50	0.17	0.24	2.09	0.05	1.74	0.05	0.03	12.89	0.24	0.68	4.31
2.80	1.35	0.13	0.25	1.43	0.03	2.30	0.74	0.61	8.98	0.40	0.34	3.43
2.40	1.40	0.15	0.28	1.30	0.03	2.10	0.61	0.52	9.59	0.68	0.38	4.11
2.75	1.40	0.10	0.33	1.43	0 03	2.20	0.70	0.59	9.38	0.40	0.60	3.99
1.00	1.05	0.13	0.18	0.67	0.03	2.00	0.48	0.38	6.52	0.40	0.64	5.43
2.45	1.35	0.14	0.28	1.36	0.03	2.22	0.66	0.57	9.62	0.88	0.19	3.77

*CC $\frac{N}{10}$ HCl per gram of coffee.

1. *G. Washington Prepared Coffee.* This product is completely soluble in water, and is a coffee extract concentrated about four times. Accordingly only about one-fourth as much of this would be used in making a cup of coffee as would be necessary in the other brands. On this basis we find about the usual content of caffein and caffetannic acid found in ordinary coffee, an almost complete absence of petroleum ether extract (fat), as would be expected, and considerably less nitrogen and water-insoluble carbohydrates than found in normal coffee.

2. *Kaffee Hag* and *Dekofa* (names for the same product) in which the caffein has been largely eliminated as claimed. The water-soluble solids, the caffetannic acid and the other ingredients show little variation from ordinary coffee.

3. *Richelieu Vacuum Coffee,* which shows scarcely any variation from the composition of normal coffee, there being practically no reduction in caffein or caffetannic acid.

4. *Café des Invalides,* which contains about 80 per cent as much caffein as normal coffee, due to dilution with chicory and possibly other vegetable products. This addition has affected the content of caffetannic acid but little, but has caused an increase in water-soluble solids and a very marked increase in chlorin.

5. The three *Cafab* samples, *Hübner's Health Coffee* and *Pura Café,* in which there has been a considerable reduction in both caffein and caffetannic acid. The partial removal of these ingredients apparently has had a serious effect on the other constituents of these coffees. While in the sample of commercial coffee 23.01 per cent of the solids was soluble in water, in these we find only from 13.58 to 17.80 per cent; the water-soluble ash, potash and carbohydrates likewise are all very much lower than in normal coffee. This is particularly striking in the *Hübner* brand, which contains only 59 per cent of the water-soluble solids, 32 per cent of the water-soluble ash, 33 per cent of the potash and 76 per cent of the carbohydrates found in ordinary coffee. In other words, in removing a part of the caffein and caffetannic acid the leaching process has also removed much of the food material of the coffee.

The coffees of the first four classes (excepting *Dekofa*) were discussed in detail in our last report. The present discussion will be confined to the new analyses.

Dekofa. As already stated, this is the European brand corresponding to the *Kaffee Hag* of the American market. Its composition in general agrees closely with that of *Kaffee Hag,* but we find somewhat less soluble solids, petroleum ether extract and carbohydrates. The claim that the "caffeine has been largely removed" is strictly correct.

Cafab Certified Coffee. The three brands may be considered together as they differ but little in composition. Their labels clearly show that originally the false claim was made that "about 90 per cent of the caffein has been removed." This was later modified to read "large per cent," etc. Our analyses show that the modified statement is approximately correct, as from 50 to 60 per cent of the caffein has been removed. With this removal nearly one-fourth of the soluble solids, about one-third of the potash, and from two-fifths to one-half of the carbohydrates have also disappeared, and the strength of the coffee decoction made from these brands would be just that much weaker than ordinary coffee.

Hübner's Health Coffee. This brand claims the removal of from 80 to 90 per cent of the caffein, as well as a small percentage of caffetannic acid and other ingredients. Instead of an 80 to 90 per cent removal of caffein we find but 68 per cent. About 40 per cent of the caffetannic acid also is removed. The serious feature, however, in connection with this brand is that in the process employed much of the real substance of the coffee is also taken away. About two-fifths of the soluble solids, about seven-tenths of the water-soluble ash, one-fourth of the phosphoric acid, two-thirds of the potash and about one-fourth of the carbohydrates have been removed with the caffein and caffetannic acid. In other words, this is a partially leached coffee.

Pura Café. The claim "Presque sans Caffeine" ("almost without caffein") is not substantiated by our analysis, as we find about one-half the normal amount present. The same leaching effect is apparent as in the *Cafab* and *Hübner* brands. In fact the analyses of the *Cafab* and *Pura* coffees are almost the same. The claim that all of the strength of the coffee remains is untrue, as the coffee has only about three-fourths the strength of the ordinary product.

Analytical Note. The point has often been raised that in the determination of caffein the direct weighing of the residue may give too high results, and that accordingly nitrogen should be determined in this residue and the caffein percentage calculated therefrom. Our experience last year where carbon tetrachlorid was used as the solvent showed only trifling differences

between the results by the direct and indirect methods, ranging from 0.01 to 0.05 per cent. This year we had considerable difficulty in completely extracting the caffein with carbon tetrachlorid and we were obliged to resort to chloroform. Using this solvent the direct method gives too high results and the only accurate method when chloroform is used is to determine the nitrogen in the residue and from this value calculate the caffein. The direct method this year gave results from 0.09 to 0.13 per cent too high.

CREAM OF TARTAR.

Thirty-two samples of cream of tartar were examined. Thirty-one of these were genuine without adulteration, while one was labeled as "Cream Tartar Substitute." The tests for heavy metals and arsenic were negative in all cases, except in one where a trace of iron was present.

Cream of tartar has been inspected eight times in this laboratory, and the following tabulation shows the very great improvement in its purity from 1896 to the present time.

Year.	Number of Samples.	Number Pure.	Number Adulterated.	Number Compound.	Adulteration %.
1896	103	72	31	0	30
1900	48	33	15	0	31
1901	43	34	9	0	21
1904	91	72	19	0	21
1905	19	17	1	1	5
1906	73	67	6	0	8
1907	30	28	2	0	7
1916	32	31	0	1	0

Sixteen of the samples were sold in labeled containers, the other fifteen in bulk. The following manufacturers were represented in the labeled brands:

Acker, Merrall & Condit Co.
Austin, Nichols & Co. (2)
Bennett, Simpson & Co.
E. R. Durkee & Co.
B. Fisher & Co.
J. H. Folkins Co.
Grand Union Tea Co.
Great Atl. & Pac. Tea Co.
Miner, Read & Tullock.
The Mohican Co. (2)
D. & L. Slade Co.
James P. Smith & Co.
Stickney & Poor Spice Co.
Union Pacific Tea Co.

The net weight stated on the package goods was correct in all cases. One bulk sample, however, bought for 4 oz. from D. M. Welch and Son, New Haven, contained only 2 oz. The usual wide variations in price were shown. Four oz. packages cost from 5 to 20 cents, and two oz. from 10 to 13 cents.

CREAM OF TARTAR SUBSTITUTE.

7987. *Revere Cream Tartar Substitute,* Revere Mills, Boston. "Contains acid phosphate of calcium, sodic alumina sulphate, bicarbonate of soda and corn starch."

The following analytical data were obtained:

Soda	6.79	Potash	0.16
Alumina	7.37	Iron oxid	0.23
Phosphoric anhydrid	12.91	Starch	18.74
Sulphuric anhydrid	21.36	Carbon dioxid	present
Lime	4.36	Arsenic	none

This substitute cost 10 cents per 4 oz.; compared with an average of 14 cents for the genuine product.

DIABETIC FOODS.

Few new brands of this class of foods have appeared on the market during the past year. The 22 analyses herewith reported represent chiefly further analyses of brands previously examined in this laboratory. Uniformity in composition from year to year is a desirable characteristic of such foods, and until the manufacturers can secure such uniformity, the use of these foods by dietitians will be attended with much uncertainty.

The brands examined were as follows:

7237. *Christian's Imported Protoid Nuts,* Christian's Natural Food Co.; Kenilworth, N. J. "Protein 35, fat 45, carbohydrates 10; 2800 calories per pound."

5579. *Akoll Biscuits,* Huntley and Palmer, Reading, Engl.

7277. *Roman Meal,* sold by S. S. Pierce Co., Boston.

Made by The Kellogg Food Co., Battle Creek, Mich.

7498. *20% Gluten Meal.* "Moisture 5-10, gluten 20-30, carbohydrates (starch) 65-70, fats 1-2, ash 1-2, cellulose and undetermined 1-2, protein factor 5.7."

7496. *40% Gluten Flour.* "Moisture 5-10, gluten 40-45, carbohydrates 40-45, fats 0.2-0.5, ash 0.5-1, cellulose and undetermined 1-3."

7497. *40% Gluten Meal.* "Moisture 5-10, gluten 40-45, carbohydrates (starch) 40-45, fats 0.2-0.5, ash 1-2, cellulose and undetermined 1-2, protein factor 5.7."

7499. *Pure Gluten Meal.* "Moisture 5-10, protein 75-80, carbohydrates (starch) 0-5, fats 0.25-0.7, ash 1-2, cellulose and undetermined 1-3, protein factor 5.7."

7495. *40% Gluten Biscuit.*

7494. *Pure Gluten Biscuit.* "Moisture 5-10, protein 75-80, carbohydrates (starch) 0-5, fats 0.25-0.7, ash 1-2, cellulose and undetermined 2.4-3, protein factor 5.7."

Made by Loeb's Diabetic Food Bakery, New York City.

8412. *Genuine Gluten Bread.* "For Diabetes, Dyspepsia, Constipation, Obesity."

8420. *Gluten Luft Bread.* "The best Bread for Diabetes, Dyspepsia, Weak Stomach. More nourishing than meat."

8413. *Pure Gluten Flour.*

8414. *Diabetic Bread Sticks.*

8415. *Gluten Noodles.*

8416. *Diabetic Sponge Cookies.* "Guaranteed to be without Flour or Sugar."

8417. *Diabetic Almond Macaroons.*

8418, 7030. *Diabetic Butter Cookies.*

8419. *Diabetic Lady Fingers.* "Guaranteed to be without Flour or Sugar."

8421. *Gluten Cracker Meal.* "Made from Pure Gluten Flour and Eggs."

8422. *Gluten Almond Zwieback.*

8423. *Gluten Zwieback.*

Christian's Imported Protoid Nuts have the composition of pine nuts, and are a very nutritious, starch-free food.

Akoll Biscuits. The present analysis agrees closely with those made by us in 1912 and 1913, showing the preparation to be practically starch-free and with high percentages of protein and fat.

Roman Meal. This sample was sent by a diabetic to learn whether its use was safe. We do not know whether it is recommended by the manufacturer for the use of diabetics, but certainly a food containing 37.35 per cent of starch is inappropriate for a *strict* diabetic dietary.

Kellogg Preparations. These samples require special comment. Inasmuch as the analyses given by the Company on the labels are based on the protein factor 5.7, the samples will be discussed on that basis. *Pure Gluten Biscuit* contains less protein than is claimed. It also contains more starch than one might expect from the Company's analysis. The Company makes the

TABLE II:—DIABETIC FOODS.

Station No.	Brand.	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free extract.	Fat.	Starch.
7237	Christian's Imported Protoid Nuts	4.23	4.27	37.63	5.65		48.22	Trace.
5579	Akoll Biscuits	7.97	3.43	53.56	0.49	6.22	28.33	Trace.
7498	Kellogg's 20% Gluten Meal	7.65	1.22	27.06[1]	0.12	63.03	0.92	51.24
7496	" 40% Gluten Flour	8.62	0.89	36.88[2]	0.08	52.10	1.43	48.04
7497	" 40% Gluten Meal	7.30	1.36	45.56[3]	0.10	44.57	1.11	36.59
7499	" Pure Gluten Meal	4.60	0.96	84.19[4]	0.08	9.36	0.81	6.77
7494	" Pure Gluten Biscuit	8.30	2.04	81.00[5]	0.12	7.71	0.83	4.02
7495	" 40% Gluten Biscuit	8.50	1.48	45.13[6]	0.08	43.83	0.98	36.98
8412	Loeb's Genuine Gluten Bread	27.72	1.51	35.40	0.21	34.99	0.17	26.37
8420	" Gluten Luft Bread	7.05	1.20	44.50	0.18	37.29	9.78	29.93
8413	" Pure Gluten Flour	8.85	0.51	47.81	0.13	41.69	1.01	35.78
8414	" Diabetic Bread Sticks	8.15	2.87	46.31	0.19	42.19	0.29	35.02
8415	" Gluten Noodles	9.25	0.69	45.19	0.15	43.69	1.03	33.19
8416	" Diabetic Sponge Cookies	5.82	3.49	44.63	0.23	8.66	37.17	1.91
8417	" Diabetic Almond Macaroons	4.55	4.01	34.25	1.72	10.46	45.01	Trace.
8418	" Diabetic Butter Cookies	6.14	2.22	39.31	0.15	37.25	14.93	32.18
7030	" " " "	4.07	2.86	31.38	0.35	39.05	22.29	30.66
8419	" Diabetic Lady Fingers	5.97	3.46	48.00	0.07	9.71	32.79	2.14
8421	" Gluten Cracker Meal	8.22	1.07	42.63	0.19	38.97	8.92	31.59
8422	" Gluten Almond Zwieback	8.04	1.97	44.00	0.33	39.56	6.10	33.10
8423	" Gluten Zwieback	8.27	2.34	45.44	0.20	41.06	2.39	35.72
7277	Roman Meal	8.54	3.68	13.31	4.98	66.06	3.43	37.35

[1] Using factor 5.7 protein = 24.68, nitrogen-free extract = 65.41
[2] " " " " = 33.63, " " = 55.35
[3] " " " " = 41.55, " " = 48.58
[4] " " " " = 76.78, " " = 16.77
[5] " " " " = 73.87, " " = 14.84
[6] " " " " = 41.15, " " = 47.81

error of confusing starch and carbohydrates. If the maximum figures of the Company's analysis are used, the starch and other carbohydrates would reach 8 per cent, whereas we find 14.84 per cent of total carbohydrates. The claim "Guaranteed to contain less than 5% of carbohydrates" is incorrect.

The following remarks in the Company's booklet under the caption "Vegetable Proteins" are exaggerated:

"Leading authorities are now agreed that meat, fish, eggs and other animal proteins are greatly inferior to vegetable proteins in diabetes, often increasing the sugar output, and the dangerous acidosis which leads to diabetic coma. . . . . After many years of experimentation we have succeeded in perfecting a process whereby the carbohydrates are excluded."

In this connection Von Noorden, whom the Company constantly quotes to suit its own purpose, says:

"In the slightest form [of diabetes], the influence of meat albumins is not great, and it is difficult to demonstrate the reaction of the patient to different forms of albumin. It may be necessary to add more albumin than the patient can actually take before the glycosuric indication is reached. . . . . Once a medium amount of albumin is exceeded, say 70-80 grams, the glycosuria increases, no matter what the type of albumin is."

No analysis of *40% Gluten Biscuit* is supplied by the Company, but no criticism can be made against the use of this name. The Company, however, claims that it is "Best for Diabetics," which is not true. Here as in the case of *40% Gluten Flour* the label states "A Good Gluten flour is made by the Battle Creek Sanitarium Co., Mich.," *Dr. Wm. Osler in Practice of Medicine.* "Of Gluten Foods many are unpalatable, others are frauds." We have no way of knowing to which gluten flour of the Company Dr. Osler had reference. Its *Pure Gluten Meal* might properly be called a "good gluten flour," but the *40% Gluten Flour* is no better, and no worse, than the average gluten flour on the market. The quotation from Osler gives an entirely false impression.

The analysis of *40% Gluten Flour* shows 6.37 per cent less protein than the Company's minimum and 10.35 per cent more carbohydrates than its maximum. In past years we have found this brand to vary from 35.0 to 42.9 per cent of protein (factor 5.7). It is true that in the case of this brand the Company fails to state the protein factor used, but even using 6.25 the protein would be only 36.88, 3.12 per cent below the minimum guaranty. The following statement, as applied to a food containing over 48 per cent of starch, does not seem tenable: "This food is of special service in cases of Glycosuria, and in the milder forms of Diabetes." With this brand the Company again uses the misleading quotation from Osler noted above.

The composition claimed for *40% Gluten Meal* is justified by our analysis. The following statement, however, is objectionable: "Prepared with great care from a good grade of Spring Wheat, by our special process, which preserves the natural food properties of the product." The Company evidently tries to carry water on both shoulders, on the one hand claiming the reduction in starch content, while on the other claiming the preservation of "the natural food properties."

The Company's analysis of *20% Gluten Meal* is confirmed. As the Company claims directly that this is "Not a Diabetic Food" any criticism of its use for that purpose is disarmed as far as the Company is concerned. However, exception again must be taken to the statement that "the natural properties of the product" are preserved.

The minimum protein claim for *Pure Gluten Meal* is justified. Here again the Company confuses carbohydrates and starch, and the food instead of containing from "0-5 per cent of carbohydrates (starch)" actually contains 16.77 per cent of carbohydrates with 6.77 per cent of starch. Once more the statement referring to "the natural food properties" is untrue, especially when applied to a wheat product deprived of most of its starch.

The inclusion on the label of the direction "Write for a copy of Diabetic Foods and How to Use Them" is a more or less direct invitation to self-treatment. In justice to the Company, however, it should be noted that on the labels of three of these preparations the following warnings are given:—"Every person suffering from diabetes should be under the care of an experienced physician," and on two of these also appear these words: "persons suffering from diabetes should use this food only on the advice of a physician."

Loeb's Preparations. The claim that *Loeb's Gluten Luft Bread* is "the best Bread for Diabetes" is open to serious objection. While as a rule the Loeb preparations agree quite satisfactorily with the composition claimed for them, individual products show far too wide variations in their composition from year to year. In some cases, such as *Gluten Luft Bread, Gluten Cracker Meal* and *Pure Gluten Flour,* the manufacturer has been quite successful in increasing the protein content and reducing the carbohydrates. In others, such as *Gluten Zwieback* and *Gluten Almond Zwieback,* there has been a very material reduction in fat with a corresponding increase in starch. Such variations as these emphasize the necessity of manufacturers standardizing their products more accurately, if they expect intelligent dietitians to use them.

The following tabulation shows the variations in composition of certain of the Loeb products in the past four years:

Year.		Protein.	Fat.	Carbohydrates.	Starch.
1913	Gluten Cracker Meal	27.8	7.7	53.5	40.2
1916	" " "	42.6	8.9	39.0	31.6
1913	Pure Gluten Flour	40.3	2.4	46.3	39.6
1916	" " "	47.8	1.0	41.7	35.8
1913	Genuine Gluten Bread	10.4	2.6	53.7	44.2
1913	" " "	25.8	2.7	27.8	23.9
1914	" " "	38.8	4.1	25.7	19.2
1916	" " "	35.4	0.2	35.0	26.4
1913	Gluten Luft Bread	27.9	9.2	54.2	44.1
1913	" " "	34.1	8.7	47.4	40.1
1914	" " "	52.4	13.2	26.0	22.9
1916	" " "	44.5	9.8	37.3	29.9
1914	Diabetic Bread Sticks	50.4	3.4	34.5	24.6
1916	" " "	46.3	0.3	42.2	35.0
1915	Gluten Zwieback	46.7	13.5	29.8	23.4
1916	" "	45.4	2.4	41.1	35.7
1913	Gluten Almond Zwieback	42.6	20.6	26.0	19.1
1916	" " "	44.0	6.1	39.6	33.1

CONDENSED MILK.

The new standards for condensed milks proposed by the Federal Committee on Food Definitions and Standards, and recently adopted by the organizations represented in that committee, are as follows:

"Condensed milk, evaporated milk, concentrated milk, is the product resulting from the evaporation of a considerable portion of the water from the whole, fresh, clean, lacteal secretion obtained by the complete milking of one or more healthy cows, properly fed and kept, excluding that obtained within fifteen days before and ten days after calving, and contains, all tolerances being allowed for, not less than 25.5 per cent of total solids, and not less than 7.8 per cent of milk fat."

"Sweetened condensed milk is the product resulting from the evaporation of a considerable portion of the water from milk to which sugar (sucrose) has been added. It contains, all tolerances being allowed for, not less than 28 per cent of total milk solids, and not less than 8 per cent of milk fat."

"Condensed skimmed milk, evaporated skimmed milk, concentrated skimmed milk, is the product resulting from the evaporation of a considerable portion of the water from skimmed milk, and contains, all tolerances being allowed for, not less than 20 per cent of milk solids."

"Sweetened condensed skimmed milk, sweetened evaporated skimmed milk, sweetened concentrated skimmed milk, is the product resulting from the evaporation of a considerable portion of the water from skimmed milk to which sugar (sucrose) has been added. It contains, all tolerances being allowed for, not less than 28 per cent of milk solids."

The above standards for both sweetened and unsweetened condensed milk are somewhat different from those hitherto official. In the unsweetened product the required solids have been reduced from 28 to 25.5 per cent, while the fat has been raised from 7.75 to 7.8 per cent. The phrase, "all tolerances being allowed for," in the standards makes the fat requirement considerably higher than would appear from a casual reading of the standard, as under the new standard the product must contain at least 7.8 per cent irrespective of any possible errors of analysis, which in some cases may amount to as much as 0.2 per cent. In the sweetened condensed milk standard no change is made in the solids, but the fat requirement is raised from 7.75 to 8 per cent.

The examination of condensed milk this year was undertaken chiefly to determine to what degree the manufacturers were complying with the new standards. The inspection included 18 samples of unsweetened, 21 of sweetened and 4 of sweetened condensed skimmed milk. The unsweetened and sweetened varieties have each been inspected by us twice before, and the following table shows the average composition of the samples in our three inspections.

	Unsweetened.			Sweetened.		
	1906	1909	1916	1904	1909	1916
Net weight, oz.	11.6	14.6	15.9	14.0	14.2	13.3
Cost per can, cents	8.5	10.2	9.4	10.3	10.8	11.4
Cost per pound, cents	11.7	11.2	9.4	11.8	12.3	13.7
In original material.						
Water	71.85	71.87	73.27	26.08	26.68	26.29
Total solids	28.15	28.13	26.73	73.92	73.32	73.71
Cane sugar	.....	.....	.....	40.32	40.05	40.57
Milk solids	28.15	28.13	26.73	33.60	33.27	33.14
Ash	1.68	1.55	1.55	1.90	7.73	1.80
Protein	7.75	7.57	6.92	8.77	8.30	7.90
Milk sugar	11.03	10.34	10.10	14.07	13.88	14.43
Fat	7.69	8.67	8.16	8.86	9.36	9.01
In the milk solids.						
Ash	5.97	5.81	5.80	5.68	5.23	5.43
Protein	27.53	26.91	25.89	26.17	25.09	23.84
Milk sugar	39.18	36.76	37.78	41.76	41.37	43.54
Fat	27.32	30.82	30.53	26.39	28.31	27.19

This comparison shows that the manufacturers are now supplying considerably more of the unsweetened milk in their packages at a correspondingly lower cost per pound; with the sweetened

TABLE III:—

Station No.	Brand and Manufacturer.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.
		cts.	oz.	oz.
7990	Armour's Veribest. Armour & Co., Chicago	10	16	15.9
7954	Peerless Brand. Borden's Condensed Milk Co., New York.	10	16	16.0
7973	Beauty Brand. Delavan Condensed Milk Co., Chicago	10	16	16.4
8088	A. & P. Brand. Great Atl. & Pac. Tea Co., Jersey City, N. J.	10	16	16.0
7972	Our Pet Brand. Helvetia Milk Cond. Co., Highland, Ill.	10	16	16.2
8092	Honor Brand. Highland Milk Cond. Co., Elkland, Pa.	5	6	6.1
8092	Honor Brand. Highland Milk Cond. Co., Elkland, Pa.	5	6	6.2
8026	Hires Gold Brand. Hires Cond. Milk Co., Philadelphia, Pa.	10	16	15.9
7978	Wilson's. Indiana Cond. Milk Co., Sheridan, Ind.	9	16	16.4
8002	Gold Cross. Mohawk Cond. Milk Co., New York	9	16	16.1
7946	Supreme. Morris and Co., Chicago	8	16	16.0
7974	Globe. National Cond. Milk Co., Chicago	10	16	15.9
7979	Carnation. Pacific Coast Cond. Milk Co., Seattle, Wash.,	9	16	15.9
8041	Belle Brook Brand. Seminole Cond. Milk Co., Holland Patent, N. Y.	9	15	15.3
8040	Lake View Brand. Seminole Cond. Milk Co., Holland Patent, N. Y.	8	15.5	15.3
7945	Van Camp's. The Van Camp Packing Co., Indianapolis, Ind.	10	16	16.0
7953	Lion Brand. Wisconsin Cond. Milk Co., Burlington, Wis.	10	16	15.6
7992	Mohican Brand. Wisconsin Cond. Milk Co., Burlington, Wis.	9	16	16.1
	Average.	*9.4	*15.9	*15.9

*Excluding 8092.

milks the reverse is true. The average composition of the unsweetened milks examined this year shows 1.4 per cent less milk solids than in 1909, the solids-not-fat showing a greater decline than the fat. The fat content this year is about the average of that found in 1906 and 1909. The fat in the milk solids is almost the same as in 1909, and considerably higher than in 1906. The ratio of protein to fat is a useful indication of the quality of the original milk used, a whole milk of good quality usually showing considerably more fat than protein. These ratios were 0.99, 1.15 and 1.18 for the three years, respectively. The original milk used in these unsweetened milks appeared to be of good quality and compares very favorably with that found in our 1909 inspection; this will be considered in more detail in a later paragraph.

UNSWEETENED CONDENSED MILK.

In Material as Sold. Water.	Solids.	Ash.	Protein (N x 6.38).	Milk Sugar.	Fat.	In Milk Solids. Ash.	Protein.	Milk Sugar.	Fat.
74.57	25.43	1.58	6.38	9.80	7.67	6.21	25.09	38.54	30.16
73.72	26.28	1.39	6.64	9.82	8.43	5.29	25.27	37.37	32.07
74.04	25.96	1.53	6.83	9.49	8.11	5.89	26.31	36.56	31.24
74.07	25.93	1.50	6.57	9.85	8.01	5.78	25.34	37.99	30.89
71.82	28.18	1.69	7.53	10.63	8.33	6.00	26.72	37.72	29.56
71.29	28.71	1.48	7.08	11.39	8.76	5.16	24.66	39.67	30.51
71.95	28.05	1.53	7.08	10.54	8.90	5.45	25.24	37.58	31.73
73.72	26.28	1.52	7.27	9.59	7.90	5.79	27.66	36.49	30.06
73.45	26.55	1.51	7.91	8.55	8.58	5.69	29.80	32.20	32.31
72.72	27.28	1.75	7.91	9.58	8.04	6.41	29.00	35.12	29.47
73.05	26.95	1.60	6.51	10.73	8.11	5.94	24.16	39.81	30.09
72.60	27.40	1.57	7.02	10.84	7.97	5.73	25.62	39.56	29.09
73.75	26.25	1.49	6.76	9.89	8.11	5.68	25.75	37.68	30.89
72.94	27.06	1.62	6.57	10.83	8.04	5.99	24.28	40.02	29.71
73.83	26.17	1.60	6.44	10.08	8.05	6.11	24.61	38.52	30.76
72.90	27.10	1.69	6.76	10.65	8.00	6.25	24.94	39.29	29.52
74.48	25.52	1.45	6.70	9.38	7.99	5.68	26.25	36.76	31.31
73.89	26.11	1.37	6.57	10.24	7.93	5.25	25.16	39.22	30.37
73.27	**26.73**	**1.55**	**6.92**	**10.10**	**8.16**	**5.80**	**25.89**	**37.78**	**30.53**

The milk solids found in the sweetened milks this year is almost the same as found in 1909. There is, however, a slight decrease in fat of 0.35 per cent, amounting to 1.12 per cent decrease when calculated on the basis of milk solids. The protein-fat ratio is 1.14 compared with 1.01 in 1904 and 1.13 in 1909. The milk used in the sweetened milks apparently is not of as high grade as that used in the unsweetened, as on the average the milk solids and fat in the former are 23.84 and 27.19 per cent compared with 25.89 and 30.53 per cent in the unsweetened milks.

The composition of a condensed milk depends not only upon the quality of the milk condensed but also on the amount of this condensation, the concentration being carried much further in the sweetened than in the unsweetened milks. Various methods

TABLE IV.—

Station No.	Brand and Manufacturer.	Price per Can.	Net Weight. Claimed.	Net Weight. Found.
		cts.	oz.	oz.
7950	Canada First. Aylmer Cond. Milk Co., Aylmer, Ont.	10	14	13.8
7951	Swiss Milk Berna. Berna Milk Co., Thonne, Switz	10	14	13.9
8035	Swiss Milk. Bernese Alps Milk Co., Stalden, Switz.	14	15	14.6
7952	Baby Brand. Borden's Cond. Milk Co., New York	18	12	12.3
7926	Challenge Brand. Borden's Cond. Milk Co., New York	12	12.5	12.4
8008	Daisy Brand. Borden's Cond. Milk Co., New York	10	14	15.1
8078	Defiance Brand. Borden's Cond. Milk Co., New York	13	12.5	12.6
7975	Dime Brand. Borden's Cond. Milk Co., New York	10	11	11.1
8073	Dixie Brand. Borden's Cond. Milk Co., New York	10	11	11.1
7976	Eagle Brand. Borden's Cond. Milk Co., New York	15	15.5	15.4
7936	Magnolia Brand. Borden's Cond. Milk Co., New York	10	14	14.0
8020	Benefit Brand. Direct Importing Co., Boston	11	14	14.0
8013	Milkman Brand. Holland Food Corporation, New York	11	14	14.1
8072	Kitten Brand. Hudson Cond. Milk Co., New York	12	12.5	12.3
7934	Libby's. Libby, McNeil & Libby, Chicago	10	11	11.2
8027	Gold Medal. Mohawk Cond. Milk Co., New York	11	14	14.0
7937	Sweet Clover Brand. Mohawk Cond. Milk Co., New York	12	14	13.7
8038	Butler's Brand. Seminole Cond. Milk Co., Holland Patent, N. Y.	10	12	12.7
8039	Essie Brand. Seminole Cond. Milk Co., Holland Patent, N. Y.	11	13	13.8
7927	Grandmother's A. & P. Wisconsin Cond. Milk Co., Burlington, Wis.	11	14	13.9
7928	Lion Brand. Wisconsin Cond. Milk Co., Burlington, Wis.	8	14	14.1
	Average.	**11.4**	**13.2**	**13.3**

SWEETENED CONDENSED

8024	Marvel Brand. M. Darlington's Sons, Pomeroy, Pa.	10	14.5	14.0
7989	Target Brand. Foster Packing Co., Chicago	10	14	14.3
8048	Square Brand. Hires Cond. Milk Co., Philadelphia, Pa.	10	12.6	12.7
7991	Van Troup Brand. South Holland Milk Corp., New York	8	14	14.0
	Average.	**9.5**	**13.8**	**13.8**

of calculation have been devised for determining this factor of condensation, but of course these yield only approximate results. In the following tables we have made this calculation based on 0.7 per cent of ash and 8.8 per cent of solids-not-fat in normal milk. The results secured by the two methods agree reasonably well, at any rate closely enough to warrant a judgment on the quality of the milk.

SWEETENED CONDENSED MILK.

In Material as Sold. Water.	Solids.	Cane Sugar.	Milk Solids.	Ash.	Protein (N x 6.38).	Milk Sugar.	Fat.	In Milk Solids. Ash.	Protein.	Milk Sugar.	Fat.
28.93	71.07	39.62	31.45	1.56	7.53	13.30	9.06	4.96	23.94	42.29	28.81
25.01	74.99	37.52	37.47	2.02	8.36	17.12	9.97	5.39	22.31	45.69	26.61
23.72	76.28	41.73	34.55	1.86	8.17	14.91	9.61	5.39	23.65	43.15	27.81
27.55	72.45	40.84	31.61	1.72	8.17	12.96	8.76	5.44	25.85	41.00	27.71
25.02	74.98	39.88	35.10	1.88	7.98	15.45	9.79	5.36	22.74	44.01	27.89
26.08	73.92	41.80	32.12	1.79	7.52	14.24	8.57	5.57	23.41	44.34	26.68
23.97	76.03	42.22	33.81	2.00	7.72	15.03	9.06	5.92	22.83	44.46	26.79
27.85	72.15	39.44	32.71	1.77	7.77	14.26	8.91	5.41	23.76	43.59	27.24
26.06	73.94	38.41	35.53	1.81	8.04	16.51	9.17	5.09	22.63	46.47	25.81
26.26	73.74	39.90	33.84	1.70	7.59	15.76	8.79	5.02	22.43	46.58	25.97
26.66	73.34	42.16	31.18	1.75	7.85	13.09	8.49	5.61	25.18	41.98	27.23
29.57	70.43	40.60	29.83	1.65	7.91	12.01	8.26	5.53	26.52	40.26	27.69
25.67	74.33	39.44	34.89	2.08	8.68	14.98	9.15	5.96	24.88	42.94	26.22
27.68	72.32	26.99	45.33	1.99	8.49	24.68	10.17	4.39	18.73	54.44	22.44
23.61	76.39	43.90	32.49	1.79	8.36	13.02	9.32	5.51	25.73	40.08	28.68
27.46	72.54	43.30	29.24	1.66	6.95	12.22	8.41	5.68	23.77	41.79	28.76
26.52	73.48	41.20	32.28	1.67	8.42	13.21	8.98	5.17	26.09	40.92	27.82
25.28	74.72	43.81	30.91	1.76	7.78	12.45	8.92	5.69	25.17	40.28	28.86
23.61	76.39	46.02	30.37	1.92	7.27	12.95	8.23	6.32	23.94	42.64	27.10
26.15	73.85	43.22	30.63	1.64	7.52	12.63	8.84	5.36	24.58	41.24	28.82
29.53	70.47	39.93	30.54	1.70	7.91	12.21	8.72	5.57	25.90	39.98	28.55
26.29	**73.71**	**40.57**	**33.14**	**1.80**	**7.90**	**14.43**	**9.01**	**5.43**	**23.84**	**43.54**	**27.19**

SKIMMED MILK.

28.60	71.40	48.22	23.18	1.86	8.29	12.36	0.67	8.03	35.76	53.32	2.89
26.32	73.68	38.63	35.05	1.90	8.74	23.37	1.04	5.42	24.93	66.67	2.97
28.34	71.66	47.45	24.21	1.71	8.36	13.28	0.86	7.06	34.53	54.85	3.56
29.80	70.20	37.83	32.37	2.19	9.57	20.00	0.61	6.77	29.56	61.78	1.89
28.26	**71.74**	**43.04**	**28.70**	**1.91**	**8.74**	**17.25**	**0.80**	**6.82**	**31.20**	**59.15**	**2.83**

The degree of condensation in the unsweetened milks ranges from 1.96 to 2.50 on the ash basis, and from 1.97 to 2.24 on the basis of solids-not-fat, the respective averages being 2.21 and 2.09. In the sweetened milks the corresponding condensation factors range from 3.69 to 5.08 and from 4.09 to 5.41, with averages of 4.32 and 4.56, respectively. These condensation factors, however, are of interest chiefly as a means for the

Table V.—Degree of Condensation.

Sweetened.

Brand.	Times Condensed. Based on .7% ash.	Times Condensed. Based on 8.9% solids-not-fat.	Fat in Original Milk. Based on .7% ash.	Fat in Original Milk. Based on 8.9% solids-not-fat.	Protein-Fat Ratio.
Canada First	3.69	4.17	4.02	3.56	1.20
Swiss Milk Berna	4.63	4.95	3.45	3.22	1.19
Bernese Swiss Milk	4.56	4.81	3.62	3.43	1.18
Baby	4.16	4.34	3.56	3.41	1.07
Challenge	4.47	4.73	3.64	3.44	1.23
Daisy	4.40	4.55	3.35	3.24	1.14
Defiance	4.95	4.81	3.17	3.26	1.17
Dime	4.18	4.41	3.52	3.34	1.15
Dixie	4.21	4.81	3.54	3.10	1.14
Eagle	4.04	4.68	3.62	3.13	1.16
Magnolia	4.32	4.41	3.40	3.33	1.08
Benefit	3.97	4.14	3.50	3.43	1.04
Milkman	4.90	4.72	3.08	3.20	1.05
Kitten	3.89	5.41	3.58	3.57	1.20
Libby's	4.55	4.63	3.65	3.59	1.11
Gold Medal	4.08	4.13	3.63	3.59	1.21
Sweet Clover	4.07	4.46	3.75	3.43	1.07
Butler's	4.47	4.40	3.55	3.61	1.15
Essie	5.08	4.61	3.00	3.31	1.13
A. and P.	4.12	4.31	3.78	3.61	1.18
Lion	4.05	4.08	3.58	3.55	1.10
Average	4.32	4.56	3.51	3.32	1.14

Table VI.—Degree of Condensation.

Unsweetened.

Brand.	Times Condensed. Based on .7% ash	Times Condensed. Based on 8.9% solids-not-fat.	Fat in Original Milk. Based on .7% ash.	Fat in Original Milk. Based on 8.9% solids-not-fat.	Protein-Fat Ratio.
Armour's	2.26	2.00	3.39	3.84	1.20
Peerless	1.99	2.01	4.22	4.19	1.27
Beauty	2.19	2.01	3.70	4.03	1.19
A. and P.	2.14	2.01	3.74	3.99	1.22
Our Pet	2.41	2.22	3.46	3.75	1.11
Honor	2.11	2.24	4.15	3.92	1.24
Honor	2.19	2.15	4.06	4.14	1.26
Hires'	2.17	2.07	3.64	3.81	1.09
Wilson's	2.16	2.02	3.97	4.25	1.08
Gold Cross	2.50	2.16	3.22	3.72	1.02
Supreme	2.29	2.12	3.54	3.83	1.25
Globe	2.24	2.18	3.56	3.66	1.13
Carnation	2.13	2.04	3.81	3.98	1.20

Belle Brook	2.31	2.14	3.48	3.76	1.22
Lake View	2.29	2.04	3.51	3.95	1.25
Van Camp's	2.41	2.15	3.32	3.72	1.18
Lion	2.07	1.97	3.86	4.06	1.19
Mohican	1.96	2.04	4.05	3.89	1.21
Average	2.21	2.09	3.69	3.90	1.18

approximate calculation of the fat content of the original milk. Applying them to the unsweetened milks we find the original fat to range from 3.22 to 4.22 per cent on the ash basis, and from 3.72 to 4.25 on the basis of solids-not-fat, with respective averages of 3.69 and 3.90 per cent. In the sweetened milks the corresponding fat percentages range from 3.00 to 4.02 and from 2.57 to 3.61, with respective averages of 3.51 and 3.32.

On the whole the original milks used in the unsweetened brands appear to be of the quality of good average market milk. In the sweetened milks, however, the quality of the original milk is not always beyond suspicion.

With reference to the requirements of the standards only one of the unsweetened milks is deficient, **7990**, containing 0.07 per cent less solids and 0.13 per cent less fat than the standard requires. The milk solids in all the samples range from 25.43 to 28.71, and the fat from 7.67 to 8.90 per cent. Only three of the brands satisfy the older standard of 28 per cent milk solids.

All of the sweetened milks satisfy the standard, ranging from 29.24 to 45.33 per cent milk solids and from 8.26 to 10.17 per cent fat. In certain samples, particularly **8072**, an apparently abnormal percentage of milk sugar is shown, and the corresponding apparent deficiency of fat in the milk solids. The low cane sugar percentage found in this sample suggests a partial inversion of cane sugar during condensation, so that the method used for determining milk sugar in the finished product gives the sum of the lactose and of the invert sugar calculated as lactose. It is quite possible that inversion of cane sugar may increase in all the samples the calculated amount of lactose, and hence diminish the ratio of fat in the milk solids.

Claims of the Manufacturers.

In our inspection of 1909 attention was called to the very misleading directions for dilution then given on the labels of many condensed milks. By following these older directions an

extremely dilute product was obtained, which was quite unfit for the purposes indicated. From our tables it is apparent that none of the brands can be diluted with much more than 1.5 parts of water to one of the milk and still yield a product equalling standard milk in fat content. It is gratifying to notice a decided change for the better in the directions on many of the labels. A very common claim made this year by many of the brands is as follows:—"By adding one part of water to one part of the contents of this can a resulting milk product will be obtained which will not be below the legal standard for whole milk." This claim is correct as applied to all the brands of unsweetened milks examined this year. Such a diluted product will closely resemble market milk in composition. However, the same claim is made on the labels of nine brands of sweetened milk, and with these it is less tenable. To average composition of a sweetened milk thus diluted would show 36.85 solids, 20.28 cane sugar, 0.90 ash, 3.95 protein, 7.22 milk sugar and 4.50 per cent fat, a product very different from normal milk.

The *Essie Brand,* **8039,** makes the following claim:—"3 or 4 parts of water to one of condensed milk will make a rich milk." Giving the brand the full benefit of the lower dilution, 3 parts of water, such a diluted product would contain only 2.06 per cent fat, by no means "a rich milk."

It is in connection with the directions for infant feeding, however, that the severest criticism must be made as to the manufacturer's claims. The following table gives the composition of the food intended for infants of the ages specified when made according to the formulas recommended by the various manufacturers on the labels. Where alternative proportions are given, the greater concentration was used in the calculation, thus giving the manufacturer every advantage. In the table is also shown the average composition of mother's milk when the infants are from 5 to 6 and from 20 to 40 days old.

TABLE VII.—COMPOSITION OF MIXTURES FOR INFANT FEEDING PREPARED AS DIRECTED.

Age of Infant.	Prop. Milk to water.	Water.	Milk Solids.	Cane Sugar.	Ash.	Protein.	Milk Sugar.	Fat.
Our Pet, 1st week	½ tea. milk, ¼ tea. sugar, 1 oz. water	95.26	1.71	3.03	0.10	0.46	0.66	0.52

Age of Infant.	Prop. Milk to water.	Water.	Milk Solids.	Cane Sugar.	Ash.	Protein.	Milk Sugar.	Fat.
Wilson's, 1st week	½ tea. milk, ¼ tea. sugar, 1 oz. water	95.35	1.62	3.03	0.09	0.48	0.52	0.52
Bernese, " "	1 to 14	94.91	2.31	2.78	0.12	0.54	0.99	0.64
Eagle, " "	½ tea. milk, 1½ oz. water	95.08	2.26	2.66	0.11	0.51	1.05	0.59
Baby, " "	½ tea. milk, 1½ oz. water	95.17	2.11	2.72	0.11	0.54	0.86	0.58
Peerless, 1st month,	1 to 6 or 7	96.25	3.75	...	0.20	0.95	1.40	1.20
Globe, " "	1 to 6 or 7	96.09	3.91	...	0.22	1.00	1.55	1.14
Kitten, " "	1 to 13	94.83	3.24	1.93	0.14	0.61	1.76	0.73
Armour's, Not stated,	1 to 5 or 6	95.76	4.24	...	0.26	1.06	1.63	1.28
Hires', " "	1 to 4 or 6	94.74	5.26	...	0.30	1.45	1.92	1.50
Libby's, " "	1 to 7 or 14	90.45	4.06	5.49	0.22	1.05	1.63	1.17
Dime, " "	1 to 8 or 14	91.98	3.64	4.38	0.20	0.86	1.58	0.99
Berna, " "	1 to 14	95.00	2.50	2.50	0.13	0.56	1.14	0.66
Mother's milk, 5 to 6 days,		**87.91**	**12.09**	...	**0.30**	**1.83**	**5.83**	**3.26**
" " **20 to 40 days,**		**87.52**	**12.48**	...	**0.22**	**1.30**	**6.52**	**3.91**

It is evident from the table how deficient diets, prepared according to these directions, will be for the young child. In no case do the resultant mixtures even approximate the composition of human milk, the deficiencies in protein and fat being especially striking. In the sweetened milks cane sugar makes up from 30 to 60 per cent of the solids in the child's diet. The seriousness of the matter lies in the fact that many ignorant mothers, trusting to the manufacturer's directions, offer to their babies diets which by no possibility can maintain them or secure adequate growth.

CONDENSED SKIMMED MILK.

Four samples were examined, two of which, **8024** and **8048,** did not satisfy the standard's requirement of 28 per cent milk solids. Both **7989** and **7991** had a reddish tinge and their odor was disagreeable. (For analyses see Table IV.)

The average cost of the condensed skimmed milks was 9.5 cents per can, about the same as for unsweetened condensed milk and two cents less than that of sweetened condensed milk.

SKIM MILK POWDERS.

5580. *Borden's White Cross Skimilkris,* Borden's Condensed Milk Co., New York. "A dried, skimmed cow's milk in crystal form."

8681. *Soluble Dry Milk,* W. A. Randel and Co., Seymour, Conn. "It's cow's (separator skim) milk, dry."

	5580	8681
Water	2.90	3.37
Protein (N x 6.38)	35.73	34.45
Ash	8.30	8.10
Fat	1.93	1.46
Milk sugar	51.14	52.62

The analysis of these two products is very similar. In these days of high prices there is every reason to recommend foods of this kind, especially as their production represents a distinct conservation of our food resources. Too often fat is considered the only valuable constituent of milk, the value of the protein being almost entirely overlooked. At the present time skim milk is one of our cheapest sources of protein.

The sample of *Soluble Dry Milk* was sent in to us and we have not seen the label of the original package. Such a brand name for a skim milk product would of course be improper.

SPICES.

In the earlier inspections of food products in this state the spices as a rule were found to be quite seriously adulterated. Repeated inspections with the consequent publication of the results obtained gradually improved conditions until it was believed that the spices sold in Connecticut were as free from adulteration as those sold in any part of the country. The later inspections being so favorable, only a desultory examination of spices, except ginger, has been made here since 1907. In order to determine, therefore, whether equally favorable conditions still maintained in the state, a general inspection, including 205 samples, was made this year of the more commonly used spices, except ginger and cinnamon, sold in package form. An inspection of sage and thyme was also included in order to secure analytical data as an aid to the formulation of standards for these seasoning materials.

A summary of the results of the inspection in 1916 is given below:

	No. of Samples.	Standard.	Below Standard.	Purity. %
Allspice	24	21	3	88
Cloves	27	21	6	78
Mustard	30	30	0	100
Pepper, black	32	28	4	88
Pepper, cayenne	28	8	20	29
Pepper, white	28	24	4	86
Sage	20	..	..	..
Thyme	16	..	..	..

Before discussing the results of the present inspection it is of interest to compare present conditions with those found in earlier years. The following table shows the percentage purity found in the different years from 1896 to the present time:

Percentage Purity of Spices.

	'96	'97	'98	'01	'02	'04	'05	'06	'07	'08	'16
Allspice	..	54	81	63	97	71	..	98	84	..	88
Cinnamon	..	76	92	79	93	90	..	..	100	..	..
Cloves	..	54	65	76	86	78	..	..	82	..	78
Ginger	..	..	74	84	..	..	100	..	88	89	..
Mustard	22	..	69	55	..	..	88	84	94	..	100
Pepper, black	59	67	86	59	55	55	78	78	88	..	88
Pepper, cayenne	..	60	*100	85	65	65	..	59	..	..	29
Pepper, white	71	80	†92	76	47	47	75	87	96	..	86

The present inspection is fairly satisfactory except in the case of cayenne pepper, which makes the poorest showing noted in any of our inspections. It is of interest to note, however, that whereas in our earlier examinations of spices very frequently foreign matters were present and the spices were grossly adulterated, to-day such is rarely found to be the case. Microscopical examination showed one brand of cloves to contain excessive stems, three each of black and white pepper with excessive pepper shells, and one of cayenne pepper with cereal starch. In other words, of 169 samples only one contained material foreign to the spices in question. This is by far the best showing ever made for spices sold in this state.

A study of the individual spices will show in more detail the nature and amount of the adulteration observed.

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* Only 14 brands. † Only 13 brands.

TABLE VIII:—

Station No.	Manufacturer and Brand.
	Not found adulterated.
7141	Acker, Merrall and Condit, New York
6701	Austin, Nichols and Co., New York. Republic Brand
7057	Austin, Nichols and Co., New York. Sunbeam Brand
7045	The Wm. Boardman and Sons Co., Hartford
7147	James Butler, New York. Peerless Brand
7129	Andrew Davey, New York. Atlas Brand
7096	Davey Bros., Bridgeport
7087	Direct Importing Co., Boston. Benefit Brand
6742	E. R. Durkee and Co., New York. Gauntlet Brand
7124	East India Tea Co., So. Norwalk
6755	Grand Union Tea Co., Brooklyn, N. Y.
6737	Great Atl. and Pac. Tea Co., Jersey City, N. J. Red Front Brand
7062	Chas. G. Lincoln & Co., Hartford. Capitol Mills Brand
6748	Logan Bros. Co., New Haven. L. B. C. Brand
6685	The Mohican Co., New York. Mohican Brand
6759	Seeman Bros., New York. White Rose Brand
6705	The Shartenberg and Robinson Co., New Haven. Alliance Brand
6700	Stickney and Poor Spice Co., Boston, Mass.
7102	Union Pacific Tea Co., New York. Sovereign Brand
7093	Village Store Co., Bridgeport. Mardor Brand
7037	The Williams and Carleton Co., Hartford
	Adulterated or below standard.
7118	A. F. Beckmann and Co., New York. Crown Aster Brand
7165	The A. Colburn Co., Philadelphia, Pa.
7111	No manufacturer given (Sold by Erberle's Delicatessen, Bridgeport)

ALLSPICE.

U. S. Standard. "The dried fruit of *Pimenta pimenta,* and contains not less than 8 per cent of quercitannic acid, not more than 6 per cent of total ash, not more than 0.5 per cent of ash insoluble in hydrochloric acid, and not more than 25 per cent of crude fibre."

Twenty-one of the 24 samples fully satisfied this standard. **7118** contained an excess of total ash and acid-insoluble ash (sand), while **7165** and **7111** each contained a slight excess of crude fiber.

The following averages for the 21 brands show the liberality of the standard:

	Average.	Standard.
Ash, total	4.99	6
Ash, acid-insoluble	0.13	0.5
Crude fiber	22.14	25

ALLSPICE.

Cost per package.	Net Weight. Claimed.	Net Weight. Found.	Ash. Total.	Ash. Insoluble in acid.	Crude Fiber.	Microscopical Examination.
cts.	oz.	oz.				
10	4	4.2	4.63	0.06	21.60	o. k.
9	4	4.2	4.75	0.13	21.95	o. k.
10	3	3.1	5.15	0.18	22.80	o. k.
10	4	4.1	4.73	0.03	21.10	o. k.
12	4	4.0	5.12	0.07	23.53	o. k.
10	4	4.0	5.73	0.47	21.03	o. k.
10	3	3.2	4.13	0.00	19.60	o. k.
7	3	3.1	4.73	0.08	24.12	o. k.
13	3	3.2	4.56	0.02	23.18	o. k.
10	4	3.7	5.17	0.28	24.50	o. k.
10	2.5	2.8	5.12	0.04	22.53	o. k.
7	4	3.8	4.60	0.04	21.95	o. k.
10	4	3.8	4.75	0.05	22.28	o. k.
10	4	4.2	4.84	0.04	22.78	o. k.
10	4	4.2	5.96	0.50	20.93	o. k.
10	4	3.9	5.40	0.20	22.10	o. k.
8	4	3.7	4.97	0.17	23.08	o. k.
10	4	3.7	5.05	0.06	20.13	o. k.
10	2	2.5	4.53	0.05	21.40	o. k.
10	4	4.0	5.65	0.18	23.25	o. k.
10	4	4.0	5.18	0.03	21.03	o. k.
15	4	4.1	6.37	1.97	20.63	o. k.
15	..	7.7	5.05	0.31	25.06	o. k.
5	2	2.0	5.15	0.10	25.13	o. k.

All the samples but one, **7165**, bore the required statement of net weight. Three samples, **7124, 6705** and **6700,** showed a deficiency of 0.3 oz. in a 4 oz. package. The most popular sized package, 4 oz., sold at prices ranging from 7 to 15 cents.

CLOVES.

U. S. Standard. "The dried flower buds of *Caryophyllus aromaticus,* which contains not more than 5 per cent of clove stems, not less than 10 per cent of volatile ether extract, not less than 12 per cent of quercitannic acid, not more than 8 per cent of total ash, not more than 0.5 per cent of ash insoluble in hydrochloric acid, and not more than 10 per cent of crude fiber."

Twenty-one of the 27 samples fully satisfied this standard. Five brands, **7048, 7157, 7130, 6745** and **7152,** contained an

TABLE IX:—

Station No.	Manufacturer and Brand.
	Not found adulterated.
7137	Acker, Merrall and Condit Co., New York
7151	James Butler, New York. Peerless Brand
7176	Clark, Chapin and Bushnell, New York. Elite Brand
7101	Davey Bros., Bridgeport
7173	Lewis De Groff and Son, New York. Health Brand
7086	Direct Importing Co., Boston. Benefit Brand
6740	E. R. Durkee and Co., New York. Gauntlet Brand
7123	East India Tea Co., South Norwalk
7154	B. Fischer and Co., New York
6753	Grand Union Tea Co., Brooklyn, N. Y.
7068	The Great Atl. and Pac. Tea Co., Jersey City, N. J. Sultana Brand
7161	Edw. E. Hall and Son, New Haven. (Amboyna.)
7114	Francis H. Leggett and Co., New York. Premier Brand
7065	Chas. G. Lincoln and Co., Hartford. Capitol Mills Brand
7071	The Mohican Co., New York. Mohican Brand
7066	D. and L. Slade Co., Boston, Mass.
7056	Stickney and Poor Spice Co., Boston, Mass.
7104	Union Pacific Tea Co., New York. Sovereign Brand
7095	Village Store Co., Bridgeport. Mardor Brand
7038	The Williams and Carleton Co., Hartford
7110	No manufacturer given (Sold by Erberle's Delicatessen, Bridgeport)
	Adulterated or below standard.
7048	Austin, Nichols and Co., New York. Sunbeam Brand
7118	A. F. Beckmann and Co., New York. Crown Aster Brand
7157	Bennett, Simpson and Co., New York. (Amboyna.)
7130	Andrew Davey, New York. Atlas Brand
6745	Logan Bros. Co., New Haven. L.B.C. Brand
7152	Logan Bros. Co., New Haven. L.B.C. Brand

excess of acid-insoluble ash (sand), while **7118** contained an excess of fiber, due to excessive clove stems.

That the standard is unduly liberal as regards ash and volatile ether extract is shown by the average composition of the unadulterated samples:

	Average.	Standard.
Ash, total	6.44	8
Ash, acid-insoluble	0.35	0.5
Crude fiber	8.84	10
Volatile ether extract	17.57	10

CLOVES.

Cost per package.	Net weight. Claimed.	Net weight. Found.	Ash. Total.	Ash. Insoluble in acid.	Crude Fiber.	Volatile Ether Extract.	Microscopical Examination.
cts.	oz.	oz.					
15	4	4.0	6.12	0.34	8.98	19.51	o. k.
12	4	3.6	6.38	0.34	8.90	18.12	o. k.
15	4	4.8	6.31	0.23	8.80	18.74	o. k.
10	3	3.1	6.05	0.20	8.78	17.28	o. k.
10	2.7	2.6	6.44	0.36	9.80	17.43	o. k.
8	2	2.0	6.30	0.35	8.23	17.56	o. k.
10	3	3.2	6.34	0.42	7.33	18.87	o. k.
10	4	3.8	6.25	0.31	8.35	17.80	o. k.
10	2	2.0	7.08	0.35	9.53	17.40	o. k.
10	2.5	3.0	6.35	0.31	8.90	17.95	o. k.
10	4	3.8	6.48	0.38	9.55	16.92	o. k.
15	4	4.4	6.48	0.37	8.43	17.24	o. k.
10	4	4.1	6.38	0.48	8.65	17.76	o. k.
10	4	3.9	6.45	0.38	9.03	16.72	o. k.
10	4	4.2	6.60	0.40	9.08	17.15	o. k.
10	4	3.9	6.68	0.30	9.03	16.62	o. k.
10	4	4.2	6.53	0.35	9.15	16.85	o. k.
10	2	3.0	6.38	0.33	8.03	18.21	o. k.
10	4	4.0	6.30	0.45	8.53	18.90	o. k.
13	4	4.0	6.73	0.40	9.05	16.35	o. k.
5	2	2.0	6.58	0.25	9.58	15.66	o. k.
15	4	4.1	6.55	0.70	7.90	18.49	o. k.
15	4	4.1	6.95	0.28	10.53	14.51	excess of stems
15	4	4.1	6.94	0.75	9.33	18.96	o. k.
10	4	3.7	6.68	0.54	9.45	16.81	o. k.
13	4	4.7	6.94	0.51	9.18	16.39	o. k.
13	4	4.1	6.83	0.53	9.45	17.75	o. k.

All the brands bore a statement of net weight, two brands, **7151** and **7130**, showing respective deficiencies of 0.4 and 0.3 oz. in 4 oz. packages. The price of the 4 oz. packages ranged from 10 to 15 cents, that of the 2 oz. from 5 to 10 cents.

MUSTARD.

U. S. Standard. "A powder made from mustard seed, with or without the removal of the hulls and a portion of the fixed oil, and contains not more than 2.5 per cent of starch and not more than 8 per cent of total ash."

TABLE X:—

Station No.	Manufacturer and Brand.
	Not found adulterated.
7139	Acker, Merrall and Condit Co., New York
7174	Austin, Nichols and Co., New York. Republic Brand
7149	James Butler, New York. Peerless Brand
7076	Clark, Chapin and Bushnell, New York. Elite Brand
6697	J. and J. Colman, London. Double Superfine
7128	Andrew Davey, New York. Atlas Brand
7097	Davey Bros., Bridgeport
7172	Lewis De Groff and Son, New York. Health Brand
7090	Direct Importing Co., Boston, Mass. Benefit Brand
6744	E. R. Durkee and Co., New York. Gauntlet Brand
7122	East India Tea Co., South Norwalk
7181	B. Fischer and Co., New York. English Style
7153	B. Fischer and Co., New York. Strictly Pure
7169	Edwin J. Gillies and Co., New York. Tiger Head Brand
6756	Grand Union Tea Co., Brooklyn, N. Y.
6714	Great Atl. and Pac. Tea Co., Jersey City, N. J. Red Front Brand
7163	Edw. E. Hall and Son, New Haven. English
7080	Howland's, Bridgeport. Howco Brand
7041	The E. S. Kibbe Co., Hartford
7156	Francis H. Leggett and Co., New York. Premier Brand
7060	Chas. G. Lincoln and Co., Hartford. Capitol Mills Brand
7074	Lincoln, Seyms and Co., Hartford. Union Club Brand
6750	Logan Bros. Co., New Haven. L.B.C. Brand
6687	The Mohican Co., New York. Mohican Brand
7126	Seeman Bros., New York. White Rose Brand
7034	D. and L. Slade Co., Boston, Mass.
7106	Union Pacific Tea Co., New York. Sovereign Brand
6693	James Van Dyck Co., New York. Ambassador Brand
7094	Village Store Co., Bridgeport. Mardor Brand
7039	The Williams and Carleton Co., Hartford

* No artificial color in any of the samples.
† Contained traces of charlock.

All of the 30 samples satisfied this standard. Nine of the samples contained traces of charlock, but this was deemed an accidental, rather than an intentional, adulteration.

Again the extreme liberality of the standard is shown when it is compared with the average composition of these commercial brands. Of the 30 samples only three show over one per cent of starch, while the standard permits 2.5 per cent.

MUSTARD.*

Cost per package.	Net Weight. Claimed.	Net Weight. Found.	Ash.	Starch.	Microscopical Examination.
cts.	oz.	oz.			
15	4	4.0	5.74	0.17	o. k.
8	3.2	3.5	5.16	0.84	†
12	4	4.1	5.41	0.73	†
10	4	4.2	5.28	0.28	o. k.
16	4	4.1	4.60	0.11	o. k.
10	4	4.3	5.47	0.37	†
10	3	3.6	4.78	0.68	†
10	4	4.0	5.34	0.56	o. k.
7	4	4.0	7.63	1.95	o. k.
10	3	3.4	4.82	0.45	o. k.
10	4	3.9	4.38	0.68	o. k.
5	1.75	2.0	4.49	0.56	†
10	2	2.2	5.93	0.56	o. k.
10	4	4.1	5.06	0.73	o. k.
10	2.75	2.8	5.41	0.11	o. k.
7	4	4.0	5.55	1.29	o. k.
15	4	3.8	4.33	trace	o. k.
10	4	4.1	5.08	0.11	o. k.
10	4	4.2	5.70	0.60	o. k.
10	4	4.1	4.83	0.17	o. k.
10	4	3.8	5.98	0.58	o. k.
10	4	4.1	5.60	0.59	o. k.
10	4	4.3	5.32	0.72	†
10	4	4.2	5.02	0.91	†
15	4	4.3	5.33	0.50	o. k.
10	3	3.1	5.20	1.07	†
10	2	2.8	4.48	0.39	o. k.
12	4	4.2	5.03	0.37	o. k.
10	4	4.1	4.88	0.43	†
10	4	3.9	5.38	0.90	o. k.

	Average.	Standard.
Ash	5.91	8
Starch	0.58	2.5

All the samples bore a statement of net weight, which was practically satisfied in all cases. The cost of 4 oz. packages ranged from 7 to 15 cents.

TABLE XI:—

Station No.	Manufacturer and Brand.	Cost per package.	Net Weight. Claimed.	Net Weight. Found.	Ash. Total.	Ash. Insoluble in acid.	Crude Fiber.	Starch.	Non-volatile ether extract.	Microscopical Examination.
		cts.	oz.	oz.						
	Not found adulterated.									
7140	Acker, Merrall and Condit Co., New York	10	4	4.2	6.37	1.41	10.75	39.82	8.08	o. k.
6703	Austin, Nichols and Co., New York. Republic Brand	9	4	4.2	5.06	0.57	13.23	35.44	7.29	o. k.
7058	Austin, Nichols and Co., New York. Sunbeam Brand	10	3	3.1	6.53	1.23	11.68	37.63	7.76	o. k.
7112	A. F. Beckmann and Co., New York. Crown Aster Brand	10	4	3.9	6.33	0.96	12.55	36.73	7.41	o. k.
6683	Bennett, Simpson and Co., New York. (Genuine Malabar.)	14	4	4.1	4.02	0.16	12.15	39.78	6.86	o. k.
6712	A. C. Blenner and Co., New Haven. Diamond Brand	10	1.5	1.7	6.85	1.15	13.45	35.05	8.72	o. k.
7146	James Butler, New York. Peerless Brand	10	4	4.3	6.76	1.35	12.13	35.61	7.57	o. k.
7177	Clark, Chapin and Bushnell, New York. Elite Brand	10	4	4.1	4.77	0.15	11.78	37.30	8.34	o. k.
7167	The A. Colburn Co., Philadelphia, Pa.	15	..	7.5	5.23	0.67	12.73	40.39	8.41	o. k.
7099	Davey Bros., Bridgeport	10	3	3.1	5.28	0.60	14.85	33.25	7.74	o. k.
7088	Direct Importing Co., Boston, Mass., Benefit Brand	7	3	2.9	6.15	1.18	10.40	42.58	7.64	o. k.
6741	E. R. Durkee and Co., New York. Gauntlet Brand	10	3	3.2	5.71	1.18	10.83	40.78	8.40	o. k.
7125	East India Tea Co., South Norwalk	10	3	3.0	6.64	1.50	11.20	41.40	7.71	o. k.
6757	B. Fischer and Co., New York	10	1.5	1.3	6.95	1.52	14.18	34.76	8.23	o. k.
6707	B. Fischer and Co., New York	10	2	2.0	4.70	0.08	10.33	39.88	8.50	o. k.
6754	Grand Union Tea Co., Brooklyn, N. Y.	10	2.5	2.8	6.58	1.33	13.60	34.42	7.50	o. k.
6738	Great Atl. and Pac. Tea Co., Jersey City, N. J. Red Front Brand	7	4	4.1	5.55	0.89	9.85	43.37	8.12	o. k.
6696	Edw. E. Hall and Son, New Haven. (Singapore.)	13	4	4.1	5.86	0.86	11.33	37.86	8.21	o. k.
7040	The E. S. Kibbe Co., Hartford	10	4	4.1	5.83	1.43	14.60	32.90	8.09	o. k.
7171	Francis H. Leggett and Co., New York. Premier Brand	10	4	4.1	6.62	1.43	11.10	39.38	7.62	o. k.
6749	Logan Bros. Co., New Haven. L.B.C. Brand	10	4	4.3	6.45	1.02	14.10	32.62	8.51	o. k.
6711	Miner, Read and Tullock, New Haven. Sunrise Brand	10	4	3.8	6.23	1.55	13.58	33.69	7.83	o. k.
6686	The Mohican Co., New York. Mohican Brand	10	4	4.0	5.00	0.11	11.10	38.25	7.56	o. k.
6761	D. and L. Slade Co., Boston, Mass.	10	4	3.9	5.23	0.00	11.93	38.87	7.30	o. k.
7050	Sprague, Warner and Co., Chicago. Richelieu Brand	10	2	1.9	4.98	0.18	13.48	35.89	7.23	o. k.
6699	Stickney and Poor Spice Co., Boston, Mass.	10	4	3.6	5.80	0.68	13.68	34.65	8.98	o. k.
7108	Union Pacific Tea Co., New York. Sovereign Brand	10	2	2.8	6.83	1.35	11.28	38.59	7.77	o. k.
7079	Village Store Co., Bridgeport. Mardor Brand	10	4	3.8	5.38	0.25	13.13	34.15	7.55	o. k.
	Adulterated or below standard.									
7067	Seeman Bros., New York. White Rose Brand	10	4	4.0	6.30	0.88	15.70	33.58	7.79	excess shells
6691	James Van Dyk Co., New York. Ambassador Brand	12	4	4.1	6.03	1.16	16.18	30.60	7.64	excess shells
7077	Ross W. Weir and Co., New York. Tiger Head Brand	10	4	4.0	6.08	0.93	17.05	28.24	8.53	excess shells
7164	The Williams and Carleton Co., Hartford. Williams' Brand	10	3	3.2	7.15	1.79	11.58	39.71	8.10	o. k.

BLACK PEPPER.

U. S. Standard. "The dried immature berry of *Piper nigrum,* and contains not less than 6 per cent of non-volatile ether extract, not less than 25 per cent of starch, not more than 7 per cent of total ash, not more than 2 per cent of ash insoluble in hydrochloric acid, and not more than 15 per cent of crude fiber."

BLACK PEPPER.

Twenty-eight of the 32 samples satisfied this standard. **7164** contained an excess of ash, while **7067, 6691** and **7077** contained excessive pepper shells. The standard is so liberal as regards crude fiber that manufacturers at times take advantage of it by adding ground pepper shells to a high-grade pepper, a practice which of course constitutes adulteration, although the sample may meet the standard's requirements.

A comparison of the average composition of the unadulterated samples with the standard shows that the latter is in great need of revision, particularly as regards insoluble ash, crude fiber and starch:

	Average.	Standard.
Ash, total	5.85	7
Ash, acid-insoluble	0.89	2
Crude fiber	12.32	15
Starch	37.32	25
Non-volatile ether extract	7.90	6

All but one of the samples, **7167,** bore the required statement of net weight. All but two of these were full-weight, **6757** showing a shortage of 0.2 oz. with 1.5 oz. claimed, and **6699** a shortage of 0.4 oz. in a 4 oz. package. The cost of 4 oz. packages ranged from 7 to 14 cents, whereas the two 1.5 oz. samples each cost 10 cents.

Cayenne Pepper.

U. S. Standard. "The dried ripe fruit of *Capsicum frutescens, C. baccatum,* or some other small-fruited species of *Capsicum,* and contains not less than 15 per cent of nonvolatile ether extract, not more than 6.5 per cent of total ash, not more than 0.5 per cent of ash insoluble in hydrochloric acid, not more than 1.5 per cent of starch, and not more than 28 per cent of crude fiber."

Only 8 of the 28 samples satisfied this standard. All but one of the deficient samples showed an excess of acid-insoluble ash (sand). **6702, 6706, 6694, 7064** and **6710** showed also an excess of total ash. **7166, 7089** and **7091** showed high total ash, high insoluble ash and low nonvolatile ether extract. **7121, 6688** and **7109** were deficient in nonvolatile ether extract, **7166** and **7109** showing the unusually low percentages of 9.22 and 6.57, respectively: the last named sample also showed an excess of starch. **7107** was adulterated with cereal starch, containing nearly four times as much starch as permitted by the standard.

Apparently the cayenne pepper coming into our ports is frequently very dirty and manufacturers have some difficulty in cleaning it sufficiently to meet the standard. In spite of the criticism often heard that this standard is too exacting it is evident from the analyses here reported that certain manufacturers are able to meet it without charging the consumer excessive prices for the purified spice. This fact is clearly shown by the average composition of the standard and sub-standard spices.

	Standard.	Sub-standard.
Ash, total	5.84	6.48
Ash, acid-insoluble	0.36	0.79
Crude fiber	24.37	24.25
Starch	1.17	1.13*
Non-volatile ether extract	16.59	15.50

All but one of the samples, **7166,** bore the required statement of net weight. Three samples showed a decided shortage, **7121** 0.5 oz. in a 4 oz., **6706** 0.2 oz. in a 2 oz., and **6694** 1.1 oz. in a 3 oz. package; the last named brand contained only about one-third of the weight claimed. The cost of 4 oz. packages ranged from 7 to 15 cents, that of 2 oz. from 5 to 10 cents.

White Pepper.

U. S. Standard. "The dried mature berry of *Piper nigrum,* from which the outer coating, or the outer and inner coatings, have been removed, and contains not less than 6 per cent of nonvolatile ether extract, not less than 50 per cent of starch, not more than 4 per cent of total ash, not more than 0.5 per cent of ash insoluble in hydrochloric acid, and not more than 5 per cent of crude fiber."

Twenty-four of the 28 samples satisfied this standard. **7061** exceeded the limit for total ash and acid-insoluble ash, while **7098, 6704** and **7043** contained excessive fiber due to an excess of pepper shells.

The average composition of the unadulterated samples as compared with the standard is shown below. The standard for total ash and insoluble ash is far too liberal.

	Average.	Standard.
Ash, total	1.69	4
Ash, acid-insoluble	0.16	0.5
Crude fiber	3.79	5
Starch	57.92	50
Non-volatile ether extract	8.20	6

* Excluding **7107.**

TABLE XII:—

Station No.	Manufacturer and Brand.
	Not found adulterated.
7178	Clark, Chapin and Bushnell, New York. Elite Brand
6743	E. R. Durkee and Co., New York. Gauntlet Brand
6739	Great Atl. and Pac. Tea Co., Jersey City, N. J. Red Front Brand
7155	Francis H. Leggett and Co., New York. Premier Brand
7033	The E. S. Kibbe Co., Hartford
6713	Miner, Read and Tullock, New Haven. Sunrise Brand
7135	R. C. Williams and Co., New York. Royal Scarlet Brand Paprika
7117	The Williams and Carleton Co., Hartford. Williams' Brand
	Adulterated or below standard.
7136	Acker, Merrall and Condit Co., New York
6702	Austin, Nichols and Co., New York. Republic Brand
7150	James Butler, New York. Peerless Brand
7166	†The A. Colburn Co., Philadelphia, Pa.
7131	Andrew Davey, New York. Atlas Brand
7100	Davey Bros., Bridgeport
7089	Direct Importing Co., Boston, Mass. Benefit Brand
7121	East India Tea Co., South Norwalk
6706	B. Fischer and Co., New York
6752	Grand Union Tea Co., Brooklyn, N. Y.
6694	Edw. E. Hall and Son, New Haven. (Zanzibar.)
7064	Chas. G. Lincoln and Co., Hartford. Capitol Mills Brand
6746	Logan Bros. Co., New Haven. L.B.C. Brand
6688	The Mohican Co., New York. Mohican Brand
7042	Seeman Bros., New York. White Rose Brand
6710	Serv-us Pure Food Co., New York. Serv-us Brand
7107	Union Pacific Tea Co., New York. Sovereign Brand
6690	James Van Dyk Co., New York. Ambassador Brand
7091	Village Store Co., Bridgeport. Mardor Brand
7109	No manufacturer given (Sold by Erberle's Delicatessen, Bridgeport)

* No artificial color in any sample.
† Sample caked.

All but two of the samples bore the required statement of net weight. **7085** was short by 0.6 oz. in a 3 oz. package. The cost of 4 oz. packages ranged from 9 to 15 cents.

SAGE.

In the absence of a standard for this seasoning material we hesitate to class any of the samples as adulterated. Sage is usually classified commercially according to the amount of stems present, as stemless, fancy picked, and ordinary grinding sage. In such a classification the amount of crude fiber would be an important criterion for judgment.

Various authorities have found the ash of commercial sage to range from 3.8 to 8.8 per cent. It will be noted from the table that ten of our samples exceed this maximum. **7120** with

CAYENNE (RED) PEPPER.*

Cost per package.	Net Weight. Claimed.	Net Weight. Found.	Ash. Total.	Ash. Insoluble in acid.	Crude Fiber.	Starch.	Non-volatile ether extract.	Microscopical Examination.
cts.	oz.	oz.						
10	2	2.2	6.00	0.41	25.55	0.51	17.48	o. k.
13	3	3.1	5.27	0.38	24.95	1.29	16.82	o. k.
7	4	4.3	5.79	0.31	25.38	1.25	15.63	o. k.
10	4	4.1	5.63	0.39	25.03	1.07	17.26	o. k.
10	4	4.1	6.24	0.16	23.58	1.46	15.17	o. k.
5	1.5	2.0	6.24	0.46	23.95	1.46	15.89	o. k.
10	1	1.6	7.91	0.70	19.63	2.03	13.99	o. k.
10	4	4.0	5.67	0.43	22.18	1.13	17.88	o. k.
16	4	4.2	5.49	0.66	23.04	0.96	19.31	o. k.
9	4	4.3	6.73	0.72	23.48	0.93	17.26	o. k.
12	4	3.8	5.99	0.66	23.25	0.90	18.55	o. k.
15	..	8.0	6.54	0.82	26.88	0.53	9.22	o. k.
10	4	3.9	5.84	0.51	24.85	1.13	18.29	o. k.
10	3	3.0	5.88	0.53	24.13	1.18	17.69	o. k.
7	3	3.1	7.10	0.68	24.25	0.96	13.34	o. k.
15	4	3.5	5.66	0.54	26.28	1.18	13.70	o. k.
10	2	1.8	7.71	1.89	24.13	1.35	16.60	o. k.
13	2.5	2.8	6.43	1.10	27.95	1.13	16.04	o. k.
15	3	1.9	8.22	1.08	25.25	0.84	15.11	o. k.
10	4	4.0	6.73	0.65	24.58	1.29	15.75	o. k.
13	4	4.3	6.31	0.56	21.80	1.46	16.78	o. k.
10	4	4.3	5.10	0.31	18.20	1.01	13.10	o. k.
10	4	3.9	5.71	0.56	23.68	1.29	19.07	o. k.
10	3	3.2	8.34	1.17	21.83	1.24	15.26	o. k.
10	2	2.9	6.33	1.25	24.15	5.57	15.37	cereal starch
15	4	4.1	5.78	0.69	24.00	1.43	18.05	o. k.
10	4	4.2	7.43	0.80	26.45	0.90	14.84	o. k.
5	2	1.9	6.38	0.53	26.78	1.69	6.57	o. k.

TABLE XIII:—

Station No.	Manufacturer and Brand.
	Not found adulterated.
7138	Acker, Merrall and Condit Co., New York
7113	A. F. Beckmann and Co., New York. Crown Aster Brand
6684	Bennett, Simpson and Co., New York. (Tellicherry.)
7148	James Butler, New York. Peerless Brand
7175	Clark, Chapin and Bushnell, New York. Elite Brand
7132	Andrew Davey, New York. Atlas Brand
7085	Direct Importing Co., Boston, Mass. Benefit Brand
6709	E. R. Durkee and Co., New York. Gauntlet Brand
6708	B. Fischer and Co., New York
7078	Edwin J. Gillies and Co., New York
7168	Edwin J. Gillies and Co., New York. Tiger Head Brand
6751	Grand Union Tea Co., Brooklyn, N. Y.
6715	Great Atl. and Pac. Tea Co., Jersey City, N. J. Red Front Brand
6695	Edw. E. Hall and Son, New Haven. (Tellicherry)
7075	Lincoln, Seyms and Co., Hartford. Union Club Brand
6747	Logan Bros. Co., New Haven. L.B.C. Brand
7083	Miner, Read and Tullock, New Haven. Sunrise Brand
6689	The Mohican Co., New York. Mohican Brand
7072	D. and L. Slade Co., Boston, Mass.
7051	Sprague, Warner and Co., Chicago. Richelieu Brand
6698	Stickney and Poor Spice Co., Boston, Mass.
7105	Union Pacific Tea Co., New York. Sovereign Brand
6692	James Van Dyk Co., New York. Ambassador Brand
7092	Village Store Co., Bridgeport. Mardor Brand
	Adulterated or below standard.
6704	Austin, Nichols and Co., New York. Republic Brand
7098	Davey Bros., Bridgeport
7061	Chas. G. Lincoln Co., Hartford. Capitol Mills Brand
7043	Seeman Bros., New York. White Rose Brand

15.86 per cent of ash is certainly abnormal in this respect; the high ash is apparently due to excessive stems rather than to sand, as the insoluble ash amounts to only 0.58 per cent.

The crude fiber also shows a wide range, from 13.72 to 24.35 per cent. The samples group themselves into two fairly well-defined classes in respect to crude fiber, one showing from 13.72 to 18.92, the other from 19.92 to 24.35 per cent. The samples of whole leaves show a much lower fiber than most of the

WHITE PEPPER.

Cost per package.	Net Weight. Claimed.	Net Weight. Found.	Ash. Total.	Ash. Insoluble in acid.	Crude Fiber.	Starch.	Non-volatile ether extract.	Microscopical Examination.
cts.	oz.	oz.						
15	4	4.1	1.43	0.13	4.00	56.08	7.12	o. k.
10	4	3.9	1.08	0.10	3.20	58.11	7.24	o. k.
15	4	3.9	1.16	0.12	3.42	59.68	7.46	o. k.
12	4	4.2	2.25	0.24	4.28	54.96	7.32	o. k.
15	4	4.0	1.13	0.17	3.88	56.59	7.27	o. k.
10	4	4.0	1.48	0.19	3.98	57.77	7.54	o. k.
8	3	2.4	3.50	0.35	4.90	57.40	6.57	o. k.
13	3	3.1	1.67	0.05	1.63	58.84	9.45	o. k.
10	..	2.9	2.00	0.12	1.60	61.48	8.82	o. k.
10	4	4.0	1.43	0.25	4.63	55.69	7.08	o. k.
10	..	2.0	1.88	0.28	4.45	57.15	7.19	o. k.
13	2.5	2.8	1.36	0.11	4.95	61.48	7.42	o. k.
7	4	4.2	1.27	0.21	3.93	56.92	7.53	o. k.
15	4	4.0	1.42	0.17	3.75	57.55	7.43	o. k.
10	4	3.9	3.95	0.35	4.70	56.70	7.23	o. k.
13	4	4.0	1.72	0.14	4.08	57.38	6.83	o. k.
5	1.5	1.7	1.40	0.18	4.43	56.02	7.02	o. k.
10	4	4.1	1.46	0.16	4.08	56.76	6.47	o. k.
10	3	3.6	1.15	0.10	4.05	59.96	7.63	o. k.
10	2	2.1	1.25	0.03	4.68	64.41	7.63	o. k.
10	3	2.9	1.68	0.26	4.40	56.14	7.48	o. k.
10	2	3.0	1.48	0.13	4.10	56.42	6.38	o. k.
12	4	4.0	1.45	0.10	3.25	60.19	6.95	o. k.
10	4	4.0	1.68	0.13	4.70	56.42	7.73	o. k.
9	4	4.1	2.95	0.24	5.25	51.75	6.96	excess shells
10	3	3.0	2.40	0.08	6.40	52.14	7.02	excess shells
10	4	4.0	4.33	0.65	4.13	55.47	7.14	o. k.
10	4	3.9	2.00	0.13	5.25	54.45	8.24	excess shells

ground samples, suggesting that many of the latter contain more than the normal amount of stems.

The ether extract also shows a considerable range, not so wide, however, as with the other ingredients. The total extract ranged from 10.11 to 15.14, the non-volatile from 9.23 to 13.86, and the volatile from 0.88 to 2.11 per cent.

It is worthy of note that the single imported sample, and one presumably of high quality, put up by Crosse and Blackwell,

TABLE XIV:—

Station No.	Manufacturer and Brand.
	Whole leaves.
7120	W. Burton and Co., New York
7047	Crosse and Blackwell, London, Engl.
7127	John S. Sills and Sons, New York
	Ground leaves.
7142	Acker, Merrall and Condit Co., New York
7070	Austin, Nichols and Co., New York. Sunbeam Brand
7159	Bennett, Simpson and Co., New York
7046	The Wm. Boardman and Sons Co., Hartford
7145	James Butler, New York. Peerless Brand
7049	E. R. Durkee and Co., New York. Gauntlet Brand
7052	B. Fischer and Co., New York
7180	B. Fischer and Co., New York
7035	Grand Union Tea Co., Brooklyn, N. Y.
7160	Edw. E. Hall and Son, New Haven
6760	The E. S. Kibbe Co., Hartford
7059	Chas. G. Lincoln and Co., Hartford. Capitol Mills Brand
7082	Miner, Read and Tullock, New Haven. Sunrise Brand
7073	D. and L. Slade Co., Boston, Mass.
7054	Stickney and Poor Spice Co., Boston, Mass.
7103	Union Pacific Tea Co., New York. Sovereign Brand
7115	The Williams and Carleton Co., Hartford. Williams' Brand
	Maximum
	Minimum
	Average

contained minimum amounts of ash and crude fiber and by far the largest amount of volatile ether extract.

The writer has suggested to the U. S. Government the following tentative standard for this material:

"Sage is the dried leaf of *Salvia officinalis* L.; and contains not less than 1 per cent of volatile ether extract, not more than 10 per cent of total ash, not more than 1 per cent of ash insoluble in hydrochloric acid, and not more than 20 per cent of crude fiber."

This standard appears to be a liberal one, yet of the 20 samples examined 4 fail to meet its requirements for total ash, 2

SAGE.

Station No.	Cost per package.	Net Weight. Claimed.	Net Weight. Found.	Ash. Total.	Ash. Insoluble in acid.	Crude Fiber.	Ether Extract. Total.	Ether Extract. Non-volatile.	Ether Extract. Volatile.
	cts.	oz.	oz.						
7120	3	..	0.5	15.86	0.58	13.92	13.55	11.77	1.78
7047	20	1.5	2.0	7.87	0.35	13.89	14.25	12.14	2.11
7127	5	..	0.7	9.48	0.65	16.94	15.14	13.86	1.28
7142	10	4	4.3	8.30	0.45	20.10	13.28	12.22	1.06
7070	10	2	2.2	8.53	0.60	13.72	14.65	13.49	1.16
7159	20	4	3.8	7.33	0.10	24.23	11.64	10.60	1.04
7046	10	4	3.7	8.09	0.62	22.60	10.39	9.41	0.98
7145	3	..	0.7	10.02	1.79	15.40	14.33	13.24	1.09
7049	10	1.25	1.3	8.30	0.57	20.72	12.46	11.03	1.43
7052	9	2	2.1	9.91	0.96	16.32	13.91	12.50	1.41
7180	5	1.75	1.4, 1.5, 1.3	8.55	0.33	24.05	10.11	9.23	0.88
7035	10	2.5	2.6, 3.2	8.89	0.68	18.92	11.89	10.75	1.14
7160	20	?	2.2	10.59	1.01	22.32	12.70	11.81	0.89
6760	10	4	4.1	9.08	0.66	19.92	11.33	10.13	1.20
7059	10	3	3.1	7.64	0.51	24.35	10.61	9.62	0.99
7082	10	4	4.2	9.04	0.53	20.90	11.75	10.72	1.03
7073	10	2	2.1	9.87	0.65	14.62	12.75	11.74	1.01
7054	15	4	4.3	10.00	0.85	18.17	13.03	12.10	0.93
7103	10	1	2.5	8.80	0.51	20.71	10.74	9.83	0.91
7115	10	4	4.1	8.28	0.51	22.05	12.39	11.34	1.05
	..	..	..	**15.86**	**1.79**	**24.35**	**15.14**	**13.86**	**2.11**
	..	..	..	**7.33**	**0.10**	**13.72**	**10.11**	**9.23**	**0.88**
	..	..	..	**9.22**	**0.65**	**19.19**	**12.55**	**11.38**	**1.17**

for insoluble ash, 10 for crude fiber and 4 for volatile ether extract.

Three of the samples bore no statement of net weight, and on one the statement was too indistinct to be read. The only serious shortages were noted in the three packages of **7180,** for which 1.75 oz. was claimed, but which contained only 1.4, 1.5 and 1.3 oz. The prices asked were very variable, 3 cents for 0.5 oz.; from 5 to 20 cents for 1.5 oz.; and from 10 to 20 cents for either 2 or 4 oz.

THYME.

The U. S. Government has adopted the following tentative standard for thyme:—"Not more than 14 per cent of total ash, not more than 4 per cent of ash insoluble in hydrochloric acid, and not less than 1 per cent of volatile ether extract."

Judged by this standard 10 samples contained an excess of total ash, 12 an excess of acid-insoluble ash, and all but 2 were deficient in volatile ether extract.

Especial attention is called to **7053** and **7162**, which contained very high percentages of ash due to the presence of abnormal amounts of sand, 7.82 and 9.29 per cent, respectively; these samples likewise showed a marked deficiency in volatile ether extract.

TABLE XV:—

Station No.	Manufacturer and Brand.
	Whole leaves.
7144	James Butler, New York. Peerless Brand
7036	Grand Union Tea Co., Brooklyn, N. Y.
	Ground leaves.
7143	Acker, Merrall and Condit Co., New York
7081	Austin, Nichols and Co., New York. Sunbeam Brand
7158	Bennett, Simpson and Co., New York
7044	Bennett, Simpson and Co., New York
7069	The A. Colburn Co., Philadelphia, Pa.
6758	E. R. Durkee and Co., New York. Gauntlet Brand
7053	B. Fischer and Co., New York
7179	B. Fischer and Co., New York
7170	Edwin J. Gillies and Co., New York. Tiger Head Brand
7162	Edw. E. Hall and Son, New Haven
7063	Lincoln, Seyms and Co., Hartford
7084	D. and L. Slade Co., Boston, Mass.
7055	Stickney and Poor Spice Co., Boston, Mass.
7116	The Williams and Carleton Co., Hartford. Williams' Brand
	Maximum
	Minimum
	Average

Five of the samples bore no statement of net weight. Prices of 10 cents for either 2 or 4 oz. prevailed.

DOVITAM.

5578. *Dovitam* (I give life), White King Squab Products Co.; Vineland, N. J.: Price 25 cents for 5.7 oz.; (= 5.3 fl. oz.) A turbid liquid with solidified fatty particles.

Solids	3.47
Total nitrogen	0.26
Protein (N x 6.25)	1.63
Ash	0.21
Phosphoric acid in ash	0.07
Lecithin phosphoric acid	0.014
Fat	1.66

THYME.

Cost per package.	Net Weight. Claimed.	Net Weight. Found.	Ash. Total.	Ash. Insoluble in acid.	Crude Fiber.	Ether Extract. Total.	Ether Extract. Non-volatile.	Ether Extract. Volatile.
cts.	oz.	oz.						
3	..	0.7	13.85	3.86	18.64	8.72	7.98	0.74
10	1.5	1.7	16.41	5.30	18.67	9.75	8.96	0.79
10	4	4.1	15.20	4.80	17.90	8.88	8.30	0.58
10	4	4.3	13.90	4.17	16.65	9.03	8.16	0.87
10	4	4.1	11.07	2.41	17.97	10.72	9.98	0.74
10	..	4.2	16.14	4.56	14.52	7.22	6.43	0.79
9	2	2.8	17.14	4.35	17.27	7.75	7.05	0.70
10	2	2.2	13.94	3.92	19.55	9.75	9.07	0.68
9	2	2.0	19.83	7.82	15.17	8.39	7.72	0.67
5	..	1.5	13.94	3.74	17.61	8.34	7.69	0.65
10	4	4.0	15.56	4.58	17.98	8.66	7.88	0.78
20	4	2.9	21.47	9.29	13.48	4.91	4.56	0.35
10	..	2.9	13.70	4.18	17.57	8.09	7.09	1.00
10	2	2.0	17.81	6.99	20.24	7.51	6.83	0.68
10	..	2.0	15.75	6.05	16.55	8.86	7.80	1.06
10	4	4.4	18.56	6.51	16.47	8.48	7.78	0.70
..	..	..	21.47	9.29	20.24	10.72	9.98	1.06
..	..	..	11.07	2.41	13.48	4.91	4.56	0.35
..	..	..	15.89	5.16	17.27	8.44	7.70	0.74

In discussing this product it is necessary to quote some of the statements of the label and the circular accompanying the sample.

"*Dovitam* is a highly nutritious liquid food prepared from four week old White King squabs by a process devised after lengthy experimentation in the department of food chemistry of a leading Eastern university.

"The method of preparation renders available in a most palatable and assimilable form, organic phosphorus, marrow fat, protein and the mineral salts of the bony structures. *Dovitam* is, therefore, a powerful reconstructive, presenting the more important principles of the body tissues, differing from beef extracts and other excrementitious products in that it is rich in protein, fat and other constituents of the human economy. An analysis of an average sample shows it to contain, per six ounces:

"Lecithin		3.00 grains
Phosphate of lime	65.66	
Phosphate of potash	14.08	
Phosphate of soda	11.60	
Phosphate of magnesia	4.19	0.24%
Phosphate of iron	1.11	
Sulphate of potash	1.04	
Chlorid of soda	0.90	
Undetermined (silica)	1.42	
Protein		1.44%
Fat		3.18%

"*Dovitam* is a Natural, healthful product, containing most important nutritive principles. Its food value is very high as may be seen by the following table:

	Calories per lb.
"Guinea hen	865
Chicken broiler	880
Quail	945
Squab	1470

"*Dovitam* is indicated in the case of impaired vitality and all wasting diseases, in Anaemia, Malnutrition, in nerve and body weakness of the aged, and in the case of delicate children, who need the greatest amount of nourishment with the least possible digestive effort.

"*Dovitam* insures rapid convalescence because of its high Lecithin (organic phosphorus) content and its unusual assimilability."

The following are extracts from published testimonials accompanying the sample:

"In cases of Tuberculosis, Marasmus and other wasting diseases the results obtained have been extraordinarily good." "Regarding Mrs. ———, a case of pulmonary tuberculosis, I am pleased to report that I am using *Dovitam* with almost unbelievable results." "I am convinced that the food value of *Dovitam* is beyond question superior to any of the so called 'foods.'"

In another case of acute miliary tuberculosis the obliging physician testifies as follows:

"About this time *Dovitam* was called to my attention, and after consideration of its analysis decided to administer it to the patient. Two cans of *Dovitam* were ordered per day. Up to the present she had gained 26¾ lbs. (three months) and I regard this case as completely arrested."

The misleading form in which the Company's analysis of the product at once raises suspicion as to its value as a food. The jumbling of values in grains and percents, and the percentage analysis of the ash, are most confusing even to one accustomed to chemical data. The lecithin claimed amounts to three grains per six ounces, or if properly expressed to 0.114 per cent, a much less imposing figure. The ash amounts to only 0.21 per cent, which likewise takes away most of the significance from the 65.66 per cent of phosphate of lime, this meaning of course 65.55 per cent of the ash and not of the original material. Assuming that the Company's ash analysis is correct, and assuming that all the nitrogen is present in the form of protein (a somewhat generous assumption), the following would be a proper statement of its composition in the general form used by the Company:

	%
Lecithin phosphoric acid	0.014
Phosphate of lime	0.138
Phosphate of potash	0.030
Phosphate of soda	0.024
Phosphate of magnesia	0.009
Phosphate of iron	0.002
Sulphate of potash	0.002
Chlorid of soda	0.002
Undetermined (silica)	0.003
Protein	1.63
Fat (including lecithin)	1.66
Water	96.53

The importance of the ash analysis entirely disappears when expressed in this proper form, the fat is seen to be only about one-half the amount claimed, and the water percentage, 96.53, shows with what an extremely attenuated food product we are dealing.

The expression of the calorific values of different forms of poultry is also misleading. The high value given for squabs of course refers to the whole edible portion of the bird (exclusive of giblets) and not to an extremely dilute extract of a part of it, as is *Dovitam.* Instead of the 1470 calories per pound as claimed for squabs, *Dovitam* would yield 97.

The "high lecithin" content of *Dovitam* is quite imaginary, as it contains only 0.014 per cent of lecithin phosphoric acid.

The testimonials regarding its value in the feeding of tuberculosis patients would be more convincing if more details were given. In the Company's circular it is stated that *Dovitam*

"may also be given with rice, barley, instant tapioca or easily digested vegetables, macaroni, spaghetti, milk or cream, etc."

If the physicians whose testimonials are quoted used *Dovitam* in connection with the above-named foods, it is not improbable that some favorable results might have been secured, but such results would have been due to the nutritious foods supplied and not to this watery infusion of squab juice. *Dovitam* may possess some value as an appetizer and a stimulant, but for nutritive purposes our analysis indicates that it would be almost as valueless as meat extract, of which it is in reality a species.

VEGETABLE EXTRACTS.

1932. *Milennium Extract,* The Milennium Food Co., Boston. "Not made from flesh." Price 60 cents for 4.3 oz.

5535. *Savora Vegetable Meat Extract,* The Kellogg Food Co.: Battle Creek, Mich. Price 50 cents for 16.6 oz.

	1932	5535
Moisture	26.13	25.09
Total nitrogen	5.67	3.37
Ash	26.39	42.87
Chlorin	8.70	20.97
= Sodium chlorid	14.36	34.60
Creatinin	none	none
Nitrates	none	none

These products are both vegetable extracts of the yeast extract type, and contain no meat extract. Such products, like meat extract, have but little food value, and their main usefulness lies in their stimulating and appetizing qualities. They are by no means inexpensive products. It will be noted that the Kellogg extract contains nearly 60 per cent of water and common salt. Its brand name, "Vegetable Meat Extract," is improper and contradictory.

II. DRUG PRODUCTS.

DRUGS FROM STOCKS OF DISPENSING PHYSICIANS.

An amendment to the Food and Drug Act passed at the last session of the Legislature authorized the Dairy and Food Commissioner to examine the drugs dispensed by physicians throughout the state. Obviously it was impossible to sample in a single inspection all the drugs kept in stock by such physicians, and our attention was first directed to drugs sold by the manufacturers at prices somewhat below the market or under other suspicious circumstances. One hundred and thirty-one such samples have thus far been collected by the Commissioner's agent, Mr. Benze, and the analyses of 53 of these, all that have been completed, are reported herewith. Of the samples 41 were tablets or pills, while 12 were liquid preparations, the latter appearing to be dispensed comparatively rarely by physicians. It is very satisfactory to record the almost universal courtesy with which the agent was received by the different physicians, and the spirit of coöperation manifested. The samples represent 26 classes of preparations made by 17 manufacturers. The names and addresses of the firms represented and the drugs attributed to each are shown below.

Bristol Myers Co., Brooklyn, N. Y.
- Strychnin sulphate.
- Antiseptic Tablets.
- Sol. Pept. Iron and Manganese.

Buffington Pharm. Co., Worcester, Mass.
- Sol. Pept. Iron and Manganese.

C. P. Cippola, Bridgeport.
- Tinct. Iodin.

Daggett & Miller Co., Providence, R. I.
- Formin (2).
- Phenolphthalein.
- Calomel and Phenolphthalein.

The Drugs Products Co., New York.
- Calomel and Soda.

The G. F. Harvey Co., Saratoga Springs, N. Y.
- Blaud's Compound No. 9.
- Digestive Aromatic Tablets.
- Headache Pills.
- Migrain Citrated Tablets.

The Harvey Co., Saratoga Springs, N. Y.
- Calomel and Soda.
- Nitroglycerin (2).
- Tablet Triturates Paregoric.

Independent Pharm. Co., Worcester, Mass.
- Elix. Iron and Manganese Peptonates.

The National Drug Co., Philadelphia.
- Calomel (2).
- Fowler's Solution.
- Elix. Pepsin Lactated No. 2.
- Hexamethylene tetramine.

The Norwich Co., Norwich, N. Y.
- Corrosive sublimate.

The Norwich Pharmacal Co., Norwich, N. Y.
- Formin.

Tailby-Nason Co., Boston.
- Tabs. Salparettes.
- Elix. Iron, Quinin and Strychnin.
- Aspirin.
- Quinin sulphate.
- Syr. Codein Compound.

The Tilden Co., New Lebanon, N. Y.
- Syr. Iodid of Iron.
- Elix. Iron, Quinin and Strychnin (2).

The Tracy Co., New London, Conn.
- Quinin sulphate.
- Antiseptic Tablets No. 1.
- Hepatic Tablets No. 2.
- Sedative Tablets.
- Neurosal, Tracy.
- Migrain No. 7.
- Corrosive sublimate.

Walker & Gibson, Albany, N. Y.
- Spirit of Nitre.

Yates Drug and Chemical Co., New York.
- Sodium bromid.
- Calomel and Soda.
- Migrain Tablets.
- Sodium salicylate (2).
- Antiseptic Tablets.
- Calomel.
- Headache Tablets.
- Nitroglycerin.

Manufacturer unknown.
- Acetphenetidin.

In the case of tablets at least half of the number making up the sample were weighed individually. These were then ground into a composite sample and the mixture analyzed. In certain instances only the active drug or drugs were determined, while in others a complete analysis was made.

TABLETS.

Antiseptic Tablets.

11433. *Antiseptic Tablet Triturates,* made by Bristol Myers Co.; stock of Dr. F. L. Day, Bridgeport.

Claimed per tablet. Corrosive sublimate 1.75 grs.; citric acid 0.87 gr.

Found. The weights of 25 tablets ranged from 154.9 to 187.2, average, 166.9 mgms. These contained 65.22 per cent of corrosive sublimate, or from 1.56 to 1.88 grs.; average, 1.68 grs. per tablet.

Tablets satisfactory.

11423. *Corrosive Mercuric Chlorid Tablets No. 1,* made by The Norwich Co.; stock of Dr. D. J. McCarthy, Bridgeport.

Claimed per tablet. Corrosive sublimate 7.3 grs.; ammonium muriate, 7.7 grs.

Found. The weights of 10 tablets ranged from 1004.8 to 1061.2, average, 1026.1 mgms. These contained 47.73 per cent of corrosive sublimate, or from 7.40 to 7.82, average, 7.56 grs. per tablet.

Tablets satisfactory.

11417. *Antiseptic Tablets No. 1,* made by The Tracy Co.; stock of Dr. C. F. English, New Hartford.

Claimed per tablet. Corrosive sublimate 7.3 grs.; ammonium muriate 7.7 grs.

Found. The weights of 10 tablets ranged from 1072.8 to 1157.6, average, 1124.6 mgms. These contained 44.08 per cent of corrosive sublimate, or from 7.30 to 7.87, average, 7.65 grs. per tablet.

Tablets satisfactory.

11439. *Corrosive Sublimate Tablets,* made by The Tracy Co.; stock of Dr. B. S. Barrows, Hartford.

Claimed per tablet. Corrosive sublimate 1.75 grs., citric acid 0.87 gr.

Found. The weights of 24 tablets ranged from 133.6 to 166.2, average, 145.3 mgms. These contained 60.26 per cent of corrosive sublimate, or from 1.24 to 1.54, average, 1.35 grs. per tablet.

Tablets deficient in corrosive sublimate.

11408. *Berney's Special Antiseptic Tablets,* made by Yates Drug and Chem. Co.; stock of Dr. R. W. Crane, Stamford.

Claimed per tablet. Corrosive sublimate 7 grs.; citric acid 3.48 grs.

Found. Sample consisted of 8 more or less perfect tablets and some broken fragments. The only perfect tablet weighed 782.0 mgms. The material contained 62.70 per cent of corrosive sublimate, or 7.57 grs. per tablet.

Tablets satisfactory.

Aspirin Tablets.

11416. *Aspirin Tablets* (The Sphinx Pharmaceuticals), made by Tailby-Nason Co.; stock of Dr. L. D. H. Caya, New Hartford.

Claimed per tablet. Aspirin 5 grs.

Found. The weights of 12 tablets ranged from 332.9 to 365.9, average, 352.2 mgms. These contained 90.66 per cent of aspirin and 9.00 per cent of matter insoluble in chloroform; no free salicylic acid present. The tablets, therefore, contained from 4.66 to 5.12, average, 4.93 grs. of aspirin per tablet.

Tablets satisfactory.

Blaud's Compound No. 9.

11412. *Blaud's Compound No. 9,* made by The G. F. Harvey Co.; stock of Dr. A. F. Hewitt, Bridgeport.

Claimed per tablet. Blaud's mass 5 grs.; corrosive sublimate 1/80 gr.; strychnin sulphate 1/60 gr.; arsenious acid 1/50 gr.; capsicum oleoresin 1/64 gr.; and gentian extract 1/16 gr. Blaud's mass should contain not less than 20 per cent of iron carbonate, so 5 grs. should contain at least 1 gr. of iron carbonate.

Found. The weights of 20 pills ranged from 520.8 to 562.6, average, 538.8 mgms. The sample showed the following composition:

Iron carbonate	11.09	Strychnin sulphate	0.21
Corrosive sublimate	0.13	Capsicum oleoresin	present
Arsenious acid	0.23	Gentian extract	probably

The pills therefore had the following composition in grains:

	Iron carbonate.	Corrosive sublimate.	Arsenious acid.	Strychnin sulphate.
Heaviest	0.963	0.0113	0.0200	0.0182
Lightest	0.893	0.0105	0.0185	0.0169
Average	0.922	0.0108	0.0191	0.0175
Claimed	1.000	0.0125	0.0200	0.0167

While there is a slight deficiency in corrosive sublimate, the pills as a whole may be considered satisfactory.

Calomel Tablets.

11438. *Calomel Tablets Triturates,* made by The National Drug Co.; stock of Dr. B. S. Barrows, Hartford.

Claimed per tablet. Calomel 0.25 gr.; flavored with wintergreen.

Found. The weights of 25 tablets ranged from 77.5 to 88.2, average, 83.7 mgms. These contained 17.36 per cent of calomel, or from 0.208 to 0.236, average, 0.223 gr. per tablet.

Tablets showed a slight deficiency in calomel.

11406. *Calomel Tablet Triturates,* made by The National Drug Co.; stock of Dr. J. J. Costanzo, Stamford.

Claimed per tablet. Calomel 0.10 gr.; flavored with wintergreen.

Found. The weights of 20 tablets ranged from 30.5 to 35.0, average, 32.7 mgms. These contained 18.64 per cent of calomel, or from 0.088 to 0.101, average, 0.093 gr. per tablet.

Tablets satisfactory.

11418. *Hepatic Tablets No. 2,* made by The Tracy Co.; stock of Dr. K. E. Kellogg, New Britain.

Claimed per tablet. Calomel 2 grs.; aloin 1/5 gr.; hydrastin 1/4 gr.; podophyllin 1/4 gr.; leptandrin 1/4 gr.

Found. The weights of 10 tablets ranged from 420.9 to 454.1, average, 441.9 mgms. These contained 27.65 per cent of calomel; aloin and hydrastin present; no specific tests made for podophyllin and leptandrin. The tablets contained from 1.79 to 1.94, average, 1.89 grs. of calomel.

Tablets satisfactory.

11409. *Calomel Tablets,* made by Yates Drug and Chem. Co.; stock of Dr. P. P. Vanoleet, Stamford.

Claimed per tablet. Calomel 0.10 gr.

Found. The weights of 30 tablets ranged from 30.9 to 34.9, average, 33.7 mgms. They contained 18.70 per cent of calomel, or from 0.090 to 0.101, average, 0.097 gr. per tablet.

Tablets satisfactory.

Calomel and Phenolphthalein Tablets.

11437. *Calomel and Phenolphthalein Tablets,* made by Daggett and Miller Co.; stock of Dr. D. C. Brown, Danbury.

Claimed per tablet. Calomel 0.10 gr.; phenolphthalein 0.10 gr.; aromatics q. s.

Found. The weights of 25 tablets ranged from 70.2 to 77.9, average, 75.0 mgms. They contained 8.82 per cent of phenolphthalein and 8.62 per cent of calomel, so that

	Phenolphthalein. grs.	Calomel. grs.
Heaviest contained	0.106	0.103
Lightest contained	0.095	0.093
Average contained	0.101	0.099

Tablets satisfactory.

Calomel and Soda Tablets.

11451. *Calomel and Soda Tablets No. 1,* made by The Drug Products Co.; stock of Dr. C. P. Townsend, Bridgeport.

Claimed per tablet. Calomel 0.10 gr.; sodium bicarbonate 1 gr.

Found. The weights of 35 tablets ranged from 78.9 to 88.4, average, 83.6 mgms. They contained 7.78 per cent of calomel and 77.60 per cent of sodium bicarbonate, so that

	Calomel grs.	Sodium bicarbonate. grs.
Heaviest contained	0.106	1.06
Lightest contained	0.095	0.95
Average contained	0.100	1.00

Tablets satisfactory.

11425. *Calomel and Soda Tablets No. 5,* made by The Harvey Co.; stock of Dr. Joseph Cohen, Bridgeport.

Claimed per tablet. Calomel 0.25 gr.; sodium bicarbonate 2 grs.

Found. The weights of 20 tablets ranged from 165.5 to 178.4, average, 172.6 mgms. They contained 10.15 per cent of calomel and 76.33 per cent of sodium bicarbonate, so that

	Calomel grs.	Sodium bicarbonate. grs.
Heaviest contained	0.28	2.10
Lightest contained	0.26	1.95
Average contained	0.27	2.04

Tablets satisfactory.

11402. *Calomel and Sodium Tablets No. 4,* made by Yates Drug and Chem. Co.; stock of Dr. H. F. Moore, Bethel.

Claimed per tablet. Calomel 1 gr.; sodium bicarbonate 1 gr.

Found. The weights of 25 tablets ranged from 147.2 to 175.9, average, 161.5 mgms. They contained 34.60 per cent of calomel and 39.82 per cent of sodium bicarbonate, so that

	Calomel grs.	Sodium bicarbonate. grs.
Heaviest contained	0.94	1.08
Lightest contained	0.79	0.90
Average contained	0.86	0.99

Twenty-two of 25 tablets contained less than 0.90 gr. of calomel, in other words were deficient by more than 10 per cent.

Digestive Aromatic Tablets.

11414. *Digestive Aromatic Tablets,* made by The G. F. Harvey Co.; stock of Dr. T. J. Bergin, Coscob.

Claimed per tablet. Pepsin 4 grs.; diastase 1/20 gr.; pancreatin 1/2 gr.; lactic acid 1/20 gr.

Found. The weights of 24 tablets ranged from 313.6 to 351.0, average, 335.8 mgms. The enzymatic activity of the tablets was equal to diastase and trypsin of about 20 per cent U. S. P. strength, and to pepsin from 3.6 to 5.5 per cent of U. S. P. strength.

Tablets deficient in enzymatic activity.

Headache Tablets.

11415. *Headache Pills (Saratoga Goldens),* made by The G. F. Harvey Co.; stock of Dr. Walter Hitchcock, Norwalk.

Claimed per pill. Acetanilid 2 1/8 grs.; sodium bicarbonate 1/4 gr.; caffein alkaloid 3.8 gr.; camphor monobrom. 1/4 gr.; strychnin sulphate 1/250 gr.; nitroglycerin 1/3000 gr.

Found. The weights of 10 pills ranged from 230.3 to 269.2, average (excluding single light pill), 261.4 mgms. They contained as follows:

Acetanilid	51.26	Strychnin sulphate (approx.)	0.15
Caffein	8.94	Nitroglycerin	present
Sodium bicarbonate	5.87		

The content of the tablets in grains, therefore, was as follows:

	Acetanilid.	Caffein.	Sodium bicarbonate.	Strychnin sulphate.
Heaviest	2.13	0.37	0.24	0.006(?)
Lightest	1.82	0.32	0.21	0.005(?)
Average	2.07	0.36	0.24	0.006(?)

The amount of material was too small for accurate determinations of strychnin and nitroglycerin; both were present but the figures reported for the former are only approximate.

Pills satisfactory.

11410. *Migraine Citrated Tablets No. 2,* made by The G. F. Harvey Co.; stock of Dr. W. E. Rice, Stamford.

Claimed per tablet. Acetanilid 2 grs.; camphor monobrom. 1/2 gr.; caffein citrate 1/2 gr.

Found. The weights of 10 tablets ranged from 240.2 to 249.8, average, 246.8 mgms. They contained 51.62 per cent of acetanilid and 13.40 per cent of caffein citrate (U. S. P.); camphor monobrom. present. The content of the tablets in grains was, therefore, as follows:

	Acetanilid.	Caffein citrate.
Heaviest	1.99	0.52
Lightest	1.81	0.50
Average	1.97	0.51

Tablets satisfactory.

11403. *Tab. Salparettes (Headache Powder Improved)*, made by Tailby-Nason Co.; stock of Dr. W. M. Stahl, Danbury.

Claimed per tablet. Acetanilid 3 grs.; strontium salicylate 1/2 gr.; sodium bicarbonate 1/2 gr.; celery seed, caffein.

Found. The weights of 16 tablets ranged from 441.4 to 470.8, average, 460.1 mgms. They contained

Acetanilid	42.12	Chloroform-insoluble	54.74
Strontium salicylate	8.92	Ash	13.68
Sodium bicarbonate	8.74	Celery	present
Caffein	2.10		

The content of the tablets in grains was, therefore, as follows:

	Acetanilid.	Strontium salicylate.	Sodium bicarbonate.	Caffein.
Heaviest	3.06	0.65	0.64	0.15
Lightest	2.87	0.61	0.60	0.14
Average	2.99	0.63	0.62	0.15

Tablets satisfactory.

11431. *Migraine Tablets No. 7,* made by The Tracy Co.; stock of Dr. J. H. Finnegan, Bridgeport.

Claimed per tablet. Phenacetin 2.5 grs.; caffein citrate 0.5 gr.; camphor monobrom. 1 gr.; sodium bicarbonate 1 gr.

Found. The weights of 20 tablets ranged from 260.0 to 317.9, average, 304.0 mgms. They contained

Acetphenetidin (phenacetin)	22.10	Sodium bicarbonate	11.42
Acetanilid	24.75	Camphor monobrom	present
Caffein citrate (U. S. P.)	8.72		

The content of the tablets in grains was, therefore, as follows:

	Acetphenetidin.	Acetanilid.	Caffein citrate.	Sodium bicarbonate.
Heaviest	1.09	1.22	0.43	0.56
Lightest	0.89	0.99	0.35	0.46
Average	1.04	1.16	0.41	0.53

The claimed amounts of active and inactive ingredients was 5 grs., but in no case did any tablet weigh as much as this, the average being only 4.69 grs. A deficiency in the claimed amounts of the drugs, therefore, was to be expected, and was found. Furthermore, instead of the tablets containing 2.5 grs. of acetphenetidin, they contained on the average 1.04 grs. of acetphenetidin and 1.16 grs. of acetanilid. The tablets were clearly misbranded both as to amount and identity of ingredients present.

11411. *Headache Tablets (Dr. F. H. Hawley)*, made by Yates Drug and Chem. Co.; stock of Dr. R. R. Gaudy, Stamford.

Claimed per tablet. Acetanilid 2.5 grs.; aromatic powder 0.5 gr.; sodium bicarbonate 1 gr.; caffein 0.5 gr.; camphor 0.10 gr.; cassia oil.

Found. The weights of 10 tablets ranged from 338.5 to 359.9, average, 350.1 mgms. They contained

Acetanilid	45.70	Oil of cassia, or cinnamon	present
Caffein	9.40	Camphor	present
Sodium bicarbonate	18.65	Vegetable tissue	present

The content of the tablets in grains was, therefore, as follows:

	Acetanilid.	Caffein.	Sodium bicarbonate.
Heaviest	2.54	0.52	1.04
Lightest	2.39	0.49	0.97
Average	2.47	0.51	1.01

Tablets satisfactory.

11405. *Migraine Tablets,* made by Yates Drug and Chem. Co.; stock of Dr. T. J. O'Donnell, Greenwich.

Claimed per tablet. Acetanilid 2 grs.; camphor monobrom. 0.5 gr.; caffein citrate 0.5 gr.

Found. The weights of 10 tablets ranged from 245.2 to 260.8, average, 253.4 mgms. They contained 50.54 per cent of acetanilid and 14.48 per cent of caffein citrate (U. S. P.); camphor monobrom. present. The content of the tablets in grains was, therefore, as follows:

	Acetanilid.	Caffein citrate.
Heaviest	2.12	0.58
Lightest	1.91	0.55
Average	1.98	0.57

Tablets satisfactory.

11446. *Acetphenetidin Tablets.* Manufacturer and physician unknown.

Claimed per tablet. Acetphenetidin 3 grs.

Found. The weights of 18 tablets ranged from 195.2 to 243.8, average, 220.9 mgms. They contained no acetphenetidin, but did contain approximately 58 per cent of terpin hydrate, 36.14 per cent of sugar and 5.86 per cent of talc. They contained, therefore, from 1.75 to 2.18, average, 1.98 grs. of terpin hydrate per tablet.

Tablets clearly misbranded.

Hexamethylene Tetramine Tablets.

11404. *Formin Tablets,* made by Daggett and Miller Co.; stock of Dr. D. N. Selleck, Danbury.

Claimed per tablet. Formin 5 grs.

Found. The weights of 18 tablets ranged from 312.4 to 329.6, average, 320.3 mgms. They consisted wholly of hexamethylene tetramine, so they contained of that drug from 4.82 to 5.09, average, 4.94 grs. per tablet.

Tablets satisfactory.

11424. *Formin Tablets,* made by Daggett and Miller Co.; stock of Dr. N. T. Pratt, Bridgeport.

Claimed per tablet. Formin 5 grs.

Found. The weights of 15 tablets ranged from 310.0 to 331.6, average, 323.5 mgms. They consisted wholly of hexamethylene tetramine, so they contained of that drug from 4.78 to 5.12, average, 4.99 grs. per tablet.

Tablets satisfactory.

11430. *Hexamethylene Tetramine Tablets,* made by The National Drug Co.; stock of Dr. F. C. Buckmiller, Bridgeport.

Claimed per tablet. 5 grs.

Found. The weights of 15 tablets ranged from 315.4 to 332.8, average, 324.3 mgms. They consisted wholly of hexamethylene tetramine, so they contained of that drug from 4.87 to 5.14, average, 5.00 grs. per tablet.

Tablets satisfactory.

11429. *Formin Tablets,* made by Norwich Pharmacal Co.; stock of Dr. E. R. Kelsey, Winsted.

Claimed per tablet. Formin 5 grs.

Found. The weights of 15 tablets ranged from 321.8 to 335.8, average, 328.8 mgms. They contained 99.8 per cent of hexamethylene tetramine, or from 4.97 to 5.18, average, 5.07 grs. per tablet.

Tablets satisfactory.

Neurosal.

11422. *Neurosal, Tracy, (Neuralgic, Headache),* made by The Tracy Co.; stock of Dr. J. W. Gerber, Bridgeport.

Claimed per tablet. Acetanilid 2.5 grs.; camphor monobrom. 0.5 gr.; sodium salicylate 1 gr.; extr. hyoscyamus 1/8 gr.; tinct. gelsemium 2 min.

Found. The weights of 10 tablets ranged from 357.8 to 399.8, average, 370.9 mgms. Their analysis was as follows:

Acetanilid	40.02	Camphor monobrom	present
Sodium salicylate	17.26	Gelsemium	present
Alkaloids	0.70	Caffein	none
		Hyoscyamus	no test made

The content of the tablets in grains, therefore, as far as was quantitatively determined, was as follows:

	Acetanilid.	Sodium salicylate.	Alkaloids.
Heaviest	2.47	1.06	0.043
Lightest	2.21	0.95	0.039
Average	2.29	0.99	0.040

Tablets satisfactory although slightly low in acetanilid.

Nitroglycerin Pills.

11448. *Nitgoglycerin Pills,* made by The Harvey Co.; stock of Dr. S. M. Garlick, Bridgeport.

Claimed per pill. Nitroglycerin 1/100 gr.

Found. The weights of 25 pills ranged from 40.6 to 47.8, average, 44.0 mgms. They were gelatin-coated and contained 1.42 per cent of nitroglycerin, or from 0.0089 to 0.0105, average, 0.0096 gr. per pill.

Pills satisfactory.

11551. *Nitroglycerin Pills,* made by The Harvey Co.; stock of Dr. C. K. Heady, Milford.

Claimed per pill. Nitroglycerin 1/100 gr.

Found. The weights of 25 pills ranged from 41.8 to 49.2, average, 46.1 mgms. They contained 1.32 per cent of nitroglycerin, or from 0.0085 to 0.0100, average, 0.0094 gr. per pill.

Pills satisfactory.

11554. *Nitroglycerin Tablets,* made by Yates Drug and Chem. Co.; stock of Dr. G. F. Lewis, Stratford.

Claimed per tablet. Nitroglycerin 1/100 gr.

Found. The weights of 25 tablets ranged from 86.8 to 106.2, average, 97.1 mgms. They contained 0.74 per cent of nitroglycerin, or from 0.0099 to 0.0121, average, 0.0111 gr. per tablet.

Tablets satisfactory.

Paregoric Tablets.

11435. *Tablet Triturates of Paregoric,* made by The Harvey Co.; stock of Dr. J. R. Coffey, New Haven.

Claimed per tablet. Paregoric 20 min.

Found. The weights of 25 tablets ranged from 90.0 to 107.2, average, 95.0 mgms. The tablets contained 0.00052 gm. of morphin. The minimum strength of U. S. P. paregoric is 0.00049 gm. of morphin per 20 min. The average tablet, therefore, contained morphin slightly in excess of the U. S. P. requirement for 20 min. of paregoric. Paregoric was further indicated by the presence of camphor, oil of anise and benzoic acid, all normal ingredients of that drug.

Phenolphthalein Tablets.

11436. *Videns Phenolphthalein Tablets,* made by Daggett and Miller Co.; stock of Dr. D. C. Brown, Danbury.

Claimed per tablet. Phenolphthalein 1.5 grs.

Found. The weights of 24 tablets ranged from 312.9 to 377.8, average, 356.0 mgms. Their analysis showed loss at 100° C. 0.36, ash 9.53 and phenolphthalein 21.60 per cent; oil of cassia, or cinnamon, present. The tablets contained, therefore, from 1.04 to 1.26, average 1.19 grs. of phenolphthalein, or a deficiency ranging from 0.24 to 0.46 gr.

Tablets deficient in phenolphthalein.

Quinin Sulphate Tablets.

11432. *Quinin Sulphate Tablets,* made by Tailby-Nason Co.; stock of Dr. W. C. Watson, Bridgeport.

Claimed per tablet. Quinin sulphate 2 grs.

Found. The weights of 15 tablets ranged from 248.6 to 271.5, average, 263.7 mgms. They contained 47.80 per cent of quinin sulphate, or from 1.84 to 2.00, average, 1.95 grs. per tablet.

Tablets satisfactory.

11400. *Quinin Sulphate Tablets,* made by The Tracy Co.; stock of Dr. Wm. B. Cogswell, Stratford.

Claimed per tablet. Quinin sulphate 2 grs.

Found. The weights of 16 tablets ranged from 250.6 to 269.5, average, 260.2 mgms. They contained 48.44 per cent of quinin sulphate, or from 1.87 to 2.02, average, 1.95 grs. per tablet.

Tablets satisfactory.

Sedative Tablets.

11420. *Sedative Tablets (Dr. Brown),* made by The Tracy Co.; stock of Dr. C. W. Gardner, Bridgeport.

Claimed per tablet. Sodium bromid 2.5 grs.; potassium bromid 2.5 grs.; ammonium bromid 2.5 grs.; tinct. cannabis indica 5 min.; tinct. hyoscyamus 5 min.

Found. The weights of 20 tablets ranged from 523.5 to 540.4, average, 531.2 mgms. Their composition was as follows:

Loss at 100° C.	7.86	Ammonium	5.54
Bromin	68.22	= Ammonium bromid	30.08
Potassium	10.47	Chloroform extract	1.92
= Potassium bromid	31.87	Cannabis indica	present
Sodium	6.71	Alkaloids	present
= Sodium bromid	29.84	Hyoscyamus	no test made

The content of the tablets, therefore, as far as the bromids were concerned, was as follows:

	Potassium bromid. grs.	Sodium bromid. grs.	Ammonium bromid. grs.
Heaviest	2.66	2.49	2.51
Lightest	2.58	2.41	2.43
Average	2.61	2.45	2.47

Tablets satisfactory.

Sodium Bromid Tablets.

11401. *Sodium Bromid Tablets,* made by Yates Drug and Chem. Co.; stock of Dr. G. F. Wight, Bethel.

Claimed per tablet. Sodium bromid 10 grs.

Found. The weights of 25 tablets ranged from 646.3 to 647.8, average, 647.0 mgms. On drying the sample showed a loss of 1.87 per cent. The dried material was titrated with silver nitrate. The U. S. P. IX requires that "each gram of sodium bromid, previously dried, corresponds to not less than 95.7 mils (cc) nor more than 98.3 mils (cc) of tenth. normal silver nitrate." In this sample 1 gm. of material corresponded to 98.35 cc of tenth-normal silver nitrate, very slightly above the U. S. P. maximum limit, indicating only a small amount of chlorid present. The minimum U. S. P. value, 95.7, is equivalent to 98.5 per cent of sodium bromid, the U. S. P. standard of purity for that drug.

Tablets satisfactory.

Sodium Salicylate Tablets.

11407. *Sodium Salicylate Tablets,* made by Yates Drug and Chem. Co.; stock of Dr. J. F. Harrison, Stamford.

Claimed per tablet. Sodium salicylate 5 grs.

Found. The weights of 20 tablets ranged from 415.4 to 480.2, average, 449.2 mgms. They contained 71.56 per cent of sodium salicylate, or from 4.59 to 5.30, average, 4.96 grs. per tablet.

Tablets satisfactory.

11434. *Sodium Salicylate Tablets,* made by Yates Drug and Chem. Co.; stock of Dr. E. K. Roberts, New Haven.

Claimed per tablet. Sodium salicylate 5 grs.

Found. The weights of 21 tablets ranged from 769.1 to 837.7, average, 804.7 mgms. Their analysis showed loss at 100°C. 1.22, ash 17.80 and sodium salicylate 39.21 per cent, so that they contained from 4.65 to 5.07, average, 4.75 grs. of sodium salicylate per tablet.

Tablets satisfactory.

Strychin Sulphate Tablets.

11428. *Strychnin Sulphate Tablets,* made by Bristol Myers Co.; stock of Dr. C. H. Robbins, New Haven.

Claimed per tablet. Strychnin sulphate 1/60 gr.

Found. The weights of 25 tablets ranged from 68.6 to 78.4, average, 74.0 mgms. They contained 1.44 per cent of strychnin sulphate, or from 0.0153 to 0.0174, average, 0.0164 gr. per tablet.

Tablets satisfactory.

SOLUTIONS.

Sol. Peptonized Iron and Manganese.

11565. *Sol. Peptonized Iron and Manganese,* made by Bristol Myers Co.; stock of Dr. G. E. Bradford, New London.

Claimed. B. and M. formula: Average alcohol 16 per cent; contains iron peptonate and manganese peptonate corresponding to 0.6 per cent of iron and 0.1 per cent of manganese.

Found. The sample contained

Alcohol by volume	16.25
Ash	1.40
Iron oxid	1.15
= Iron	0.80
Manganese oxid	0.17
= Manganese	0.12

Liquor Ferri Peptonati et Mangani, N. F., according to analyses of the American Medical Association, should contain from 0.99 to 1.05 per cent of ash, from 0.58 to 0.64 per cent of iron and from 0.13 to 0.19 per cent of manganese. This preparation agrees satisfactorily with these requirements and contains somewhat more of both iron and manganese than is claimed on the label.

11584. *Aromatic Cordial of Iron and Manganese Peptonates,* made by Buffington Pharmacy Co.; stock of Dr. F. E. Wilson, Willimantic.

Claimed. Alcohol 15 per cent maximum. The physician claimed he bought this for the U. S. P. preparation, but there is no such preparation cited by that authority. There is, however, in the N. F., a *Liquor Ferri Peptonati et Mangani* to which he may have had reference (See No. **11565**).

Found. The sample contained

Alcohol by volume	17.50	Iron oxid	0.15
Ash	0.36	= Iron	0.10
Sodium oxid	0.13	Manganese oxid	0.03
		= Manganese	0.02

The preparation, therefore, contained only 17.2 per cent of the minimum iron and 15.4 per cent of the minimum manganese of the N. F. preparation.

Sample below requirements of N. F. preparation.

11442. *Elixir Iron and Manganese Peptonates,* made by Independent Pharmaceutical Co.; stock of Dr. G. F. Converse, New Haven.

Claimed. Each fl. dram contains about 2.5 grs. of neutral organic salts of iron and manganese. This claim is rather indefinite as the particular organic salts of iron and manganese are not stated. However, if the preparation corresponds to *Liquor Ferri Peptonati et Mangani, N. F.* 2.5 grs. per fl. dram of neutral organic salts would equal 20 grs. per fl. oz.; or 1.296 gms. per fl. oz.; or 1.296 gms. per 30.59 gms. of the solution (sp. gr. 1.0197), equal to 4.24 per cent. If the N. F. organic salts are used, the source of the iron would be iron peptonate (containing 25 per cent of iron), and the source of the manganese manganese citrate (containing 22.4 per cent of manganese). The ash of such a preparation would be about 1.57 per cent, calculated as oxids of iron and manganese, not taking into account alkali bases, the N. F. formula showing sodium citrate and sodium hydroxid. For the composition of the N. F. preparation see No. **11565.**

Found. The sample contained the following

Alcohol by volume	7.00	Iron oxid	0.20
Ash	0.62	= Iron	0.14
Sodium oxid	0.25	Manganese oxid	0.13
Chlorin	trace	= Manganese	0.09

The preparation, therefore, contained only 34.5 per cent of the minimum iron and 69.3 per cent of the minimum manganese of the N. F. preparation. It also contained only 46.7 per cent of the alcohol claimed on the label.

Sample below requirements of the N. F. preparation.

Elixir of Iron, Quinin and Strychnin.

11413. *Elixir of Iron, Quinin and Strychnin.* (Sphinx Pharmaceuticals), made by Tailby-Nason Co.; stock of Dr. J. A. Clarke, Greenwich.

Claimed. Each fl. oz. contains alcohol about 20 per cent; tinct. iron citrochlorid 24 min.; quinin muriate 2 grs.; strychnin 8/60 gr. (This is equivalent to 0.1145 gm. of total anhydrous alkaloids per fl. oz.)

Found. The composition of the sample was as follows:

Spec. grav. at 15.6° C.	1.2223	
Alcohol by volume	19.03	per cent
Total alkaloids (anhydrous)	0.4192	gm. per 100 cc.
Iron	0.2552	" " "
Quinin (anhydrous)	0.3724	" " "
= Quinin hydrochlorid	0.4557	" " "
Strychnin (anhydrous)	0.0402	" " "

The N. F. elixir should contain 0.155 gm. of iron, 0.2625 gm. of quinin hydrochlorid and 0.0021 gm. of strychnin per fl. oz. This sample contained 0.0766 gm. of iron, 0.1348 gm. of quinin hydrochlorid and 0.0119 gm. of strychnin per fl. oz. It contained, therefore, about half of the iron and quinin of the N. F. formula and about five times the strychnin. By the method used with this sample the results for quinin are slightly low and those for strychnin slightly high.

Preparation is substandard.

11427. *Elixir of Phosphates of Iron, Quinin and Strychnin,* made by The Tilden Co.; stock of Dr. G. F. Converse, New Haven.

11443. The same brand from stock of Dr. W. H. Donaldson, Fairfield.

Claimed. Alcohol 10 per cent; each fl. oz. contains ferric phosphate 8 grs.; quinin phosphate 4 grs.; strychnin phosphate 8/60 gr.

Found. The composition of the elixirs was as follows:

	11427	11443
Spec. grav. at 15.6° C.	1.1186	1.1388
Alcohol by volume	11.30	12.20
Total alkaloids (gms. per 100 cc.)	0.840	0.847
Strychnin " " "	0.0275	0.025
Quinin " " "	0.813	0.822
Iron " " "	0.38	0.36
Phosphoric acid " " "	0.32	0.44

The *Elixir of the Phosphates of Iron, Quinin and Strychnin, U. S. P. VIII* contains 0.21 gm. of iron, 0.875 gm. of quinin and 0.0275 gm. of strychnin per 100 cc. The above analyses agree quite well with these requirements. It is impossible to calculate the alkaloids in terms of their phosphates as there are several theoretical phosphates. The iron present is equivalent

to 14.7 grs. of ferric phosphate per fl. oz. in **11427** and 13.9 grs. in **11443.**

Preparations satisfactory.

Elixir of Lactated Pepsin.

11426. *Elixir Pepsin Lactated No. 2,* made by The National Drug Co.; stock of Dr. G. F. Converse, New Haven.

Claimed. Alcohol 14 per cent; each fl. oz. contains pepsin lactated (The N. D. Co's) 50 grs.; composed of pepsin, pancreatin, maltose, diastase, lactic and hydrochloric acids. (The fact that we have no knowledge of the strength of The N. D. Co.'s lactated pepsin makes the above claim very indefinite.)

Found. The following analytical details were secured:

Spec. grav. at 15.6° C.	1.1136
Alcohol by volume	13.70
Amylase	none detected
Tryptic digestion	none detected
Peptic digestion	active pepsin present

The elixir in our tests showed no power of digesting starch or casein. Its action on egg albumin showed about one-thirteenth of the digesting power of U. S. P. pepsin.

The cause of the low digestive powers above noted may possibly be explained by the paralyzing effect of alcohol on enzyme action (*see Euler, p. 120*), or by the fact that the N. D. Co's lactated pepsin may contain less than the 10 per cent of pepsin of the standard, or by the fact that the pepsin used was not of U. S. P. strength, as has been the case with many samples of commercial pepsin which we have examined.

To test the retarding action of alcohol the following experiment was made: 0.972 gm. of starch paste + 0.0324 gm. of pancreatin + 0.0032 gm. of diastase + 4.3 cc of water + 0.7 cc of alcohol (equal to 14 per cent by volume) were digested at 40° C. for thirty minutes. Digestion was found to be complete by the iodin test as in similar checks made without alcohol. Although the effect of alcohol was negative in this trial, it is still possible that prolonged contact of the enzymes and alcohol (as is the case in the sample) might result in paralysis of the ferments.

Preparation of low digestive power.

Fowler's Solution

11421. *Fowler's Solution,* made by The National Drug Co.; stock of Dr. S. L. Katzoff, Bridgeport.

Claimed. Solution Potassium Arsenite. The U. S. P. IX preparation should contain not less than 0.975 nor more than 1.025 per cent of arsenious oxid.

Found. The solution contained 1.014 per cent of arsenious oxid.

Preparation satisfactory.

Spirits of Nitre.

11556. *Spirits Nitre,* made by Walker and Gibson; stock of Dr. B. A. Bryon, Ridgefield.

Claimed. Spirits Nitre, U. S. P. Alcohol 92 per cent, ethyl nitrite 4 per cent.

Found. The sample contained 90.7 per cent of alcohol by volume and 2.51 per cent of ethyl nitrite. This amount of ethyl nitrite corresponds to 71.7 per cent of minimum U. S. P. strength and to 62.8 per cent of the amount claimed on the label.

Preparation deficient in ethyl nitrite.

Syrup of Codein Compound.

11550. *Syrup of Codein Compound,* made by Tailby-Nason Co.; stock of Dr. C. K. Heady, Milford.

Claimed. Each fl. oz. contains alcohol about 2 per cent, codein phosphate 1 gr. and virtues of wild cherry, ipecac and white pine.

Found. The preparation contained 2.83 per cent of alcohol by volume and 0.921 gr. of codein phosphate per fl. oz. No tests were made for the other ingredients claimed.

Preparation satisfactory.

Syrup of Iodid of Iron.

11555. *Syrup of Iodid of Iron,* made by The Tilden Co.; stock of Dr. B. A. Bryon, Ridgefield.

Claimed. Syr. Iodid Iron.

Found. The following analytical data were obtained:

Spec. grav. at 15.6° C.	1.2793	Free iodin	none
Ferrous iodid	2.69	Color	brown

The U. S. P. IX requires that this preparation shall contain not less than 4.75 nor more than 5.25 per cent of ferrous iodid. The sample, therefore, was below standard as it contained only 2.69 per cent or 56.6 per cent of the minimum requirement.

Preparation below standard.

Tincture of Iodin.

11419. *Tincture of Iodin,* made by C. P. Cippola, Bridgeport; sample taken from his stock.

Claimed. Tinct. Iodin.

Found. The sample contained 6.11 gms. of iodin, and 4.58 gms. of potassium iodid per 100 cc, and 88.50 per cent of alcohol. Tincture of iodin, U. S. P. should contain not less than 6.5 gms. nor more than 7.5 gms. of iodin, and not less than 4.5 nor more than 5.5 gms. of potassium iodid per 100 cc. The tincture also should contain 83 per cent of alcohol, but the U. S. P. tolerates a variation of 10 per cent above or below this figure.

Preparation deficient in iodin.

SUMMARY.

Fourteen of the 53 samples failed to contain the amounts of drugs claimed (allowing a variation of 10 per cent), or were below the standard of the corresponding U. S. P. or N. F. preparation. The names of these with their manufacturers were as follows:

Buffington Pharm. Co.
  Sol. Pept. Iron and Manganese.
C. P. Cippola.
  Tinct. Iodin.
Daggett & Miller Co.
  Phenolphthalein.
G. F. Harvey Co.
  Digestive Aromatic Tablets.
Independent Pharm. Co.
  Elix. Iron and Manganese Pept.
The National Drug Co.
  Calomel.
  Elix. Pepsin Lactated No. 2.
Tailby-Nason Co.
  Elix. Iron, Quinin and Strychnin.
The Tilden Co.
  Syr. Iodid of Iron.
The Tracy Co.
  Migrain No. 7.
  Corrosive Sublimate.
Walker & Gibson.
  Spirits Nitre.
Yates Drug & Chem. Co.
  Calomel and Soda.
Manufacturer unknown.
  Acetphenetidin.

Of 41 samples of tablets 8, or 20 per cent, were deficient, while of 12 samples of solutions 7, or 60 per cent, were unsatisfactory.

The most serious discrepancies arose from substitutions, intentional or otherwise. In one sample acetanilid was substituted in part for acetphenetidin; and in another terpin hydrate was present instead of acetphenetidin as claimed.

VARIATIONS IN THE WEIGHTS OF TABLETS.

A claim frequently heard in favor of the use of tablets is that they afford "uniform dosage and medication." It is therefore important to determine the degree of uniformity secured by the manufacturers both as regards the weight of the tablets and the amount of medicament they contain. Kebler has pointed out (*The Tablet Industry, 1914, p. 42*) that the chief defects causing variations in the weights of tablets are (1) improper feeding to the machines, (2) worn machinery, punches or dies, (3) loosening of adjustments, and (4) careless weighing of the finished tablets. It is almost universally conceded that a variation in weight of 5 per cent above and below the average is generous especially for the larger tablets. In the smaller tablets a somewhat greater variation would be expected.

The present examination afforded an opportunity to add to the data on this subject collected by Kebler (loc. cit). In the forty-one samples of tablets examined individual weighings were made of 836 tablets, ranging from 10 to 80 tablets per sample. The maximum, minimum and average weights of the tablets are shown in Table XVI, together with the percentage variation above and below the average.

While in some cases remarkable uniformity in weight is shown, in others the variations are very great. In the case of only two manufacturers are all the total variations less than 10 per cent, while in the others they range from 13.2 to 19.4, 3.1 to 22.5, 3.9 to 14.9, 6.1 to 20.0, 5.4 to 13.7, 5.4 to 18.0, and from 7.5 to 23.4, respectively. In other words, in over half of our samples carelessness in the preparation of the tablets is shown.

Although Kebler examined 231 lots of tablets and our present inspection covers only 41, the results of the two investigations are strikingly similar, as is shown in the following tabulation:

	Kebler. Per cent.	Conn. Per cent.
Showing variation less than 10%	43	45
" " more " 10%	57	55
" " " " 12%	44	42
" " " " 15%	28	28
" " " " 20%	9	10

TABLE XVI:—VARIATIONS IN THE WEIGHT OF MEDICINAL TABLETS.

Station No.	Name of Tablet.	Weight per tablet.			Maximum variation.		
		Maximum. mgms.	Minimum. mgms.	Average. mgms.	Above average. Per cent.	Below average. Per cent.	Total. Per cent.
	Antiseptic (Corrosive sublimate).						
11433	Bristol Myers Co. (1.75 grs.)	187.2	154.9	166.9	12.2	7.2	19.4
11423	The Norwich Co. (7.3 grs.)	1061.2	1004.8	1026.1	3.4	2.1	5.5
11417	The Tracy Co. (7.3 grs.)	1157.6	1072.8	1124.6	2.9	4.6	7.5
11439	The Tracy Co. (1.75 grs.)	166.2	133.6	145.3	14.4	8.1	22.5
	Acetanilid.						
11415	G. F. Harvey Co. (2⅛ grs.)	269.2	230.3	261.4	3.0	11.9	14.9
11410	G. F. Harvey Co. (2 grs.)	249.8	240.2	246.8	1.2	2.7	3.9
11403	Tailby-Nason Co. (3 grs.)	470.8	441.4	460.1	2.3	4.1	6.4
11411	Yates Drug & Chem. Co. (2½ grs.)	359.9	338.5	350.1	2.8	3.3	6.1
11405	Yates Drug & Chem. Co. (2 grs.)..	260.8	245.2	253.4	2.9	3.2	6.1
	Acetphenetidin.						
11446	The Tracy Co. (2½ grs.)	317.9	260.0	304.0	4.6	14.5	19.1
11404	(3 grs.)	243.8	195.2	220.9	10.4	11.6	22.0
	Aspirin.						
11416	Tailby-Nason Co. (5 grs.)	365.9	332.9	352.2	3.9	5.5	9.4
	Blaud's Compound.						
11412	G. F. Harvey Co.	562.6	520.8	538.8	4.4	3.3	7.7
	Calomel.						
11438	The National Drug Co. (¼ gr.)..	88.2	77.5	83.7	5.4	7.4	12.8
11406	The National Drug Co. (1/10 gr.)	35.0	30.5	32.7	7.0	6.7	13.7
11418	The Tracy Co. (2 grs.)	454.1	420.9	441.9	2.8	4.8	7.6
11409	Yates Drug & Chem. Co. (1/10 gr.)	34.9	30.9	33.7	3.6	8.3	11.9
	Calomel and Phenolphthalein.						
11437	Daggett & Miller Co. (1/10 gr.) ...	77.9	70.2	75.0	3.9	6.4	10.3
	Calomel and Soda.						
11451	The Drug Products Co. (1/10 gr.)	88.4	78.9	83.6	5.7	5.6	11.3
11425	The Harvey Co. (¼ gr.)	178.4	165.5	172.6	3.4	4.1	7.5
11402	Yates Drug & Chem. Co. (1 gr.)..	175.9	147.2	161.5	8.9	8.8	17.7
	Digestive Tablets.						
11414	G. F. Harvey Co.	351.0	313.6	335.8	4.5	6.6	11.1
	Hexamethylene tetramine.						
11404	Daggett & Miller Co. (5 grs.)	329.6	312.4	320.3	2.9	2.5	5.4
11424	Daggett & Miller Co. (5 grs.)	331.6	310.0	323.5	2.5	4.2	6.7
11430	The National Drug Co. (5 grs.) ...	332.8	315.4	324.3	2.6	2.8	5.4
11429	Norwich Pharmacal Co. (5 grs.) ..	335.8	321.8	328.8	2.1	2.1	4.2
	Neurosal.						
11422	The Tracy Co.	399.8	357.8	370.9	7.8	3.5	11.3
	Nitroglycerin.						
11448	The Harvey Co. (1/100 gr.)	47.8	40.6	44.0	8.6	7.7	16.3
11551	The Harvey Co. (1/100 gr.)	49.2	41.8	46.1	6.7	9.3	16.0
* 11553	The Harvey Co. (1/100 gr.)	107.5	84.9	96.8	11.1	12.3	23.4
11554	Yates Drug and Chem. Co. (1/100 gr.)	106.2	86.8	97.1	9.4	10.6	20.0
	Paregoric.						
11435	The Harvey Co. (20 min.)	107.2	90.0	95.0	12.8	5.3	18.1
	Phenolphthalein.						
11436	Daggett & Miller Co. (1½ grs.) ...	377.8	312.9	356.9	5.9	12.3	18.2
	Quinin Sulphate.						
11432	Tailby-Nason Co. (2 grs.)	271.5	248.6	263.7	3.0	5.7	8.7
11400	The Tracy Co. (2 grs.)	269.5	250.6	260.2	3.6	3.7	7.3
	Sedative (Bromids).						
11420	The Tracy Co. (7.5 grs.)	540.4	523.5	531.2	1.7	1.4	3.1
	Sodium Bromid.						
11401	Yates Drug & Chem. Co. (10 grs.)	688.5	603.9	647.8	6.3	6.8	13.1
	Sodium Salicylate.						
11434	Yates Drug & Chem Co. (5 grs.)..	837.7	769.1	804.7	4.1	4.4	8.5
11407	Yates Drug & Chem. Co. (5 grs.)..	480.2	415.4	449.2	6.9	7.4	14.3
	Strychnin Sulphate.						
11428	Bristol Myers Co. (1/60 gr.)	78.4	68.6	74.0	5.9	7.3	13.2

Four of our samples show total variations in weight of 20 per cent or over. The fact that these particular samples contained such potent drugs as corrosive sublimate, nitroglycerin and acetphenetidin makes the discrepancy a matter of considerable gravity, and if the oft-repeated claim of uniformity in weight and dosage is to be substantiated certain manufacturers at least must reform their methods in preparing their tablets.

VARIATIONS IN AMOUNT OF MEDICAMENT IN TABLETS.

It is of even greater importance, however, to ascertain how closely the composition of the tablets conforms with that claimed for them on the label. In securing these data it has been necessary to assume that the tablets are of uniform composition, and that the manufacturer has carefully prepared his mix before passing it through the machines. The small quantity of medicament in certain tablets, for instance, nitroglycerin and strychnin tablets, makes the analysis of individual tablets of such drugs almost an impossibility. In the table which follows, therefore, it has been assumed that all the tablets in any one lot were chemically the same and the amounts of medicament recorded for the heaviest and lightest tablets have been calculated directly from the data obtained from the analysis of a composite of 10, 25 or more tablets.

Considering the variations both above and below the claimed amounts, we find a wide range, from 30 per cent above to 64.6 per cent below. The following is a summary of these variations in both directions:

	Number.	Per cent of total determinations.
Variations less than 5%	68	58
" from 5.00-9.99%	24	21
" " 10.00-14.99%	10	8
" " 15.00-19.99%	5	4
" " 20.00-29.99%	5	4
" " 30.00-50.00%	3	3
" over 50%	2	2

That is, 21 per cent of all the drugs determined varied from the claimed amount by more than 10 per cent, and 13 per cent by more than 15 per cent. These results while far from satisfactory show a considerable improvement over the tablets exam-

TABLE XVII:—VARIATIONS IN MEDICAMENT IN TABLETS.

Station No.	Name of Tablet.	Amount declared. grs.	Amount found. Maximum. grs.	Amount found. Minimum. grs.	Amount found. Average. grs.	Maximum Variation from Claim. Above.	Maximum Variation from Claim. Below.
						%	%
11433	Antiseptic Tablets.						
	Corrosive sublimate	1.75	1.88	1.56	1.68	7.4	10.9
11423	Corrosive Sublimate Tablets.						
	Corrosive sublimate	7.30	7.82	7.40	7.56	7.1	0
11417	Antiseptic Tablets No. 1.						
	Corrosive sublimate	7.30	7.87	7.30	7.65	7.8	0
11439	Corrosive Sublimate Tablets.						
	Corrosive sublimate	1.75	1.54	1.24	1.35	0	29.1
11408	Antiseptic Tablets.						
	Corrosive sublimate	7.00	7.57	0.00	7.57	8.1	0
11416	Aspirin Tablets.						
	Aspirin	5.00	5.12	4.66	4.93	2.4	6.8
11412	Blaud's Compound No. 9.						
	Iron carbonate	1.00	0.96	0.89	0.92	0	11.0
	Corrosive sublimate	0.0125	0.0113	0.0105	0.0108	0	16.0
	Arsenious oxid	0.0200	0.0200	0.0185	0.0191	0	7.5
	Strychnin sulphate	0.0167	0.0182	0.0169	0.0175	9.0	0
11438	Calomel Tablets.						
	Calomel	0.25	0.236	0.208	0.223	0	16.8
11406	Calomel Tablet Triturates.						
	Calomel	0.10	0.101	0.088	0.093	1.0	12.0
11418	Hepatic Tablets No. 2.						
	Calomel	2.00	1.94	1.79	1.89	0	10.5
11409	Calomel Tablets.						
	Calomel	0.10	0.101	0.090	0.097	1.0	10.0
11437	Calomel and Phenolphthalein Tablets.						
	Calomel	0.10	0.103	0.093	0.099	3.0	7.0
	Phenolphthalein	0.10	0.106	0.095	0.101	6.0	5.0
11451	Calomel and Soda Tablets No. 1.						
	Calomel	0.10	0.106	0.095	0.100	6.0	5.0
	Sodium bicarbonate	1.00	1.06	0.95	1.00	6.0	5.0
11425	Calomel and Soda Tablets No. 5.						
	Calomel	0.25	0.28	0.26	0.27	12.0	0
	Sodium bicarbonate	2.00	2.10	1.95	2.04	5.0	2.5
11402	Calomel and Soda Tablets No. 4.						
	Calomel	1.00	0.94	0.79	0.86	0	21.0
	Sodium bicarbonate	1.00	1.08	0.90	0.99	8.0	10.0
11415	Headache Pills.						
	Acetanilid	2.125	2.13	1.82	2.07	2.4	14.4
	Caffein	0.375	0.37	0.32	0.36	0	14.7
	Sodium bicarbonate	0.250	0.24	0.21	0.24	0	16.0
			(?)	(?)	(?)		
	Strychnin sulphate	0.004	0.006	0.005	0.006	..	..
11410	Migrain Citrated Tablets No. 2.						
	Acetanilid	2.00	1.99	1.81	1.97	0	9.5
	Caffein citrate	0.50	0.52	0.50	0.51	4.0	0
11403	Tab Salparettes.						
	Acetanilid	3.00	3.06	2.87	2.99	2.0	4.3
	Strontium salicylate	0.50	0.65	0.61	0.63	30.0	0
	Sodium bicarbonate	0.50	0.64	0.60	0.62	28.0	0

TABLE XVII:—VARIATIONS IN MEDICAMENT IN TABLETS.—*Cont.*

Station No.	Name of Tablet.	Amount declared. grs.	Amount found. Maximum. grs.	Amount found. Minimum. grs.	Amount found. Average. grs.	Maximum Variation from Claim. Above.	Maximum Variation from Claim. Below.
11431	Migrain Tablets No. 7.						
	Phenacetin	2.50	1.09	0.89	1.04	0	64.6
	Acetanilid	0.00	1.22	0.99	1.16	..	..
	Caffein citrate	0.50	0.43	0.35	0.41	0	30.0
	Sodium bicarbonate	1.00	0.56	0.46	0.53	0	54.0
11411	Headache Tablets.						
	Acetanilid	2.50	2.54	2.39	2.47	1.6	4.4
	Caffein	0.50	0.52	0.49	0.51	4.0	2.0
	Sodium bicarbonate	1.00	1.04	0.97	1.01	4.0	3.0
11405	Migrain Tablets.						
	Acetanilid	2.00	2.12	1.91	1.98	6.0	4.5
	Caffein citrate	0.50	0.58	0.55	0.57	16.0	0
11404	Formin Tablets.						
	Hexamethylene tetramine	5.00	5.09	4.82	4.94	1.8	3.6
11424	Formin Tablets.						
	Hexamethylene tetramine	5.00	5.12	4.78	4.99	2.4	4.4
11430	Hexamethylene Tetramine Tablets.						
	Hexamethylene tetramine	5.00	5.14	4.87	5.00	2.8	2.6
11429	Formin Tablets.						
	Hexamethylene tetramine	5.00	5.17	4.96	5.06	3.4	0.8
11422	Neurosal Tablets.						
	Acetanilid	2.50	2.47	2.21	2.29	0	11.6
	Sodium salicylate	1.00	1.06	0.95	0.99	6.0	5.0
11448	Nitroglycerin Pills.						
	Nitroglycerin	0.01	0.0105	0.0089	0.0096	5.0	11.0
11551	Nitroglycerin Pills.						
	Nitroglycerin	0.01	0.0100	0.0085	0.0094	0	15.0
11553	Nitroglycerin Tablets.						
	Nitroglycerin	0.01	0.0129	0.0102	0.0117	29.0	0
11554	Nitroglycerin Tablets.						
	Nitroglycerin	0.01	0.0121	0.0099	0.0111	21.0	1.0
11436	Phenolphthalein Tablets.						
	Phenolphthalein	1.50	1.26	1.04	1.19	0	30.7
11432	Quinin Sulphate Tablets.						
	Quinin sulphate	2.00	2.00	1.84	1.95	0	8.0
11400	Quinin Sulphate Tablets.						
	Quinin sulphate	2.00	2.02	1.87	1.95	1.0	6.5
11420	Sedative Tablets.						
	Sodium bromid	2.50	2.66	2.58	2.61	6.4	0
	Potassium bromid	2.50	2.49	2.41	2.45	0	3.6
	Ammonium bromid	2.50	2.51	2.43	2.47	0.4	2.8
11401	Sodium Bromid Tablets.						
	Sodium bromid	10.00	10.00	9.97	9.98	0	0.3
11407	Sodium Salicylate Tablets.						
	Sodium salicylate	5.00	5.30	4.59	4.96	6.0	8.2
11434	Sodium Salicylate Tablets.						
	Sodium salicylate	5.00	5.07	4.65	4.75	1.4	7.0
11428	Strychnin Sulphate Tablets.						
	Strychnin sulphate	0.0167	0.0174	0.0153	0.0164	4.2	8.4

ined by Kebler, who found over one-third exceeding a variation of 10 per cent.

In the smaller tablets a slight variation causes a relatively large percentage variation, and possibly a comparison based on grains of active drug present is more illuminating. On this basis the following variations from claim are shown:

Drug.	Claimed. grs.	Found. Max. grs.	Found. Min. grs.	Maximum Variation from Claim. grs.	Maximum Variation from Claim. Per cent.
Acetanilid	2.00	2.12	1.81	— 0.19	— 9.5
"	2.125	2.13	2.82	— 0.305	—14.4
"	2.50	2.54	2.21	— 0.29	—11.6
"	3.00	3.06	2.87	— 0.13	— 4.3
Acetphenetidin	2.50	1.09	0.89	— 1.61	—64.6
Ammonium bromid	2.50	2.51	2.43	— 0.07	— 2.8
Arsenious oxid	0.02	0.0200	0.0185	— 0.0015	— 7.5
Aspirin	5.00	5.12	4.66	— 0.34	— 6.8
Caffein	0.375	0.37	0.32	— 0.055	—14.7
"	0.50	0.52	0.49	+ 0.02	+ 4.0
Caffein citrate	0.50	0.58	0.35	— 0.15	—30.0
Calomel	0.10	0.103	0.088	— 0.012	—12.0
"	0.25	0.280	0.208	— 0.042	—16.8
"	1.00	1.06	0.79	— 0.21	—21.0
"	2.00	1.94	1.79	— 0.21	—10.5
Corrosive sublimate	0.0125	0.0113	0.0105	— 0.002	—16.0
" "	1.75	1.88	1.24	— 0.51	—29.1
" "	7.30	7.87	7.37	+ 0.57	+ 7.8
Hexamethylene tetramine	5.00	5.17	4.78	— 0.22	— 4.4
Iron carbonate	1.00	0.96	0.89	— 0.11	—11.0
Nitroglycerin	0.01	0.0129	0.0085	+ 0.0029	+29.0
Phenolphthalein	0.10	0.106	0.095	+ 0.006	+ 6.0
"	1.50	1.26	1.04	— 0.46	—30.7
Potassium bromid	2.50	2.49	2.41	— 0.09	— 3.6
Quinin sulphate	2.00	2.02	1.84	— 0.16	— 8.0
Sodium bicarbonate	0.25	0.24	0.21	— 0.04	—16.0
" "	0.50	0.64	0.60	+ 0.14	+28.0
" "	1.00	1.08	0.46	— 0.54	—54.0
Sodium bromid	2.50	2.66	2.58	+ 0.16	+ 6.4
" "	10.00	10.00	9.97	— 0.03	— 0.3
Sodium salicylate	1.00	1.06	0.95	+ 0.06	+ 6.0
" "	5.00	5.30	4.59	— 0.41	— 8.2
Strontium salicylate	0.50	0.65	0.61	+ 0.15	+30.0
Strychnin sulphate	0.0167	0.0182	0.0153	+ 0.0015	+ 9.0

While the average composition of the tablets agrees as a rule very satisfactorily with that claimed, the above table shows that the individual variations from the claim are far too wide. Moreover, the maximum variation is more often below than above the amount claimed, only 10 of the 35 kinds of drugs showing a maximum above the claim. These variations may be summarized as follows:

	Number.	Per cent.
Variation less than 5%	7	20
" " " 10%	18	51
" " " 15%	23	66
" " " 20%	26	74
" " " 30%	32	91
" " " 50%	33	94
" more " 50%	2	6

In other words, in nearly half of the determinations the variation from the claim amounts to over 10 per cent, in one-third over 15 per cent, in one-fourth over 25 per cent, while in the case of two drugs the maximum variation amounted to 54.0 and 64.6 per cent. These last two wide variations occurred in the same tablets, in which there was a deficiency in all of the drugs claimed, and an unclaimed drug, acetanilid, was present. These variations are far too wide and are by no means favorable to the claim of uniform dosage previously referred to.

MAGNESIUM SULPHATE.

(*Epsom Salt.*)

The 37 samples analyzed showed a high degree of purity, ranging from 48.60 to 49.30, average, 49.10, per cent of anhydrous magnesium sulphate. The U. S. P. sets limits of 48.59 and 53.45 per cent for this ingredient. All the samples reacted neutral to litmus; no heavy metals were present in any case; and in only four samples was there a trace of arsenic, the amount in each instance being considerably less than one part in 100,000.

In purchasing these samples the agent asked for four ounces of material. In seven cases considerably less than this amount was delivered. The deficient samples were as follows:

No.		oz.	Deficiency Per cent.
7949.	Notkin's Pharmacy, New Haven	3.2	20
7965.	S. J. Rickman, Hartford	3.6	10
7968.	Front Pharmacy, Hartford	2.3	42
7969.	J. J. Seinsoth, Hartford	3.2	20
7981.	M. A. McCarthy, Waterbury	3.0	25
8054.	City Drug Store, New Britain	3.5	12
8057.	Lincoln's Drug Store, Middletown	3.0	25

The usual price was 5 cents per 4 oz.; although in three samples 10 cents was charged for this quantity.

SODIUM PHOSPHATE.

(*Sodii Phosphas.*)

Eleven samples of this drug were analyzed. The U. S. P. VIII requires that

"it should contain, in an uneffloresced condition, not less than 99 per cent of pure Di-sodium-ortho-phosphate, and should be kept in well-stoppered bottles, in a cool place."

The U. S. P. IX has changed the requirements to read

"It contains not less than 39.25 per cent, nor more than 44.00 per cent of anhydrous sodium phosphate (di-sodium-ortho-phosphate), corresponding to not less than 99 per cent of the crystallized salt."

No impurities were found in any of the samples, the arsenic, when present, being in all cases considerably less than one part per 100,000. The content of anhydrous sodium phosphate is shown in the following tabulation:

		Per cent.
7962.	The Gladding Drug Co., Hartford	45.88
8030.	Louis K. Liggett Co., New York	40.92
7964.	Mallinckrodt Chem. Works, St. Louis	42.15
7963.	Merck and Co.	41.29
7942.	" " "	41.76
7918.	In bulk	53.47
7919.	" "	42.62
7920.	" "	44.85
7961.	" "	53.51
7984.	" "	54.11
8064.	" "	45.72

While no adulteration was found in any of the samples, it is evident that in certain cases there was carelessness in storage, resulting in a partial efflorescence of the salt, and consequently a loss of water of hydration. The phosphate bought in cartons showed as a rule less change than the bulk samples. The latter were bottled immediately on receipt in the laboratory, and the dehydration observed took place before the samples reached our hands. Only five of the eleven samples fully met the U. S. P. requirements.

7964, Mallinckrodt Chem. Works, claimed one pound net weight, but contained only 14.7 oz. **7961**, sold in bulk by A. Laschever, Hartford, for 4 oz. contained only 3.5 oz.

The prices ranged from 15 to 25 cents for pound packages, and from 5 to 15 cents for 4 oz. portions.

EFFERVESCENT SODIUM PHOSPHATE.

(*Sodii Phosphas Effervescens.*)

Three samples of this product were examined, all of which were delivered on a request for Sodium Phosphate. The U. S. P. formula for this substance is 200 gms. exsiccated sodium phosphate, 477 gms. sodium bicarbonate, 252 gms. tartaric acid and 162 gms. citric acid, the whole to make 100 gms. of the finished product.

The analyses of the samples were as follows:

		Loss @ 100° C.	Phosphoric acid.	Equal to exsiccated sod. phos.	Soda.	Carbonic acid.
7944.	Am. Drug. Synd., New York	1.67	10.23	20.41	26.48	17.75
7941.	McKesson & Robbins, N. Y.	2.30	9.38	18.70	31.02	28.79
7917.	Henry Thayer & Co., Boston	10.04	11.58	23.09	28.92	7.41

Tartaric and citric acids were present in all the samples. Less than one part of arsenic per 100,000 was present in any sample.

While the samples contained not far from the theoretical amount of exsiccated sodium phosphate, they all showed a deficiency in carbonate. The percentages of sodium bicarbonate, calculated from the sodium oxid in excess of that required for the sodium phosphate, called for 25.04, 32.42 and 26.79 per cent of carbon dioxid, while only 17.75, 28.79 and 7.41 per cent, respectively, was present, showing that a decomposition had taken place, probably due to exposure to damp air.

PROPRIETARY MEDICINES.

The work of the past few years in connection with proprietary remedies has been continued this year, and the analyses of 38 additional preparations are herewith reported. Most of these represent remedies extensively advertised in the newspapers of the state. A number of additional phenolphthalein preparations were also examined.

Partly because of the nature of the remedies examined, and partly because there has been an actual improvement in the ingredients used in such remedies during the past few years, only a few dangerous drugs (other than alcohol) were found in the medicines. These included pyrogallol and corrosive sublimate each once, and strychnin three times.

The remedies examined this year, however, include some outrageously fraudulent preparations. Remedies for female disorders depending chiefly upon their alcoholic content, a "hair curler" composed of washing soda and gum, dangerous kidney remedies (dangerous because of their ingredients and because they encourage self-medication for such serious ailments), constipation remedies abounding in cathartics (whose presence is often disclaimed), "cure-alls" (whose chief medicament is a mixture of simple, well-known laxatives), fake flesh producers, nerve remedies, germ destroyers, and vitality restorers, are found in the list.

Most of these remedies depend for their sale upon the advertising given them in our newspapers. The speciousness and falsity of their claims are apparent to any one who gives them the slightest consideration, and yet the advertising managers of most of our papers open their columns to them, apparently without the slightest compunctions of conscience. Certain druggists too in order to gain a little free advertising are willing to allow their names to be used in the exploitation of remedies which from their very experience and training they must know to be fraudulent.

The leaven, however, is working and gradually the decent newspapers of the country are taking the stand that their advertising columns shall be as clean and honest and respectable as the news part of their papers. When the newspapers quite generally take this stand the "patent medicine" problem will in great measure be solved, as publicity is the chief stock in trade of these nostrums, and especially as under the Sherley amendment the manufacturers no longer dare to lie on their labels or in the circular matter accompanying the medicines.

A classified list of the brands examined in 1916 follows:

Female Disorders.

McElree's Wine of Cardui.
Pinkham's Vegetable Compound.

Hair and Scalp.

Brownatone.
Eureka Hair Tonic.
Harfina.
Liquid Silmerine.
Mason's Old English Hair Tonic.

Kidneys and Liver.

Cystogen.
Fulton's Renal Compound.
Pierce's Anuric Tablets.
Uricol.
Warner's Safe Remedy.

Skin and Complexion.

Creme Tokalon.
Rexall Tan and Freckle Lotion.

Stomach and Bowels.

A-Lax Tablets.
Analax.
Auto-Laks Chocolates.
Bisuroids.
Bonalax.
Casca Beans.
Ex-Lax.
Lax-A-Tone.
Laxol.
Limestone Phosphate.
Stuart's Calcium Wafers.
Tanlac.
Tanlac Laxative Tablets.

Tonics.

Mark Tonic Bitters.
Nuxated Iron.
Paine's Celery Compound.
Rexall Celery and Iron Tonic.
Rexall Wine of Peruvian Bark.

Miscellaneous.

Comfort Powder.
Kellogg's Sanitone Wafers.
Parmint.
Protone.
Pyorrhocide.
Quaker Herb Extract.

Physicians' Drugs.

Brown's Sedative Tablets.
Formin.
Hawley's Headache Tablets.
Neurosal, Tracy.
Saratoga Goldens.
Tailby-Nason's Tabs. Salparettes.
Tracy's Hepatic Tablets.
Videns Phenolphthalein Tablets.

During the past eight years about 400 proprietary remedies have been analyzed in this laboratory. Below will be found a summary of those remedies containing habit-forming, dangerous, or poisonous drugs. The list of alcoholic medicines includes only those intended for internal use and containing over 10 per cent of alcohol.

Acetanilid.

Aceton.
A. D. S. Headache Wafers.
Antikamnia Tablets.
Bristol Headache Cure.
Broderick and Curtin's Headache Konseals.
Bromo-Lithia.
Callahan's Headache Powder.
Conway's Headache Konseals.
Coughlin's Sure Remedy Head. Powd.
Davis' Anti-Headache.
Duggan's Headache Konseals.
El-Ce-Dee Headache Wafers.
Goodwin's Headache Remedy.
Goulden's Headache Wafers.
Halloran's Headache Powder.
Hawley's Headache Tablets.
Hill's Cascara-Bromide-Quinine.
Hobson's Headache Wafers.
Hoffman's Harmless Headache Powders.
Ingram's Celero-Caffeine Headache Wafers.
Instant Headache Remedy.

Instant Headache Wafers.
James' Miniature Headache Powders.
Jamieson's Headache Konseals.
Jamieson's Improved Headache Powd.
Jones' Grip and Cold Tablets.
Kelly's Headache Konseals.
Lee's Headache Powders.
Linde's Headache Wafers.
Matchless Headache Cure.
McCarthy's Headache Wafers.
Migrain Tablets.
Mohegan Headache Wafers.
Murphy's Instantaneous Headache Remedy.
Narco Headache Remedy.
Neurosal, Tracy.
Notkin's Headache Cure.
Nugent's Headache Wafers.
Nyal's Headache Wafers.
Old B's Headache Tablets.
Orangeine Powder.
Parker's Headache Cure.
Pelton's Headache Powder.
Phenyo-Caffein.
Quick Relief Headache Powder.
Reliable Headache Wafers.
Salparettes Tablets.
Saratoga Goldens.
Shac (Stearns' Headache Cure).
Simon's Headache Pills.
Smith's Headache Tablets.
Stanley Headache Powder.
Superior Headache Powder.
Tanner's Headache Powder.
Taylor's Headache Wafers.
Wheeler's Headache Wafers.
Wilson's Headache Wafers.
Wolff and Fitch's Headache Konseals.
Woodward's Headache Powder.

Acetanilid and Acetphenetidin.

Nicholson's Headache Powder.
Radon's Headache Wafers.

Acetphenetidin (Phenacetin).

Antikamnia Tablets.
Budd's Headache Wafers.
Emerson's Bromo-Seltzer.
Grove's Laxative-Bromo-Quinine.
Halloran's Headache Wafers.
Howard's Headache Powder.
Hufeland's Sure Headache Cure.
Kohler's Antidote for Headache, etc.
Nolan's Headache Powder.
Poyer's Headache Powder.
Rapport's Headache Powder.
Rex Headache Powder.
Rexall Headache Powder.
Shoop's 20 Minute Headache Tablets.
Smith's Headache Wafers.
Toucey's Headache Wafers.
Tracy's Headache Wafers.
Wood's Improved Headache Powder.

Alcohol, ethyl.

%	
42.56	Boker's Stomach Bitters.
30.65	Porter's Medicated Stomach Bitt.
27.68	Sayle's Sarsaparilla.
24.82	Hostetter's Cel. Stomach Bitters.
24.80	Purogen.
24.48	Severa's Stomach Bitters.
23.86	Callahan's Sarsaparilla.
23.36	Rexall Celery and Iron Tonic.
22.52	Rexall Sarsaparilla Tonic.
22.39	Kaufmann's Sulphur Bitters.
21.46	Lash's Kidney and Liver Bitt.
21.42	Rexall Wine of Peruvian Bark.
21.20	Phytoline.
20.75	Wampole's Kola Wine.
20.68	Tona Vita.
19.76	McElree's Wine of Cardui.
19.61	Wincarnis.
19.48	Claflin's Coca Wine.
19.39	Harris' Beef Tonic.

19.28	Burdock's Blood Bitters.
19.13	Bucklen's Electric Bitters.
19.10	Wadewitz's Vegetable Worm Syrup.
18.85	Cuticura Resolvent.
18.94	Mark Tonic Bitters.
18.70	Cardiol Essence.
18.69	Vinol.
18.49	Bowe's Turf Club Bitters.
18.48	Paine's Celery Compound.
18.39	Beef, Iron and Wine (ave.).
18.32	Nyal's Iron Tonic Bitters.
18.00	Pinex.
17.95	Tanlac.
17.89	A. D. S. Iron Tonic Bitters.
17.83	Satoin.
17.37	Peruna.
17.35	Manola.
17.27	Greene's Nervura.
17.20	Rheumatogen.
17.17	Irondequoit Wine of Pomelo.
16.92	Quaker Herb Extract.
16.59	Wampole's Tasteless Prep. C. L. Oil.
16.32	Pinkham's Vegetable Compound.
16.25	Vin Mariani.
15.84	Hopkin's Cel. Union Stomach Bitters.
15.69	Hood's Sarsaparilla.
15.56	Metcalf's Coca Wine.
15.35	Carnrick's Coca Muscatel.
15.20	Neutrone Prescription 99.
15.20	Warner's Safe Remedy.
15.00	Kargon Compound.
14.98	Fowler's Asthma Cure.
14.80	Thompson's Lax. Appetizing Bitters.
14.55	A. D. S. Premium Peptonized Wine.
14.44	Eckman's Alterative.
13.87	Hale's Honey of Horehound and Tar.
13.62	Var-ne-sis.
13.55	Atwood's Veg. Phys. Jaundice Bitt.
13.10	Parmint.
12.43	Maltine with Coca Wine.
12.13	Heckler Palatable Prep. C. L. Oil.
11.25	Waterbury's Compound.
10.90	Manhattan Worm Syrup.
10.20	Hand's Worm Elixir.

Alcohol, methyl (wood).

Carnation Hair Tonic.
Frost's Superior Bay Rum.
Hanford's Balsam of Myrrh.
Jarden's French Bouquet Toilet Water.
Johnson's Bouquet Toilet Water.
Stephan's Clescalp.

Ammoniated mercury (white precipitate).

Kintho Beauty Cream.
Mercolized Wax.
Othine.

Bromids.

Brown's Sedative Tablets.
Kosine.
Mile's Restorative Nervine.

Chloral hydrate.

D. D. D. Prescription.

Cocain.

Anglo-American Catarrhal Powder.
Birney's Catarrh Powder.
Carnrick's Coca Muscatel.
Cole's Catarrh Cure.
Gray's Catarrh Powder (old formula).
Maltine with Coca Wine.
Metcalf's Coca Wine.

Corrosive sublimate.

Hill's Freckle Lotion.
Kingsbery's Freckle Lotion.
McCorrison's Famous Diamond Lotion.
Perry's Moth and Freckle Lotion.
Rexall Tan and Freckle Lotion.
Ruppert's World Renowned Face Bleach.

Fusel Oil.
En-Ar Co Oil.

Lead acetate.
Allen's World's Hair Color Restorer.
Barbo Compound.
Hay's Hair Health.
Parker's Hair Balsam.
Perry's Moth and Freckle Lotion.
Q-Ban Hair Color Restorer.
Wyeth's Sage and Sulphur Hair Remedy.

Opium or morphin.
Cubanos.
Kopp's Baby's Friend.

Paraphenylene diamine.
Potter's Walnut Tint Hair Stain.

Potassium acetate.
Kargon Compound.

Pyrogallol.
Brownatone.

Silver nitrate.
Farr's Gray Hair Restorer.
Goldman's Gray Hair Color Restorer.

Thyroid Gland.
Marmola.
Phy-thy-rin.

REMEDIES FOR FEMALE DISORDERS.

McElree's Wine of Cardui.

5501. *McElree's Wine of Cardui, or Woman's Relief,* for Menstrual Disturbances of Women, Chattanooga Medical Co.; Chattonooga, Tenn. "Alcohol 20 per cent." Price one dollar for 9 fl. oz.

Solids	3.08	gms. per 100 cc.
Glycerin	0.50	" " "
Ash	0.86	" " "
Invert sugar	0.42	" " "
Vegetable extractives	1.30	" " "
Potash	0.282	" " "
Nitrogen, total	0.074	" " "
" nitric	0.026	" " "
Chlorin	0.056	" " "
Spec. grav. at 15.6° C.	0.9910	
Alcohol by volume	19.76	
Phosphates, sulphates, Fe, Ca, Mg	traces	
Black haw, blessed thistle	present	
Bitter principle	present	
Iodids, bromids, emodin, alkaloids	none	
Reaction	neutral	

This remedy contained 19.76 per cent of alcohol by volume, and 3.08 gms. of solids per 100 cc. The latter contained 0.50 per cent of glycerin, 0.86 per cent of ash, 0.42 per cent of invert sugar and 1.30 per cent of vegetable extractives. While the tests for identity were rather inconclusive, the vegetable extractives appeared to be derived from blessed thistle (*Carduus benedictus*) and blackhaw (*Viburnum prunifolium*). No potent drugs, such as iodids, bromids, alkaloids, or emodin were present. Wine also was absent.

The manufacturers of this remedy in their literature recommended it for practically all of woman's ills. Blessed thistle is not recognized in the U. S. P. and the therapeutic value of blackhaw has long been a controversial question. The amounts of these drugs present in the preparation are so small as to indicate little probable beneficial effect on the user, and the fact (recently testified to in the American Medical Association suit) that in the South the women frequently take this remedy direct from the bottle, shows the medicament present is not sufficient to prevent its use as a beverage. Its popularity, especially in prohibition areas, would seem to rest upon its 20 per cent of alcohol (two-fifths the strength of whiskey) rather than on its small amount of medicament. In many derangements of the female system the amount of alcohol in the daily dosage would have a distinctly prejudicial effect.

Pinkham's Vegetable Compound.

5502. *Lydia E. Pinkham's Vegetable Compound,* The Lydia E. Pinkham Medicine Co., Lynn, Mass. "Alcohol 18 per cent." "Recommended for the treatment of non-surgical cases of Weaknesses and Disorders of the Female Generative Organs, Catarrhal Leucorrhoea and Irritation." Price one dollar for 13.8 fl. oz.

Solids	3.12	gms. per 100 cc.
Glycerin	0.56	" " "
Ash	0.34	" " "
Sucrose	0.29	" " "
Invert sugar	0.47	" " "
Total nitrogen	0.07	" " "
Vegetable extractives	1.02	" " "
Chlorin	0.08	" " "
Spec. grav. at 15.6° C.	0.9917	
Alcohol by volume	16.32	
Phosphates, sulphates, Fe, Ca, Mg	traces	
Lovage or angelica	present	
Aloes, or aloin	(?)	
Tansy	(?)	
Emodin, alkaloids, bromids, iodids	none	
Reaction	acid	

This much-advertised remedy contains 16.32 per cent of alcohol by volume with 3.12 gms. of solids per 100 cc. All but a trifle over one per cent of these solids consist of glycerin, sugars and mineral matter. In the vegetable extract lovage (or angelica), and possibly aloes (or aloin) and tansy were identified. No alkaloids, iodids or bromids were present.

As in the case of *Wine of Cardui,* the chief therapeutic effect of the *Compound* rests in its content of alcohol. Like many other proprietary medicines the composition of this remedy is not constant, an analysis of the British Medical Association made in 1912 showing 19.3 per cent of alcohol and only 0.60 per cent of solids and 0.06 per cent of ash.

The persistent advertising of this familiar preparation must mean an extensive sale, which is difficult to explain on any other ground than that the exhilaration afforded by its use brings to the woman temporary forgetfulness of the ills to which her flesh is heir.

HAIR AND SCALP REMEDIES.

Brownatone.

6723. *Brownatone, Dark Brown to Black,* The Kenton Pharmacal Co., Covington, Ky. "Alcohol 10 per cent." "An Ideal Hair Stain. Free from lead, sulphur, silver, mercury, zinc, peroxide, aniline coal-tar products or their derivatives." Price 21 cents for 0.6 fl. oz.

Solids	5.88	gms.	per	100 cc.
Ash	0.74	"	"	"
Iron (Fe)	0.67	"	"	"
Copper (Cu)	0.52	"	"	"
Alcohol	present			
Pyrogallol	present			
Chlorids	present			
Free hydrochloric acid	present			
Acidity (cc. N/10 NaOH per 2 cc.)	16.			
Lead, silver, mercury, arsenic, zinc	none			
Sulphur, peroxids, paraphenylene diamine, diamidophenol	none			

This appears to be a solution of iron and copper chlorids with pyrogallol, having a strongly acid reaction. This pyrogallol preparation is quite similar in composition and properties to *Seeger's Hair Dye* and *Shadeine,* well-known English nostrums. Pyrogallol has a strong affinity for oxygen and rapidly reduces metallic oxids and because of this property is used in photography. It is an active irritant substance, and is sometimes used in certain skin diseases, "but even for this purpose the remedy is not devoid of danger, as at least two deaths are on record from its external application." *U. S. Dispens. 19th ed., p. 1030.*

Eureka Hair Tonic.

5581. *Eureka Hair Tonic,* G. M. Duncan, Springfield, Mass. A brown, slightly turbid liquid.

Spec. grav. at 15.6° C.	1.0068			
Alcohol	none			
Non-volatile solids	1.30	gms.	per	100 cc.
Ash	0.86	"	"	"
Boric acid	1.53	"	"	"
Soda	0.11	"	"	"
Volatile oils (bergamot (?))	present			
Heavy metals, arsenic, ammonia, glycerin, sulphur, capsicum, cantharidin, alkaloids, phenols	none			
Reaction	acid			

The material appears to be simply a perfumed, dilute aqueous solution of boric acid with a very small amount of unidentified vegetable extractive.

Harfina.

6731. *Harfina,* Philo Hay Specialties Co., Newark, N. J.: "A Delightful Tonic for the Hair." Price 45 cents for 3.8 fl. oz.

Solids	2.30	gms.	per	100 cc.
Ash	0.38	"	"	"
Glycerin	1.35	"	"	"
Fatty acids (from soap)	0.66	"	"	"
Quinin	0.073	"	"	"
Spec. grav. at 15.6° C.	0.9838			
Alcohol by volume	18.10			
Wood alcohol	none			
Capsicum, soap, resorcin	present			
Cantharidin, pilocarpin, boric acid	none			
Salicylates	(?)			
Soda, carbonates, sulphates	present in ash			
Reaction	alkaline			
Perfume	present			

This preparation contains only 2.30 gms. of non-volatile solids per 100 cc, consisting chiefly of glycerin and soap, with small amounts of quinin, resorcin, capsicum, perfume, and possibly a small amount of salicylic acid. The claims made for it are not unreasonable and its ingredients are harmless for the purposes recommended. The 18 per cent of alcohol, however, is not declared on the label.

Liquid Silmerine.

6726. *Liquid Silmerine,* Parker, Belmont and Co., Chicago. Price one dollar for 4.4 fl. oz.

Solids	2.16	gms. per 100 cc.
Ash	1.34	" " "
Prec. by alcohol (gum)	1.65	" " "
Boric acid	1.35	" " "
Soda, lime, carbonates	present	
Spec. grav. at 15.6° C.	1.0132	
Alcohol	none	
Sulphates, phosphates, chlorids	traces	
Benzoic acid	trace(?)	
Salicylic acid, phenols, alkaloids	none	

The preparation is a very dilute solution (2.16 per cent) of sodium carbonate, boric acid and a gum, with a possible trace of benzoic acid.

Silmerine is recommended as a means of making hair curl. Any such power which it may possess could be secured just as well by the use of a little gum and washing soda. In either case the effect would be but temporary. A bottle of *Silmerine* costs one dollar, and the ingredients are worth only about 0.8 of a cent.

Mason's Old English Hair Tonic.

6725. *Mrs. Mason's Old English Hair Tonic,* The Paxton Toilet Co., Boston. "Alcohol 25 per cent." Price 89 cents for 5.7 fl. oz.

Spec. grav. at 15.6° C.	0.9722	
Alcohol by volume	26.00	
Wood alcohol	none	
Solids	0.98	gm. per 100 cc.
Ash (mostly sod. phos.)	0.33	" " "
Glycerin	0.61	" " "
Phosphorus or hypophosphorous acid	present	

Ether extract	0.0075
Quinin	trace(?)
Benzaldehyde, benzoic acid	present
Heavy metals, arsenic, capsicum, cantharidin	none

This tonic contains only 0.98 gm. of non-volatile solids per 100 cc, 0.61 gm. of which is glycerin. The remainder probably consists chiefly of a phosphorized oil, with benzaldehyde, benzoic acid and possibly a trace of quinin.

REMEDIES FOR KIDNEYS AND LIVER

Cystogen.

6722. *Cystogen,* Uri-Solvent, Genito-urinary Germicide, Cystogen Chemical Co., St. Louis. Price 39 cents per box of 25 tablets, weighing 124.5 grs.

The material corresponds to the U. S. P. tests for hexamethylene tetramine, and contains 39.80 per cent of nitrogen against a theoretical percentage of 40.

Hexamethylene tetramine is a drug of established value, whose usefulness is in no wise enhanced by the fanciful and therapeutically suggestive name here used. Furthermore 5 gr. tablets of the drug itself were quoted at the time of purchase of our sample of *Cystogen* at the rate of 30 for 15 cents, less than one-third the cost of the proprietary article. This useful drug is also sold under other proprietary names, such as *Urisep-tin, Formin, Urotropin, Ammoform, Cystamine, Hexamine,* etc.

Fulton's Renal Compound.

6732. *Fulton's Renal Compound for Bright's Disease,* John J. Fulton Co., Oakland, Cal. "Alcohol 5 per cent." "The first known specific for Bright's Disease." Price one dollar for 16.3 fl. oz.

A brown, turbid liquid, with much sediment, and with the odor and taste of oil of wintergreen followed by a bitter flavor.

Solids	5.61	gms. per 100 cc.
Ash	0.95	" " "
Boric acid	0.38	" " "
Nitric nitrogen	0.061	" " "
Potash	0.37	" " "
Phosphoric acid	0.17	" " "

Sucrose	2.57	gms. per 100 cc.
Invert sugar	1.19	" " "
Vegetable extractives	0.90	" " "
Resin	present	
Alkaloids	very slight trace	
Methyl salicylate	present	
Licorice	present (?)	
Spec. grav. at 15.6° C.	1.0183	
Alcohol by volume	4.58	
Heavy metals, bromids, iodids, arsenic, glycerin, acetates, antipyrin, acetanilid, acetphenetidin, caffein, emodin	none	
Citrates, lime, magnesia, soda, sulphates	none	

The *Compound* contains about 4.5 per cent of alcohol and 5.61 gms. of solids per 100 cc. 3.76 gms. of the latter are sugars, 0.38 gm. boric acid, with 0.90 gm. of vegetable extractives and an undetermined potassium salt equivalent to 0.37 gm. of potash. Oil of wintergreen (methyl salicylate) is present, and probably licorice.

The analysis indicates the presence of only an extremely small amount of medicament, certainly not sufficient to warrant the remedy's claim of being "the first known specific for Bright's Disease," for which disease of course there is no specific.

The following excerpts from the Company's literature illustrate the extravagance of its claims and its effort to frighten the ignorant into a belief that they are the victims of kidney disease.

"It is the first and only thing we know of that reduces inflammation and stops degeneration in the kidney tissue."

"While Fulton's Compounds have a proven efficiency of about 85 per cent in Bright's Disease and Diabetes, it is to be impressed on patients that what nature does slowly she undoes slowly and that in chronic cases very little is to be expected from the first three or four bottles; in fact, it commonly takes from four to six to begin to make a showing, and it often takes dozens to effect a cure."

"Loomis, of Bellevue Hospital, is on record as saying that from autopsies at Bellevue he believed that nine-tenths of men and women over forty have Bright's Disease in some form."

Among the dietary prohibitions properly recommended by the Company are included malt and spirituous liquors, in spite of the fact that the *Compound* is of about the same alcoholic strength as ordinary beer and ale.

Pierce's Anuric Tablets.

6721. *Dr. Pierce's Anuric Tablets for Kidneys and Backache,* World's Dispensary Medical Association, Buffalo, N. Y. Price 50 cents for 51 tablets, weighing on the average 7.79 grs.

Pink tablets of kidney form, with a bitter saline taste, and with a slight odor of aloes.

Loss at 100° C.	4.00
Ash	35.58
Reducing sugars, as dextrose	42.00
Citric acid	5.44
Iodin	0.70
Total nitrogen	1.52
Free ammonia	0.10
Alkaloids, chiefly cinchonin	2.30
Salicylic acid, about	1.00
Potassium oxid	16.54
Sodium oxid	0.40
Calcium oxid	3.74
Sulphuric anhydrid	0.56
Carbonates, potassium iodid, potassium bicarbonate, potassium citrate	present
Magnesia, phosphates, chlorids	traces
Hexamethylene tetramine	present
Oxymethylanthraquinons	present
Aloin	present
Quinin, cinchonidin	very slight
Acetates, tartrates, nitrates, acetanilid, acetphenetidin, antipyrin	none

These tablets consist essentially of potassium citrate, potassium bicarbonate, potassium iodid, calcium carbonate, hexamethylene tetramine, aloin, cinchonin (probably as sulphate), salicylic acid (probably as sodium salicylate), and sugar. The free ammonia reported is due to the decomposition of hexamethylene tetramine. The source of the salicylic acid is somewhat uncertain; salol (phenyl salicylate) could not be isolated; and the alcoholic extract had a slight odor of methyl salicylate.

In the pamphlet accompanying the remedy the manufacturer notes 78 symptoms of diseases of the kidneys. It is somewhat comforting, however, to be assured that "in no case are all these symptoms felt at one time," but the symptoms are so comprehensive as to lead almost any impressionable person to believe that he is the victim of kidney disease of some sort. Many of

these symptoms are commonly experienced by persons not suffering from any form of kidney disease. "Occasionally colicky abdominal pains," "low spirits," "worry," "nervous dyspepsia," "constipation," "headache," "vomiting," "short of breath," "fever," "itching," "redness of face," "loud breathing," "recurring attacks of bronchitis," "the arteries gradually become stiff," "ringing of ears," "sick feeling," and "poor appetite" are no certain symptoms of kidney disease, although they may at times accompany that malady. The publication of this staggering array of symptoms can have but one purpose, the scaring of the reader into the belief that he is seriously sick.

In referring to Bright's Disease the pamphlet states that "it is not to be expected that these tablets are a cure for all serious kidney diseases, when present in chronic form, but we have found them a great help, giving relief and comfort," but a later paragraph in the same section tells us that "the advantages we possess, and which are enjoyed by few doctors, have resulted in our perfecting methods of treatment and elaborating remedies, which are veritable specifics in this dangerous disease." In other words the tablets are not a "cure" but a "veritable specific," certainly contradictory statements.

In spite of the dangers of self-medication, especially in such a serious ailment as kidney disease, the manufacturer emphasizes the fact that the tablets can be purchased at any drug store, "or sent by mail anywhere," so that "every one who is afflicted with any form of urinary disease has at command reliable remedies which are sure to be of material service. No one will go astray by using them at least until consulting us, or until the necessity for other treatment is unmistakable." This last clause is a wonderfully clear exposition of the danger in using nostrums recommended for the treatment of serious diseases. Many diseases, taken in their earlier stages and treated intelligently, may be checked or even cured, whereas even a short delay caused by self-medication may be fatal and may reveal all too late the distressing fact that "the necessity for other treatment is unmistakable."

Uricol.

27569. *Uricol (Benoit's)*, The Uricol Co., New Haven, Conn. "An Eliminative Solvent for Uric Acid." Price 50 cents for 4.6 oz.

A dry, white powder with a saline taste.

Loss at 100° C.	3.58	K	trace
Na	25.20	Citric acid	45.16
SO_4	5.76	Carbon dioxid	3.48
PO_4	4.86	Ash	62.00
Cl	0.98	Salicylates, acetates, tartrates, nitrogen	none
Li	0.48		

From the above data the following hypothetical composition of *Uricol* may be calculated:

Loss at 100° C.	3.58	Sodium carbonate	8.17
Sodium phosphate	8.49	Sodium citrate	59.42
Disodium phosphate	7.11	Lithium citrate	1.40
Sodium chlorid	1.61	Water of hydration (by diff.)	10.22

Warner's Safe Remedy.

5497. *Warner's Safe Remedy for Kidneys and Liver and Bright's Disease,* Warner's Safe Remedies Co., Rochester, N. Y. "Alcohol 15.5 per cent." Price 50 cents for 7.7 fl. oz.

Spec. grav. at 15.6° C.	1.0236	
Alcohol by volume	15.20	
Solids	13.39	gms. per 100 cc.
Glycerin	9.56	" " "
Ash	1.31	" " "
Invert sugar	0.76	" " "
Vegetable extractives	1.76	" " "
Nitric nitrogen	0.144	" " "
= Potassium nitrate	1.04	" " "
Potash	0.78	
Phosphates, Cl, Fe, Ca, Mg	traces	
Tannin, horehound	present	
Bitter principle	present	
Taraxacum	(?)	
Emodin	none	
Alkaloids, bromids, iodids	none	
Reaction	acid	

The remedy contains 15.20 per cent of alcohol by volume, with 13.39 gms. of solids per 100 cc, 10.32 gms. of which are glycerin and sugar. Potassium nitrate, 1.04 per cent, is present as well as bitter principles and 1.76 gms. of vegetable extractives, among which hoarhound, tannin, and possibly taraxacum were identified.

This remedy, until quite recently exploited as a "cure" for

Bright's disease and other kidney and liver troubles, contains as its most essential ingredients alcohol and potassium nitrate, both contraindicated in kidney diseases because of their irritant properties. The manufacturer in referring to the importance of diet in Bright's disease advises the patient that all stimulating drink should be avoided and yet he supplies to the patient a preparation by taking which according to directions the sufferer will receive the equivalent of 1.25 oz. of whiskey per day.

The advertising of this Company, formerly blatant in its disregard for truth, to-day is more conservative, especially in the literature accompanying the medicine, and yet its effort to scare people into believing they are suffering from kidney affections is continued by such statements as the following:

"Consumption, pneumonia, typhoid fever, appendicitis and heart failure are physical and organic troubles, justly and rightly to be dreaded, but the annual mortality of all put together, we believe, does not equal that of kidney disease."

REMEDIES FOR SKIN AND COMPLEXION.

Creme Tokalon.

6730. *Creme Tokalon, Non-Greasy,* Tokalon, Paris. Price 50 cents.

A white cream with the odor of oil of rose geranium.

Solids	37.60
Ash	0.95
Glycerin	16.91
Fatty acids (stearic and palmitic)	19.90
Boric acid	0.89
Sodium	present
Heavy metals, nitrogen	none
Solubility in 95% alcohol	practically complete

The cream consists of about 79 per cent water and glycerin, 20 per cent stearic and palmitic acids, and 1 per cent of boric acid. The manufacturer claims that it contains predigested dairy cream and olive oil, while an American authority found Irish moss present. If any of the latter is present the amount must be extremely small as the material is practically completely soluble in 95 per cent alcohol. No attempt was made to identify the source of the fatty acids. The absence of nitrogen shows that *Tokalon* is not a casein cream.

Rexall Tan and Freckle Lotion.

6724. *Rexall Tan and Freckle Lotion,* United Drug Co., Boston. "For External Use Only, Poison." Price 25 cents for 1.68 fl. oz.

Spec. grav. at 15.6° C.	1.0344	
Solids	7.32	gms. per 100 cc.
Ash	2.78	" " "
Mercury	0.10	" " "
Boric acid	1.42	" " "
Glycerin	2.01	" " "
Alcohol	none	
Sulphites, or hyposulphites	present	
Chlorids, sodium	present	
Heavy metals, arsenic	none	
Gum, possibly	a trace	

The *Lotion* is a slightly perfumed aqueous-glycerin solution of mercuric chlorid (corrosive sublimate) with borax and an alkaline sulphite.

Corrosive sublimate is a dangerous poison, and while it will remove the freckles it will have the same effect on the skin itself.

REMEDIES FOR STOMACH AND BOWELS.

A-Lax Tablets.

6735. *A-Lax Tablets,* Raymond Chemical Co., Albany, N. Y. Price 25 cents per box of 27 tablets, each weighing on the average 3.38 grs.

Brown, chocolate-covered tablets, with a persistent bitter taste, and on grinding the odor of aloes.

Loss at 100° C.	6.00	Sulphuric anhydrid	6.40
Ash	31.61	Carbonates	present
Ash, insol. in acid	1.89	Manganese	trace
Sucrose	25.44	Strychnin, brucin	present
Invert sugar	trace	Belladonna alkaloids	(?)
Insoluble in 95% alcohol	69.79	Anthraquinons	present
Alkaloids	0.28	Aloin, resins	present
Iron oxid	4.64	Drug plant tissues	very slight
Calcium oxid	11.85	Starch	trace
Magnesium oxid	4.08	Phenolphthalein, capsicum	none

The tablets contain nux vomica, probably belladonna, aloin and possibly other vegetable cathartics, with an iron salt, calcium carbonate and magnesium sulphate.

The remarkable action of the tablets is shown by the following:

"They search every corner of the system, and will help fill you with new rich red blood, life and vigor, impart the glow of health to your cheeks, clear that sallow complexion and relieve that tired feeling; your steps become light and your eyes clear. They aid the stomach in digesting the food and strengthening the nerves. These tablets act as a tonic and blood purifier and must not be classed as a cathartic pill."

It is difficult not to class "as a cathartic pill" a preparation containing aloin and Epsom salt.

Analax.

6718. *Analax,* McKesson and Robbins, New York. "A Delicious Fruity Laxative." "Prepared from a vegetable base containing a high percentage of fruit acids and other vegetable products which have a decided aperient and regulating effect." Price 10 cents for 9 pastilles, weighing on the average 22.3 grs.

Pastilles covered with crystals of sugar, with a sweet, slightly acid taste, and with a strawberry-like flavor.

Loss at 100° C.	11.72	Organic acids (cc. N/10 NaOH per gm.)	1.15
Phenolphthalein	9.25	Citric and tartaric acids	present
Sucrose	45.19	Esters	present
Invert sugar	23.90	Starch	slight trace
Ash	0.26	Nitrogen	none
Gum tragacanth	2.24		

The pastilles each contain 2.17 grs. of phenolphthalein, 16.24 grs. of sugars, with gum tragacanth, citric and tartaric acids, and strawberry flavor.

The claims of the manufacturers are somewhat misleading as undue stress is placed on the presence of fruit acids, whereas the primary effect of *Analax* in relieving constipation is due to the familiar drug phenolphthalein.

Auto-Laks Chocolates.

6716. *Auto-Laks Chocolates,* Auto-Laks Mfg. Co., New York. Price 10 cents for 8 tablets, weighing on the average 21.8 grs.

Loss at 100° C.	1.26	Ash	2.03
Phenolphthalein	13.65	Ether extract	31.27
Sucrose	39.85	Starch	6.11
Invert sugar	trace	Chocolate	present

These are chocolate tablets containing 2.98 grs. of phenolphthalein, 8.69 grs. of sucrose and 1.33 grs. of starch per tablet.

This is one of the many phenolphthalein preparations now on the market. While phenolphthalein is a useful drug and in most cases a harmless remedy, the statement that *Auto-Laks* "is the only laxative known that will not cause any harm if taken habitually" is untrue, as the claim is equally applicable to most phenolpthalein and mineral oil preparations.

Bisuroids.

6733. *Bisuroids,* International Druggists and Chemists Laboratories, New York. Price 17 cents for 31 tablets, weighing on the average 3.04 grs.

Loss at 100° C.	3.24	Heavy metals	none
Phenolphthalein	67.44	Bismuth	none
Starch	25.27	Emodin	none
Ash	2.31	Alkaloids	none
Ash, insol. in acid	2.10		

A simple mixture of about two-thirds phenolphthalein and one-third starch and talc.

The name of the remedy shows a close resemblance to *Bisurated Magnesia* exploited by the same company, but unlike that preparation contains no bismuth. The manufacturers advise the purchaser that "it was found possible to incorporate all the valuable properties of the remedy in the form of a convenient small tablet," surely an illustration of consummate pharmaceutical skill.

Bonalax.

6734. *Bonalax (Roberts),* Practitioners Pharmacal Co., New York. Price 38 cents for 51 tablets, weighing on the average 6.67 grs.

Yellow, sugar-coated tablets with a sweet, licorice-ginger taste.

Loss at 100° C.	4.02	Magnesium oxid	3.80
Phenolphthalein	13.22	Sodium oxid	1.54
Sucrose	35.92	Potassium oxid	0.28
Invert sugar	trace	Carbonates, chlorids	present
Ash	14.21	Sulphates, phosphates, iron	traces
Ash insol. in acid	1.61	Licorice, ginger, starch	present
Insol. in 95% alcohol	44.02	Bile acids	present
Calcium oxid	3.52	Emodin, aloin, alkaloids	none

The tablets contain 0.99 gm. of phenolphthalein and 2.40 grs. of sugar per tablet, with bile acids, licorice, ginger and excipients.

Casca Beans.

4694. *Casca Beans,* P. J. Kellogg Co., Battle Creek, Mich. These tablets accompanied the sample of *Kellogg's Sanitone Wafers.* (See page 285.)

The sample consisted of 10 bean-shaped, chocolate-coated tablets, weighing on the average about 5 grs. per tablet.

Ash	16.87	Rhubarb, aloes, cascara	present
Ash insol. in acid	2.37	Licorice	probably present
Iron oxid	5.17	Capsicum	present
Manganese oxid	0.65	*Alkaloids	very slight amount
Calcium oxid	4.67	Calomel, arsenic	none
Insoluble carbonates	present		

The tablets consist of rhubarb, aloes, cascara, capsicum, and probably licorice, with iron carbonate, manganese oxid and calcium carbonate; a very small amount of an unidentified alkaloid is present.

The manufacturer lays great stress on the "damage done by cathartics" and calls attention to the fact that "there is a raft of stuff sold as laxatives and cathartics that are a positive curse to the human body. Among these cruel bowel-paralyzers are calomel, blue moss, aloes, croton oil, jalap, gamboge and some others." It is, therefore, somewhat disturbing to find of these "cruel bowel-paralyzers," aloes, present in *Casca Beans.* The manufacturer again lays stress on the presence of the "Sacred Bark," a popular name for *Cascara sagrada.* Cascara is present in the remedy, but its newness as a laxative drug is much overstressed.

Ex-Lax.

6717. *Ex-Lax,* Ex-Lax Mfg. Co., New York. "A Chocolate Laxative." Price 19 cents per box of 18 tablets, weighing on the average 23.9 grs.

Loss at 100° C.	1.03	Invert sugar	trace
Phenolphthalein	9.67	Starch	2.90
Ash	1.12	Ether extract	34.92
Sucrose	44.03	Chocolate	present

* Could obtain no reaction for quinin, strychnin or belladonna alkaloids.

Tablets of sweet chocolate containing 2.31 grs. of phenolphthalein, 10.52 grs. of sucrose and 0.69 gr. of starch per tablet.

Ex-Lax is simply phenolphthalein incorporated with sweet chocolate, and whatever virtues it may possess are shared equally by that important drug.

Lax-A-Tone.

7182. *M. J. Kraus' Herbal Lax-A-Tone,* T. G. Walton and Co., Chicago. "A purely Herbal Extract carefully prepared from a proper selection of the Herbs, Roots, Barks, Leaves and Blossoms that cleanse and strengthen the human system." Price one dollar for 6.6 fl. oz.

A brown turbid liquid with an alcoholic, senna-like odor, and with a bitter taste.

Spec. grav. at 15.6° C.	1.0735	
Alcohol by volume	9.74	
Solids	21.51	gms. per 100 cc.
Cane sugar	7.21	" " "
Invert sugar	5.75	" " "
Ash	1.54	" " "
Calcium oxid	0.40	" " "
Carbonates	present	
Rhubarb	present	
Cascara, senna, aloes	prob. present	
Phenolphthalein	none	
Alkaloid, unidentified	trace	
Bitter principles	present	
Other vegetable extractives	present	
Glycerin	none	

Lax-A-Tone is simply an alcoholic, sweetened infusion of vegetable drugs among which rhubarb seems to predominate; cascara, senna and aloes, as well as other unidentified vegetable drugs are probably present. The total vegetable extractives amount to about 7 gms. per 100 cc.

This remedy has been widely advertised in the local newspapers during the past year and wonderful testimonials have been offered attesting its efficacy. As long as constipation continues to be the popular American ailment, various mixtures of well-known cathartics, whether they be named *Lax-A-Tone* or some other fanciful name, will doubtless find a ready sale, even if the misguided user is obliged to pay $5.00 a quart, a cham-

pagne price, for them. Moreover, the habitual user of cathartic drugs should remember that he is simply laying up trouble for himself in the future.

Laxol.

6720. *Laxol,* A. J. White, New York. "99 per cent Cold Pressed Castor Oil made Palatable by the addition of 1 per cent of sweetening and flavoring." Price 25 cents for 3.2 fl. oz.

Spec. grav. at 15.6° C.	0.9630	Castor oil	present
Iodin No.	87.8	Oil of peppermint	present
Refractive index at 25° C.	1.4758	Saccharin	present
Alcohol solubility	complete	Color	pale yellow

The preparation consists of castor oil sweetened with saccharin and flavored with oil of peppermint. The claims made for *Laxol* are conservative.

Limestone Phosphate.

6719. *Limestone (Brand) Phosphate,* Limestone Phosphate Co., New York. Price 35 cents for 4.1 oz.

A fine, dry, white powder, showing a strong effervescence on the addition of water with evolution of carbonic acid gas.

Sodium (Na)	23.84	Lime, if any	very slight trace
Phosphoric acid (PO_4)	56.69	Chlorids, sulphates	traces
Carbon dioxid	12.42	Organic acids	none
Insoluble in water	0.02	Nitrates, potassium	none

This preparation is a mixture of monosodium phosphate and sodium bicarbonate, with possibly a small amount of disodium phosphate. It contains no organic acids and not more than a very slight trace of lime.

The use of the word "Limestone" in connection with this preparation is totally unwarranted, and is most misleading in spite of the word "brand" which appears on the package in small letters.

The reaction between monosodium phosphate and sodium bicarbonate in the presence of water is a simple one, carbonic acid being evolved and disodium phosphate and water remaining. Disodium phosphate has been used by physicians as a mild purgative for over a century. The only possible advantage we can see

in the use of *Limestone Phosphate* is the securing the effect of the disodium phosphate, the U. S. P. drug, without the use of organic acids. *Limestone Phosphate* will have the same effect in preventing auto-intoxication as Sodium Phosphate, U. S. P., no more, no less.

Stuart's Calcium Wafers.

4695. *Stuart's Calcium Wafers Compound,* F. A. Stuart Co., Marshall, Mich. Price 50 cents for 125 wafers weighing 157.4 grs.

Brown wafers with a fetid odor after grinding.

Loss at 100° C.	2.62	Reducing sugars, as dextrose	48.72
Ash	25.15	Alcohol extract	24.50
Ash insol. in acid	0.36	Total alkaloids	0.62
Iron and aluminum oxids	1.36	Strychnin	present
Calcium oxid	15.20	Aloes, or aloin	present
Total sulphur as SO_3	17.12	Carbonates	present
Sulphate sulphur as SO_3	4.29	Starch	present
Magnesium oxid	0.51	Chlorids, phosphates	none

The wafers consist essentially of calcium sulphid, aloes (or aloin), a strychnin preparation, and excipients.

Calcium sulphid some years ago had vogue among certain physicians as an alleged "blood-purifier." The U. S. P. does not consider the drug of sufficient importance to deserve recognition, and whatever virtues the wafers may possess are doubtless due to the cathartic action of the aloes and the stimulating effect of strychnin.

Tanlac.

8003. *Tanlac,* The Cooper Medicine Co., Dayton, Ohio. "18 per cent alcohol by volume." Price one dollar for 8.3 fl. oz.

A brown, vinous liquid with the bitter taste of gentian.

Spec. grav. at 15.6° C.	1.0231	
Alcohol by volume	17.95	
Solids	10.74	gms. per 100 cc.
Ash	0.32	" " "
Sucrose	8.00	" " "
*Alkaloids	0.168	" " "

* This residue was apparently from a berberin-like alkaloid; no reactions for quinin or strychnin were given.

Tartaric acid	0.37	gms. per 100 cc.
Glycerin	small amount	
Rhubarb, gentian	present	
Licorice, cascara	prob. present	
Phenolphthalein	none	

Tanlac, therefore, is apparently simply a sweetened wine, containing rhubarb, gentian and probably licorice and cascara, with a small amount of an alkaloid of the berberin type.

For many months a vigorous advertising campaign has been waged for this remedy in our newspapers. Fabulous cures have been recorded and, if the carefully edited testimonials were to be believed, in *Tanlac* long-suffering humanity is given a panacea for all its ills. The analysis, however, unfortunately solves the *Tanlac* mystery, and shows it to be a simple wine containing laxatives and bitter principles.

Tanlac Laxative Tablets.

8003. *Tanlac Laxative Tablets,* The Cooper Medicine Co., Dayton, Ohio.

These accompanied the sample of *Tanlac* and are supposed to be taken in connection with it. The sample was too small for quantitative determinations, as it consisted of only four brown, coated tablets, weighing on the average 6.56 grs. The presence of the following substances was indicated: cascara, resin, sugar, carbonates, iron, licorice and possibly aloes; phenolphthalein, capsicum, ginger and alkaloids were not present.

It would seem that the manufacturer has so little confidence in the laxative properties of the wine that it is necessary to supplement it with these cathartic tablets.

TONICS.

Mark Tonic Bitters.

6785. *Mark Tonic Bitters,* Henry Thayer and Co., Cambridge, Mass. "Alcohol 18 per cent." "Contains gentian root, cardamon, nutmeg, allspice, bitter orange, quassia, kola nut, cascara bark, sweet flag." Price 50 cents for 7.8 fl. oz.

Spec. grav. at 15.6° C.	1.0417	
Solids	17.86	gms. per 100 cc.
Glycerin	1.61	" " "
Ash	0.54	" " "
Sucrose	1.25	" " "
Invert sugar	10.07	" " "
Total nitrogen	0.042	" " "
Vegetable extractives	4.13	" " "
Iron (Fe)	0.004	" " "
Phosphoric acid	0.048	" " "
Alcohol by volume	18.84	
Chlorids, sulphates, lime, magnesia	traces	
Allspice, cardamon, cloves, bitter orange, oil of bay	present	
Bitter principles	present	
Oxymethylanthraquinons	none	
Alkaloids	none	
Bromids, iodids	none	
Reaction	acid	

These bitters contain 18.84 per cent of alcohol by volume, with 17.86 gms. of solids per 100 cc, of which 10.93 gms. are sugars and glycerin and 4.13 gms. vegetable extractives. Among the latter were identified allspice, cardamom, cloves, bitter orange and other bitter principles. A trace of iron was present, but no alkaloids.

Nuxated Iron.

6728. *Nuxated Iron,* Dae Health Laboratories, Detroit. "Organic iron in the form of ferrum peptonate in combination with nux vomica, phospho-glycerate de chaux and other valuable ingredients." Price one dollar for 60 tablets weighing on the average 4.65 grs.

Brown tablets with the odor of cinnamon and with an intensely bitter taste.

Loss at 100° C.	4.58	Cinnamon, or cassia	present
Ash	38.08	Carbonates	present
Ash insol. in acid	2.08	Cascara	present
Iron oxid	0.80	Calcium glycerophosphate	present
Calcium oxid	8.16	Resin	present
Phosphoric acid	9.20	Vegetable tissue	slight
Alkaloids (nux vomica)	0.155	Starch, Mg, K, Cl, Na, SO_3	traces
Nitrogen	2.34	Sugar, capsicum, aloin, phenolphthalein	none
Strychnin, brucin	present		
Peptonates	present		

The composition claimed for this remedy, as far as ingredients are concerned, is substantially confirmed by our analysis. The impressiveness of "phospho-glycerate de chaux," however, is lost to a considerable degree when translated into its English equivalent, calcium glycerophosphate.

The tablets consist essentially of calcium glycerophosphate, iron peptonate, a nux vomica preparation and cascara. The therapeutically important ingredients present are the iron and nux vomica. We find, however, only 1/40 gr. of iron and 1/140 gr. of nux vomica alkaloids per tablet, almost negligible amounts, especially of the latter. The whole box of 60 tablets, costing one dollar, contains only about 1.5 grs. of iron. One of the best known official iron preparations is *Blaud's Pills,* and these can be purchased at any drug store for from 50 to 75 cents per 100, and they will supply 48 grs. of iron.

"The exploiters of 'Nuxated Iron' would have the public believe that iron is the one thing that most ailing people need. Nothing could be much further from the truth. Iron is a useful and valuable drug in selected cases, but the conditions for which it may be used are limited. The indiscriminate use of iron is illogical and unwise. The claim that 'Nuxated Iron' possesses great advantages over other forms of iron is the sheerest advertising buncombe." *Jour. Amer. Med. Assoc., Oct. 21, 1916, p. 1244.*

The newspaper exploitation of this remedy is mendacious in the extreme. Were one to believe the statements made in these advertisements, it would be necessary to attribute Ty Cobb's success as a baseball artist and Jess Willard's prowess in his contests with Frank Moran and Jack Johnson, solely to these little tablets with their 1/40th grain of iron and their trace of nux vomica alkaloids.

Paine's Celery Compound.

5492. *Paine's Celery Compound,* Wells, Richardson Co., Burlington, Vt. "Alcohol 19.85 per cent." "Contains celery seed, calisaya bark, cascara sagrada, senna leaves, prickly ash bark, sarsaparilla root, hops, ginger root, dandelion root, mandrake root, blackhaw, gentian root, chamomile flowers, black cohosh root, yellow dock root, potassium nitrate, glycerin, sugar and water." Price one dollar for 15.2 fl. oz.

Solids	13.71	gms. per 100 cc.
Glycerin	5.96	" " "
Ash	0.82	" " "
Sucrose	4.01	" " "
Invert sugar	1.45	" " "
Potash	0.47	" " "
Nitric nitrogen	0.114	" " "
= Potassium nitrate	0.79	" " "
Vegetable extractives	1.47	" " "
Cl, Fe, SO_3, Ca, Mg, P_2O_5	traces	
Senna, ginger, celery, sarsaparilla, blackhaw	present	
Bitter principles	present	
Alkaloid (unidentified)	present	
Iodids, bromids	none	
Reaction	acid	
Spec. grav. at 15.6° C.	1.0248	
Alcohol by volume	18.48	

This remedy contains 18.48 per cent of alcohol by volume with 13.71 gms. of solids per 100 cc, of which 11.42 gms. are glycerin and sugars. It also contains 0.79 per cent of potassium nitrate and 1.47 gms. of vegetable extractives, among the latter senna, ginger, celery, sarsaparilla and blackhaw being identified. Bitter principles and a small amount of an unidentified alkaloid are also present.

The list of fifteen vegetable drugs of more or less efficacy given on the label loses much of its impressiveness when it is seen that the total amount of vegetable extractives is less than 1.5 per cent. The manufacturers lay great stress upon the use of celery in cases of nervous prostration, general debility and kindred diseases, but it is somewhat disturbing to note that celery is not included among the official drugs of the U. S. P.; in spite of the worthlessness of many there recognized. Aside from the bitter principles supplied and their consequent tonic effect, it is difficult to see how the small amounts of vegetable extractives, the alleged product of fifteen different drugs, can have any very distinct value. The presence of 18.5 per cent of alcohol is more impressive than the traces of vegetable drugs present.

In spite of its long existence on the market, the manufacturers tell us that

"after much experimenting and research we are able to say to our friends that such a revised formula has been adopted by us and we feel free to

say that for real medicinal merit it stands at the head of remedies of its kind."

This last clause of course means little, but the earlier part of the statement again illustrates the changing formulas of proprietary medicines and the impossibility of depending upon any constancy in their composition.

Rexall Celery and Iron Tonic.

5491. *Rexall Celery and Iron Tonic,* United Drug Co., Boston. "Alcohol 25 per cent." "A General Blood Tonic in Conditions of Debility." Price 75 cents for 15.5 fl. oz.

Spec. grav. at 15.6° C.	1.0176	
Alcohol by volume	23.36	
Solids	12.24	gms. per 100 cc.
Glycerin	1.92	" " "
Ash	0.38	" " "
Sucrose	3.66	" " "
Invert sugar	4.39	" " "
Nitrogen, 0.04 = protein	0.25	" " "
Vegetable extractives	1.64	" " "
Fe, P_2O_5, Cl, SO_3, Ca, Mg	traces	
Capsaicin (or piperin), celery, cardamon	present	
Alkaloid (unidentified)	present	
Bitter principle	present	
Oxymethylanthraquinons	present	
Salicylates, iodids, bromids	none	
Reaction	acid	

This tonic contains 23.36 per cent of alcohol by volume with 12.24 gms. of solids per 100 cc, 9.97 gms. of which consist of sugars and glycerin. Capsaicin (or piperin), celery, cardamom, a cathartic drug, a bitter principle, and possibly other vegetable extractives are present; a small amount of an unidentified alkaloid is also indicated; only a trace of iron (0.008 gm. per 100 cc) is present. Whatever value this tonic possesses must rest upon other drugs than those which are given prominence in its name.

Rexall Wine of Peruvian Bark.

6786. *Rexall Wine of Peruvian Bark,* United Drug Co., Boston. "Alcohol 22 per cent." Price one dollar for 15.3 fl. oz.

Spec. grav. at 15.6° C.	1.0225	
Alcohol by volume	21.42	
Solids	12.82	gms. per 100 cc.
Glycerin	1.05	" " "
Ash	0.32	" " "
Invert sugar	9.40	" " "
Total nitrogen	0.044	" " "
Vegetable extractives	1.77	" " "
Quinin	present	
P_2O_5, Cl, SO_3, Ca, Mg	traces	
Emodin	none	
Iodids, bromids	none	
Reaction	acid	

The preparation contains 21.42 per cent of alcohol with 12.82 gms. of solids per 100 cc, of which 10.45 gms. are sugar and glycerin and 1.77 gms. vegetable extractives, probably derived chiefly from Peruvian bark; quinin alkaloids are present.

It is a fortified wine containing quinin as a tonic.

MISCELLANEOUS REMEDIES.

Kellogg's Sanitone Wafers.

4694. *Kellogg's Sanitone Wafers,* F. J. Kellogg Co., Battle Creek, Mich. "One of the Greatest Nerve Vitalizers Ever Known. Unequalled Strengthener For Mind and Body." Price one dollar for 21 tablets weighing on the average 12.8 grs. per tablet. The package also contained ten *Casca Beans* (see page 276).

Orange colored, sugar-coated tablets.

Total ash	28.93	Sucrose	32.00
Ash insol. in acid	18.20	Phenolphthalein	1.44
Chromium oxid (Cr_2O_3)	16.72	Carbonates in original	present
= Chromium	11.44	Carbonates in ash	trace
Calcium oxid	4.08	Emodin	none
Iron oxid	0.86	Capsicum	none
Total sulphate by $BaCl_2$	17.29	*Alkaloid	slight
Total sulphate by fusion	20.47	Loss at 100° C.	7.98
Sulphate in ash	6.18		

The tablets contain chromium as a sulphate, phenolphthalein, and a trace of an alkaloid-bearing constituent, with calcium car-

*No reaction obtained for quinin or strychnin.

bonate and sugar as excipients. The small amount of iron found is probably present as an impurity in the chromium sulphate, and the undetermined matter is probably simply water of hydration.

Authorities on therapeutics are strangely silent on the virtues of chromium sulphate, which the manufacturer hails in these enthusiastic words:

"The success of this new discovery, contained in Kellogg's Sanitone Wafers, has been determined by its results on a dilapidated array of nervous wrecks; some in the first stages of nervous prostration; some trembling like leaves;—some with punctured ambitions;—some with nerves like limp spaghetti, with memory gone, clear-thinking gone;—some victims of alcohol, and some in the final stages of ruin, locomotor ataxia."

"What have we to say about its effect on a man who had for ten years locomotor ataxia, the worst possible condition into which the nerves may lapse, and by the aid of this great discovery was able in a comparatively short time to walk without assistance,—a circumstance which has compelled the attention of scientists and physicians in many parts of this country and other countries?"

Among the ailments for which the Wafers are especially recommended are lack of energy, lack of ambition, lack of self-confidence, weakness of old age, nervous prostration "even in its most serious and hopeless stage," and paresis. One would almost think that an aphrodaisiac were being recommended.

"In all forms of nervous afflictions—Kellogg's Sanitone Wafers stand out as the most powerful, lasting, striking, curative nerve-strengthener now known. Of this there is no question. There has been no form of treatment known heretofore as a remedy for locomotor ataxia—absolutely none. But this new discovery contained in Kellogg's Sanitone Wafers is the only known treatment so far known to science which has been able to produce striking changes in this disease."

According to the manufacturer these Wafers are not only indispensable for the sick, but also for those who are well, "for you and every grown member of your family."

"Even on healthy nerves, the curative effect of Kellogg's Sanitone Wafers should prove their almost unbelievable power. Neither you nor any grown member of your family will ever be able to fully realize the exquisite sensation of high nerve-power and all the brightness, bounding force and supreme happiness which they should bring in every detail of life, until after using Sanitone Wafers for a time."

The language is somewhat guarded but again the aphrodaisaical suggestion.

The value (?) of this remedy is best shown by the methods used in its exploitation.

"The reader is advised that a 'fifty cent trial package' will be sent free to anyone who applies for it. Those who write for the free samples receive a small box in which are a few orange-colored tablets, and by the same mail a larger box containing a 'complete thirty days' treatment' for which $5 is asked. If no further notice is taken of the Kellogg concern, the unwilling recipient of the $5 'treatment' is bombarded with a series of fellow-up letters each succeeding letter being more insistent than its predecessor in urging that the money be sent for the treatment. Like all mail-order medical fakers, Kellogg has a sliding scale of prices. The first two letters ask $5 for the 'treatment' that was sent unasked; the third and fourth letters offer to accept $3.50 while the fifth and sixth letters inform the prospective victim that a mere $2.50 will square the account. The sixth letter ends with the statement 'This is final,' and, apparently it is, for no further reduction in the price of the treatment is made and neither is the postage sent for the return of the $5 treatment. As it only takes four cents to send the $5 treatment by mail, and as, apparently, the Kellogg company would lose money by sending the four cents for the return of the treatment that was sent unasked, the evident value of this $5 package of pills is less than four cents." *Nostr. and Quack., 1912, p. 385.*

PARMINT.

6727. *Parmint, Double Strength,* International Laboratories, Binghamton, N. Y. "Alcohol 12 2/3 per cent, chloroform 8 min. per fl. oz." Price 75 cents per fl. oz.

A reddish liquid with a strong odor of anise, and with a burning, sweet taste.

Solids	46.00	gms. per 100 cc.
Glycerin	16.68	" " "
Sucrose	20.63	" " "
Ash	0.11	" " "
Chloroform	0.65	" " "
Spec. grav. at 15.6° C.	1.1353	
Alcohol by volume	13.10	
Oil of anise	present	
Other volatile oils (camphor, eucalyptol (?))	present	
Alkaloid, unidentified	trace	
Cochineal	present	

Parmint appears to be an alcoholic solution containing sugar, glycerin, a small amount of chloroform, and a mixture of volatile

oils with oil of anise predominating. Certainly the analysis fails to reveal "the secret of the great success of Parmint."

The solicitude of the manufacturer for the sufferer from catarrh is indeed touching:

"To rid the system of Catarrhal poison and heal all affected parts, and to cleanse and purify the blood, generally requires from 4 to 12 weeks' time. The treatment must be taken without interruption. Not a dose should be skipped and you positively must not allow any lapse of time when you have finished one bottle before starting another.—A break of this kind in leaving off the treatment means a loss of much of the good already done by the medicine, and allows a setback that is unnecessary and useless.—When you start to drive this loathsome disease, Catarrh, from your system, don't stop until you feel sure you have succeeded. Your feelings will be the best guide and will tell you when you are cured."

The above words simply state in another way, what we have often said in connection with other nostrums, if the remedy does not cure you it is your fault, not the medicine's.

Protone.

4707. *Protone,* The Protone Co., Detroit, Mich. "The New Flesh Builder." Price one dollar for 25 tablets and 21 gelatin globules. The average weight of the tablets was 9.91 grs., that of the globules 9.52 grs.

Analysis of Tablets.

Loss at 100° C.	2.80	Sucrose	50.84
Ash	18.89	Invert sugar	4.92
Ash insol. in acid	7.74	Ether extract	16.91
Phosphoric acid, total	4.81	Total nitrogen	0.52
Phosphoric acid, in ether extr.	0.48	= Protein	3.25
Phosphoric acid, water-sol.	0.52	Sulphates, chlorids, carbonates	slight
Calcium oxid	4.64	Hypophosphites	none
Sodium oxid	1.08		
Potassium oxid	0.30		

The percentage of phosphoric acid is rather high, and we find 0.48 per cent of this in the ether extract, indicating the probable presence of a phosphatid of the lecithin type, or a soluble glycerophosphate; there is also 0.52 per cent of water-soluble phosphoric acid. The ash is chiefly calcium phosphate, which again may be derived from calcium glycero phosphate.

Analysis of globules.

These contained a bark brown oil, with the odor of oil of wintergreen, and a black tablet suspended therein. Six capsules yielded about 1.6 cc of this oil. The tablets had a persistent, bitter, distinctly ferruginous taste. Freed from oil they averaged 0.115 gm. in weight.

The oil on heating at 100° C. lost 1.82 per cent, oil of wintergreen being given off. At least 98 per cent was a fixed oil having the characters of castor oil. The oil also contained a cinchona alkaloid, probably cinchonin.

The tablets in the oil contained 41.60 per cent of ash, 6.41 of ash insoluble in acid, 16.83 of iron oxid and 7.91 of calcium oxid; sulphates and carbonates were present as well as iron in the metallic state. The tablets contained reduced iron, iron sulphate, calcium carbonate, and a cinchona alkaloid, probably cinchonin.

Protone is offered to the public as a means for increasing one's weight.

"Protone, remarkable as the fact may appear, contains the main constituent of the cell tissues of the body, scientifically prepared so that it can be taken internally like any ordinary treatment. This is the reason why it can produce such prompt results—it enters almost immediately into the blood circulation and induces from the very beginning of the treatment an increase in weight and a strengthening of the whole nervous system."

The above doubtless refers to the phosphoric acid, probably in the form of a glycerophosphate. The excessive claims made for the glycerophosphates have become very familiar, due to the wide advertising of *Sanatogen* and similar nostrums.

"Protone should be taken alone. Nothing else is needed but Protone, and no diet is necessary."

"Protone is calculated to affect every case of leanness, and it needs but a faithful adherence to the treatment to bring about a successful result."

"Massages, developers, creams, cosmetics, and similar treatments produce but a superficial stimulation, and necessarily cannot *produce* flesh. Internal treatments, such as cod liver oil, milk, emulsions of various kinds, do not serve to distribute over the body the tissue material that *is* formed from digestion."

The daily dosage of *Protone* is 3 of the globules and 4 of the tablets, a total of 69 grs. or about one-eighth of an ounce. The

preparation undoubtedly contains certain tonic principles and may stimulate the appetite, but that the daily use of one-eighth of an ounce of its ingredients will produce the wonderful increases in weight claimed certainly strains our powers of credulity. "Nothing else is necessary" is claimed for *Protone* over and over again in its literature.

The following excellent advice given by the manufacturer probably indicates the reason for any favorable effect from its use:

"Try to cultivate a cheerful disposition, go about your work as usual, avoid intoxicants as much as possible, keep away from the scales except once a week, and you should then without fail begin to notice a distinct improvement in your general condition, your nerves should grow more steady, your mind quicker, your complexion clearer, your carriage become more erect, your self-confidence become stronger, and with it all pound by pound should be gradually added to your weight, your cheeks begin to fill out, wrinkles to disappear, shoulders and chest to develop, the whole body to round out with firm, solid flesh, and your health become firmly established."

And yet heretics tell us "The age of miracles is past."

According to *Nostrums and Quackery, 1912, p. 387,* the Protone Co. is owned by Frank J. Kellogg, whose *Sanitone Wafers* have been discussed on another page. The method of selling the two preparations by mail are very similar. On asking for a free fifty cent package, as advertised, the inquirer also receives a "six weeks' treatment," for which $5 is asked. This price is gradually scaled down from $5 for six boxes to $3 for six boxes, then $1.66 for three boxes and finally twelve boxes are offered for $2.50. Such a method of doing business clearly indicates the true nature of the preparation.

Pyorrhocide.

6729. *Pyorrhocide,* The Dentinol and Pyorrhocide Co., New York. "A Powerful Antiseptic, Deodorant and Prophylactic Tooth Powder. Universally prescribed by The Dental Profession in the treatment and prevention of Pyorrhea alveolaris." Price one dollar for 3.14 oz.

A fine, reddish-brown powder with the odor of sassafras and wintergreen.

Loss at 100° C.	6.16	Fatty acids and resin	6.79
Ash	65.93	Ground vegetable drugs (approx.)	22.76
Ash, insol. in acid	5.73	Alkaloids	0.394
Calcium oxid	30.50	Carbon dioxid	much
Magnesium oxid	3.08	Cinchona alkaloids	present
Sodium oxid	2.30	Ipecac alkaloids	present
Potassium oxid	0.25	Oil of sassafras	present
Boron, as boric acid	4.59	Oil of wintergreen	present
Ether extract	3.19	Soap	present
95% alcohol extract	9.71		

Insoluble ash. This was of the nature of quartz-like grit, probably existing as an impurity of the ground vegetable drugs.

Ether extract. This was chiefly oils of sassafras and wintergreen. On saponification with alcoholic potassium hydroxid and extracting with ether, unsaponified oil identified as oil of sassafras was found. The alkaline solution was then acidified and shaken out with ether, the ethereal residue giving reactions for salicylic acid, present as methyl salicylate (oil of wintergreen).

95 per cent alcohol extract. This was a brown residue, with the odor of sassafras and also with a peculiar nauseous odor. It was of a soap-like character, producing a foam when shaken with water, and on the addition of dilute acid free fatty acids contaminated with resinous matter were separated.

Alkaloids. The acid-soluble portion of the 95 per cent alcohol extract was made alkaline with ammonia and extracted with chloroform. On evaporating the chloroform an impure brown, non-crystalline alkaloidal residue was obtained, which gave reactions indicating the presence of alkaloids from ipecac and cinchona.

Vegetable drugs. Microscopical examination showed powdered sassafras, ipecac and red cinchona, with quartz grains.

From the above data *Pyorrhocide* appears to be a mixture of chalk, borax, soap, and ground cinchona, ipecac and sassafras (containing considerable mineral impurity), flavored with methyl salicylate.

In recent years emetin (as hydrochlorid), an alkaloid contained in ipecac, has had much vogue as a remedy for pyorrhea alveolaris (Riggs' disease). Quinin is also recognized as a highly efficient amoebacide. *Pyorrhocide* contains both cinchona and ipecac in the form of the ground drugs, but whether their

alkaloids would be as effective in this condition we are not prepared to say.

The manufacturers of this product take a refreshingly enlightened attitude, as is evidenced by the following statement:

"Notwithstanding the fact that Pyorrhocide is singularly efficacious in pyorrhea alvéolaris, if used in due time with proper regularity, it should be borne in mind that the services of a competent dentist are of great importance in every instance."

Quaker Herb Extract.

6787. *Quaker Herb Extract,* The Quaker Herb Co., Cincinnati, Ohio. "Alcohol 18 per cent." "The Great Quaker System Purifier and Worm and Germ Destroyer." Price one dollar for 12.2 fl. oz.

Solids	8.29	gms. per 100 cc.
Glycerin	0.88	" " "
Ash	2.89	" " "
Magnesium oxid	0.48	" " "
Sodium oxid	0.84	" " "
Potassium oxid	0.17	" " "
Sulphuric anhydrid	1.35	" " "
Sucrose	0.29	" " "
Invert sugar	1.60	" " "
Total nitrogen	0.062	" " "
Vegetable extractives	2.24	" " "
Spec. grav. at 15.6° C.	1.0258	
Alcohol by volume	16.92	
P_2O_5, Cl, Fe_2O_3, CaO	traces	
Licorice (much)	present	
Rhubarb (much)	present	
Tannin	present	
Bitter principle	present	
Aloes, or aloin	probably	
Santonin, salicylates	none	
Reaction	neutral	

A vigorous advertising campaign in connection with this remedy has recently been conducted through the local newspapers, and tapeworms of fabulous size have been displayed in the windows of one of our drug stores as testimonials of its wonderful efficacy. It is strongly alcoholic, containing nearly 17 per

cent, and contains 8.29 gms. of solids per 100 cc. These solids are made up of sugars and glycerine, mineral matter, and vegetable extractives in nearly equal proportions. The extractives contained much licorice and rhubarb with tannin; and a bitter principle, and probably aloes (or aloin). The ash shows considerable amounts of magnesia, soda potash and sulphates, but we are unable to determine the manner in which these were combined, although the presence of some magnesium sulphate (Epsom salt) was strongly indicated. No santonin or salicylate was detected.

The analysis shows the presence of no remarkable therapeutic agents. Licorice has value as a demulcent, while rhubarb is useful as a tonic, laxative and astringent and the cathartic properties of aloin are well-known. The extractives from these three drugs, however, present in the remedy amount to only about two per cent. Just what gives the medicine its wonderful power as a "Germ Destroyer" our analysis fails to disclose. Great emphasis is placed on the purely vegetable character of the Quaker remedies, yet in this preparation we find over one-third of the total solids to be in the mineral form, with a strong suspicion that Epsom salt is one of its ingredients.

Quaker Herb Extract is recommended for a very long list of ailments, including catarrh, liver, kidney and bladder complaints, rheumatism, neuralgia, malaria, constipation, general debility, falling of the womb, leucorrhoea, change of life, worms, and, inferentially, for pneumonia, bronchitis and consumption. Perhaps licorice, rhubarb and aloes will effect cures of these diseases, but our doubts on this subject are great indeed.

FOOD AND DRUG PRODUCTS EXAMINED FOR THE DAIRY AND FOOD COMMISSIONER.

Eight hundred and eighty-six samples were examined for the Dairy and Food Commissioner. Of the total number examined, 533 were not found to be adulterated, 42 were legally labeled compounds, and 311 were adulterated, misbranded or below standard.

Butter and Butter Substitutes. Of 349 samples examined 247 were genuine butter, 83 renovated butter and 19 oleomargarine.

Cider. The single sample examined contained no chemical preservative.

Clams. Eleven samples were examined for added water, including 7 samples of long clams and 4 of round clams. The Maine authorities hold that clams, presumably long clams, should contain at least 18 per cent of solids with not more than 12 per cent of free liquor. No standards for round clams are given, but apparently much more free liquor is to expected with this kind of clams. According to the Maine standard only one of the seven samples of long clams was satisfactory both as regards solids and free liquor. **11009** carried only a small amount of free liquor but the solids were suspiciously low; with **11029** the reverse was true. **11008** and **11029** were the only samples showing a high content of salt in the liquor. **11015** and **11022** are especially worthy of attention as they contained only 12.1 and 9.8 per cent of solids with 35.0 and 35.1 per cent of free liquor, respectively; they both gave decided evidence of watering.

The round clams showed more uniformity in composition. **11025**, however, was badly decomposed when received in the laboratory.

No.	Drained Clams. gms.	Liquor. gms.	Per Cent Liquor.	In Clams. Solids. %	Ash. %	Salt. %	In Liquor. Salt. %	Loss on Boiling. %
Long clams.								
11008	440	25	5.4	22.2	1.82	0.19	1.25	68.5
11009	404	27	6.3	15.1	1.14	0.05	0.23	64.3
11015	285	169	35.0	12.1	1.02	0.07	0.29	61.0
11022	303	164	35.1	9.8	0.80	0.20	0.55	70.1
11023	404	61	13.1	17.8	1.24	0.21	0.54	60.2
11028	417	41	8.9	16.3	1.26	0.24	0.68	62.2
11029	355	122	25.6	20.7	2.46	0.79	2.17	46.1
Round clams.								
11010	189	278	59.5	20.7	2.19	1.14	2.53	46.2
11014	165	288	63.6	20.9	2.25	1.09	2.58	49.8
11018	161	267	62.4	18.6	2.43	1.29	2.61	52.8
11025*	194	294	60.4	20.9	3.30	1.23	2.50	57.2

Coffee. Eighteen brands of ground coffee were examined, all of which were free from adulteration. These brands were as follows:

Arbuckle's Yuban.
Beatsall.
Brownie.
Famous Royal Scarlet.
Frazier's Mascot.
Gold Coin.
Gate's Pioneer.
Grand Union Turkish Style.
Kar-A-Van El Perco.
Kay-Bee.
Lincoln's Capitol Mills.
Lincoln's Union Club.
Lipton's Perfection Blend.
Moody's Morning Glory.
Relicco.
Van Dyk's Duchess.
Weir's Skyline.
Weir's White Squadron.

Cordial Chocolates. Four samples were examined, which contained in the liquor 0.51, 0.79, 1.07 and 0.86 per cent of alcohol by weight. Under the law all of these were therefore adulterated.

Eggs. One sample of eight eggs was examined with the following results:

No.	Air Space.	Break.	Gain or Loss on Boiling. gm.
1	Prominent	.....	—0.08
2	Large	White watery, yolk settled	0
3	Large	Yolk flattened	...
4	Prominent	" "	...
5	Large	" "	...
6	?	" "	—0.09
7	Large	White watery, yolk settled	0
8	Prominent	.....	...

These eggs were sold as "Fresh York State Eggs." From the data given above it is evident that they were not fresh eggs, although it cannot be stated definitely that they were storage eggs.

Ketchup. Eighteen samples were examined, 14 of which claimed the use of no chemical preservative, the other 4 admitting the use of benzoate of soda. The claims were found to be correct, except that one brand contained more benzoate than claimed.

The following brands contained no benzoates, salicylates, borates or saccharin:

10951. Austin, Nichols & Co. Scottish Chief.
10788. Booth Packing Co. Booth's Pure.
10988. Cudahy Packing Co. Rex.
10799. John T. Doyle Co. Country Club.
10969. John T. Doyle Co. Country Club.
10981. John H. Fitch Co. Onward.

* Rotten when received.

10997. Frazier Packing Co. Royal Red.
10990. Frazier Packing Co. Frazier's.
10954. Great Atl. and Pac. Tea Co. A. and P.
10795. Harbauer Co. Harbauer's.
10791. Burt Olney Canning Co. Burt Olney's.
10967. T. A. Snider Conserve Co. Snider's.
10961. Stoddard, Gilbert & Co. Polo.
10957. R. C. Williams & Co. Robin Hood.

The following brands contained benzoate of soda in the amounts stated, 0.10 per cent being uniformly claimed:

11020. Curtice Bros. Blue Label (0.10).
11027. Empire Bottling Works. Just Right (0.10)
11021. Humphrey-Cornell Co. Best Yet (0.14).
11024. E. Pritchard. Pride of the Farm (0.10).

Nine samples were examined bacteriologically according to the methods outlined in *Circular 68* of the Bureau of Chemistry with the following results:

No	Bacteria per cc.	Yeasts and Spores per 1/60 cc.	Moulds Per cent of Fields.
11024	119,300,000	22	4
10981	92,400,000	133	7
11021	175,200,000	28	18
11027	188,400,000	48	25
10997	183,600,000	25	11
10961	136,800,000	19	28
11020	160,800,000	22	21
10951	219,600,000	63	28
10957	153,600,000	25	16
Bur. of Chem. max. standard	25,000,000	25	25

All of the samples exceeded the maximum of the Bureau of Chemistry standard for bacteria; four exceeded, two equalled and three were below the maximum for yeast and spores; while two exceeded the maximum for moulds.

Lard. Eight samples sold as "Compound" or "Compound Lard" were examined. These samples consisted largely of cotton seed oil and oleo stearin, with some beef stearin in a few cases. The sale as "Compound Lard" of a material containing no lard whatever is certainly contrary to the spirit of the law.

Milk. Three hundred and eight samples were analyzed. Of these 164 conformed to the legal standards, while 49 were deficient only in solids-not-fat. Eighty-nine were below standard

in solids, 51 in fat and 133 in solids-not-fat, 144 samples failing to meet the legal requirements in one or more particulars. Forty-seven samples were watered, 8 were skimmed and 1 was both skimmed and watered.

The skimmed milks were taken in Bozrah, Easton, Salem and Stonington; the watered milks in Ansonia, Bloomfield, Brookfield, Cheshire, Easton, Guilford, Manchester, Marlboro, Meriden, Middlebury, Naugatuck, New London, Newtown, Orange, Oxford, Preston, Rocky Hill, Somers, Southington, Stonington, Torrington and Wethersfield; the sample of skimmed and watered milk in Middlebury.

Molasses. Twenty-two samples were examined for sulphurous acid, which was declared in each instance. Nineteen samples contained from 51 to 296 mgms. of sulphurous anhydrid per kilo, with an average of 131 mgms. The remaining three samples contained 669, 884 and 500 mgms., respectively, far in excess of the amount permitted by the Federal Government.

Oysters. Sixteen samples were tested for added water. Shucked oysters shipped in commerce should contain but very little free liquor, certainly not more than 10 per cent. Oysters sold with their own juice, however, may carry as much as 35 per cent of liquor. Too close conclusions will not be drawn, therefore, in this respect from the date given in the following table. Nevertheless, **10982** and **10995** probably, and **10994** certainly, carried an excess of liquor.

Oysters which have not been adulterated with water, either by floating or soaking, by direct addition of water, or by the melting of ice packed with them, should not contain less than 16 per cent of solids or less than 0.25 per cent of salt in the oysters, or lose more than 50 per cent of their weight on boiling.

According to these criteria only **10974, 10975, 10976, 10994,** and **10996** show no evidence of added water. In the other samples in some cases there is evidence of the oysters having been "soaked," while in others water has been added directly. **10982** was reported by us to the retailer as being "soaked" oysters and as containing too much free liquor. The retailer claimed that the oysters were in the same condition as when received from the wholesaler except for the addition of oyster liquor supplied by said wholesaler at the time of purchase. Accordingly a sample, **11006,** was taken from the wholesaler and the

analyses of the oysters in the two samples proved to be quite similar, the wholesaler's containing somewhat more ash and salt. The amounts of free liquor, however, are very different. **11007** represents the oyster liquor claimed to have been supplied by the wholesaler with **10982.** The analysis of this liquor shows it to be a true oyster liquor, as distinguished from a brine, containing 1.26 per cent of organic matter. It shows, however, no resemblance whatever to the liquor drained off from **10982.**

To summarize concerning these two samples, the oysters in **11006** had been soaked by the wholesaler, the oysters in **10982,** already soaked when received, had been further soaked by the retailer, and water added to them.

No.	Beds.	Drained Oysters. gms.	Liquor. gms.	Per cent Liquor.	In Oysters. Solids. %	Ash. %	Salt. %	In Liquor. Salt. %	Loss on Boiling. %
	Oysters.								
10974.	Greenport, L. I..	409	70	14.6	19.5	1.49	0.32	1.09	40.2
10975.	Rockaway, N. Y.	408	91	18.2	22.6	2.07	0.47	1.38	36.0
10976.	Orange	424	45	9.6	18.5	1.58	0.39	1.27	42.4
10978.	Narragansett ..	394	92	18.9	17.1	1.22	0.22	0.76	51.8
10979.	? ..	429	40	8.5	16.2	1.05	0.08	0.37	48.8
10982.	*Stony Creek ..	286	196	40.7	13.0	0.63	0.02	0.20	58.4
11006.	†Stony Creek ..	396	63	13.7	13.3	0.81	0.10	0.18	51.9
10983.	Branford	331	162	32.9	16.0	1.21	0.17	0.70	48.9
10984.	Cristfield, Md...	361	114	24.0	16.3	0.73	0.04	0.18	54.6
10986.	Narragansett ..	282	179	38.8	14.3	0.99	0.12	0.39	52.0
10987.	Stony Creek ...	345	121	26.0	14.2	0.94	0.05	0.20	52.4
10994.	Sound Beach ...	188	284	60.2	18.5	1.86	0.69	1.59	43.0
10995.	Darien	380	101	21.0	17.6	1.28	0.21	0.71	40.6
10996.	Setauket, L. I...	288	194	40.2	16.2	1.44	0.38	1.07	45.7
11019.	? ..	334	157	32.0	14.9	2.01	1.21	2.03	53.8
	Oyster liquor.				*In liquor.*				
11007.	.....	...	...	....	3.42	2.16	1.74	....	....

Sausage. The two samples contained 0.29 and 1.20 per cent of starch.

Vinegar. Two samples were examined, which had been complained of because they blackened on standing after opening. One represented the partly used consumer's sample, the other an unopened sample purchased by our agent. Their analysis was as follows:

* Retailer. † Wholesaler.

	11289	11290
Acidity	4.70	4.72
Solids	1.88	1.90
Ash	0.29	0.29
Iron (gms. per 100 cc.)	0.0073	0.0074

On evaporation the coloring matter came down as a very fine black precipitate. On boiling the blackened vinegar became appreciably lighter in color but on exposure to the air became brown and after 36 hours black. After keeping the samples for a month, tightly stoppered, they both became clear and free from the black precipitate. While the presence of iron may have had some influence in the darkening of the vinegar, it seems more likely that the latter was due to the presence of an oxidase.

Bay Rum. Bay Rum according to the National Formulary should contain 58 per cent of ethyl alcohol. Various products are offered on our markets under this name but claiming much lower percentages of alcohol, one brand actually claiming to be non-alcoholic. It is apparent that such products are not true bay rums and there is considerable question as to the legality of their sale even when their substandard character is indicated on the label. Fifteen such samples were examined and are listed below:

Brand.	Spec. gr.	Alcohol Claimed.	Alcohol Found.
Marvo (Wm. H. Loveland Co.)	0.9777	20	18.44
Marvo (Wm. H. Loveland Co.)	0.9770	20	19.05
(United Toilet Goods Co.)	0.9883	15	9.00
Favorite (C. H. Seleck)	0.9737	20	22.33
Favorite (C. H. Seleck)	0.9747	20	21.37
Moorac (Holman)	0.9848	12	11.58
Royale (Ed. Gerarde)	0.9770	20	19.11
(Joubet & Co.)	0.9825	15	13.75
(Joubet & Co.)	0.9810	15	15.14
Eden	0.9800	..	16.68
(Chas. M. Rich)	0.9817	15	14.51
(Calavecchio & Co.)	0.9492	..	42.54
(Star Perfumery Works)	0.9801	15	16.02
(Queen Perfume Co.)	0.9764	33⅓	19.73
French's Improved	1.0025	0	0

Two brands made no specific claim as regards alcohol and must therefore be assumed to be sold as standard bay rum. These contained only 16.68 and 42.54 per cent of alcohol, respectively. Another brand claiming 15 per cent contained but 9

per cent, while another claiming 33 1/3 per cent contained only 19.73 per cent.

Hair Tonic. A sample of *Carnation Hair Tonic,* made by Eugene Warshaw and Co., Hartford, contained 38.16 per cent of methyl (wood) alcohol by volume.

Hydrogen peroxid. A sample of the product of the Busy Bee Chemical Co., New York, contained only 1.25 per cent of absolute hydrogen peroxid, and showed an acidity equivalent to 3 cc of tenth-normal alkali per 25 cc of the solution.

Physicians' Drugs. Fifty-three samples of drugs were taken from the stocks of dispensing physicians. These are discussed on pages 229 to 248.

Rum. The sample was deficient in alcohol, containing only 35.80 per cent by volume; no wood alcohol was present.

Toilet Waters. A sample of *Bouquet Toilet Water,* made by C. A. Johnson, New Haven, contained 49.25 per cent of methyl (wood) alcohol by volume. A sample of *Jarden's French Bouquet Toilet Water,* made by Eugene Warshaw and Co., Hartford, contained 16.20 per cent of ethyl alcohol and 24.49 per cent of methyl (wood) alcohol, both by weight.

Turpentine. Forty-four samples were examined, 39 of which showed no adulteration other than possible small amounts of mineral oil. Five samples were adulterated with mineral oil in amounts equal to 9.6, 16.4, 22.4, 12.0 and 13.6 per cent, respectively.

Whiskey. A sample of *Sherwood* whiskey contained 43.19 per cent of ethyl alcohol by volume; no wood alcohol was present.

Wine. A sample of California wine showed the following analysis:

Spec. grav. at 15.6° C.	0.9971	Color	natural
Alcohol by volume	14.60	Preservatives	none
Ash	0.37	Wood Alcohol	none

MISCELLANEOUS MATERIALS SENT BY PRIVATE INDIVIDUALS.

Baking Powder. The sample analyzed was not adulterated.

Buckwheat Flour. The sample analyzed was not adulterated.

Butter. Of the 7 samples tested 4 were genuine butter, 2 were renovated butter and 1 was oleomargarine.

Candy. A sample of Eatums, made by the Crescent Candy Co., was suspected of having caused sickness in children. The candy was a "taffy-on-the-stick" with a peanut butter center. It contained 8.30 per cent of fat, mostly peanut oil, 1.45 per cent of ash, only a trace of acid-insoluble ash, and no alkaloids or heavy metals. There were no abnormal features as regards taste, odor, appearance, etc. The yellow paper covering the candy was colored with turmeric, a harmless vegetable color.

Cider. The sample tested contained 5.43 per cent of alcohol by volume, placing it in the "hard" cider class.

Cream. The three samples tested contained from 21.50 to 30 per cent of butter fat.

Gluten Bread. The sample was quite stale when received, and contained in this state 10.50 per cent of protein and 50.32 per cent of starch, showing the material to be by no means a desirable "gluten" bread.

Maple Syrup. The sample analyzed was not adulterated.

Milk. All of the 9 samples analyzed were of standard quality.

Near Beer. A sample of Pabst Pablo contained 0.17 per cent of alcohol by volume.

Roman Punch Flavor. This material, made by the Daggett Chocolate Co., Boston, contained 48.41 per cent of ethyl alcohol by volume.

Vinegar. Twenty-eight samples were analyzed, chiefly for farmers intending to sell their product to local dealers. The state's minimum standard for cider vinegar is 4 per cent of acetic acid and 1.6 per cent of solids. Fourteen samples satisfied this standard, while 6 were low in acidity and 8 were low both in acidity and solids. Such abnormal values as 10.76 per cent of acid and 6.01 per cent of solids were shown by two of the samples.

Wine. Five samples were analyzed. Two were examined for alcohol only, containing 6.37 and 12.65 per cent of ethyl alcohol by volume, respectively. The other samples, all California wines and purchased for sacramental purposes, had the following composition:

	1	2	3
Spec. grav. at 15.6° C.	0.9984	1.0237	0.9967
Alcohol by volume	12.13	17.90	20.23
Extract	3.67	11.78	5.38
Acidity as tartaric (gm. per 100 cc.) ...	0.51	0.66	0.45

Animals Suspected of Poisoning. Eight animals, or portions of same, suspected of having been poisoned, were examined. The contents of the stomachs of three heifers, which died suddenly, were found to contain arsenic. The contents of the stomach of a horse, which likewise died under suspicious circumstances, showed no poisons of an alkaloidal or mineral nature; the stomach contents showed several rat faeces and many larvae of the horse fly were found attached to the walls of the stomach. Two chickens and two pigeons were also examined for poisons, in all cases with negative results. In one of the chickens the crop was gorged and of abnormal weight, the bird apparently having died from suffocation. The organs of the other chicken were in good condition except the liver which bore greenish patches.

Antikamnia. A sample of this much-advertised remedy was suspected of containing acetanilid on account of the symptoms shown by the person using it. No acetanilid was found, but 4.97 grs. of acetphenetidin (phenacetin) per tablet was present.

Disinfecting Fluid. This was found to be a mixture of volatile compounds, such as turpentine, benzine, kerosene and volatile oils (oil of sassafras predominating). No phenol, no heavy metals and no arsenic were present. The material would appear to have some value as an insecticide, but would be of little use as a disinfectant.

Gasoline. The sample examined contained no adulteration.

Habit-forming Drugs. Three samples taken on prisoners were examined, one proving to be heroin and the other two morphin sulphate.

Intestinal Cleanser for Chickens. This was found to be essentially a mixture of free sulphur, sodium bicarbonate, magnesium sulphate and iron sulphate; possibly also some sodium sulphate was present.

Massage Cream. The sample was tested for heavy metals with negative results.

Mineral. The sample consisted chiefly of silica and silicates of iron, alumina, etc.

Poison Samples. A sample of material found in a coffee cup and suspected of containing poison, was found to be a milk powder with no alkaloids or mineral poisons present. Two samples of tea suspected of containing poison were found to be free from alkaloidal or mineral poisons.

Sediment from Gin. This was found to be glass derived from the container.

Tobacco Infusion. This contained 0.042 per cent of nicotin.

TABLE XVIII:—SUMMARY OF RESULTS OF EXAMINATION OF FOOD AND DRUG PRODUCTS, 1916.

	Not found adulterated.	Adulterated, or below standard.	Compound.	Total number examined.
Sampled by Station.				
Hygienic Coffee	1	4	—	5
Cream of Tartar	31	—	1	32
Diabetic Foods	—	—	—	22
Condensed Milk	40	3	—	43
Skim Milk Powders	2	—	—	2
Allspice	21	3	—	24
Cloves	21	6	—	27
Mustard	30	—	—	30
Pepper, black	28	4	—	32
Pepper, cayenne	8	20	—	28
Pepper, white	24	4	—	28
Sage	—	—	—	20
Thyme	—	—	—	16
Dovitam	—	1	—	1
Vegetable Extracts	1	1	—	2
Magnesium Sulphate	37	—	—	37
Sodium Phosphate	5	6	—	11
Effervescing Sodium Phosphate	—	3	—	3
Proprietary Medicines	—	—	—	38
Total	249	55	1	401
Sampled by Dairy Commissioner.				
Butter	247	102	—	349
Cider	1	—	—	1
Clams	5	6	—	11
Coffee	18	—	—	18
Cordial Chocolates	—	4	—	4
Eggs	—	8	—	8
Ketchup	14	—	4	18
Lard	—	—	8	8

	Not found adulterated.	Adulterated, or below standard.	Compound.	Total number examined.
Milk	164	*144	—	308
Molasses	—	3	19	22
Oysters	3	13	—	16
Sausage	1	1	—	2
Vinegar	2	—	—	2
Bay Rum	—	4	11	15
Hair Tonic	—	1	—	1
Hydrogen Peroxid	—	1	—	1
Physicians' Drugs	38	15	—	43
Rum	—	1	—	1
Toilet Water	—	2	—	2
Turpentine	39	5	—	44
Whiskey	—	1	—	1
Wine	1	—	—	1
Total	533	311	42	886
Samples from private individuals	56	26	—	82
Total from all sources	838	392	43	1369

* Including 49 samples below standard in solids-not-fat.

PART V.

Report of the Plant Breeder.

D. F. JONES.

THE EFFECTS OF CROSS- AND SELF-FERTILIZATION IN TOMATOES[1].

H. K. HAYES AND D. F. JONES.

Numerous investigations made during the last century have established the fact that inbreeding in naturally cross-pollinated plants generally causes a decrease in vigor and, conversely, that a first generation cross between varieties of somewhat different constitution is frequently more vigorous than either parent. These results have led to many experiments designed to test the commercial possibility of first generation crosses. The value of growing first generation crosses as a commercial crop depends on the cost of producing crossed seed and on the amount of increased vigor due to crossing.

The object of this experiment was to test the value of first generation crosses in tomatoes and the effects of continued self-pollination within the variety.

PREVIOUS WORK ON FIRST GENERATION TOMATO CROSSES.

There are a number of published observations which lead to the belief that a cross between tomato varieties is more vigorous than the parents, and Wellington (1912) has reported a careful series of experiments designed to test the commercial value of first generation tomato crosses. He came to the conclusion, from

[1] The experiments included in the four sections of this report were outlined by the senior writer and carried out under his direction up to the close of the year 1914. The plants from which the data were obtained were grown at the Connecticut Agricultural Experiment Station farm.

a study of crosses between Dwarf Aristocrat and Livingston Stone, and Dwarf Aristocrat and Hedrick, that the increased vigor which was exhibited either in increased fruit number, or increased fruit size, or both, would more than pay for the extra trouble of making the cross.

With maize, greater increases have been obtained by crossing inbred strains than by crossing open-pollinated varieties. Theoretically a greater increase from crosses of inbred strains is possible, on account of the greater degree of heterogeneity secured by crossing plants which have become more homogeneous by inbreeding. If tomatoes are naturally cross-fertilized to any appreciable extent, a greater increase in vigor from crosses between artificially selfed strains than from crosses of commercial varieties would be expected. A reduction in vigor should also be apparent in the first successive inbred generations. On the other hand, if the tomato is naturally self-fertilized, no reduction of vegetative vigor should be observed when artificial self-fertilization is practiced, and crosses between such strains would not be expected to give greater increases than those between varieties not artificially self-pollinated.

Methods Used and Materials.

Four commercial varieties of tomatoes were used in the experiments reported here, namely, Lorillard, Sutton's Best of All, Livingston's Stone and Dwarf Champion[2].

Dwarf Champion differs from the other three varieties in the color of the fruit, which is pinkish purple instead of red, in the production of somewhat smaller fruit, earlier bearing, and in its dwarf habit of growth. The other three varieties are similar in color and size of fruit and in habit of growth, except that Best of All has a somewhat stockier habit of growth than has either Stone or Lorillard.

In making the crosses between the two varieties, the same plants which were used to make the cross were also used to produce the selfed seed each year. In the first two years of the experiment, 1912 and 1913, the original seed secured from the

[2] Seed of Lorillard and Best of All was obtained from J. M. Thorburn & Co., New York City; Stone and Dwarf Champion from The Frank S. Platt Co., New Haven.

seed dealers in 1910 was used to produce the plants for the non-selfed parents. This seed was at least three years old in 1913. In order that the age of the seed might not affect the vitality of the plants, off-pollinated seed of each variety was produced in 1913 by hand-pollinating several flowers with a mixture of pollen from twenty other plants of the same variety. This seed was used for the non-selfed parents in 1914, and similar seed was produced that year for the 1915 test.

The plants were started in the greenhouse in sterilized soil, transferred to pots, and later set in the field. An effort was made to have the plants in a uniform condition when transplanted to the field and to grow them under uniform cultural conditions.

The characters considered in the experiment were, size of fruit as measured by the average weight of ripe fruits, number of ripe fruits produced per plant, and average total yield in pounds of fruit per plant. The unripe fruit at the end of the season was included in the yield, but diseased or decayed fruit throughout the season was not included, as no marked difference between the varieties was noted in regard to the amount of this kind of fruit.

The Effects of Self-Fertilization.

The effects of continued self-fertilization upon vigor, as expressed in yield and size of fruit, are shown in Tables I and II.

The first selfed generation of all four varieties exceeded the non-selfed plants in both total yield and the average size of fruit, with the one exception of Dwarf Champion, of which the selfed strain was less than the non-selfed variety in size of fruit. In succeeding generations two of the selfed varieties (Best of All and Stone) showed a slight decrease in yield when compared with the non-selfed plants of the same variety grown during the same year. The other two selfed varieties maintained the increased yield which all varieties gave in the first selfed generation. When it is considered that old seed was used for the non-selfed plants in 1912 and 1913, these yearly yield variations are not significant. It is apparent from these results that continued self-fertilization does not cause any marked decrease in yield.

No non-selfed plants of Stone were grown in 1915 because of a failure to obtain off-pollinated seed. The other three non-selfed varieties showed a uniform increase in yield in 1915 as compared with their yields in the previous year, due, no doubt,

TABLE I.

A Comparison of the Yield of Selfed and Non-Selfed Tomatoes.

Variety.		Yield in Pounds of Fruit per Plant.												
		Stone.			Dwarf Champion.				Lorillard.			Best of All.		
Year grown.	A	B	C	D	B	C	D	A	B	C	D	B	C	D
1912	..	..	..	..	..	..	..	1	14.97	14.69	102	16.59	14.89	111
1913	1	17.85	16.29	110	15.71	14.96	105	2	19.38	17.07	114	16.98	17.47	97
1914	2	20.74	21.08	98	19.56	15.65	125	3	23.67	21.39	111	20.73	23.02	90
1915	3	23.15	26.13*	89	20.95	18.83	111	4	28.11	26.39	107	25.55	29.25	87

A=Number of generations selfed.
B=Yield of selfed plants.
C=Yield of non-selfed plants.
D=Yield of selfed plants as per cent. of yield of non-selfed.

* Calculated from the 1914 yield of Stone by the average increase (23.98 per cent.) of the other three varieties in 1915, as compared with these average yields of the varieties in 1914.

to a better growing season. The average increase of 23.98 per cent of these three varieties in 1915 over the yields of the same varieties in 1914 was used to calculate a yield for the Stone variety for 1915 from the yield in 1914. Although not accurate, this gives a fairly good measure of the yield of the non-selfed Stone in 1915, which may serve for comparison with the yield of the selfed plants. The average size of fruit for the Stone variety in 1915 was calculated in the same way; the average increase of the other three varieties being 49.36 per cent above the weight in 1914.

In average weight of fruit, Best of All showed a slight decrease in the selfed strain as compared with the fruit from the non-selfed plants of the same variety grown in the same years. Two of the selfed strains of the other three varieties retained a size larger than the non-selfed plants, and one a size smaller, throughout the successive generations of inbreeding. The excess in Stone was an average of 7.5 per cent, and in Lorillard 26 per cent. In Dwarf Champion there was an average deficiency of 18 per cent of the selfed plants below the non-selfed plants in average size of fruit.

These results show no harmful effects on fruit size from self-fertilization and are most logically explained by assuming that self-fertilization has isolated strains differing somewhat from the original variety.

The successive generations of self-fertilization reduced progressively both the yield and size of fruit in Best of All. Stone was reduced in yield and increased in size of fruit. Dwarf Champion remained reduced in fruit size and increased in yield, and Lorillard remained increased in both fruit size and yield throughout the experiment.

It seems logical to conclude from these results that self-fertilization of tomatoes simply isolates genotypic lines which may or may not exceed the original variety. As tomatoes are generally self-fertilized naturally, as later data will show, it is not to be expected that there is any great degree of heterozygosity in a commercial variety, especially in old established varieties used in these experiments. Commercial non-pedigreed seed of all self-fertilized crops has proven, as a rule, to contain a mixture of numerous strains. Artificial self-fertilization simply isolates these different strains.

TABLE II.

A Comparison of the Size of Fruit on Selfed and Non-Selfed Tomatoes.

Variety.		Average Weight in Pounds of Individual Ripe Fruits.												
		Stone.			Dwarf Champion.				Lorillard.			Best of All.		
Year grown.	A	B	C	D	B	C	D	A	B	C	D	B	C	D
1912	..	..	..	..	..	..	..	1	.255	.221	115	.273	.237	115
1913	1	.291	.279	104	.179	.223	80	2	.286	.199	144	.262	.228	115
1914	2	.266	.238	112	.165	.186	89	3	.231	.182	127	.242	.218	111
1915	3	.379	.355*	107	.219	.279	78	4	.345	.293	118	.303	.303	100

A = Number of generations selfed.
B = Weight of fruit of selfed plants.
C = Weight of fruit of non-selfed plants.
D = Weight of selfed fruit as per cent. of weight of non-selfed.

*Calculated from the 1914 weight of fruit of Stone by the average increase (49.36 per cent.) of the other three varieties in 1915, as compared with the average weights of fruit of these varieties in 1914.

There is some indication, however, that the variety Best of All may have been sufficiently heterozygous at the start so that a slight reduction was obtained by self-fertilization. In order to have heterozygous plants in a commercial variety there must be some natural cross-pollination. That there is a small amount of natural crossing among tomatoes is shown by results reported elsewhere (Jones, 1916), in which seed produced by open-pollinated dwarf plants interplanted among standard plants gave approximately 2 per cent of standard plants. This indicated that there was, in this case, from two to four per cent of natural crossing, since there was an equal chance for dwarf plants to be cross-pollinated with other dwarf plants as well as with standards. The standard plants could only have been produced from the seed of dwarf plants by being crossed with standard plants. Growing the next generation from these naturally crossed plants showed that they were hybrids because they gave both standard and dwarf plants in the approximate ratio of three to one.

The Effects of Cross-Fertilization.

As the results show no appreciable harmful effects of from three to four generations of selfing in tomatoes, the value of the first generation crosses may be determined by comparing them with the selfed strains used in making the crosses. In 1912 the Stone × Dwarf Champion cross is compared with commercial seed of these two varieties. From 1913 to 1915 the crosses were, in all cases, made between the same plants as were used in the production of the selfed strains.

Table III gives a comparison of average weight per fruit of the selfed varieties and the first generation crosses between them. The average size of fruit varied in different years, owing probably to different growing conditions.

The 1912 and 1913 Stone × Dwarf Champion crosses gave an average increase in fruit weight of 7.5 per cent over the average of the parents. This is exactly the same as the average gain for the years 1914 and 1915, when the parents that were used in making the crosses were one and two years selfed respectively.

In the Lorillard × Best of All cross the increases obtained in the three years from 1913 to 1915 were somewhat greater than

the increase in 1912 when the cross was made between non-selfed parents, but the results varied considerably.

It is apparent that no marked advantage is secured by crossing selfed strains rather than non-selfed. The four-year average increase in fruit weight over the parental average was 8 per cent in the Stone × Dwarf Champion cross and 3 per cent in the

TABLE III.

A Comparison in Average Weight Per Fruit of Self-Fertilized Tomatoes with Their First Generation Crosses.

Year Grown.	1912		1913		1914		1915		Average.
No. of Plants Grown.	64		48		36–46		23–30		
Variety.	A	B	A	B	A	B	A	B	B
Stone	0	.271	1	.291	2	.266	3	.379	.302
(Stone × Dwarf Champion) F_1	0	.244	0	.258	1	.213	2	.346	.265
Dwarf Champion	0	.193	1	.179	2	.165	3	.219	.189
Average of Parents	..	.232	..	.235	..	.216	..	.299	.246
Difference between F_1 and average of Parents	..	+.012	..	+.023	..	−.003	..	+.047	+.019
Per cent. Increase or Decrease	..	+5	..	+10	..	−1	..	+16	+8
Lorillard	1	.255	2	.286	3	.231	4	.345	.279
(Lorillard × Best of All) F_1	0	.247	1	.285	2	.232	3	.370	.284
Best of All	1	.273	2	.262	3	.242	4	.303	.270
Average of Parents	..	.264	..	.274	..	.237	..	.324	.275
Difference between F_1 and average of Parents	..	−.017	..	+.011	..	−.005	..	+.046	+.009
Per cent. Increase or Decrease	..	−6	..	+4	..	−2	..	+14	+3

A=Number of generations parents selfed.
B=Average weight per fruit in pounds.

Lorillard × Best of All cross. It is of interest to note that the latter cross exceeded the larger parent in average fruit size, although the increase is not great.

Table IV shows a comparison of the average number of ripe fruits per plant of the crosses with that of their parents. There is an appreciable increase over the average of the parents in the Stone × Dwarf Champion cross, amounting to 8 per cent. In

the Lorillard × Best of All no consistent results were obtained. The average of the first generation crosses for the four years was just the same as that of the parents. In neither case did the crosses between the parents which had been selfed give any greater increases than did those between the non-selfed parents.

Since both the number and size of fruits in the Stone × Dwarf

TABLE IV.

A Comparison in Number of Ripe Fruit per Plant of Self-Fertilized Tomatoes with Their First Generation Crosses.

Year Grown.	1912		1913		1914		1915		Average.
No. of Plants Grown.	64		48		36–46		23–30		
Variety.	A	B	A	B	A	B	A	B	B
Stone	0	50	1	53	2	77	3	54	59
(Stone × Dwarf Champion) F_1	0	64	0	65	1	112	2	72	78
Dwarf Champion	0	62	1	74	2	116	3	87	85
Average of Parents	..	56	..	64	..	97	..	71	72
Difference between F_1 and average of Parents	..	+8	..	+1	..	+15	..	+1	+6
Per cent. Increase	..	+14	..	+2	..	+15	..	+1	+8
Lorillard	1	59	2	55	3	102	4	75	73
(Lorillard × Best of All) F_1	0	62	1	50	2	106	3	70	72
Best of All	1	61	2	55	3	85	4	79	70
Average of Parents	..	60	..	55	..	94	..	77	72
Difference between F_1 and average of Parents	..	+2	..	−5	..	+12	..	−7	0
Per cent. Increase or Decrease	..	+3	..	−9	..	+13	..	−9	0

A=Number of generations parents selfed.
B=Average number of fruits per plant.

Champion cross were increased, the total yield was necessarily greater than the average of the parents, and was even considerably greater than the better parent in each of the four years grown, as shown in Table V. In the Lorillard × Best of All cross the number of fruits was not increased by crossing, but the size of fruit was, so that, although the first generation cross did not exceed the better parent, it was slightly above the average of the two parents.

The results shown in Table V indicate that crossing may increase the yield of tomatoes, and that in some crosses the increase is large enough to make the practice of growing first generation tomato crosses worthy of consideration. It must be understood that the advantage derived from crossing is only obtained at the maximum in the first generation following the cross. In order to utilize the increase in yield shown by the

TABLE V.

A Comparison in Yield of Self-Fertilized Tomatoes with their First Generation Crosses.

Year Grown.	1912		1913		1914		1915		Average. B
No. of Plants Grown.	64		48		36–46		23–30		
Variety.	A	B	A	B	A	B	A	B	
Stone	0	13.52	1	17.85	2	20.74	3	23.15	18.82
(Stone × Dwarf Champion) F_1	0	15.53	0	19.87	1	24.04	2	27.14	21.65
Dwarf Champion	0	11.90	1	15.71	2	19.56	3	20.95	17.03
Difference between F_1 and better parent	..	+2.01	..	+2.02	..	+3.30	..	+3.99	+2.83
Per cent. Increase	..	+15	..	+11	..	+16	..	+17	+15
Lorillard	1	14.97	2	19.38	3	26.67	4	28.11	21.53
(Lorillard × Best of All) F_1	0	15.44	1	17.88	2	24.68	3	27.75	21.44
Best of All	1	16.59	2	16.98	3	20.73	4	25.55	19.96
Difference between F_1 and better parent	..	−1.15	..	−1.50	..	+1.01	..	−0.36	−0.09
Per cent. Increase or Decrease	..	−7	..	−8	..	+4	..	−1	0

A = Number of generations parents selfed.
B = Yield of fruit per plant in pounds.

Stone × Dwarf Champion cross, it is necessary to plant crossed seed each year.

It should also be noted that not every cross is more desirable than the parents, as is shown in the Lorillard × Best of All cross, which did not surpass the better parent sufficiently in any character to make it worth growing commercially. The results do show, however, that, when a desirable combination is found, it can be counted on to give approximately the same increase in yield every time the cross is made.

The Effect of Crossing upon the Time of Production.

The commercial value of tomato varieties, aside from those grown for the canning industry, consists largely in their earliness. The behavior of the first generation crosses in respect to the time of production is compared with the behavior of the parents by dividing the entire picking season for all varieties and their crosses into two parts. That date was taken each season at which the earliest variety, Dwarf Champion, had produced half of its total crop. The per cent of the entire crop produced in the first part of the season, divided arbitrarily in this way, gives some idea of the comparative earliness of the parents and their

TABLE VI.

A Comparison of the First Generation Cross with the Two Parents in Respect to the Time of Production in Four Successive Years.

Year.	Date which divides the season.	Per cent. of total yield produced in the first part of the season.		
	September.	Dwarf Champion.	First generation cross.	Stone.
1912	9	53	52	35
1913	11	54	58	44
1914	8	56	64	46
1915	13	58	62	37
Average.	..	55	59	41

first generation crosses. The results of the Stone × Dwarf Champion cross for the four years are given in Table VI.

Lorillard and Best of All differed very little in their season for producing fruit, and the first generation cross did not differ from them in respect to this character. The data on the time of production for this cross are not given. On the other hand, Stone produced only an average of 41 per cent of its crop in the first part of the four seasons, while Dwarf Champion produced an average of 55 per cent of its crop in the same time. The first generation of the cross between these varieties, which thus differ considerably in earliness, was somewhat earlier than the earlier parent, producing an average of 59 per cent of its crop in the same time that Dwarf Champion produced 55 per cent of its

crop. From the market gardener's standpoint, the Stone × Dwarf Champion cross would be more valuable than either parent because it produced in the four years tested 15 per cent more fruit than the late parent and was earlier than the early parent.

The fact that a hastening of the time of production was obtained in the cross whose parent differed in time of production and not in the cross whose parents did not differ should not be taken to mean that the hastening of the time of production was due to that fact. The hastening of the time of production is simply one manifestation of the vigor derived from crossing, which also increases the yield. The other cross did not show hybrid vigor as expressed by yield, neither did it result in a hastening of the time of production.

Darwin (1876) gives the time of flowering of twenty-eight crosses between different strains within many different species which show positive evidence of hybrid vigor. Of these twenty-eight crosses 81 per cent flower before their parents. Four cases are given in which the crosses are less vigorous than the parents, and in each of these the crosses flower after their parents.

Recent experiments in hybridization show that many crosses which result in an increase in vigor also result in a hastening of the time of flowering and maturing. One exception to this statement must be noted in a cross between a large dent and a small pop variety of maize, reported by Emerson and East (1913). This cross showed distinct evidence of hybrid vigor in an increase in internode length over that of both parents. The parents differed in time of flowering by twenty-five days. The first generation of the cross grown the same year as the parents was, however, distinctly intermediate in time of flowering. Results obtained in crosses between inbred strains of maize, on the contrary, show in the majority of cases that, when crossing results in an increase of size, a hastening of both the time of flowering and maturing is to be expected.

East (1916) has stated that heterozygosis "effects a result comparable to favorable external conditions." In a cross between two varieties of Nicotiana he found that the first generation gave a noticeable increase in the amount of growth as shown by the height and general size of the plant, as the result of hybrid vigor. The corolla length of the flowers, which is very little affected by environmental factors, was not increased in the first generation cross above the average of the two parents.

Although in general it is evidently true that heterozygosis affects many characters in the same way as the environment, it should be noted that in time of production and maturity these two factors have directly opposite effects. It is generally recognized that favorable external conditions, such as abundant rainfall, increased fertility, etc., which result in a total greater amount of growth, tend to delay both the time of flowering and the completion of growth. Conversely, unfavorable external conditions which stunt the plants and limit their growth tend to hasten their time of flowering and maturing. The vigor derived from crossing, on the other hand, not only increases the amount of growth and yield of fruit or grain, but makes it possible to produce that increased yield in a shorter time than the parents take to produce a smaller yield.

SUMMARY.

1. Continuous self-fertilization during periods of three and four years in four commercial varieties of tomatoes did not cause any significant decrease in the size or yield of fruit, but merely resulted in isolating, in the first year, types which varied either above or below the original unselected variety in these characters.

2. In average weight per fruit the Stone × Dwarf Champion cross showed an average increase of 8 per cent over the parental average. The other cross showed a 3 per cent increase over the average of the parents and slightly exceeded the larger fruited parent.

3. In average number of ripe fruits per plant the Stone × Dwarf Champion cross gave an 8 per cent increase over the average of the parents and approached the fruit number of the better parent. The Lorillard × Best of All cross gave no increase in fruit number over the parental average.

4. Since the Stone × Dwarf Champion cross gave an appreciable increase in both size and number of fruits the total yield was necessarily increased, and even exceeded the better parent by 15 per cent. Moreover, the increase above the better parent was uniform thruout the four years of the test. The increases ranged from 11 to 17 per cent and were sufficient to make the practice of growing first generation tomato crosses commercially profitable.

Although the Lorillard × Best of All cross exceeded slightly the better parent in average weight of fruit it did not excel in total yield.

5. These results show that not all combinations of tomato varieties give the vigor usually derived from crossing, but when a desirable combination is found it can be counted on to give the increase in yield every time the cross is made.

6. Vigor due to crossing as measured by increased yield was not appreciably greater in crosses between artificially selfed strains than in crosses between ordinary commercial varieties. These results are in agreement with the fact that the tomato is naturally almost completely self-fertilized.

7. The cross of Stone × Dwarf Champion which gave a significant increase in yield also showed a hastening of the time of production. It not only gave a 15 per cent larger yield than the later parental variety but was earlier in its time of production than the earlier parent. Hence its value to market gardeners was increased.

8. In respect to the hastening of the time of production, hybrid vigor effects a result directly opposite to favorable environmental conditions which tend to delay maturity.

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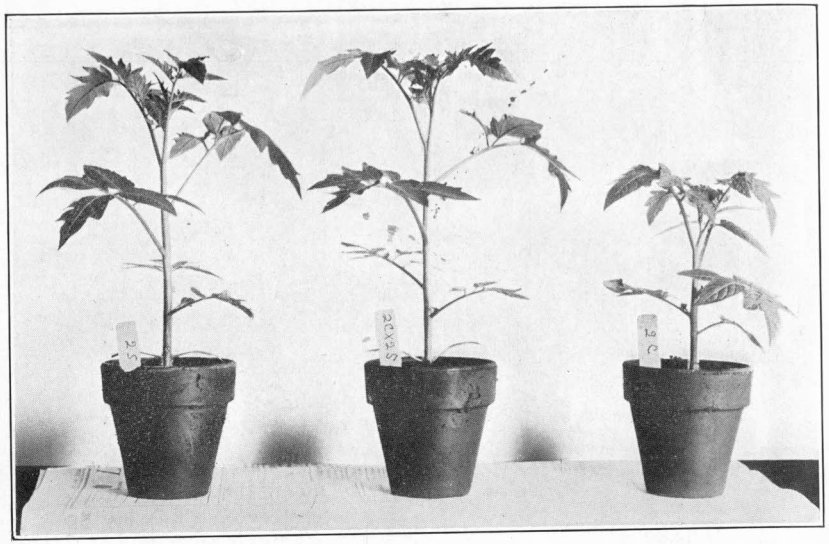
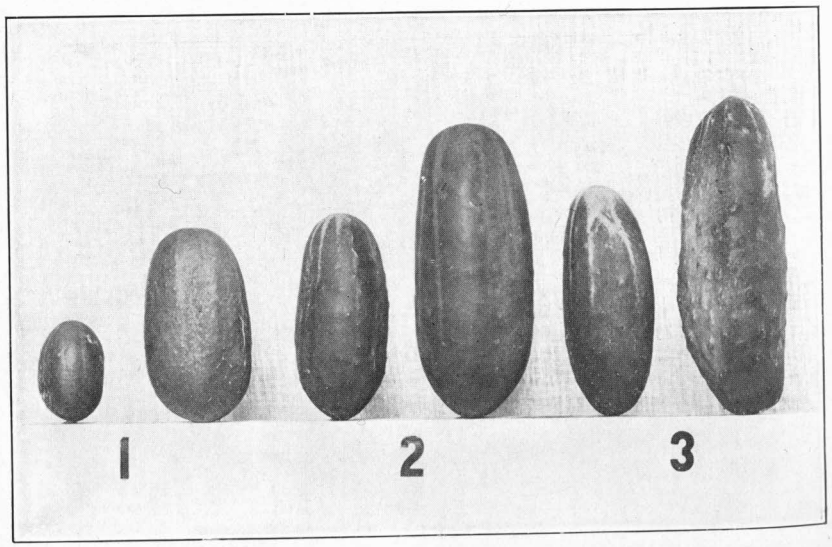
a. Dwarf Champion at the left; the first generation of the cross of Dwarf Champion by Stone at the right. All of the F_1 plants are standard like the Stone parent.

b. Dwarf Champion by Stone at the left; Stone at the right. This cross has yielded 15 per cent more than the Stone variety and has been somewhat earlier.

PLATE XVIII.



a. The tomato plants at the time of setting in the field. Stone on the left; Dwarf Champion at the right and the first generation cross of these two varieties in the center.



b. A first generation cucumber cross showing the longest and shortest fruits of each of the two parental varieties and of the cross. No. 1, Early Russian; No. 2, Early Russian by Fordhook Famous; No. 3, Fordhook Famous.

FIRST GENERATION CROSSES IN CUCUMBERS.

By

H. K. Hayes and D. F. Jones.

It was the plan of this experiment to make a two year test of a few plants of various cucumber crosses as a preliminary survey of the value of first generation crosses, and finally to test the better crosses on a commercial scale. The plants grown in 1914 were so badly attacked by the Mosaic or White Pickle* disease that no reliable results were obtained. As another attempt was made in 1915 with even less satisfactory results due to the same trouble, the testing of the crosses on a larger scale was abandoned and the preliminary results which were obtained in 1913 are given here.

In the spring of 1912 commercial seed was obtained of the following 4 varieties of cucumbers, Early Russian, White Spine, London Long Green and Fordhook Famous.

The vines of Early Russian do not grow to as large a size as those of the other three varieties. They produce a large number of male and female blossoms, with a tendency to set fruit in clusters. White Spine produces fruit of medium size and medium sized vines while Fordhook Famous and London Long Green produce large sized fruit and vigorous vines.

A few plants of each variety were grown in 1912 and four crosses were obtained. Unopened male and female blossoms were covered with a paper bag and when the female flowers opened they were pollinated with the desired male pollen. The following crosses were obtained: Early Russian × White Spine, White Spine × London Long Green, London Long Green × Fordhook Famous and Fordhook Famous × White Spine.

Each variety and the four crosses were planted in 1913 in hills in rows five feet apart each way. As soon as the plants were well started they were thinned to one plant per hill, for the purpose of making a study of individual plant differences. Two-thirds of the plants of each kind were sprayed about every ten

*For a description of this disease see Part VI of the Annual Report of 1915, p. 430, of this Station.

TABLE I.

First Generation Cucumber Crosses and Their Parents.

Varieties.	No. of Plants grown.	Ave. No. of Fruits per Plant.	Increase above more Prolific Parent.	Ave. Weight of Individual Fruits in Lbs.	Decrease below Larger Fruited Parent.	Ave. Length of Individual Fruits in Inches.	Decrease below Longer Fruited Parent.	Ave. Yield of Fruit per Plant in Lbs.	Increase above Heavier Yielding Parent.	Per cent. Increase in Yield.
Early Russian	7	32.9	...	.19	...	3.4	...	6.2	...	...
Early Russian×White Spine	12	39.5	6.6	.28	.09	4.7	.8	11.1	.2	1.8
White Spine	26	29.3	...	.37	...	5.5	...	10.9	...	...
White Spine×London Long Green	10	37.3	8.0	.37	.08	6.0	.6	13.9	2.7	24.1
London Long Green	9	25.0	...	.45	...	6.6	...	11.2	...	...
London Long Green×Fordhook Famous	10	26.6	1.6	.44	.01	6.5	.1	11.6	.4	3.6
Fordhook Famous	13	22.5	...	.45	...	6.6	...	10.1	...	...
Fordhook Famous×White Spine	9	35.7	6.4	.43	.02	6.2	.4	15.2	4.3	39.4
White Spine	26	29.3	...	.37	...	5.5	...	10.9	...	...

days with Bordeaux Mixture to prevent blight. The remainder of the plot was unsprayed.

The fruits were harvested before they commenced to turn yellow and the length, weight and number of fruits noted for each plant. Some plants were injured by borers, others by wilt and the mosaic disease. Those plants which were injured early in the season are not included in the table.

Table I gives the average number of fruits per plant, the average weight of individual fruits, the average length of fruit in inches and the average yield of fruit in pounds per plant for the varieties and crosses. The unsprayed plants were killed by blight about the seventh of September. The sprayed vines continued to bear until the last week in September.

An average of the sprayed and unsprayed results are given in the table. Column I gives the number of plants of each variety and cross from which data were taken. The number of healthy plants available were too few to base positive statements upon, however, the various crosses gave comparable results.

In average length and weight of fruit the crosses are of intermediate habit and considering the number of plants upon which the figures are based they correspond very closely to the average of the parents. The most important test of hybrid vigor is the total average yield of fruit per plant. The cross between Early Russian and White Spine gave about the same yield as the higher yielding parent; the White Spine × London Long Green cross exceeded the higher yielding parent by 24 per cent; the cross of Fordhook Famous × White Spine exceeded the better parent by 39 per cent while the London Long Green × Fordhook Famous cross gave about the same yield as the parents.

The character in which the increased vigor of the crosses is chiefly manifested is in the number of fruits per plant. All of the crosses exceeded the more prolific parent by an average of 1.6 to 8 fruits per plant which is from 6 to 27 per cent.

Summary of Results.

These preliminary experiments indicate that first generation cucumber crosses may frequently be expected to exceed the higher yielding parent in yield. The only cross which did not exceed the average of the parents in any character by an appreci-

able amount was the one between London Long Green and Fordhook Famous. The parental varieties of this cross are of similar habit, both producing about the same type of vine and size of fruit. The other three crosses were between parents which differ in vine habit, and in size of fruit. These crosses show an increase of vigor which was manifested in an increase in total number of fruits per plant.

INCREASING THE YIELD OF CORN BY CROSSING.

D. F. JONES AND H. K. HAYES,
Connecticut Agricultural Experiment Station,
AND
W. L. SLATE, JR., AND B. G. SOUTHWICK,
Storrs Agricultural Experiment Station.

Two lines of investigation have been carried on at the Connecticut Experiment Station dealing with the improvement of corn by crossing. The first of these was planned to determine the effect of crossing varieties of corn which had been inbred previously for a long series of generations. The result of crossing such inbred strains has been, in many cases, a large increase in vigor and in a general tendency towards greater productivity. The increase obtained is not only above either of the inbred parental strains but surpasses that of the original variety before being subjected to inbreeding. The utilization of first generation crosses between suitable inbred strains promises to be a method of considerable value in improving the yield of corn.

However, the process of inbreeding and testing the crosses of the inbred strains to determine the most advantageous crosses is a matter of time. In order to have something of an immediately practical value the second line of investigation, to be reported here, has been carried out, which has consisted in testing numerous crosses between varieties of corn commonly grown in Connecticut without previously putting them thru the process of inbreeding. This investigation is a continuation of the work described in the 1913 Report of the Connecticut Station, but since that time has been carried on by the two Stations coöperating in order to have the crosses tested as thoroly as possible in different parts of the State.

The crosses have been grown both at Mt. Carmel and at Storrs and many of the same crosses have been grown more than one year. The results given here, together with the previous work carried on at the Connecticut Station (Hayes, 1913) and else-

where,* are considered to be conclusive as to the value of crossing, without previous inbreeding, as a method for increasing the yield of corn.

Varieties Used in the Experiments.

The aim has been to test the crosses between the highest yielding varieties grown in Connecticut that it has been possible to obtain. The corn variety tests carried on by the two stations has made available a large number of excellent varieties from which to select for crossing. The parental varieties used in making the crosses given here are among the best varieties as shown by the variety tests and are probably above the average of the varieties grown in Connecticut.

The following descriptions give the name of the variety, by whom grown and the number by which it is designated in the tables together with some of the chief distinguishing features of the variety:

Flint Varieties.

No. 38, Montgomery's White Flint. From Phelps Montgomery, Mt. Carmel, Conn.

A medium to large flint, maturing in about 100 days.

No. 40, Burwell's Yellow Flint. From E. E. Burwell, New Haven, Conn.

A medium to large flint, maturing in about 100 days.

No. 41, King Phillip. From W. E. Price, Warehouse Point, Conn.

A small, yellow flint with red colored pericarp, which is lighter in color at the crowns of the seeds. Matures in about 100 days.

No. 42, Davis' Yellow Flint. From Perley E. Davis, Granby, Mass.

A large, dark yellow flint, maturing in about 95 days.

No. 43, Taylor's Yellow Flint. From Geo. E. Taylor and Sons, Shelburne, Mass.

A medium sized flint, maturing in about 95 days.

No. 44, Brewer's Yellow Flint. From N. H. Brewer, Hockanum, Conn.

* For publications dealing with corn crosses the reader is referred to the literature list at the end of this report. Names and dates in parenthesis thruout the text indicate individual publications in this list.

A medium to large flint of the Canada Flint type, maturing in about 100 days.

No. 45A, Rhode Island White Flint. From the Rhode Island Experiment Station, Kingston, Rhode Island.

A short-eared flint, maturing in about 90 days.

No. 45B, Rhode Island White Flint. From F. W. Newton, South Canterbury, Conn.

A medium sized flint, maturing in about 100 days.

No. 47, Hill's Red Flint. From S. F. Brown, Windsor, Conn.

A medium large flint similar in type to King Phillip, maturing in about 100 days.

No. 51, Olmsted's White Flint. From O. S. Olmsted, Hazardville, Conn.

A large flint with from 8 to 10 rows on the ears which average over 12 inches in length. The butts are large and the tips do not fill out well. Mr. Olmsted uses this variety for silage. It matures in about 110 days.

No. 62, Lathrop's Yellow Flint. From Jason Lathrop, Plainfield, Conn.

A small-eared flint of the Canada Flint type, maturing in about 100 days.

Dent Varieties.

No. 36, Holcomb's Dent. From Wayne Holcomb, East Granby, Conn.

A medium sized dent of the "shoe-peg" type. Kernels spaced far apart between rows. Matures in about 100 days.

No. 37, Montgomery's White Dent. From Phelps Montgomery, Mt. Carmel, Conn.

A large dent, maturing in about 120 days.

No. 39A, Pride of the North. From A. G. Gulley, Storrs, Conn.

A medium sized, yellow dent, maturing in about 110 days.

No. 48, Tyler's White Cap Dent. From G. D. Hall, Wallingford, Conn.

A medium sized yellow dent with white tipped seeds, maturing in about 110 days.

No. 49, Early Huron Dent. From Joseph Harris Seed Co., Coldwater, New York.

A small eared, yellow dent with well shaped ears and seeds. It matures in about 110 days.

No. 52, Connecticut Dent. From C. L. Howes, Stamford, Conn.
A medium to large, yellow dent, maturing in about 115 days.

No. 53, Brewer's Dent. From N. H. Brewer, Hockanum, Conn.
A medium sized, yellow dent, maturing in about 115 days.

No. 54, Funk's 90 Day. From Funk Bros. Seed Co., Bloomington, Illinois.
A medium to large, yellow dent. Grains well shaped giving a large proportion of grain to cob. Ripens rather late in Connecticut, maturing in about 130 days.

No. 60, Golden Dent. From P. H. Woodford, Avon, Conn.
A distinct type of yellow dent corn with the outer hull or pericarp red on the sides of the seeds giving the ears a reddish appearance. The ears are short and thick. It matures in about 120 days.

No. 67, Dowd Dent. From R. C. Willcox & Sons, Guilford, Conn.
A medium to large, yellow dent. Seeds large and broad. It matures in about 110 days.

No. 83, Minnesota White Cap. From C. S. Griswold, West Hartford, Conn.
A medium to small eared, yellow dent with white tipped seeds, maturing in about 115 days.

Methods of Carrying on the Experiments and Sources of Error.

The crosses grown in any one year have resulted from a number of different varieties all crossed with one variety as a pollen parent by planting them in alternate rows between the variety used as male and detasseling all plants of the varieties to be crossed. The seed obtained from such detasseled and therefore necessarily cross-pollinated plants was grown the following year in a plot between the two varieties used in making the cross. The seed of the parental varieties was obtained each year from the original source so that the crosses and their parents were all grown from one-year-old seed. In a few cases where fresh seed could not be obtained two-year-old seed was used but we do not believe that there is any appreciable difference in the behavior of one or two-year-old seed of corn, and if there was, the number of times that two-year-old seed was used are so few that this factor would be negligible.

The methods used to obtain a fair comparison in yield between the several varieties and their crosses were the same as used in the variety tests. One variety was grown thruout the field in every fifth plot as a control in order to be able to correct for differences in the soil. The variety used as check was the pollen parent of the crosses. The arrangement of the varieties in the field, in all the tests except at Storrs in 1914, was as follows:

Plot No.
1. Male Parent, M (Check Plot).
2. Cross (A × M).
3. Female Parent, A.
4. Female Parent, B.
5. Cross (B × M).
6. Male Parent, M (Check Plot).
7. Cross (C × M).
8. Female Parent, C.
9. Etc.

This series was duplicated and triplicated in other parts of the field whenever space permitted and the separate yields were averaged, after being corrected for differences in the fertility of the soil as shown by the check plots.

Since the cross was grown immediately adjacent to and between its two parents the comparison between the crosses and their parents is a fair one except in some cases where the parents differ greatly in time of ripening. A cross between a late dent for example and an early flint would have a better chance to grow when planted between its two parents than the late, heavier yielding parent because of the fact that the early parent would not grow as tall and as vigorously as the later parent toward the end of the season. Hence the cross would have the advantage of more sunshine and less root competition than the later parent. This is not considered to be a very serious factor in these experiments because the two varieties of flints used as the pollen parent were rather large growing varieties, yielding more than many of the dents in some years. However, in 1915 three rows of each variety and cross were grown together in a plot and the yield taken only from the center row of each plot. This method tends to obviate the advantage noted above, which the crosses might have, because the center row is in competition with only

similar plants on either side of it. In 1915, when this method was followed, the crosses did not show up to quite as good advantage as in other years. This is a source of error which should be taken into consideration in testing first generation crosses.

Hartley et al. (1912) have raised an objection against the accuracy of previous tests of first generation crosses because they thought that the crosses were better acclimatized and adapted than the parents to the climatic and soil conditions where the tests were carried on because the plants to produce the crossed seed were grown the year previous to the test under those conditions, while the parents were not. This objection does not apply to our results as the varieties used were for the most part local Connecticut varieties already acclimatized and adapted to the conditions under which the tests were carried out. Furthermore, the crosses were all made at Mt. Carmel and grown at Storrs as well as Mt. Carmel.

Characters Which May Show the Vigor Derived from Crossing.

Numerous experiments with different species of plants have shown that the vigor due to hybridization may be manifested in many different ways. It is most noticeable in an increase in the general vegetative luxuriance of the crossed plants as shown by an increase in height, thickness of stem and number of leaves and branches in plants where these are indeterminant in number as well as a more vigorous and healthy appearance in general. The most important characteristic of corn crosses is their ability to yield. The yield of grain in some respects is also a good measure of hybrid vigor because it indicates the sum total of a plant's ability to grow. In other ways yield of grain is a poor indicator of hybrid vigor because some crosses between distantly related types are partially or completely sterile, yet exceedingly vigorous in vegetative parts. Moreover, yield depends upon so many things, chief of which are the environmental factors, that it is almost impossible to obtain consistent results when this character is used.

In its effect upon yield hybrid vigor acts in exactly the same

way as favorable external factors. The crossed plants are enabled to make a better use of the situation wherein they may be placed. As far as external appearances go this amounts to the same effect as would be obtained if the external conditions were made more favorable, such as by better cultural methods, more nearly the right amount of moisture or increased fertilization.

In other respects hybrid vigor has a directly opposite effect to that of favorable environmental factors chiefly in that it tends to shorten the time of production, as is noted in the part of this report on tomato crosses, whereas the opposite effect usually results from any external factor which also increases yield. In the experiments on corn reported here the time of ripening of the crosses is exactly intermediate between time of ripening of the two parents. It should be noted, however, that in yield the majority of the crosses exceed the performance of the higher yielding parents, which are almost always the later ones in ripening, so that, since the crosses are intermediate in time of ripening, the rate of growth is greatly accelerated. If by crossing an early variety of corn with a late one a larger yield can be obtained than from either variety and if that larger yield is produced in a week or ten days shorter time than the later parent requires, the saving in time is fully as valuable as the increase in yield. In Connecticut, which approximates the northern limit of profitable corn cultivation, the time of ripening is an important consideration and other things being equal determines the suitability of a variety of corn for growing here.

The Behavior of First Generation Crosses as Compared with Their Parents.

As should always be borne in mind, first generation corn crosses have no value unless they either excel their parents in one or more desirable features or combine valuable characters from two different varieties which can not be obtained in a single variety. In the following tables the yields of 51 first generation crosses are given and the increase of the cross above or the decrease below the higher yielding parent stated in bushels per acre and also in per cent. The yields are based on the average of all plots grown after they have been corrected according to differences

in fertility in different parts of the fields by the following method. Check rows are grown every fifth plot as noted before. Assuming the yields of the check plots to represent the productivity of that part of the field in which they were grown and also assuming that differences in the productivity of the soil graduate uniformly from one check plot to another, a theoretical check yield is calculated for the four plots between every two check plots in the field. The actual yield obtained from each plot is then compared with this theoretical check yield and the deviation above or below this is added to or subtracted from the average of all the check rows grown. The following illustration may help to make this method of correcting the yields clear:

Plot Number.	Corn Grown.	Actual Yield.	Theoretical and Actual Check Yield.	Difference between actual yield of corn tested and theoretical yield of check.	Corrected yield obtained by adding or subtracting this difference to the average of all check plots grown.
1	Check	50	50	0	52.5
2	Cross	75	51	+24	76.5
3	Variety	70	52	+18	70.5
4	Variety	40	53	—13	39.5
5	Cross	50	54	—4	48.5
6	Check	55	55	0	52.5

For the purpose of comparing the crosses with their parents directly it makes little difference whether this method of correcting the yields is followed or not since the crosses are grown close to and between their parents, but for the purpose of comparing the yields of the crosses with other crosses and varieties grown in other parts of the field it is essential to have some means of correcting for differences in soil fertility where these differences are appreciable.

When husking the corn after all of it has been weighed in the field a representative sample is taken and dried to a uniform moisture content and the yields all calculated to bushels of 68 pounds of ear corn, with 12 per cent. moisture, per acre. In this way late maturing varieties and crosses containing a large percentage of moisture when husked are on an equal footing with early maturing varieties.

TABLE I.

COMPARATIVE YIELD OF FIRST GENERATION CROSSES AND THEIR PARENTS, MT. CARMEL, 1914.

Variety No.	Variety Name.	Yield—Bushels per Acre.			Increase above Higher yielding Parent.	Decrease below Higher yielding Parent.	Per cent. Increase or Decrease.	Per cent. Increase over Average.
		Variety.	Variety Crossed by King Phillip.	King Phillip.				
36	Holcomb's Dent.....	76.1	91.1	78.9	12.2	....	15.5	17.5
44	Brewer's Flint.....	85.4	94.1	78.9	8.7	....	10.2	14.5
39A	Pride of the North.....	82.3	89.0	78.9	6.7	....	8.1	10.4
42	Davis' Flint.....	86.0	91.3	78.9	5.3	....	6.2	10.7
37	Montgomery's Dent.....	93.4	98.5	78.9	5.1	....	5.5	14.3
43	Taylor's Flint.....	79.0	81.8	78.9	2.8	....	3.5	3.5
38	Montgomery's Flint.....	75.5	79.6	78.9	.7	....	.9	3.8
53	Brewer's Dent.....	93.9	94.3	78.9	.4	....	.4	9.1
51	Olmsted's Flint.....	93.7	90.3	78.9	....	3.4	—3.6	4.6

TABLE II.

COMPARATIVE YIELD OF FIRST GENERATION CROSSES AND THEIR PARENTS, STORRS, 1914.

Variety No.	Variety Name.	Yield—Bushels per Acre.			Increase above Higher yielding Parent.	Decrease below Higher yielding Parent.	Per cent. Increase or Decrease.	Per cent. Increase over Average.
		Variety.	Variety Crossed by King Phillip.	King Phillip.				
53	Brewer's Dent	57.3	69.5	64.1	5.4	....	8.4	14.5
37	Montgomery's Dent.....	69.2	71.9	64.1	2.7	....	3.9	7.8
43	Taylor's Flint.....	60.0	66.4	64.1	2.3	....	3.6	6.9
39A	Pride of the North.....	67.5	69.7	64.1	2.2	....	3.3	5.9
51	Olmsted's Flint.....	72.1	72.9	64.1	.8	....	1.1	7.0
38	Montgomery's Flint.....	51.2	62.8	64.1	....	1.3	— 2.0	8.8
44	Brewer's Flint.....	50.8	59.3	64.1	....	4.8	— 7.5	3.1
36	Holcomb's Dent.....	71.4	66.4	64.1	....	5.0	— 7.0	—1.9
42	Davis' Flint.....	49.2	57.4	64.1	....	6.7	—10.5	1.2

In the tables the first column following the name of the variety gives the yield of that variety as the female parent of the cross. The second column gives the yield of the first generation cross of that variety with the male parent. King Phillip Flint was used as the male parent in 1914. The third column gives the yield of the male parent. This yield is the average of all

TABLE III.

COMPARATIVE YIELD OF FIRST GENERATION CROSSES AND THEIR PARENTS, MT. CARMEL, 1915.

Variety No.	Variety Name.	Yield—Bushels per Acre.			Increase above Higher yielding Parent.	Decrease below Higher yielding Parent.	Per cent. Increase or Decrease.	Per cent. Increase over Average.
		Variety.	Variety Crossed by Burwell's Flint.	Burwell's Flint.				
53	Brewer's Dent	63.1	77.1	69.6	7.5	....	10.8	16.1
49	Harris' Early Huron Dent	64.1	76.6	69.6	7.0	....	10.1	14.5
52	Howe's Connecticut Dent	48.3	73.6	69.6	4.0	....	5.7	24.7
48	Tyler's White Cap Dent	59.4	72.0	69.6	2.4	....	3.4	11.6
44	Brewer's Flint	59.0	71.3	69.6	1.7	....	2.4	10.9
43	Taylor's Flint	61.7	71.1	69.6	1.5	....	2.2	8.2
45A	Rhode Island White Flint	68.7	70.4	69.6	.8	....	1.1	1.7
47	Hill's Red Flint	62.3	69.6	69.6	.0	.0	.0	5.5
54	Funk's 90 Day Dent	47.9	65.5	69.6	....	4.1	— 5.9	11.4
42	Davis' Flint	62.7	64.9	69.6	....	4.7	— 6.8	— 2.0
41	King Phillip	51.9	59.8	69.6	....	9.8	—14.1	— 2.4
51	Olmsted's Flint	76.9	53.9	69.6	....	23.0	—29.9	—26.5

the plots grown of this variety. The fourth and fifth columns give the increase of the cross above or the decrease below the higher yielding parent in bushels per acre, and the sixth column expresses this difference in per cent. of the yield of the higher yielding parent. The last column gives the increase of the cross in per cent. above the average of the parents.

At Mt. Carmel all but one of the first generation crosses exceeded either parent in yield. At Storrs about half exceeded

the better parent, all but one exceeding the average of the parents. The greatest increase was 15.5 per cent at Mt. Carmel. No uniformity, however, is to be observed in the performance of these same crosses grown at New Haven and at Storrs. Some of the crosses which gave the greatest increase at Mt. Carmel gave a large decrease at Storrs and vice versa.

In 1915 all the varieties were crossed by Burwell's Yellow Flint and the same seed of both crosses and parents grown at

TABLE IV.

COMPARATIVE YIELD OF FIRST GENERATION CROSSES AND THEIR PARENTS, STORRS, 1915.

Variety No.	Variety Name.	Yield—Bushels per Acre.			Increase above Higher yielding Parent.	Decrease below Higher yielding Parent.	Per cent. Increase or Decrease.	Per cent. Increase over Average.
		Variety.	Variety Crossed by Burwell's Flint.	Burwell's Flint.				
49	Harris' Early Huron Dent	....	82.8	67.3	....	....	....	....
51	Olmsted's Flint	59.6	73.6	67.3	6.3	....	9.4	15.9
48	Tyler's White Cap Dent.	69.0	73.5	67.3	4.5	....	6.5	7.8
44	Brewer's Flint	54.4	68.9	67.3	1.6	....	2.4	13.0
43	Taylor's Flint	64.1	66.5	67.3	....	.8	— 1.2	.7
42	Davis' Flint	61.2	66.1	67.3	....	1.2	— 1.8	2.8
41	King Phillip	60.3	61.5	67.3	....	5.8	— 8.6	—3.6
52	Howe's Connecticut Dent	80.1	74.1	67.3	....	6.0	— 7.5	.5
47	Hill's Red Flint	64.9	60.4	67.3	....	6.9	—10.3	—8.6

Storrs and New Haven as in the previous year. At New Haven the majority of the crosses exceeded the better parent while at Storrs about half exceeded and half did not. All but two exceeded the average. On account of an error in determining the moisture in Harris' Early Huron the yield of that variety is not known at Storrs. Since the cross of that variety with Burwell's Flint gave the highest yield of any variety or cross grown that year it is pretty safe to assume that it yielded more, at least, than the average of its parents. It will be so considered in these tabulations. Two crosses, those of Harris' Early Huron and

Tyler's White Cap Dent by Burwell's Flint were among the highest yielding crosses at both Stations. Some of the other crosses, notably Howe's Connecticut Dent and Olmsted's Flint by Burwell's Flint, behaved in exactly the opposite way at the two Stations.

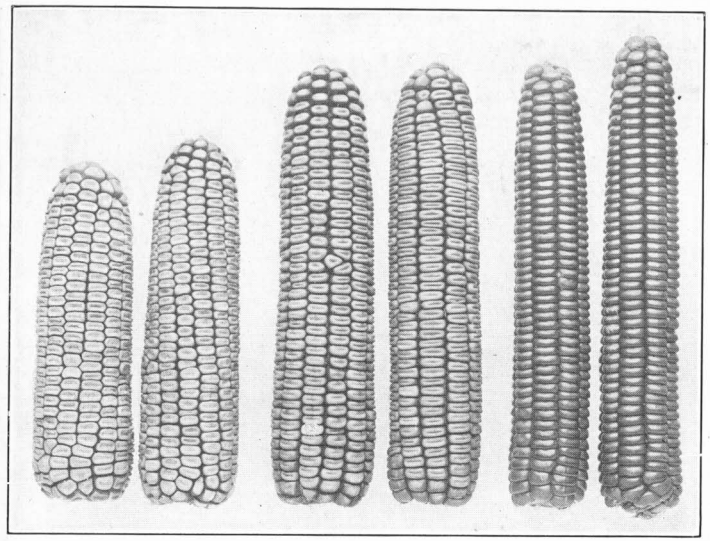
In 1916 the varieties were all crossed with Burwell's Yellow

TABLE V.

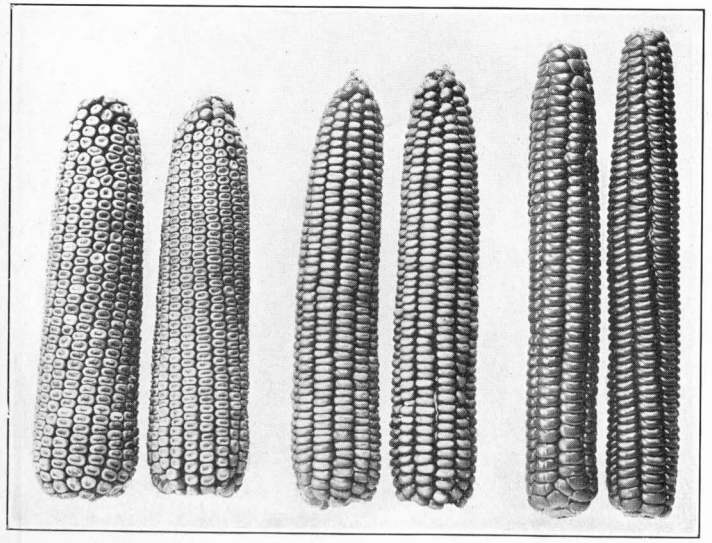
COMPARATIVE YIELD OF FIRST GENERATION CROSSES AND THEIR PARENTS, MT. CARMEL, 1916.

Variety No.	Variety Name.	Yield—Bushels per Acre.			Increase above Higher yielding Parent.	Decrease below Higher yielding Parent.	Per cent. Increase or Decrease.	Per cent. Increase over Average.
		Variety.	Variety Crossed by Burwell's Flint.	Burwell's Flint.				
48	Tyler's White Cap Yellow Dent	75.2	87.2	67.1	12.0	....	16.0	22.5
52	Howe's Connecticut Dent	80.8	91.8	67.1	11.0	....	13.6	24.1
47	Hill's Red Flint	54.4	73.9	67.1	6.8	....	10.1	21.5
60	Woodford's Golden Dent	80.6	86.9	67.1	6.3	....	7.8	17.6
49	Harris' Early Huron Dent	79.1	83.4	67.1	4.3	....	5.4	14.1
41	King Phillip	64.9	70.1	67.1	3.0	....	4.5	6.2
83	Minnesota White Cap Dent	93.6	95.9	67.1	2.3	....	2.5	19.3
45B	Rhode Island White Flint	52.8	68.1	67.1	1.0	....	1.5	13.5
67	Willcox's Dowd Dent	87.5	87.9	67.1	.4	....	.5	13.7
54	Funk's 90 Day Dent	95.0	95.5	67.1	.5	....	.5	17.8
62	Lathrop's Flint	52.9	65.3	67.1	....	1.8	−2.7	8.8
44	Brewer's Flint	....	60.9	67.1	....	6.2	−9.2	....

Flint as in the year before, but were grown only at Mt. Carmel. All but two of the twelve crosses grown exceeded the better parent and three of them gave increases of over 10 per cent. No seed of the Brewer's Flint variety was obtained that year. This cross did not exceed the male parent and it is not known whether or not it would have exceeded the average of the two parents. All the other crosses did.

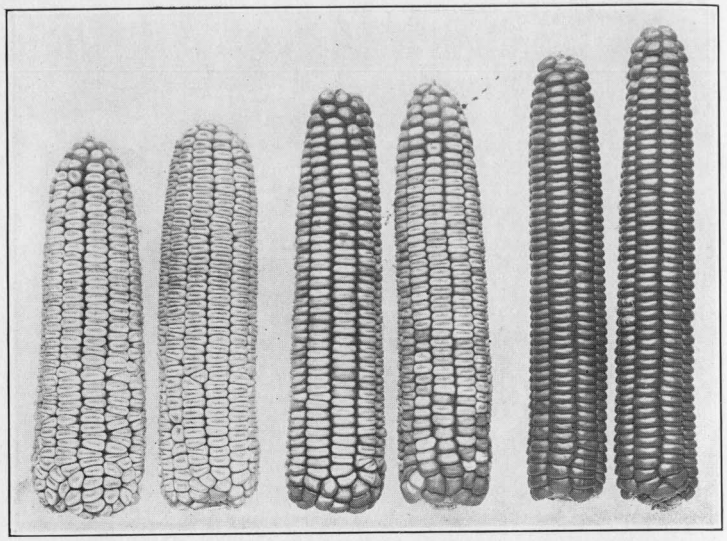


a. At the left Harris' Early Huron, at the right Burwell's Yellow Flint and the cross in the center. This cross has consistently yielded more than the dent parent and has been earlier in ripening.

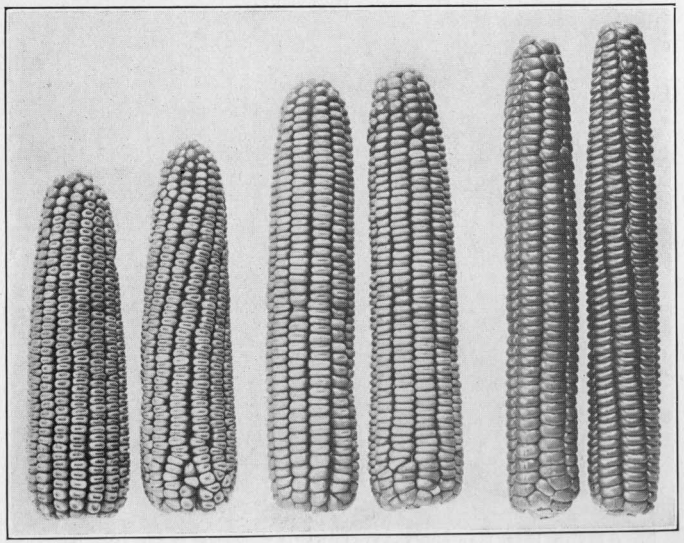


b. At the left Brewer's Dent, at the right Burwell's Yellow Flint and the cross in the center which gave the highest yield obtained in 1915 at Mt. Carmel, 10 per cent higher than the flint parent, the higher yielding parent, and ripened earlier than the dent parent.

PLATE XX.



a. Tyler's White Cap at the left and Burwell's Yellow Flint at the right. The first generation cross of these two varieties has consistently yielded more than the dent, the higher yielding parent.



b. The cross of Howe's Connecticut Dent by Burwell's Flint, shown in the center, has always matured earlier than the dent parent and at Mt. Carmel has also outyielded it.

In Table VI the average height of all the crosses and their parents is given together with the average number of days from planting to tasseling and maturing. In height the crosses exceeded the average of the parents slightly and in time of growth were almost exactly intermediate with the two parents. This fact is of considerable importance, as mentioned before, because in most cases it is possible to obtain not only as large or a larger yield from a cross of two varieties than from the higher yielding parent, but also to get this yield in a shorter time. For instance, in 1916, Howe's Connecticut Dent crossed with Burwell's Yellow Flint gave an increase of 13.6 per cent above the higher yielding parent and matured a week earlier than the dent

TABLE VI.

A Comparison of First Generation Crosses with their Parents in Height and Number of Days Required to Tassel and to Mature.

Place of Test.	Year.	Number of Crosses.	Aver. Height in Inches.		Average No. Days to Tassel.		Average No. Days to Mature.	
			Parents.	Crosses.	Parents.	Crosses.	Parents.	Crosses.
Mt. Carmel	1914	9	101	105	69	69	107	106
Mt. Carmel	1915	12	100	104	65	64	105	107
Mt. Carmel	1916	12	90	93	70	69	110	110
Storrs	1914	9	98	100	..	..	..	..
Storrs	1915	9	65	67	..	..	..	..
	Average		91	94	68	67	107	108

variety. Funk's 90 Day crossed with Burwell's Flint did not exceed the later variety in yield by any significant amount but matured in 12 days less time than the late parent, Funk's 90 Day; being almost exactly intermediate with both parents in time of ripening.

The behavior of corn crosses with respect to the time of ripening as compared with their parents is much more uniform than the yield. In general then the value of these corn crosses is found not alone in their ability to outyield their parents in many cases but also in their ability to grow in a shorter time than varieties giving the same yields,—a matter of great importance in Connecticut where the growing season is none too long.

Determination as to the amount of dry fodder produced by the crosses were made only at Storrs. The results for the two years in which crosses were grown there are given in Table VII.

TABLE VII.

THE YIELD OF FODDER OF FIRST GENERATION CROSSES AND THEIR PARENTS AT STORRS.

Year.	Number of Crosses.	Tons of Dry Fodder per Acre.	
		Average of Parents.	Average of Crosses.
1914	9	2.52	2.57
1915	12	2.90	2.98
Average.		2.71	2.78

The increase above the average of the parents in the amount of fodder produced is apparent each year but is inconsiderable. In corn the vigor derived from crossing seems to be expended in the production of grain rather than in vegetative parts.

Summing up all the crosses given in the preceding tables and classifying them according to their yields being more or less than either parent or average of parents the results given in Table VIII are obtained.

TABLE VIII.

SUMMARY OF THE CROSSES GIVEN IN TABLES I TO V.

Classification of all Crosses Yielding:	Tests at Mt. Carmel.			Tests at Storrs.		Total.	Per Cent.
	1914	1915	1916	1914	1915		
More than Either Parent.	8	7	10	5	3	33	66
More than Ave. of Parents.	1	2	1	3	4	11	22
Less than Ave. of Parents.	0	2	..	1	1	4	8
Less than Either Parent.	0	1	..	0	1	2	4
Total.	9	12	11	9	9	50	100

It can be seen from Table VIII that a large majority of the crosses exceeded either parent in yield and that 88 per cent exceeded the average of the parents. In all experimental work

with field crops there is a large fluctuation of results. Even if there were no tendency to increased yielding resulting from crossing, many crosses would be above the average or even above either parent as well as below, following the rule of chance variation. However, the fluctuations due to uncontrollable factors, which were above, would be balanced by an approximately equal number of fluctuations below. In these experiments the fact that 88 per cent of the crosses yielded more than the average of the parents means without any doubt that there is a tendency for hybrid vigor to result from crossing and that this added vigor increases yield.

In order that this hybrid vigor may have a practical value it must not only increase the yield above the higher yielding parent or shorten the time of growth, but must make it possible for some crosses to surpass any variety that it is possible to obtain. In other words, the corn grower, before he can give this method of improving corn any consideration, must know that it is possible to obtain, on the average, higher yields from crosses than from pure varieties. In this connection we can say that at the New Haven Station during the past five years* the testing of first generation crosses has been carried along with a test of all the most promising varieties of corn obtainable. From 15 to 65 varieties have been grown each year and a total of 78 different varieties in all tested in the five years. Altho only a fourth of these varieties were represented among the crosses, *every year the highest yield obtained was from a first generation cross.* The difference between the highest yielding cross and the next highest yielding variety was small but taking into consideration the fact that many new excellent varieties were added each year to the test as they were obtained which were not represented among the crosses makes the uniform excellence of the crosses of considerable importance.

To be strictly fair, the crosses should be compared with only the varieties used in making the crosses. This is done in Table IX by giving the distribution of the crosses and varieties in respect to yield. The yield classes are divided into differences of five bushels in yield. When the crosses and varieties both occur in highest yielding class the highest cross in every case

* Including the two years' results given in the 1913 report.

TABLE IX.

THE DISTRIBUTION OF ALL CROSSES AND THEIR PARENTS WITH RESPECT TO YIELD.

Year.	Yield, Bu. per Acre.	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–94	95–99	Ave.
1914 Mt. Carmel	Crosses	..	..	..	..	..	..	1	1	1	5	1	90.0
	Parents	..	..	..	..	..	..	12	1	2	3	..	82.0
1915 Mt. Carmel	Crosses	..	1	1	1	2	5	2	..	..	..	..	68.8
	Parents	2	1	2	5	13	..	1	..	..	..	..	62.6
1916 Mt. Carmel	Crosses	..	..	..	1	2	2	..	1	3	1	2	80.6
	Parents	..	3	..	1	12	..	2	2	1	1	1	70.5
1914 Storrs	Crosses	..	..	2	1	4	2	..	..	..	..	..	66.3
	Parents	1	2	1	10	2	2	..	..	..	..	..	62.5
1915 Storrs	Crosses	..	..	..	2	3	3	..	1	..	..	..	69.7
	Parents	..	1	1	4	10	..	..	1	..	..	..	65.8
Total Both Stations	Crosses	..	1	3	5	11	12	3	3	4	6	3	75.0
	Parents	3	7	4	20	37	2	15	4	3	4	1	69.0

outyielded the next highest yielding variety by from 0.2 to 3.0 bushels. This excess is small and occurring a few times would have little real significance but since it occurs every year and the crosses, as a whole, surpass the parents by an appreciable amount the results show clearly that crossing is a method of considerable importance in increasing the yield of corn. On the average the crosses exceed their parents by 6 bushels per acre or about 9 per cent.

It is not alone necessary that a cross should outyield its parents

TABLE X.

THE BEHAVIOR OF FIRST GENERATION CROSSES GROWN IN DIFFERENT YEARS AND IN DIFFERENT PARTS OF THE STATE.

Variety number.	Variety Crossed.	Per cent. Increase in yield above (+) or Decrease below (−) Higher yielding Parent. Storrs. 1915	Mt. Carmel. 1915	Mt. Carmel. 1916
49×40	Early Huron× Burwell's Yellow Flint..	......	+10.1	+ 5.4
48×40	Tyler's White Cap× " " " ..	+ 6.5	+ 3.4	+16.0
52×40	Connecticut Dent× " " " ..	− 7.5	+ 5.7	+13.6
44×40	Brewer's Flint× " " " ..	+ 2.4	+ 2.4	− 9.2
43×40	Taylor's Flint× " " " ..	− 1.2	+ 2.2	......
47×40	Hill's Red Flint× " " " ..	−10.3	0	+10.1
54×40	Funk's 90 Day× " " " ..	......	− 5.9	+ .5
51×40	Olmsted's Flint× " " " ..	+ 9.4	−29.9	......
42×40	Davis' Flint× " " " ..	− 1.8	− 6.8	......
41×40	King Phillip× " " " ..	− 8.6	−14.1	+ 4.5

in any one year but it must be counted on to give that increase in most of the years grown in order to have real value. In Table X all of the crosses which were grown in more than one year and in more than one place are given and it can be seen that not all crosses behave uniformly in this respect.

Since no certain varieties for the most part give the highest yields year after year in the same locality or in different places in the same year, it cannot be expected that crosses between these variable varieties will differ from them in this respect. All we can say is, that our results show that on the average, with any varieties that may be grown, a higher yield can be expected from these varieties when crossed among themselves than can be

obtained from the varieties themselves and that on the average this increase amounts to about 9 per cent. Moreover, the crosses will produce a given amount of grain in a somewhat shorter time than their parental varieties require.

Whether or not these advantages resulting from crossing are sufficient to justify the increased cost of producing crossed seed is largely an individual matter. So much can be accomplished towards increasing the production of corn by growing the varieties best suited to a given locality and improving the cultural conditions under which these varieties grow that rightly the chief emphasis should be placed on these methods of improvement. But when all that can be done profitably has been done toward improving the methods of growing corn and when the varieties best adapted to the conditions under which they are grown are obtained, any further improvement must come thru either a process of selection within a variety or by utilizing the increased vigor to be derived from crossing suitable varieties. The process of selection within a variety is usually attended with more or less uncertain results. Moreover, the increase in yield which may be obtained in the first years of selection by the ear-to-row method, or progeny preformance test, usually ceases after selection has been practiced for a few years, owing to the more or less certain amount of inbreeding which takes place. At this stage a further increase in yield can be obtained only from crosses of certain varieties which crosses by thorough testing have been proven to surpass any variety known for the particular conditions in which the corn is grown.

Desirable Crosses.

The results show that certain crosses are clearly more desirable than others.

Tyler's White Cap Dent × Burwell's Flint has consistently outyielded the dent parent and has matured at about the same time.

Harris' Early Huron × Burwell's Flint has given high yields and has been earlier than the dent parent.

Howe's Connecticut Dent × Burwell's Flint has not always surpassed the higher yielding parent, but has always ripened considerably earlier.

Montgomery's Dent × King Phillip Flint gave the highest yield at Mt. Carmel in 1914 and the third highest yield at Storrs of all the varieties and their crosses, and was 15 days earlier in ripening at Mt. Carmel than the dent parent.

Brewer's Dent × King Phillip gave the second highest yield at Mt. Carmel in 1914 and was 6 days earlier in ripening. It also gave a good yield at Storrs that year.

Brewer's Dent × Burwell's Flint gave the highest yield in 1915, 10 per cent higher than Burwell's Flint, the higher yielding parent that year, ripening about a week later than the flint but earlier than the dent parent.

General Characters of the Crosses.

In nearly all hereditary characters these first generation crosses are as uniform as the parent varieties and generally intermediate with the two parents in such characters as the number of rows of grain on the cob, size, and shape of seeds, number of suckers and height of plant. Crosses between yellow and white seeded varieties give a mixture of yellow and white seeds in the ears. This mixture is no doubt rather objectionable in a market corn, altho it detracts nothing from its feeding value. If one or both of the parents has colored pericarp as for example, King Phillip, the first generation has red colored ears like the colored parent. Where there is such a mixture, this pericarp color nearly obscures the mixture of yellow and white endosperms underneath.

Special Consideration of the Crosses.

As would be expected there is a high correlation between the average yield of the two parents and the first generation crosses between them as shown in Table XI. This means that comparative yield is to a great extent determined by inheritance as would be expected, and that any effect which hybrid vigor may have on the crosses is uniform in its influence.

It was also expected that the greatest increases in yield of crosses above the average of their parents would be found in varieties which did not, themselves, give the highest yields,—simply for the reason that the amount of grain which any conceivable variety can yield is necessarily limited for physiological reasons, altho what that limit is may not be known. As varie-

ties approach that physiological limit it becomes increasingly more difficult for any increase in yield to be possible. However, in Table XII the crosses studied do not show any marked negative correlation between the average yield of the two parents and

TABLE XI.

CORRELATION BETWEEN AVERAGE YIELD OF PARENTS AND YIELD OF CROSSES.

Average Yield of Parents—Bu. per Acre.	Yield of Crosses—Bu. per Acre.										
	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–94	95–99	
55–59		2	1	1	1						5
60–64			2	5	4						11
65–69			1	3	9	2					15
70–74	1				1		1	2	1		6
75–79							2	1	1		4
80–84								1	2	2	5
85–89									2	1	3
	1	2	4	9	15	2	3	4	6	3	49

the per cent increase of the cross over the average of the parents. Altho the largest increases did not occur when the highest yielding varieties were crossed, the varieties, on the other hand, which were above the average in yield taken all together gave fully as large increases when crossed as those crosses whose parents were below the average in yield.

TABLE XII.

CORRELATION BETWEEN AVERAGE YIELD OF PARENTS AND PER CENT INCREASE OF THE CROSSES ABOVE THE AVERAGE YIELD OF PARENTS.

Average Yield of Parents—Bu. per Acre.	Per cent Increase of Crosses above Average Yield of Parents.										
	26–30	21–25	16–20	11–15	6–10	0–(−5)	+5–0	6–10	11–15	16–20	21–25	
55–57							1					1
58–60							1	2	2		1	6
61–63						1		1	2		1	5
64–66					1	2	2	4	2	2		13
67–69						1	1	3	1			6
70–72											1	1
73–75	1						1		1	1	1	5
76–78							1		1	1		3
79–81							1	1		2		4
82–84									2			2
85–87							1	1	1			3
	1				1	4	9	12	12	6	4	49

It is of considerable interest to note that the largest increase above the average of the parents occurs when the parents differ widely in yield as shown in Table XIII by the moderate correlation between the difference in yield of parents and per cent increase above the average of the two parents. This is due to the fact that greater increases occurred in the dent × flint crosses than in the flint × flint crosses. The deviation of all the flint × flint crosses was on the average 1.8 per cent below the average of the higher parents. The deviation below

TABLE XIII.

CORRELATION BETWEEN THE DIFFERENCE IN YIELD OF THE PARENTS AND THE PER CENT. INCREASE OF THE CROSSES ABOVE THE AVERAGE YIELD OF THE PARENTS.

Difference in Yield of Parents—Bu. per Acre.	Per cent. Increase of Crosses above Average Yield of Parents.										
	26–30	21–25	16–20	11–15	6–10	0–(−5)	+5–0	6–10	11–15	16–20	21–25	
0– 2					1		2	2				5
3– 5							2	4		1		7
6– 8	1					3	1	3	4	2	1	15
9–11									2			2
12–14							2	2	3	1	2	10
15–17							2	1	1			4
18–20						1			1			2
21–23									1		1	2
24–26												
27–29										2		2
	1				1	4	9	12	12	6	4	49

is largely due to one cross, in 1915 at Mt. Carmel, which was very much below the yield of the higher yielding parent. The dent × flint crosses gave an average increase of 5.7 per cent above the higher yielding parent which in nearly all crosses was the dent variety.

These results are in agreement with the conclusions reached by others who have tested first generation crosses, namely: that, in general, varieties of a more or less different type or from different geographical regions tend to show the greatest amount of hybrid vigor when crossed. This fact has an important bearing upon the cause of hybrid vigor. It has been assumed (East and Hayes, 1912) (Shull, 1914) that this stimulus to

development, so frequently accompanying cross-fertilization, was a physiological effect dependent upon the degree of heterozygosity in the organism and unrelated to the normal inheritance of definable, alternative characters. A way has recently been shown (Jones, 1917) by which it is possible to consider hybrid vigor as due to the bringing together of a greater number of favorable growth factors in one individual than were present in either parent alone, some of these favorable factors being contributed by one parent, some by the other. On this view, dent varieties of corn, in general, have certain characters which enable them to grow and produce grain which the flint varieties do not have. On the other hand, varieties of flint corn have certain characters which the dents do not have. Both types must have many characters in common. It is not unreasonable to assume that some varieties have many favorable characteristics which others do not possess. This must be so, or there could be no superiority of one variety over another in certain inherited characters. In order to apply this fact to a means of accounting for hybrid vigor it is necessary only to assume that no one variety has all the favorable characters. Crossing different varieties combines in the first generation all the characters which both parents possessed. True, these characters are all hybrid, i. e., represented by one determiner instead of two, but it has been shown that many characters are almost if not quite as well developed when in a hybrid as in a pure condition.

The chief objection previously held against this view has been the supposition, that if it were true, it would be possible to recombine in some individuals, in a pure or homozygous condition all the favorable growth characters which might be scattered about among different varieties of a species and that these fortunate recombinations could not be reduced in vigor by any amount of inbreeding. Since no such variety was known in corn or any other naturally cross-pollinated species it was thought that this objection was valid. Such, however, is not the case, because it has been shown, in the last few years, that characters are inherited in groups (linkage of hereditary factors*) and that there is not an independent reassortment of the characters

* For a complete account of factorial linkage see "The Mechanism of Mendelian Heredity" by Morgan, Sturtevant, Muller and Bridges. New York. 1915.

represented in these groups. For this reason it is not possible to accumulate all the desirable characters in one individual, and ultimately in a variety, in a pure condition unaffected by subsequent inbreeding.

In the varieties of corn as they exist at present many of the favorable growth characters are kept in a continual hybrid condition due to the constant crossing going on. Inbreeding automatically sorts out these hybrid characters so that certain of the inbred strains get some of the desirable characters and some get others in a pure condition together with the characters which all have in common. No one strain gets all of the favorable growth factors. Thus it is that inbreeding a naturally, widely crossed species is always attended by a reduction of vigor and that crossing these inbred strains brings back an immediate return, if the right combination is made, to a vigorous growing condition.

In the process of inbreeding many weak and undesirable types appear. These are eliminated, in time, by their own inability to reproduce themselves at as fast a rate as the more vigorous types. This result takes place whether or not there is a conscious selection of the more desirable types. With many unfavorable characters eliminated, crosses between inbred strains naturally grow to better advantage than the original variety, as has been shown by actual experiments (Shull, 1909; East and Hayes, 1912). Crossing different varieties of corn, as in the experiments reported here, has the same effect as crossing inbred strains, but to a lesser degree. From this view of the situation it is also possible to understand why crosses between varieties of a naturally self-pollinated species, as for example the tomato, may also give an increase in growth over either parental variety on the assumption that each variety has something to contribute to the cross which the other variety does not possess.

In the generations following the first one after the cross the automatic segregation of the different characters takes place whether the cross is artificially self-pollinated or left to pollinate itself at will. The reduction in vigor is most noticeable in the generations immediately following the first, in which the maximum stimulus to increased development is obtained. For this reason only first generation crosses give any promise of commercial value.

It is a well known practice among stock feeders to cross two pure breeds of live stock and grow only the first generation of this cross without attempting to breed from these crossed animals. They have found that such crossed animals are often more vigorous, less liable to disease, grow faster and are for these reasons more profitable to raise than the pure breeds. They know from actual experience that the following generations are usually not desirable.

For almost as long a time as animal husbandry itself has been given thought this practice of crossing fixed types of animals, to take advantage of hybrid vigor, has been followed. The principles underlying this phenomenon are essentially the same in plants as in animals. From the numerous crosses reported here and elsewhere it seems entirely as feasible for the corn grower to utilize this means of increasing production as it is for the live stock raiser.

Summary.

1. Fifty first generation corn crosses have been compared with their parents. Eighty-eight per cent. yielded more than the average and of these 66 per cent yielded more than either parent.

2. In time of ripening the first generation crosses were on the average intermediate when compared with their parents. Thus in crosses between varieties differing widely in time of ripening the first generation crosses not only yielded more than the late parent but matured considerably earlier. This increase in the rate of growth is considered to be fully as important under Connecticut conditions as any increase in yield.

3. The highest yielding parents gave the highest yielding crosses, as would be expected, but a rather unexpected result was obtained in that there was apparently no relation between the yield of the parents and the increase in the yield of the cross. High average yielding parents gave as large increases, when stated in per cent, as low yielding parents.

4. There was a tendency for the crosses whose parents differed in their ability to yield to give the greatest increase. This is also shown by the fact that the dent × flint crosses gave greater increases in growth than the flint × flint crosses.

5. These facts bear out the assumption that hybrid vigor is not the result of an indefinite physiological stimulation but merely

the result of the bringing together of greatest number of favorable growth factors. Crosses between varieties of diverse type therefore possess a greater total number of favorable growth factors than crosses between similar varieties and hence give larger increases when crossed.

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THE PURIFICATION OF SOY-BEAN VARIETIES.

D. F. JONES AND H. K. HAYES.

In the variety test of soy beans in 1913 a variety known as Kentucky appeared to be quite variable in plant habit and in flower and pod color. This variety was imported from Manchuria in 1911 and grown the following year in Kentucky. From its appearance, as grown in 1913, it was evident that the variety was not pure but consisted of a mixture of more or less diverse types. In order to obtain a uniform variety from this mixed stock it was necessary to select individual plants and propagate from them. It was thought that by selecting the more promising plants and testing their progeny that it might be possible to improve the variety somewhat.

Since the soy bean is a naturally self-pollinated plant the method of procedure for improvement by selection is the same as for any plant which is also naturally self-pollinated as for example wheat or beans. In varieties of such species numerous different types or pure lines often exist and these may differ from each other not only in visible characters but also in productiveness. All that selection can do in these naturally selfed varieties is to isolate these different pure lines after proper testing. When once isolated no further improvement in a pure variety is expected by continued selection. This does not mean that selection may not have some effect on self-pollinated plants altho in most plants any real change seems doubtful. All investigations on the efficacy of selection in pure lines of cultivated plants show that, for all practical purposes, selection is without results after the homogeneous type or strain is isolated.

The question may be raised, if self-pollinated plants do not vary, how do mixed varieties, such as this variety of Kentucky soy beans, come to exist? Such a mixed variety may result either from a mechanical mixture of seed, from cross-pollination or there may be actual germinal changes or mutations bringing about variation in a variety originally coming from a single plant. Some natural cross-pollination takes place in other closely related leguminous plants, as for example, peas and beans, altho self-pollination in these plants is the rule. No clear cases of natural

crosses are known to the writers to occur in soy beans but it is not unlikely that crossing does sometimes take place. The chances for mechanical mixing of seed are also very great where several varieties are grown and stored together.

From the Kentucky variety of soy beans grown in 1913 twenty-three plants were selected. These differed considerably in height and number of pods and in minor points with regard to color and shape of seed as shown in the accompanying table. Seed from these mother plants was planted in 1914 and records made of height, average number of pods and yield of seed calculated to bushels per acre. Notes were also made of differentiating characters such as time of flowering, color of flowers and seeds and habit of plant. These are all given in the table.

From this tabulation it can be seen that the selections grown from individual plants differ markedly in such definite characters as flower, seed and pod color and in type of plant. They also differed in quantitatively variable characters such as time of blossoming, height and number of pods. In these last two characters the progeny do not correspond closely to their parents, showing that these characters are largely fluctuations due to environment. Probably the yields are also largely fluctuations of similar nature. However, some of this difference in yield may be due to inheritance.

Unlike the original mixed variety all the plants in any selection were uniform in color of flowers, color of pods (one exception noted in table) and general type of plant.

Ten of the highest yielding selections in 1914 were grown the following year in plots consisting of three rows 100 feet long. The mixed seed of the original variety was grown in four different plots as checks and the yields corrected according to the check plot yields as explained in the part of this report on corn crosses. The yields of seed in pounds per acre of the ten different selections were as follows:

Variety.	Yield: Bu. per Acre.
Kentucky, unselected (ave. 4 plots)	25.9
Selection No. 1	24.1
" " 1 (Duplicate)	30.0
" " 2	25.6
" " 8	28.3
" " 9	30.0

TABLE SHOWING DIFFERENCES IN PURE LINES

	Parent Plants Grown 1913.			Progeny	
Selection.	Height of Parent Plant—Inches.	Number Pods on Parent Plant.	Color of hairs on Pods.	Average Height Inches.	Average Number of Pods.
Kentucky	(Unselected variety)	variable	grey and brown	40.4	57.4
1	23	106	grey	48.2	44.9
2	28	58	grey	48.8	46.8
3	25	82	grey (2 plants brown)	44.0	47.3
4	28	64	brown	42.4	44.0
5	16	62	brown	48.9	47.4
6	13	35	grey	34.6	35.5
8	31	32	grey	48.0	52.6
9	21	98	brown	43.0	52.7
10	29	79	grey	54.0	42.7
11	16	70	brown	40.3	36.2
12	24	117	brown	43.0	35.0
13	26	83	grey	41.0	22.5
15	29	43	grey	38.0	51.8
18	32	89	grey	40.0	30.4
18a	26	90	grey	46.0	40.0
20	21	92	grey	33.0	20.7
22	34	125	grey	42.0	53.6
23	28	162	brown	46.0	36.0
24	18	105	grey	35.7	34.2
25	23	109	grey	39.0	35.3
26	30	94	brown	32.0	29.3
27	21	94	brown	40.0	30.4
28	19	121	grey	35.0	23.8

Variety.	Yield: Bu. per Acre.
Selection No. 10	25.7
" " 11	30.4
" " 18a	26.2
" " 22	24.2
" " 24	32.8
" " 25	29.0

Two plots of selection No. 1 were grown in different parts of the field. They differed in yield by nearly as much as any two of the selections so that no great importance can be attached to the observed differences in yield. All but two exceeded the original variety in yield.

In 1916 three of these selections were grown in the general variety test of soy beans carried on that year. The yield of seed was not determined but in yield of forage, as published in bulletin 193 of this Station one of the selections was consistently more productive than the others and gave the third largest yield of dry forage of all the varieties grown.

Along with these selections from the Kentucky variety a

SELECTED FROM A MIXED VARIETY OF SOY BEANS.

GROWN 1914.

Selection.	Yield Bu. per Acre.	Color of Blossoms.	Date Blossomed.	Color of Seeds.	Plant Habit.
Kentucky	30.2	.....	.....	variable.....	.....
1	24.3	White	Aug. 1	yellow, uncolored eye	Falls down early
2	31.2	White	Aug. 1	light buff, brown eye	Nearly erect
3	23.3	Purple	Aug. 4	light buff, uncolored eye	Falls down badly
4	23.3	White	July 27	yellow, uncolored eye	Nearly erect
5	25.2	Purple	Aug. 1	greenish yellow, brown eye	Erect, red stalks
6	17.8	White	July 27	yellow, uncolored eye	Erect
8	27.6	White	Aug. 1	yellow, uncolored eye	Twining on tip
9	27.6	Purple	July 28	greenish yellow, black eye	Nearly erect
10	25.5	White	Aug. 1	greenish yellow, brown eye	Twining at ends
11	26.7	White	July 27	buff, uncolored eye	Nearly erect
12	22.3	Purple	Aug. 1	greenish yellow, black eye	Erect
13	18.0	White	July 27	greenish yellow, uncolored eye	Erect
15	24.7	.....	.....	yellow, uncolored eye	Nearly erect
18	22.3	White	July 29	yellow, uncolored eye	Nearly erect
18a	28.5	White	July 28	yellow, uncolored eye	Nearly erect
20	15.6	White	July 25	yellow, uncolored eye	Erect
22	37.4	.....	.....	yellow, uncolored eye	Nearly erect
23	22.3	Purple	Aug. 1	greenish yellow, uncolored eye	Falls down, retains leaves
24	26.8	White	July 28	yellow, uncolored eye	Erect
25	27.9	White	July 28	yellow, uncolored eye	Erect
26	20.1	Purple	Aug. 1	greenish yellow, black eye	Erect
27	16.8	Purple	Aug. 1	greenish yellow, black eye	Erect, red stem
28	25.7	White	July 28	yellow, uncolored eye	Erect, red stem

similar selection experiment was carried on with another variety known as Ito San. This variety, unlike Kentucky, was quite uniform. Seventeen selections were made in 1913 and grown the following year. These selections ranged in yield from 12.4 to 25.1 bushels of seed per acre whereas the unselected variety yielded 30.2 but was favored by its position in the field. Five of the highest yielding of these 17 selections were grown in larger plots in 1916 together with the original unselected variety. Their yields were as follows:

Variety.	Yield: Bu. per Acre.
Ito San, unselected (ave. 2 plots)	22.5
Selection No. 1	21.2
" " 2	22.8
" " 15	22.3
" " 29	20.3
" " 38	21.8

The yields of these selections are so nearly equal to each other and to the original, unselected variety that it is evident that the variety itself was quite pure and did not contain any types dif-

fering appreciably in productiveness just as no visible differences were observed.

No extensive experiment was planned with regard to methods of improving soy beans as the principles underlying the improvement of self-pollinated plants have already been fairly well determined. These results simply show that a mixed variety of soy beans can be purified and made uniform by selecting individual plants and increasing their progeny. These selections represent separately what was present in the original variety mixed together. Since these isolated types differ in visible, qualitative characters they may also differ in quantitative characters, such as height and productiveness as the results obtained indicate. If pure strains can be isolated which are more productive than the original variety the result is an improvement over the original variety.

The improvement, however, is more than in yield alone. A variety of a self-pollinated species composed of plants of similar hereditary constitutions tends to remain the same from year to year under different environmental conditions. A mixed variety tends to fluctuate from one year to another as the different component types respond differently to varying environments so that a variety may be greatly changed in a few years. This is due to the fact that the several types of which the variety is composed are not equally productive under different growing conditions.

This may be made clear by taking an assumed case, as an illustration, of a mixture of rye and wheat. If rye is assumed to be more productive than wheat on poor soil and that wheat is more productive than rye on good soil the results would be far different, in a few years in such a mixture, grown on a poor soil, than in the same mixture grown on good soil during the same period of years. If equal parts of the two grains were taken at the start the plot grown continually on poor soil would show an increasing proportion of rye. The plot on good soil would give an increasing proportion of wheat. The rate of change might be so rapid, if no selection was practiced and a representative sample, of the mixture harvested, planted each year, that conceivably in time one lot would become all rye and the other all wheat.

Something like this process is going on in mixed varieties of plants. Where productiveness of seed is the only consideration for which a variety is grown such fluctuations may not detract from its value since the more productive types, other things being equal, tend to be perpetuated. But if other considerations such as quality and yield of products other than seed, are sought, which are not correlated with seed production such fluctuations within a mixed variety may result in a marked decrease in the value of that variety. In this way also a chance mechanical mixture of one seed of a foreign variety might entirely change a variety in time if no selection was practised.

This is a rather extreme picture of what, in actual practice, is probably going on to a limited extent. It may, however, account in part for the present great confusion of names in soy bean varieties. Many quite different varieties are now being grown under the same names. It may also account for some of the apparent "running-out" of seed which is thought to take place in many varieties of plants. At least it emphasizes the importance of keeping varieties selected to type.

CO-OPERATIVE POTATO SPRAYING 1916.

G. P. Clinton, *Botanist.*
F. E. Rogers, *Farm Bureau Agent.*

NATURE OF EXPERIMENTS.

This is an account of co-operative experiments of the Connecticut Agricultural Experiment Station and the New Haven County Farm Bureau, with certain farmers in this county, to test the relative merits of Bordeaux Mixture and Pyrox, in spraying Green Mountain potatoes for the blight, etc., under ordinary farm conditions. The experiments were carried on at the farms of C. R. Treat and A. D. Clarke of Orange, and D. L. Clarke & Sons of Milford. The Pyrox used was kindly furnished by the Bowker Insecticide Company of Boston.

Iron-Age, horse-power sprayers of 50 gallon tank capacity were used, spraying four rows at once. In the case of D. L. Clarke & Sons and A. D. Clarke, two nozzles per row were used, whereas on C. R. Treat's patch only single nozzles were tried. Seven sprayings were made on the following dates:—1st, June 22d; 2d, July 3d; 3d, July 19th; 4th, July 28th; 5th, August 4th; 6th, August 17th; 7th, August 30th. This last spraying was omitted at A. D. Clarke's because the weeds at that time were too abundant to allow proper and efficient treatment. In the first and second sprayings of Bordeaux, lead-arsenate paste about 3-50, was added to control potato-bugs. Pyrox contains lead arsenate, so none was added to this. The checks were also given the 1st and 2d sprayings with lead arsenate only. The details of the treatments on the different farms were as follows.

TREATMENT AND FIELD CONDITIONS.

At the Treat farm as only one nozzle was used per row, it was thought advisable in order to secure a thorough coating of all of the vines with both the Pyrox and Bordeaux, that these plots be sprayed twice at each treatment. To compare with these and the checks, two other plots were gone over once, at each treatment, with Bordeaux. These latter served to determine the value of an imperfect method of spraying, which is very often followed. At both of the Clarke farms the plots were too large

to allow a single tank to cover them twice over at a single treatment. A tank was sufficient, however, to cover a plot about 1⅔ times over at A. D. Clarke's, and 1⅘ times at D. L. Clarke & Sons'. Each alternate time the spraying was started so that the portion which received only one application at the previous treatment, was sprayed twice over. At A. D. Clarke's there was also a Bordeaux plot that received only a single treatment at each application.

C. R. Treat.

The potato field here occupied a low level piece of ground where blight was liable to appear early and do considerable injury, if the season was favorable for its development. It contained about 4 acres with 90 rows running lengthwise averaging about 660 feet long, and planted 2 feet 10 inches apart. Rows 53-90, while not in the experiment, received partial treatment. The cultivation was good, although no hand work was given, and the field was well fertilized. The fertilization was not quite the same on the whole field, part receiving potash; but this was not taken into consideration, as the owner was not sure where it was applied, and no difference in the appearance of the plants was apparent. The vines made a very luxuriant growth, densely covering the field when fully grown.

The plan of spraying was as follows:

Rows 1– 8, Bordeaux, 4–4–50, once over each treatment.
" 9–12, Check. No treatment except two applications twice over of lead arsenate.
" 13–28, Pyrox, 10–50, twice over each treatment.
" 29–44, Bordeaux, 4–4–50, twice over each treatment.
" 45–48, Check. Same as rows 9–12.
" 49–52, Bordeaux, 4–4–50, same as rows 1–8.

A. D. Clarke.

This potato field was on a piece of ground much higher than that of Mr. Treat's, although in the same general neighborhood. It was also more uneven, so that during a wet period at one of the sprayings in July a few of the rows at one end could not be sprayed. The more elevated portions suffered somewhat from drought during the drier periods. The soil also was not so heavy, being more of a gravel. The potatoes received good fertilization and cultivation, except that after cultivation was

over the weeds gave more trouble than at the other farms. The field contained about three acres, with 123 rows varying somewhat in length because of its irregular shape. Those from which the yields were taken averaged about 475 feet long, and were planted 2 feet and 9 inches apart. The vines while making a good growth, did not so completely cover the ground as at the other two places.

The plan of spraying was as follows:

Rows 1– 8, Check. No treatment except two applications twice over of lead arsenate.
" 9– 32, Pyrox, 10–50, 1⅔ times over each treatment.
" 33– 56, Bordeaux, 4–4–50, 1⅔ times over each treatment.
" 57– 64, Check. Same as rows 1–8.
" 65–123, Bordeaux, 4–4–50, once over each treatment.

D. L. Clarke & Sons.

This was a level field somewhat similar to that of Mr. Treat's, except that as compared with the surrounding country it was more elevated, and the soil was somewhat lighter and more sandy. It was well fertilized and cultivated, and while the weeds in general were kept in control, nut-grass was plentiful in certain areas. It is not known what effect its presence exercised on the yield of potatoes. The field was about two acres in extent, containing 59 rows averaging about 525 feet in length, and 2 feet 10 inches apart. The vines were so luxuriant that it was difficult in the later sprayings to follow the rows across the field without running over the matted vines. The same difficulty was encountered at Mr. Treat's, but in a lesser degree, due to the higher ridging of the rows.

The plan of spraying was as follows:

Rows 1–16, Check. No treatment except one application of lead arsenate twice over.
" 17–36, Pyrox, 10–50, 1⅘ times over each treatment.
" 37–56, Bordeaux, 3–3–50, 1⅘ times over each treatment.
" 57–59, Check. Same as 1–16.

BLIGHT CONDITIONS.

Blight first appeared between July 19th and 28th, following a period of rainy and cloudy weather, when it got started over the state, and was seen in all three experimental fields, perhaps most

abundantly in that of Mr. Treat. Fortunately the weather changed soon afterwards and a bright dry period followed, so that on August 4th the blight had not made much further progress. By August 17th its gradual increase was becoming more evident on the checks, and some little was showing on the imperfectly sprayed vines. From this period until the end of the season it progressed slowly, but the damage was not as great as expected because of the check the disease received after its first appearance, and the bright dry weather during the latter part of the summer.

At the time of the last spraying, August 30th, the blight at A. D. Clarke's did not show prominently on either the sprayed or unsprayed plots, although the vines in all of these plots were dying prematurely, apparently from competition with the weeds. On this account the last spraying was omitted, as it would have been of little value. At Charles R. Treat's, while from the street no very marked difference was apparent between the sprayed and unsprayed plots, when one walked into these plots and examined the plants carefully, it was quite evident that the twice over Bordeaux had very little blight and the foliage was in excellent shape, whereas the checks had considerable blight, with the result that a large part of the foliage was either dead or dying. The once over Bordeaux and the Pyrox were intermediate between these two extremes.

At D. L. Clarke & Sons' from a distance there was perhaps the most contrast between the vines sprayed with Bordeaux and Pyrox and those unsprayed, the latter showing stiff erect vines largely denuded of their foliage, while the former still held their leaves for the most part unaffected.

COST OF SPRAYING.

A general account of cost of labor and material used in the different treatments was kept. We have figured that a man and boy were necessary to do the spraying, the boy to help make the fungicide and follow the machine to watch the nozzles. For success it is essential to thoroughly strain the mixture as it is put into the tank, and to clean the tank carefully at the close of each spraying to remove sediment. As a general rule it takes one hour to fill a 50 gallon tank and spray it on the vines.

This time will vary with the number of nozzles used and the distance of the field from the water supply. With single nozzles, spraying four rows, 50 gallons will spray on the average one acre once over, varying with the speed of the horse, etc. At the Treat farm it took one hour and one tank of material to spray an acre once over. At the Clarke farms where two nozzles were used per row, it took approximately one and one-seventh tanks of material and one and one-seventh hours of time to spray an acre.

Computing the expenses has been more difficult than in ordinary years due to the great variation in prices of materials and labor, which, through all the season have been higher than usual. Somewhat arbitrarily these have been placed as follows:—

Copper sulphate @ 15c per pound.
Lime @ 1c per pound.
Lead arsenate (paste) @ 13c per pound.
Pyrox @ 13½c per pound.
Man with horse and spray-cart per day of 10 hours $4.50, or 45c per hour.
Boy per day of 10 hours $1.25, or 12½c per hour.

The actual costs for each of the various treatments based on uniform plots of one acre, are as follows:—

Charles R. Treat.

Bordeaux twice over:	
7 sprayings (14 tanks), @ 64c per tank of 4–4–50 Bordeaux, ...	$8.96
12 lbs. lead arsenate in 2 sprayings of above, @ 13c per lb., ...	1.56
Cost of making and applying same, 14 hours, @ 57½c per hour, ..	8.05
Total cost, ...	$18.57
Cost of spraying with lead arsenate, ...	3.86
Net cost over check, ...	$14.71
Bordeaux once over:	
7 sprayings (7 tanks), @ 64c per tank of 4–4–50 Bordeaux, ...	$4.48
6 lbs. lead arsenate, @ 13c per lb., ...	.78
Cost of making and applying same, 7 hours, @ 57½c per hour, ..	4.02
Total cost, ...	$9.28
Cost of spraying check with lead arsenate, ...	3.86
Net cost over check, ...	$5.42

Pyrox twice over:	
7 sprayings (14 tanks) of 10–50 Pyrox, @ $1.35 per tank,	$18.90
Cost of mixing and applying same, 14 hours, @ 57½c per hour,	8.05
Total cost,	$26.95
Cost of spraying check with lead arsenate,	3.86
Net cost over check,	$23.09
Check, no fungicide:	
12 lbs. (4 tanks) lead arsenate, 2 sprayings, twice over,	$1.56
Cost of applying same, 4 hours, @ 57½c per hour,	2.30
Total cost,	$3.86

A. D. Clarke.

Bordeaux 1⅔ times over:	
6 sprayings (11 3/7 tanks) 4–4–50 Bordeaux, @ 64c per tank,	$7.31
11 3/7 lbs. lead arsenate in 2 sprayings of above, @ 13c per lb.,	1.48
Cost of making and applying same, 11 3/7 hours, @ 57½c per hour,	6.55
Total cost,	$15.34
Cost of spraying checks with lead arsenate,	3.68
Net cost over check,	$11.66
Bordeaux once over:	
6 sprayings (6 6/7 tanks) 4–4–50 Bordeaux, @ 64c per tank,	$4.39
6 6/7 lbs. lead arsenate in 2 sprayings of above, @ 13c per lb.,	.89
Cost of making and applying same, 6 6/7 hours, @ 57½c per hour,	3.94
Total cost,	$9.22
Cost of spraying checks with lead arsenate,	3.68
Net cost over check,	$5.54
Pyrox 1⅔ times over:	
6 sprayings (11 3/7 tanks) 10–50 Pyrox, @ $1.35 per tank,	$15.43
Cost of mixing and applying same, 11 3/7 hours, @ 57½c per hour,	6.55
Total cost,	$21.98
Cost of spraying checks with lead arsenate,	3.68
Net cost over check,	$18.30
Check, no fungicide:	
11 3/7 lbs. lead arsenate (3.8 tanks), 2 sprayings 1⅔ times over,	$1.49
Cost of applying same, 3.8 hours, @ 57½c per hour,	2.19
Total cost,	$3.68

D. L. Clarke & Sons.

Bordeaux 1⅘ times over:	
7 sprayings (14⅖ tanks) 3–3–50 Bordeaux, @ 48c per tank,	$6.91
12⅓ lbs. lead arsenate in 2 sprayings of above, @ 13c per lb.,	1.60
Cost of making and applying same, 14⅖ hours, @ 57½c per hour,	8.28
Total cost,	$16.79
Cost of spraying check with lead arsenate,	2.20
Net cost over check,	$14.59
Pyrox 1⅘ times over:	
7 sprayings (14⅖ tanks) 10–50 Pyrox, @ $1.35 per tank,	$19.44
Cost of making and applying same, 14⅖ hours, @ 57½c per hour,	8.28
Total cost,	$27.72
Cost of spraying check with lead arsenate,	2.20
Net cost over check,	$25.52
Check, no fungicide:	
6 6/7 lbs. lead arsenate (2 2/7 tanks) 1 spraying, twice over,	$ .89
Cost of applying same, 2 2/7 hours, @ 57½c per hour,	1.31
Total cost,	$2.20

DATA AND CONCLUSIONS.

Manner of obtaining data.

The potatoes of D. L. Clarke & Sons were dug on September 20th, and those of Messrs. C. R. Treat and A. D. Clarke, on October 9th. In each case the vines were entirely dead at the time of digging. To determine the yields in each plot, at least three 100 foot lengths were dug and weighed. These were selected from different rows at each end and the center of the plot. Where possible these lengths were parallel and adjacent to each other in the different plots. The potatoes were weighed as firsts and seconds, the class being determined solely by size, as it was not considered fair to throw scabby potatoes into the second grade, since spraying bears no relationship to scab. The rotten and blight infected tubers were not weighed, but a record kept of the number occurring in each plot. There was not any considerable number found in either the sprayed or unsprayed plots.

The yield per acre for each plot was determined by multiplying

the average weight of the different tests by 145.2, since an acre field 10 by 16 rods with the rows 3 feet apart will contain this number of 100 foot lengths, and by dividing by 60, the number of lbs. per bushel. The actual yields should run somewhat higher than the figures given, since in all the fields the rows were less than 3 feet apart; but to make the results more uniform they were computed on that distance.

Price of Potatoes.

The yields were very satisfactory averaging much higher than those of the ordinary farmer this year, although the yield for the state was also higher than usual. Coupled with the good yields was the unusually high price which the tubers brought when sold. These good yields and prices must be taken into consideration when comparing the results with those of ordinary years. None of the growers sold their firsts for less than $1.25, and a portion of one crop was sold as high as $1.80. A very satisfactory price was also received for the seconds. According to the grading the growers would make, about 1 bushel of seconds was secured to 10 bushels of firsts. It would not seem more than fair, therefore, to estimate the entire crop of each grower at $1.25 per bushel, which figure has been used in determining the results of the different experiments. The results computed on the basis of yields, costs, with gain or loss per acre, are given in the accompanying table.

Conclusions.

A perusal of the table will show that the spraying of these fields with Pyrox was not a profitable venture, since in two of the experiments the yields were actually less than in the adjacent check or unsprayed plots. In the third case (Treat's), the increased yield was sufficient to a little more than pay for the cost of the spraying. Under more satisfactory conditions the Pyrox at least should have given as good yields as the checks, as will be explained later, but due to its greater cost, and its apparently less beneficial results, there seems to be no particular reason for its use in the place of home-made Bordeaux.

The thorough spraying with Bordeaux in two of the three

TABLE I.

YIELDS, COSTS, GAINS OR LOSS PER ACRE FOR DIFFERENT TREATMENTS.

	1sts. bu.	2ds. bu.	Total bu.	+ or − bu. over check.	Value + or −	Cost over check.	Gain or loss over check.
At C. R. Treat's Farm:—							
Bordeaux, 4-4-50, twice over	339.8	28.1	367.9	(+) 70.2	(+) $87.75	$14.71	(+) $73.04
Bordeaux, 4-4-50, once over	286.1	40.6	326.7	(+) 29.0	(+) 36.25	5.42	(+) 30.83
Pyrox, 10-50, twice over	282.7	36.3	319.0	(+) 21.3	(+) 26.63	23.09	(+) 3.54
Checks, with lead arsenate only	265.0	32.7	297.7				
At A. D. Clarke's Farm:—							
Bordeaux, 4-4-50, 1⅔ times over each treatment	187.6	22.5	210.1	(−) 43.0	(−) $53.75	$11.66	(−) $65.41
Bordeaux, 4-4-50, once over each treatment	206.2	29.0	235.2	(−) 17.9	(−) 22.38	5.54	(−) 27.92
Pyrox, 10-50, 1⅔ times over each treatment	194.1	38.7	232.8	(−) 20.3	(−) 25.38	18.30	(−) 43.68
Checks with lead arsenate only	222.1	31.0	253.1				
At D. L. Clarke & Sons' Farm:—							
Bordeaux, 3-3-50, 1⅘ times over each treatment	279.0	44.3	323.3	(+) 30.0	(+) $37.50	$14.59	(+) $22.91
Pyrox, 10-50, 1⅘ times over each treatment	237.8	52.8	290.6	(−) 2.7	(−) 3.38	25.52	(−) 28.90
Checks with lead arsenate only	246.1	47.2	293.3				

experiments (Treat's and Clarke & Sons), gave very satisfactory results. Not only did the yields prove greater than those of the checks, but these were great enough to return a profit of about $73 per acre in one case, and of $23 in the other, after the expense of the spraying had been deducted. In the third case the spraying was not profitable, for the same reason that the Pyrox was not at this farm, as will be stated later.

The less thorough spraying once over with Bordeaux, in one case gave a profit and the other did not. The profit was so much less at the Treat farm, about $31 net as compared with $73 for the thorough treatment, that the latter type of spraying seems to be much more desirable.

Why the Pyrox did not give as large a yield as the checks at the D. L. Clarke & Sons farm is not very clear, since the vines kept green longer and seemed to indicate a higher yield. Possible variation in the fertility of the land may have had something to do with it. At the A. D. Clarke farm there seemed to be a definite reason for the lower yield of both the Pyrox and the Bordeaux plots. As stated previously these plots were greener and freer from blight than the checks up to the end of the sixth spraying on August 17th. About that time, however, the weeds began to make such headway that by the time of the last spraying, August 30th, they were so large as to make the treatment impracticable, and their competition had caused the potato vines, especially in the sprayed plots, to begin to die prematurely. This was at a time when the sprayed vines were just beginning to gain from the treatment by adding to the growth of the tubers. Previously the spraying had caused the vines to develop at the expense of the tubers, and this, together with the slight injuries due to the trampling of the vines in the process of spraying, had made the actual tuber development at this time less than that of the checks; then before they had time to catch up, much less to lead the checks, as they undoubtedly would have done due to the protection of the foliage against blight, they were killed prematurely by the weeds. In the fifteen years of the senior writer's experiments with potato spraying, this is the only case where vines sprayed with Bordeaux mixture have actually given a lower yield than the unsprayed vines, so the explanation seems probable.

REPORT OF ORCHARD WORK ON MOUNT CARMEL EXPERIMENT FARM FOR YEARS 1911 TO 1916 INCLUSIVE.

E. M. STODDARD, *Assistant Botanist.*

The orchard work at the Mount Carmel Experiment Farm has been divided between the Old Apple Orchard, a New Apple Orchard, and a Peach Orchard, and each division will be separately considered. While we believe that a large part of the operations conducted in these orchards are practical for the individual orchardist, they have not been conducted as model, but rather as experimental orchards, where the relation of cost to receipts cannot approximate commercial orchard operations.

THE OLD ORCHARD.

The old apple orchard contained forty-six neglected trees, about twenty-five years old, planted irregularly on approximately one acre of ground. The varieties were chiefly Greenings and Baldwins, with two Russets and four trees of unidentified varieties, presumably local seedlings. These trees were growing in sod and had received very little pruning or care of any kind. The trees on the north end of the plot had received the drainage from a barnyard and had consequently made considerably more growth than the trees on the south end of the orchard.

This orchard has been pruned with the idea of getting low headed trees with open centers on which the fruit can be sprayed and picked easily, and which will also be open enough to permit good coloring of the fruit on all parts of the tree. This has necessarily been done gradually, as excessive pruning at one time would have resulted in sun scald and injury to the trees. At this writing the process of thinning is nearly completed, but the heading back on some of the trees is still being done. The trees which are being headed back are putting out branches lower down on the main limbs very satisfactorily, in fact fruit was gathered in 1915 on branches which have grown since 1911. In connection with the pruning it may be mentioned that rotten stubs have been cleaned out and the holes filled with cement. This was done in

1914, and so far seems to have been successful, as in all cases wood is growing over the cement and all the fillings have held firmly in place.

Four large trees have been grafted to more desirable varieties, and while the limbs in most cases were larger than is usual to graft, a large per cent of the scions are growing vigorously. The grafting was done on the upper part of the trees in 1914 and the remaining part in 1915, to prevent too great a shock to trees by the removal of so many large limbs.

The orchard was badly infested with San José scale, but by careful and thoro fall and winter spraying with commercial lime and sulphur this pest has been practically exterminated. Summer spraying for fungous troubles and insects has been practiced since the summer of 1912, the details of treatment and materials used being given below. In this report it is not desirable to take up the results of spraying in detail; however, comparison with check trees, not sprayed in summer, shows that all the mixtures used, have controlled both fungi and insects.

In 1911 the orchard was left in sod, but since has been plowed each year until 1916 and cultivated to keep out a heavy growth of weeds until cover crops were sown in the late summer or fall. In 1915 the entire plot was seeded to orchard grass and is to be left in sod for a few years, as the trees have made a very heavy growth, evidently at the expense of color on the fruit. The clover sown in 1912 as a cover crop was a failure, but the rye made a rank growth which provided ample cover for the winter, as have succeeding crops of rye.

In 1911 the fruit was inferior and the yield insignificant, no record being kept. The yield of 90 bushels in 1912 was of inferior quality, but was harvested and sold. The largest yield was in 1913, but due to rapid growth following rains in the fall, was of poor color and in general did not keep well. The per cent of first grade fruit increased in 1914 and 1915, and reports from buyers show that the keeping quality was good. The fruit has been picked by hand, sorted immediately, and from lack of storage facilities and the nature of the trade supplied, was put on the market at once. A large per cent of the first grade fruit was sold in boxes, not because it was a particularly fancy grade of fruit, but on account of the ease in handling, the demand of the trade catered to, and the cheapness as compared with barrels.

Three boxes holding somewhat more than a barrel could be had for 39 cents, including cost of assembling, while new barrels with heads cost 45 to 48 cents apiece. A large part of the increase in average price per bushel as noted in Table No. I is due to the increased per cent of first grade fruit, and not to increase in apple prices, for the crop was sold at nearly the same price per bushel for the different grades in 1913, 1914 and 1915.

TABLE I. FERTILIZERS, COVER CROPS, CULTIVATION, YIELD OF FRUIT.

Fertilizers.

1911. None.

1912. 10 tons horse manure and about 31 lbs. nitrogen, 8 of phosphoric acid and 75 of potash in form of nitrate of soda (200 lbs.), muriate of potash (150 lbs.), and basic phosphate (50 lbs.).

1913. About 23 lbs., 32 lbs., and 225 lbs. respectively of nitrogen, phosphoric acid and potash in the same forms as above.

1914. About 31 lbs. of nitrogen and 96 lbs. of phosphoric acid in form of nitrate of soda (200 lbs.) and basic phosphate (600 lbs.).

1915. About 32 lbs. of nitrogen and 116 lbs. phosphoric acid in form of nitrate of soda (150 lbs.), acid phosphate (350 lbs.), and ground bone (300 lbs.).

1916. None.

Cover Crops.

1911. None.
1912. Red clover and rye, sown Aug. 1-7.
1913. Rye, sown Sept. 10.
1914. Rye, sown Sept. 17.
1915. Seeded with 22 lbs. orchard grass July 31.
1916. Hay cut and placed around trees.

Cultivation. Plowed early and cultivated as necessary until midsummer each year.

Yield of Apples	Bushels	Av. price per bushel Cts.
1911	Very few	—
1912	90	50
1913	328	58
1914	202	60.6
1915	240	72.3
1916	160	96.5

Table II gives the cost of all operations included in Table I. The cost of materials represents the actual amounts paid for the various items, while labor is estimated from records of

average time taken for the various operations. Hand labor is computed at 20 cents per hour, double team labor at 50 cents per hour, and single horse labor at 37½ cents per hour. It will be noted that labor comprises 71.6 per cent of total cost, from which it may be supposed that the private individual undertaking the same operations could cut down the actual cash outlay required by doing considerable of the work himself. Also, while this orchard has been managed to a large extent in a commercial way, certain experimental work has increased the labor cost somewhat.

THE NEW APPLE ORCHARD.

The new apple orchard covers an area of 3.03 acres of land which had formerly been an old pasture, overgrown with gray birch, sumac and other bushes, and plentifully besprinkled with all sizes of stones. In the spring of 1911 this piece of land was cleared of the brush and large stones, and the trees planted 40 x 35 feet. The following varieties and numbers of each were set in the spring of 1911:

Baldwin	32	Northern Spy	4
R. I. Greening	16	Gravenstein	4
Rox. Russet	8	Fall Pippin	4
McIntosh	8	Hurlburt	4
Sutton	8	King	4
Wealthy	8	Duchess	4

In making this list of varieties the object sought was to include the standard varieties that are most commonly grown in Connecticut.

At the time of planting the trees were cut to whips about two feet in height for the purpose of inducing a growth of branches low enough down to insure low headed trees. In succeeding years the orchard has been pruned to secure low headed, open, and uniform shaped trees, which will bear crops of fruit where they can be easily sprayed and harvested.

These trees have been sprayed with commercial lime and sulphur, 1–9, each winter as an insurance against attacks of San José scale, and at the present writing only two trees have shown any infection of this insect. Bordeaux and lime and sulphur, with lead arsenate as an insecticide, have been used as a summer spray, the details of which are shown in Table IV.

TABLE II. OLD APPLE ORCHARD.

EXPENSES AND INCOME, 1911–1916.

Year.	Fertilizer.		Cover Crops.		Spraying.		Harvesting.		Cultivating.	Pruning.	Total Expenses for Year.	Receipts.	Gain or Loss.
	Material.	Labor.	Seed.	Labor.	Material.	Labor.	Material.	Labor.					
1911	.....	.....	.....	.....	$ 2.40	$ 7.00	.....	.....	.....	$16.00	$ 25.40	.....	—$25.40
1912	$16.36	$11.00	$3.50	$2.00	8.56	20.00	$ 6.00	$ 6.00	$12.42	10.00	95.84	$ 54.00	—41.84
1913	14.35	3.00	.90	2.00	6.16	13.00	30.00	70.00	12.50	8.00	159.91	192.70	+32.79
1914	8.30	3.00	.75	2.00	13.89	23.75	23.50	48.00	12.23	17.00	152.42	122.48	—29.94
1915	9.07	3.00	3.96	2.00	8.40	13.50	5.00	51.60	11.00	4.00	111.53	173.60	+62.07
1916	.....	.....	.....	2.69	10.92	14.30	18.14	72.00	.....	7.00	125.05	154.10	+29.05
Total	$48.08	$20.00	$9.11	$10.69	$50.33	$91.55	$82.64	$247.60	$48.15	$62.00	$670.15	$696.88	+26.73

Income over expenses in six years, $26.73.
Cost of labor, $479.99; 71.6 % of total cost.
Cost of material, $190.26; 28.4 % of total cost.

The condition of the land previous to planting made cultivation difficult and expensive for the first three years, but the soil is in such condition now that this item can be much reduced in the future. The present plan of cultivation consists of spring plowing followed by clean cultivation to such time as the cover crops are sown.

A variety of cover crops have been used on this orchard, all of which have seemed to serve the purpose satisfactorily, altho it is impossible to say at this time that any one crop has a marked advantage over another as regards growth or appearance of the trees. Considering a crop to cover the ground during the winter and to supply an abundance of green manure to plow in, it is evident from what work has been done that a mixed crop such as on Plot A in 1913-14-15 (see Table III) is most desirable. For the vetch could be substituted red clover, which is cheaper if clover is known to grow well in the soil where it is to be used.

Altho soy beans and cow peas are killed by frost, the leaves and stems falling to the ground make a very satisfactory winter cover which will prevent damage from washing on sloping land. It was found that where soy beans followed buckwheat the beans made unsatisfactory growth the first season, altho in subsequent seasons no difference could be noted. In connection with the mention of buckwheat it might be well to state that no harmful effect was noticed on the trees where it was used as a cover crop.

As will be noted in Table III a definite plan of fertilization has not yet been established, but rather the different elements have been supplied in such quantities as were thought necessary. The excellent growth of the trees has seemed thus far to warrant such a method of application.

TABLE III. FERTILIZERS, COVER CROPS, AND CULTIVATION IN YOUNG APPLE ORCHARD.

Fertilizers per acre.

1911. Complete fertilizer containing about 20 lbs. nitrogen, 30 lbs. phosphoric acid and 28 lbs. potash.

1912. 151 lbs. muriate of potash and 320 lbs. bone meal.

1913. 159 lbs. muriate of potash, 116 lbs. acid phosphate and 1.3 tons limestone.

1914. 100 lbs. muriate of potash, 300 lbs. basic phosphate, 158 lbs. nitrate of soda and 300 lbs. tankage.

1915. 300 lbs. acid phosphate, 165 lbs. nitrate of soda and 330 lbs. tankage.

1916. 636 lbs. tankage and 33 lbs. bone.

Cover Crops on Plot A, southern half of orchard, (per acre).

1911. None.

1912. ⅓ bush. winter vetch and 1 bush. barley.

1913. Self-sown vetch, ½ bush. rye, 7½ lbs. red clover, 14 lbs. crimson clover, 2 oz. cowhorn turnips.

1914. Winter vetch and rye, each 1 bush., 3.8 lbs. timothy, 2 oz. cowhorn turnips.

1915. ⅓ bush. vetch, 1 bush. rye, 3.8 lbs. timothy, 4 oz. cowhorn turnips.

1916. Same as on northern half of orchard in 1914 and 1915, except that no rye was used.

Cover Crops on Plot B, northern half of orchard, (per acre).

1911. None.

1912 and 1913. Cow peas, Soy beans and buckwheat, each on one-third of the area.

1914 and 1915. Soy beans grown in drills. After harvesting and threshing vines and trash were put on the land which was then seeded with 1 bush. rye.

1916. 1 bush. rye.

Cultivation. The land was plowed early and clean cultivated until the end of July.

TABLE IV. SPRAY TREATMENT OF YOUNG APPLE ORCHARD.

1911. None.

1912. Mar. 27. Lime and sulphur.
May 27 and June 29. Bordeaux 4-4-50 and Arsenate of Lead.

1913	Plot I	Plot II
Mar. 28.	Lime and Sulphur.	Lime and Sulphur.
Apr. 29.	Bordeaux and Arsenate of Lead.	Lime and Sulphur and Arsenate of Lead.
May 19.	Arsenate of Lead.	Arsenate of Lead.
June 18.	Bordeaux and Arsenate of Lead.	Bordeaux and Arsenate of Lead.
1914, 1915 and 1916.		
Apr. 8 to 13.	Lime and Sulphur.	Lime and Sulphur.
May 20 to 29 and June 22-July 6.	Bordeaux and Arsenate of Lead.	Lime and Sulphur and Arsenate of Lead.

In the above table it should be noted that Commercial Lime and Sulphur was used 1-9 for dormant spray, 1½-50 for summer spray; Bordeaux 1-4-50, except as noted otherwise; Arsenate of Lead (paste) 3-50, or powder, 1½-50.

Cost Table V has been compiled as was Table II, namely, materials at actual cost, and hand and horse labor estimated at a fixed charge per hour.

TABLE V. YOUNG APPLE ORCHARD.

EXPENSES AND INCOME, 1911–1916.

Year.	Fertilizers.		Cover Crops.		Spraying.		Cultivation.	Pruning.	Total Cost for Year.
	Material.	Labor.	Seed.	Labor.	Material.	Labor.			
1911	$19.12	$6.00	$22.50	$43.14	...	...	$ 93.98	...	$184.74
1912	21.50	6.00	11.84	6.00	$0.15	$0.37	105.91	$0.50	152.27
1913	35.55	6.00	5.59	6.00	.52	.75	67.19	2.00	123.60
1914	34.73	6.00	12.90	6.00	1.10	1.50	40.81	2.00	105.04
1915	31.22	6.00	12.90	6.00	1.10	1.50	16.96	6.00	81.68
1916	40.35	1.25	1.73	6.87	4.72	6.50	44.50	7.00	112.92
Total	$182.47	$31.25	$67.46	$74.01	$7.59	$10.62	$369.35	$17.50	$760.25

Cost of labor, $502.73=66.1 % of total cost.
Cost of material, $257.52=33.9 % of total cost.

The returns have been in potatoes and Soy beans. The latter were used in experimental work and free seed distribution which gave no cash income.

THE PEACH ORCHARD.

The peach orchard covers 1.2 acres, and the land previous to setting the trees was in the same condition as described for the new apple orchard. The slope is entirely to the north and west. The following varieties and numbers of each were set 17 ft. 6 inches x 20 ft. in the spring of 1911:

Heiley	8	Carman	14
Greensboro	8	Mt. Rose	16
Stevens	8	Champion	30
Late Crawford	6	Elberta	60

As with the apples, the varieties selected represent varieties that are commonly grown in the state.

When planted, the trees were cut to whips about one foot high, thus starting the head of the tree as low as is desirable to have it. The aim in pruning has been to have a low, spreading tree with such an arrangement of main branches as to prevent breaking from loads of fruit or from ice and strong winds in winter.

TABLE VI. SPRAYING OF PEACH ORCHARD.

		II	III	IV	V*	VI*	Yield of Fruit. Baskets.	Av. price, cts. per basket.
1911	Not sprayed							
1912	All plots sprayed Mar. 27 with commercial L. & S., 1–9							
1913	Plot I	II	III	IV	V*	VI*		
Mar. 28	L. & S.	L. & S.	L. & S.	L. & S.	L. & S.	L. & S.		
June 4	Self-boiled L. & S.	Atomic Sulphur	Nothing	"	*	*	very few	
July 15	"	"		"	*	*		
1914								
Apl. 8	L. & S.	L. & S.	L. & S.	L. & S.	L. & S.			
June 2	Self-boiled L. & S.	Sulphur paste	Calcium benzoate	Atomic Sulphur	"		185	58.2
June 24	"	"	"	"	"			
July 17	"	"	"	"	"			
1915								
Apl. 12	L. & S.	L. & S.	L. & S.	L. & S.	L. & S.	L. & S.		
June 8	Self-boiled L. & S.	B. T. S.	Sulphur paste	Calcium benzoate	Atomic Sulphur	"	785	30
July 2	"	"	"	"	"	"		
July 16	"	"	"	"	"	"		
1916								
Apl. 13	L. & S.	L. & S.	L. & S.	L. & S.	L. & S.	L. & S.		
June 14	Self-boiled L. & S.	B. T. S.	Sulphur paste	Calcium benzoate	Atomic Sulphur	"	444	75
July 6	"	"	"	*	"	"		
July 29	"	"	"	*	"	"		

* Spraying omitted for lack of material.

For all dormant spraying commercial Lime & Sulphur (L. & S.) was used, 1–9. In summer sprays, 1–150. Self-boiled Lime & Sulphur, 8–8–50. Sulphur paste, 8–50. Atomic Sulphur, 5–50. Calcium Benzoate, 2–50. B. T. S., 4–50.

This method of pruning has been successful, as evidenced by the fact that to date only three trees out of 150 have been broken by ice storms, and only one by weight of fruit. It may be noted that in 1914 no thinning was done on some of the heaviest loaded trees, to test their ability to hold heavy weights of fruit.

In 1915 all the fruit was harvested from these trees without the use of ladders, which indicates the possibility of cutting down the cost of harvesting by keeping the trees low. Of course this process of spreading may in time cause the trees to crowd each other, but that danger is not imminent at this time.

The spraying, with the exception of a dormant spraying with commercial lime and sulphur, 1–9, each year, has been entirely experimental. Various recommended compounds have been used, and thus far all treatments have been nearly equal in control of fungous diseases. From a commercial point of view, self-boiled lime and sulphur, "Atomic Sulphur," and commercial lime and sulphur are evidently the best, with the least cost and greatest ease of preparing in favor of the commercial lime and sulphur. See Table VI for details of spraying.

The remarks on cultivation and cover crops of the young apple orchard apply to the peaches, details of these being given in Table VII.

A comparison of different forms and combinations of phosphoric acid has been made on .12-acre plots in this orchard, and while it is too early yet to draw definite conclusions, the indications are that acid phosphate gives the highest yield, and that lime is detrimental to the production of fruit.

The cost table (No. VIII) has been compiled in the same manner as the foregoing tables, namely, materials at actual cost, and labor estimated at a fixed rate per hour for horse and hand work.

TABLE VII. FERTILIZERS, COVER CROPS AND CULTIVATION IN PEACH ORCHARD.

Fertilizers per acre, Plot A. 1911, same as on young apple orchard. See p. 370.

1912 and 1913. 150 lbs. each of nitrate of soda and muriate of potash and 350 lbs. acid phosphate.

1914. 150 lbs. muriate of potash, 320 lbs. acid phosphate and 264 lbs. basic phosphate.

1915. 275 lbs. nitrate of soda, 117 lbs. acid phosphate. June 15th, 150 lbs. nitrate of potash.

1916. June 15th, 178 lbs. acid phosphate, 105 lbs. nitrate of potash, broadcast and cultivated in.

Fertilizers per acre on Plot B. In 1911 the same was used as on A. In following years B was divided into 5 plots to make a comparison of the effects of acid phosphate and basic phosphate. Plots I, II and III have had yearly 50 lbs. of phosphoric acid per acre, Plot I in basic phosphate, Plots II and III in acid phosphate, and carbonate of lime in amount equal to the lime content of basic slag has been put on Plots II and IV.

In 1912 and 1913 all Plots had per acre 150 lbs. each of nitrate of soda and muriate of potash. In 1914 no fertilizers were used additional to the phosphate and lime above noted. In 1915 125 lbs. nitrate of soda and 167 lbs. acid phosphate was broadcast June 15. In 1916 105 lbs. nitrate of potash was broadcast about the middle of June.

Cover Crops. These were essentially the same as on Plots A and B of the apple orchard.

Cultivation. The whole orchard was plowed early and cultivated until near midsummer.

Table VIII shows the cost and income from the young peach orchard.

Table IX shows the details of an experiment with different substances to prevent attacks of borers and gnawing by mice and rabbits. The only result of this experiment is the fact that none of the substances used caused injury to the trees. The fact that there was no injury to either treated or untreated trees makes the results in control negative.

This report does not necessarily represent work done personally by the author, but rather represents work of all departments pertaining to the orchards, collected and tabulated by him.

TABLE VIII. PEACH ORCHARD EXPENSES AND INCOME.

Year.	Fertilizer.		Cover Crops.		Spraying.		Harvesting.		Cultivation.	Pruning.	Total Cost for Year.	Receipts.	Gain or Loss.
	Material.	Labor.	Seed.	Labor.	Material.	Labor.	Material.	Labor.					
1911	$ 7.58	$2.50	$9.00	$25.00	.....	.....	.....	.....	$37.28	.....	$ 81.36	$ 6.14	−$ 75.22
1912	9.06	2.50	4.06	2.50	$ 0.25	$ 0.38	.....	.....	42.00	$1.00	61.75	.....	−61.75
1913	10.00	2.50	3.13	2.50	3.48	7.50	.....	.....	26.91	4.00	60.02	.....	−60.02
1914	9.50	2.50	4.06	2.50	5.53	9.00	$ 7.00	$ 7.40	16.19	6.00	69.68	107.61	+37.93
1915	11.37	2.50	4.06	2.50	6.00	10.00	23.55	31.40	6.73	6.00	104.11	236.00	+131.89
1916	5.47	2.50	.57	.60	6.00	22.77	18.00	35.00	7.00	7.00	104.91	336.30	+231.39
Total	$52.98	$15.00	$24.88	$35.60	$21.26	$49.65	$48.55	$73.80	$136.11	$24.00	$481.83	$686.05	+$204.22

Cost, $481.83
Receipts, 686.05
Profit, $204.22

Cost of labor, $334.88 = 69.5 % of total cost.
Cost of material, $146.95 = 30.5 % of total cost.

TABLE No. IX. TREATMENT FOR BORERS.

	Plot I.	Plot II.	Plot III.	Plot IV.	Plot V.
1911	Wrapped with tarred paper. Banked with soil.	No treatment.	Banked with soil.	White lead and oil. Banked with soil.	Lead arsenate, ¼ lb. Water, 1 pt. Sulphur, ¼ lb. Banked with soil.
1912	do.	do.	do.	do.	do.
1913	do.	Banked with soil.	Banked with soil.	Banked with soil.	Banked with soil.
1914	Sludge on trunks.	Ditto 1911–12.	Ditto 1911–12.	Ditto 1911–12.	Ditto 1911–12.
	Plot VI.	Plot VII.	Plot VIII.	Plot IX.	
1911	Lead arsenate, ¼ lb. Commercial L. & S., ½ pt. Water, ½ pt. Banked with soil.	Lead arsenate, ¼ lb. Water, 1 pt. Banked with soil.	Wrapped with building paper. Banked with soil.	Wrapped with wire netting. Banked with soil.	
1912	do.	do.	do.	do.	
1913	Banked with soil.	Banked with soil.	Banked with soil.	Banked with soil.	
1914	Wrapped with tarred paper. Banked with soil.	No treatment.	Sludge on trunks.	Sludge on trunks.	

PART VI.

Report of the Forester for 1916

BEING THE

NINTH REPORT OF THE STATE FORESTER.

In the report of the Forester for 1915 it was stated that the intensive forest survey of the town of Redding, made in the summer of 1915, would be published later as a bulletin. It has seemed best, however, to include it as the major part of this report, since the working up of the field notes and the office work in connection with the survey was mostly done during the period covered by the report. The most important project of the year was the investigation and attempt to control the spread of the white pine blister rust. Although much was accomplished during the summer of 1916, the results were far from conclusive, and as the work will be continued during 1917, the publication of results will be postponed until the end of another season.

The forest fire season of 1916 was an unusual one for Connecticut, as is shown by the tables on page 382. Following the record-breaking season of 1915 with its total of 1,443 fires, the total for 1916 was but 487. This is smaller than for any year since 1909, and in that year the reports were by no means complete. For the first four months of 1916 only 163 fires were reported, while 1,220 were reported for the corresponding period of the preceding year. This difference is readily accounted for by prevailing weather conditions. The New Haven Weather Bureau records for March and April, 1915, show a total precipitation of but slightly over two inches, and March had the lowest precipitation recorded for that month in forty-three years. On the other hand, the total precipitation recorded in New Haven during March and April, 1916, was 7.08 inches. Not only was the rainfall abundant and well distributed throughout

these two months, but the preceding winter was a severe one with heavy snows which continued well into March. This fortunate combination of climatic conditions naturally prevented the spread of fires resulting from locomotive sparks, matches, cigarettes and other forms of human carelessness during the period before vegetation started, when fires are usually most serious in the woods.

As though intended to prove that human carelessness is a constant factor in the fire problem, this period of abundant rainfall was followed by two weeks of dry and windy weather culminating in two days of high winds on May 11th and 12th when many serious fires occurred. Of the sixteen fires reported during the year as exceeding one hundred acres in extent, ten occurred on these two days. The total acreage of these ten fires was reported as approximately twelve thousand,—nearly sixty per cent of the entire acreage burned in the state during the year. Four of these fires on May 11th and 12th burned more than one thousand acres each, and the total area burned over by the four was over nine thousand acres. Of the total damage attributed to forest fires during the year ($132,597), at least $80,000, or more than sixty per cent, is accounted for by the ten fires of May 11th and 12th. It would therefore seem that a little extra care on these two days when all conditions indicated the necessity for care, would have prevented more than half the fire damage of the year. Although the fires during the fall months were not unusually numerous or serious, the total was somewhat greater than during the fall months of 1915, and there were more fires than usual reported in December. This was undoubtedly due to the lack of rainfall during the first half of the month, and especially to the lateness of the first snow throughout much of the state.

The cost of fire fighting and protection work during the year was small as compared with 1914 and 1915. In 1914 the total expenditures for this work were $18,959.70; in 1915, $20,906.40; while in 1916 the total amount expended was only $4,540.81. If the ten large fires of May 11th and 12th could have been prevented or checked sooner, this expense would have been greatly reduced. If the amount spent for fire fighting had been spent in the prevention of forest fires, it seems reasonable to believe that the expense of fighting fires might have been still

further reduced, and the damage very largely prevented. A radical change in the present fire warden system would be necessary, however, to accomplish such a result. Until this can be brought about emphasis must be laid on the education of the public to the necessity for care with fire in the open.

The cause of the fires as reported in 1916 were: railroad 45 per cent; unknown 33 per cent; general carelessness (including fishermen and hunters) 17 per cent; burning brush 4 per cent; incendiary 1 per cent. A comparison with the causes of 1915 fires brings out the interesting point that in 1915, a season of numerous fires, the percentage of railroad fires was smaller than in 1916 when the total number of fires was much less; that is, when weather conditions are favorable for fires, the fires of unknown origin and those due to general carelessness increase in numbers at a proportionally greater rate than the railroad fires, while in a year unfavorable to fires the falling off in numbers is less apparent in the case of railroad fires than with other causes. This is undoubtedly due to the fact that conditions along a railroad right of way are more favorable for the starting of fires than in other places, regardless of climatic conditions, and that when unusual climatic conditions result in an abnormal number of fires elsewhere, the number of fires along a railroad right of way does not increase in the same proportion.

The fires due to brush burning show a great falling off in numbers as compared with previous years: in 1914, 7 per cent; in 1915, 12 per cent; in 1916, 4 per cent. This seems to be a logical result of favorable weather conditions rather than an encouraging increase in carefulness on the part of those burning brush.

SUMMARY OF FOREST FIRES BY MONTHS, 1910–1916.

Year.	Total number.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910	834	0	0	285	305	45	2	9	0	6	141	41	0
1911	978	5	0	66	425	390	13	20	25	1	10	21	2
1912	526	1	3	27	109	90	34	53	5	3	142	38	21
1913	695	3	7	48	212	174	37	64	83	1	8	43	15
1914	1056	3	9	9	254	228	36	4	5	68	280	153	7
1915	1443	0	16	787	417	106	38	1	0	1	29	48	1
1916	487	3	0	1	159	163	8	1	0	5	43	72	32

FOREST FIRES IN CONNECTICUT DURING 1916.

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....	69	27	28	6	4	4	..	1,048	$ 3,027	$ 203	$ 418.28	$251.76
Hartford....	108	24	49	21	3	11	..	4,767	20,551	1,008	1,212.34	111.27
Litchfield...	73	20	41	5	5	2	..	5,679	12,657	2,014	703.57	89.13
Middlesex..	23	9	12	2	..	..	..	362	790	110	102.00	61.72
New Haven.	82	30	29	13	4	4	2	2,016	2,220	504	389.97	74.37
New London	38	19	9	3	1	6	..	3,948	27,823	55	393.44	32.29
Tolland.....	36	9	24	2	1	..	..	881	2,641	1,344	217.95	13.75
Windham...	58	23	26	3	1	2	3	1,403	3,785	865	450.63	18.34
TOTALS.	487	161	218	55	19	29	5	20,104	$73,494	$6,103	$3,888.18	$652.63

TABLE II.—NUMBER OF FIRES BY MONTHS.

County.	Total number.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Fairfield....	69	..	..	..	25	16	1	..	..	1	4	12	10
Hartford....	108	2	..	1	26	35	3	1	..	2	13	17	8
Litchfield...	73	..	..	..	31	25	1	..	..	2	8	4	2
Middlesex..	23	..	..	..	10	6	..	..	..	..	..	6	1
New Haven.	82	..	..	..	26	25	..	..	..	..	6	19	6
New London	38	1	..	..	11	16	1	..	..	..	3	4	2
Tolland.....	36	..	..	..	8	20	1	..	..	..	1	4	2
Windham...	58	..	..	..	22	20	1	..	..	..	8	6	1
TOTALS.	487	3	..	1	159	163	8	1	..	5	43	72	32

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.....	487	471	16
Total acreage burned.....	21,114	7,319	13,795
Average acreage per fire.....	43.3	15.5	862.2

A FOREST SURVEY OF THE TOWN OF REDDING, CONN.

By ALBERT E. MOSS, M.F.

Assistant Forester.

The Forest Survey of Connecticut, published as Part III of the Annual Report of the Connecticut Agricultural Experiment Station for 1915, was intended as a general study of the forested lands of the state. Although the forests of each county were described in a general way, and the area of forest land estimated for each town, no more specific studies were attempted. It was felt that the expense of making a detailed survey would not be justified, and that one of a general nature would be of more immediate value.

Increasing interest in forestry in certain towns, however, indicated need of further information regarding particular localities. With a view to determining the expense involved in an intensive survey, the best methods to be used in making one, and the results to be expected from it, a study of the town of Redding was undertaken in the summer of 1915. Redding was chosen because of the interest shown there, and because the forest conditions are fairly typical of Fairfield County. The published results should be of especial interest to towns where similar conditions prevail, and will suggest the possibility of similar studies in all the heavily forested towns of the state.

The present town of Redding was included in the land purchased from the Indians for the town of Fairfield in 1639. The earliest survey in 1640 did not include the land between the Ridge-Center road and the present Bethel town line, but this was added to Fairfield before 1725. The first settlement was about 1700 and by 1760 there was much talk of separating Redding from Fairfield. The act making Redding a town was passed in 1767 when the population was about a thousand. Since then the original town lines have been very closely adhered to.

The town is situated in the southwest portion of the state within the western upland. The elevations range only from 300 to 800 feet and the topography is fairly regular with three ridges and four valleys running north and south. The streams are small and drain directly into the Sound. The valleys are narrow, occasionally widening into small level areas subject to overflow in the spring. The ridges are rounded and contain the greater part of the agricultural land. Many small streams rise in swamps scattered over the ridges, and flow into the main streams during wet seasons. Most of these streams do not have a drainage area sufficient to carry them through a dry season.

The location of the town between the turnpikes from New York and Poughkeepsie to Boston, and the general topography, led to the early development of north and south roads connecting the inland and the coast towns. The present Ridge Road is the only turnpike that crossed Redding in this direction although the Danbury to Norwalk road followed its western edge. The main east and west road across the town was the Newtown to Ridgefield turnpike, now the Ridge-Center road. As the first settlements were on the agricultural lands of the ridges, the lines of communication followed these instead of the valleys. The narrower valleys and the slopes were not as accessible and were left in forest. The town was not situated near markets or raw manufacturing material, so that while the water-power was developed to some extent, agriculture was always the most important industry.

The industrial census of 1845 shows that the manufactures were adapted to the local demand, and but little importation of products was needed. The dairy showed perhaps the best development, although cereals were always important. In 1845 the crops listed were as follows: corn 13,680 bushels, oats 18,500 bushels, potatoes 12,000 bushels, butter 63,500 pounds, cheese 11,780 pounds. Sheep were valued at $1,700 with a wool yield of $1,280. These crops were either sold locally or exported to New York. The list of manufactured products of the town shows a very close relation between the forests and the industries. The iron foundry and furnace listed used charcoal for fuel, and some 20,000 bushels valued at $2,000 were burned in the town. The wagon and cabinet factories with an annual output

valued at $14,000 depended on local lumber to a large extent, and at least 1,000,000 feet were cut locally that year. Four or five water-power mills were used in cutting this material. Some 95,000 bricks were burned during the year. With the lime kilns this made a demand for cordwood, a portion of which was supplied by the farmers of Redding with a cut of 425 cords valued at $4 per cord. Brooms were also manufactured in the town.

At that time the value of the forest to the inhabitants of the town was much greater than it is at present. Methods of transportation were so poor that the inhabitants were dependent on the forests for fuel to heat their buildings, as well as for the other uses mentioned above. The best of the timber went into saw logs, and probably only the tops and poorer trees were used as fuel and for charcoal. The relatively small quantity of lumber cut was due to the heavy cost of hauling the logs to the mills and the sawed product to market. The introduction of the portable mill and cheap coal caused great changes in the handling of the woodlands. Now the logs are sawed in the woodlot, and only the sawed material is hauled out. The decreased demand for wood and the total elimination of charcoal from the market has made lumbering operations as conducted at present much more wasteful than formerly.

The town probably reached its greatest industrial development in the years just prior to the Civil War, and as was the case with many other towns of the state, rapid decline followed from which it has never recovered. With the loss of the younger generation, either in the war or by their emigration to the West, the cultivation of much of the land has been abandoned, and crops formerly exported are now brought from the farms of the West. Since the war, only the best of the land has been cultivated, and the remainder allowed to come up to timber or brush. Within the past few years there has been a more general movement of city people towards the country for at least part of the year. Situated as it is within commuting distance of New York, Redding has been much affected by this movement. The greater part of the city people do not live in the town throughout the year, although they spend most of the summer there.

This influence of the summer resident throughout the region results in abnormally high land values compared with actual

agricultural values. The amount of capital necessary to establish a farm is so great that transfers of property for that purpose are infrequent. The business man has introduced his methods into farming, however, so that better results in marketing and purchasing supplies are offsetting the high capitalization necessary to carry on the industry in this region. With this renewed interest in agriculture there have been developed more intensive methods of management, and the area of land cultivated has been decreased, with improved results in many instances. The two influences have balanced to a certain extent, but at present there seems to be a slight gain in the amount of land cultivated in some portions of the town.

The slow transportation of the early part of the nineteenth century necessitated manufacturing dairy products before shipment to market. Changes following the Civil War developed the manufacturing centers at the expense of the farming communities of the state. This concentration of the population in the cities developed a market for milk which is either supplied by the adjoining region or shipped in by rail. The eastern portion of the town was within direct hauling distance of Bridgeport, and the demand for milk has led to the closing of local creameries. Since the advent of the motor truck this influence of the city market is being extended, and better service is given the producer. The manufactured dairy products formerly produced locally are now imported from the western dairy regions. Fruit growing is increasing in importance in the western part of the town as the markets are brought nearer by use of the motor truck. The farms owned for the pleasure they give the owner are usually in one or the other of the above classes. With the increased ease of transportation there is an increasing number of permanent residents from the cities, and an increase in the agricultural land as a result.

In all probability the changes in transportation have had the greatest effect on the forest area of the town. The early manufactories depended on the use of local woods to a great extent. The iron foundries used native charcoal, the chair and cabinet shops used local material, as did the wagon and carriage shops. The fuel used was entirely wood, and during the period just prior to the development of the railroad there was much talk of a wood famine. The development of the railroads made available the vast timber supply of hard and soft woods in the West and South. Coal also became the common fuel, and the problem of a timber shortage was eliminated for many years. The forests of the town were neglected except for small local demands for timber, and for poles or railroad ties. The wood-using industries moved to the source of supply, the forests began to revert to their former condition, and the forest area of the town began to increase with the seeding in of the abandoned lands.

During the past ten years there has been a change in the attitude taken towards the local forests, and with the increase in cost of material from other sections of the country, the local products are again finding their way into the markets. The use of wood for fuel, except for the burning of lime, is only in individual houses, as coal has driven cordwood out of the market for general purposes. There is no charcoal burned in the region at present, and the small quantities used are imported from the wood distilleries of New York and Pennsylvania. The local demand for timber is largely in Georgetown, 350,000 to 400,000 feet of sawed material being used there annually. Of this amount the town supplies practically nothing, although if native oak and pine were obtainable it might supply seventy-five per cent of the demand. The native timber used is largely in the form of plank or dimension material. The lime-kiln in the northern part of the town will take all cordwood within hauling distance, but the prices paid limit the haul to very short distances. This demand for small material makes intensive forestry work possible in this section of the town.

TREE SPECIES.

The distribution of tree species in the United States is limited more directly by climatic than by soil conditions. Maximum and minimum temperatures with rainfall and atmospheric moisture are the limiting factors in their geographic distribution. The range of an individual species may be extended in any direction by changes in elevation that produce the necessary climate.

Connecticut is located along the meeting line of the northern and the southern species, and is not in the optimum range of any tree of commercial importance. Chestnut perhaps came the

nearest to reaching its optimum here, but even this tree attains greater size in the mountains of Tennessee and Kentucky. Gray birch, a relatively unimportant species, is at about its maximum development in this state. Whitewood or tulip, chestnut, the oaks, the hickories, white ash and black birch are some of the southern trees found in this region. White pine, hard maple, paper birch, yellow birch and hemlock are some of the northern trees that occur here. This is known as the "Sprout hardwood region" because of the almost universal occurrence of species that coppice abundantly. This feature of the forest has enabled continued cutting of the wood on a short rotation without regard to seed years or the establishment of reproduction. Even fire will not ordinarily entirely destroy the stand, although repeated burning will reduce its vitality and change the predominant species.

Although there are at least fifty tree species found within the town of Redding (see page 426), there are relatively few that are of economic importance and only ten are of commercial value. Most of the species occur but rarely, or are of poor quality and inferior form, so that they may be compared to the weeds of the farm.

As on the farm, the weed species are the easiest to reproduce and will occupy vacant land much more readily than the more valuable species, since the former are less exacting than the latter as to soil and moisture requirements of the seed-bed and the seeds are much more widely distributed by the wind or birds. Weed species may prove of some value in forming suitable conditions for future forest development. The weed species as a rule are short-lived and exacting in light requirements, so that the better species are able to crowd them out in the end. Many species, neither weed nor commercial, form an underwood in the more mature forest, and help in the preservation of the forest floor.

White Pine (*Pinus strobus*).

This is the most valuable native tree of the region. In the forests found by the colonists the area occupied by this species was much greater than at present. The wood was the easiest worked and best of any found in the colonial forests, and as a result was very largely exported to England. While the species

probably never occupied a very large percentage of the area, the wide distribution of the remaining stands shows that it must have been common throughout the entire town. Pine only reproduces by means of seed and is at a disadvantage in competition with hardwood coppice. The seeds are borne in cones requiring two years to mature. Wings aid in their distribution by the wind, but the seed-bed requirements, together with rodent and bird damage, reduce the number of natural seedlings very greatly. Growth during the early stages is very rapid and a mature stand is much denser than a stand of hardwoods. The product is used for box boards, building material and wherever light, easily worked wood that will keep its shape is desired. Pattern makers use large quantities of the best grades, mostly obtained from the virgin stands of the West. This is the only native species that shows satisfactory profits in plantations, although the red pine of the Lake States gives great promise in recent plantations. Some of the oldest plantations in Connecticut are white pine, and many younger planted stands are now growing throughout the state.

The tree has two serious enemies at present, one an insect and the other a fungus, the insect being perhaps the more serious in this region. (See page 419.) The trees are thin-barked and easily killed by fire during the juvenile stages, but later in life become more fire resistant. The stands prune well, forming clear straight trunks that carry their diameters well into the tops.

Red Pine (*Pinus resinosa*).

This tree occurs rarely within the state, but to the North, especially in the Lake States, it grows with white pine, and is logged at the same time. The mature tree is not as large as white pine, but the growth during the early life of the two species is very similar. Red pine has no insect or fungous enemies at present, and is being favored in planting in this region. The wood is harder and stronger but not quite so valuable as white pine. The tree is not as easily injured by fire, and will grow on much poorer soils to good advantage.

Hemlock (*Tsuga Canadensis*).

This is one of the most admired trees of the town because of its habit of growing near the streams. It is not particular as

to soil requirements, but demands atmospheric moisture for the best development. As a result it is found near streams or in the narrow gorges, and on the steep north slopes of the valleys. Hemlock is very tolerant, and seedling reproduction will come in on the moss and duff under the dense shade of mature trees. Its growth is very slow, and trees fifty years old are often only ten feet high. Removal of the overwood, admitting more light, increases the rate of growth considerably, but at best hemlock is of slow growth. Suppressed trees retain the ability to recover and grow for a long period. Its habit of growth makes this tree very important in this region, from the aesthetic standpoint rather than for its forestry value. The increasing importance of the town as a place of summer residence should indicate to the townspeople that every effort must be made to preserve the scenic beauty of the roads. The valleys are in many cases narrow and their slopes are the natural sites for hemlock. The foliage of the tree is very dense, forming deep shade, and its tolerant character tends to produce a stand of all heights, making these valley roads very attractive even in winter. As there are only a few areas of these evergreens within the town, the contrast with the more common deciduous trees is very pleasing at all seasons.

Although hemlock reproduces well naturally where there are suitable seed-bed conditions, it is very hard to handle in the nursery and the cost of planting stock is high, so that natural reproduction must be secured in most cases. The trees do not prune well naturally, so that the timber is knotty as a rule, and overmature stands are apt to be very defective. Both heart rot and a separating of the growth rings called "ring-shake" are the common defects. The lumber is used as dimension material or rough boards.

Chestnut (*Castanea dentata*).

This is one of the most rapid growing trees of the region, and has been one of the most important hardwoods of the state. The species must be largely eliminated from future consideration because of the ravages of the chestnut blight (*Endothia parasitica*). It was formerly found on all sites except those subject to flooding, but formed the dominant part of the stand only on the better drained, deep soils, as more drought resistant species

crowded it out of the dry sites. The tree grows well, pruning readily, and forms a clean, full bole whether grown pure or in mixture. The lumber is of good quality and very durable in contact with the soil. It has been the chief source of supply for ties and poles within the state.

Red Oak (*Quercus rubrum*).

This is the most northern species of the oaks and its range extends well into Canada. The tree is the most valuable of the black oak group within this region and grows to a large size with good form. It is rapid growing in the juvenile stages, either from seed or coppice. The species demands better soil and moisture conditions than chestnut for its best development, but is less exacting in light requirements. The mature tree has a well formed, full bole, pruning well but with widespreading heavy crown. The timber is coarse-grained compared with other oaks and is not so durable as chestnut. It can be treated with preservative rather easily, however, and should be of great importance for this reason in the future.

With the loss of the chestnut this tree is one of the few hardwoods capable of taking a dominant place in the forest which can be profitably handled. Its root growth in the seedling stage is such that it may be grown in a nursery and transplanted with success. The soil and moisture requirements are similar to those of tulip, and it might be planted to good advantage where the latter species occupies a portion of the area naturally. Tulip will not produce good forest conditions alone, but in mixture with the red oak forms a valuable stand. Red oak is capable of producing good stands if planted pure. It should be favored in all woodlot operations, and the better formed trees left when thinning for cordwood.

White Oak (*Quercus alba*).

This is the most valuable of the oaks native to the United States. The species is at its best in the Mississippi River drainage basin, and is near the northern limit of its range here. However, it has always been important in the development of the industries of the region. The wood is of high quality and largely used where great strength is needed, as in wagon parts and ship timbers. Its close grain and lack of odor or taste has

made it a favorite in tight cooperage. Its use for this latter purpose has not been important in this region, however, since colonial days.

The tree is of slow growth even on the best of soils, and while persisting under shade, it will not recover if suppressed too long. It is common on all areas except those subject to flooding, but is of commercial value only on deep, well drained sites. Pure stands may occur over very limited areas, but mixed stands are more common. Red oak, chestnut, ash, tulip, and other species of less importance are its common associates. The present use of the timber is for ties, carstock, plank and ship timber. Its slow growth with relatively short merchantable length tends to eliminate this tree from forests under management. Because of the high quality of the wood, natural growth may be aided, but new stands will seldom be established.

Tulip (*Liriodendron tulipifera*).

This is one of the most important hardwoods of the southern Appalachians, with a range extending into Southern New England. It is an intolerant tree, exacting as to soil and moisture requirements, growing best on moist, deep soil not subject to flooding. It makes very rapid growth during the juvenile stage, which continues until the tree reaches its maximum growth. For natural production, it seems to be necessary that the surface mulch should be broken up so that the seed may easily reach mineral soil for germinating. This tree forms the cleanest stem of any in the region, and carries its diameter well into the top. It grows vigorously for many years, often living for one hundred and fifty to two hundred years and reaching a diameter of three feet, with a height of two hundred feet. The wood is used for many of the same purposes as white pine, and is also valuable for veneerings and auto or carriage bodies. It is light, soft, uniform in grain, and does not split easily, but is not durable in contact with the soil.

Tulip is one of the most valuable trees to encourage in place of chestnut in the hardwood forests. It is free from insect and fungous damage, but the seedlings are hard to raise in a nursery. The seed is very infertile and natural reproduction is poor, as a rule, thus limiting the spread of the species. The tree will not produce good timber in pure stands, as its shade is not sufficiently

dense to ensure natural pruning. It should therefore be handled in mixture with other rapid-growing species. Where these are not present in the natural stands, tulip reproduction should be encouraged by the removal of inferior species, and supplemented by planting red oak or pine in the openings thus made.

Red or Soft Maple (*Acer rubrum*).

This tree occurs throughout the eastern half of the United States, but attains its greatest size in the Mississippi Valley. In this region it is the typical tree of the swamps where it occurs either pure or in mixture with black ash and elm. The stands will endure flooding for long periods and it is about the only tree in the region that will mature in the wetter swamps. Its commercial value is not great, as the lumber is of small size and inferior quality. It is usually cut for cordwood with a maximum rotation of twenty to thirty years. A longer rotation will reduce the sprouting capacity of the stumps, at the same time failing to secure the best returns from the rapid growth of the young stands. This species will produce a crop on sites not suitable for any other, which is its greatest value from the forester's point of view. The tree has some aesthetic value because of its red blossoms early in the spring and bright foliage in the early fall.

FOREST TYPES.

Under natural conditions, trees tend to associate in communities, each individual having its own life history, and each exerting a direct influence on its neighbors. They must compete with each other for moisture and light in order to grow, and each species has developed certain characteristics that enable it to survive in the struggle for existence. Differences in these characteristics cause each species to predominate on the soil and moisture site conditions to which it is best adapted. The grouping of the tree species in a given region is fairly uniform on similar site conditions, since the same external influences tend to cause the same differences in composition. Such typical groupings or associations of tree species are termed *forest types.*

The following types are distinguished in this report: Mixed hardwoods, old field, swamp maple, oak, chestnut, oak-chestnut, hemlock and pine. The classification is based almost entirely on

the composition of the stand, but as the area is small, the composition indicates the site conditions very clearly. External influences, such as chestnut blight and forest fires, have converted some of the stands into other than the original types within the past few years, and the process is still being carried on, especially in the chestnut and the oak-chestnut types. The types merge into one another with changes in site so that a sharp dividing line is hard to define.

Mixed Hardwoods Type.

This is the most common type of the region and its composition varies with the location within wide limits, commonly containing a large number of weed species and a few scattering commercial trees. The type is natural in some sites, but in others it is the result of damage or changes due to methods of handling. On the moist rocky sites that approach the swamp type but are not subject to flooding, the natural mixture is yellow birch, sugar maple, black birch, elm and ash. Natural reforestation of abandoned land often results in a mixed stand in which a large number of species may be present for the first few tree generations, but eventually the type will revert to one that is natural for the site. Change in type effected by damage is illustrated in the elimination of chestnut by the blight, leaving a large number of inferior species none of which are dominant. Cutting in the oak-chestnut type may result in similar conditions with the removal of these commercial species. The type in general promises profitable results from management in the future. Cuttings should be so made as to assure the reoccupation of the area by species at least as valuable as those cut. The trees to be favored and their reproduction protected are tulip, oak, ash and hickory. At present the percentage of tulip seems to be increasing as competition with chestnut decreases. Introduction of pine by planting is advised where cuttings are made as it will increase the productivity of the area.

Old Field Type.

This type is the result of the abandoning of pastures or cultivated land. Its composition is mostly of the light-seeded species like gray birch, or those spread by the birds such as red cedar. The stands are uneven-aged and rather open as a rule, but

density increases as seeding in from the original trees progresses. Under established tree growth there is very little underbrush, but in the open, shrubs may occupy the ground at first.

The life history of this type may be detailed as follows: Land abandoned after cultivation passes through the pasture stage with a gradual increase in the tree growth. This is at first noticeable along the borders of adjoining woodland and along the fences. Light-seeded species are the most common, but those with edible seeds are soon brought in by birds. Clumps of brush appear in the open lots and around the rocks. Even though cut over a few times to save the pasture, the tree species only coppice more vigorously. As a rule, such species mature very early and seeding in then becomes more rapid. The clumps of brush serve to catch and hold wind-blown seeds, and are themselves soon crowded out by trees which they have helped to establish.

Gray birch is perhaps the best adapted of Connecticut trees to afforest such lands naturally because of the seed production, methods of distribution and seed-bed requirements of the species. The cone-like fruiting bodies produce many small, two-winged seeds which ripen in the fall. These cones fall apart during the winter and the seeds are scattered on the snow. They germinate best in mineral soils, so fields with scant humus are the ideal places. Birch forms a nurse crop for better species of forest trees that are not able to seed in on open lands, but take advantage of improved conditions produced under other trees. This natural succession of species is very slow, and to afforest such an area naturally with a commercial species requires a long time.

Small waste areas are found on most of the farms and this type is one of general distribution throughout the town, but it is most common in the western half. It is largely due to economic changes in the community, such as those following the Civil War which were responsible for more abandoned land than any other single cause. Although some of this land is being reclaimed at the present time, intensive cultivation of the present farms tends rather toward the abandonment of more land. It is at present one of the types most needing attention within the town, as it is not producing anything. If left to nature, many years must elapse before such areas can become productive. In

fact, the owners are paying taxes on the land without any immediate prospects of returns sufficient to pay interest on their investments.

The type occupies some of the best land not now under cultivation, and from the forester's standpoint has great possibilities. Eventually much of the land will doubtless be cleared again for agricultural purposes, but in the meantime there is no reason why the owner should not be getting some returns in the line of forest products. The growing of trees tends to increase the fertility of the soil by depositing on the surface of the ground vegetable material containing much mineral matter. This mineral matter drawn from the lower soil by the roots, is used in the life processes of the trees, a portion of it being returned to the soil by the falling and decay of leaves and twigs. In this way the growing of a crop of timber will increase the future productive capacity of such land. These waste areas alone, if properly planted and managed, would produce more timber than the whole town does at the present time.

Swamp Maple Type.

The region is characterized by numerous hard rock ledges that cross the drainage, forming natural dams. On their lower reaches, the streams as a rule have cut through these, making sufficient fall to prevent swamping, but near the head waters and in the depressions of the ridges there is very little drainage. As a result sediment and vegetable matter has collected until the flow areas have been filled flush with the dams, thus making numerous small level tracts subject to flooding. The soil is very rich and in some cases would make fine farm land, but the cost of drainage and clearing is too great to warrant it at present. Small narrow areas of this type may be found near all the streams where local conditions are suitable.

As the name indicates, the type tree is the red or swamp maple. Other species such as alder, elm and black or splinter ash are also common. While red maple never grows to large size, the stands are often dense, so that it is a good cordwood proposition where there is a market for the product. Its rapid growth during the juvenile stage makes it most profitable to handle this type on a short rotation of twenty-five to thirty years. In this way the possibility of failure to secure coppice reproduction is eliminated, as the species does not begin to lose its vitality until later in life.

The type is very generally distributed throughout the region, especially on the divides. While the established species is of small value, the site conditions are such that there is slight possibility of changing to a more valuable one, except in isolated cases. Draining the swamps for agriculture will probably be a slow development in this region, and the substitution of a better tree species should be attempted wherever the land is not subject to flooding.

Oak Types.

The oaks are the most common tree species in the town. While formerly second in value to the chestnut, they are at present the more important, due to the damage caused by chestnut blight. The species differ greatly in soil and moisture requirements, and the oak type may be found under all conditions with species varying according to site. The timber qualities and rates of growth of different species of oaks also vary greatly, and even in the same species vary with the site. At least eight species are found within the town. The more valuable are white, red, chestnut, black and scarlet oak, while pin and swamp white oak are of relatively rare occurrence. Scrub oak is the least valuable, being one of the most persistent forest weeds.

The most valuable oak type is the result of eliminating chestnut from mixed stands on bottom and lower slope sites, leaving the oaks as the dominant trees. These stands are of relatively small extent as there are a large number of species that compete for such sites, resulting in a mixed hardwoods stand in most cases. Red, white and black oak are the species found under these conditions. The type is slower growing than the chestnut type, but is one of the most valuable in the town for timber, and one that may pay to manage by favoring the better formed trees in making cuttings.

Two other oak types form by far the greater part of the oak stand, but are of relatively little value. The better of these is the ridge type in which the scarlet, and chestnut or rock oak are the principal species. This is usually in pure oak stands on shallow ridge soils, but other species appear as the soil and moisture conditions improve on the slopes. These two oaks are

both capable of making good growth on the better soils, but are not able to compete with other species there because of the limited amount of shade they can endure. Chestnut oak is the better of the two and is used for ties. On the better soils it is capable of fairly rapid growth. Both of these trees are well adapted for a cordwood rotation, as they coppice well and there is usually advance seedling reproduction on the ground. Their light shade allows a fairly heavy ground cover of such shrubs as vaccinium and viburnum.

The scrub oak type results from repeated burning of the oak ridge type. The present growth is of no value except that it covers the ground and develops a better condition of soil which has been damaged by fire. The converting of this type to a more valuable one is important, especially in the western part of the town. The best method to use would probably be underplanting with a desirable species, later removing the oak in a series of liberation cuttings as required for the development of the planted trees. The final elimination of the scrub oak would be accomplished by the shade of the introduced species. The site is not as good nor the conditions as favorable for reforestation as in the old field type, and the scrub oak type might well be left until the old fields are reforested. Better fire protection is necessary if there is to be any improvement in this type.

Chestnut Type.

Chestnut was once the most important timber tree of the region, but the blight has in recent years very nearly eliminated it. There are a few pure stands left but present conditions seem to indicate that the tree will soon be a thing of the past from the lumberman's standpoint. Chestnut grew on almost all sites not subject to flooding, forming an increasing percentage of the stand until on the better class of well-drained slopes a pure chestnut type was found. This was the most rapid growing type of the region, and was of the greatest commercial value.

The growth habit of the species produced stands of two distinct forms:—one a dense coppice of rapid growth up to fifty or sixty years and reaching maturity at about that age; and the other largely made up of seedling trees which, having a slower juvenile growth, continued to increase in volume for one hundred to one hundred and fifty years, forming a much larger tree of somewhat more open crown with a larger number of other species in the stand. The former was the more valuable for the production of poles and ties, as well as of importance for handling on short cordwood rotation, while the latter produced the better grades of sawed material, such as boards and plank. With the cutting of these stands, some rapid growing and commercially valuable species must necessarily be artificially introduced to replace the chestnut, as the remaining trees of value are not capable of doing it.

Oak—Chestnut Type.

This type is a fairly uniform mixture of oak and chestnut, with other species forming a small percentage of the stand. The type is in a transition stage at the present time, as the chestnut is disappearing and oak and other species are beginning to fill the vacant spaces. Because the chestnut is often left until the remaining species are large enough to cut, the change is somewhat slower and not so noticeable as in pure stands of that species. The type was not so productive as pure chestnut, but more so than pure oak, and has been of considerable value to the owners. In the northern part of the town its handling on a short cordwood rotation was very common. The species of oak in mixture with the chestnut varies with the site conditions. In the same way the productive capacity of the type grades from a maximum in the bottom lands to a minimum at the upper limits where it merges into pure oak. The oak species on the bottom lands are red and white, changing to red, black, white, scarlet and chestnut oak on the slopes, and finally to pure scarlet and chestnut oak stands on the ridges.

The substitution of some other rapid growing species in place of the chestnut is essential as the latter is cut out, if the productive capacity of this type is to be maintained.

Hemlock Type.

Hemlock is one of the most exacting trees of the region as to site and environment. A cool slope near a stream or other body of water where there is plenty of atmospheric as well as soil moisture produces the best growth. The tree is very tolerant and reproduces well under the densest shade. This enables

it to shade out other species on the suitable sites and eventually form pure stands. Its rate of growth is very slow at best and while the tree reaches large size, its greatest value in this region is from the aesthetic side. The roads follow many of the suitable locations for the species, and it is of much value because of its attractive habits of growth. The commercial importance of the type is small, as the growth is very slow and the product usually of inferior quality. The type can be handled best by the selection system, removing the defective and larger trees, as the reproduction can stand great shading for a long period and still recover its normal rate of growth if liberated.

Pine Type.

The two species of pine native in the town are white pine which is of importance as a timber tree throughout the northeastern states, and pitch pine which is generally a scrub tree of little commercial importance. Both species are of only local occurrence and of slight commercial importance within the town. Pitch pine forms one open stand at the summit of a small hill on the western side of the town near Georgetown. The site is very exposed and the growing conditions such that other tree growth is almost lacking because of repeated burning. White pine forms a small portion of the stand in the central and eastern parts of the town, but has been mostly introduced there artificially in the reforestation of waste land.

White pine is one of the best trees for forest management as it grows rapidly, in dense, pure stands, and with a large yield per acre. It will not do well on land subject to flooding, but is well adapted for most other sites. A third species, the Norway or red pine, is found within the town in forest plantations, but does not occur naturally here, although native to the extreme northern part of the state. This species is more resistant to insects and fungi than white pine, and is being used in increasing amount for reforestation work in the state.

FOREST DESCRIPTION.

The forests of this region are at present a mixture in which the weed species are the most common, as a result of improper cutting and damage caused by fire and disease. In a region

where there is very little market for cordwood the disposal of such material is a hard problem. Under present conditions there is very little hope of natural improvement in the stand, as the weed trees are best able to hold the land. These trees are usually well equipped by nature for rapid spread into the openings before the more valuable species are able to get a start, with the result that they occupy more area with each cutting.

The best methods of management for these areas involve the artificial introduction of more valuable species wherever possible, with the expectation that they will increase in numbers by natural reproduction. At the same time cuttings should favor any valuable species already on the ground. In the woodlot the cutting of cordwood for home use forms one of the easiest methods of improving the stand. Such cuttings should take out the poorer species such as birch, maple and elm, as well as inferior trees of the valuable species. The openings thus made should be planted with trees of commercial value and rapid growth. This planting will not take much time, and the cost of the stock is not very great. Such a selection of fuel wood followed by planting will eventually make the forest one of only valuable species. This will increase the rate of growth for the thinned stand left, as well as for the rapid growing species introduced, and the final yield will be much greater than for the original unthinned forest.

In the northern part of the town there is a market for cordwood which will permit clear cutting followed by planting. The brush may be piled and burned to lessen the fire danger, or may be scattered so that planting will be possible. Over the remainder of the town there is less market for cordwood, and the cuttings are for lumber, only the valuable trees being removed. The trees remaining are in very bad shape as a rule. As the lumberman only buys the timber he has no interest in the future crops, and his men fell the trees in the easiest way without regard to reproduction or immature trees that may be on the ground. This results in the breaking of much young growth, and the leaving of large weed trees to seed in the vacant areas. Tops are left unlopped and form a bad fire danger, especially if the cutting is in summer when the leaves are on the trees. On such areas it is advisable to have an understanding with the lumbermen that care will be used in felling to protect the younger trees, and also

as to the disposal of the tops. Lopping or "limbing to the tip," as it is sometimes called, is perhaps the best way to dispose of them where burning is impracticable. This allows the limbs to lie in contact with the ground where they rot much more quickly than in the air. After logging, such areas should be planted, scattering the plants in the openings where they will not be unduly shaded.

Areas that are not producing a crop at the present time present a different problem. They are of two classes, the old field and the scrub oak types. Of these the former is the easier to handle and is the one in which the most work should be done in the near future. As a rule the old field is not only good forest land, but present ground conditions offer very little hindrance to planting operations. When there are open conditions with bunch grass or low brush and a few scattering clumps of trees, planting is done without regard to the tree growth, unless there are wide spreading pasture trees which should be removed for cordwood. Spacing the trees six feet apart each way requires 1,210 trees per acre, and assures the establishment of forest conditions at an early age. The planting up of such old fields promises the best returns on the money invested of any operation in forestation.

The second class of non-productive land is the scrub oak type which occupies a minor area in the town, and follows the repeated burning of an oak type which has impoverished the soil to such an extent that the better class of trees can not compete with the more hardy scrub oak. This species sprouts very vigorously after a fire, and seems to increase in numbers every time an area is burned. The final result is the elimination of the better species for a long term of years, and the loss of returns from the land for a much longer time. Natural reforestation with a valuable species is very slow in such cases and may never take place. Scrub oak is a light-requiring tree and if once shaded will soon die out. This fact may be taken advantage of in artificial forestation, as the stand could be planted with a species that would grow under more or less shade and eventually grow up through the scrub oak to supplant it.

While there are a few areas of unbroken forest in the town, the greater part of the tree growth is in the form of woodlots connected with the farms. These woodlots are more or less isolated, many being surrounded with cultivated land and having

very little fire danger. There are no large holdings entirely within the town, but some of the larger estates include considerable forest land. Since the town is naturally divided into three ridges and four valleys extending from north to south, these natural divisions will be followed in the description of the forest areas.

Aspetuck Valley Area.

This stream rises in the northeast corner of the town and flows south near the eastern border. The head waters are in a large estate where the forest is highly prized for its aesthetic value. All parts of this tract are accessible by means of fine roads, and much improvement work is being carried out in the woods. The chestnut is being removed where necessary, and the resulting stand will be oak on the ridges, changing to mixed hardwoods on the slopes and bottomlands. The mixture includes black and yellow birch, ashes, maples, oaks, hickories, tulip, and other less important species. The swamp species are soft maple and black ash with some elm. Very little planting has been carried out here as yet, but probably much of the area opened up by the removal of the chestnut will be reforested in this manner. This and an adjoining estate include some of the oldest stands in the town.

Near these areas but lower down the stream is a ridge on which the topography is not as broken, and here the forests have been cut solely as a commercial proposition. The species are largely oaks of somewhat inferior quality. The soft maple swamps are common along the stream, as the fall is very slight here. The valley widens out with a large percentage of the land cultivated, but near the center of the town the stream enters a narrow valley where the sides are steep and the fall is very abrupt. This was once used for water power, but is now owned by the Bridgeport Hydraulic Company, which is protecting the stream as a source of municipal water supply, and eventually plans to reforest its banks. Hemlock is the ultimate type of the slopes and some very good stands are found along the stream at this point. The ridge to the east is oak, or oak and chestnut, but has been culled of the latter species within the past few years. The valley is largely owned by summer residents, and there is good reason to expect that the forest will be improved, both for

the commercial and the aesthetic values it will add to the properties. The lower valley is again more open, with swamp land along the stream and much of the area cultivated. The forests are on the steep slopes at some distance from the stream.

As a whole the Aspetuck valley offers a very favorable opportunity for forest improvement. Planting should follow the removal of the chestnut, not only to increase the growth of merchantable material but also to improve appearances by the introduction of conifers. At present the only break in the broadleaf forest is the hemlock along the river, which adds greatly to the attractiveness of the road at this point. By scattering rapid growing evergreens throughout the forest the landscape may be made more diversified and more attractive, especially in winter. The rapid growth of pine plantations in this valley is well illustrated on areas just outside of the town to the south.

Redding Ridge Area.

The Ridge extends entirely across the town, dividing the Aspetuck from the Saugatuck drainage. This was one of the earliest settled portions, and contains some of the best of the farming land. This ridge has a relatively uniform elevation, being broad and flat-topped with gradual slopes to the valleys. One of the oldest roads in the town follows it towards Danbury, while the old Newtown-Ridgefield turnpike crossed it at what is now known as Redding Ridge.

The greater part of the original forests were entirely cleared from this section, the present remnant being found as woodlots on the rougher sections. The possibilities of forest management in these woodlots are as good as for the practice of scientific farming on the agricultural lands. At present the woodlots are not being utilized to their capacity. The land occupied is relatively valuable, while the crop produced is of minor quality and quantity. Very little labor would be necessary to convert these stands into a type that would produce a crop in keeping with the rest of the farmlands. There are many small corners in this section that are at present idle but which should be planted for their aesthetic value with financial returns as a secondary consideration.

There extends into the southern portion of the town to the west of the Ridge Road, a more broken area of fairly heavy

woodland. This contains some small pieces of fine timber, although the greater part has been culled. Within this area there are a number of tracts of waste land where the opportunities for reforestation are very good. Some of this idle land is probably agricultural, but does not appear to be needed for the present and should be used for forestry purposes.

While this region is within direct marketing distance of Bridgeport, the cost of hauling wood prohibits its disposal in this manner. The northern part of the region has a market for wood in the lime-kilns, and to a limited extent in Bethel. The greatest use for wood is local in the form of fuel.

Little River Valley Area.

This stream is one of the main branches of the Saugatuck. It crosses the northern boundary of the town east of its center, and flows to the southwest into the Saugatuck near the southern boundary. Its valley is relatively wide, and for the most part agricultural. There are a series of woodlots near the stream, while the slopes are cultivated.

The Putnam Memorial Park at the northern side of the town is of historical interest as it marks the winter camp of a portion of the Continental army during the Revolution. The woodlands of this tract are being improved as park, and the waste land is planted with pine. A small artificial lake at this point is privately owned as a summer camping ground, and the area adjoining it has been planted with pine for the purpose of improving the camp sites in the future. Both of these plantations show good growth.

This valley tends to be swampy, with tree growth of little value. The land will probably be drained at some future time and used for agriculture, but in the meantime the woodlots should be handled on the selection system in order to get the best growth possible, while the small areas of forest soil on the steeper slopes should be planted with conifers in order to bring them into a producing state. Near the lower end there is a sharper gradient, causing the stream to cut through a number of ledges and form a narrow gorge with a series of small falls. The banks are open, or at most covered with brush, giving little indication of the natural beauty of the stream at this point. Small plantings of evergreen trees, such as the spruces or pines,

would make this one of the most attractive places in the town, and would be of great value to the whole community. The cost of such an operation probably would not exceed one hundred dollars, and the future benefits to a town depending on summer residents for much of its income can be readily appreciated.

Gallows Hill Area.

The triangle formed by the Little and Saugatuck rivers with the northern boundary of the town as a base includes the ridge known as Gallows Hill. Redding Center is also located within this area, the broad flat-topped ridge forming some of the best farming land of the town, especially toward the eastern edge of the triangle. The economic changes of the past half century have caused the abandoning of numerous small areas in the western part of the tract which are still unproductive.

In the portion north of the center lies one of the larger forest areas of the town. This forest is very broken in character, due to irregular cuttings. The topography changes as the western edge of the ridge is approached, becoming steeper with more rock outcrop and a larger percentage of true forest soil. The types to be found on this area are extremely variable, but the mixed hardwoods type prevails with a large percentage of oak in the mixture. The chestnut and the oak-chestnut types were once common but chestnut is at present largely eliminated. Maple swamps are common in the depressions.

This area is within the region where cordwood may be handled at a profit, as the haul to the lime-kiln is relatively short. The railroad also is within easy hauling distance, and saw material may be marketed in this manner. At present the tendency in the northern part is to cut clean on a short rotation, while to the south, culling of the stands is the common practice. Intensive forest management is entirely possible here, even under present market conditions, and gives great promise for the future. On the poorer ridge sites, pine should be planted to take the place of the slow growing oak. On the better sites, the selection system in which the best trees are left and the remainder cut for cordwood is recommended, planting the resulting openings with pine. The remaining mixture will then contain only the best of the native species, and will be very productive, since

not only will the mature product be merchantable, but also thinnings and culled material.

South of the center there is not so good a market for cordwood, and intensive management is not so practicable, but the planting of conifers in openings and on waste land would greatly increase the value of the forest in this section. There is at present some good timber, but the greater part of the stand is open and suitable for restocking with conifers. Hemlock increases in abundance near the western side as the Saugatuck is approached, and finally merges into pure stands along the banks of the stream.

Saugatuck Valley Area.

The Saugatuck valley has the form of a question mark with the point of the hook a short distance south of Umpawaug Pond, extending north around Umpawaug Hill and turning southeast to leave the town near the center of the southern boundary. The upper portion of its drainage is characterized by gentle gradients, and swamps are common. The steepest of the slopes are forest soil, but the greater part are cultivated, the forests being mostly of the woodlot type. The mixed hardwood type is most common as the result of the removal of chestnut, but on the rough hill in the northwest corner of the town there are many areas of shallow soil with oak as the dominant tree. With the exception of small isolated stands inaccessible because of the rough character of the topography, the timber of the section has been entirely culled or clearcut. The annual production of the present type is very small, and should be increased by the introduction of pine wherever possible, especially after cutting the merchantable timber. Near the small lake on the western boundary of the town there is a good stand of old hemlock, of value because of its location rather than for lumber. At the north, Umpawaug Hill ends in a rocky outcrop on which the elimination of chestnut, and the burning over of portions by fires originating from the railroad, has resulted in a mixed hardwood type of a more northern character, including hard maple and beech.

Turning south, the stream becomes swifter with a relatively narrow valley, until near the junction with the Little River.

The one exception is at the point where the Newtown-Ridgefield road crosses. Here there are small areas of agricultural land on the slopes and in the valley. The northern end of the valley has mixed hardwood species on the slopes, with some pine near the stream and oak on the ridges. Small areas of maple are common. Below the road the valley narrows for a short distance into what is known as the Glen. The road here has been cut into the hill, as there is only room for the stream in the bottom. Hemlock is the natural type in this section, and the stands add materially to the beauty of stream and road, especially in the summer when the dense shade is very agreeable. Below this the valley widens out into an extensive river meadow, subject to flooding at times. At the lower end of this flat the river passes out of the town over a ledge which, acting as a natural dam, has caused the depositing of sufficient material to produce the meadow conditions above.

This valley as a whole is one in which there is a large percentage of forest land. Its upper portion has the same conditions as the Gallows Hill tract, and the same system of management would apply. Scattering white pines of large size show the possibility of the species in this region. Conditions in the lower portions of the valley are not as favorable for intensive operations, but where they can be carried out without present financial loss, the increased future values of the woodlot would assure a satisfactory profit. In places where chestnut has been cut out, leaving much large timber, conditions are suitable for underplanting with tolerant evergreens such as hemlock and spruce. Other stands that have been cut clear of all merchantable species should be replanted with pine. The natural reproduction of tulip is very good in this region, and should be encouraged. Much of the planting, especially in the northern part, should have the increased beauty of the roads as an object. The effect of evergreen trees on the beauty of the roads is seen in the Glen, and this same effect should be secured in other parts of the valley as soon as possible.

Umpawaug Hill Area.

This section has three distinct parts: the "Seventy Acre" tract, the "Den," and the remainder to the north and east of these which will be called the "Hill" for purposes of description.

The Hill section is largely woodlots, although the Saugatuck Valley forest extends into it at several points on the east. The headwaters of several small streams are within this area, but small swamps are not as abundant as in other sections. The forest as a whole is of mixed species, although small areas of true forest soil are occupied by hemlock or oak. The greater part of the woodlots are on fairly good soil which is not needed for agriculture at present. These stands produce the wood supply of the owners, and on this account are capable of intensive management. Even though a little longer time is required to cut the year's wood, the removal of inferior species only, and the planting of openings in the spring would soon produce increased income from the woodlot.

The area is characterized by a large amount of idle land, much of which is good agricultural soil. The agricultural possibilities of the Hill are apparently as great as of the other ridges in the town, but the area is not so well developed. This is probably due to its being beyond the direct haul to market which has tended to improve other sections of the town. At present there seems to be some indication of increased agricultural activity, with the reclaiming of some waste land. Several plantations of pine have been made which show very good results. The planting of such waste land is perhaps the most important line of forest development at present in this section.

The Den section is only the upper end of a large forest tract that extends into the town from Weston. This tract is along the divide between the Norwalk and the Saugatuck rivers. The relatively level ridge is broken by numerous ledge outcrops, resulting in swamps subject to overflow alternating with rocky ridges. The types vary greatly as to species and value. The ridge type is largely oak which is cut for timber and ties, while the swamp type is maple with a few scattering trees of more value. Towards the eastern side, chestnut becomes more abundant with the increasing depth of soil, especially on the slopes. With the loss of the chestnut, however, this type is changing to the oak or mixed types.

This whole tract, including the portion which is in the town of Weston, should be handled as a unit. There is, however, a fringe of woodlots along the edge that are used by adjoining owners as the source of their wood supply. There are also a

number of areas of waste land that ought to be planted soon in order to produce a crop of timber within a reasonable time. The ridges should also be replanted as the wood is cut off, to increase the annual production of the region.

The Seventy Acre tract is located on the ridge to the north of Georgetown and to the east of Branchville, extending north to a point near Topstone Station. This is perhaps the largest unbroken area of forest soil within the town, and is very favorably located for handling as a small forest unit. The topography is broken, with numerous ledge outcrops and abrupt slopes. The ledges are higher than in the Den section, especially towards the southern end, but they do not prevent all parts of the area being accessible for lumbering. The tract is a divide between the Saugatuck and the Norwalk rivers, with the greater part sloping towards the Norwalk. The railroad follows its western side, and constitutes a serious fire hazard at many points.

The dominant type is the oak ridge with chestnut oak and scarlet oak very abundant. The largest areas of scrub oak are also in this region as the result of repeated burnings by railroad fires. Cuttings have been very irregular. Some of the small swamps apparently have never been cut, as the soft maple and sour gum show virgin conditions. There is a small area of pitch pine on shallow soil at the top of a rocky hill near the railroad where the site is very unfavorable and other species were not so well able to survive. The areas of old field are mostly in the northern end of the area, and are relatively small. Very probably some of these areas will be cultivated again, while other portions will be left to restock with forest trees.

In the development of forestry in European countries, publicly owned forests have played an important part. Forests owned by some of the cities and towns pay the greater part of the expenses of local government. In this country there is a growing tendency toward the purchase of town forests. These are of two classes: one for the protection of the water supply, and the other for the use of the public as parks. In either case there is a definite plan to improve the growing conditions, and realize the greatest income possible. Waste areas are being planted and the forest put in the care of trained men who are carrying out a definite plan of management with an increased future yield as the main object.

The forest area within the Seventy Acre tract amounts to about 1,300 acres, probably one thousand of which will always remain forest. This area is of sufficient size to make a small working unit under management, and is so situated that it could be developed into a very attractive park if owned by the town. Many good camping sites could be provided, and as there is a fair system of woods roads, the development along this line would not be very difficult. A park of this description would not tend to change the character of the forest, except to improve the growing conditions and to protect the area from fire. Much of the growing stock on the area is inferior at present, due to past methods of handling. Because of increased quantity of products, systematic management of the entire area as a unit would permit more economical marketing than is possible at present with a large number of individual owners. Reforestation of the area would be very important, as the species now on the ground are slow growing. Placing this tract of a thousand acres under management with a permanent owner, such as the town, would eventually bring it to its maximum producing capacity. With a rotation of fifty years, pine on an area of this size ought to give an annual yield of at least 700,000 board feet with a stumpage value of about $7,000, and if cut in a mill also owned by the town, ought to produce an income of at least $8,000 per annum. A forest of this kind would be of very great value to any town, but especially to one which has a large number of summer residents.

FOREST FIRES.

Protection from fire is absolutely essential to the practice of forestry. During the past fifty years probably no one factor, not even the chestnut blight, has caused so much damage to the forest resources of Connecticut as fire. The loss has not been so apparent, as it has not often been total, but repeated burnings have gradually changed the character of many valuable stands, lowering their quality and value to the vanishing point in some cases.

To prevent this economic loss, a system of fire wardens has been established by the State. The state forester is, *ex officio*, state forest fire warden. The selectmen of each town appoint a

town fire warden, subject to the approval of the state warden. The town warden in turn appoints district wardens in the sections of his town where there is the greatest fire danger. All wardens have power to arrest violators of the forest fire laws, and to summon such assistance as they may need to control forest fires. The cost of this protection is divided between the towns, the counties and the State.

During the progress of this survey, notes were taken as to areas in the town of Redding which showed signs of having been burned over recently. Approximately 670 acres of woodland were estimated as having suffered from fire damage in the past five or six years. Most of this area is in the western part of the town near the railroad. The total number of fires reported to the state fire warden by Redding wardens from 1910 to June, 1915, was thirty-seven, and the total area of woodland burned was estimated to be about 1,500 acres. It is fair to assume that much of this land was burned over more than once, which would account for the difference in the two estimates of area. The lesser amount is nearly ten per cent of the town's forest area, so that the importance of protection is readily apparent.

Of the thirty-seven fires reported, twenty were attributed to railroad causes, three to brush burning, two to general carelessness, one was thought to be incendiary, and the remaining twelve were of unknown cause. For purposes of discussion, the causes of fire may be divided into three classes: malicious fires, careless fires and railroad fires. Even though none of the fires of unknown origin are attributed to railroad causes, it is evident that the latter class is the most serious in Redding. Carelessness of individuals is undoubtedly responsible for most of the fires whose cause is not determined. Malicious or incendiary fires are liable to occur in any community, and can only be guarded against by strict enforcement of the law.

Careless fires are of two kinds. The least numerous are those due to the escape of fires kindled for the legitimate burning of brush, rubbish, etc. In such cases, the carelessness consists in failure to take proper precautions to prevent the spread of the fires, or poor judgment in choosing a time for burning. The remedy is provided by the law which requires written permission from fire wardens for the kindling of such fires during the ordinary dry periods of the spring and fall. This law gives a

warden an opportunity to insist on necessary precautions being taken, and also gives the public an opportunity to coöperate with him in eliminating one possible cause of forest fires. As the best judgment will sometimes fail, however, there will always be danger of fire from this source, and any one through whose carelessness or poor judgment such a fire is allowed to escape, should be held responsible for the expense incurred by the town in extinguishing it.

Other fires of this class are due to carelessness with matches, smoking materials, etc., by pleasure seekers, hunters and fishermen. While occasional fires may be caused by failure to extinguish a camp fire, it is probable that more are due to the carelessness of smokers, either in the woods or on adjoining highways. A large portion of Redding is fairly well protected against such fires, as most of the woodland is closed to hunting or fishing, and the land along the main auto roads is largely cleared. Picnic parties are most frequent along the streams in this region, where the fire danger is relatively slight. Putnam Park, much used for picnic parties, has a permanent watchman who should be able to guard against fires there.

Careless fires can be entirely prevented by thorough enforcement of the laws, and education of the public to the need for care in such matters. This should be the most important duty of a fire warden, but he must have the full coöperation of his fellow citizens in putting into effect such preventive measures as seem necessary. An increased investment in forest plantations throughout the town will result in a demand for greater protection from fire, and owners of plantations will assist wardens in preventing the careless burning of brush or rubbish by irresponsible neighbors.

The railroad fires are due to sparks from locomotive stacks or ash pans and the danger is increased by conditions along the right of way. The necessity of crossing the divide between the Norwalk and the Saugatuck drainage causes an up-grade run halfway across the town for trains in either direction. The greatest danger is in the southern half where the woodland area is more extensive. The broken topography causes many cuts and sharp curves which makes the fire danger greater than in a level country, as the top of the locomotive stack is closer to the level of the ground in a cut, especially if the high bank is

on the inside of the curve. More level, open ground with numerous swamps reduces the fire danger in the northern half of the town, although there are a few spots where fires are frequently set by sparks. Fortunately the highway follows the railroad the greater part of the way, acting as a fire line and making the region readily accessible for fire fighting. The law requires that all steam locomotives must be equipped with effective spark arresters and ash pans. If there is reason to believe at any time that locomotives are in use with defective equipment of this nature, the state fire warden should be informed at once.

The only method of protection employed within the town at present consists in the fire wardens keeping a lookout for fires. When one is seen, a crew is gathered to put it out. The location of wardens for lookout purposes should be carefully considered, as well as the fitness of each one for the work. One who can overlook a large amount of territory may be able to notify other wardens of fires which they can reach more quickly than he can. Where the railroad is the greatest problem there are two methods that should help in solving it. First; clearing up and disposing of all inflammable material to a distance of one hundred feet from the center of the track, leaving the standing trees as screens to prevent the sparks being blown to a greater distance. This can only be done through the coöperation of property owners with the fire wardens and section men, since the railroad company has as yet no authority to do such clearing outside its right of way. Second; patrolling the track after each train during dry seasons. These two measures together would form a control system that should prevent the spreading of railroad fires. Under normal conditions there would probably be very little need of the patrol, but the location of district wardens so as to overlook the railroad right of way would answer the same purpose.

IMPROVEMENT CUTTINGS.

The cultural operations used in intensive forestry consist of a series of cuttings for the improvement of an existing stand in composition, rate of growth, and value of final product. Such cuttings may be grouped in three classes. 1. Cleanings and liberation cuttings to remove undesirable tree growth interfering

with that of greater value. 2. Thinnings to stimulate the rate of growth. 3. Damage cuttings to remove and utilize material damaged by fire, insects, disease, etc. The possible intensiveness of improvement operations depends on the forest conditions and the market for small products such as cordwood.

The life history of a forest stand is the same whether it is of seed or coppice origin. During the first few years each tree is an individual with plenty of room to develop on all sides and above, but soon the side branches begin to be shaded and the tree increases its height growth in order to keep its crown in the open light. The more intolerant the tree, the greater the height growth at this stage. With the development of forest community life, competition becomes keener, and the intolerant trees grow faster in height, overtopping their more tolerant neighbors, while the weaker are suppressed by the more vigorous. The loss in numbers through competition is consequently very great in a natural stand. The shaded side branches die for lack of sufficient light, are eventually broken off and the tree prunes itself naturally.

Clean lumber can thus be secured from a stand which has grown in crowded condition long enough to produce the degree of pruning and height growth necessary. After the trees attain their height growth, the crowding is from the side instead of by overtopping. The loss in numbers is very much smaller now, but breaks due to the loss of mature trees make openings that allow seeding in from nearby trees, thus maintaining trees of all ages in the stand. As the stand is thinned out by nature, the material removed is lost through decay, returning to the soil in the form of humus. This loss in mature trees offsets the growth of the younger ones, so that a natural forest is usually at a standstill so far as production is concerned.

Thinnings are the artificial means used to relieve excessive crowding, and at the same time to save as great an amount of the material grown as possible. Where there are markets so that the owner can even cover expenses, thinnings will pay because of the increased growth of the remaining timber. Light or medium thinnings will save the material usually lost in decay, while the time necessary to grow special-sized material may be shortened considerably, since each tree can be allowed its maximum growing space. Thinnings of existing stands in this region

should remove the weed species and the defective specimens of the crop trees without making an opening greater than can be closed in five to eight years by the crowns of trees left standing. The spacing of the trees on the ground does not necessarily determine the density of the stand, and only an examination of the space occupied by the crowns will tell how much of a break in the crown canopy a given tree will make if removed. The cutting of all undergrowth in a stand is not advisable, as the small shrubs aid in the formation and protection of the humus.

In a large part of the town there is no market for cordwood except for local fuel. When cuttings of any sort are made in such sections, the top wood should be removed if it will at least pay the cost of the operation, as there will be less fire danger and the remaining stand will be in better growing condition. Where this is not possible, the lumbermen should be required to lop the tops, as well as protect the young growth during cutting. Care should be taken in all operations within the forest to protect the fringe of brush and limby trees along the edge next an opening. These trees and shrubs act as a wind break to prevent excessive air circulation within the forest and help to preserve the humus in this manner. The practice of raking up leaves under the forest trees, either for use as a mulch or because near a summer cabin, will tend to cause drying out of the soil. In some cases this change in the soil moisture conditions, and winter damage to the roots not protected by a covering of leaves, will cause the death of forest trees.

In plantations, the cultural operations prior to thinnings are usually confined to cleanings. These consist in lopping brush and sprouts that are overtopping the planted trees. Only such growth as is directly interfering with them is cut, and then only lopped so as to prevent the rapid growth produced if cut back to the ground, but at the same time freeing the planted trees.

PLANTING.

High labor costs in this country necessitate different methods from those practiced in Europe for the reforestation of abandoned lands, or the changing of species in existing forests. The common method there is to plant seed in more or less cultivated spots, the resulting seedlings being thinned out to the required

number for the area. In this country the seed spot method is seldom used because of cost of labor in preparing, loss of seed by rodents and birds, and injury to the seedlings from excessive competition of other plant growth. Broadcast sowing of seed is also too expensive, as four to ten pounds per acre are required at a cost of $1.50 to $6 per pound for seed. Direct planting of nursery stock is cheapest and most satisfactory in the end in this country, as a stand of the species desired is thus established without loss of time and with the proper spacing.

Selection of the proper species for reforestation purposes is limited by the desires of the owner as well as by the site conditions. From a financial standpoint it is further limited to the rapid growing softwoods or conifers because of the value of the crop and the ease of marketing it. Certain special uses may give some of the hardwoods or broad leaf trees local value for reforestation, but their relatively low yield prevents very attractive financial returns. A comparison of the habits of growth of the hardwoods and conifers in the seedling stages, and their relative ease of handling, is all in favor of the conifers. Since seedlings of the latter do not develop deep taproots as rapidly, they are more easily handled in the nursery, and can be shipped greater distances with less loss. After a forest is established the conifers reproduce naturally from seed more readily than do valuable hardwood species, and for this reason are easier to handle by a natural system of regeneration. The conifers are particularly well adapted to growing in pure stands with a large number of stems per acre. Thinnings have merchantable value even though of small size, as much smaller material is sawed with conifers than is possible with hardwoods. Most of the latter grow best in a mixed stand where the cost of protection is highest, and the logging areas necessarily more extended to get sufficient material for profitable marketing, while the conifers can be grown pure with small logging areas.

The planting of conifers in waste areas near roads would be of great value to the town from the aesthetic point of view. The attractiveness of coniferous growth is well illustrated in the Glen, through which many people drive at all seasons because of the absolute contrast with the ordinary hardwood stands. The Glen without the hemlock would be little more attractive than many other stretches of road within the town. A system of

coöperation between adjacent landholders should be developed to secure plantings of sufficient width to make conditions similar to those in the Glen common throughout the town. The cost would be very slight compared with the benefits to the community.

The stock to be used depends on the site to be planted. Where exposed to root competition with other growth, or where the site has unfavorable conditions, better developed stock is necessary than where the forest growth has just been removed or where underplanting is planned. Nursery stock is of two classes, seedlings and transplants. Seedlings are taken directly from the seed-bed and may be either two or three years old. Transplant stock is produced by setting one- or two-year seedlings in nursery rows, and allowing them to grow one or more years there before use for forest planting. Low cost is the only reason for recommending the use of seedling stock of most species. Transplant stock is better able to withstand adverse conditions, and is more commonly used. The cost of stock varies from six to eight dollars for three-year transplants and about half as much for seedlings.

The field work of planting is very simple and a mattock or grub hoe is the only tool required for the work. The average farm laborer can easily set 500 to 800 trees per day, the number depending much on the site conditions. With experienced labor one thousand trees per day per man can be set on good sites. The usual spacing is six by six feet on open land or where there is no established tree growth. Great care should be taken that the roots do not dry out at any time. The total cost of reforestation should not be greater than ten to twenty dollars per acre when transplant stock is used. The time to set forest trees is as soon as the ground is open in the spring. This is often before conditions are fit for other spring planting and the work should be finished before the middle of May. With reasonable care in the planting and handling of stock, the average plantation should have ninety per cent of the trees living at the end of the first year. Broadleaf trees are only handled as one-year seedlings because of their greater seedling growth. Red oak is the easiest handled of the native species but not much used for reforestation as yet. White ash and tulip are sometimes used but it is not always possible to secure stock. In a region where

hardwoods abound, pine or some other coniferous tree should have preference in planting.

White Pine.

This is a native pine and one of the most valuable timber trees of the United States. It is easily managed and of rapid growth, especially for the first fifty to seventy-five years. Although adapted to all sites that are not subject to flooding, it grows best on a fairly moist loamy site. In planting white pine, three-year transplant stock should be used under most conditions as it is most economical and easiest to handle.

White pine has been the most extensively planted tree in the East and several plantations are of sufficient age to show the yields that may be expected. The condition of such plantations in this and other states, and the growth of natural stands, shows that white pine completes its financial rotation in about forty-five to fifty years. That is, the difference between the sale value of the timber, and the total costs of establishing and protecting the stand plus taxes and interest for the period, is greatest at about this age. The amount of timber is then increasing, but not so fast as the interest on the investment. For this reason, if carried too long, the investment costs will consume all the profits, and there will be a loss on the forestation operation, even though the actual sale value of the crop may be much greater than at the time of greatest financial profit. While the amount of timber which may be expected from an acre varies with the site, it will be safe to assume that the average for the town will be at least 35,000 board feet for a fifty-year rotation, and in this report that figure will be used.

White pine has a serious insect enemy and a threatening fungous disease in New England. The insect is a weevil which lays its eggs in the leader in early summer. The larva or grub develops, and tunnels down the inner bark towards the base of the tree. The length of the tunnel is limited only by the length and size of the tree, as sufficient food material is the only desire of the grub. At maturity it bores into the wood and pupates there. The adult beetle emerges from the middle to the last of July. The best method of control is to cut and burn all infested shoots before the beetles emerge, thus reducing the next year's crop of weevils. In this way, damage may be limited to a

slight crook in the tree attacked, since one of the side branches soon takes the place of the leader removed.

The fungus is a blister rust requiring for its alternate host some species of currant or gooseberry and causing the deforming and death of small trees, especially in the seedling stage. It is a European disease which has secured a foothold in this country and will necessitate measures of control to prevent its further spread. Such measures have been undertaken by the State and Federal government, and the use of white pine for reforestation work need not be entirely discontinued. It should be used with discretion, however, and preferably in mixture with some other species.

Red Pine.

Red or Norway pine is a native of the Lake States and Northern New England where it is cut for lumber with the white pine. It will make a good growth on the drier sites but is not as good on moist sites as white pine or spruce. The growth for a short rotation is about the same as that of white pine. The species is free from insect or fungous attacks, and for this reason should be favored over white pine. The quality of the wood is not as high but it is better adapted to use in places where strength is required. As a rule the material can be sold in the same market. It requires somewhat more light than white pine, and is therefore not as well adapted for underplanting unless the cover is removed at an early age. The mixing of red and white pine is perhaps the best method of planting these species in the average conditions found in the town. As with white pine, three-year transplants should be used in most cases.

Scotch Pine.

This is the main timber tree of Europe, and is of very rapid growth on dry unfavorable sites. The quality of the product is not high, being suitable mainly for dimension material and rough boards. With this species the use of two-year seedlings is best, as the seedling growth is so rapid that larger stock is hard to handle.

Norway Spruce.

The planting of this species is increasing in the state, but at present there are no figures available to predict its growth

or yield. It is very extensively used in Europe, and is common here as an ornamental tree, or for wind breaks. Its growth in the juvenile stage is not rapid until after the fifth or sixth year, and the use of stock smaller than three-year transplants is not recommended. It is well adapted for use as a Christmas tree, and may be grown for this purpose in close spaced plantations, either pure or in mixture with pine.

CONCLUSION.

The survey shows that 43.3 per cent of the town, or 8,880 acres, is classified as forest or waste land. This area is divided among the various forest types as follows: 33 per cent is mixed hardwoods, a large part of which is a changing type due to the loss of chestnut; the oak and old field types each occupy 21 per cent; the swamp type 14 per cent; and the oak-chestnut type 8 per cent. The remaining 3 per cent is divided between the hemlock, the chestnut and the pine types. This shows that 64 per cent of the forest area is in types that produce timber, while the swamp and the old field types occupy the remainder. These two types are of small present value because one produces only cordwood, while the other is producing practically nothing.

Although 64 per cent of the forest area may be considered as in a producing state, it is very irregular both as to species and age. The cuttings for the past few years have greatly reduced the amount of merchantable timber still standing. The rotation necessary to produce a merchantable crop is at least forty-five years for the fastest growing of the native species, while the survey shows that only seventeen per cent of the stand is over forty years old. The poor species in the average stand indicates the relatively poor quality of the present forest. The loss of the chestnut has made great changes in the producing capacity of the stands, as it has removed the most rapid growing species. Weed species are spreading into the vacated areas, as they are better able to take advantage of the increase in the growing space than are the more valuable but slower-growing trees. It is safe to say that at present less than half of the growing space is occupied by valuable species.

The rate of growth of the merchantable species remaining is so low that at best they will not produce annually more than

three-fourths of the amount formerly grown. The yield per acre for a fifty-year rotation with the present species, should vary from 10,000 board feet on the best sites to 3,000 on the poorer, but this is much reduced because of the poor stocking of these stands. The average for the town at present is probably under 4,000 feet per acre on a fifty-year rotation, but 4,500 board feet will be taken as the yield in the following comparison. As the area in productive types amounts to 5,675 acres, the yield for a fifty-year period would be 25,540,000 board feet, so that an average annual cut of 510,800 board feet may be assumed. With a stumpage value of six dollars per thousand, this means an annual income of over three thousand dollars from the present forest area on a fifty-year rotation. Under a working plan which provided for 114 acres being cut over each year, such an income might be expected.

The value of cordwood is for local fuel, unless the stand is cut on a shorter rotation with no other product than cordwood. Taken as a whole there is very little sale value in cordwood at the present time, and the returns from this source may be assumed to barely cover the waste of such material due to lack of a market for it in the greater part of the town. The swamp type comes under this classification at present and is not considered here for that reason.

The old field type occupies some 21 per cent of the forest area, or 1,865 acres. This will not all return to forest during the next rotation, as portions will be cultivated, but it is safe to assume that two thirds of this area might be afforested and produce at least one forest crop before being required again for agriculture. This means about 1,250 acres available for afforestation, and which, although as good as the best of the forest land, is not at present producing a crop of any kind. Planted with pine, this 1,250 acres would yield a crop of at least 43,500,000 board feet in fifty years, and probably 50,000,000 board feet would be an underestimate. The area to be cut annually would be only twenty-five acres. Aside from the better quality of the product, this indicates the greater value of conifers as compared with hardwoods for reforestation purposes. If the stumpage value were figured at ten dollars per thousand, the returns from the cut at the end of the fifty-year period would be from $435,000 to $500,000, and if this material were milled,

the market value would be well over a million dollars. This represents an annual cut of at least 870,000 feet of timber valued at $8,700, from an area of twenty-five acres per year.

The gross income from the original forest on a fifty-year rotation figures about twenty-seven dollars per acre, while in the artificially established coniferous forest it should amount to at least $348. The average value of these forest lands may be assumed to be ten dollars per acre at present, and this may be assumed as a fair average value for the land and growing timber during the past fifty years. This value compounded at five per cent interest for the period equals $114.67, so that the interest charges are $104.67 per acre. At an average rate of ten mills, the taxes for fifty years at five per cent compound interest would amount to about twenty-one dollars, so that the interest on the land plus taxes and interest amounts to $125.67. If the gross sale value of the crop is twenty-seven dollars, a net loss of almost ninety-nine dollars on the crop of timber is sustained on the fifty-year investment. This may be somewhat reduced by the fact that a portion of the cordwood has been used either for fuel or sold in the open market, and that material for repair work on the farm has been cut from time to time. A profit on the land because of increased values might also slightly reduce this loss.

Waste land that is planted would carry an additional charge for the cost of afforestation, that should not average more than ten dollars per acre. On the total investment of twenty dollars per acre, the interest charge at five per cent would be approximately $220.00 for a period of fifty years. If advantage is taken of the law which provides for the listing of forest land for taxation purposes (Chap. 58, P. A. of 1913), taxes for the period can be calculated on the basis of the present valuation at the ten mill rate. The land taxes with interest would be twenty-one dollars as in the other case, and the stumpage products tax of ten per cent on a yield of $350 per acre would be thirty-five dollars. The interest charge plus taxes, therefore, amounts to $276, but as the returns are $350, the plantations would show a profit of seventy-four dollars per acre. In addition there should be returns from thinnings of merchantable size by the thirtieth year, which would offset the carrying charges to a greater extent than the sale of cordwood will under present forest conditions.

The existing forest does not seem to be much more than paying taxes at present. Interest on the investment in land is entirely overlooked and when a sale is made, the owner of woodland looks on the returns as almost pure gain because he has not expended any actual labor in getting the money. As a matter of fact, the rest of the farm has been obliged to pay not only its own share of the taxes and interest on the valuation of the farm, but the forest's share as well. With proper management, the forest might be made to pay its way without having to depend on the agricultural crops to help it along.

Forestation of the entire forest area, excluding swamp and old field types that may be cleared, would bring some 6,900 acres into pine. The possible annual cut would then be 4,800,000 feet with a sale value of $48,000, as compared with the present sale value of perhaps $4,420. Cordwood for local use as fuel could be cut in the form of thinnings, or in the swamp lands too wet for anything but hardwoods. Such a complete change in type could not be accomplished at once, nor is it necessarily desirable. It seems evident, however, that any considerable replacement of slow growing hardwoods by more rapid growing conifers will be an economic gain to the community.

SUMMARY

Redding is an agricultural town increasingly dependent for its tax income on city residents who are turning to the country for permanent or summer homes. Of the total area, 43 per cent is forest or land reverting to forest. This forest area is in very poor producing condition, due to past methods of handling, fire and loss of the most valuable species by disease. The following types are decribed in the foregoing survey.

Types.	Area in Acres.	Per cent. of Forest Land.
Mixed Hardwoods	3000	34
Old Field	1865	21
Oak	1860	21
Swamp	1250	14
Oak-Chestnut	710	8
Hemlock	100	1
Chestnut	70	1
Pine	25	
	8880	100

RECOMMENDATIONS

1.—The forests of Redding have been, and will continue to be, an important factor in its development. The existing forests are not yielding the highest possible returns from the use of the land occupied, and should be managed with a view to increasing the future yield of valuable products.

2.—Weed species should be eliminated and the most valuable species favored in all cuttings. Rapid growing conifers such as white pine, red pine and Norway spruce should be introduced by planting in place of the rapidly disappearing chestnut.

3.—Waste lands not suitable for agricultural crops should be planted with such rapid growing conifers in order that they may become fully productive.

4.—Ornamental plantings along the highways, especially in waste areas at their intersections, will greatly benefit the town by increasing the beauty of its drives. Similar plantings along some of the streams would also be of aesthetic value.

5.—If planting work is planned co-operatively for a week or two early in the spring, more may be accomplished than if individual efforts are depended on. Arbor Day is usually rather late for forest planting, but if roadside and ornamental planting is planned for that day, the school children may be utilized for much of the work.

6.—Absolute protection from fire is most essential if improved forest conditions are to be secured. This involves an active fire warden organization with the full support of the community, and a strong community feeling that forest fires are a cause of economic waste which is unnecessary and can be prevented. Public opinion fully aroused on this subject will insist that every precaution is taken to prevent the starting of fires, and that the forest fire laws are enforced in every case of violation.

TREE SPECIES FOUND IN REDDING.

Acer pennsylvanicum	Striped maple
" rubrum	Red maple
" saccharum	Sugar maple
Alnus rugosa	Smooth alder
Amelanchier canadensis	Shad bush
Betula lenta	Black birch
" lutea	Yellow "
" papyrifera	White "
" populifolia	Gray "
Carpinus caroliniana	Hornbeam
Castanea dentata	Chestnut
Cornus florida	Flowering dogwood
*Crataegus	Hawthorns
Fagus grandifolia	American beech
Fraxinus americana	White ash
" nigra	Black "
" pennsylvanica	Red "
Hamamelis virginiana	Witch hazel
Hicoria alba	Whiteheart hickory or mockernut
" glabra	Pignut hickory
" minima	Bitternut or swamp hickory
" ovata	Shagbark hickory
Juglans cinerea	Butternut
Juniperus virginiana	Red cedar
Kalmia latifolia	Laurel
Liriodendron tulipifera	Whitewood or tulip tree
Nyssa sylvatica	Pepperidge or sour gum
Ostrya virginiana	Ironwood or hop hornbeam
Pinus rigida	Pitch pine
" strobus	White "
Platanus occidentalis	Sycamore or buttonball
Populus grandidentata	Largetoothed aspen
" tremuloides	Quaking "
Prunus serotina	Black cherry
" virginiana	Choke "
Quercus alba	White oak
" coccinea	Scarlet "
" nana	Scrub "
" palustris	Pin "
" prinus	Chestnut or rock oak
" rubra	Red oak
" velutina	Black or yellow oak

*Rhus	Sumach
Robinia pseudacacia	Black locust
*Salix	Willows
Sassafras sassafras	Sassafras
Tilia americana	Basswood
Tsuga canadensis	Hemlock
Ulmus americana	White elm
*Viburnum	Viburnum

* Several species.

TESTS OF WINTER WHEAT.

The following varieties of wheat have been grown for three years in succession on the same land (no other land being available at the time).

Dawson's Golden Chaff, Fultz, Maryland Flint, Dietz Longberry, Early Geneser Giant, Rocky Mountain, Jones' Winter Fife, Bearded Winter Fife, New Amber Longberry, Martin's Amber, Poole, Fultzo-Mediterranean, Mammoth Red, Stover and Klondike.

The main object of the test was to determine whether these varieties were hardy in this climate. The land was run out meadow which had not yielded grass enough for several years to pay for cutting.

It was plowed in July, 1911, and in late August was dressed with seven tons of horse manure, 500 lbs. of basic phosphate and 200 lbs. muriate of potash, disked thoroughly and sown to wheat at the rate of 6 pecks to the acre in the middle of September. Each variety occupied one-fifteenth of an acre. The wheat was harvested July 17, 1912. The land was still "wild," the stand uneven over the plots and the yields of the different varieties were small, an average of 16.3 bushels of wheat per acre and 1,301 lbs. of straw, 23 bushels being the largest yield. In April, 14 lbs. of clover seed was sown on the wheat. It made a fair growth, was turned under September 9, 1912, after adding a ton of ground limestone and seeded with the same varieties of wheat on the 14th. The following winter was very severe for winter crops. Much of the alfalfa in the state was winter killed and clover also in some places. Not one of the wheat varieties, however, was damaged in the least. In the following April, 150 lbs. nitrate of soda, 250 lbs. of acid phosphate and 50 lbs. of muriate of potash were broadcast and the wheat field rolled.

The crop, harvested July 11, 1913, yielded an average of 27.7 bushels of grain and 3,600 of straw per acre with a maximum of 35 bushels. After putting on what little manure we had, about 4 tons to the acre, the field was plowed, dressed with 350 lbs. of acid phosphate and 200 lbs. of muriate of potash, and after fitting the land sown the third time with the same varieties of wheat on September 29. In the following spring 200 lbs. of nitrate of soda was broadcast and the field rolled. There was harvested July — an average of 16.1 bushels of grain and 1,772 lbs. of straw, 20.9 bushels of grain being the largest yield.

The land was uneven in productive power as was evident from experiments on the adjoining land, and there were spots in the field where the growth was never satisfactory so that no judgment can be made of the relative yields of the varieties tested. Of course no one would grow wheat on the same land for three years in succession as a business proposition.

The amounts of fertilizer named above are not of course recommended for wheat. They were used because the land was known to be in poor condition agriculturally, and this was the first crop grown after our purchase of the field.

The experiment, however, showed that any of the varieties named will live through even an inclement winter in this State without damage.

TESTS OF BABCOCK APPARATUS.

It is required by law that all Babcock apparatus used in fixing the price of milk or cream shall previous to such use be officially tested and its accuracy certified. This is done by etching each piece found accurate as follows:—Ct. Ag. St.. This Station has done the work of testing and certifying without charge for creameries and citizens of this state.

Since the last notice in our reports 3,410 pieces of glass ware have been tested, and their accuracy certified except in the case of 29 pieces (0.85 per cent. of the whole number) which were found inaccurate. There were tested

109	cream pipettes
169	milk pipettes
553	cream test bottles
2,579	milk test bottles
3,410	

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