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AGRICULTURAL
Experiment Station

State of Connecticut
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Fifty-First Report

OF THE

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

FOR THE YEAR

1927

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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as of

October 31, 1927

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Report of the Board of Control

OF

THE CONNECTICUT AGRICUTURAL EXPERIMENT STATION

To His Excellency, John H. Trumbull, Governor of Connecticut:

The Board of Control of the Connecticut Agricultural Experiment Station herewith submits its fifty-first report for the year ending October, 31, 1927. The several financial statements included are for the fiscal year ended June 30, 1927.

Bulletin No. 291, included herewith, is the Report of the Director, and is a summary of progress made during the year, of resignations and appointments, additions to equipment and other pertinent matters. There are also included the Reports on Fertilizers, on Insect Pests, Food and Drug Products and the experiments on Tobacco at Windsor. Because of a change in the statute no report was issued on Commercial Feeding Stuffs.

The calls upon the Station for services of various kinds have continued to increase and the resources of both staff and plant have been taxed to the utmost. The invasion of this state by the Japanese Beetle, Oriental Peach Moth and the European Corn Borer especially, have called for extended efforts.

There have been no important changes in the personnel to report, other than those indicated in the Report of the Director.

All of which is respectfully submitted.

GEORGE A. HOPSON,
Secretary.

Report of the Treasurer

July 1, 1926—June 30, 1927

W. L. SLATE, in account with THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION for the fiscal year ended June 30, 1927.

RECEIPTS.

Balance on hand, July 1, 1926:			
State General Appropriation			$4,932.13
State Comptroller (General or Current Expense)		$53,000.00	
" " (General—Additions)		1,206.40	
" " (Food and Drug)		7,500.00	
United States Appropriation (Hatch)		7,500.00	
" " " (Adams)		7,500.00	
" " " (Purnell)		14,000.00	
" " Reimbursement (Clark-McNary)		681.11	
Fertilizer Analysis Fees		12,000.00	
Feed Analysis Fees		6,000.00	
Lockwood Trust Fund		12,500.00	
			121,887.51
			$126,819.64
Miscellaneous Receipts:			
Balance on hand, July 1, 1926:		$657.40	
Sales of gasoline	$518.59		
Sales of automobile oil	29.57		
Mileage for use of automobiles	184.43		
Sale of stamped envelopes	5.10		
Sale of twine	.23		
Sale of waste paper	3.42		
Interest on bank deposits	69.86	811.20	
		$1,468.60	
LESS MISCELLANEOUS RECEIPTS DEPOSITED WITH STATE TREASURER		1,267.14	
			201.46
			$127,021.10

DISBURSEMENTS.

Salaries	$70,154.17
Labor	17,064.89
Stationery	1,301.07
Scientific Supplies (chemicals)	864.82
" " (other laboratory)	1,194.69
" " (photographic)	133.45
Feeding Stuffs	573.35
Insecticides, Fungicides, etc.	441.29
Lumber and Small Hardware	16.78
Miscellaneous Supplies	2,045.84
Automobile Oil	152.81

Food Samples	9.15	
Fertilizers	603.90	
Telegraph and Telephone	333.96	
Postage	455.37	
Travel (outlying investigations)	3,334.54	
" (meetings etc.)	1,209.14	
" (gasoline for automobiles)	1,375.90	
Freight, Express and Parcels Post	131.79	
Publications (bulletins etc.)	201.55	
" (miscellaneous)	79.50	
Coal	2,876.48	
Gas and Electricity	2,042.35	
Water	269.55	
Furniture and Fixtures (new)	1,546.27	
" " " (repairs)	204.70	
Library (books and periodicals)	1,256.73	
" (binding)	222.65	
Scientific Equipment (new)	1,834.13	
" " (repairs)	75.45	
Automobiles (new)	2,498.25	
" (repairs)	796.26	
Tools, Machinery and Appliances (new)	2,123.02	
" " " " (repairs)	151.86	
New Buildings and Structures	3,327.80	
Buildings (repairs and alterations)	3,339.49	
Grounds	24.75	
Insurance (fire, burglary and automobile)	1,352.41	
Taxes	4.20	
Miscellaneous Contingent Expenses	201.00	
Total Disbursements		$125,825.31
Balance on hand, June 30, 1927:		
State General Appropriation (in hands of State Comptroller)	$994.33	
Miscellaneous Receipts (in hands of Station Treasurer)	201.46	
		1,195.79
		$127,021.10

REPORT OF

W. L. SLATE, Treasurer

IN ACCOUNT WITH

Insect Pest Appropriation

July 1, 1926—July 1, 1927

RECEIPTS.

Insect Pest Appropriation		$17,500.00	
" " " (additions):			
Deficiency Appropr.	$13,500.00		
Miscellaneous Receipts	10.50	13,510.50	
		31,010.50	
Charged to allotment for second year of fiscal period, July 1, 1926		$4,567.93	
Net Receipts			$26,442.57
Miscellaneous Receipts:			
Balance July 1, 1926	$6.54		
Mileage for use of automobiles	3.96		
	10.50		
Less Miscellaneous Receipts Deposited with State Treasurer	10.50		
			$26,442.57

DISBURSEMENTS.

Salaries	15,570.31
Labor	2,967.96
Stationery and Office Supplies	101.62
Scientific Supplies (chemicals)	34.79
" " (other laboratory supplies)	32.21
" " (photographic)	43.58
Feeding stuffs	.55
Insecticides, etc.	2,586.60
Lumber and Small Hardware	9.48
Fuel Oil	459.53
Miscellaneous Supplies	175.86
Automobile Oil	38.38
Telegraph and Telephone	69.36
Postage	96.95
Travel (outlying investigations)	715.72
" (meetings, conferences etc.)	259.95
" (gasoline for automobiles)	427.25
Freight, Express and Parcels Post	149.00
Publications (zinc cut)	2.50
Coal	5.10

Electricity	4.00	
Water	34.60	
Furniture and Fixtures (new)	112.85	
" " " (repairs)	3.47	
Library (books and periodicals)	45.21	
Scientific Equipment (new)	143.06	
" " (repairs)	3.50	
Tools, Machinery and Appliances (new)	960.98	
" " " " (repairs)	41.65	
Automobiles (repairs)	475.86	
New Buildings and Structures	9.91	
Buildings (repairs and alterations)	16.04	
Rent of Land and Buildings	416.63	
Insurance (automobile)	225.41	
Miscellaneous Contingent Expenses	202.70	
Total Disbursements		$26,442.57

REPORT OF

W. L. SLATE, Director

IN ACCOUNT WITH

Mosquito Elimination Appropriation

For the Year Ended June 30, 1927

RECEIPTS.

State Appropriation	$7,500.00	
Additions (Madison $200, Branford $200 Westport $5,408.80, Westbrook $2,000)	7,808.80	
Deficiency Appropriation	3,000.00	
		18,308.80
Charged to allotment for second year of fiscal period		1,249.17
Total		$17,059.63

EXPENDITURES.

R. C. Botsford (salary)	$2,400.00	
Labor	10,649.78	
Stationery and Office Supplies	28.60	
Hardware supplies	4.73	
Photographic Supplies	4.08	
Miscellaneous Supplies	40.30	
Automobile Oil	7.69	
Oil for Mosquito Spraying	10.40	
Telephone and Telegraph	11.28	
Postage (excluding parcels post)	27.42	
Travel (meetings and conference and investigations)	37.86	
" (gasoline)	192.23	
Tools, Machinery and Appliances (new)	23.30	
" " " " (repairs)	19.30	
Automobile repairs	249.35	
Building New Culverts and Tide Gates	1,829.26	
Repairs to Culverts and Tide Gates	446.71	
Insurance (automobile)	64.66	
Contingent	14.50	
	16,061.45	
Transferred to New Mosquito Elimination Fund	346.62	
		$16,408.07
Balance on hand June 30, 1927		651.56

Tobacco Research Appropriation

July 1, 1926—June 30, 1927

RECEIPTS.

Appropriation	$10,000.00	
Conn. Valley Tobacco Association	3,035.76	
Sales of Tobacco	2,749.37	
Misc. (rebate on insurance)	7.81	
Balance on hand June 30, 1926	1,620.54	
		$17,413.48

EXPENDITURES.

Salaries	7,399.96	
Labor	5,183.71	
Stationery and Office Supplies	102.97	
Chemical and Laboratory Supplies	61.96	
Photographic Supplies	16.98	
Insecticides and Fungicides	11.00	
Lumber and Small Hardware	54.34	
Miscellaneous Supplies	440.12	
Automobile Oil	2.75	
Fertilizer	393.72	
Telephone and Telegraph	78.63	
Postage	40.00	
Travel (outlying investigations)	323.65	
" (Meetings)	109.94	
" (gasoline for automobiles)	42.47	
Freight, express and cartage	60.52	
Coal	387.50	
Electricity	330.09	
Furniture and Fixtures (new)	44.02	
" " " (repairs)	13.65	
Books and Periodicals	35.75	
" " " (binding)	17.50	
Scientific Apparatus (new)	516.57	
" " (repairs)	4.73	
Tools, Machinery and Appliances (new)	228.70	
" " " " (repairs)	6.85	
Automobiles (repairs)	139.60	
Buildings (repairs and alterations)	447.61	
Rent of land	75.00	
Insurance	840.19	
Contingent	3.00	
		$17,413.48

BULLETIN 290 OCTOBER, 1927

Connecticut Agricultural Experiment Station
New Haven, Connecticut

Report on Inspection of Commercial Fertilizers for 1927

E. M. BAILEY, *Chemist in Charge of the Analytical Laboratory.*

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The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

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Report on Inspection of Commercial Fertilizers, 1927

E. M. Bailey,

Chemist in Charge, Analytical Laboratory.

THE FERTILIZER LAW.

The provisions of the Connecticut fertilizer law have been discussed in previous reports but for more ready reference its essential features may be noted here.

Significance of the Term "Commercial Fertilizers"

Explaining what is meant by the term "commercial fertilizers" the law says:

"The term 'commercial fertilizers' shall be construed to mean any and every substance imported, manufactured, prepared or sold for fertilizing or manuring or soil amendment purposes, except barnyard manure and stable manure which have not been artificially treated or manipulated, marl and lime. Cottonseed meal, rapeseed meal, castor pomace and all other vegetable products used as fertilizers, including the ashes of cotton hulls and wood ashes, shall be included as fertilizers within the meaning of this act and separate analysis fees shall be paid on each different grade which is sold or offered for sale in the state. The person responsible for paying the fees above prescribed may deduct from the total tonnage sold such sales of cottonseed meal or other vegetable products as are made to anyone who gives a written certificate on a form supplied by the Connecticut Agricultural Experiment Station stating that the material bought by him was to be used exclusively for feed and not for fertilizer."

Concerning Cottonseed Meal.

Cottonseed meal is a fertilizer within the meaning of the Statute but it is provided that when this product is sold for feeding purposes only, it shall be exempt from the tonnage tax. When sold as a feed, cottonseed meal is subject to registration under the terms of the feed law. By regulation, however, if it is sold exclusively as a fertilizer, or exclusively as a feed it may be registered but once, and under that law which applies.

The status of cottonseed meal under the fertilizer law has been clearly stated in bulletin[1] from this Station from which the following may be quoted:

Registration and analysis fees. "Each brand of cottonseed meal must be registered on forms provided by this Station and an analysis fee of ten dollars paid on it before it is sold, offered or exposed for sale, and on the first day of January annually thereafter."

[1] Bull. of Information No. 9, 1919.

"A distinctive name constitutes a distinct brand. If shipments have different guaranties of composition they are held to be different brands."

Branding or tagging. "Since nitrogen is the only fertilizer ingredient considered in the trade in cottonseed meal no guaranty of phosphoric acid or potash is required. If either is guaranteed by the manufacturer, however, an additional fee of ten dollars must be paid on each element. The statement of composition now legal for feeds may be used hereafter if the percentage of nitrogen is stated.

"Note that the law regarding feeding stuffs forbids the use of metal in attaching tags and requires that each package shall be branded or tagged with the statement required by law."

Duties of shippers. "It is assumed from correspondence with shippers outside the state that they will register the brands which they sell in Connecticut, will pay analysis fees as has been done in the past by manufacturers of commercial fertilizers, and will semi-annually thereafter pay the tonnage fees.

"They will report to this Station their total sales and if they wish, may report what part has been sold for feed exclusively. From the reports of dealers within the state it will be possible to determine quite closely the amounts of each brand actually used as feed.

"In the case the jobber outside the state neglects or refuses to register a brand, the dealer who sells it within the state is responsible under the law."

Duties of dealers. "Dealers are required to file with the director of the Station on July first of each year and semi-annually thereafter a sworn statement of their total sales of each brand of cottonseed meal and the amount of each sold exclusively for feed, during the preceding six months."

Requirements to be Complied with by Sellers of Commercial Fertilizers.

The seller is responsible for the proper labeling of each package, for the registration at the Station of every brand sold by him and for the payment of the analysis fee, before offering for sale, and annually thereafter on January 1st.

The law specifies the information which shall be given on the label as follows:

1. *Weight of each package in pounds.*
2. *Brand name or trade mark.*
3. *Analysis:*
   - (a) *Available phosphoric acid, per cent.*
   - (b) *Total phosphoric acid, per cent.*
   - (c) *Nitrogen, per cent.*
   - (d) *Equivalent ammonia, per cent.*
   - (e) *Potash soluble in water, per cent.*
4. *Name and address of the manufacturer or of the person who is responsible for the statement of the guaranty.*

In the case of bone meal, tankage or other organic products, and in basic slag and mineral phosphates in which a large percentage of the phosphoric acid is not available by laboratory methods, the phosphoric acid shall be claimed as total phosphoric acid unless it is desired to claim available phosphoric acid instead, in which case the guaranty shall take the form set forth above.

The label may be a tag attached to the package or a statement printed thereon. Percentages shall be minimum percentages only.

The presence of leather in its various forms, wool waste, hair, or any inert nitrogenous material shall be declared on the label unless, by processing, the activity of these materials has been rendered satisfactory as determined by official methods.

When potash is derived from sulphate or carbonate of potash it may be so claimed.

No claim or guaranty for less than 0.82 per cent of nitrogen or for less than 1 per cent of phosphoric acid, or for less than 1 per cent of potash shall be regarded in the registration or analysis of any commercial fertilizer.

The seller must also, on the 1st of January and July, report the tonnage of fertilizer sold within the preceding six months and pay to the director of the Station a tonnage fee of 6 cents per ton. On request, copies of the law and blanks for registration and for tonnage reports will be supplied by the Station.

If, however, proper labeling, registration and payments have been provided for by the manufacturer of the brands or by another responsible person all sellers of such brands are released from the above mentioned requirements. The retailer, therefore, should assure himself that the requirements of the law have been met by the manufacturers of the brands which he handles, or himself be prepared to meet all these requirements.

Precautions to be Observed in Drawing Samples for Analysis.

The analysis of a fertilizer is of no value unless the sample analyzed represents as nearly as possible the stock from which the sample was drawn. The law prescribes the procedure to be followed by authorized agents of this Station when taking official samples for analysis as follows:

"When samples are taken from fertilizers in bags, a tube shall be used, and it shall be inserted at one end of the bag and shall pass substantially the entire length of the bag, so as to take a core of the material being sampled from substantially the entire length of the bag. Samples thus taken from individual bags shall be thoroughly mixed, and the official samples shall be taken from the mixture so drawn by the method known as 'quartering.' Samples of fertilizers taken as herein provided shall be taken from at least five per centum of the separate original unopened packages in the lot, for the mixture from which the official samples shall be taken. If less than one hundred bags are in the lot, at least five bags shall be sampled; if less than five bags, all shall be sampled. Broken packages shall not be sampled."

Gratuitous Analyses.

Under the fertilizer law the Station is charged only with the analysis of samples drawn by its own agents. It does, however, each year analyze a considerable number of samples drawn by individuals, representing stock purchased by them for their own use. The object of the purchaser is to satisfy himself as to whether he has obtained goods of the grade represented and, perhaps, to obtain evidence upon which to base a claim for shortage should the materials not meet their guaranties. The Station assumes no responsibility for the sampling in case of such unofficial samples and can only vouch for the accuracy of the results obtained on the materials as submitted. Since a representative sample is as essential as an accurate analysis in judging the quality of a shipment of fertilizer, it is evident that a satisfactory adjustment will seldom be effected on the basis of an unofficial sample. Notwithstanding certain objections which may be raised to the practice of analyzing samples submitted by individuals, the Station is disposed to continue such work so long as there is evidence that it constitutes a useful service.

REGISTRATIONS FOR 1927.

For 1927, 64 firms and individuals registered at this Station for sale in this State 414 brands of fertilizers. As required by Statute, the brands so registered are listed as follows:

American Agricultural Chemical Company, New Haven Sales Dept., New Haven, Conn.

A. A. C. 16% Acid Phosphate
AAC Tobacco Ash Element
AAC Tobacco Starter
Acme Fertilizer
Aroostook Potato Manure
Castor Pomace
Complete General Fertilizer
Cotton Seed Meal
Double A Tobacco Fertilizer
Double Manure Salts
Dry Ground Fish
Fine Ground Bone
Gladiator Fertilizer
Grass and Lawn Top Dressing
Hi-Grade Tobacco Manure
Monarch Fertilizer
Muriate of Potash
Nitrate of Soda
Old Hickory Fertilizer
Patapsco 5-8-7 Fertilizer
Pulverized Sheep and Goat Manure
Sulphate of Potash
Bowker's All Round Fertilizer
Bowker's Market Garden Fertilizer
Bowker's Potato and Vegetable Phosphate
Bowker's Stockbridge Early Crop Manure
Bowker's Stockbridge Hill and Drill Fertilizer
Bowker's Stockbridge Tobacco Manure
Bowker's Sure Crop Fertilizer
Bradley's Blood, Bone and Potash
Bradley's Complete Manure for Potatoes and Vegetables
Bradley's Complete Tobacco Manure
Bradley's Eclipse Fertilizer
Bradley's Northland Potato Grower
Bradley's Potato Fertilizer
Bradley's Potato Manure
Bradley's XL Superphosphate of Lime
National Aroostook Special Fertilizer
National Complete Tobacco Fertilizer
National Market Garden Fertilizer
National Pine Tree State Potato Fertilizer
National Premier Potato Manure
Sanderson's 5-8-7 Fertilizer
Sanderson's 5-10-5 Fertilizer
Sanderson's 3-12-3 Fertilizer
Sanderson's Atlantic Coast Mixture
Sanderson's Complete Tobacco Grower
Sanderson's Corn Superphosphate
Sanderson's Formula A
Sanderson's Formula B
Sanderson's Potato Manure

American Cyanamid Company, 535 Fifth Ave., New York City.
Ammo-Phos 20-20

Apothecaries Hall Company, Waterbury, Conn.
Acid Phosphate
Bone Meal 4-20
Bone Meal 3-22
Bone & Meat Tankage
Carbonate of Potash
Castor Pomace
Double Sulphate Potash and Magnesia
Dry Ground Fish
Liberty Corn and All Crops 2-8-2
Liberty Corn, Fruit and All Crops 2-12-4
Liberty Fish Bone and Potash 3-8-3
Liberty High Grade Market Gardeners 5-8-7
Liberty High Grade Tobacco Manure 7-4-7
Liberty Home Vegetable Garden Fertilizer
Liberty Lawn Fertilizer
Liberty Onion Special (Potash as Sulphate) 4-8-7
Liberty Potato and General Crops 4-8-10
Liberty Potato and Market Gardeners Special 4-8-4
Liberty Potato and Vegetable 2-8-10
Liberty Sheep Manure
Liberty Tobacco Special 5-4-5
Liberty Top Dresser for Grass and Grain 10-3½-8
Muriate Potash
Nitrate Soda
Nitrate Soda and Potash
Precipitated Bone
Sulphate Potash
Tankage

Armour Fertilizer Works, 50 Broad St., New York City.
Armour's Big Crop Acid Phosphate 16%
Armour's Big Crop Bone Meal 3-48
Armour's Big Crop Fertilizer 8-6-6
Armour's Big Crop Fertilizer 5-8-7
Armour's Big Crop Fertilizer 4-6-10
Armour's Big Crop Fertilizer 4-8-7
Armour's Big Crop Fertilizer 4-8-4
Armour's Big Crop Fertilizer 4-16-4
Armour's Big Crop Fertilizer 3-8-4
Armour's Big Crop Fertilizer 2-12-4
Armour's Big Crop Super Phosphate 20%
Armour's Big Crop Tobacco Special 5-4-5
Armour's Castor Pomace 5½%
Armour's Corn Grower 2-8-2
Armour's Cotton Seed Meal 8%
Armour's Dried Ground Fish 10%
Armour's Ground Tankage 9%
Armour's Lawn and Garden Grower 6-8-6
Armour's Muriate of Potash 48%
Armour's Nitrate of Soda 18%
Armour's Sheep Manure 1½-1-2
Armour's Sulphate of Potash 48%

Ashcraft-Wilkinson Company, Atlanta, Ga.
Helmet Brand
Monarch Brand
Paramount Brand

Atlantic Packing Company, New Haven, Conn.
Atlantic Grain Fertilizer 2-10-2
Atlantic Special Vegetable 4-8-4
Atlantic Tobacco Grower 5-4-5
Atlantic Tobacco Manure 5-8-6
Atlantic 5-4-16

Baker Castor Oil Company, 120 Broadway, New York City.
Castor Pomace

E. J. Bantle, Glastonbury, Conn.
Bantle's Wrapper Brand

Barrett Company, 40 Rector St., New York City.
Arcadian Sulphate of Ammonia

The F. A. Bartlett Tree Expert Co., Stamford, Conn.
Bartlett's Green Tree Food

The Berkshire Chemical Company, Bridgeport, Conn.
Berkshire Acid Phosphate
Berkshire Castor Pomace
Berkshire Complete Fertilizer
Berkshire Complete Tobacco
Berkshire Dry Ground Fish
Berkshire Economical Grass Fertilizer
Berkshire Fine Ground Bone
Berkshire Grass Special
Berkshire Long Island Special
Berkshire Market Garden Fertilizer
Berkshire Potato and Vegetable Phosphate
Berkshire Sheep Manure
Berkshire Starter with 10% Potash
Berkshire Tobacco Special
Boardman's Complete Fertilizer
High Grade Sulphate Potash
Muriate Potash
Nitrate of Soda
Precipitated Bone Phosphate

Amos D. Bridge's Sons, Incorporated, Hazardville, Conn.
Corn, Onion and Potato and General Purpose
Special Tobacco Fertilizer

F. W. Brode Corporaton, Memphis, Tenn.
Owl Brand 41% Cotton Seed Meal

A. H. Case & Company, Incorporated, Buffalo, N. Y.
Case's Brand Pulverized Sheep Manure

The E. D. Chittenden Company, 1115 Main St., Bridgeport, Conn.

Chittenden's Acid Phosphate
Chittenden's Castor Pomace
Chittenden's Complete Grain
Chittenden's High Grade Potato 7% Potash
Chittenden's High Grade Tobacco
Chittenden's Nitrate of Soda
Chittenden's Potato Special 4% Potash
Chittenden's Special Top Dresser
Chittenden's Tobacco Special
Chittenden's Tobacco Starter
Chittenden's Vegetable and Onion Grower
Fine Ground Bone

Everett B. Clark Seed Company, Milford, Conn.

16% Acid Phosphate
Nitrate of Soda
Special Mixture for General Use
Special Mixture with 6% Potash
Super Phosphate
Tip Top Brand

The Conn. Fat Rendering & Fertilizer Corp., New Haven, Conn.

Tankage

Consolidated Rendering Company, 40 North Market St., Boston, Mass.

Acid Phosphate
Castor Pomace
Corenco Sheep Manure
Dry Ground Fish
Ground Bone
Muriate of Potash
Nitrate of Soda
Sulphate of Ammonia
Sulphate of Potash
Tankage 6-30
Tankage 9-20

C. A. Cowles, Plantsville, Conn.

C. A. Cowles 4-8-4 Fertilizer

C. & R. Sales Co., Worcester, Mass.

C. & R. Lawn Shrub

Davey Tree Expert Company, Inc., Kent, Ohio.

Davey Shredded Cattle Manure
Davey Tree Food

Eastern States Farmers' Exchange, 33 Lyman St., Springfield, Mass.

Eastern States Acid Phosphate
Eastern States Fine Bone Meal
Eastern States High Analysis Fertilizer 8-16-20
Eastern States High Analysis Fertilizer 10-16-14
Eastern States High Analysis Fertilizer 8-16-8
Eastern States High Analysis Fertilizer 4-16-4
Eastern States Muriate of Potash

Eastern States Nitrate of Soda
Eastern States No Filler 3-12-3
Eastern States No Filler Fertilizer 4-8-10
Eastern States No Filler 5-8-7
Eastern States No Filler Fertilizer 5-10-5
Eastern States No Filler Fertilizer 8-6-6
Eastern States Open Formula A Tobacco Fertilizer
Eastern States Sulphate of Ammonia
Eastern States Sulphate of Potash

Ed. Eggert, Hartford, Conn.

Cotton Seed Hull Ashes

Essex Fertilizer Company, 39 North Market St., Boston, Mass.

Essex A1 Superphosphate 2-10-2
Essex Complete Manure 5-8-7
Essex Fish Fertilizer, For All Crops 3-8-4
Essex Market Garden 4-8-4
Essex Tobacco Grower 5-4-5
Essex Top Dressing 7-6-5

Ford Motor Company, Detroit, Michigan.

Ford Ammonium Sulphate

Four Seasons Fertilizer Co., Inc., 135 West 29th St., New York City.

Four Seasons Fertilizer

L. T. Frisbie Co., New Haven, Conn.

Frisbie's Corn and Grain Fertilizer 2-10-2
Frisbie's Fine Bone Meal
Frisbie's 5-8-7
Frisbie's Market Garden 4-8-7
Frisbie's Special 3-8-4
Frisbie's Special Vegetable and Grower 4-8-4
Frisbie's Tobacco Grower 5-4-5
Frisbie's Tobacco Manure 5-8-6
Frisbie's Top Dresser 7-6-5
Frisbie's 3/50 Bone Meal

Grasselli Chemical Company, Cleveland, Ohio.

Grasselli Odorless Plant Food

Humphreys-Godwin Company, Memphis, Tenn.

Bull Brand Cottonseed Meal
Danish Brand Cottonseed Feed
Dixie Brand Cottonseed Meal

International Agricultural Corporation, 126 State St., Boston, Mass.

Acid Phosphate
Basic Slag
Bone Meal
Castor Pomace
Cottonseed Meal 43%
I. A. C. Connecticut Valley Special
I. A. C. Crop Grower
I. A. C. General Favorite
I. A. C. High Grade Manure

I. A. C. Ideal
I. A. C. New England Special
I. A. C. Nitrate of Soda
I. A. C. Tobacco Producer
Rainbow Brand Cottonseed Meal
Special 4-8-6
Sulphate of Potash
Tankage

John Joynt, Lucknow, Ontario, Canada.
Joynt Brand, Wood Ashes

Spencer Kellogg & Sons, Inc., Buffalo, N. Y.
Castor Pomace
Linseed Meal

Kuttroff, Pickhardt & Co., Inc., 1150 Broadway, New York City.
Calcium Nitrate B. A. S. F. (Nitrate of Lime)
Urea B. A. S. F. (Floranid)

Lowell Fertilizer Company, 40 North Market St., Boston, Mass.
Lowell Animal Brand A High Grade Manure 3-8-4
Lowell Bone Fertilizer 2-10-2
Lowell Corn and Vegetable 4-8-4
Lowell Market Garden Manure 5-8-7
Lowell Potato Phosphate 4-8-7
Lowell Top Dressing 7-6-5
Lowell Tobacco 5-4-5
Lowell 8-6-6
Lowell 5-10-5
Lowell 3-12-3

L. B. Lovitt & Company, Memphis, Tenn.
"Lovit Brand" 41%
"Lovit Brand" 43%

The Mapes Formula & Peruvian Guano Co., 270 Madison Ave., New York City.
The Mapes Connecticut Valley Special
The Mapes Corn Manure
The Mapes General Tobacco Manure
The Mapes General Truck Manure
The Mapes General Use Manure
The Mapes Onion Manure
The Mapes Potato Manure
The Mapes Special Trucker
The Mapes Tobacco Ash Constituents
The Mapes Tobacco Ash and Starter
The Mapes Tobacco Manure, Wrapper Brand
The Mapes Tobacco Starter Improved
The Mapes Top Dresser
Pure Fine Ground Bone
Nitrate of Soda
Sulphate of Potash

A. G. Markham & Company, Sprngfield, Mass.
4-8-4
5-8-7

Memphis Cottonseed Products Company, Memphis, Tenn.
Durham Forty-Three Cottonseed Meal

Natural Guano Company, Aurora, Illinois.
"Sheep's Head" Pulverized Sheep Manure

R. N. Neal & Company, Memphis, Tenn.
"Triangle" Brand 41%

New England Fertilizer Company, 40 A North Market St., Boston, Mass.
New England Complete Manure 4-6-10
New England Corn Phosphate 2-10-2
New England Market Garden Manure 5-8-7
New England Potato and Vegetable Manure 4-8-4
New England Superphosphate A High Grade Fertilizer For All Crops 3-8-4
New England Tobacco Manure 5-4-5
New England Top Dressing 7-6-5

Olds & Whipple, Inc., Hartford, Conn.
O & W Acid Phosphate
O & W Castor Pomace
O & W Complete Market Garden Fertilizer
O & W Complete Tobacco Fertilizer
O & W Dry Ground Fish
O & W Grain and General Crop Fertilizer
O & W Grass Fertilizer
O & W High Grade Starter and Potash Compound
O & W High Grade Tobacco Starter
O & W High Grade Vegetable and Potato Fertilizer
O & W Nitrate of Soda
O & W Precipitated Bone
O & W Pure Bone Meal
O & W Tobacco Fertilizer, Blue Label Brand
High Grade Carbonate of Potash, 96-98
High Grade Sulphate of Potash

Old Deerfield Fertilizer Co., Inc., South Deerfield, Mass.
Old Deerfield Castor Pomace
Old Deerfield 7-4-7
Old Deerfield 5-8-7

Pacific Manure & Fertilizer Co., 429 Davis St., San Francisco, Cal.
Grozit Brand (Pulverized Sheep Manure)

Parmenter & Polsey Fertilizer Company, 41 North Market St., Boston, Mass.
"P & P" "AA" Brand 5-8-7
"P & P" Maine Potato Fertilizer 4-6-10
"P & P" Plymouth Rock Brand For All Crops 3-8-4
Parmenter & Polsey Corn and Vegetable 4-8-4

Piedmont Mt. Airy Guano Co., Baltimore, Md.

Harvest Brand 16% Acid Phosphate
Harvest Brand 2-8-2
Harvest Brand 3-8-4
Harvest Brand 4-6-10
Harvest Brand 4-8-4
Harvest Brand 5-8-7
Muriate of Potash
Nitrate of Soda
Piedmont 16% Acid Phosphate
Piedmont 4-8-10 Fertilizer
Piedmont 5-8-7 Fertilizer
Piedmont 8-6-6 Fertilizer
Piedmont 4-6-10 Fertilizer
Piedmont Plow Brand
Piedmont Unexcelled Guano
Steam Bone

Frank S. Platt Co., 450 State St., New Haven, Conn.

Platco Special 5-8-7

Premier Poultry Manure Co., 431 So. Dearborn St., Chicago, Illinois.

Premier Brand Poultry Manure
Premier Brand Sheep Manure

The Pulverized Manure Co., 828 Exchange Ave., Chicago, Illinois.

Wizard Brand Cattle Manure
Wizard Brand Pulverized Sheep Manure

Rackliffe Brothers Company, Inc., New Britain, Conn.

4-8-4 Rackliffe Brand
5-8-7 Rackliffe Brand
Nitrate of Soda

Rocky Mountain Fertilizer Co., Helena, Mont.

Wonder Grower Pulverized Sheep Manure

The Rogers & Hubbard Company, Portland, Conn.

4-8-4
5-8-7
Acid Phosphate
Garden Fertilizer
Hubbard's "Bone Base" Fertilizer for Seeding Down
Hubbard's "Bone Base" Oats and Top Dressing
Hubbard's "Bone Base" Soluble Corn and General Crops Manure
Hubbard's "Bone Base" Soluble Potato Manure
Hubbard's "Bone Base" Soluble Tobacco Manure
Hubbard's Pure Raw Knuckle Bone Flour
Hubbard's Strictly Pure Fine Bone
Nitrate of Potash
Rogers & Hubbard's All Soils-All Crops Fertilizer
Rogers & Hubbard's Climax Tobacco Brand
Rogers & Hubbard's Corn and Grain Fertilizer
Rogers & Hubbard's High Potash Fertilizer
Rogers & Hubbard's Potato Fertilizer
Rogers & Hubbard's Tobacco Grower, Vegetable Formula

F. S. Royster Guano Company, 602 Citizens Nat'l Bank Bldg., Baltimore, Md.

Cottonseed Meal
Nitrate of Soda
Royster's 16% Acid Phosphate
Royster's 5% Truck Guano
Royster's Gem Guano
Royster's Ground Dried Fish Scrap
Royster's Pure Raw Bone Meal
Royster's Quality Trucker
Royster's Rational Guano
Royster's Spearhead Guano
Royster's Top Dresser
Royster's Trucker's Delight
Royster's Valley Tobacco Guano
Sheep Manure
Sulphate of Ammonia
Sulphate of Potash

M. L. Shoemaker & Co., Inc., Venango St. & Delaware Ave., Philadelphia, Pa.

"Swift-Sure"Ammoniated Phos Quick Grower 5-8-7
"Swift-Sure" Four and Half Bone Meal
"Swift-Sure" Tobacco and General Use (Pot. fr. Sulphate) 3-10-3
"Swift-Sure" Tobacco Special
"Swift-Sure" Tobacco Starter 4-10-0

Springfield Rendering Co., Springfield, Mass.

Springfield Animal Brand 3-8-4
Springfield Market Garden Grower and Top Dresser 5-8-7
Springfield Special Potato, Onion and Vegetable 4-8-4
Springfield Tobacco Special 5-4-5
Springfield 4-8-7

Swift & Company Fertilizer Works, Baltimore, Md.

Vigoro

I. P. Thomas & Son Company, 1000 Drexel Bldg., Philadelphia, Pa.

16% Acid Phosphate
Economy Fertilizer 3-12-3
I. P. Thomas 5-8-7
Long Island Special 4-8-7
Muriate of Potash
Nitrate of Soda
Pure Ground Bone
Tankage
Thomas' Fish and Potash Fertilizer 5-8-5
Thomas' Tobacco Grower 5-4-5
Tip-Top Super-Phosphate 3-10-6
Truckers' High Grade Guano 4-8-4
Victor Potash Fertilizer 2-8-5
7% Guano

Triton Oil and Fertilizer Company, 101 Beekman St., New York City.

Acid Phosphate
Nitrate of Soda
Triton 4-8-4 Fertilizer
Triton 4-8-7 Fertilizer

United States Guano Co., Baltimore, Md.

Standard United States 3-9-2
Standard United States 4-8-10
Standard United States 5-8-5
Standard United States 16% Acid Phosphate
Standard United States Bone Meal
Standard United States Ever Green Fish Guano
Standard United States Mammoth Potato Grower
Standard United States Nitrate of Soda
Standard United States Royal Potato Grower

Virginia-Carolina Chemical Corporation, 120 Broadway, New York City.

V-C Aroostook Potato Grower
V-C Fairway Fertilizer
V-C XXXX Fish and Potash

Wilcox Fertilizer Company, Mystic, Conn.

Acid Phosphate
Ground Blood and Meat Tankage
Ground Steamed Bone
Nitrate of Soda, containing Potash
Wilcox Corn Special
Wilcox Dry Ground Fish
Wilcox General Vegetable Phosphate
Wilcox High Grade Fish and Potash
Wilcox Potato Fertilizer
Wilcox Special 4-8-4 Fertilizer
Wilcox 7-6-5 Top Dresser

Worcester Rendering Co., Auburn, Mass.

Prosperity Brand Complete Dressing
Prosperity Brand Corn and Grain Fertilizer
Prosperity Brand Market Garden Fertilizer
Prosperity Brand Potato and Vegetable Fertilizer

S. D. Woodruff & Sons, Orange, Conn.

"Toro" Brand of Sheep Manure
Woodruff's Home Mixed Fertilizer

Wm. P. Young & Son, 22-24 High St., Pottstown, Pa.

Young's Formula A Complete Fertilizer

INSPECTION OF 1927.

During the past season the Station agent has visited 95 towns and villages in the State and has drawn 507 official samples of fertilizers, including all of the registered brands which could be found. These, together with samples submitted by purchasers, and others interested, are classified as follows:

Classification of Fertilizers Analyzed in 1927.

	Number of Samples	Page
I. *Containing Nitrogen as the chief active ingredient.*		
Nitrate of Soda	31	18
Sulphate of Ammonia	8	18
Urea	1	21
Calcium Nitrate	2	21
Castor Pomace	74	22
Cottonseed Meal	174	27
Linseed Meal	8	27
II. *Containing Phosphoric Acid as the chief active ingredient:*		
Precipitated Bone Phosphate	8	35
Superphosphate (Acid Phosphate)	22	37
III. *Containing Potash as the chief ingredient:*		
Carbonate of Potash	11	40
Muriate of Potash	9	40
Sulphate of Potash	22	41
Sulphate of Potash-Magnesia	2	41
Cotton Hull Ashes	12	41
Wood Ashes	14	41
IV. *Containing Nitrogen and Potash:*		
Nitrate of Potash and Soda	3	47
Nitrate of Potash	2	47
V. *Containing Nitrogen and Phosphoric Acid:*		
Dry Ground Fish	34	48
Tankage	8	52
Ground Bone	37	52
VI. *Mixed Fertilizer:*		
Containing Nitrogen and Phosphoric Acid	5	57
Containing Phosphoric Acid and Potash	1	57
Containing Nitrogen, Phosphoric Acid and Potash	243	57
Special and Home Mixtures	39	78
VII. *Miscellaneous fertilizers, amendments, waste products, etc.:*		
Sheep Manure, etc.	17	78
Lime, etc.	21	78
Miscellaneous, including check meals and fertilizers	76	86
Total	884	

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA.

Commercial grades of nitrate of soda contain from 91 to 97 per cent of sodium nitrate, equivalent to from 15 to 16 per cent of nitrogen or 18.2 to 19.5 per cent of ammonia. The salt may contain also small amounts (2 to 3 per cent), of potassium and magnesium chlorides, sodium sulphate and sodium iodide.

Thirty-one samples were analyzed and all met or exceeded guaranties so far as guaranties were given. Seventeen were sampled by the Station agent and the remainder were sampled by purchasers.

The average nitrogen content is 15.52 per cent. Prices quoted ranged from $63.00 to $80.00, the average being about $68.00. Nitrogen from this source has cost about 21.9 cents per pound.

Analyses are given in Table I.

SULPHATE OF AMMONIA.

Ammonium sulphate is chiefly obtained as a by-product in the manufacture of coke and illuminating gas. Commercial grades of this material contain about 20.5 per cent of nitrogen, which is equivalent to 25 per cent of ammonia. It also may contain from ½ to 2 per cent of moisture and a little free sulphuric acid (0.1 to 0.3 per cent).

Arcadian sulphate of ammonia is specially dried and screened to remove lumps and to insure good distribution when applied. It contains less than ½ of 1 per cent of moisture and is usually guaranteed to contain 20.75 per cent of nitrogen.

Eight samples were analyzed and all exceeded 20.5 per cent of nitrogen, the average being 20.67 per cent. Only one ton price was quoted, viz., $69.00, at which the cost of nitrogen is about 16.7 cents per pound.

Analyses are given in Table II.

TABLE I. ANALYSES OF NITRATE OF SODA.

Station No.	Manufacturer or Jobber,	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
6613	American Agricultural Chemical Co., New York	Station agent. Stock of F. S. Bidwell Co., Windsor Locks	15.26	15.22
6623	American Agricultural Chemical Co., New York	J. C. Dufford, Glastonbury	15.40	15.22
6291	Apothecaries Hall Co., Waterbury, Conn.	Hatheway & Steane, Inc., Hartford	15.38	14.80
6338	Apothecaries Hall Co., Waterbury, Conn.	Hatheway & Steane, Inc., Hartford	15.42	14.80
6371	Apothecaries Hall Co., Waterbury, Conn.	Hatheway & Steane, Inc., Hartford	15.66	14.80
6377	Apothecaries Hall Co., Waterbury, Conn.	Hatheway & Steane, Inc., Hartford	15.66	14.80
6611	Apothecaries Hall Co., Waterbury, Conn.	Station agent. Stock of R. W. Hine, Cheshire	15.42	14.80
7144	Apothecaries Hall Co., Waterbury, Conn.	A. N. Shepard & Son, Hartford	15.56	14.80
6699	Armour Fertilizer Works, New York	Station agent. F. A. Bartlett Tree Expert Co., Stamford	15.68	14.81
6637	Berkshire Chemical Co., Bridgeport	Station agent at factory	15.50	15.00
7221	E. D. Chittenden Co., Bridgeport	Station agent. Stock of Fred Schlichting, Broad Brook	15.42	15.00
6701	E. B. Clark Seed Co., Milford	Station agent at factory	15.38	15.00
6633	Consolidated Rendering Co., Boston, Mass.	Station agent. Stock of Frank Libner & Son, Norwalk	15.62	15.22
6957	Consolidated Rendering Co., Boston, Mass.	Daigle Bros., Marion	15.32	15.22
6704	Eastern States Farmer's Exchange, Springfield, Mass.	Station agent. Stock of Stephen Hoyt's Sons, New Canaan	15.44	14.80
5731	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield	15.60	....
5732	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield	15.56	....
5733	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield	15.34	....
5734	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield	15.60	....
6878	International Agricultural Corp., Boston, Mass.	Station agent. Stock of Willimantic Grain Co., Willimantic	15.92	15.00
6657	Mapes Formula & Peruvian Guano Co., New York	Station agent. Stock of Mapes Branch, Hartford	15.34	14.81
6676	Olds & Whipple Inc., Hartford	Station agent. Stock of Silberman & Kahn, Hartford	15.22	15.00
7530	Olds & Whipple Inc., Hartford	John M. Herr, Burnside	15.64	15.00
7184	Piedmont Mt. Airy Guano Co., Baltimore, Md.	Station agent. Stock of Fred H. Rolf, Inc., Guilford	15.42	15.00

TABLE I. ANALYSES OF NITRATE OF SODA—*Concluded*

Station No.	Manufacturer or Jobber,	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
7177	Rackliffe Bros., Co., New Britain	Station agent at factory	15.64	15.00
6845	F. S. Royster Guano Co., Baltimore, Md.	Station agent. Stock of Geo. S. Phelps & Co., Thompsonville	15.38	15.00
6749	I. P. Thomas & Son Co., Philadelphia, Pa.	Station agent. Stock of F. C. Morse & Son, Guilford	15.54	15.00
6922	Triton Oil & Fertilizer Co., New York	Station agent. Stock of Red Wing Feed & Lumber Co., Colchester.	15.38	14.80
7353	United States Guano Co., Baltimore, Md.	Station agent. Stock of E. O. Chapman, North Haven	16.70	15.00
6138	Wessel Duval Co.	Conn. Sumatra Tobacco Co., Buckland	15.32	....
6139	Wessel Duval Co.	Conn. Sumatra Tobacco Co., Buckland	15.54	....

TABLE II. ANALYSES OF SULPHATE OF AMMONIA

Station No.	Manufacturer or Jobber,	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.
6642	The Barrett Company, New York	Station agent. Stock of Berkshire Chemical Co., Bridgeport	20.86	20.75
7140	The Barrett Company, New York	A. N. Shepard & Son, Hartford	20.54	20.75
6956	Consolidated Rendering Co., Boston	Daigle Bros., Marion	20.58	20.50
6635	Consolidated Rendering Co., Boston	Station agent. Stock of L. T. Frisbie Co., New Haven	20.54	20.50
7470	Consolidated Rendering Co., Boston	Station agent. Stock of G. S. Jennings, Southport	20.60	20.50
6702	Eastern States Farmers' Exchange, Springfield, Mass.	Station agent. Stock of Stephen Hoyt's Sons, New Canaan	20.52	20.55
7098	Ford Motor Co., Detroit, Mich.	Manufacturer's sample	21.00	20.80
7181	F. S. Royster Guano Co., Baltimore, Md.	Station agent. Stock of W. S. Brown, Trumbull	20.74	20.56

UREA.

Urea is one of the newer ammoniates and is made synthetically in Europe on a considerable scale. It is a white crystalline substance and the grade offered for fertilizer purposes contains about 45 per cent of nitrogen equivalent to 55 per cent of ammonia. In a pure state urea contains 46.65 per cent of nitrogen.

One sample, **6904**, was analyzed. It was taken by the Station agent from stock of Olds and Whipple, Hartford, the American agents being Kuttroff, Pickhardt and Co., Inc., New York. The salt was guaranteed to contain 46 per cent of nitrogen, equivalent to 55.9 per cent of ammonia, and was found to contain 46.08 per cent of nitrogen equivalent to 55.94 per cent ammonia.

Urea leaves no residue in the soil and it said to equal nitrate of soda in availability. Many tests are being made in this and other States to determine the value of this material for fertilizer purposes.

NITRATE OF LIME.

Nitrate of lime or calcium nitrate is produced by combining lime or limestone with nitric acid. It is produced in large quantities in Europe, where atmospheric nitrogen is utilized for the producton of nitric acid.

The salt absorbs moisture to such an extent that it is shipped in drums or in paper-lined bags. The grade offered for fertilizer purposes contains about 15.5 per cent of nitrogen equivalent to 18.8 per cent of ammonia. The lime (CaO), content is about 30 per cent.

Two samples were examined.

5836. Purchased by the Station for experimental purposes. It contained 15.52 per cent of nitrogen equivalent to 18.87 per cent of ammonia.

6903. Sampled from stock of Olds and Whipple, Hartford; jobbers, Kuttroff, Pickhardt and Co., Inc., New York. The nitrogen found was 15.26 per cent, equivalent to 18.55 per cent ammonia. It was sold under a guaranty of 15 per cent nitrogen, 18.2 per cent ammonia.

CASTOR POMACE.

Castor pomace is the ground residue left after the removal of oil from the castor bean. It should be stored out of reach of farm animals, as it is very poisonous. The material is chiefly valuable as a source of nitrogen, although, like other vegetable ammoniates, cottonseed meal and linseed meal, it contains small amounts of phosphoric acid and potash.

Seventy-four samples have been analyzed. Fifteen were taken officially by the Station agent and the remainder were sampled and submitted by the purchasers.

The material was found to be of very satisfactory quality, only four samples showing less than the guaranteed amount of nitrogen, and these deficiencies did not exceed ¼ of 1 per cent. These goods are generally sold on a guaranty of 4.5 per cent of nitrogen, and the average nitrogen for all the samples examined is 4.80 per cent.

Prices quoted have ranged from $21.50 to $30.00 per ton, which makes the cost of nitrogen about 24 cents per pound.

Analyses are given in Table III.

TABLE III. ANALYSES OF CASTOR POMACE

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	The American Agricultural Chemical Co., New York City.			
6684	.....	Station agent, from stock of Frank Seeman, Milford.....	4.36	4.53
6945	.....	Station agent, from stock of T. J. Barrisford, West Suffield.....	4.64	4.53
7397	.....	Station agent, from stock of Frank Seeman, Milford.....	4.54	4.53
	Apothecaries Hall Co., Waterbury, Conn.			
6621	.....	Station agent, from factory.....	4.50	4.52
6165	Car No. 79553.....	Hatheway & Steane, Inc., Hartford.....	4.52	4.52
6341	Car No. 36425.....	Hatheway & Steane, Inc., Hartford.....	5.09	4.52
6366	Car No. 20094.....	Hatheway & Steane, Inc., Hartford.....	4.63	4.52
6367	Car No. 17835.....	Hatheway & Steane, Inc., Hartford.....	4.99	4.52
6370	Car No. 17786.....	Hatheway & Steane, Inc., Hartford.....	5.21	4.52
6872	Car No. 17776.....	Hatheway & Steane, Inc., Hartford.....	5.50	4.52
7145	Car No. N. H. 73843.....	A. N. Shepard & Sons, Hartford..	5.28	4.52
	Armour Fertilizer Works, New York City.			
6825	.....	Station agent, from stock of Geo. S. Phelps & Co., Thompsonville	5.00	4.52
	Baker Castor Oil Co., New York City.			
5526	Car No. 10534.....	American Sumatra Tobacco Co., Bloomfield.....	4.76	4.50
5527	Car No. 215961.....	American Sumatra Tobacco Co., Bloomfield.....	4.84	4.50
5528	Car No. 16446.....	American Sumatra Tobacco Co., Bloomfield.....	4.77	4.50
5529	Car No. 27497.....	American Sumatra Tobacco Co., Bloomfield.....	4.54	4.50
5530	Car No. 39553.....	American Sumatra Tobacco Co., Bloomfield.....	4.78	4.50
5612	Car No. 33449.....	American Sumatra Tobacco Co., Bloomfield.....	4.67	4.50

TABLE III. ANALYSES OF CASTOR POMACE— *Continued*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Baker Castor Oil Co., New York City			
5613	Car No. 517497	American Sumatra Tobacco Co., Bloomfield	4.74	4.50
5614	Car No. 75043	American Sumatra Tobacco Co., Bloomfield	4.60	4.50
5869	Car No. 597157	American Sumatra Tobacco Co., Bloomfield	4.82	4.50
5949	Car No. 531097	American Sumatra Tobacco Co., Bloomfield	4.71	4.50
5950	Car No. 86131	American Sumatra Tobacco Co., Bloomfield	4.83	4.50
5951	Car No. 17021	American Sumatra Tobacco Co., Bloomfield	4.49	4.50
6036	Car No. 290232	American Sumatra Tobacco Co., Bloomfield	4.81	4.50
6037	Car No. 90385	American Sumatra Tobacco Co., Bloomfield	4.68	4.50
6038	Car No. 510771	American Sumatra Tobacco Co., Bloomfield	4.82	4.50
6075	Car No. 35119	American Sumatra Tobacco Co., Bloomfield	4.89	4.50
6213	Car No. 559133	American Sumatra Tobacco Co., Bloomfield	5.74	4.50
6214	Car No. 568368	American Sumatra Tobacco Co., Bloomfield	5.08	4.50
6215	Car No. 95103	American Sumatra Tobacco Co., Bloomfield	5.34	4.50
6216	Car No. 23648	American Sumatra Tobacco Co., Bloomfield	5.57	4.50
6217	Car No. 76281	American Sumatra Tobacco Co., Bloomfield	5.16	4.50
6220	Car No. 33987	American Sumatra Tobacco Co., Bloomffeld	4.65	4.50
6240	Car No. 560608	American Sumatra Tobacco Co., Bloomfield	5.34	4.50
6950	Car No. 35119	American Sumatra Tobacco Co., Bloomfield	4.88	4.50
6678		Station agent, from stock of Silberman & Kahn, Hartford	4.42	4.50
7344		Station agent, from stock of Rogers & Hubbard, Portland	4.96	4.50
7389		J. E. Phelps, Suffield	4.51	4.50

TABLE III. ANALYSES OF CASTOR POMACE—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Berkshire Chemical Co., Bridgeport, Conn.			
5609		E. N. & C. C. Austin, Suffield	4.86	4.52
6105		L. B. Haas & Co., Hartford	4.50	4.52
6140	Car No. 35351	Conn. Sumatra Tobacco Co., Buckland	4.43	4.52
6141	Car No. 35351	Conn. Sumatra Tobacco Co., Buckland	4.55	4.52
6148	Car Nos. 72453 and 62697	Conn. Sumatra Tobacco Co., Buckland	4.50	4.52
6149	Car Nos. 72453 and 62697	Conn. Sumatra Tobacco Co., Buckland	4.58	4.52
6150	Car Nos. 72453 and 62697	Conn. Sumatra Tobacco Co., Buckland	4.25	4.52
6151	Car Nos. 72453 and 62697	Conn. Sumatra Tobacco Co., Buckland	4.34	4.52
6158	Car No. 80193	Conn. Sumatra Tobacco Co., Buckland	4.40	4.52
6159	Car No. 80193	Conn. Sumatra Tobacco Co., Buckland	4.70	4.52
6294	Car No. 23331	Hatheway & Steane Inc., Hartford	4.49	4.52
6334		Station agent, from stock of L. B. Haas & Co., Hartford	4.57	4.52
6602		Charles A. Huntington, Windsor	4.21	4.52
6865	Car No. N. Y. 84948	Spencer Bros., Inc., Suffield	4.66	4.52
6974		W. S. Pinney, Suffield	4.61	4.52
7169		George F. King, Suffield	4.28	4.52
7345		Station agent, from stock of E. N. Austin, Suffield	4.86	4.52
7399		Station agent, from stock of T. W. Ryan, Stratford	4.94	4.52
	E. D. Chittenden Co., Bridgeport, Conn.			
7222		Station agent, from stock of P. F. Chamberlain, Broad Brook	4.54	4.50
	Consolidated Rendering Co., Boston, Mass.			
7155		Station agent, from stock of Fred Getto, Glastonbury	4.92	4.52
7497		Station agent, from stock of Arthur Manning, Manchester	4.52	4.52

TABLE III. ANALYSES OF CASTOR POMACE—*Concluded.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Old Deerfield Fertz. Co., Inc., South Deerfield, Mass.			
6352	.....	The Allied Tobacco Co., Hartford.	4.83	4.52
6496	Car No. 231910.....	The Allied Tobacco Co., Hartford.	5.14	4.52
6497	Car No. 226655, N. Y. C.....	The Allied Tobacco Co., Hartford.	5.30	4.52
6556	Car No. 247357.....	The Allied Tobacco Co., Hartford.	4.45	4.52
	Olds & Whipple, Inc., Hartford, Conn.			
6695	.....	Station agent, from factory.....	4.74	....
7031	.....	Station agent at factory.....	5.22	5.00
7531	.....	John M. Herr, Burnside.....	5.13	5.00
7041	Thum No. 1.....	Henry E. Wells, Warehouse Point.	5.45	5.00
7042	Thum No. 2.....	Henry E. Wells, Warehouse Point.	5.12	5.00
	The Rogers & Hubbard Co., Portland, Conn.			
7170	.....	George F. King, Suffield.....	5.31	....
	Silberman & Kahn, Hartford, Conn.			
5902	Car No. 13763.....	American Sumatra Tobacco Co., Bloomfield.....	5.03	....
	Manufacturer Unknown			
7029	.....	Marcus Floyd, Hartford.....	4.52	....
7512	.....	Joe Pavano, Plainville.....	5.02	....
6333	.....	Truman H. Hale, Gildersleeve....	4.64	....

COTTONSEED MEAL.

The quality of cottonseed meal purchased for fertilizer during the year is shown by the following summary:

Grade.	No. of samples	Average nitrogen per cent	Average nitrogen, per cent, in 1926	1925	1924
36 per cent protein (5.76 N.).....	12	5.78	5 84	5.87	5.79
41 per cent protein (6.58 N.).....	88	6.56	6.60	6.65	6.76
43 per cent protein (6.88 N.).....	31	7.05	6.78	6.87	7.02
No guaranty reported	43	6.64	...	...	...
Total	174	6.61	...	...	...

Of one hundred and thirty-one samples for which guaranties were given, one hundred and nine substantially equalled or exceeded their guaranties and twenty-two did not.

As for several years past, most of the samples were of the 41 per cent protein grade.

The 43 per cent grade of meal was the only one of the three grades to show any substantial overrun in nitrogen.

In the last four years the nitrogen content of the three grades of meal has remained fairly uniform; however, the 41 per cent grade has shown a slight but constant decrease.

The average nitrogen content of all samples is 6.61 per cent, which is a 41 per cent protein grade.

So far as ton price quotations are available the range has been from $33.50 to $45.00; the average, based on 67 quotations, is $37.00. The cost per pound of nitrogen is 27.8 cents, which is the lowest in several years.

Analyses are given in Table IV.

LINSEED MEAL.

Eight samples of linseed meal were analyzed and all were of good quality. The average nitrogen content is 5.75 per cent. The average of seven price quotations is $47.00 and the cost of nitrogen from this source has been about 41 cents per pound.

Analyses are given in Table IV.

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS.

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	American Agricultural Chemical Co., New York	**Cottonseed Meal**		
7475	.....	Station agent at factory, West Haven.....	7.05	6.58
	Armour Fertilizer Works, New York.			
6881	Armour's 8%.....	Station agent, from stock of Jacob Bantly, Glastonbury.....	6.65	6.58
7495	Armour's 8%.....	Nicholas Schug, Burnside.....	6.62	6.58
	Ashcraft-Wilkinson Co., Atlanta, Ga.			
5531	Car No. 22204.....	American Sumatra Tobacco Co., Bloomfield.....	6.95	....
5616	Car No. 48134.....	American Sumatra Tobacco Co., Bloomfield.....	6.81	....
5026	Paramount, Car No. A. C. L., 35862.....	The Coles Company, Middletown.	5.14	5.76
6152	No. 15, Car Nos. 89224-71886-81058, (Schumacher Oil Works).....	Conn. Sumatra Tobacco Co., Buckland.....	7.21	....
6153	No. 16, Car Nos. 89224-71886-81058, (Schumacher Oil Works).....	Conn. Sumatra Tobacco Co., Buckland.....	6.98	....
6154	No. 17, Car Nos. 89224-71886-81058, (Schumacher Oil Works).....	Conn. Sumatra Tobacco Co., Buckland.....	7.24	....
6155	No. 18, Car Nos. 89224-71886-81058, (Schumacher Oil Works).....	Conn. Sumatra Tobacco Co., Buckland.....	7.18	....
6156	No. 19, Car Nos. 89224-71886-81058, (Schumacher Oil Works).....	Conn. Sumatra Tobacco Co., Buckland.....	7.61	....
6157	No. 20, Car Nos. 89224-71886-81058, (Schumacher Oil Works).....	Conn. Sumatra Tobacco Co., Buckland.....	6.75	....
6144	No. 7, Car No. 75212, (So. Texas Cotton Oil Co.).....	Conn. Sumatra Tobacco Co., Buckland.....	6.95	....
6145	No. 8, Car No. 75212, (So. Texas Cotton Oil Co.).....	Conn. Sumatra Tobacco Co., Buckland.....	7.00	....
6146	No. 9, Car No. 75212, (So. Texas Cotton Oil Co.).....	Conn. Sumatra Tobacco Co., Buckland.....	6.76	....
6147	No. 10, Car No. 75212, (So. Texas Cotton Oil Co.).....	Conn. Sumatra Tobacco Co., Buckland.....	7.24	....
5977	Car No. 76128.....	L. B. Haas & Co., Inc., Hartford..	7.62	....

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed
	Ashcraft-Wilkinson Co., Atlanta, Ga.	**Cottonseed Meal.**		
6544	Helmet, Lot 1.....	E. G. Hastings, Suffield.....	6.77	6.58
6545	Helmet, Lot 2.....	E. G. Hastings, Suffield.....	6.72	6.58
6856	Monarch, Car No. A. C. L. 47316	Spencer Bros., Suffield.....	7.05	6.88
6860	Monarch, Car No. A. C. L. 48532	Spencer Bros., Suffield.....	7.11	6.88
7111	Helmet, Car No. S. A. L. 85058	Spencer Bros., Suffield.....	5.74	6.58
7112	Helmet, Car No. N. S. 4233...	Spencer Bros., Suffield.....	6.05	6.58
7113	Paramount, Car No. Ga. 19026	Spencer Bros., Suffield.....	5.89	5.76
7115	Paramount, Car No. Ga. 7795.	Spencer Bros., Suffield.....	5.84	5.76
7116	Paramount, Car No. Ga. 18586	Spencer Bros., Suffield.....	5.98	5.76
7117	Helmet, Car No. A. C. L. 38286	Spencer Bros., Suffield.....	6.81	6.58
7120	Helmet, Car No. N. S. 20923..	Spencer Bros., Inc., Suffield.....	6.59	6.58
7121	Helmet, Car No. N. S. 4358...	Spencer Bros., Inc., Suffield.....	6.32	6.58
7198	Paramount, Car No. A. C. L. 35483.....	Spencer Bros., Inc., Suffield.....	5.88	5.76
7199	Paramount, Car No. S. A. L. 10918.....	Spencer Bros., Inc., Suffield.....	5.73	5.76
7200	Paramount, Car No. S. L. S. F. 127137.....	Spencer Bros., Inc., Suffield.....	5.58	5.76
5911	Monarch, Car No. M. C. 35205	Steane, Hartman & Co., Hartford.	7.59	6.88
5912	Monarch, Car No. N. Y. N. H. & H. 86622.....	Steane, Hartman & Co., Hartford.	7.50	6.88
5952	Monarch, Car No. N. Y. N. H. & H. 89889.....	Steane, Hartman & Co., Hartford.	7.50	6.88
5953	Monarch, Car No. P. R. R. 19644.....	Steane, Hartman & Co., Hartford.	7.67	6.88
7401	Paramount.....	Station agent, from stock of John Sullivan & Son, Thompsonville.	5.88	5.76
5954	Monarch, Car No. M. C. 8829	Oliver J. Thrall, Windsor.....	7.74	6.88
5955	Monarch, Car No. N. H. 80382	Oliver J. Thrall, Windsor.....	7.70	6.88
5956	Monarch, Car No. H. & T. C. 84975.....	Oliver J. Thrall, Windsor.....	7.69	6.88
5957	Monarch, Car No. N. H. 74649	Oliver J. Thrall, Windsor.....	7.57	6.88
	The Berg Company, Philadelphia, Pa.			
7432	.....	The Conn. Sumatra Tobacco Co., Buckland.....	6.65	....
	F. W. Brode Corp., Memphis, Tenn.			
7087	Owl Brand.....	Station agent, from stock of Jos. Rostek, Jr., Melrose.....	6.70	6.56
7101	Owl Brand.....	Station agent, from stock of L. P. M. Hickey, East Hartford.....	6.57	6.56

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	F. W. Brode Corp., Memphis, Tenn.	**Cottonseed Meal.**		
7171	Owl Brand	Geo. S. Phelps & Co., Thompsonville	6.53	6.56
7172	Owl Brand, Car No. P. & O. 195770	Geo. S. Phelps & Co., Thompsonville	6.72	6.56
7247	Owl Brand, No. 1	A. L. Koster, West Hartford	6.60	6.56
7248	Owl Brand, No. 2	A. L. Koster, West Hartford	6.68	6.56
7249	Owl Brand, No. 3	A. L. Koster, West Hartford	6.91	6.56
7341	Owl Brand	Station agent, from stock of E. N. Austin, Suffield	6.80	6.56
	Humphreys-Godwin Co., Memphis, Tenn.			
5813	Car No. 31497	American Sumatra Tobacco Co., Bloomfield	6.38	....
5814	Car No. 55077	American Sumatra Tobacco Co., Bloomfield	7.85	....
5615	Car No. 77630	American Sumatra Tobacco Co., Bloomfield	6.79	....
5227	Dixie Brand, Car No. 31227	American Sumatra Tobacco Co., Bloomfield	6.44	6.58
5728	Dixie Brand, Car No. 25778	American Sumatra Tobacco Co., Bloomfield	6.60	6.58
5729	Dixie Brand, Car No. 83936	American Sumatra Tobacco Co., Bloomfield	6.20	6.58
5730	Dixie Brand, Car No. 25491	American Sumatra Tobacco Co., Bloomfield	6.58	6.58
5765	Dixie Brand, Car No. 58366	American Sumatra Tobacco Co., Bloomfield	6.49	6.58
5766	Dixie Brand, Car No. 84201	American Sumatra Tobacco Co., Bloomfield	6.82	6.58
5767	Dixie Brand, Car No. 85717	American Sumatra Tobacco Co., Bloomfield	6.34	6.58
5768	Dixie Brand, Car No. 56629	American Sumatra Tobacco Co., Bloomfield	6.50	6.58
5770	Dixie Brand, Car No. 72137	American Sumatra Tobacco Co., Bloomfield	6.50	6.58
5771	Dixie Brand, Car No. 80162	American Sumatra Tobacco Co., Bloomfield	6.55	6.58
5772	Dixie Brand, Car No. 17706	American Sumatra Tobacco Co., Bloomfield	6.27	6.58
5773	Dixie Brand, Car No. 87848	American Sumatra Tobacco Co., Bloomfield	6.60	6.58
5774	Dixie Brand, Car No. 7367	American Sumatra Tobacco Co., Bloomfield	6.46	6.58

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Humphreys-Godwin Co., Memphis, Tenn.	**Cottonseed Meal.**		
5775	Dixie Brand, Car No. 55588	American Sumatra Tobacco Co., Bloomfield	6.47	6.58
5776	Dixie Brand, Car No. 4869	American Sumatra Tobacco Co., Bloomfield	6.45	6.58
5777	Dixie Brand, Car No. 28254	American Sumatra Tobacco Co., Bloomfield	6.82	6.58
5778	Dixie Brand, Car No. 50752	American Sumatra Tobacco Co., Bloomfield	6.49	6.58
6949	Car No. 40100	American Sumatra Tobacco Co., Bloomfield	6.62	....
6222	Dixie Brand, Car No. P. McK & Y 80227	L. B. Haas & Co., Inc., Hartford	6.58	6.58
7166	Dixie Brand, Car No. C & N. W. 47160	L. B. Haas & Co., Inc., Hartford	6.31	6.58
6167	Car No. 167624	Hatheway & Steane, Inc., Hartford	6.30	....
6168	Car No. 164639	Hatheway & Steane, Inc., Hartford	6.11	....
6169	Car No. 170897	Hatheway & Steane, Inc., Hartford	6.69	....
6170	Car No. 57015	Hatheway & Steane, Inc., Hartford	6.36	....
6171	Car No. 248430	Hatheway & Steane, Inc., Hartford	6.71	....
6172	Car No. 159489	Hatheway & Steane, Inc., Hartford	6.66	....
6173	Car No. 10561	Hatheway & Steane, Inc., Hartford	6.60	....
6292	Car No. 15846	Hatheway & Steane, Inc., Hartford	6.34	....
6296	Car No. 226504	Hatheway & Steane, Inc., Hartford	6.65	....
6297	Car No. 82078	Hatheway & Steane, Inc., Hartford	6.69	....
6375	Dixie Brand, Car No. 709598	Hatheway & Steane, Inc., Hartford	6.64	6.58
6870	Dixie Brand, Car No. 56341	Hatheway & Steane, Inc., Hartford	6.33	6.58
7136	Dixie Brand	A. N. Shepard & Son, Hartford	6.66	6.58
7137	Dixie Brand	A. N. Shepard & Son, Hartford	6.66	6.58
6679	Dixie Brand	Station agent, from stock of Silberman & Kahn, Hartford	6.48	6.58
6660	Bull Brand	Station agent, from stock of Spencer Bros., Inc., Suffield	6.99	6.88
6852	Bull Brand, Car Southern 409401	Spencer Bros., Inc., Suffield	6.93	6.88
6853	Bull Brand, Car Southern 150389	Spencer Bros., Inc., Suffield	6.97	6.88
6854	Bull Brand, S. F. 14526	Spencer Bros., Inc., Suffield	6.76	6.88
6855	Bull Brand, I. C. 330213	Spencer Bros., Inc., Suffield	6.88	6.88
6858	Bull Brand, C. B. & Q. 131837	Spencer Bros., Inc., Suffield	6.93	6.88
6861	Bull Brand, I. C. 340615	Spencer Bros., Inc., Suffield	7.02	6.88
6862	Bull Brand, I. C. 342716	Spencer Bros., Inc., Suffield	6.89	6.88
6863	M. C. 98467	Spencer Bros., Inc., Suffield	6.82	6.88
6864	Bull Brand, Southern 253511	Spencer Bros., Inc., Suffield	6.91	6.88

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Humphreys-Godwin Co., Memphis, Tenn.	**Cottonseed Meal.**		
7105	Dixie Brand, Car No. I. C. 156222	Spencer Bros., Inc., Suffield	6.40	6.58
7106	Dixie Brand, Car No. M. C. 52571	Spencer Bros., Inc., Suffield	6.64	6.58
7107	Dixie Brand, Car No. M. C. 99982	Spencer Bros., Inc., Suffield	6.40	6.58
7108	Dixie Brand, Car No. I. C. 155718	Spencer Bros., Inc., Suffield	6.38	6.58
7109	Dixie Brand, Car No. I. C. 247162	Spencer Bros., Inc., Suffield	6.67	6.58
7110	Dixie Brand, Car No. Ga. 51411	Spencer Bros., Inc., Suffield	6.55	6.58
7114	Dixie Brand, Car No. A. C. L. 17546	Spencer Bros., Inc., Suffield	6.67	6.58
7118	Bull Brand, Car No. I. C. 223252	Spencer Bros., Inc., Suffield	6.77	6.88
7119	Dixie Brand, Car No. So. 164943	Spencer Bros., Inc.,Suffield	6.74	6.58
7122	Dixie Brand, Car No. Ga. 55952	Spencer Bros., Inc., Suffield	6.47	6.58
7123	Dixie Brand, Car No. I. C. 247864	Spencer Bros., Inc., Suffield	6.48	6.58
7124	Dixie Brand, Car No. P. & E. 3560	Spencer Bros., Inc., Suffield	6.60	6.58
7201	Dixie Brand, Car No. N. Y. C. 245186	Spencer Bros., Inc., Suffield	6.65	6.58
6101	Dixie Brand, Car No. P. & L. C. 45772	Steane, Hartman & Co., Hartford	6.52	6.58
6102	Dixie Brand, Car No. C. C. C. & St. L 54234	Steane, Hartman & Co., Hartford	6.64	6.58
6103	Dixie Brand, Car No. P. & C. 33168	Steane, Hartman & Co., Hartford	6.42	6.58
6329	Dixie Brand, Car No. A. C. L. 29639	Steane, Hartman & Co., Hartford	6.79	6.58
6330	Dixie Brand, Car No. A. C. L. 43009	Steane, Hartman & Co., Hartford	6.61	6.58
6331	Dixie Brand, Car No. C. C. C. & St. L. 45262	Steane, Hartman & Co., Hartford	6.66	6.58
7013	Dixie Brand, Car No. 19058	L. Wetstone & Sons, Inc., Hartford	6.48	6.58
7014	Dixie Brand, Car No. 21413	L. Wetstone & Sons, Inc., Hartford	6.75	6.58
7015	Dixie Brand, Car No. 42832	L. Wetstone & Sons, Inc., Hartford	6.39	6.58
7016	Dixie Brand, Car No. 31042	L. Wetstone & Sons, Inc., Hartford	6.68	6.58
7017	Dixie Brand, Car No. 84717	L. Wetstone & Sons, Inc., Hartford	6.77	6.58
7018	Dixie Brand, Car No. 51094	L. Wetstone & Sons, Inc., Hartford	6.67	6.58

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Station No.	Manufacturer or Jobber Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found	Per cent Nitrogen. Guaranteed.
	Humphreys-Godwin Co., Memphis, Tenn.	**Cottonseed Meal.**		
7019	Dixie Brand, Car No. 86232	L. Wetstone & Sons, Inc., Hartford	6.68	6.58
7020	Dixie Brand, Car No. 5615	L. Wetstone & Sons, Inc., Hartford	6.53	6.58
7230	Dixie Brand, Car No. 163931	L. Wetstone & Sons, Inc., Hartford	6.69	6.58
6871	Car No. 92703	Hatheway & Steane, Inc., Hartford	6.33	....
7391	Dixie Brand	J. E. Phelps, Suffield	6.63	6.58
7009	Car No. 135931	Hatheway & Steane, Inc., Hartford	6.47	....
5764	Bull Brand	Lawton, Miner & Co., Unionville.	7.02	6.88
7421	Dixie Brand	Station agent, from stock of Geo. A. Peckham, Suffield	6.38	6.58
6885	Danish Brand	Station agent, from stock of S. J. Orr, West Suffield	6.38	5.76
	International Agricultural Corp., Woburn, Mass.			
6947	43%	Huntington Bros., Windsor	6.68	6.88
6952	43%	Huntington Bros., Windsor	6.75	6.88
6973	43%, Car No. 62225	L. B. Haas & Co., Inc., Hartford	6.43	6.88
7167	43%, Car No. 15852	L. B. Haas & Co., Inc., Hartford	6.42	6.88
7168	43%, Car No. 75741	L. B. Haas & Co., Inc., Hartford	6.78	6.88
7072	International Rainbow	Arthur E. Pascoe, Warehouse Point	5.68	5.76
7089	International Rainbow	Station agent, from stock of Geo. S. Phelps & Co., Thompsonville.	5.58	5.76
6550	Zenith, Car No. 67271	Allied Tobacco Co., Hartford	6.68	6.56
6555	Zenith, Car No. 66785	Allied Tobacco Co., Hartford	6.67	6.56
6557	Zenith, Car No. 63710	Allied Tobacco Co., Hartford	6.44	6.56
6558	Zenith, Car No. 66278	Allied Tobacco Co., Hartford	6.57	6.56
6559	Zenith, Car No. 62016	Allied Tobacco Co., Hartford	6.68	6.56
6910	Zenith, Car No. Ga. 7055	Allied Tobacco Co., Hartford	6.61	6.56
6911	Zenith, Car No. 10925	Allied Tobacco Co., Hartford	6.53	6.56
6912	Zenith, Car No. 562078	Allied Tobacco Co., Hartford	6.55	6.56
	Spencer Kellogg & Son, Buffalo, N. Y.			
6342	Car No. 48246	Hatheway & Steane, Inc., Hartford	6.64	6.56
	L. B. Lovitt & Co., Memphis, Tenn.			
7154	Lovit Brand 41%	Station agent, from stock of Berkshire Chemical Co., Bridgeport	6.25	6.56
7268	Lovit Brand 41%	C. D. Cannon, Windsor Locks	7.05	6.56
7160	Lovit Brand 43%	Station agent, from stock of Dayville Coal & Grain Co., Putnam.	6.76	6.88
6301	Car S. P. 17175	S. F. Holcomb & Son, W. Granby.	6.71	....

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	L. B. Lovitt Co., Memphis, Tenn.	**Cottonseed Meal**		
6223	Car No. M. O. P. 27777	N. E. Kendall & Son, Granby	6.70	....
6029	Lovit Brand 43%, Car No. U. P. 19498	Spencer Bros., Inc., Suffield	6.99	6.88
6030	Lovit Brand 43%, Car No. I. C. 246483	Spencer Bros., Inc., Suffield	6.97	6.88
6857	Lovit Brand 41%, Car No. M. & O. 20875	Spencer Bros., Inc., Suffield	6.64	6.56
6859	Lovit Brand 41%, Car No. A. C. L. 28060	Spencer Bros., Inc., Suffield	6.50	6.56
7560	.....	Berkshire Chemical Co., Bridgeport	6.53	....
	Marianna Sales Co., Memphis, Tenn.			
5608	Car No. A. C. L. 40777	The Coles Company, Middletown.	5.75	5.76
	Memphis Cottonseed Products Co., Memphis, Tenn.			
7134	Durham 41%	Hartz Bros., Burnside	6.54	6.56
6672	Durham 43%	John F. Luddy, Elmrose Farm, Hazardville	6.89	6.88
	R. N. Neal & Son, Memphis, Tenn.			
6551	"Triangle" Brand 41%, Car No. 20476	The Allied Tobacco Co., Hartford.	6.49	6.56
6552	"Triangle" Brand 41%, Car No. 335912	The Allied Tobacco Co., Hartford.	5.95	6.56
6553	"Triangle" Brand 41%, Car No. 47285	The Allied Tobacco Co., Hartford.	6.32	6.56
	Manufacturer Unknown.			
6554	Car No. 67729	Allied Tobacco Co., Hartford	6.81	....
6907	No. 1	F. Albert Carlson, New Milford	6.79	....
6908	No. 2	F. Albert Carlson, New Milford	6.67	....
6369	Car No. 34896	Hatheway & Steane, Inc., Hartford	6.54	....
6373	Car No. 109217	Hatheway & Steane, Inc., Hartford	6.87	....
7007	Car No. 4059	Hatheway & Steane, Inc., Hartford	6.51	....
7023	.....	Marcus Floyd, Hartford	7.11	....
7024	.....	Marcus Floyd, Hartford	6.65	....
7025	.....	Marcus Floyd, Hartford	7.00	....
7026	.....	Marcus Floyd, Hartford	6.58	....

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS—*Concluded.*

Station No.	Manufacturer or Jobber, Car. No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Spencer Kellogg & Son, Buffalo, N. Y.	**Linseed Meal.**		
7500	.....	Station agent, from stock of Apothecaries Hall Co., East Windsor	5.47	5.44
6293	Car No. 84219	Hatheway & Steane, Inc., Hartford	5.76	5.44
6295	Car No. 9499	Hatheway & Steane, Inc., Hartford	5.83	5.44
6298	Car No. 8408	Hatheway & Steane, Inc., Hartford	5.79	5.44
6340	Car No. 38957	Hatheway & Steane, Inc., Hartford	5.72	5.44
7138	Car No. N. H. 92027	A. N. Shepard & Son, Hartford	5.68	5.44
	Manufacturer Unknown.			
6365	Car No. 8044	Hatheway & Steane, Inc., Hartford	5.89	....
6378	Car No. 38395	Hatheway & Steane, Inc., Hartford	5.84	....

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

PRECIPITATED BONE PHOSPHATE.

This material is a by-product in the manufacture of gelatin and practically all of the phosphoric acid in it is in the "available" form.

Eight samples were analyzed and all were of good quality, although two fell a little short of their guaranties.

Available phosphoric acid from this source has cost about 5.6 cents per pound so far as can be estimated from the prices quoted.

Analyses are given in Table V.

TABLE V. ANALYSES OF PRECIPITATED BONE PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer	Place of Sampling	Phosphoric Acid			
			Citrate-insoluble.	Total	"Available" Found	"Available" Guaranteed.
	Sampled by Station.		%	%	%	%
6616	Apothecaries Hall Co., Waterbury	At factory	0.84	42.32	41.48	36.00
6640	Berkshire Chemical Co., Bridgeport	At factory	0.48	38.24	37.76	38.00
6694	Olds & Whipple, Inc., Hartford	At factory	0.32	37.94	37.62	38.00
	Sampled by Purchaser.					
7028	.....	Marcus Floyd, Hartford	0.60	39.00	38.40	....
6289	Apothecaries Hall Co., Waterbury, Car No. 88276	Hatheway & Steane, Inc., Hartford	0.85	42.12	41.27	36.00
6372	Apothecaries Hall Co., Waterbury, Car No. 1085	Hatheway & Steane, Inc., Hartford	0.73	42.80	42.07	36.00
7527	Olds & Whipple, Inc., Hartford	John M. Herr, Burnside	0.70	41.90	41.20	38.00
5067	Olds & Whipple, Inc., Hartford	John B. Stewart, Windsor	1.49	43.16	41.67	38.00

SUPERPHOSPHATE (ACID PHOSPHATE).

This important raw material is made by treating finely ground phosphate rock with sulphuric acid. The mixture while still in a fluid condition is run into tanks called "hot dens", where it soon solidifies, after which it is broken up and pulverized to make it suitable for use in fertilizer mixtures.

Superphosphate is a mixture of calcium phosphate (soluble mono-calcium phosphate), and calcium sulphate (gypsum). It contains 16 per cent or more of available phosphoric acid.

Twenty-two samples were analyzed and all met their guaranties with two exceptions, where deficiencies of about 0.4 per cent were found.

The average available phosphoric acid found this year is 16.87 per cent. The average of prices quoted is $20.70 and available acid has therefore cost about 6.2 cents per pound in this raw material.

Analyses are given in Table VI.

TABLE VI. ANALYSES OF SUPERPHOSPHATE (ACID PHOSPHATE).

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid. Citrate-insoluble.	Total.	"Available." Found.	Guaranteed.	Station No.
	Sampled by Station.		%	%	%	%	
6615	American Agricultural Chemical Co., New York	Suffield: Spencer Bros.	0.27	16.94	16.67	16.00	6615
6618	Apothecaries Hall Co., Waterbury	Sampled at factory, East Windsor	0.88	17.11	16.23	16.00	6618
6815	Armour Fertz. Works, New York	Stamford: F. A. Bartlett Tree Expert Co.	0.65	20.85	20.20	20.00	6815
6696	Armour Fertz. Works, New York	Danbury: F. C. Benjamin	0.47	16.77	16.30	16.00	6696
6641	Berkshire Chemical Co., Bridgeport	Sampled at factory	0.13	17.58	17.45	16.00	6641
7219	E. D. Chittenden Co., Bridgeport	Broad Brook: Fred Schlichting	0.91	16.98	16.07	16.00	7219
6700	E. B. Clark Seed Co., Milford	Sampled at factory	0.24	15.83	15.59	16.00	6700
6652	Consolidated Rendering Co., Boston, Mass.	Highwood: H. D. Peters	0.31	18.08	17.77	16.00	6652
6697	Eastern States Farmers' Exchange Springfield, Mass.	New Canaan: Stephen Hoyt & Sons	0.22	16.76	16.54	16.00	6697
7151	International Agricultural Corp., Boston, Mass.	Willimantic: Willimantic Grain Co.	0.30	16.50	16.20	16.00	7151
6739	Olds & Whipple, Inc., Hartford	So. Manchester: F. T. Blish Hardware Co.	0.31	16.46	16.15	16.00	6739
7178	Piedmont Mt. Airy Guano Co., Baltimore, Md.	Plantsville: Mehmel & Sarvi	0.83	17.00	16.17	16.00	7178
6744	Rogers & Hubbard Co., Portland	Sampled at factory	0.30	18.40	18.10	16.00	6744

TABLE VI. ANALYSES OF SUPERPHOSPHATE (ACID PHOSPHATE)—*Continued.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid. Citrate-insoluble.	Total.	"Available." Found.	Guaranteed.	Station No.
			%	%	%	%	
6844	F. S. Royster Guano Co., Baltimore, Md.	Thompsonville: Geo. S. Phelps & Co.	0.38	15.95	15.57	16.00	6844
7476	F. S. Royster Guano Co., Baltimore, Md.	Plainville: F. B. Newton	0.20	17.10	16.90	16.00	7476
6748	I. P. Thomas & Son Co., Philadelphia, Pa.	Guilford: F. C. Morse & Son	1.35	18.35	17.00	16.00	6748
6827	I. P. Thomas & Son Co., Philadelphia, Pa.	Talcottville: Lyman Bros.	1.20	17.80	16.60	16.00	6827
6921	Triton Oil & Fertilizer Co., New York	Colchester: Red Wing Feed & Lumber Co.	0.15	18.40	18.25	16.00	6921
7351	United States Guano Co., Baltimore, Md.	North Haven: E. O. Chapman	0.33	17.30	16.97	16.00	7351
7450	Wilcox Fertilizer Co., Mystic	Willimantic: Jordan Hardware Co.	0.20	17.25	17.05	16.00	7450
	Sampled by Purchaser.						
6955	Consolidated Rendering Co., Boston	Marion: Daigle Bros.	0.95	17.35	16.40	16.00	6955
7027	.....	Hartford: Marcus Floyd	0.30	17.15	16.85	....	7027

III. RAW MATERIALS CHIEFLY VALUABLE FOR POTASH.

CARBONATE OF POTASH.

The commercial grades of carbonate of potash generally contain from 60 to 65 per cent of actual potash (K_2O). The pure and moisture-free salt contains 68.2 per cent K_2O.

Eleven samples of this material were analyzed, three of these being samples taken by the Station agent and the remainder being sampled and sent by purchasers.

The official samples contained well over 65 per cent of potash. Some of the samples submitted by purchasers tested somewhat under 60 per cent. The dealers, Apothecaries Hall Co., advise that their stock was purchased on a guaranty of 65 per cent, but for resale they made the guaranty 61 per cent to insure a margin of safety. The low results are explained by the fact that the goods as sampled contained more moisture than that upon which the original guaranty was based. Potassium carbonate absorbs moisture rather readily and while it may contain as little as 1 per cent or less, it is more likely to contain 5 to 10 per cent as the purchaser receives it. However, if the absorption of moisture takes place after the goods are packed the purchaser is not defrauded because he receives all the potash which was originally packed but in a somewhat more dilute form.

The average potash content in the samples examined is 63.8 per cent. Price quotations are so limited and so variable that an estimated cost per pound for potash is not very informing. According to valuations which we have used this year 11 cents per pound is the accepted figure for potash from this source.

Analyses are given in Table VII.

MURIATE OF POTASH.

Muriate of potash in commercial grades contains about 50.5 per cent of actual potash, which is equivalent to about 80 per cent pure potassium chloride. Guaranties for potash are usually placed at 48 to 50 per cent. The Association of Official Agricultural Chemists has accepted tentatively a standard of not less than 48 per cent potash for this salt.

The nine samples examined all exceeded their guaranties and the average potash content is 51.5 per cent. Potash from this source has cost about 4.6 cents per pound according to the average of quoted prices, viz., $46.00.

Analyses are given in Table VII.

SULPHATE OF POTASH.

This salt usually contains about 48 per cent of actual potash as offered for fertilizer purposes.

Twenty-two samples were analyzed, nine of which were officially drawn by the Station agent. All samples exceeded their guaranties, and the average potash content was slightly over 49.5 per cent. The cost per pound of potash at the average ton price, $53.70, is 5.4 cents.

Analyses are given in Table VII.

SULPHATE OF POTASH-MAGNESIA.

Only two samples of this salt were analyzed and both exceeded their guaranties, which were 26 per cent potash in both cases.

Analyses are given in Table VII.

COTTONHULL ASHES.

Twelve samples of cottonhull ashes have been analyzed. This material is very variable in composition, the potash content having ranged from less than 10 per cent to over 35 per cent. Last year it was found that low potash was associated with very high phosphoric acid content, about 30 per cent.

Analyses are given in Table VII.

WOOD ASHES.

Canada hard wood ashes are used in considerable quantities by tobacco growers in this State, purchases being made on the unit of potash basis. Besides potash wood ashes contain 1 to 3 per cent of phosphoric acid and 30 per cent or more of lime (CaO).

Fourteen samples were analyzed and all except No. **7566** were of good quality. Potash ranged from 4.6 to over 7 per cent.

Analyses are given in Table VII.

TABLE VII. ANALYSES OF POTASH SALTS, ETC.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Carbonate of Potash.				
	Sampled by Station:		%	%	
7157	Apothecaries Hall Co., Waterbury	Sampled at factory	67.01	61.00	7157
6675	A. Klipstein & Son, New York	Hartford: Silberman & Kahn	66.92	....	6675
6741	Olds & Whipple Inc., Hartford	Sampled at factory	65.98	65.00	6741
	Sampled by Purchaser:				
6868	Apothecaries Hall Co., Waterbury, Car No. 83283	Hatheway & Steane, Inc., Hartford	60.64	61.00	6868
6869	Apothecaries Hall Co., Waterbury, Car No. 10626	Hatheway & Steane, Inc., Hartford	59.16	61.00	6869
7008	Apothecaries Hall Co., Waterbury, Car No. 141927	Hatheway & Steane, Inc., Hartford	58.72	61.00	7008
7143	Apothecaries Hall Co., Waterbury, Car No. 73843	A. N. Shepard & Son, Hartford	64.78	61.00	7143
6221	A. Klipstein, New York	American Sumatra Tobacco Co., Bloomfield	65.70	....	6221
6804	Olds & Whipple, Inc., Hartford	L. B. Haas & Co., Hartford	65.16	65.00	6804
7390	Olds & Whipple, Inc., Hartford	J. E. Phelps, Suffield	66.11	65.00	7390
6626	W. S. Pinney, Suffield	P. J. Anderson: Tobacco Station, Windsor	61.88	....	6626
	Muriate of Potash.				
	Sampled by Station:				
7079	American Agricultural Chemical Co., New York	Sampled at factory, New Haven	51.72	50.00	7079
6620	Apothecaries Hall Co., Waterbury	Sampled at factory, East Windsor	52.20	50.00	6620
6698	Armour Fertilizer Works, New York	Stamford: F. A. Bartlett Tree Expert Co.	51.90	48.00	6698
6638	Berkshire Chemical Co , Bridgeport	Sampled at factory	51.77	50.00	6638
7346	Berkshire Chemical Co., Bridgeport	E. N. Austin: Suffield	50.40	50.00	7349
6651	Consolidated Rendering Co., Boston, Mass.	H. D. Peters, Highwood	51.55	50.00	6651

TABLE VII. ANALYSES OF POTASH SALTS, ETC.—*Continued.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash Found.	Potash Guaranteed.	Station No.
	Muriate of Potash				
	Sampled by Station:		%	%	
7075	Eastern States Farmers' Exchange, Springfield, Mass.	Ridgewood Farm, North Haven	51.82	50.00	7075
6746	I. P. Thomas & Son Co., Philadelphia, Pa.	F. C. Morse & Son, Guilford	50.47	50.00	6746
	Sampled by Purchaser:				
6958	Consolidated Rendering Co., Boston, Mass.	Daigle Bros., Marion	51.70	50.00	6958
	Sulphate of Potash.				
	Sampled by Station:				
6614	American Agricultural Chemical Co., New York	Spencer Bros., Suffield	48.76	48.00	6614
6617	Apothecaries Hall Co., Waterbury	Sampled at factory, East Windsor	50.85	48.00	6617
6923	Armour Fertilizer Works, New York	Jacob Bantly, Glastonbury	49.54	48.00	6923
6639	Berkshire Chemical Co., Bridgeport	Sampled at factory	49.04	48.00	6639
6636	Consolidated Rendering Co., Boston, Mass.	L. T. Frisbie Co., New Haven	49.20	48.00	6636
7152	International Agricultural Corp., Boston, Mass.	Willimantic Grain Co., Willimantic	51.41	48.00	7152
7153	Mapes Formula & Peruvian Guano Co., New York	S. J. Orr, West Suffield	49.36	48.00	7153
6740	Olds & Whipple, Inc., Hartford	Sampled at factory	49.21	48.65	6740
6843	F. S. Royster Guano Co., Baltimore, Md.	Geo. S. Phelps & Co., Thompsonville	49.40	48.00	6843
	Sampled by Purchaser:				
6290	Apothecaries Hall Co., Waterbury, Car No. 88276	Hatheway & Steane, Inc., Hartford	50.96	48.00	6290
6299	Apothecaries Hall Co., Waterbury, Car No. 1095	Hatheway & Steane, Inc., Hartford	50.62	48.00	6299
6337	Apothecaries Hall Co., Waterbury, Truck No. 1090	Hatheway & Steane, Inc., Hartford	49.57	48.00	6337
6374	Apothecaries Hall Co., Waterbury, Car No. 78058	Hatheway & Steane, Inc., Hartford	50.20	48.00	6374

TABLE VII. ANALYSES OF POTASH SALTS, ETC.—*Continued.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sulphate of Potash.				
	Sampled by Purchaser:		%	%	
6624	American Agricultural Chemical Co., New York	J. C. Dufford, Glastonbury	48.23	48.00	6624
7139	Apothecaries Hall Co., Waterbury, Car No. 92027	A. N. Shepard & Son, Hartford	50.25	48.00	7139
5532	Hollingshurst Co., New York, Car No. 100022	American Sumatra Tobacco Co., Bloomfield	47.76	....	5532
6142	Olds & Whipple, Inc., Hartford, No. 5	Conn. Sumatra Tobacco Co., Buckland	49.46	48.65	6142
6143	Olds & Whipple, Inc., Hartford, No. 6	Conn. Sumatra Tobacco Co., Buckland	49.80	48.65	6143
6160	Olds & Whipple, Inc., Hartford, No. 23	Conn. Sumatra Tobacco Co., Buckland	49.63	48.65	6160
6161	Olds & Whipple, Inc., Hartford, No. 24	Conn. Sumatra Tobacco Co., Buckland	49.79	48.65	6161
7387	Olds & Whipple, Inc., Hartford	J. E. Phelps, Suffield	49.47	48.65	7387
7528	Olds & Whipple, Inc., Hartford	John M. Herr, Burnside	48.26	48.65	7528
	Sulphate of Potash and Magnesia.				
	Sampled by Station:				
7211	American Agricultural Chemical Co., New York	T. J. Barrisford, West Suffield	27.60	26.00	7211
6643	Apothecaries Hall Co., Waterbury	Sampled at factory, East Windsor	31.34	26.00	6643
	Cotton Hull Ashes.				
	Sampled by Station:				
6875	Ed. Eggert, Hartford	American Agricultural Chemical Co., New Haven	31.19	....	6875
7088	Ed. Eggert, Hartford	Jos. Rostek, Jr., Melrose	33.79	....	7088
7342	Ed. Eggert, Hartford (Dixie)	Jos. Rostek, Jr., Melrose	9.48	13.00	7342
7343	Ed. Eggert, Hartford (Gayoso)	Jos. Rostek, Jr., Melrose	18.64	18.81	7343

TABLE VII. ANALYSES OF POTASH SALTS, ETC.—*Continued.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found	Potash. Guaranteed	Station No.
	Cotton Hull Ashes.				
	Sampled by Station:		%	%	
7626	Ed. Eggert, Hartford	Jos. Rostek, Jr., Melrose	26.06	....	7626
7347	Ed. Eggert, Hartford, Car M. K. T. 84949	Spencer Bros., Suffield	24.22	24.25	7347
	Sampled by Purchaser:				
6631	Ed. Eggert, Hartford	Ed. Eggert, Hartford	33.95	....	6631
6630	Ed. Eggert, Hartford	Ed. Eggert, Hartford	36.76	....	6630
6987	Ed. Eggert, Hartford, Car No. 40493	Ed. Eggert, Hartford	25.23	....	6987
7564	Ed. Eggert, Hartford, Car No. 2272	Ed. Eggert, Hartford	27.38	....	7564
7565	Car No. 2295	Ed. Eggert, Hartford	12.72	....	7565
7022	.....	Marcus Floyd, Hartford	21.78	....	7022
	Wood Ashes.				
	Sampled by Station:				
6944	John Joynt, Lucknow, Canada	J. B. Rose, West Suffield	7.26	3.00	6944
6946	John Joynt, Lucknow, Canada	G. A. Peckham, Suffield	6.03	3.00	6946
6959	John Joynt, Lucknow, Canada	T. J. Clark Est., Simsbury	5.97	3.00	6959
6960	John Joynt, Lucknow, Canada	G. S. Potwine, Warehouse Point	6.88	3.00	6960
	Sampled by Purchaser:				
6287	John Joynt, Lucknow, Canada, Car No. 422783	Allied Tobacco Co., Hartford	6.09	3.00	6287
6288	John Joynt, Lucknow, Canada, Car No. 65215	Allied Tobacco Co., Hartford	4.57	3.00	6288
6364	John Joynt, Lucknow, Canada, Car No. 5187	Hatheway & Steane, Inc., Hartford	6.71	3.00	6364

TABLE VII. ANALYSES OF POTASH SALTS, ETC.—*Concluded.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found	Potash. Guaranteed	Station No.
			%	%	
	Wood Ashes				
	Sampled by Purchaser:				
6866	John Joynt, Lucknow, Canada, Car No. 8314	Hatheway & Steane, Inc., Hartford	6.92	3.00	6866
6867	John Joynt, Lucknow, Canada, Car No. 212783	Hatheway & Steane, Inc., Hartford	5.94	3.00	6867
7006	John Joynt, Lucknow, Canada, Car No. 67461	Hatheway & Steane, Inc., Hartford	6.74	3.00	7006
7231	John Joynt, Lucknow, Canada, Car No. 62657	Ed. Eggert, Hartford	5.63	3.00	7231
7232	John Joynt, Lucknow, Canada, Car No. 60015	Ed. Eggert, Hartford	4.61	3.00	7232
7566	Car No. 2296	Ed. Eggert, Hartford	1.82	....	7566
7233	John Joynt, Lucknow, Canada, Car No. 84756	Olds & Whipple, Inc., Hartford	5.49	3.00	7233

IV. RAW MATERIALS CONTAINING NITROGEN AND POTASH.

Five samples of this group of materials have been examined, three taken by the Station agent and two sent by purchasers.

Analyses are given in Table VIII.

7073. Nitrate of Soda and Potash. Apothecaries Hall Co., Waterbury. Sampled by Station agent, stock of B. H. Barnes, Waterbury.

6934. Nitrate of Soda and Potash. Wilcox Fertilizer Co., Mystic. Sampled by Station agent, stock of Jordan Hardware Co., Willimantic.

6163. Nitrate of Soda and Potash. W. R. Grace & Co., New York. Submitted by L. B. Haas & Co., Inc., Hartford.

6745. Nitrate of Potash. The Rogers & Hubbard Co., Portland. Sampled by Station agent at factory.

6083. Nitrate of Potash. The Rogers & Hubbard Co., Portland. Submitted by L. B. Haas & Co., Inc., Hartford.

TABLE VIII. ANALYSES OF NITRATE OF SODA AND POTASH, ETC.

Station No.	7073	6934	6163	6745	6083
	%	%	%	%	%
Nitrogen:					
found	14.90	14.81	14.16	14.58	14.52
guaranteed	14.80	14.72	....	11.50	30.98
Equivalent to ammonia:					
found	18.12	18.01	17.22	17.73	17.65
guaranteed	18.00	17.90	....	13.98	17.00
Potash:					
found	13.03	12.53	15.97	12.66	12.08
guaranteed	10.00	11.80	....	11.00	11.00

V. RAW MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

DRY GROUND FISH.

Dry ground fish or fish scrap is made from non-edible fish, such as menhaden and dogfish, and the offal from fish canneries. The fish are first steamed and pressed to remove oil and then dried and ground.

Thirty-four samples were analyzed, nine of which were sampled by the Station agent and the remainder sampled and submitted by purchasers.

Six samples showed considerable deficiencies in nitrogen. The guaranties for phosphoric acid were largely exceeded in most cases, but slight shortages were found in two samples.

The average nitrogen content found in this material this year is 8.5 per cent, and the average phosphoric acid content is 6.8 per cent. The average ton price, based on quotations reported, is about $64.00. Allowing 5 cents per pound for phosphoric acid, the cost of nitrogen per pound has been about 33.6 cents.

Analyses are given in Table IX.

TABLE IX. ANALYSES OF DRY GROUND FISH.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Nitrogen.		Ammonia equivalent to total nitrogen.	Phosphoric Acid.		Station No.
			Total found.	Total Guaranteed.		Total found.	Total Guaranteed.	
	Sampled by Station:		%	%	%	%	%	
6659	American Agricultural Chemical Co., New York	F. S. Bidwell Co., Windsor Locks	8.61	8.23	10.47	8.29	6.00	6659
6674	Apothecaries Hall Co., Waterbury	Sampled at factory	8.50	8.20	10.34	7.12	5.00	6674
6924	Armour Fertilizer Works, New York	Jacob Bantley, Glastonbury	8.88	8.23	10.80	9.90	4.00	6924
6335	Berkshire Chemical Co., Bridgeport	L. B. Haas & Co., Hartford	8.39	8.22	10.20	5.92	6.00	6335
6693	Consolidated Rendering Co., Boston, Mass.	H. D. Peters, Highwood	8.23	8.22	10.01	9.18	6.40	6693
6900	Olds & Whipple, Inc., Hartford	Sampled at factory	9.44	8.23	11.48	7.28	5.00	6900
7443	F. S. Royster Guano Co., Baltimore, Md.	John Krancunas, Granby	8.34	8.22	10.14	6.48	3.50	7443
6935	Wilcox Fertilizer Co., Mystic	Sampled at factory	8.46	9.04	10.29	6.38	6.00	6935
7478	Wilcox Fertilizer Co., Mystic	Olds & Whipple, Inc., Hartford	8.20	9.04	9.97	7.55	6.00	7478
	Sampled by Purchaser:							
6622	American Agricultural Chemical Co., New York	J. C. Dufford, Glastonbury	8.70	8.23	10.58	8.10	6.00	6622
6166	Apothecaries Hall Co., Waterbury, Car No. 88690	Hatheway & Steane, Inc., Hartford	9.28	8.20	11.28	7.45	5.00	6166
6300	Apothecaries Hall Co., Waterbury, Car No. 1095	Hatheway & Steane, Inc., Hartford	9.19	8.20	11.17	7.56	5.00	6300

TABLE IX. ANALYSES OF DRY GROUND FISH—*Continued.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Nitrogen		Ammonia equivalent total nitrogen.	Phosphoric Acid.		Station No.
			Total found.	Total Guaranteed.		Total found.	Total Guaranteed.	
	Sampled by Purchaser:		%	%	%	%	%	
6336	Apothecaries Hall Co., Waterbury, Truck No. 1092	Hatheway & Steane, Inc., Hartford.	9.14	8.20	11.11	7.37	5.00	6336
6376	Apothecaries Hall Co., Waterbury, Car No. 78058	Hatheway & Steane, Inc., Hartford.	8.92	8.20	10.84	8.06	5.00	6376
7141	Apothecaries Hall Co., Waterbury, Car No. 92027	A. N. Shepard & Son, Hartford	8.58	8.20	10.43	6.68	5.00	7141
5607	Atlantic Packing Co., New Haven	American Sumatra Tobacco Co., Bloomfield	7.68	8.23	9.34	4.87	....	5607
5610	Atlantic Packing Co., New Haven, Car No. 220794	American Sumatra Tobacco Co., Bloomfield	8.18	8.23	9.95	4.96	....	5610
5611	Atlantic Packing Co., New Haven, Car No. 30491	American Sumatra Tobacco Co., Bloomfield	8.10	8.23	9.85	4.86	....	5611
5621	Atlantic Packing Co., New Haven, Car No. 252740	American Sumatra Tobacco Co., Bloomfield	8.00	8.23	9.73	5.23	....	5621
5622	Atlantic Packing Co., New Haven, Car No. 32902	American Sumatra Tobacco Co., Bloomfield	8.46	8.23	10.29	5.32	....	5622
5725	Atlantic Packing Co., New Haven, Car No. 14689	American Sumatra Tobacco Co., Bloomfield	7.91	8.23	9.62	5.10	....	5725
5726	Atlantic Packing Co., New Haven, Car No. 14195	American Sumatra Tobacco Co., Bloomfield	8.22	8.23	9.99	4.97	....	5726

TABLE IX. ANALYSES OF DRY GROUND FISH—*Concluded.*

Station No.	Manufacturer or Wholesale Dealer	Dealer or Purchaser	Nitrogen.		Ammonia equivalent to total nitrogen	Phosphoric Acid		Station No.
			Total found	Total guaranteed		Total found.	Total guaranteed.	
	Sampled by Purchaser:		%	%	%	%	%	
5810	Atlantic Packing Co., New Haven, Car No. 207025	American Sumatra Tobacco Co., Bloomfield	8.07	8.23	9.81	5.13	....	5810
6948	Atlantic Packing Co., New Haven, Car No. 23276	American Sumatra Tobacco Co., Bloomfield	8.68	8.23	10.55	7.43	....	6948
5749	Berkshire Chemical Co., Bridgeport	A. & S. Hartman, Hartford	8.62	8.22	10.48	7.90	6.00	5749
6104	Berkshire Chemical Co., Bridgeport	L. B. Haas & Co., Inc., Hartford	8.56	8.22	10.41	5.77	6.00	6104
6603	Berkshire Chemical Co., Bridgeport	Chas. A. Huntington, Windsor	8.48	8.22	10.31	5.61	6.00	6603
6211	Consolidated Rendering Co., Boston, Mass., Car No. 49178	American Sumatra Tobacco Co., Bloomfield	8.58	8.22	10.43	7.58	6.40	6211
6212	Consolidated Rendering Co., Boston, Mass., Car No. 19646	American Sumatra Tobacco Co., Bloomfield	8.36	8.22	10.16	7.93	6.40	6212
6218	Consolidated Rendering Co., Boston, Mass., Car No. 23276	American Sumatra Tobacco Co., Bloomfield	8.41	8.22	10.22	8.00	6.40	6218
6219	Consolidated Rendering Co., Boston, Mass., Car No. 25912	American Sumatra Tobacco Co., Bloomfield	8.73	8.22	10.61	7.59	6.40	6219
7529	Olds & Whipple, Inc., Hartford	John M. Herr, Burnside	8.25	8.23	10.03	6.63	5.00	7529
5769	Car No. 245064	American Sumatra Tobacco Co., Bloomfield	8.20	....	9.97	4.90	....	5769
6332	.....	Truman H. Hale, Gildersleeve	8.48	....	10.31	7.69	....	6332

TANKAGE.

This material is meat and bone refuse from various sources. The refuse is steamed and pressed to remove fat and is then dried and ground. Its composition depends upon the proportions of meat and of bone which are present. In general, 5 per cent or less of nitrogen and 15 per cent or more of phosphoric acid indicate considerable admixtures of bone. High grade tankage contains 8 to 10 per cent of nitrogen and 5 to 10 per cent of phosphoric acid.

Garbage tankage is of much less value as a fertilizer and contains usually not over 3.5 per cent of nitrogen and not over 5 per cent of phosphoric acid.

Eight samples of meat and bone tankage were analyzed during the year. Two, and possibly three, of them were essentially bone tankage; the remainder were high in nitrogen and relatively low in phosphoric acid, indicating considerable amounts of meat. All met the guaranties under which they were sold.

Analyses are given in Table X.

GROUND BONE.

Thirty-seven samples of ground bone were analyzed. Twenty-one of them were sampled by the Station agent and the remainder were sampled and submitted by the dealers or purchasers.

Of the official samples only two deficiencies were found, one in nitrogen and one in phosphoric acid.

The average composition of this raw material this year based upon analyses of all samples submitted is 3.12 per cent of nitrogen and 24 per cent of phosphoric acid.

Analyses are given in Table XI.

TABLE X. ANALYSES OF TANKAGE.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen.		Ammonia equivalent to total nitrogen.	Phosphoric Acid.		Mechanical Analysis.		Station No.
			Total found.	Total guaranteed.		Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	
	Sampled by Station:		%	%	%	%	%	%	%	
6619	Apothecaries Hall Co., Waterbury	Sampled at factory	3.79	3.29	4.61	23.64	20.00	50.0	50.0	6619
6683	Apothecaries Hall Co., Waterbury	Chas. Templeton, Waterbury	7.96	7.40	9.68	6.21	3.00	51.0	49.0	6683
6634	Connecticut Fat Rendering & Fertilizer Corp., New Haven	Sampled at factory	3.30	3.29	4.01	22.21	25.00	61.0	39.0	6634
6650	Consolidated Rendering Co., Boston, Mass.	Frank Libner & Son, Norwalk	5.32	4.92	6.47	17.16	14.00	28.0	72.0	6650
6653	Consolidated Rendering Co., Boston, Mass.	L. T. Frisbie Co., New Haven	7.43	7.41	9.03	10.22	9.15	20.0	80.0	6653
7179	I. P. Thomas & Son Co., Philadelphia, Pa.	Wm. Snyder, East Wallingford	7.36	7.40	8.95	11.15	....	45.0	55.0	7179
6933	Wilcox Fertilizer Co., Mystic	M. E. Thompson, Ellington	8.89	7.40	10.81	6.48	4.50	58.0	42.00	6933
	Sampled by Purchaser:									
6954	Consolidated Rendering Co., Boston, Mass.	Daigle Bros., Marion	7.52	7.41	9.14	10.45	9.15	18.0	82.0	6954

TABLE XI. ANALYSES OF GROUND BONE.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Station No.
	Sampled by Station:		%	%	%	%	%	%	%	
6610	American Agricultural Chemical Co., New York	Roodner Feed Co., So. Norwalk	2.65	2.47	3.22	25.36	22.88	72.0	28.0	6610
6612	Apothecaries Hall Co., Waterbury	J. A. Glasnapp, West Cheshire	4.00	3.29	4.86	22.72	20.00	55.0	45.00	6612
6884	Apothecaries Hall Co., Waterbury	Sampled at factory	3.02	2.46	3.67	25.80	22.00	60.0	40.0	6884
6809	Armour Fertilizer Works, New York	F. C. Benjamin, Danbury	2.79	2.47	3.39	23.65	22.00	63.0	37.0	6809
6632	Berkshire Chemical Co., Bridgeport	Frank Libner & Son, Norwalk	4.56	2.47	5.54	19.71	20.00	49.0	51.0	6632
7532	E. D. Chittenden Co., Bridgeport	J. E. Stoddard, Abington	3.31	2.47	4.02	22.40	20.00	41.5	58.5	7532
6661	Consolidated Rendering Co., Boston, Mass.	Geo. S. Phelps & Co., Thompsonville	2.09	2.46	2.54	24.47	22.90	52.0	48.0	6661
7398	Consolidated Rendering Co., Boston, Mass.	Pring Bros., Wallingford	2.92	2.46	3.55	27.00	22.90	52.0	48.0	7398
6703	Eastern States Farmers' Exchange, Springfield, Mass.	Stephen Hoyt's Sons, New Canaan	3.12	2.46	3.79	24.57	23.00	53.0	47.0	6703
6654	L. T. Frisbie Co., New Haven	Sampled at factory	2.98	2.46	3.62	23.50	22.90	53.0	47.0	6654
6655	L. T. Frisbie Co., New Haven	Frank S. Platt Co., New Haven	3.97	3.28	4.83	22.87	22.00	40.0	60.0	6655
6902	International Agricultural Corp., Boston, Mass.	Willimantic Grain Co., Willimantic	2.22	2.47	2.70	25.55	22.00	83.0	17.0	6902
6656	Mapes Formula & Peruvian Guano Co., New York	Mapes Branch, Hartford	4.10	3.29	4.98	20.33	20.00	35.0	65.0	6656
6677	Olds & Whipple, Inc., Hartford	Silberman & Kahn, Hartford	2.86	2.50	3.48	22.65	22.00	63.0	37.0	6677

TABLE XI. ANALYSES OF GROUND BONE—*Continued*

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Station No.
	Sampled by Station		%	%	%	%	%	%	%	
7335	Piedmont Mt. Airy Guano, Baltimore, Md.	Fred H. Rolf, Inc., Guilford	2.66	2.47	3.23	24.15	21.00	42.0	58.0	7335
6658	The Rogers & Hubbard Co., Portland	Cadwell & Jones, Hartford	3.74	3.82	4.55	24.91	24.70	78.0	22.0	6658
6743	The Rogers & Hubbard Co., Portland	Sampled at factory	3.44	3.29	4.18	20.80	20.50	55.0	45.0	6743
7584	M. L. Shoemaker & Co., Philadelphia, Pa.	Olds & Whipple, Inc., Hartford	3.38	3.70	4.11	25.05	21.00	69.0	31.0	7584
6747	I. P. Thomas & Sons Co., Philadelphia, Pa.	F. C. Morse & Son, Guilford	2.75	2.45	3.34	24.10	23.00	61.0	39.0	6747
6847	Wilcox Fertilizer Co., Mystic	M. E. Thompson, Ellington	2.48	2.46	3.02	24.40	22.00	48.0	52.0	6847
	Sampled by Purchaser:									
6625	American Agricultural Chemical Co., New York	J. C. Dufford, Glastonbury	2.55	2.47	3.10	25.56	22.00	47.0	53.0	6625
6174	Apothecaries Hall Co., Waterbury, Car No. 81894	Hatheway & Steane, Inc., Hartford	4.91	3.29	5.97	20.92	20.00	32.0	68.0	6174
6339	Apothecaries Hall Co., Waterbury, Car. No. 160545	Hatheway & Steane, Inc., Hartford	3.96	3.29	4.81	22.97	20.00	57.0	43.0	6339
6368	Apothecaries Hall Co., Waterbury, Car. No. 92564	Hatheway & Steane, Inc., Hartford	4.28	3.29	5.20	21.61	20.00	32.0	68.0	6368
7010	Apothecaries Hall Co., Waterbury, Car No. 150092	Hatheway & Steane, Inc., Hartford	4.13	3.29	5.02	22.10	20.00	43.0	57.0	7010
7142	Apothecaries Hall Co., Waterbury, Car No. N. H. 73843	A. N. Shepard & Son, Hartford	3.94	3.29	4.79	23.35	20.00	58.0	42.0	7142

TABLE XI. ANALYSES OF GROUND BONE—*Concluded*

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. Found.	Nitrogen. Guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Station No.
	Sampled by Purchaser:		%	%	%	%	%	%	%	
5811	Armour Fertilizer Works, New York, Car No. S 41390	American Sumatra Tobacco Co., Bloomfield	2.92	2.47	3.55	26.10	22.00	48.0	52.0	5811
5812	Armour Fertilizer Works, New York, Car No. 78584	American Sumatra Tobacco Co., Bloomfield	2.71	2.47	3.29	26.53	22.00	43.0	57.0	5812
5821	Armour Fertilizer Works, New York, Car No. 84878	American Sumatra Tobacco Co., Bloomfield	2.62	2.47	3.19	26.48	22.00	48.0	52.0	5821
5903	Armour Fertilizer Works, New York, Car No. 58278	American Sumatra Tobacco Co., Bloomfield	2.62	2.47	3.19	26.32	22.00	43.0	57.0	5903
5904	Armour Fertilizer Works, New York, Car No. 149319	American Sumatra Tobacco Co., Bloomfield	2.36	2.47	2.87	27.22	22.00	55.5	44.5	5904
7132	Armour Fertilizer Works, New York, Car No. 22050	American Sumatra Tobacco Co., Bloomfield	2.28	2.47	2.77	27.25	22.00	51.5	48.5	7132
5524	Hollingshurst Co., New York, Car No. 254306	American Sumatra Tobacco Co., Bloomfield	2.75	....	3.34	21.07	....	40.0	60.0	5524
5525	Hollingshurst Co., New York, Car No. 48826	American Sumatra Tobacco Co., Bloomfield	2.59	....	3.15	20.51	....	51.0	49.0	5525
7598	The Rogers & Hubbard Co., Portland	The Rogers & Hubbard Co., Portland	3.34	....	4.06	26.30	24.70	....	....	7598
6750	.....	Elliott A. Gardner, Meriden	1.01	....	1.23	25.64	....	20.0	80.0	6750
7234	.....	Frank L. Davis, Putnam	3.25	....	3.95	22.95	....	53.0	47.0	7234

VI. MIXED FERTILIZERS.

MIXTURES CONTAINING ONLY NITROGEN AND PHOSPHORIC ACID.

Five samples of this group of materials were analyzed.

6882. Ammo Phos. American Cyanamid Co., New York. Sampled by the Station agent from stock of Olds & Whipple, Inc., Hartford, Conn.

7213. Ammo Phos. American Cyanamid Co., New York. Sampled by the Station agent from stock of Olds & Whipple, Inc., Hartford, Conn.

6808. Liberty Lawn Fertilizer. Apothecaries Hall Co., Waterbury. Sampled by the Station agent at factory.

7433. "Swift-Sure" Tobacco Starter 4-10-0. M. L. Shoemaker, Philadelphia, Pa. Sampled by the Station agent from stock of F. T. Blish Hardware Co., South Manchester, Conn.

7426. O & W High Grade Tobacco Starter. Olds & Whipple, Inc., Hartford, Conn. Sampled by the Station agent from stock of Steane, Hartman & Co., Hartford, Conn.

	6882	7213	6808	7433	7426
	%	%	%	%	%
Nitrogen, found	15.60	16.00	4.51	3.46	8.58
guaranteed	16.00	16.00	3.29	3.25	8.23
Ammonia equivalent to nitrogen	18.97	19.45	5.48	3.46	10.43
Phosphoric acid, total	21.80	21.70	13.88	11.73	5.03
available found	21.20	20.82	8.18	10.55	4.33
guaranteed	19.00	19.00	4.00	10.00	3.00

MIXTURES CONTAINING ONLY PHOSPHORIC ACID AND POTASH.

Only one sample in this group was analyzed.

7078. A. A. C. Tobacco Ash Elements. American Agricultural Chemical Co. Sampled by Station agent from stock of Spencer Bros., Suffield.

It contained 5.63 per cent total and 5.35 per cent available phosphoric acid, and 14.32 per cent of potash. It was guaranteed 0-5-15.

MIXTURES CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH.

In Table XII are given analyses of two hundred and forty-three samples of complete fertilizers, all being official samples drawn for inspection purposes by the Station agent.

The A. O. A. C. Committee on Definitions of Terms and Interpretation of Results on Fertilizers urges the practice of including the analysis or grade of fertilizer as a part of the brand name thereof, both by manufacturers in labelling their goods and by control officials in reports and publications. Accordingly, in our analyses the grade is given following the brand name, and for ready comparison, the corresponding items in the analytical results are given in bold face type.

The outstanding facts brought out by the inspection this year may be summarized as follows:

Total number of official samples analyzed		243
Samples considerably deficient in		
one item	69	
two items	8	
three items	1	
total samples deficient		78
Total items of plant food guaranteed (243 x 3)		729
Total items found deficient:		
ammonia	24	
available P_2O_5	30	
potash	34	88
Commercial deficiencies exceeding $1.00 per ton		7

This tabulated statement shows that one-third of the total number of samples analyzed were deficient in one or more of the guaranteed items of plant food; but that less than four per cent were deficient in more than one of such items.

Ammonia, available phosphoric acid and potash being guaranteed in each of the samples analyzed there was a total of seven hundred and twenty-nine guaranties made, of which number eighty-eight were short by considerable amounts; in other words about 12 per cent of the guaranties made were not met and 88 per cent were substantially met or exceeded.

The distribution of deficiencies is about equally divided between ammonia, phosphoric acid and potash. The deficiencies in the most expensive ingredient (ammonia), were fewest in number.

Shortages in money value in excess of $1.00 per ton have been found in only seven samples, which is less than 3 per cent of the total number.

However, guaranties required by law are minimum guaranties in all cases and purchasers are not altogether satisfied when only about two-thirds of the samples examined in an official inspection meet these conditions. With all due allowance for analytical differences which may occur between industrial and control laboratories, it would seem, nevertheless, that a greater number of samples should be found which meet guaranties in all respects.

Concerning Deficient Samples.

The following brands show deficiencies in money value in excess of $1.00 per ton, the approximate amount being arrived at by balancing overruns against shortages and reckoning ammonia at 20 cents, available phosphoric acid at 5½ cents, and potash at 5 cents per pound.

Table XIII. Samples Showing Commercial Deficiencies.

Sta. No.	Brand.	Approximate deficiency in money value per ton.
7057	Eastern States 10-16-14	$4.26
7100	Eastern States 8-6-6	1.83
7339	Essex Top Dresser 7-6-5	2.32
6838	Royster's 5% Truck Guano 5-8-7	1.30[1]
7435	U. S. Guano Co. 4-8-10	7.70[2]
6937	V-C XXXX Fish and Potash	1.68[3]
6932	Wilcox Top Dresser 7-6-5	1.53

[1] Second sample 7480 deficient, but by less than $1.00.
[2] See comment below.
[3] Second sample not deficient.

Sample **7435**, U. S. Guano Co. 4-8-10 shows a large shortage in ammonia and also in potash. The analysis shows that this stock was nearer a 2-8-10 grade than a 4-8-10 and suggested a possible mistake in our sample inasmuch as 2-8-10 goods were in stock at the place of sampling. Another sample could not be secured, but an examination of the inspector's records showed no error; and an examination of the empty sacks at the purchaser's farm showed that the markings were clear and not likely to be confused. The grade 4-8-10 was plainly marked, and in the case of the 2-8-10 goods the grade did not appear at all, but the brand name "Mammoth Potato Grower" was given. We could only conclude that 2-8-10 goods were packed in bags marked 4-8-10 by mistake; but in any event there was a substantial deficiency in potash.

Commercial Deficiencies for a Period of Years.

In a system of inspection where many brands are represented by single analyses the products of the several manufacturers may not be fairly evaluated in any one year. Although it is our purpose to examine at least two samples of any brand showing considerable deficiencies, a second sample is not always obtainable. Comparisons are more informing, therefore, if made upon data covering a period of years. A number of different bases might be chosen for such comparisons, but since it has been our practice for many years to cite brands in which commercial deficiencies amount to one dollar or more per ton, these data have been com-

piled for the 7-year period 1921-1927, and are tabulated in Table XIV. No manufacturer is included unless ten or more samples have been analyzed in the period covered. The compilation shows that of a total of over 1600 samples analyzed less than 10 per cent have fallen short of guaranties to any considerable extent in commercial value. Or, in other words, purchasers have received commercial values represented by the guaranties in over 90 per cent of purchases made.

TABLE XIV. COMMERCIAL DEFICIENCIES FOR THE PERIOD 1921-1927.

Manufacturer.	Total number of samples.	Number equaling or exceeding guaranties in money value.	Per cent for 7 yr. period.	Per cent for 1927.
American Agricultural Chemical Co.	305	293	96	100
Apothecaries Hall Co.	61	61	100	100
Armour Fertilizer Works	73	55	75	100
Atlantic Packing Co.	48	44	92	100
Berkshire Fertilizer Co.	60	60	100	100
Boardman, F. E.	12	12	...[1]	...
Bridges, A. D. & Sons	15	15	100	100
Chittenden, E. D. Co.	45	41	92	100
Clark, E. B., Seed Co.	32	30	94	100
Coe-Mortimer Co.	30	27	...[1]	...
Eastern States Farmers' Exchange	65	54	83	77
Essex Fertilizer Co.	46	45	98	83
Frisbie, L. T. Co.	74	64	87	100
International Agricultural Corp.	59	54	92	100
Lowell Fertilizer Co.	73	65	89	100
Mapes Formula and Peruvian Guano Co.	90	89	99	100
New England Fertilizer Co.	55	52	95	100
Nitrate Agencies	14	11	...	...
Olds & Whipple, Inc.	44	44	100	100
Parmenter & Polsey	25	24	96	100
Piedmont-Mt. Airy Guano Co.	29	20	69	100
Rogers & Hubbard Co., The	97	94	97	100
Royster, F. S. Guano Co.	54	41	76	89
Shoemaker, M. L. & Co.	19	19	100	100
Springfield Rendering Co.	29	27	93	100
Thomas, I. P. & Son	24	24	100[2]	100
United States Guano Co.	16	15	93[2]	75
Virginia-Carolina Chemical Co.	53	49	92	75
Wilcox Fertilizer Co.	56	52	93	83
Worcester Rendering Co.	25	22	88	100
Totals	1628	1503	92	97

[1] No samples in 1927.
[2] For three years.

NEW ENGLAND STANDARD NINE.

The nine fertilizer grades chosen as adequate for all agricultural needs in New England have been represented in the inspection this year as shown in the accompanying summary:

Grade.	No. of Samples.
0-12-6	0
2-12-4	2
3-10-4	2
3-10-6	0
4- 8-4	35
4- 8-6	4
5- 4-5	20
5- 8-7	38
8- 6-6	4
Total	105

In no year since the standard nine was selected has the number of samples taken in official inspection and falling in these respective grades equalled one-half of the total number of samples drawn. We are unable to say what proportion of the total tonnage is represented in these nine grades.

QUALITY OF INSOLUBLE ORGANIC NITROGEN.

Examination of the insoluble organic nitrogen in mixed fertilizers this year has shown no conclusive evidence of inferior ammoniates.

TABLE XII. ANALYSES OF MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH.

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station: **American Agricultural Chemical Co., New York.**														
7210	A. A. C. Tobacco Starter	3-7-16	Ellington	0.08	1.60	0.14	0.79	2.61	3.17	0.27	7.35	7.08	1.28	16.17	7210
6939	Acme Fertilizer	1-9-4	Bloomfield	0.12	0.44	0.38	0.26	1.20	1.46	0.60	9.24	8.64	4.02	4.02	6939
6970	Aroostook Potato Manure	5-8-7	Bloomfield	0.00	3.08	0.52	0.52	4.12	5.01	0.35	8.20	7.85	6.96	6.96	6970
6940	Complete General Fertilizer	3-8-4	Bloomfield	0.02	1.60	0.48	0.48	2.58	3.14	0.45	8.46	8.01	4.00	4.00	6940
7084	Double A Tobacco Fertilizer	5-4-5	Gaylordsville	0.07	1.13	0.36	2.56	4.12	5.01	0.20	4.65	4.45	0.39	4.98	7084
6968	Gladiator Fertilizer	4-8-7	North Haven	0.12	2.32	0.42	0.50	3.36	4.09	0.17	8.14	7.97	7.05	7.05	6968
6765	Grass & Lawn Top Dressing	6-6-4	Middletown	0.35	3.92	0.13	0.54	4.94	6.01	0.15	6.47	6.32	3.75	3.75	6765
6919	Grass & Lawn Top Dressing	6-6-4	Milford	0.92	3.06	0.22	0.58	4.78	5.81	0.38	6.80	6.42	3.99	3.99	6919
7477	Hi-Grade Tobacco Manure	7-4-7	Poquonock	0.45	0.77	0.48	3.91	5.61	6.82	0.20	4.63	4.43	0.69	7.23	7477
6963	Monarch Fertilizer	4-8-4	New Britain	0.22	1.93	0.57	0.53	3.25	3.95	0.55	8.58	8.03	3.90	3.90	6963
6936	Old Hickory Fertilizer	2-8-10	North Haven	0.04	1.00	0.34	0.32	1.70	2.07	0.28	8.46	8.18	10.07	10.07	6936
7533	Patapsco 5-8-7	5-8-7	Silver Lane	0.00	2.78	0.73	0.51	4.02	4.89	0.53	8.24	7.71	6.39	6.39	7533
6768	Bowker's All Round Fertilizer	3-8-4	New Milford	0.21	1.58	0.27	0.46	2.52	3.06	0.26	8.10	7.84	4.05	4.05	6768
6965	Bowker's Market Garden Fertilizer	4-8-4	Willimantic	0.12	2.10	0.47	0.57	3.26	3.96	0.37	8.41	8.04	4.13	4.13	6965
6767	Bowker's Potato & Vegetable Phosphate	2-9-3	New Milford	0.04	0.94	0.40	0.38	1.76	2.14	0.58	9.78	9.20	2.90	2.90	6767
6769	Bowker's Stockbridge Early Crop Manure	5-8-7	New Canaan	0.12	3.08	0.36	0.52	4.08	4.96	0.37	8.23	7.86	6.66	6.66	6769
6926	Bowker's Stockbridge Early Crop Manure	5-8-7	Milldale	0.07	3.09	0.62	0.50	4.28	5.20	0.30	8.50	8.20	6.72	6.72	6926
6969	Bowker's Stockbridge Hill & Drill Fertilizer	4-8-7	Milldale	0.00	2.32	0.43	0.54	3.29	4.00	0.20	8.43	8.23	7.04	7.04	6969
6962	Bowker's Stockbridge Tobacco Manure	5-4-5	New Milford	0.52	0.79	0.49	2.38	4.18	5.08	0.18	4.13	3.95	0.13	5.44	6962
7407	Bowker's Sure Crop Fertilizer	1-9-4	Higganum	0.06	0.28	0.43	0.27	1.04	1.26	0.54	9.50	8.96	4.02	4.02	7407
6993	Bradley's Blood, Bone and Potash	5-8-7	Suffield	0.00	3.11	0.48	0.52	4.11	5.00	0.48	8.88	8.40	6.75	6.75	6993
7083	Bradley's Complete Manure for Potatoes and Vegetables	4-8-7	Bethel	0.00	2.30	0.52	0.56	3.38	4.11	0.30	8.33	8.03	7.08	7.08	7083
6992	Bradley's Complete Tobacco Manure	5-4-5	Suffield	0.29	0.83	0.56	2.46	4.14	5.03	0.20	3.85	3.65	0.39	4.96	6992
6764	Bradley's Eclipse Fertilizer	1-9-4	Meriden	0.08	0.19	0.43	0.24	0.94	1.14	0.45	9.06	8.61	3.92	3.92	6764
6967	Bradley's Northland Potato Grower	4-8-4	Glastonbury	0.30	1.80	0.68	0.53	3.31	4.02	0.65	8.73	8.08	3.68	3.68	6967
7076	Bradley's Potato Fertilizer	2-9-3	Colchester	0.00	1.00	0.47	0.38	1.85	2.25	0.55	9.90	9.35	3.47	3.47	7076
6762	Bradley's Potato Manure	3-8-4	Suffield	0.00	1.55	0.48	0.45	2.48	3.02	0.40	8.45	8.05	3.68	3.68	6762
6918	Bradley's Potato Manure	3-8-4	Meriden	0.00	1.62	0.48	0.47	2.57	3.12	0.52	8.45	7.93	3.88	3.88	6918
6761	Bradley's XL Superphosphate of Lime	3-10-4	Windsor Locks	0.14	1.40	0.52	0.39	2.45	2.98	0.93	11.10	10.17	3.95	3.95	6761
6991	National Aroostook Special Fertilizer	5-8-7	West Cheshire	0.06	3.00	0.47	0.49	4.02	4.89	0.13	8.39	8.26	7.12	7.12	6991
7081	National Complete Tobacco Fertilizer	5-4-5	Simsbury	0.45	0.67	0.22	2.88	4.22	5.13	0.15	4.73	4.58	0.61	5.76	7081
6995	National Market Garden Fertilizer	3-8-4	Middletown	0.00	1.58	0.44	0.45	2.47	3.00	0.27	8.00	7.73	3.90	3.90	6995
6994	National Pine Tree State Potato Fertilizer	4-8-4	Middletown	0.00	2.29	0.48	0.55	3.32	4.04	0.28	8.25	7.97	3.90	3.90	6994
7080	National Premier Potato Manure	4-8-7	Simsbury	0.00	2.34	0.55	0.52	3.41	4.14	0.25	8.33	8.08	6.85	6.85	7080
6998	Sanderson's Atlantic Coast Mixture	3-10-4	West Cheshire	0.26	1.59	0.45	0.43	2.73	3.32	0.88	10.29	9.41	4.26	4.26	6998
7077	Sanderson's Complete Tobacco Grower	5-4-5	Glastonbury	0.49	0.57	0.18	2.76	4.00	4.86	0.23	4.33	4.10	0.63	5.03	7077
6996	Sanderson's Corn Superphosphate	2-9-3	So. Coventry	0.00	1.12	0.40	0.33	1.85	2.25	0.24	9.43	9.19	3.59	3.59	6996
6997	Sanderson's Formula A	4-8-4	So. Coventry	0.00	2.34	0.43	0.57	3.34	4.06	0.43	8.25	7.82	4.19	4.19	6997
7402	Sanderson's Formula A	4-8-4	Woodstock	0.32	1.63	0.73	0.49	3.17	3.85	0.68	8.95	8.27	3.77	3.77	7402
6999	Sanderson's Formula B	4-8-7	West Cheshire	0.82	1.25	0.11	1.30	3.48	4.23	0.26	8.00	7.74	0.70	6.86	6999
7408	Sanderson's Potato Manure	3-8-4	West Haven	0.08	1.52	0.44	0.51	2.55	3.10	0.63	8.83	8.20	3.85	3.85	7408
7074	Sanderson's 5-8-7 Fertilizer	5-8-7	Milford	0.00	3.00	0.44	0.55	3.99	4.85	0.33	8.23	7.90	6.72	6.72	7074

TABLE XII. ANALYSES OF MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	American Agricultural Chemical Co., New York—Continued.														
7161	Sanderson's 5-8-7. Fertilizer	5-8-7	Woodstock	0.13	3.05	0.69	0.41	4.28	5.20	0.30	8.30	8.00	7.07	7.07	7161
7162	Sanderson's 5-8-7. Fertilizer	5-8-7	Woosdtock	0.00	3.37	0.47	0.43	4.27	5.19	0.28	8.85	8.57	6.67	6.67	7162
7206	Sanderson's 5-10-5 Fertilizer	5-10-5	Woodstock	0.29	3.09	0.25	0.49	4.12	5.01	0.43	10.06	9.63	5.31	5.31	7206
7207	Sanderson's 3-12-3 Fertilizer	3-12-3	Woodstock	0.19	1.79	0.37	0.44	2.79	3.39	0.83	11.86	11.03	3.10	3.10	7207
	Apothecaries Hall Co., Waterbury.														
6759	Liberty Corn and All Crops 2-8-2	2-8-2	Cheshire	0.09	0.98	0.00	0.87	1.94	2.36	0.78	9.05	8.27	3.33	3.33	6759
6770	Liberty Corn Fruit and All Crops 2-12-4	2-12-4	Greenwich	0.11	1.20	0.47	0.14	1.92	2.33	1.24	12.88	11.64	4.22	4.22	6770
6766	Liberty Fish Bone and Potash 3-8-3	3-8-3	Waterbury	1.01	1.03	0.00	0.74	2.78	3.38	0.60	8.58	7.98	3.08	3.08	6766
6990	Liberty High Grade Market Gardners Special 5-8-7	5-8-7	Cheshire	0.80	2.78	0.35	0.14	4.07	4.95	0.60	9.08	8.48	7.60	7.60	6990
7055	Liberty Home Vegetable Garden Fertilizer	4-2-5	Waterbury	0.23	0.08	0.52	3.05	3.88	4.72	4.58	11.35	6.77	6.35	6.35	7055
7001	Liberty Onion Special (Potash as Sulphate) 4-8-7	4-8-7	East Windsor	1.30	0.10	0.51	1.68	3.59	4.36	2.14	10.06	7.92	0.89	7.22	7001
7000	Liberty Potato and General Crops 4-8-10	4-8-10	East Windsor	2.42	0.84	0.34	0.11	3.71	4.51	0.68	9.20	8.52	9.89	9.89	7000
6760	Liberty Potato and Market Gardners Special 4-8-4	4-8-4	Cheshire	0.12	2.12	0.36	0.76	3.36	4.09	0.55	9.00	8.45	4.20	4.20	6760
6883	Liberty Potato and Vegetable 2-8-10	2-8-10	East Windsor	0.92	0.80	0.27	0.12	2.11	2.57	0.05	8.15	8.10	11.24	11.24	6883
7158	Liberty Tobacco Special 5-4-5	5-4-5	East Windsor	0.09	1.70	0.00	2.63	4.42	5.37	0.20	6.28	6.08	0.57	5.92	7158
7062	Liberty Top Dresser for Grass and Grain 10-3½-8	10-3½-8	New London	0.82	6.54	0.31	0.21	7.88	9.58	0.30	4.50	4.20	7.64	7.64	7062
7499	Liberty Top Dresser for Grass and Grain 10-3½-8	10-3½-8	East Windsor	0.00	6.60	0.31	1.08	7.99	9.71	0.10	4.65	4.55	9.72	9.72	7499
	Armour Fertilizer Works, New York.														
6925	Armour's Big Crop 4-8-4	4-8-4	Meriden	0.65	2.11	0.28	0.25	3.29	4.00	0.27	8.05	7.78	3.90	3.90	6925
6810	Armour's Big Crop 5-8-7	5-8-7	Danbury	0.76	3.00	0.23	0.10	4.09	4.97	0.28	8.63	8.35	6.84	6.84	6810
6879	Armour's Big Crop 8-6-6	8-6-6	Madison	1.50	4.75	0.20	0.10	6.55	7.96	0.05	7.03	6.98	6.08	6.08	6879
6824	Armour's Big Crop Fertilizer 3-8-4	3-8-4	Thompsonville	0.14	1.86	0.24	0.21	2.45	2.98	0.24	8.41	8.17	4.31	4.31	6824
6886	Armour's Big Crop Fertilizer 4-6-10	4-6-10	Seymour	0.51	2.41	0.31	0.09	3.32	4.04	0.15	6.47	6.32	9.17	9.17	6886
6811	Armour's Big Crop Fertilizer 4-8-4	4-8-4	Danbury	0.62	2.02	0.17	0.22	3.03	3.68	0.25	8.48	8.23	4.48	4.48	6811
7159	Armour's Big Crop Fertilizer 4-16-4	4-16-4	Hampton	0.71	2.39	0.31	0.09	3.50	4.26	0.33	16.30	15.97	3.32	4.01	7159
6823	Armour's Big Crop Tobacco Special 5-4-5	5-4-5	Thompsonville	0.83	0.14	0.13	2.79	3.89	4.73	0.58	5.78	5.20	0.56	5.02	6823
7400	Armour's Corn Grower	2-8-2	Wethersfield	0.29	0.94	0.10	0.21	1.54	1.87	0.45	8.65	8.20	2.11	2.11	7400
	Atlantic Packing Co., New Haven														
6887	Atlantic Grain Fertilizer 2-10-2	2-10-2	Sampled at factory	0.13	1.02	0.21	0.36	1.72	2.09	0.14	10.09	9.95	1.74	2.07	6887
7204	Atlantic 5-4-16	5-4-16	Glastonbury	1.40	1.00	0.37	1.43	4.20	5.11	2.95	9.65	6.70	0.66	17.10	7204
7471	Atlantic Grain Fertilizer 2-10-2	2-10-2	East Hartford	0.03	1.06	0.23	0.32	1.64	1.99	0.38	10.80	10.42	2.03	2.03	7471
7203	Atlantic Special Vegetable 4-8-4	4-8-4	Glastonbury	0.64	1.28	0.55	0.79	3.26	3.96	0.68	8.94	8.26	3.90	3.90	7203
7205	Atlantic Tobacco Manure 5-8-6	5-8-6	East Hartford	1.44	1.30	0.56	0.81	4.11	5.00	0.65	9.05	8.40	0.58	5.98	7205

TABLE XII. ANALYSES OF MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	E. J. Bantle, Glastonbury														
6880	Bantle's Wrapper Brand	7-4-7	Sampled at factory	1.42	1.22	0.49	3.07	6.20	7.54	0.46	5.68	5.22	0.66	7.84	6880
	F. A. Bartlett Tree Expert Co., Stamford.														
6877	Bartlett's Green Tree Food	6-8-4	Sampled at factory	0.02	3.80	0.28	0.92	5.02	6.10	3.14	11.12	7.98	3.62	3.62	6877
	Berkshire Chemical Co., Bridgeport.														
6814	Berkshire Complete Fertilizer	3-8-3	Ridgefield	0.08	2.10	0.21	0.56	2.95	3.59	0.55	9.30	8.75	3.37	3.37	6814
6927	Berkshire Complete Tobacco	5-4-5	Windsorville	1.26	0.14	0.20	2.93	4.53	5.51	0.50	6.05	5.55	0.98	6.40	6927
6928	Berkshire Economical Grass Fertilizer	10-3-8	Sampled at factory	2.06	4.54	0.39	1.08	8.07	9.81	1.98	9.30	7.32	8.73	8.73	6928
6813	Berkshire Grass Special	7-6-5	Ridgefield	1.51	2.54	0.35	1.38	5.78	7.03	0.23	7.80	7.57	5.10	5.10	6813
6807	Berkshire Long Island Special	5-8-7	Guilford	0.04	2.91	0.31	1.24	4.50	5.47	0.25	8.98	8.73	7.32	7.32	6807
6806	Berkshire Market Garden Fertilizer	4-8-4	Guilford	0.10	2.68	0.27	0.63	3.68	4.47	0.38	8.80	8.42	4.36	4.36	6806
6805	Berkshire Potato and Vegetable Phosphate	2-9-3	Norwalk	0.15	1.41	0.00	0.46	2.02	2.46	0.70	10.88	10.18	3.37	3.37	6805
7209	Berkshire Starter 10% Potash	5-8-10	East Granby	0.02	2.74	0.24	1.36	4.36	5.30	0.85	8.78	7.93	2.22	10.67	7209
7212	Berkshire Tobacco Special	7-4-7	Suffield	0.91	0.91	0.19	3.87	5.88	7.15	0.13	4.78	4.65	0.97	8.03	7212
	A. D. Bridges Sons Co., Hazardville.														
7419	A. D. Bridges Sons Special Tobacco Fertilizer.	5-4-5	Somers	0.12	1.06	0.05	3.11	4.34	5.28	0.38	5.23	4.85	0.35	5.78	7419
7061	Corn, Onion, Potato and General Purpose	4-8-4	Sampled at factory	0.83	1.52	0.19	0.92	3.46	4.21	0.68	9.38	8.70	4.23	4.23	7061
	E. D. Chittenden Co., Bridgeport.														
7216	Chittenden's Complete Grain	2-9-3	Bloomfield	0.20	1.50	0.19	0.33	2.22	2.70	0.47	9.28	8.81	3.68	3.68	7216
7217	Chittenden's High Grade Potato 7% Potash	5-8-7	Abington	0.00	3.44	0.28	0.34	4.06	4.94	0.55	8.60	8.05	7.00	7.00	7217
7202	Chittenden's Potato Special 4% Potash	4-8-4	Bloomfield	0.00	2.86	0.13	0.36	3.35	4.07	0.30	8.45	8.15	4.43	4.43	7202
7220	Chittenden's Tobacco Special	5-4-5	Broad Brook	0.16	2.50	0.26	1.36	4.28	5.20	0.13	4.93	4.80	1.28	5.78	7220
7225	Chittenden's Tobacco Starter	4-6-10	Wapping	0.00	3.07	0.09	0.40	3.56	4.33	0.23	6.45	6.22	2.47	9.29	7225
7218	Chittenden's Vegetable and Onion Grower	3-8-4	Tolland	0.03	2.05	0.18	0.32	2.58	3.14	0.48	8.80	8.32	3.82	3.82	7218
	E. B. Clark Seed Co., Milford.														
6816	Special Mixture General Use	4-8-4	Sampled at factory	0.21	2.02	0.05	1.04	3.32	4.04	2.18	9.75	7.57	3.40	4.15	6816
7063	Special Mixture with 6% Potash	4-8-6	Branford	0.00	2.32	0.30	0.78	3.40	4.13	0.48	9.03	8.55	6.25	6.25	7063
7064	Superphosphate	5-8-7	Branford	0.00	3.00	0.41	0.90	4.31	5.24	0.33	8.48	8.15	7.07	7.07	7064
7053	Tip Top Brand	5-10-5	Sampled at factory	0.04	3.44	0.14	0.46	4.08	4.96	0.40	10.48	10.08	5.06	5.06	7053
	C. A. Cowles, Plantsville.														
7054	C. A. Cowles 4-8-4 Fertilizer	4-8-4	Sampled at factory	0.12	2.16	0.51	0.57	3.36	4.09	0.38	8.90	8.52	4.12	4.12	7054
	C & R. Sales Corp., Worcester, Mass.														
7208	C. & R. Lawn and Shrub	6-5-5	Norwich	0.18	0.98	1.17	2.94	5.27	6.41	1.18	7.68	6.50	6.12	6.12	7208
	Davey Tree Expert Co., Kent, Ohio.														
7082	Davey Tree Food	7-7.3-3	Sound Beach	0.00	3.44	0.45	2.03	5.92	7.20	1.58	9.90	8.32	3.40	3.40	7082

TABLE XII. ANALYSES OF MIXED FERTILIZERS

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	Eastern States Farmers' Exchange, Springfield, Mass.														
7059	Eastern States High Analysis Fertilizer 8-16-20	8-16-20	North Haven	1.52	3.26	0.13	1.21	6.12	7.44	0.95	16.45	15.50	22.56	22.56	7059
7057	Eastern States High Analysis Fertilizer 10-16-14	10-16-14	North Haven	1.35	4.77	0.44	1.33	7.89	9.59	1.03	15.42	14.39	13.15	13.15	7057
7099	Eastern States No-Filler 3-12-3	3-12-3	Granby	0.10	1.84	0.32	0.39	2.65	3.22	1.08	13.05	11.97	3.83	3.83	7099
7060	Eastern States No-Filler 4-8-10	4-8-10	North Haven	0.41	1.92	0.70	0.26	3.29	4.00	0.51	8.45	7.94	9.24	9.24	7060
7056	Eastern States No-Filler 5-8-7	5-8-7	North Haven	0.46	2.39	0.37	0.82	4.04	4.91	0.25	8.68	8.43	6.59	6.59	7056
7058	Eastern States No-Filler Fertilizer 5-10-5	5-10-5	North Haven	0.54	2.22	0.38	0.86	4.00	4.86	0.63	10.93	10.30	4.49	4.49	7058
7100	Eastern States No-Filler Fertilizer 8-6-6	8-6-6	Unionville	2.48	1.88	0.86	0.80	6.02	7.32	0.50	7.00	6.50	6.34	6.34	7100
7338	Open Formula A Tobacco Fertilizer	6.5-4.25-5.50	Feeding Hills	0.95	0.17	0.32	3.85	5.29	6.43	0.28	6.60	6.32	0.41	4.11	7338
7420	Open Formula A Tobacco Fertilizer	6.5-4.25-5.50	Thompsonville	1.20	0.12	0.08	3.99	5.39	6.55	0.23	5.65	5.42	1.02	6.54	7420
	Essex Fertilizer Co., Boston, Mass.														
7336	Essex A 1 Superphosphate 2-10-2	2-10-2	Rockville	0.04	0.68	0.56	0.54	1.82	2.21	1.15	11.15	10.00	1.91	1.91	7336
7215	Essex Complete Manure 5-8-7	5-8-7	Wallingford	0.28	2.69	0.45	0.66	4.08	4.96	0.55	8.58	8.03	6.55	6.55	7215
7095	Essex Fish Fertilizer, For All Crops 3-8-4	3-8-4	Wallingford	0.00	1.42	0.49	0.70	2.61	3.17	0.48	8.70	8.22	4.05	4.05	7095
7094	Essex Market Garden 4-8-4	4-8-4	Wallingford	0.15	2.08	0.50	0.91	3.64	4.43	0.68	8.90	8.22	4.05	4.05	7094
7224	Essex Tobacco Grower 5-4-5	5-4-5	Wapping	0.85	0.83	0.38	2.07	4.13	5.02	0.35	5.38	5.03	0.74	6.05	7224
7339	Essex Top Dressing 7-6-5	7-6-5	West Stafford	0.07	4.69	0.31	0.13	5.20	6.32	0.48	6.81	6.33	5.04	5.04	7339
	L. T. Frisbie Co., New Haven.														
7090	Frisbie's 5-8-7	5-8-7	Clintonville	0.54	2.24	0.63	0.79	4.20	5.11	1.08	9.83	8.75	6.92	6.92	7090
7474	Frisbie's 5-8-7	5-8-7	Norwich	0.48	2.17	0.85	0.77	4.27	5.19	0.95	9.43	8.48	7.10	7.10	7474
7092	Frisbie's Corn and Grain Fertilizer 2-10-2	2-10-2	Danbury	0.03	0.97	0.33	0.53	1.86	2.26	1.15	11.15	10.00	2.02	2.02	7092
7156	Frisbie's Market Garden 4-8-7	4-8-7	Buckland	0.73	1.20	0.62	0.76	3.31	4.02	0.55	8.80	8.25	6.55	6.55	7156
7096	Frisbie's Special 3-8-4	3-8-4	New Haven	0.36	1.13	0.43	0.69	2.61	3.17	1.03	9.20	8.17	4.00	4.00	7096
7091	Frisbie's Special Vegetable and Potato Grower.	4-8-4	Danbury	0.77	1.44	0.57	0.58	3.36	4.09	1.10	9.53	8.43	4.09	4.09	7091
7223	Frisbie's Tobacco Grower 5-4-5	5-4-5	Burnside	1.64	0.04	0.28	2.14	4.10	4.98	0.50	5.35	4.85	0.86	5.82	7223
7423	Frisbie's Tobacco Manure	5-8-6	Burnside	1.18	1.34	0.80	0.68	4.00	4.86	0.75	9.55	8.80	0.66	6.03	7423
7097	Frisbie's Top Dresser 7-6-5	7-6-5	Orange	1.74	2.57	0.94	0.89	6.14	7.47	1.23	7.80	6.57	4.76	4.76	7097
	International Agricultural Corp. Boston, Mass.														
7330	I. A. C. Crop Grower	5-8-7	Willimantic	0.33	2.38	0.30	1.09	4.10	4.98	0.18	8.33	8.15	7.02	7.02	7330
7424	I. A. C. High Grade Manure 4-8-10	4-8-10	Rockville	0.42	1.90	0.13	0.80	3.25	3.95	2.53	10.65	8.12	10.73	10.73	7424
7331	I. A. C. Ideal	4-8-4	Willimantic	0.54	1.73	0.20	0.84	3.31	4.02	0.10	8.10	8.00	4.12	4.12	7331
7427	I. A. C. Tobacco Producer 5-4-5	5-4-5	Suffield	0.02	2.10	0.37	2.17	4.66	5.67	0.06	3.33	3.27	1.37	6.82	7427
7425	I. A. C. Connecticut Valley Special	7-4-7	Rockville	0.16	2.04	1.49	2.21	5.90	7.17	0.09	3.98	3.89	0.58	7.18	7425
7214	Special 4-8-6	4-8-6	Willimantic	0.64	1.74	0.09	0.71	3.18	3.87	0.13	8.28	8.15	5.85	5.85	7214
	Lowell Fertilizer Co., Boston, Mass.														
7260	Lowell Animal Brand, A High Grade Manure 3-8-4	3-8-4	Southington	0.00	1.33	0.50	0.62	2.45	2.98	0.92	8.51	7.59	3.82	3.82	7260

TABLE XII. ANALYSES OF MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	Lowell Fertilizer Co., Boston, Mass.														
7261	Lowell Bone Fertilizer 2-10-2	2-10-2	Southbury	0.05	0.61	0.47	0.60	1.73	2.10	1.08	10.06	8.98	2.35	2.35	7261
7258	Lowell Corn and Vegetable 4-8-4	4-8-4	Southington	0.20	2.02	0.36	0.73	3.31	4.02	0.80	8.38	7.58	4.11	4.11	7258
7416	Lowell Market Garden Manure 5-8-7	5-8-7	Somersville	0.25	2.92	0.57	0.56	4.30	5.23	0.35	8.58	8.23	6.83	6.83	7416
7262	Lowell Market Garden Manure 5-8-7	5-8-7	Milford	1.00	2.06	0.51	0.77	4.34	5.28	0.70	8.83	8.13	4.90	6.82	7262
7259	Lowell Potato Phosphate 4-8-7	4-8-7	Southington	0.25	2.02	0.35	0.71	3.33	4.05	0.91	8.35	7.44	7.42	7.42	7259
7267	Lowell Tobacco 5-4-5	5-4-5	Ellington	0.94	0.86	0.29	2.17	4.26	5.18	0.20	5.10	4.90	1.06	5.74	7267
7266	Lowell Top Dressing 7-6-5	7-6-5	Ellington	1.32	2.98	0.83	0.75	5.88	7.15	0.80	7.08	6.28	3.35	4.99	7266
6681	Lowell 3-12-3	3-12-3	Cheshire	0.12	1.47	0.57	0.47	2.63	3.20	0.74	13.07	12.33	2.50	3.20	6681
6680	Lowell 5-10-5	5-10-5	Cheshire	0.12	2.71	0.77	0.71	4.31	5.24	0.75	11.02	10.27	5.14	5.35	6680
7417	Lowell 5-10-5	5-10-5	Orange	0.00	2.62	1.02	0.68	4.32	5.25	0.88	11.05	10.17	5.13	5.13	7417
6682	Lowell 8-6-6	8-6-6	Cheshire	3.63	0.77	1.25	1.06	6.71	8.16	0.61	6.95	6.34	6.27	6.27	6682
	Mapes Formula and Peruvian Guano Co., New York.														
6984	Mapes Conn. Valley Special	6-4-7	East Granby	1.86	0.14	0.42	2.58	5.00	6.08	1.13	6.55	5.42	0.58	8.07	6984
6897	Mapes Corn Manure	3-8-3	Hartford	0.72	1.38	0.13	0.48	2.71	3.29	1.60	11.18	9.58	2.41	3.22	6897
6985	Mapes General Tobacco Manure	5-4-5	East Granby	1.71	0.10	0.42	2.45	4.68	5.69	1.38	6.03	4.65	0.39	5.95	6985
6898	Mapes General Truck Manure	5-6-5	Hartford	0.73	2.93	0.17	0.34	4.17	5.07	0.93	9.35	8.42	4.72	5.67	6898
6976	Mapes General Use Manure	3-6-4	Windsor Locks	1.06	1.23	0.03	0.32	2.64	3.21	0.83	8.55	7.72	3.02	4.54	6976
7263	Mapes Onion Manure	4-6-4	Hartford	1.03	1.96	0.03	0.33	3.35	4.07	0.70	7.75	7.05	0.23	4.49	7263
6896	Mapes Potato Manure	4-7-5	Hartford	0.82	2.08	0.06	0.36	3.32	4.04	1.25	10.68	9.43	4.95	4.95	6896
7257	Mapes Special Trucker	5-8-7	Hartford	0.62	2.97	0.19	0.39	4.17	5.07	1.08	11.93	10.85	7.21	7.21	7257
7264	Mapes Tobacco Ash Constituents	1-4-15	East Granby	0.49	0.08	0.18	0.65	1.40	1.70	1.85	6.93	5.08	0.70	15.35	7264
7274	Mapes Tobacco Ash and Starter	4-6-15	East Granby	2.72	0.02	0.33	0.55	3.62	4.40	1.73	7.88	6.15	0.82	17.04	7274
7405	Mapes Tobacco Manure, Wrapper Brand	7.5-2-10.5	East Granby	2.65	0.15	0.00	4.02	6.82	8.29	1.53	5.63	4.10	0.88	11.76	7405
6977	Mapes Tobacco Starter Improved	5-6-1	Windsor Locks	1.51	1.88	0.24	1.13	4.76	5.79	2.08	8.73	6.65	0.27	1.71	6977
7256	Mapes Top Dresser	10-4-2	Hartford	5.19	2.51	0.17	0.40	8.27	10.05	0.45	7.45	7.00	0.25	2.66	7256
	A. G. Markham & Co., Springfield, Mass.														
7281	4-8-4	4-8-4	Stafford Springs	0.37	1.50	0.78	0.71	3.36	4.09	0.83	8.55	7.72	4.10	4.10	7281
7282	5-8-7	5-8-7	Stafford Springs	0.44	2.37	0.67	0.76	4.24	5.15	0.90	8.92	8.02	7.02	7.02	7282
	New England Fertilizer Co., Boston, Mass.														
7271	New England Complete Manure 4-6-10	4-6-10	Meriden	0.16	1.98	0.47	0.75	3.36	4.09	0.69	6.60	5.91	9.97	9.97	7271
6978	New England Corn Phosphate 2-10-2	2-10-2	Rockville	0.04	0.63	0.49	0.49	1.65	2.01	1.07	10.38	9.31	1.98	1.98	6978
6980	New England Market Garden Manure 5-8-7	5-8-7	Meriden	0.15	2.81	0.53	0.67	4.16	5.06	0.70	8.38	7.68	7.21	7.21	6980
6979	New England Potato and Vegetable Manure 4-8-4	4-8-4	Chester	0.26	2.00	0.46	0.70	3.42	4.16	0.75	8.65	7.90	4.02	4.02	6979
6986	New England Superphosphate, A High Grade Fertilizer for All Crops 3-8-4	3-8-4	Unionville	0.07	1.41	0.48	0.75	2.71	3.29	1.05	8.89	7.84	4.02	4.02	6986
7404	New England Tobacco Manure 5-4-5	5-4-5	Unionville	0.88	0.88	0.28	2.20	4.24	5.15	0.45	5.33	4.88	1.39	6.07	7404
7273	New England Top Dressing 7-6-5	7-6-5	Chester	0.00	5.14	0.31	0.09	5.54	6.74	0.58	7.33	6.75	5.16	5.16	7273

TABLE XII. ANALYSES OF MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	Old Deerfield Fertilizer Co., So. Deerfield, Mass.														
7277	Old Deerfield 5-8-7	5-8-7	Suffield	0.79	1.30	1.24	0.62	3.95	4.80	0.98	9.43	8.45	6.96	6.96	7277
7276	Old Deerfield 7-4-7	7-4-7	Suffield	0.89	0.41	1.49	3.39	6.18	7.51	0.15	5.28	5.13	0.97	7.74	7276
	Olds & Whipple, Inc., Hartford														
6975	O & W Complete Market Garden Fertilizer	4-8-4	So. Manchester	0.63	2.02	0.18	0.69	3.52	4.28	0.40	8.83	8.43	4.20	4.20	6975
7280	O & W Complete Tobacco Fertilizer	5-4-5	E. Windsor Hill	0.03	1.08	0.08	3.09	4.28	5.20	0.38	5.03	4.65	0.31	5.54	7280
6982	O & W Grain and General Crop Fertilizer	2-9-3	Sampled at factory	0.44	0.88	0.01	0.60	1.93	2.35	0.60	10.18	9.58	3.41	3.41	6982
6899	O & W Grass Fertilizer	6-6-4	So. Manchester	2.40	2.46	0.19	0.11	5.16	6.27	0.50	6.90	6.40	4.86	4.86	6899
6981	O & W High Grade Vegetable and Potato Fertilizer	5-8-7	Wethersfield	0.96	2.20	0.20	1.08	4.44	5.40	0.68	8.90	8.22	0.66	7.08	6981
6983	O & W High Grade Starter and Potash Compound	5-4-15	Burnside	1.09	0.86	0.26	2.01	4.22	5.13	0.45	5.40	4.95	1.02	16.12	6983
6964	O & W Tobacco Fertilizer Blue Label Brand	6-3-6	Manchester	0.17	1.18	0.37	3.42	5.14	6.25	0.23	3.95	3.72	0.40	6.90	6964
	Parmenter & Polsey, Boston, Mass.														
7403	P & P A. A. Brand 5-8-7	5-8-7	Plainville	0.16	2.66	0.51	0.75	4.08	4.96	0.40	8.65	8.25	6.57	6.57	7403
7534	P & P Corn and Vegetable 4-8-4	4-8-4	Plainville	0.00	2.02	0.31	0.86	3.19	3.88	0.75	8.06	7.31	4.00	4.00	7534
7278	P & P Maine Potato Fertilizer 4-6-10	4-6-10	Wallingford	0.33	2.09	0.39	0.69	3.50	4.26	0.57	6.53	5.96	9.83	9.83	7278
7406	P & P Plymouth Rock Brand for All Crops 3-8-4	3-8-4	Hartford	0.10	1.30	0.56	0.71	2.67	3.25	1.10	8.95	7.85	4.03	4.03	7406
	Piedmont Mt. Airy Guano Co., Baltimore, Md.														
7275	Piedmont 4-6-10 Fertilizer	4-6-10	Seymour	0.00	2.50	0.20	0.54	3.24	3.94	1.00	7.45	6.45	9.67	9.67	7275
6972	Piedmont 5-8-7 Fertilizer	5-8-7	Seymour	0.09	2.91	0.51	0.46	3.97	4.83	1.25	9.33	8.08	6.60	6.60	6972
6971	Piedmont 8-6-6 Fertilizer	8-6-6	Seymour	0.22	5.13	0.44	0.36	6.15	7.48	0.85	7.70	6.85	6.17	6.17	6971
7334	Piedmont Plow Brand	2-8-2	Guilford	0.04	0.82	0.39	0.43	1.68	2.04	1.83	10.05	8.22	2.79	2.79	7334
7279	Piedmont Unexcelled Guano	4-8-4	Plantsville	0.06	2.22	0.33	0.58	3.19	3.88	1.14	9.03	7.89	4.24	4.24	7279
	Frank S. Platt Co., New Haven.														
6961	Platco Special	5-8-7	Sampled at factory	0.38	2.66	0.52	0.60	4.16	5.06	1.15	9.23	8.08	6.97	6.97	6961
	Rackliffe Bros. Co., New Britain.														
7175	4-8-4 Rackliffe Brand	4-8-4	Sampled at factory	0.18	1.30	0.88	0.76	3.12	3.79	0.58	8.63	8.05	3.80	3.80	7175
7176	5-8-7 Rackliffe Brand	5-8-7	Sampled at factory	1.33	1.27	0.63	0.79	4.02	4.89	0.80	9.48	8.68	6.70	6.70	7176
	The Rogers & Hubbard Co., Portland.														
7272	4-8-4	4-8-4	Willimantic	0.04	2.38	0.46	0.42	3.30	4.01	0.38	8.65	8.27	4.09	4.09	7272
7439	5-8-7	5-8-7	Norwich	0.00	3.42	0.51	0.34	4.27	5.19	0.28	8.43	8.15	7.16	7.16	7439
6836	Garden Fertilizer	2-8-4	Hartford	0.10	0.82	0.61	0.42	1.95	2.37	0.60	8.63	8.03	4.35	4.35	6836
6820	Hubbard's "Bone Base" Fertilizer for Seeding Down	3-5-6	Sampled at factory	0.09	0.21	0.32	2.06	2.68	3.26	5.35	12.03	6.68	6.92	6.92	6820
6818	Hubbard's "Bone Base" Oats and Top Dressing	10-3-8	Higganum	7.75	0.08	0.48	0.15	8.46	10.29	1.98	8.48	6.50	5.06	8.31	6818

TABLE XII. ANALYSES OF MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Continued.*

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	The Rogers and Hubbard Co., Portland.														
7265	Hubbard's "Bone Base" Soluble Corn and General Crops	3-8-6	Branford	0.07	0.80	0.96	0.81	2.64	3.21	2.25	9.83	7.58	6.63	6.63	7265
7543	Hubbard's "Bone Base" Soluble Corn and General Crops Manure	3-8-6	Fair Haven	.....	.....	.....	.....	2.61	3.17	1.02	9.88	8.86	6.66	6.66	7543
6966	Hubbard's "Bone Base" Soluble Potato Manure	6-8-5	Willimantic	1.06	2.12	1.04	0.88	5.10	6.20	1.99	9.88	7.89	0.70	4.97	6966
7183	Hubbard's "Bone Base" Soluble Tobacco Manure	6-8-10	New Milford	1.04	1.91	1.19	0.86	5.00	6.08	2.28	10.65	8.37	0.86	10.33	7183
6846	R & H All Soils All Crops Fertilizer	4-10-4	Ellington	0.17	2.02	0.44	0.71	3.34	4.06	0.50	10.72	10.22	4.33	4.33	6846
7182	R & H Climax Tobacco Brand	5-4-5	New Milford	1.30	0.04	0.13	2.81	4.28	5.20	0.23	4.40	4.17	0.58	5.57	7182
6822	R & H Corn and Grain Fertilizer	1-10-3	New Britain	0.15	0.35	0.27	0.44	1.21	1.47	0.50	10.60	10.10	3.79	3.79	6822
6841	R & H High Potash Fertilizer	3-8-10	New Britain	0.08	1.22	0.45	0.67	2.42	2.94	0.48	8.76	8.28	10.79	10.79	6841
6821	R & H Potato Fertilizer	2-10-4	New Britain	0.06	0.37	0.55	0.66	1.64	1.99	0.56	10.49	9.93	4.05	4.05	6821
6826	R & H Tobacco Grower Vegetable Formula	6-4-4	Ellington	1.37	0.09	0.32	3.64	5.42	6.59	0.75	5.43	4.68	0.43	4.08	6826
	F. S. Royster Guano Co., Baltimore, Md.														
7333	Royster's Gem Guano	2-12-4	Watertown	0.13	0.98	0.12	0.51	1.74	2.11	1.18	13.30	12.12	4.02	4.02	7333
6840	Royster's Quality Trucker	4-8-7	New Canaan	0.00	2.12	0.48	0.64	3.24	3.94	0.50	8.73	8.23	7.03	7.03	6840
6839	Royster's Rational Guano	1-9-4	New Canaan	0.07	0.46	0.00	0.32	0.85	1.03	1.12	9.91	8.79	4.03	4.03	6839
6842	Royster's Spearhead Guano	3-8-4	Thompsonville	0.09	1.76	0.28	0.62	2.75	3.34	0.65	8.78	8.13	4.44	4.44	6842
7332	Royster's Top Dresser	7-6-5	Plainville	0.78	3.00	0.84	0.91	5.53	6.72	0.68	7.03	6.35	5.02	5.02	7332
6838	Royster's 5% Truck Guano	5-8-7	New Canaan	0.06	2.54	0.55	0.76	3.91	4.75	0.68	8.68	8.00	6.70	6.70	6838
7480	Royster's 5% Truck Guano	5-8-7	Canton	0.03	2.60	0.72	0.63	3.98	4.84	0.63	8.78	8.15	6.63	6.63	7480
6837	Royster's Trucker's Delight	4-8-4	New Canaan	0.11	2.09	0.38	0.60	3.18	3.87	0.47	8.39	7.92	3.85	3.85	6837
7337	Royster's Valley Tobacco Guano 5-4-5	5-4-5	So. Windsor	0.44	0.94	0.29	2.47	4.14	5.03	0.25	4.50	4.25	0.57	5.03	7337
	M. L. Shoemaker & Co., Philadelphia, Pa.														
7585	"Swift-Sure" Special 4-8-5	4-8-5	New Milford	0.71	0.65	0.25	1.53	3.14	3.82	1.63	10.10	8.47	0.64	5.28	7585
6931	"Swift-Sure" Tobacco and General Use 3-10-3.	3-10-3	New Milford	0.18	1.72	0.09	0.88	2.87	3.49	0.87	10.51	9.64	0.15	3.15	6931
	Springfield Rendering Co., Springfield, Mass.														
7329	Springfield Animal Brand 3-8-4	3-8-4	Thompsonville	0.33	1.14	0.77	0.32	2.56	3.11	1.08	8.98	7.90	3.93	3.93	7329
7359	Springfield Market Garden Grower and Top Dresser 5-8-7	5-8-7	Stafford Springs	0.38	2.27	0.73	0.77	4.15	5.05	0.78	9.06	8.28	7.05	7.05	7359
7360	Springfield Special Potato, Onion and Vegetable 4-8-4	4-8-4	Stafford Springs	0.37	1.65	0.84	0.44	3.30	4.01	1.33	8.88	7.55	4.07	4.07	7360
7442	Springfield 4-8-7	4-8-7	Suffield	0.47	1.53	0.77	0.57	3.34	4.06	1.25	9.05	7.80	6.90	6.90	7442
	I. P. Thomas & Son, Philadelphia, Pa.														
7173	Economy Fertilizer 3-12-3	3-12-3	North Haven	0.53	1.62	0.26	0.43	2.84	3.45	1.88	13.92	12.04	3.00	3.00	7173
7350	I. P. Thomas 5-8-7	5-8-7	North Haven	0.33	2.69	0.50	0.69	4.21	5.12	2.13	10.33	8.20	5.97	6.79	7350
7355	Long Island Special 4-8-7	4-8-7	Ansonia	0.51	2.20	0.29	0.60	3.60	4.38	1.75	10.08	8.33	7.31	7.31	7355
7349	Tip Top Superphosphate 3-10-6	3-10-6	North Haven	0.26	1.80	0.14	0.50	2.70	3.28	1.80	11.93	10.13	5.34	6.02	7349

TABLE XII. ANALYSES OF MIXED FERTILIZERS

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Concluded.*

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	I. P. Thomas & Son, Philadelphia, Pa.														
7357	7% Guano	7-6-5	Milford	0.56	4.00	0.57	0.79	5.92	7.20	1.70	8.33	6.63	4.76	5.33	7357
6829	Thomas Tobacco Grower	5-4-5	Talcottville	0.22	0.39	0.26	3.25	4.12	5.01	2.83	10.40	7.57	1.17	6.54	6829
6828	Truckers' High Grade Guano 4-8-4	4-8-4	Talcottville	0.56	2.06	0.22	0.59	3.43	4.17	1.56	9.58	8.02	3.82	4.30	6828
7174	Victor Potash Fertilizer 2-8-5	2-8-5	Ansonia	0.08	1.34	0.09	0.43	1.94	2.36	1.45	9.70	8.25	5.06	5.51	7174
	Triton Oil and Fertilizer Co., New York														
7356	Triton 4-8-4 Fertilizer	4-8-4	Milford	0.44	1.48	0.72	0.86	3.50	4.26	0.58	8.68	8.10	3.91	3.91	7356
7358	Triton 4-8-7 Fertilizer	4-8-7	New London	0.08	2.02	0.54	0.67	3.31	4.02	0.63	9.65	9.02	7.24	7.24	7358
	United States Guano Co., Baltimore, Md.														
7435[1]	4-8-10	4-8-10	North Haven	0.13	1.12	0.07	0.57	1.89	2.30	1.18	9.23	8.05	9.04	9.04	7435
7434	5-8-5	5-8-5	North Haven	0.25	3.12	0.00	0.68	4.05	4.92	0.88	9.25	8.37	5.02	5.02	7434
7354	Standard United States Mammoth Potato Grower	2-8-10	North Haven	0.19	0.96	0.00	0.55	1.70	2.07	1.18	9.90	8.72	8.69	8.69	7354
7352	Standard United States Royal Potato Grower	4-8-7	North Haven	0.12	2.57	0.10	0.84	3.63	4.41	1.30	9.20	7.90	6.72	6.72	7352
	Virginia-Carolina Chemical Co., New York.														
6938	V. C. Aroostook Potato Grower	5-8-7	New Britain	0.02	2.88	0.51	0.67	4.08	4.96	0.88	9.13	8.25	6.72	6.72	6938
7444	V-C Fairway Fertilizer	8-6-5	Danbury	0.08	3.68	0.59	1.94	6.29	7.65	0.75	7.48	6.73	5.74	5.74	7444
6937	V-C XXXX Fish and Potash	4-8-4	New Britain	0.00	2.22	0.42	0.36	3.00	3.65	1.08	9.24	8.16	3.53	3.53	6937
7481	V-C XXXX Fish and Potash	4-8-4	Danbury	0.22	2.06	0.73	0.47	3.48	4.23	0.98	9.28	8.30	4.00	4.00	7481
	Wilcox Fertilizer Co., Mystic.														
7437	Wilcox Corn Special	3-10-4	Willimantic	1.25	0.06	0.56	0.50	2.37	2.88	0.68	11.13	10.45	4.49	4.49	7437
7436	Wilcox General Vegetable Phosphate	4-8-6	Ellington	1.75	0.10	0.63	0.80	3.28	3.99	0.83	9.35	8.52	6.56	6.56	7436
7440	Wilcox High Grade Fish and Potash	4-8-4	Sampled at factory	1.64	0.21	0.67	0.66	3.18	3.87	0.63	8.51	7.88	3.28	4.14	7440
7461	Wilcox Potato Fertilizer	5-8-7	Norwich	1.13	1.46	0.90	0.62	4.11	5.00	0.78	8.78	8.00	6.30	6.98	7461
7438	Wilcox Special 4-8-4 Fertilizer	4-8-4	Willimantic	0.92	1.22	0.67	0.46	3.27	3.98	0.55	8.93	8.38	4.05	4.05	7438
6932	Wilcox 7-6-5 Top Dresser	7-6-5	Ellington	1.86	1.70	0.75	1.08	5.39	6.55	0.78	7.18	6.40	4.15	4.83	6932
	S. D. Woodruff & Sons, Orange.														
6930	Woodruff's Home Mixed Fertilizer	4-8-6	Sampled at factory	1.42	0.14	0.47	2.09	4.12	5.01	1.68	8.51	6.83	5.67	7.00	6930
	Worcester Rendering Co., Auburn, Mass.														
7454	Prosperity Brand Complete Dressing	6-6-4	Groton	0.27	3.34	1.10	0.42	5.13	6.24	0.70	7.38	6.68	4.27	4.27	7454
7451	Prosperity Brand Corn and Grain Fertilizer	2-10-2	Colchester	0.00	0.89	0.49	0.30	1.68	2.04	1.07	10.25	9.18	2.09	2.09	7451
7453	Prosperity Brand Market Garden Fertilizer	5-8-7	Norwich	1.26	1.08	1.07	1.07	4.48	5.45	0.80	9.30	8.50	7.48	7.48	7453
7452	Prosperity Brand Potato and Vegetable Fertilizer	4-8-4	Colchester	0.24	1.80	0.80	0.49	3.33	4.05	0.60	8.43	7.83	4.20	4.20	7452
	Wm. P. Young, Pottstown, Pa.														
6941	Young's Formula, A Complete Fertilizer	8-7-6	Mfg's sample	0.60	5.04	0.21	0.89	6.74	8.19	0.60	7.98	7.38	8.02	8.02	6941

[1] See note page 59.

SPECIAL MIXTURES AND HOME MIXTURES.

A considerable number of samples of this type of fertilizers are examined each year for individual purchasers or others interested. For the most part such samples are drawn and submitted by the persons interested, in which case the Station is responsible only for the analyis of the material as received. The Station agent does sample such stock in some instances upon request of purchasers.

Thirty-nine samples in this group have been analyzed during the year and the results are given in Table XV.

VIII. MISCELLANEOUS FERTILIZERS, AMENDMENTS AND OTHER MATERIALS.

SHEEP MANURE, ETC.

Seventeen samples of sheep manure and other farm manures were analyzed. While such materials do not contain large amounts of plant food (about 130 pounds to the ton usually), they have some further agricultural value as amendments and as culture media for soil bacteria.

Analyses are given in Table XVI.

LIME.

Twenty-one samples of liming materials have been analyzed during the year. Samples have been drawn and submitted largely by purchasers. Lime is not classed as a fertilizer under the fertilizer law of this State and no registration is required.

Analyses are given in Table XVII.

TABLE XV. ANALYSES OF SPECIAL MIXTURES AND HOME MIXTURES.

Station No.	Manufacturer or Brand.	Place of Sampling.	Total Nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid.				Potash.		
					Citrate-insoluble.	Total.	So-called "available."		As muriate.	Total.	Station No.
	Sampled by Station:		%	%	%	%	%		%	%	
7458	Corn Fertilizer	Cornelius Ahearn, Stratford	2.62	3.19	0.90	9.70	8.80		....	5.78	7458
7457	Top Dressing	Cornelius Ahearn, Stratford	3.28	3.99	1.50	9.95	8.45		....	5.28	7457
7479	Berkshire Chemical Co., Bridgeport	F. W. Buckland, Hillstown	5.82	7.08	0.20	4.70	4.50		....	5.75	7479
7460	Tobacco Mixture	Edwards & Brewer Inc., Hockanum	5.82	7.08	0.30	4.28	3.98		....	6.16	7460
7459	Tobacco Mixture	Fred Getto, Glastonbury	5.94	7.22	0.40	3.53	3.13		....	7.94	7459
7422	International Agricultural Corp., Boston, Mass.	David Hastings, Suffield	3.54	4.30	0.08	1.30	1.22		....	8.54	7422
7441	Olds & Whipple, Inc., Hartford	L. W. Newberry, So. Windsor	5.77	7.02	0.25	6.30	6.05		....	8.43	7441
7498	Olds & Whipple, Inc., Hartford	Arthur Manning, Manchester	6.06	7.37	0.98	5.65	4.67		....	5.95	7498
7496	The Rogers & Hubbard Co., Portland	Arthur Manning, Manchester	5.73	6.97	0.85	4.78	3.93		....	5.78	7496
7456	Corn Fertilizer	T. W. Ryan, Stratford	2.70	3.28	0.63	10.68	10.05		....	6.13	7456
7455	Top Dressing	T. W. Ryan, Stratford	4.02	4.89	0.55	8.48	7.93		....	8.04	7455
	Sampled by Purchaser:										
7293	American Agricultural Chemical Co., New Haven	Michael Davis, Suffield	4.12	5.01	0.33	4.53	4.20		....	5.12	7293
7640	Apothecaries Hall Co., Waterbury	M. E. Thompson, Ellington	5.09	6.19	0.29	6.08	5.79		1.01	6.16	7640

TABLE XV. ANALYSES OF SPECIAL MIXTURES AND HOME MIXTURES—*Continued.*

Station No.	Manufacturer or Brand.	Place of Sampling.	Total Nitrogen.	Ammonia equivalent to tota lnitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "available."	Potash. As muriate.	Potash. Total.	Station No.
			%	%	%	%	%	%	%	
	Sampled by Purchaser:									
6359	Formula AA	American Sumatra Tobacco Co., Bloomfield	9.86	11.99	0.82	4.29	3.47	....	0.95	6359
6210	Formula A	American Sumatra Tobacco Co., Bloomfield	5.90	7.17	0.46	4.39	3.93	....	5.48	6210
6307	Formula A	American Sumatra Tobacco Co., Bloomfield	5.69	6.92	0.56	4.91	4.35	....	5.07	6307
6308	Formula B	American Sumatra Tobacco Co., Bloomfield	5.40	6.57	0.91	5.82	4.91	....	7.49	6308
6309	Formula C	American Sumatra Tobacco Co., Bloomfield	4.93	5.99	1.56	5.77	4.21	....	7.81	6309
6850	Formula C	American Sumatra Tobacco Co., Bloomfield	4.88	5.93	1.20	5.90	4.70	....	8.10	6850
6360	Formula D	American Sumatra Tobacco Co., Bloomfield	5.82	7.08	0.20	4.16	3.96	....	5.79	6360
6361	Formula E	American Sumatra Tobacco Co., Bloomfield	5.90	7.17	0.69	5.24	4.55	....	.....	6361
6851	Formula E	American Sumatra Tobacco Co., Bloomfield	5.82	7.08	0.58	5.05	4.47	....	5.80	6851
5533	Fall Tobacco Bed Fertilizer	American Sumatra Tobacco Co., Bloomfield	5.32	6.47	0.92	5.97	5.05	0.74	5.74	5533
7131	Tobacco Bed Starter	American Sumatra Tobacco Co., Bloomfield	7.00	8.51	3.08	9.40	6.32	....	.....	7131

TABLE XV. ANALYSIS OF SPECIAL MIXTURES AND HOME MIXTURES—*Concluded.*

Station No.	Manufacturer or Brand.	Place of Sampling.	Total Nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "available."	Potash. As muriate.	Potash. Total.	Station No.
			%	%	%	%	%	%	%	
	Sampled by Purchaser:									
7511	Armour Fertilizer Works, New York	Mrs. Ruth P. Bartlett, East Windsor	3.55	4.32	0.28	5.40	5.12	....	4.85	7511
5449	.....	Allan J. Bartlett, Greenwich	5.95	7.23	3.57	11.54	7.97	....	3.62	5449
6953	.....	Daigle Bros., Marion	3.88	4.72	....	10.60	....	....	8.78	6953
6423	.....	Joseph E. Drepeau, New Milford	4.16	5.06	0.15	5.36	5.21	....	6.03	6423
7040	L. T. Frisbie Co., New Haven	A. E. Plant & Sons, Branford	4.22	5.13	0.98	9.25	8.27	....	6.86	7040
6803	.....	L. B. Haas & Co. Inc., Hartford	5.28	6.42	....	8.90	....	....	12.52	6803
7039	Lowell Fertz. Co., Boston, Mass.	A. E. Plant & Sons, Branford	3.95	4.80	0.54	10.59	10.05	....	5.30	7039
7492	Lowell Fertz. Co., Boston, Mass.	Paul Liebman, Ellington	4.26	5.18	0.70	9.30	8.60	....	5.98	7492
7043	Olds & Whipple, Inc., Hartford	Henry E. Wells, Warehouse Point	5.15	6.26	0.18	6.43	6.25	....	13.12	7043
7044	Olds & Whipple, Inc., Hartford	Henry E. Wells, Warehouse Point	5.36	6.52	0.18	6.15	5.97	....	13.43	7044
7229	The Rogers & Hubbard Co., Portland	Henry P. Smith, Glastonbury	6.17	7.50	1.03	4.75	3.72	....	6.65	7229
7045	.....	Henry E. Wells, Warehouse Point	5.13	6.24	0.28	6.30	6.02	....	7.75	7045
7046	.....	Henry E. Wells, Warehouse Point	3.76	4.57	0.38	7.83	7.45	....	4.52	7046
6988	.....	I. D. Woodworth, Hartford	5.90	7.17	0.53	4.25	3.72	....	4.21	6988
6670	Worcester Rendering Co., Auburn, Mass.	Walter Scott, Niantic	6.68	8.12	0.63	6.93	6.30	....	6.72	6670

TABLE XVI. ANALYSES OF SHEEP MANURE, ETC.

Station No.	Manufacturer or Brand.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen. Found.	Ammonia equivalent to total nitrogen. Guaranteed.	Phosphoric acid. Available. Found.	Phosphoric acid. Available. Guaranteed.	Phosphoric acid. Total. Found.	Phosphoric acid. Total. Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sampled by Station:		%	%	%	%	%	%	%	%	%	
6763	Pulverized. American Agricultural Chemical Co., New York.....	Geo. S. Phelps & Co., Thompsonville.....	1.45	1.76	1.75	....	....	1.03	0.50	2.41	2.00	6763
6876	Liberty. Apothecaries Hall Co., Waterbury.....	F. B. Newton, Plainville.....	1.30	1.58	1.80	....	....	0.77	1.00	2.24	2.00	6876
6812	Armour Fertilizer Works, New York	F. C. Benjamin, Danbury....	1.58	1.92	1.50	....	....	1.10	1.00	3.22	2.00	6812
6742	Berkshire Chemical Co., Bridgeport	F. S. Bidwell Co., Windsor Locks.....	3.12	3.79	3.00	....	....	....	....	....	....	6742
6673	Case Brand Pulverized. A. H. Case & Co., Buffalo, N. Y.....	Frank Libner & Son, Norwalk	2.28	2.77	1.21	3.63	1.00	3.94	1.25	1.07	1.00	6673
7340	Corenco. Consolidated Rendering Co., Boston, Mass.....	Dennis Grain Mill, Stafford Springs.....	1.38	1.68	1.50	0.63	....	0.78	0.50	2.68	2.00	7340
7093	Davey Shredded Cattle Manure Davey Tree Expert Co., Kent, Ohio	R. E. Landis, Sound Beach...	1.88	2.29	1.00	1.00	1.00	1.25	1.00	2.16	1.00	7093
6901	"Sheepshead" Pulverized. Natural Guano Co., Aurora, Ill.....	Cadwell & Jones, Hartford...	2.38	2.89	2.73	....	0.25	2.13	1.25	2.82	2.00	6901
6738	Groz-It. Pacific Manure & Fertilizer Co., San Francisco, Cal.....	W. S. Eaton, Plainville.....	1.54	1.87	1.82	....	....	1.13	1.25	2.81	3.00	6738
6905	Premier Brand Poultry Manure. Premier Poultry Manure Co., Chicago, Ill.....	Lightborn & Pond, New Haven	4.89	5.95	6.00	2.48	2.50	2.60	2.75	1.28	1.30	6905
6906	Premier Brand Sheep Manure. Premier Poultry Manure Co., Chicago, Ill.....	Lightborn & Pond Co., New Haven.....	2.00	2.43	2.00	....	0.80	0.85	1.00	2.02	2.00	6906
6895	Wizard Brand Pulverized Sheep Manure. The Pulverized Manure Co., Chicago, Ill.....	S. P. Strople, New Britain....	1.75	2.13	2.43	....	1.25	1.45	....	2.67	2.00	6895
6917	Wizard Brand Cattle Manure. The Pulverized Manure Co., Chicago Ill.....	S. P. Strople, New Britain....	1.88	2.29	2.10	1.02	1.00	1.20	....	1.79	1.00	6917
6920	Wonder Grower Brand Pulverized Sheep Manure. Rocky Mountain Fertz. Co., Helena, Mont.....	C. W. Lines Co., New Britain.	1.77	2.15	2.43	....	....	1.13	1.20	2.83	2.00	6920
7180	F. S. Royster Guano Co., Baltimore Md.....	W. S. Brown, Trumbull.....	1.83	2.22	....	0.60	1.00	0.70	....	2.14	2.00	7180
6819	Toro. S. D. Woodruff & Sons, Orange.....	Gabriel Dadio, Highwood....	1.58	1.92	1.94	....	1.00	1.08	....	3.14	2.00	6819
	Sampled by Purchaser:											
5192	.....	S. D. Woodruff & Sons, Orange	1.73	2.10	....	....	....	1.28	....	3.55	....	5192

TABLE XVII. ANALYSES OF LIMESTONE, ETC.

Station No.	Manufacturer or Brand.	Sampled by.	Chemical Analysis. Lime (CaO). Found.	Lime (CaO). Guaranteed.	Magnesia (MgO). Found.	Magnesia (MgO). Guaranteed.	Total Oxides.	Insoluble in acid.	Mechanical Analysis. 20 mesh.	40 mesh.	50 mesh.	80 mesh.	100 mesh.	Station No.
			%	%	%	%	%	%	%	%	%	%	%	
	Coe Lime Works, Northford.													
6353	Limestone	Sidney Edwards, Middletown	54.17	....	0.72	....	54.89	....	92.00	75.00	63.00	53.00	51.00	6353
6662	Limestone	M. F. Morgan	52.70	.....	0.73	.....	53.43	.....	89.00	72.00	62.50	54.50	51.50	6662
6708	Limestone	New Haven County Farm Bureau	52.67	.....	0.96	.....	53.63	.....	89.00	69.00	58.00	48.00	42.50	6708
	The Connecticut Agstone Co., Danbury.													
7599	Lime	Stephen H. Brown, Woodbury	38.22	.....	6.39	.....	44.61	.....	.....	.....	.....	.....	.....	7599
7147	Ground Limestone	Raymond Clapp, New Haven Farm Bureau	38.28	.....	6.96	.....	45.24	.....	96.00	87.00	79.00	67.00	63.00	7147
	Conn. Lime Co., Canaan.													
7003	Hydrated Lime	Woodbury Coop. Assoc., Woodbury	47.78	.....	22.82	.....	70.60	.....	78.00	46.00	31.00	21.00	19.00	7003
	Grangers Mfg. Co., West Stockbridge, Mass.													
5072	Hydrated Lime	Hatheway & Steane, Inc., Hartford	53.84	.....	3.61	.....	57.45	.....	.....	.....	.....	.....	.....	5072
6709	Limestone	New Haven County Farm Bureau	40.20	.....	7.15	.....	47.35	.....	97.50	85.50	72.00	54.00	43.50	6709
6916	Limestone	Chas. R. Treat, Orange	52.51	.....	1.39	.....	53.90	.....	100.00	100.00	99.00	91.00	87.50	6916
	Kelly Island Lime & Transport Co., Cleveland, Ohio													
7600	Hydrated Builders Lime	B. A. Brown, Storrs	47.26	.....	31.99	.....	79.25	.....	100.00	100.00	99.50	99.30	98.50	7600
	Miller Lime Products Corp., West Stockbridge, Mass.													
7002	Limestone	Woodbury Coop. Assoc., Woodbury	39.21	.....	10.69	.....	49.90	.....	100.00	92.00	84.00	74.00	70.50	7002
7473	Monarque Brand Agricultural Lime	Station agent from stock of H. F. Joy, Woodstock	40.92	36.87	9.85	13.72	50.77	.....	100.00	92.50	84.00	72.00	53.00	7473
7472	Monarque Brand Agricultural Lime	Station agent from stock of H. F. Joy, Woodstock	38.38	36.87	11.14	13.72	49.52	.....	100.00	93.00	84.50	75.00	63.00	7472
5137	Lime	C. N. Herold, New Canaan	43.92	.....	30.74	.....	74.66	1.42	89.00	59.00	49.00	42.00	40.00	5137
7004	Hydrated Lime	Woodbury Coop. Assoc., Woodbury	48.53	.....	32.14	.....	80.67	.....	100.00	100.00	99.50	95.50	93.50	7004
7601	Hydrated Builders Lime	B. A. Brown, Storrs	44.98	.....	26.11	.....	71.09	.....	94.50	94.00	94.00	93.80	89.00	7601
	Warner-Miller Co., New Haven.													
7146	Hydrated Lime	Raymond Clapp. New Haven Farm Bureau	42.78	.....	27.46	.....	70.24	.....	92.00	61.00	48.00	28.00	23.00	7146
	U. S. Gypsum Co., Genoa, Ohio.													
7410	Ivory Finishing Lime	P. J. Anderson, Windsor	47.04	.....	31.80	.....	78.84	.....	100.00	100.00	99.00	96.00	92.00	7410
	Manufacturer Unknown.													
5901	Limestone	Robert Coe, Durham	.....	.....	.....	.....	.....	.....	92.50	75.00	64.00	54.00	51.00	5901
7021	Hydrated Lime	Mr. Putnam, Sharon	47.43	.....	32.88	.....	80.31	.....	.....	.....	.....	.....	.....	7021
7388	Lime	J. E. Phelps, Suffield	47.02	.....	31.72	.....	78.74	.....	100.00	100.00	99.50	93.00	72.00	7388

OTHER MISCELLANEOUS MATERIALS.

Thirty-four samples of miscellaneous materials have been examined for fertilizer ingredients, and are summarized in the following Table, XVIII.

COLLABORATIVE WORK.

The laboratory has continued to collaborate in the check meal program of the American Oil Chemists' Society, and in a similar program of check fertilizer analyses sponsored by the F. S. Royster Guano Co. Thirty samples of cottonseed meal were analyzed for nitrogen; and twelve samples of mixed fertilizers were analyzed for nitrogen, phosphoric acid and potash.

TABLE XVIII. MISCELLANEOUS MATERIALS.

No.	Material	Nitrogen	Phosphoric acid	Potash	Remarks
6079	Ashes from factory refuse (American Brass Co.)	....	0.18	0.14	Small amount of scrap metal sifted out before analysis.
5985	Ash from Grape Pomace	....	5.74	18.62	.....
6664	Chicken Manure	6.35	1.82	1.15	.....
6817	Chicken Manure	6.35	1.83	1.20	.....
7250	Cottonseed Hulls	0.61	....	....	.....
6349	Garbage Waste (Dept. of Parks, Bridgeport)	1.54	....	....	As received 45.8% water, 17.9% ash, 36.3% organic matter. Probably not over 40 lbs. plant food in a ton.
6106	Humus (Abington)	1.54	....	....	As received 54.8% water, 5.3% ash, 39.9% organic matter.
6107	Humus (Abington)	1.03	....	....	As received 25.6% water, 41.5% ash, 32.9% organic matter.
5640	Locust Meal (Dried and ground locusts from Argentine)	7.68	1.67	0.98	Contained 3.3% insoluble organic nitrogen which was about 60% "active" by usual methods. Contained iron and small amount of copper.
5063	Mineral	....	....	....	Sandstone with particles of pyrites.
6832	Mineral	....	....	....	
5193	Nitrogen base goods. (Olds & Whipple, Inc.)	9.33	....	....	Contained 8% insoluble organic nitrogen 75% of which was "active" by usual laboratory methods.
6351	Peat Moss	0.92	trace	1.07	As received 16% water, 1.6% ash, 82.4% organic matter. Oat straw on same water basis contains about 0.6% N., 0.3% P_2O_5, and 1.8% K_2O.

TABLE XVIII. MISCELLANEOUS MATERIALS—*Concluded.*

No.	Material	Nitrogen	Phosphoric acid	Potash	Remarks
5116	Sewage Sludge (dried)	0.51	....	....	.....
6350	Sewage Sludge (Dept. of Parks, Bridgeport)	0.40	....	....	As received 82.4% water, 3.5% ash, 14.1% organic matter. One ton contains not over 10 lbs. of plant food.
7567	Soil	....	....	....	A trace of chloride.
7568	Soil	....	....	....	A trace of chloride.
6929	Soot (Flue deposit from incinerator)	0.06	1.45	1.20	.....
7165	Sulphate of ammonia	0.20	....	....	Not sulphate of ammonia; probably potassium sulphate.
5879	Swamp humus (Warehouse Point)	0.66	....	....	As received 69.5% water, 6.2% ash, 24.3% organic matter.
5880	Swamp humus (Windsor)	2.41	....	....	As received 11.9% water, 8.3% ash, 79.8% organic matter. Useful as an absorbent and conditioner. Amount of plant food small and slowly available in such material.
7194	Swamp Muck (West Suffield)	0.23	....	....	As received 87.5% water, 3.2% ash, 9.3% organic matter.
6425	Tobacco Dust	2.30	0.46	2.29	.....
6546	Tobacco Dust	0.98	0.46	1.47	.....
7606	Tobacco Dust	3.38	0.60	2.90	.....
5220	Tobacco Stems	2.31	0.50	8.37	.....
5308	Tobacco Stems	2.31	0.57	4.33	Nicotine 1.01%
5309	Tobacco Stems	3.02	0.68	7.79	Nicotine 0.05%
5990	Tobacco Stems	2.87	....	8.64	.....
6208	Tobacco Stems	2.91	0.65	8.93	.....
6302	Tobacco Stems	2.67	0.52	4.79	.....
6357	Tobacco Stems	2.66	0.43	4.77	.....
6424	Tobacco Stems	2.14	0.43	3.48	.....
6547	Tobacco Sweepings	1.58	0.61	2.03	.....

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BULLETIN 291 DECEMBER, 1927

Connecticut Agricultural Experiment Station
New Haven, Connecticut

REPORT OF THE DIRECTOR

FOR THE

YEAR ENDING OCTOBER 31, 1927

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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as of

October 31, 1927

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QUINNIPIACK PRESS, INC., NEW HAVEN

REPORT OF THE DIRECTOR

For the Year Ending October 31, 1927.

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

The year covered by this report is the fifty-second in the history of the Station—a half century that has seen the United States grow in population from 44 million to 110 million, the number of farms increase from less than four million to over six million, and the area under cultivation more than double. Changes of far-reaching and fundamental influence have been wrought in our whole economic and social structure.

Fifty years ago in the vast territory west of the Mississippi there were still unconquered tribes of Indians, herds of wild buffalo and millions of acres of cheap land, the too rapid settling of which brought disaster not only to the farmer but to the nation as a whole. There was no telephone, no automobile, the radio was undreamed of and the railroads were just beginning to reach out into the great central grain and cattle country. In 1875 the reaper was a relatively new tool; last season in a single day, a Kansas farmer and his son harvested and threshed 100 acres of wheat with a "combine." In Connecticut we were growing our own fresh beef, mutton and pork—the first refrigerator car reached New York in 1879. Creameries manufacturing butter and cheese were to be found in almost every town in the State. A few far-seeing men had sensed the changes that were to come, and many more had only a vague feeling of uneasiness—they saw cheap grain, wool, meat and butter flooding New England, and some predicted the everlasting ruin of our New England agriculture.

Out of this was born the Experiment Station Idea, not to stay the hand of change and progress but to discover the fundamental laws of plant and animal life upon which the new agriculture was to be built—an agriculture that in Connecticut has discarded unprofitable fields, crops and flocks, but which today produces over twice the *actual* wealth of 1875.

To enumerate all of the Station's contributions to this process of evolution would be tedious. Some of the most outstanding are: the discovery of the cause of potato scab; the introduction of spraying to control plant pests; the study of the chemistry of the vegetable proteins which led to discovery of the vitamines and a knowledge of the food value of milk and other farm products; the introduction of shade for tobacco growing; bulk fermentation of tobacco; better methods of fertilizing this important crop; a new method of corn breeding which has completely changed our methods of improving this cereal.

During all these years the Station has continued its important "defense" work, annually collecting and analyzing thousands of samples of fertilizers, feeds, foods and drugs; has inspected the orchards and nurseries and kept down the toll of insect and fungous damage. But the two-fold function of the Station was recognized from the beginning, for while the first director believed thoroughly in performing the direct services of control and education, he wrote in his first report, "the Experiment Station will be worthy the name in proportion as it carries on accurate and thorough investigations in agricultural science."

FIG. 1.—The Station Agent drawing a sample of fertilizer.

REVIEW OF THE YEAR

During the year under review, the work in all departments has gone forward without interruption and with gratifying results. It is a particular pleasure to here acknowledge the debt of the Station, and especially that of the director, to Dr. E. H. Jenkins, Director Emeritus, for his constant interest and wise counsel.

CONTROL AND INSPECTION WORK

INSPECTION OF FERTILIZERS, FEEDS, FOODS, DRUGS, ETC.

In accordance with the statutes assigning these duties to the Station, the Chemical Laboratory has examined during the year 884 samples of fertilizer, lime and similar materials, of which 507

were drawn officially by the Station Agent and the balance received from farmers. The annual report on fertilizers was issued as usual in December.

Under the new feeding stuffs law, which went into effect July 1, 1925, all "Commercial Feeding Stuffs" offered for sale must be licensed. For the year 1927, 177 firms registered 793 brands. For the inspection of these, 670 official samples were drawn, which with other samples received required 898 complete analyses.

As usual much time was consumed in the analysis of foods and drugs, the samples being collected by the State Dairy and Food

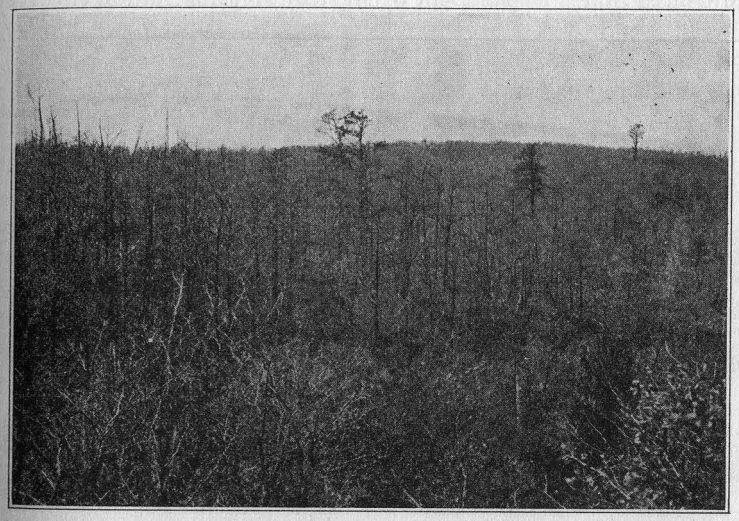

FIG. 2.—Part of a large area, outside of Connecticut, completely defoliated by the Gipsy Moth—photograph taken July 15. Courtesy of Dr. A. F. Burgess, U. S. D. A.

Commissioner and also by the Station Agent. Reports on 1100 food products and 150 drug products were published in Bulletins 286 and 287 respectively.

In addition to the above the laboratory calibrated 3100 pieces of Babcock glassware, examined Insecticides and Fungicides offered for sale in the state and made a large number of miscellaneous analyses, including several submitted by the newly-created State Water Commission.

CONTROL OF INSECT PESTS

The problems of insect and disease control are becoming more and more difficult each year as new pests appear in the State. The campaign against the *Asiatic Beetle,* which was discovered two

years ago in the city of New Haven, has been carried on vigorously. During the past year lawns in a large area in the Westville district were again treated with Carbon Disulphide Emulsion and very encouraging results obtained. In addition, a strict quarantine on the moving of soil from this area was enforced. Studies of the Asiatic Beetle indicate that it probably will never be a serious pest in this climate, and the treatment, above mentioned, offers an effective control against damage to lawns.

The *Japanese Beetle* has spread from the region of Philadelphia into New York and southwestern Connecticut. Cooperating with the United States Department of Agriculture, the Station enforced

FIG. 3.—Anti-mosquito Work—cleaning out an old ditch.

a quarantine on farm products and plants bearing soil as shipped out of the New York metropolitan district. This required a twenty-four-hour patrol on the Boston Post Road near Stamford as well as on other roads in this region. The quarantined area now includes most of Fairfield County and will require continued inspection, scouting and patrolling.

As usual members of the Station staff inspected all *nurseries* in the State and issued permits for the importation and shipment of nursery stock. Here again there is a steady increase in the amount of service required.

In the control of the *Gipsy Moth* we have continued to wage a successful battle. By intensive scouting, spraying and destruction of egg clusters it has been possible to prevent any injury within

the borders of the State. In adjoining states, where funds were not available, serious damage occurred during 1927.

The *European Corn Borer* has continued to be a constant threat since its introduction into the State some five years ago. However, the number of infestations discovered each year has been small, never numbering over six. All corn stalks and weeds have been destroyed in the neighborhood of each infestation found, thus undoubtedly preventing the serious spread of this insect. The cordial cooperation of the United States Department of Agriculture has greatly aided in all of our work.

While the State appropriation for the *elimination of mosquitoes* was not increased it was possible to arouse a very lively interest

FIG. 4.—Station crew eradicating wild Ribes from pine land.

in New Haven and the surrounding towns with the result that the several Chambers of Commerce undertook the raising of a fund of $40,000 for completing the drainage work in this district. Results have been very encouraging and the plans now call for commencement of operations in the spring of 1928.

In addition to the above, all apiaries in the State were inspected for European Foul Brood, many orchards and gardens were visited and general assistance rendered in the control of insect pests.

WHITE PINE BLISTER RUST

During the season of 1927, 159,121 wild Ribes and 2,235 cultivated Ribes were destroyed on 20,904 acres. The work was carried on in 16 towns. 10,400 acres of white pine were protected.

In addition 20,100 acres of non-pine land were eliminated in the general pine region. Approximately 1,000 acres of land adjoining 10 commercial nurseries were freed from Ribes as a preliminary step in an effort to secure a modification of the Federal quarantine on white pine shipments out of the state. The nurserymen cooperated with us in this sanitation work.

All eradication this year represents cooperative effort on the part of the state and towns, individuals and nurseries.

Experimental work was conducted to study some of the factors that make up crew efficiency.

Comparative figures for the last three years are given below:

Year.	Initial eradication Acres.	Re-eradication Acres.	Total eradication Acres.	Wild Ribes Pulled.	Cultivated Ribes Pulled.	Area pine protected Acres.	Nursery sanitation Acres.
1925.....	6,688	40	6,728	258,515	684	?	0
1926.....	21,687	570	22,256	182,826	330	7,400	0
1927.....	12,068	8,836	20,904	159,121	2,235	10,400	1,000

The drop in acres eradicated in 1927 from that in 1926 is due to the fact that more time was devoted to experimental and sanitation work, and to the scattered location of the eradication areas.

SEED TESTING

The total number of seed samples tested during the year, November 1, 1926, to November 1, 1927, was 416. These were from 73 sources and comprised 43 different species of plants.

Last year a special inspection was made of vegetable seed sold in packets and reported in Bulletin No. 283. This year the study was confined to bulk seed obtained chiefly from the market gardeners. Only fair germination was obtained.

Progress of Investigations

BIOCHEMISTRY

The Chemistry of the Proteins. Much time has been devoted to a revision of the standard procedure for the separation of histidine from arginine, as these two basic amino acids not only appear to form an important part of the base fraction from yeast but are also found in many other materials. A method has been developed which is much simpler and more expeditious than that formerly employed and is practically quantitative.

The great difficulty in dealing with yeast and other extracts has been the selection of a method for separating the bases from other substances which form insoluble precipitates with phosphotungstic acid. This reagent has been widely employed upon the assumption that the nitrogen precipitated by it belonged to bases. The presence of peptides in extracts of plant material renders this

assumption unwarranted, and attempts to isolate derivatives of basic substances gave results which fall far short of those to be expected from their nitrogen content. Until methods are developed whereby peptides can be quantitatively removed, further progress in the analysis can only be made by hydrolysis of the peptides to their constituents of amino acids before the precipitation of the bases. Papers on these phases have been published in the Journal of Biological Chemistry and the Journal of Plant Physiology.

Experiments in Nutrition. The investigations on the rate of growth have been continued as a major study. As reported last

Fig. 5.—Two rats from the same litter. Age 79 days.
Left—Diet, standard. Weight, 160 gms.
Right—Diet, high protein + alfalfa and liver. Weight, 301 gms.

year, growth at a rate of three times the average rate was secured with a number of animals. Subsequent experiments have confirmed this, not only with casein furnishing the protein but also with rations containing edestin, lactalbumin and cottonseed globulin. Liver, lettuce and yeast added to rations previously considered sufficient have all produced these results, but there are indications that a combination of two of these is more effective. Fresh alfalfa leaves, in daily quantities that compare favorably with lettuce, have proved to be notably potent. Studies dealing with the effect of high protein diets upon various physiological functions have been continued and a report published; also the effect of diet on the reproductive organs and the construction of bone.

BOTANY

Mosaic. The year 1927 has been the most favorable one we have known for some time for the development and spread of mosaic troubles of all susceptible hosts. This was because of the favorable weather and abundance of insect carriers, especially lice. Over-winter weed-carriers were observed in some cases in the vicinity of fields of infected cultivated plants.

The chief new observation along microscopical lines was the finding, in a certain type of mosaic sent us by Dr. Valleau of Kentucky, of definite inclusions in the nucleus of infected cells. These were similar to the common "plate crystals" found in the cell outside.

In 1926 a most interesting discovery was the fact that tobacco leaves dried and preserved in the herbarium for 24 years, still

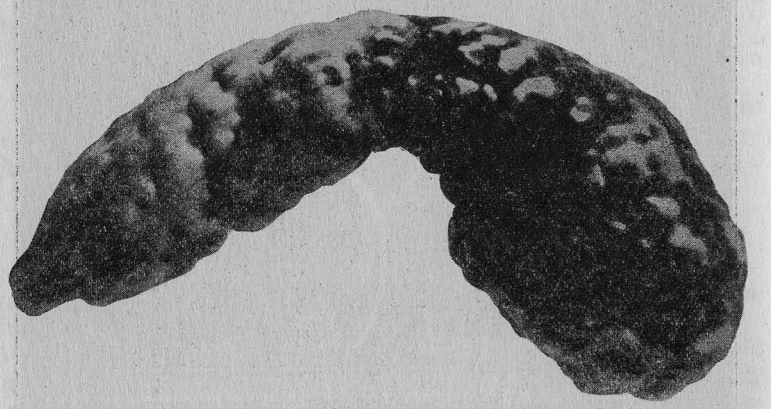

Fig. 6.—Effect of Mosaic on Summer Squash.

carry the active principle and could be used to infect living plants with the mosaic disease. Infection experiments continued this year with old dried leaves and preserved juice gave similar results.

Experiments with New Seed Disinfectants for Potatoes. The results of our experiments with the three fungicides tried, Semesan, Formalin and Mercuric Chloride, showed no positive stimulating effects for any of them over the check as regards earliness of first vines to appear, earliness of vines as a whole, size or vigor of the vines, or increased yields of tubers. The experiments were carried on in triplicate with two varieties of potatoes.

Spraying and Dusting of Apples. The results from the several treatments on the orchard of F. N. Platt, Milford, in 1927 were not as good as for the past few years. This was due to the excessive rainfall during the latter part of the season which caused an unusual development of fungous diseases, especially apple scab infection late in the season.

Five different treatments were used: complete spray schedule, complete dust schedule with each of two dusts, Pomodust and Kolodust; and two combinations of dust and spray. Contrary to the usual performance of these materials the Kolodust gave the best control of scab, with Pomodust second and spray third. We find this was doubtless due to the fact that the calyx treatment of dust was put on immediately before a three day rain period during which the maximum discharge of scab spores took place, while the spray was not put on until after this period.

Spraying gave considerably better control of sooty blotch and fruit speck than did the dust.

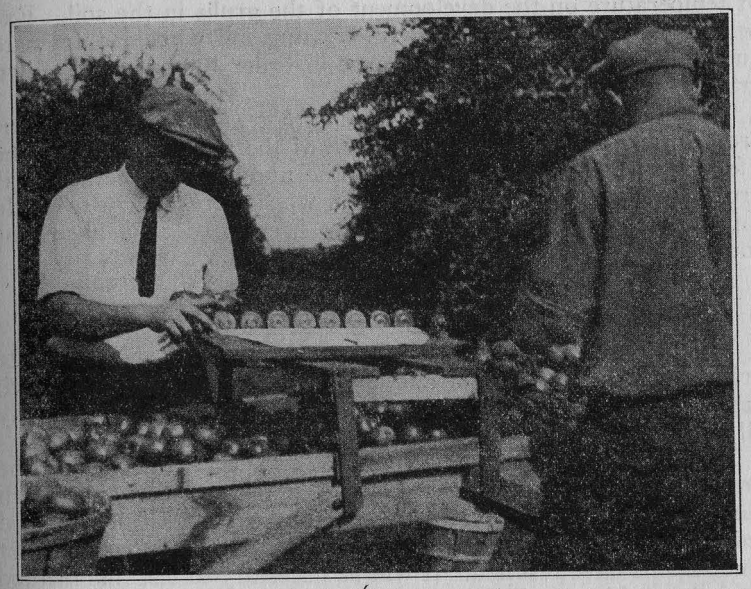

Fig. 7.—Scoring Apples in the Spraying and Dusting Experiments at the F. N. Platt orchard.

ENTOMOLOGY

Further investigations have been conducted on the life history, habits and control of the *Oriental peach moth.* Considerable data have been obtained from field cages and bait pans placed in the orchard. Three broods were evident, the same as in 1926. Considerable work has also been done towards developing a substitute for arsenical sprays which promise to be less toxic to human beings and cause less injury to peach foliage. Thus far, sprays have not been effective in controlling the insect. One parasite, *Macrocentrus ancylivora* Rohwer, was reared in considerable numbers the past season from one orchard, and work is also in progress in

the artificial breeding of an egg parasite, *Trichogramma minutum* Riley, which infests the eggs of the Oriental peach moth in Connecticut.

The study of the *Plum Curculio on apple* has been continued as a part of the five-year program on this subject. During the year, jarring records have been kept and field tests continued with sprays applied at different times, and with fish oil as a sticker with a view to eliminating some of the sprays.

The studies of the life history, habits, and distribution of the *Asiatic beetle,* begun in 1926, have been continued and nearly completed. These include many temperature records and the effect of temperature on the development of the grubs in the soil. Experiments have also been made in treating soil with lead arsenate and other materials before seeding, in order to render the lawn grub-proof.

The life history and habits of the *Imported Birch Leaf Miner,* are being investigated, and the length of the various stages of the life cycle have been determined. The number of generations is probably three, but another season's work is necessary to settle this point. Several insecticides have been tried as a means of control, but so far none has proved satisfactory.

FORESTRY

Under the Clark-McNary Act 194,000 trees were distributed to private owners and 445,000 under the usual Station plan which has been in force for a number of years and whereby farmers pay all costs except overhead.

The investigation of *soil as a site factor* has continued to be the major research problem. In 1926 and 1927 a very thorough study was made of two tracts. The soils were carefully mapped and the forest vegetation listed and measured. No significant correlations have resulted. It will be necessary to test this method on forests of known history which is now being done on pine plantations. In 1927 a very careful study was made of the lesser vegetation in several tracts in an attempt to establish indicator plants or groups of plants. The tentative conclusion reached is that the history of the stand has greater influence on the lesser vegetation than the soil type.

PLANT BREEDING

A sterile tassel character in white flint corn has been found to be controlled by an inherited factor linked with the factor for white seed color. The possibilities of using this character in the production of crossed corn seed are being investigated. By back-crossing, this character is being transferred to several different types of sweet corn and field corn.

The Connecticut AGRICULTURAL Experiment Station

Inbred strains in the twentieth generation of self-fertilization have been separated into two strains in each line and are being continued for another period of continuous inbreeding to determine their fixity and trueness to type and the effects of long continued inbreeding.

Thirteen crosses of inbred strains of Evergreen sweet corn have been selected out of nearly 200 crosses as promising for canning purposes. These are being tested further.

A large number of self-fertilized lines of early yellow sweet corn are being selected for the purpose of producing a desirable market garden type.

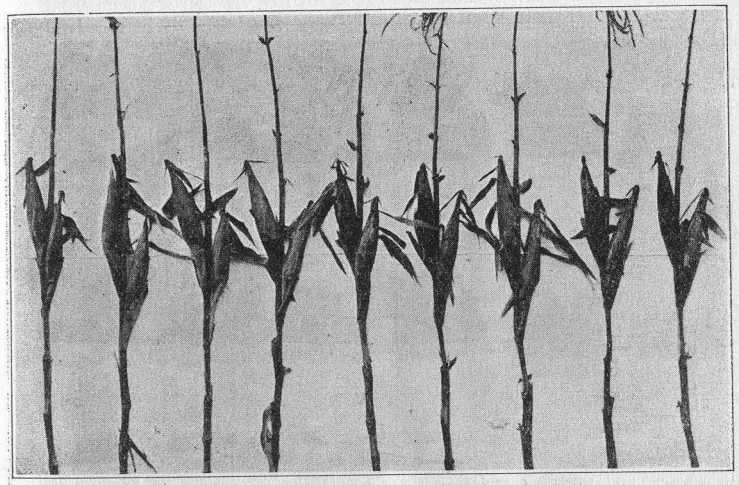

FIG. 8.—Red Leaved White Evergreen, a cross of inbred strains of Sweet Corn. Note uniform earing.

A method of combining a number of inbred strains of field corn and crossing two such combinations, called "multiple crossing," is being tried out to simplify the production of crossed seed corn on a large scale.

Inbreeding and selection are also being applied to some of the naturally cross-fertilized vegetables. It has been found that about 15 per cent of carrot plants set seed from their own pollen. Onions and beets are being self-fertilized for the first time this year. A number of self-fertilized lines of black raspberries are in their second generation and of strawberries in the second generation. Both series are showing many important differences. The strawberries have notably declined in vigor and productiveness and therefore will presumably give the same response to crossing as corn.

Several selections of a cross of Cuban and Broadleaf tobacco have been backcrossed to Cuban from one to four times. The number of generations of backcrossing to restore the main type of one of the parents while retaining a few of the most valuable characters of the other parent is being determined.

Pure line selections are also being made in tobacco, lettuce, lima beans and peppers to find out possibilities for improvement by this method.

SOILS

In the attempt to identify all of the soils of the state 51 different series have been classified. When these are divided into

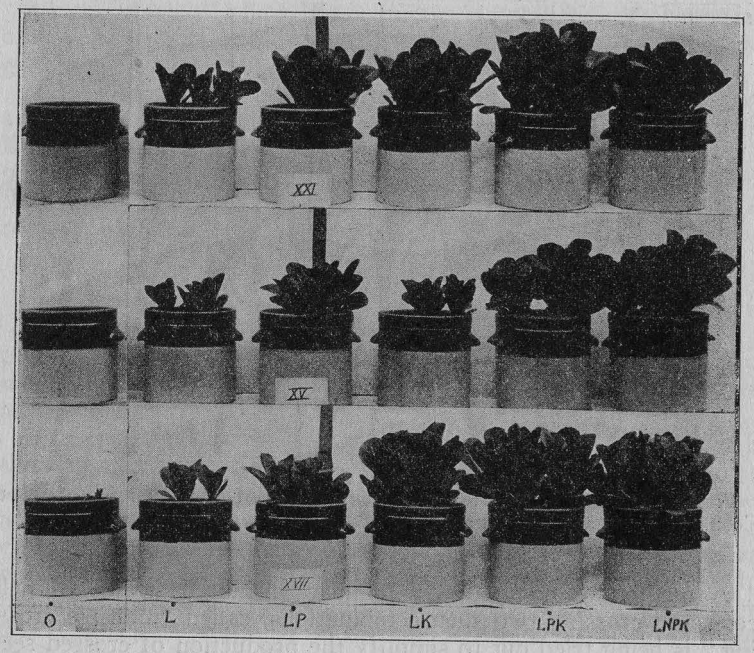

FIG. 9.—Crops Vary in their Fertilizer Requirements on Different Soils. Growth of lettuce on three different soils with treatments as follows:

O—Nothing.
L—Lime.
LP—Lime and Phosphorus.
LK—Lime and Potassium.
LPK—Lime, Phosphorus and Potassium.
LNPK—Lime, Nitrogen, Phosphorus and Potassium.

On Soil XXI there is an almost equal response to Phosphorus and Potassium. On Soil XV there is a marked response to Phosphorus, but a slight response to Potassium until Phosphorus has been applied. Soil XVII shows only slight response to Phosphorus but very large benefits from Potassium.

types we find over 150 distinct soils represented in Connecticut. The major problem has been to devise a workable agronomic classification of these many types, which are taxionomically different. Some progress can be definitely reported. The 51 soil series can be divided into 10 major groups, which with some sub-grouping make 15 in all. A key has been worked out for the use of county agents or other workers.

Greenhouse studies were conducted on 22 soils representing 12 distinct types. All but three show a marked response to lime. Potash produced some increase on all but two soils, but on five only was it as valuable as phosphorus.

An outgrowth of the laboratory studies was the discovery that old tobacco soils are very high in available phosphorus and as this was confirmed by field tests at the Tobacco Station, farmers have been advised that phosphorus applications may be reduced in such cases. (Tobacco Bulletin No. 7).

TOBACCO SUB-STATION

The fertilizer experiments, coupled with the studies of the soil department, have shown definitely that old tobacco soils do not respond to applications of phosphoric acid in any form. It appears that there are large accumulations in available form in these fields and growers may therefore omit or greatly reduce the application of phosphoric acid which is usually in the form of precipitated bone.

On the extensive *"source of potash"* plots, carbonate of potash has so far given the best quality of leaf. Double manure salts are of no advantage over sulfate of potash.

During the last two years over 1,500 tobacco soil samples have been tested for *acidity*. All cases of Black Root rot have fallen above 5.6 pH, the worst being above 6.0 pH. (Tobacco Bulletin No. 8).

In cooperation with the Bureau of Chemistry, U. S. D. A., we have tested *shade cloth treated in various ways to increase its life*. Untreated cloth loses 47% in strength in one season, while treated cloth lost but 5%. Thus, it would seem that the treatment makes possible a second season for the cloth which is usually discarded after one season. Cloth costs $150 to $200 per acre. Treatment adds 15% only to this cost. The process therefore should effect very material savings. From the standpoint of the yield and quality of the tobacco the yellow, treated cloth is just as satisfactory as the untreated.

In the *topping and suckering experiments* the best results have been obtained when plants are topped four leaves below the first bald sucker, at the time of the opening of the first flowers. Removing suckers twice seems to give the optimum results.

Field Days and Exhibits

Since the purchase of the Mt. Carmel Farm in 1911, no field day had been held on the Station grounds on Huntington Street, the farm being considered a more suitable place. This year it was decided to set aside June 3rd as a special day for inspection of the work being conducted in the laboratories and greenhouses. The Connecticut Dairymen's Association voted to make this their summer meeting and special attention was given to a discussion of alfalfa as a crop for dairy farms. Mr. J. S. Owens and Mr. Raymond Clapp of the Extension Service gave us excellent co-operation. The address by Dr. G. F. Warren of the Cornell College of Agriculture was particularly well received.

The Annual Field Day at the Tobacco Station in Windsor was held on August 2nd with a large attendance. Dr. H. J. Wheeler gave the principal address.

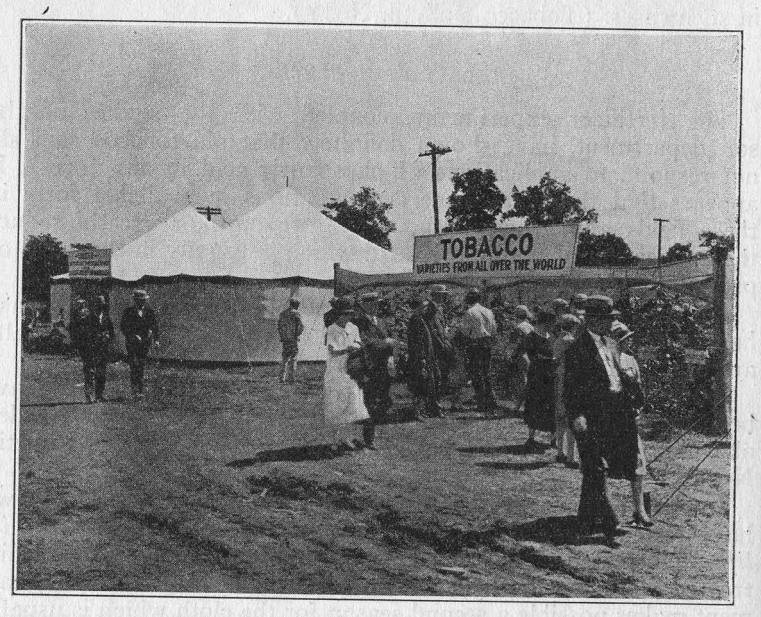

Fig. 10.—Tobacco Exhibit at the Connecticut State Fair—September, 1927.

One of the most successful and attractive exhibits ever shown by the Station was that prepared for the New Haven Progress Exposition held in February, 1927. Five large wall panels were used to illustrate the principal agricultural industries of Connecticut—Dairy, Poultry, Vegetables, Tobacco, Fruit and Forestry. Before these on tables were arranged material showing how the Station serves each of these enterprises.

For the Connecticut State Fair in September this same exhibit was shown, and attracted much attention.

Changes in the Station Staff

Appointments:

W. R. Singleton, S.M., Assistant Geneticist, March, 1927.
H. J. Lutz, M.F., Assistant Forester on Purnell Project, June, 1927.
T. R. Swanback, B.S., Scientific Assistant at Tobacco Station in Windsor, June, 1927.
G. P. Zundel, M.S., Assistant in Botany, July, 1927.
J. P. Johnson, B.S., Deputy in Charge of Asiatic and Japanese Beetle Quarantine, July, 1927.
David S. Walden, B.S., Assistant Chemist, August, 1927.

Resignations:

P. C. Mangelsdorf, S.D., Assistant Geneticist, January, 1927.
Willis R. Hunt, Ph.D., Scientific Assistant in Botany, July, 1927.

Physical Equipment

Additions to the Station's scientific equipment included a Spencer Binocular Microscope for plant pathological work, a Bausch and Lomb Petrographic Microscope for soils investigations, a High Pressure Autoclave for hydrolysis of proteins, a Lovibond Tintometer, a Saybolt Viscosimeter, an electric refrigerator, and a Leitz Research Microscope for cytological studies in plant breeding.

Additions to the library of permanent value were 900. Of these, 100 were bound books and the balance journals and the like which are bound by the Station. The total number of volumes on October 31, 1927, was 16,600.

PROJECTS ACTIVE DURING THE YEAR

Analytical Chemistry

Dr. E. M. Bailey in charge

1. Inspection of Fertilizers.
2. Inspection of Feeding Stuffs.
3. Inspection of Foods and Drugs.
4. Calibration of Babcock Glassware.
5. Inspection of Insecticides and Fungicides.
7. Analysis of Diabetic Foods.

Biochemistry

Dr. T. B. Osborne in charge

(In Collaboration with Dr. L. B. Mendel, Yale University)

I. Nitrogenous Constituents of Plants.
  1. (a) The nature of the simpler nitrogenous constituents of yeast.

(b) The protein and non-protein nitrogenous constituents of the tobacco leaf.
2. (a) Possible means of improvement in the methods for the determination of basic amino acids of proteins.
(b) Methods for the preparation of pure proteins on the large scale necessary for obtaining material for chemical and nutritional studies.

II. Nutrition Investigations.
1. Certain factors in the diet which appear to be responsible for extraordinarily rapid growth.
2. The relation of diet to opthalmia.
3. The relation of diet to fertility in cooperation with Dr. Mason of Vanderbilt University.

Botany

Dr. G. P. Clinton in charge

1. The Effect of Fertilizers, Especially Nitrate of Soda, on the Growth, Yield, Longevity and Yellows of Peaches. (*Terminated during this year*).
2. The Nature and Cause of Mosaic Disease of Plants.
4. The Rusts of Connecticut.
5. Plant Disease Survey of Connecticut.
6. *Thielavia Basicola*, a Study of the Perfect Stage.
7. A Study of *Pythiums*.
8. Comparison of Spraying and Dusting on Apples and Peaches.
9. Control of Celery Blights with Sprays and Dusts. (*Terminated during this year*).
13. Peach "Yellows."
15. Chestnut Blight—virulence studies.
21. Influence of Bud Inheritance on Yield of Peaches. (*Terminated during this year*).
22. Influence of Root Grafts on Scions of Apples. (*Terminated during this year*).

Entomology

Dr. W. E. Britton in Charge

1. The Life History, Habits and Control of the Plum Curculio on Apple.
2. Comparisons of Spraying and Dusting on Apples and Peaches. (See Botany).
6. Control of Foul Brood of Bees.
7. A Study of the Asiatic Beetle, *Anomala orientalis*.
9. Insect Survey of Connecticut.
14. A Study of the Chemical Changes in Standard Spray Mixtures.
15. Bionomics of the Birch Leaf Skeletonizer, *Bucculatrix canadensisella*.
16. Experiments with Baits Attractive to the Cabbage Maggot Fly.
17. Life History and Methods of Controlling the Oriental Peach Moth, *Laspeyresia molesta*.
18. Life History of Imported Current Worm.
20. Life History, Habits and Control of the Imported Birch Leaf-Miner, *Fenusa pumila*.
21. Life History and Control of the Spinach Leaf-Miner.
22. Insects Infesting Nursery Stock in Connecticut.
23. Spraying to Control the Spruce Gall Aphid.

Control Projects

10. Inspection of Orchards and Nurseries.
11. Control of Gipsy Moth.
12. Elimination of the Mosquito Nuisance in Salt Marshes.
13. Inspection of Apiaries.
19. Control of the European Corn Borer.
24. Control of the Asiatic Beetle.

Forestry

Mr. W. O. Filley in charge

1. Experimental Plantations on a Sandy Tract at Rainbow.
   a. Comparison of a wide variety of conifers and hard woods.
   b. Methods of management for those species that have survived.
   c. Studies on growth and habits of the several species.
2. Effect of Thinning in White Pine (At Shaker Station)—Three Grades of Thinning.
3. Effect of Thinning in Hard woods (At Quassipaug Lake).
8. Studies of Forest Plantations (State-wide).
   a. Comparative growth of various species.
   b. Reasons for success or failure.
   c. Soil and other site factors necessary for success of each species.
10. Distribution and Growth of Forest Trees as Influenced by Soil Conditions.
   a. To determine the basic factors inherent in forest soils which influence the natural growth and distribution of trees.
   b. To study the natural distribution of tree species and forest types with reference to soil.
   c. To study the growth and yield of forests as influenced by soil factors.
11. Coniferous Seed Bed Study to Determine:
   a. The value of fertilizers in seed beds.
   b. The value of different amounts of seed.
   c. The value of Dusts and Sprays in preventing damping off.

Control Project

7. Control of White Pine Blister Rust.

Genetics (Plant Breeding)

Dr. D. F. Jones in charge

1. A Genetic Study of Hereditary Characters in Corn Involving Their Linkage Relations and Variability.
2. The Effects of Inbreeding and Crossing Upon Corn in Relation to Vigor, Rate of Growth, Productiveness and Variability.
3. Methods for the Improvement of Naturally Cross-Fertilized Plants by Selection in Self-Fertilized Lines—with Particular attention to the Monoecious, Wind-Pollinated Corn Plant.
4. Methods for the Improvement of Naturally Self-Fertilized Plants—with Particular Attention to Tobacco.

Soils

Mr. M. F. Morgan in charge

1. What Soil Characters are Factors in Determining the Agronomic Value or Utilization of Land?
2. Experiments in Lawn Fertilization.

Tobacco Sub-Station at Windsor

Dr. P. J. Anderson in charge

1. Fertilizer Experiments on Yield and Quality.
   a. Sources of Nitrogen.
   b. Rates of Phosphoric Acid.
   c. Sources and Rates of Potash.
   d. Fractional applications.
   e. Stable Manure.
2. Strain Tests of Havana and Broadleaf.
3. Improvement of "Cuban" Shade Tobacco.
4. Effect of Cover Crops.
5. Brown Root Rot (Tobacco Sick Soils) with U. S. D. A.
6. Black Root Rot—relation of soil reaction.
7. Trials of Cigarette Types of Tobacco.
9. Tests of Chemically Treated Shade Cloth—with U. S. D. A.
10. Role of Humidity and Temperature in Curing.
11. Role of Nitrogen and Sulfur in the Metabalism of the Tobacco Plant.
12. Topping and Suckering—the effects at different Heights and Dates.
13. The Effect of Fertilizers (Acid or Alkaline Residues) on Black Root Rot.
14. Control of Wire Worms in Tobacco.

PUBLICATIONS

Bulletins

No. 282. Fertilizer Report for 1926.
No. 283. The Quality of Vegetable Seed Sold in Packets in Connecticut.
No. 284. Index to Reports on Food Products and Drugs, 1915-1925.
No. 285. Report of the State and Station Entomologist.
No. 286. Report on Food Products and Drugs, Part I.
No. 287. Report on Food Products and Drugs, Part II.
No. 288. The Biology of the Birch Leaf Skeletonizer.
No. 289. Report on Commercial Feeding Stuffs.

Tobacco Series

No. 7. Phosphorus on Tobacco Soils.
No. 8. Report of the Tobacco Station at Windsor (1926).

Circulars of Immediate Information

No. 55. Asiatic Beetle Quarantine.
No. 56. Japanese Beetle Quarantine.
No. 57. Regulations Concerning the Transportation of Nursery Stock in the United States and Canada.
No. 58. Japanese Beetle Quarantine (Revised).
No. 59. European Corn Borer Quarantine (Revised).
No. 60. Revision of Feed Regulations.

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Analytical Chemistry

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W. E. Britton. Engineering News-Record, v. 97, p. 922, Dec. 1926.
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Philip Garman. American Produce Grower, v. II, No. 4, p. 3 and 36, April, 1927.

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R. C. Botsford. Proceedings 14th Annual Meeting of the New Jersey Mosquito Extermination Assoc., p. 115, June, 1927.

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WHAT THE STATION CAN DO

Each mail brings to the station requests for information and service, the range of subjects being almost without limit. Every effort is made to comply with these requests, even though they are outside the fields under investigation. This is one of the purposes for which the library is maintained. However, some of the letters request help that requires an intimate knowledge of live stock management and the like and again we are asked to make laboratory determinations for which we do not have the equipment or staff. Therefore it is helpful to publish from time to time a list of the subjects on which we can furnish information and the kinds of samples we can accept.

The Station can furnish information on:

Fertilizers and fertilization.
Soils and their management.
The chemical composition of Foods, Drugs, Insecticides and Fungicides.
The composition of Diabetic Foods.
Insect Pests of plants and their control.
Fungus and other Diseases of plants and their control.
Sprays and spraying.
Fruits and fruit management.
Weeds and their control.
Forestry—all phases.
Care of Shade Trees.
Plant breeding—especially field and sweet corn.
Lawns, establishment and care.
Bees.
Mosquito Elimination.
Tobacco culture.

Samples and specimens that can be analyzed, tested or identified:

Fertilizers.
Feeding stuffs.
Foods and Drugs.
Milk—except for bacterial count.
Seeds.
Weeds and other plants.
Insects.
Diseased and injured plants.
Soils.

The Station cannot furnish information on:

Live stock feeding and management, including Poultry.
Animal diseases.
Household management.
Clothing.
Farm management.
Marketing and coöperation.

Requests for information on these subjects should be sent to the Connecticut Agricultural College at Storrs.

The Station cannot make analyses and examinations of:

Drinking water—apply to the State Board of Health, Hartford.
Milk for bacterial content—apply to the Dairy Commissioner, Hartford.
Sick or dead poultry should be sent to Poultry Department, Storrs Experiment Station, Storrs, Conn.

All of which is respectfully submitted.

WILLIAM L. SLATE,
Director.

BULLETIN 292 DECEMBER, 1927

Connecticut Agricultural Experiment Station
New Haven, Connecticut

Some Insect Pests of Nursery Stock in Connecticut

W. E. BRITTON and M. P. ZAPPE

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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Some Insect Pests of Nursery Stock in Connecticut

W. E. Britton and M. P. Zappe

Just about thirty years ago, the first nursery inspections were made in Connecticut at the request of nurserymen, so that they could advertise their stock as having been officially inspected. In 1901, the General Assembly passed a law establishing the office of State Entomologist and providing for the annual inspection of nurseries. Thus for twenty-seven years all nurseries have been inspected each year as required by law, and records are available showing the various insects found on the many species and varieties of fruit, shade, forest, and ornamental stock. The more important insect pests are treated in this bulletin for the guidance of nurserymen and plant growers throughout the State.

For convenience in identifying nursery insects, brief keys are arranged under each of the following classes: General Feeders; Insects Injuring Fruit Stock; Shade and Forest Trees; Shrubs and Vines; Evergreens; Perennials.

Following the account of each insect in most cases, one or two references are given where more complete information may be found, mostly reports and bulletins of this Station and of the United States Department of Agriculture.

GENERAL FEEDERS

Key

1. Chewing caterpillars devouring the tissues 2
   Scale insects on bark, sucking the sap 6
2. Feeding upon the leaves 3
   Boring in the wood .....Leopard Moth, p. 120
3. Making no conspicuous nest or web 4
   Hairy caterpillars feeding in web at end of branches, Fall Webworm, p. 120
4. Caterpillars covered with prominent hairs 5
   Caterpillars smooth, making loop when crawling, Cankerworms, p. 120
5. With black, white, or yellow tufts of hair.....Tussock Moths, p. 121
   Gray or brown, without black, white, or yellow tufts; first five pairs of tubercles blue, remaining six pairs red.....Gipsy Moth, p. 122
6. Convex hemispherical brown shells...European Fruit Lecanium, p. 123
   Elongated curved shells, nearly the same color as bark, Oyster-shell Scale, p. 123

Leopard Moth (*Zeuzera pyrina* Linn.)

The larva of the leopard moth is a borer in the wood of nearly all kinds of deciduous trees and frequently is found in nursery stock—especially in apple trees. It requires two years for its complete development. The adults emerge and the female lays eggs on the bark in July. The young larva tunnels in small twigs, which often break off, and then the borer enters the trunk or larger branches. It pupates in the burrow, from which the adult emerges, leaving the pupa case protruding from the tree. The mature larva is about two inches long and is whitish, with tubercles, head, cervical and anal shields dark brown or black, and is shown on Plate I, d. The adults are a dirty white with semi-transparent wings marked with metallic blue dots and have a wing expanse of about one and three-fourths inches in the male to two and one-half inches in the female. In small nursery trees it is best to destroy the tree or branch infested. In larger trees it is possible to kill the borers with knife or wire, or inject a few drops of carbon disulphide and close the mouth of the tunnel.

(Bulletin 169).

Fall Webworm (*Hyphantria cunea* Drury)

All kinds of fruit, shade, and forest deciduous trees and shrubs are subject to the attack of the fall webworm. This insect makes webs or nests on the ends of branches late in summer, and the caterpillars feed inside them. The nests are most noticeable in August and September, though an occasional nest may be seen in June, and a larger number in July. Nests are shown on Plate II, a. There is one generation each year, with a partial second in Connecticut. The earliest nests may produce webworms which develop to the adult stage the same season, and the females lay eggs for the second generation. The adult is a white moth which lays eggs in a compact mass on the under side of a leaf. The young caterpillars make a nest enclosing the leaves on the end of a branch. After devouring the food, they extend the nest to include more leaves. The mature caterpillars are more than an inch long, striped lengthwise with brown and yellow, and covered with brownish hairs.

Trees may be protected by spraying with lead arsenate, and the nests may be destroyed by clipping off and burning them.

(Report for 1917, page 319).

Cankerworms

Cankerworms are small looping caterpillars which feed upon the leaves during May. Some are green and others are dark brown or gray. Two species are involved. The more common one in Connecticut is known as the fall cankerworm, *Alsophila pometaria* Harris, because the moths emerge and the females lay their eggs in late fall. These eggs are gray, cylindrical, and laid on the bark in compact clusters of about one hundred eggs arranged side by side and all standing on end. (Shown in Fig. 11 and on Plate I, a, b, c). The other species is called the spring cankerworm, *Paleacrita vernata* Peck, and lays its eggs in loose clusters on the bark in March. These egg-clusters contain an average of about fifty eggs each and are not all arranged on end like those of the fall cankerworm.

The caterpillars of both species appear at the same time and cause the same type of injury to the leaves. They may be distin-

Fig. 11. Cankerworms.

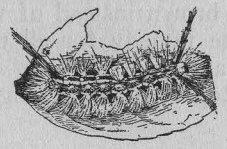

Fig. 12. Larva of the white-marked tussock moth.

guished by the fact that the fall cankerworm has a pair of pro-legs on the eighth segment, which are absent in the spring cankerworm.

Each has a single generation annually. The caterpillars usually become full grown by the first week of June and enter the ground to pupate. The females of both species are without wings and are obliged to crawl up the trunks of trees in order to lay their eggs. The males have wings and are ash-gray in color.

Spraying the foliage with lead arsenate is the remedy.

(Bulletin 1238, U. S. Dept. of Agriculture).

Tussock Moths

There are several species of tussock moths, the larvae of which devour the leaves of deciduous trees and shrubs. Perhaps the most important is the white-marked tussock moth, *Hemerocampa leucostigma* S. & A., which has two generations each season. It hibernates in the egg stage as glistening white frothy egg-clusters on the bark of trees. The caterpillars present a very striking appearance, being striped lengthwise with brown and yellow; the head is bright red and there are four tufts of white or buff up-

standing hairs on the back; two forward-reaching pencils of long black hairs are borne near the head and a similar one reaches backward near the tail, as shown in Fig. 12 and on Plate II, c.

The caterpillars feed on the leaves of fruit trees, and shade and forest trees, especially elm, maple, linden, and horsechestnut. The female is wingless and lays its eggs on the old cocoon, as shown on Plate II, f.

The hickory tussock moth, *Halisidota caryae* Harris, has one generation annually, and the caterpillar, shown on Plate II, b, is covered with white hairs marked with black hairs to form a black median line, and two pencils of black hairs at each end of the body. It feeds upon hickory, apple, oak, elm, maple, poplar, linden, and many other trees. The tessellated tussock moth, *H. tessellaris* S. & A., also feeds upon a large number of shade and forest trees, though it is usually less abundant than the hickory or white-marked tussock moths. Its caterpillar resembles *caryae* but has light brown instead of white hairs.

The remedy for all three species is to spray the foliage with lead arsenate.

(Report for 1917, page 325).

Gipsy Moth (*Porthetria dispar* Linn.)

Though not particularly a pest of nursery stock, in seriously infested areas it may be considered as such. There is but one generation each year, the eggs being laid in midsummer and hatching the following spring. The caterpillars feed from birth, about May 1, until fully grown, late in June. They are about two inches in length, hairy, and generally of a brownish or grayish color, sometimes with a distinct median stripe, each side of which there is a row of tubercles or spots. Beginning with the head, the first five pairs of tubercles are bright blue, and the remaining six pairs are a dull brick red.

The pupae are formed in cavities, crotches, on the under side of branches, fence rails, and in other protected situations. From ten to fourteen days are passed in this stage, when the adults emerge. The male is usually a light, grayish-brown moth with a wing-spread of about one and one-half inches, though varying to dark brown. It is a strong flyer and flies during the day. The female has a heavy body and does not fly, is dirty white or buff in color, with wings marked with brownish zigzag cross-bands, as shown in Fig. 13. It has a wing expanse of two inches or more and is usually seen resting on the trunks or branches of trees where the eggs are laid. The eggs are laid in clusters of 200 to 400 each and are covered with hairs from the body of the female parent. These clusters are about an inch long and two-thirds as broad. They

look and feel like a bit of chamois skin. An egg cluster, cocoon, and caterpillar are shown on Plate II, d. and e.

Though the gipsy caterpillars feed upon many kinds of trees, shrubs, and plants, they seem to prefer apple, oak, and willow. Ash is nearly exempt from injury. The remedies are to spray the foliage with lead arsenate in May and June to kill the caterpillars, and to soak the egg-clusters, whenever found, with creosote to prevent hatching.

(Bulletin 186).

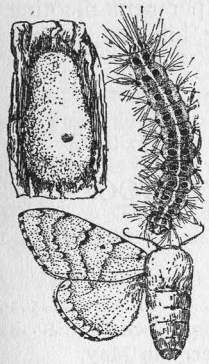

Fig. 13. Gipsy Moth.

Fig. 14. Oyster-shell scale.

European Fruit Lecanium (*Lecanium corni* Bouché—*armeniacum* Craw.)

This European scale has now become one of the most common of all the brown soft scales in the eastern United States. Not only does it attack and injure fruit trees, but also rose, blackberry, ash, chestnut, oak, maple, elm, and linden.

This is a reddish-brown scale, very convex in shape, and the individuals are usually thickly clustered on one side of the stem. Each reaches a diameter of about one-eighth of an inch. The species hibernates on the twigs in a partially grown condition. The young emerge in May and June. (Shown on Plate III, b).

This scale may be killed by dormant sprays of lime-sulphur and miscible oils.

(Report for 1905, page 237).

Oyster-Shell Scale (*Lepidosaphes ulmi* Linn.)

The oyster-shell scale is found on nearly all kinds of deciduous trees and shrubs, and even occasionally on evergreen species like boxwood. It is one of the commonest pests of nursery stock and occurs particularly on apple, ash, birch, lilac, poplar, walnut (*Juglans*), and willow.

The female shells are long and narrow, more or less curved, and about the same color as the bark. They are shown on Plate III, a, and in Fig. 14. Males are less elongate and much smaller.

There is one generation each year, the insect passing the winter in the form of white, oval eggs under the female shells. These eggs are laid in August and September and hatch the latter part of the following May.

All thoroughly infested trees or shrubs or branches thereof should be removed and burned. The remaining portions should be sprayed while dormant with liquid lime-sulphur (1 - 9) or with a miscible oil (1 - 15). Also a spray of 40 per cent nicotine solution (1 - 500) about June 10 will readily kill the young.

(Report for 1903, page 229).

INSECTS INJURING FRUIT STOCK

Key

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   Not forming prominent nests or webs 3
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4. Striped lengthwise with brown and yellow; with dorsal spines and prominent red hump on fourth segment, Red-humped Caterpillar, p. 126
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Eastern Tent Caterpillar (*Malacosoma americana* Fabr.)

Makes nests or tents in the crotches of apple and wild cherry trees in early spring, and is often found on pear, peach, and plum. This is a one-generation insect. Caterpillars reach a length of about two inches and are brown, with a white line along the back, more or less blue along the sides and sparsely covered with light brown hairs. They feed outside the nest and leave a strand of

silk wherever they travel along a twig or branch. They reach full size in early June, crawl about for a few days, then under rubbish or in protected places spin white, oval cocoons about an inch long. Two weeks later, emerge the fawn-colored moths which fly at night, mate, and the females during July lay on the twigs clusters of eggs which hatch the following April. These clusters are in the form of cylinders partially or entirely encircling the twigs, and covered with a tough, glue-like substance to protect the eggs. Egg-mass, caterpillars, and nest are shown on Plate III, c, d, and e.

The remedies are: Clip off and burn the egg clusters during the winter; rub off the nests when first formed, and crush the young caterpillars; spray the foliage with lead arsenate.

(Bulletin 177).

Fall Webworm. See page 120

Apple and Thorn Skeletonizer (*Hemerophila pariana* Clerck)

For the past few years, small, slender caterpillars feeding under webs on the upper surface of apple leaves have been rather common. It is a European pest first appearing in this country in Westchester County, New York, whence it has spread over the New England States, eastern New York and portions of New Jersey and Pennsylvania. There are three generations each year, with a partial fourth in certain seasons. In 1923, nearly all unsprayed apple trees in central Connecticut were skeletonized and brown in July. Since then it has subsided, and though careful search shows it to be present in nearly every orchard, it has done little harm and most of the caterpillars apparently have been either parasitized or eaten by birds, and have not developed to the adult stage. Eggs are laid singly on the under side of leaves. The caterpillars feed at first on the lower surface, but when about one-third grown they move to the upper side and spin a light web across the leaf, often curling it, and feed beneath the web. White cocoons are often made on the leaves. Injured leaf and cocoon are shown on Plate IV, a. Apparently the insect hibernates in the adult form, which is a small brownish or grayish moth, often with purplish tinge. It rests on window-screens with folded wings, forming a triangle, each side of which is about one-fourth of an inch.

This insect is easily controlled by a spray of lead arsenate.

(Bulletin 246).

Cankerworms. See page 120

Red-Humped Caterpillar (*Schizura concinna* S. & A.)

In late summer, curious caterpillars are often found feeding in clusters on young apple trees, sometimes defoliating them. These

caterpillars reach a length of one and one-half inches and are striped lengthwise with fine lines of yellow, black and white. Spines are borne on the back, but these are longest on the fourth segment, which is dorsally enlarged and a bright coral red, giving the caterpillar its common name. Instead of resting on leaf or stem in the usual position of most caterpillars, the tail end of the body is elevated, as shown on Plate VI, a. The adult is a light brown moth with a wing expanse of over an inch, and there is only one brood each year. The pupae live in the ground over winter.

The caterpillars may be gathered by hand and destroyed, or the foliage may be protected with a spray-coating of lead arsenate.

(Bulletin 203, and Report for 1917, page 329).

Yellow-Necked Caterpillar (*Datana ministra* Drury)

Another caterpillar which feeds in clusters on apple trees in nurseries and young orchards in late summer is the yellow-necked caterpillar. When fully grown it is nearly two inches long and is striped lengthwise with yellow and black along the back. Like other caterpillars of the genus *Datana,* when disturbed it elevates head and tail, as shown on Plate VI, b. Head and legs are black and shining, and an orange-yellow cross band next the head gives the insect its name. It is sparsely covered with rather short and weak light brown hairs. Only one generation occurs each year, the winter being passed by the pupae in the ground.

As these caterpillars feed mostly on young trees and in clusters, it is easy to remove and destroy them, or the foliage may be protected by spraying with lead arsenate.

(Bulletin 203, and Report for 1917, page 328).

Gipsy Moth. See page 122

Tussock Moths. See page 121

Japanese Beetle (*Popillia japonica* Newman)

This insect from the Orient was first discovered in this country at Riverton, New Jersey, in 1916. Since then it has spread over most of New Jersey, eastern Pennsylvania, western Long Island and Westchester County, New York, into Connecticut as far as Bridgeport, and in 1927 it was found in Washington, D. C., and at several points in Maryland.

There is only one generation each season, and the insect passes the winter as a grub or larva in the soil. The beetles emerge from June 15 to August 15, most of them coming out in July. The grubs feed upon grass roots, and the beetles devour the foliage and fruit of most kinds of fruit trees, the foliage of many shade

trees and ornamental shrubs, as well as the flowers and leaves of many annual and perennial plants. Nursery plants with soil on the roots are liable to contain larvae, and if not treated, they may be transported in this manner. The beetle, egg and grub are shown in Fig. 15, and beetles and rose leaves injured by them are shown on Plate IV, b. and c.

The remedies are: treating the soil with carbon disulphide emulsion; spraying the foliage with coated lead arsenate; spraying the beetles with oleoresinate of pyrethrum. It is a difficult pest to control.

(Report for 1926, page 244).

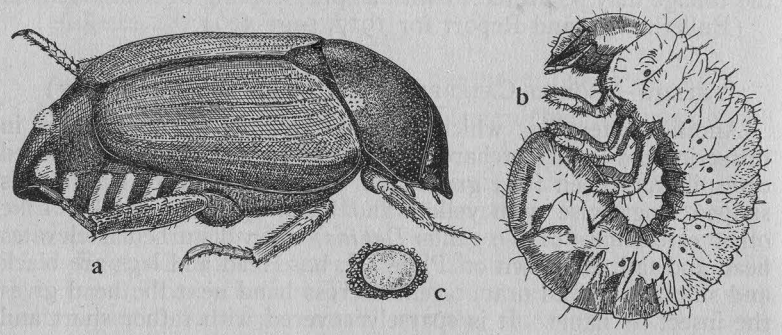

FIG. 15. The Japanese beetle. a, adult beetle; b, grub or larva; c, egg. All enlarged about five times.

THE ROSE CHAFER (*Macrodactylus subspinosus* Fabr.)

The rose chafer occurs from Canada south to Virginia and Tennessee and west to 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.

The injury to the foliage and fruit is done by the adult beetle. The rose chafer is a yellowish-brown beetle about one-third of an inch long and with long sprawling legs. The larva or grub is yellowish-white with pale brown head; it lives in the ground and is rarely seen. The adult beetles feed upon the leaves of a number of plants, as well as flowers and fruit. They are very fond of grape blossoms and newly set fruit, often destroying the entire crop. Roses and peonies, especially the light-colored varieties, are often ruined by this insect. In nurseries grape leaves are sometimes partly eaten. Hydrangeas were injured quite severely in 1927. The work of this insect is shown in Fig. 16, and on Plate V, a.

The beetles emerge from the ground and attack the plants usually about the second week in June in Connecticut. Soon after emerging, the beetles mate, and the female lays her eggs singly in

the ground, usually depositing from 24 to 36 eggs. These eggs soon hatch, and the young larvae feed on the roots of grass and other plants until fall, when they descend deeper into the soil below the frost line. In the spring the grubs ascend, transform to pupae in earthen cells, and the beetles emerge two to four weeks later.

The rose chafer is an exceedingly difficult insect to control by ordinary measures. The best remedy known is to cover the foliage with a heavy application of arsenate of lead. In vineyards, hand picking is sometimes recommended to protect the blossoms

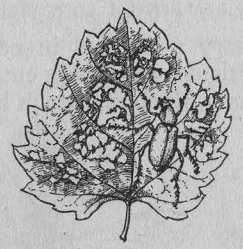

FIG. 16. Rose chafer.

and newly set fruit from being eaten by this insect. In New Jersey, self-boiled lime-sulphur is an effective repellent on fruit trees.

(Report for 1916, page 111).

THE PEAR SLUG (*Eriocampoides limacina* Ratz.; *Caliroa cerasi* Linn.)

In late summer the leaves of pear stock are often eaten by soft, slimy, brown, slug-like worms which feed upon the upper surface. Cherry leaves are likewise injured. This has been called the cherry and pear slug, and several scientific names have also been applied to it. It is the larva of a sawfly, and there are two generations each season. This insect is shown in Fig. 17.

The pest is easily controlled by spraying or dusting with lead arsenate or fresh hellebore.

(Report for 1920, page 199).

IMPORTED CURRANT WORM (*Pteronidea ribesi* Scop.)

This insect often defoliates currant and gooseberry bushes in nurseries. The adults of the currant worm spend the winter months in the ground and emerge during the latter part of April or early May. They lay their eggs on the under side of the leaves. In about a week or ten days the eggs hatch, and the young larvae

begin to feed on the tender leaves. After they are full grown, they enter the ground and spin small brown cocoons, from which the adults for the second brood emerge. Shown in Fig. 18.

The control measures for this insect are very simple. Usually one application of arsenate of lead, either in the form of dust or spray, will hold it in check. If the fruit is to be picked and sold, it is better to dust the plants with hellebore, as this soon washes off and is not so poisonous to man as arsenate of lead.

(Report for 1902, page 170).

Climbing Cutworms

Apple trees in nursery rows and in newly set orchards have been injured in Connecticut by climbing cutworms. In May, 1925, on apple stock in Durham, the buds which had been set the preced-

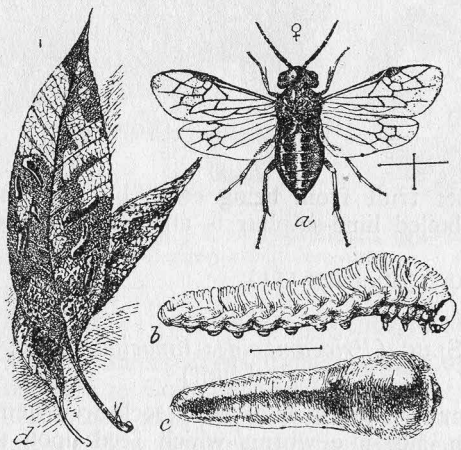

Fig. 17. Pear slug. a, adult sawfly, female; b, larva with slime removed; c, larva in normal state; d, leaves and larvae, natural size; a, b, c, much enlarged. (After Marlatt, Circular 26, Division of Entomology, U. S. Department of Agriculture).

ing summer were eaten off (see Plate VI, c), and raspberry plants near by had also been stripped. Two species of cutworms were responsible, and when reared, the adults proved to be *Agrotis unicolor* Walker (formerly *Noctua clandestina* Harris) and *Noctua fennica* Tausch. In May, 1926, similar injury occurred on grafts set in young orchard trees in Wallingford, and was caused by the dingy cutworm, *Feltia subgothica* Haworth. In May, 1922, raspberries in East Haven were injured by cutworms, and from the material two moths were reared, *Paragrotis messoria* Harris and *P. tessellatus* Harris. The same season larvae of *Noctua c-nigrum*

Linn. injured strawberry plants in a field near New Haven. As the injury is seldom noticed until too late, treatment is ineffective. In certain cases a liberal application of lead arsenate may protect the plants.

(Bulletin 247, and Report for 1922, pages 373, 375; Bulletin 275 and Report for 1925, page 324; Bulletin 285, and Report for 1926, page 276).

New York Weevil (*Ithycerus noveboracensis* Först.)

Though the injury is not common, occasionally young pear and plum trees are injured by this weevil, which eats into the bases of new shoots, sometimes nearly severing them. In a young orchard in Wallingford in 1908, injury by this weevil was quite prominent

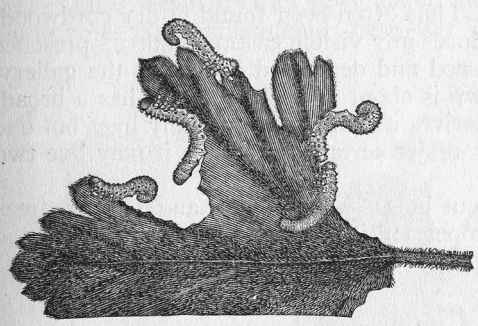

Fig. 18. Imported currant worm.

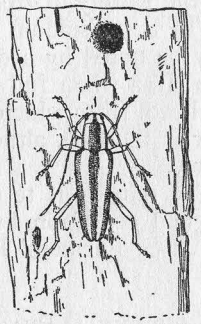

Fig. 19. Round-headed borer.

the last week in May. The insect is a snout beetle about half an inch in length, gray or slightly reddish, marked with quadrate black spots.

Spraying with lead arsenate proved an effective remedy.

(Report for 1908, page 845).

Leopard Moth. See page 120

Apple Tree Borers

There are two common species of borers which attack apple trees in Connecticut. They are known as the flat- and round-headed borers.

The round-headed borer, *Saperda candida* Fabr., usually attacks the main trunk of the trees near the base. The adult is one of the long-horned beetles and may be easily recognized by two straight white lines running lengthwise on its back (see Fig. 19). The eggs are laid during the summer, and the young borers tunnel just

under the bark until winter. The following year they tunnel into the sapwood and the third year feed directly in the solid wood. By this time the borers are quite large and do much damage to young trees, often killing them. The best remedy is to cut them out with a knife. Often a wire with a barb near the end is very useful to push into the tunnels and draw out the borers. The insect sometimes attacks other trees beside apple, quince being a favorite host, as well as *Crataegus* and mountain ash. The presence of borers may be noted by sawdust on the ground at the base of trees, which the borers have pushed from their burrows.

(Report for 1907, page 333).

The flat-headed apple tree borer is the larva of a Buprestid beetle, *Chrysobothris femorata* Fabr. As a rule, this insect attacks only trees that have been weakened by some other cause. It attacks a large variety of trees and has often been found in dry cordwood.

The borer seldom produces any visible castings, but its presence may be noted by a darkened and depressed area over the gallery. The larva when full grown is about an inch long and has a broad, flat head, from which it derives its name. It normally lives but one year in the tree, although under certain conditions it may live two years.

The remedy is to cut out borers when found and to keep trees in good condition by proper cultivation and fertilization.

(U. S. Farmers' Bulletin 1270, page 73).

Oriental Peach Moth (*Laspeyresia molesta* Busck)

This pest from the Orient is believed to have been brought into the United States on flowering cherries from Japan and has now spread throughout the Atlantic States as far north as Massachusetts and as far west as the Mississippi River. It has also been found in Ontario, Canada. There are three generations each season, and the larvae live through the winter in inconspicuous cases on the bark. The larvae tunnel in the twigs (see Plate V, b), causing the tips to die and the lateral buds to develop and form thick bushy tops. Though primarily an orchard pest, it often attacks nursery trees. No good remedies are known.

(Reports for 1925, page 280; 1926, page 234).

Peach Borer (*Synanthedon exitiosa* Say)

The adult of the peach borer is a wasplike moth. It lays its eggs in midsummer, and the borers hatching from them live in the trunks and often the larger roots until the following June or July, when they pupate in their burrows. The adults emerge to lay eggs for the next generation. This borer is shown on Plate VI, d.

The only satisfactory remedy on nursery trees is to cut open the burrows and kill the borers. A small piece of wire is very useful to insert into the burrows to pull the borers out, saving considerable cutting of the trunk of the tree. The injury may easily be seen by masses of gum at the base of the tree. This gum is often full of small particles of wood which the borer pushes from the burrow. Older peach trees may be treated with paradichlorobenzene, but this treatment is not safe on nursery trees.

(Report for 1909, page 359).

Shot Hole Borer (*Scolytus rugulosus* Ratz.)

This insect attacks most of the fruit trees which are normally grown in Connecticut. The injury is caused by the larva of a small beetle which lays its eggs under the bark of weakened and sickly trees, rarely attacking vigorous, healthy trees. The eggs

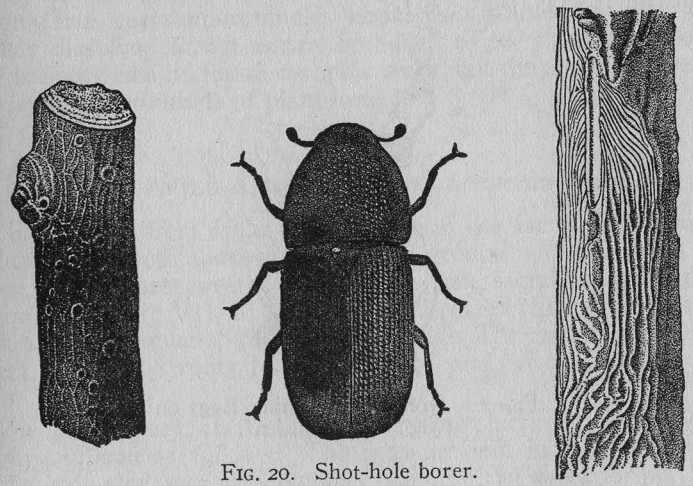

Fig. 20. Shot-hole borer.

hatch into small white grubs which bore just under the bark and slightly into the wood. The larvae live over the winter in these galleries and during the following summer transform to the adult stage and emerge from the trees, leaving small round holes in the bark. The bark of the infested trees looks as though it had been riddled by shot, and this fact gives the insect its common name. Occasionally the beetles tunnel at the base of small twigs, which may weaken the tree to such an extent that the grubs may live under the bark. This insect is shown in Fig. 20.

The only remedy is to cut out infested trees or branches and burn. Much can be done to prevent injury by removing sickly trees in or near the nursery and keeping all fruit stock in a vig-

orous growing condition by the application of nitrogenous fertilizer and by cultivation.

Imported Currant Borer (*Sesia tipuliformis* Clerck)

The adult is a clear-wing moth which appears in June, and the female lays eggs singly on the bark. The young larvae enter the stem and bore upward or downward in the pith, killing the stem. They are nearly full grown when winter approaches and hibernate in the burrows. The following May, each larva tunnels outward but leaves the burrow covered by a thin layer of bark. It then pupates in the burrow, and in June the moth emerges, leaving the pupa skin projecting from the cavity. There is only one brood each season. Infested canes appear sickly and should be cut off and burned before June 1 to kill the borers before the moths emerge.

(Fruit Insects, page 339).

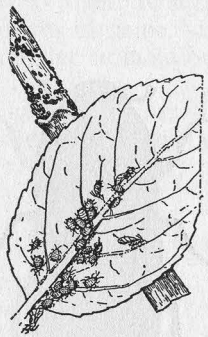

Fig. 21. Green apple aphid. Eggs on twig; aphids on leaf.

Green Apple Aphid (*Aphis pomi* De G.)

This insect probably causes more injury to apple trees in the nursery than any other insect attacking apple trees in Connecticut. This was particularly true during the early summer of 1927, when these insects were very numerous and caused much injury by stopping growth and distorting young apple trees in Connecticut nurseries.

The insect passes the winter in eggs laid on twigs. The eggs are yellowish-green when laid, becoming glossy black. The young aphids hatch early in the spring, as soon as the buds begin to open, and start to feed on the young, unfolding leaves. No eggs are laid during the summer generations, the young aphids being born alive, and are ready to feed immediately. There are from 9 to 17 broods

produced during the season, following which the sexual individuals appear and deposit the overwintering eggs. This aphid is shown on Plate VII, b, and in Fig. 21.

Thorough spraying of the trees when the buds are opening in spring, using lime and sulphur at the rate of one part to nine parts of water, plus one pint of nicotine sulphate to every one hundred gallons of water, will be found of great value. Some of the miscible oils are also very good for this purpose, if the directions of the manufacturers are followed. Spraying at this time with either of these sprays will also help in the control of San José scale. During the summer, after the leaves have become curled, it is almost impossible to hit the aphids with any sprays. It is therefore necessary to dip the tips of the branches—where most of the aphids are found—in a pail of spray material consisting of one pint of nicotine sulphate to one hundred gallons water. It is very important that about four pounds of soap, previously dissolved in hot water, be added to the mixture. Other aphids may often be found on apple stock, but the above treatment is effective on all kinds of plant lice.

Woolly Apple Aphid (*Eriosoma lanigerum* Haus.)

This aphid differs from other aphids in the fact that it attacks its host plants both above and below the ground, and those that are above ground are covered by a white wax secretion resembling cotton (see Plate VII, c). These aphids often cluster in wounds, such as scars, cankers, and other injuries. The root form of this insect causes the roots to be deformed and covered with small galls.

The life history of this aphid is rather intricate but may be briefly outlined as follows: The eggs are laid in the crevices of the bark on elm trees in September and hatch in early spring. The aphids hatching from these eggs are wingless females and their young are also wingless, but the next brood produces winged adults which migrate to apple and sometimes to pear, quince, mountain ash and *Crataegus*. There are three summer broods, and in August winged females appear which migrate back to elm and lay winter eggs.

The aerial form may be controlled by spraying with kerosene emulsion or with nicotine sulphate and soap. The underground forms are harder to kill, as it is almost impossible to make spray permeate the ground sufficiently to kill the aphids. Carbon disulphide emulsion has been used with some success. One-half pound of carbon disulphide emulsion in four gallons of water poured into a shallow trench around the trees will kill the underground forms.

(Report for 1924, page 308).

Black Cherry Aphid (*Myzus cerasi* Fabr.)

The black cherry aphid is often very abundant on sweet cherry stock in nurseries. It is a black insect with a rounded abdomen, giving it a more or less globular appearance.

The eggs are laid upon cherry twigs in the fall and hatch early in the spring, often before the cherry buds open. They are able to withstand freezing, and as soon as warm weather comes and the buds open, they begin to feed and reproduce. This usually takes place in two or three weeks. Later broods become mature in less than a week. Some of the individuals of the later broods become winged and migrate to pepper grass, where they continue to reproduce until fall. They then migrate back to cherry and lay the overwintering eggs. Not all of the aphids migrate from cherry, and some can usually be found on it all summer, although during the latter part of the season they may not be very plentiful.

Control measures given for green apple aphids will be found useful for the cherry aphids. (See page 135).

(U. S. Farmers' Bulletin 1128, page 20).

Currant Aphids

There are several species of aphids causing injury to currant foliage. Their life histories are very similar and the same control measures would be equally effective on all species.

Perhaps the most common species in Connecticut is called the currant aphid, *Myzus ribis* Linn., which causes the terminal leaves to become much distorted, and little pits or pockets are formed on the under side of the leaves. The upper surface becomes more or less reddish in color, which is noticeable some distance away. When plants are heavily infested, these leaves fall, causing the plants to make a poorer growth.

The stem mothers hatch from eggs on currant twigs soon after the leaves develop in spring. Some of the young from the stem mothers develop wings and migrate to motherwort, hedge-nettle, and other related plants. The wingless forms remain on currants and continue reproduction. In each generation some winged individuals appear which migrate, but wingless forms are found on bushes until late summer. Early in October, migrants return and deposit the sexual females, which, when mature, mate with the winged males, and eggs are laid upon the twigs.

Spraying with nicotine sulphate and soap when the buds are opening will kill the stem mothers, or a later spray of the same material, directed upward to hit the aphids on the under side of the leaves, will hold the insects in check.

(U. S. Farmers' Bulletin 1128, page 28).

San José Scale (*Aspidiotus perniciosus* Comst.)

A number of years ago this insect was considered one of the most destructive scales infesting nursery stock. It is thought to have been introduced from China and was first found in this country in San José, California, about 1870. Since that time it has been spread through the principal fruit and nursery districts of the United States.

The general use of dormant and summer sprays, together with its natural enemies, has so reduced its numbers that it is not considered so serious a menace as formerly. Occasionally, however, nursery trees are nearly killed by this insect. This is particularly true of fruit stock which has been heeled in for a few years; it invariably becomes infested with scale and must be destroyed. Apple, pear, and peach trees are its favorite food plants, but other fruit trees, as well as shrubs and shade trees, are often attacked.

The scale or covering beneath which the insect lives is circular, about the size of a pin-head, grayish in color, with the central portion raised, and is shown in Fig. 22, and on Plate VII, a.

The best method of control is to spray the trees while dormant with a lime-sulphur solution, using one part to nine parts of water, or with one of the many miscible oils now on the market, following the manufacturer's directions.

(U. S. Farmers' Bulletin 1270, page 62).

Oyster-Shell Scale. See page 123

Scurfy Scale (*Chionaspis furfura* Fitch)

Apple and pear trees, as well as other common deciduous trees and bush fruits, are often attacked by the scurfy scale, which retards the growth and sometimes causes the death of the trees if the infestation is severe. This insect is a native of the United States, but is most common in the New England and Middle Atlantic States. It is easily recognized by its dirty-white color and pear-shaped scale in the female, and the white elongated scale of the male, as shown on Plate VII, f.

The insect winters in the egg stage, the eggs being found under the female scales. The eggs and the young scales are purplish, tinted with red, and hatch the last week of May. In the North there is but one brood each season, but farther south there may be two or three broods.

A dormant spray of lime and sulphur, or a miscible oil, applied as for San José scale, will usually control the scurfy scale.

(U. S. Farmers' Bulletin 1270, page 65).

Leaf Hoppers on Apple

There are two species of leaf hoppers commonly found on apple stock in Connecticut nurseries. They are quite similar in appearance but their life histories, as well as the injury they cause to growing apple trees, are quite different.

The leaf hopper causing the most injury to young apple trees is known as the apple leaf hopper, *Empoasca mali* LeBaron, shown in Fig. 23. The other is commonly known as the rose leaf hopper, *Empoa rosae* Linn. The injury caused by the former is very noticeable on young trees, where it attacks the tender terminal leaves, causing them to become reduced in size, curled, and misshapen. The effect of feeding by the insects is to make the tips and edges of the leaves brown and dry.

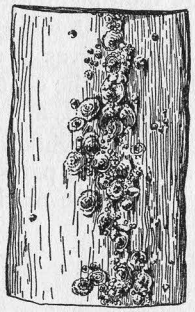

Fig. 22. San José scale.

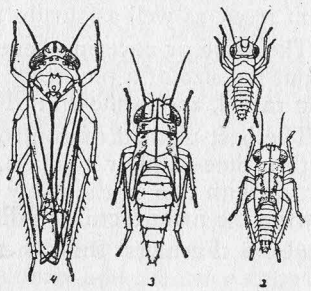

Fig. 23. The apple leaf hopper, in its different stages. (After Washburn, 9th Report State Entomologist of Minnesota).

The life history of the apple leaf hopper is as follows: The adults pass the winter under fallen leaves or any other convenient shelter. When the weather becomes warm in the spring, they leave their hibernating quarters and go to the young apple leaves to feed. Later the eggs are laid under the lower epidermis of the leaves and hatch in a short time. Three generations are produced each year, the last one hibernating.

The so-called rose leaf hopper makes the apple leaves appear more or less stippled or mottled. Leaves seriously infested by this insect are unable to function properly, and in extreme cases fall to the ground, interfering with the proper growth of the trees.

This insect is believed to have been introduced from Europe, perhaps on nursery stock, and is now widely distributed throughout the United States. Among its food plants, besides apple, are grape, raspberry, currant, gooseberry, blackberry, elm, oak, and others, though rosaceous plants are preferred.

The leaf hopper passes the winter in the egg stage. The eggs are deposited beneath the bark of apple and rose, producing tiny, raised, blister-like spots. They hatch in early spring, and the young are mature early in summer. The eggs for the second brood are deposited in the veins of the leaves. There are two broods each season.

Control measures are the same for both species: A spray of one pint of nicotine sulphate in a hundred gallons of water in which four pounds of soap have been dissolved will be found very effective if applied when the first generation is still young. The spray must strike the underside of the leaves where the young leafhoppers feed.

(U. S. Farmers' Bulletin 1128, page 26).

Tarnished Plant Bug (*Lygus pratensis* Linn.)

This insect injures peach stock by puncturing the tip of the tender new shoots, sucking out the juices, and probably injecting

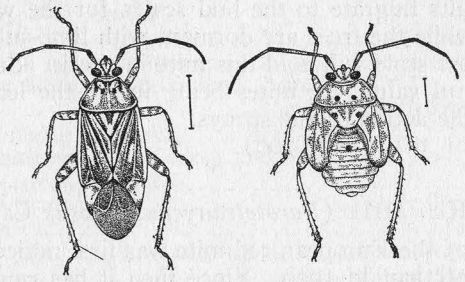

Fig. 24. Tarnished plant bug: adult at left: last stage of nymph at right. Enlarged about four times. (After Chittenden, Bulletin 43, Bureau of Entomology, U. S. Department of Agriculture).

some poisonous substance into the tissues, which soon die. This injury is called "stop-back" or "bush-head." Pear and apple trees, and many flowering plants are also injured by the tarnished plant bug. The female lays eggs in the tender shoots or in the petioles or veins of the leaves. The young bugs are yellowish-green and pass through five stages before the mature winged form appears. Both nymph and adult are shown in Fig. 24. There are probably several generations each year, and all stages may be found from May until November.

All weeds and rubbish around the field should be destroyed by burning or plowing. Spraying heavily with nicotine solution and soap will probably kill the nymphs.

(Missouri Bulletin 170, page 17).

Pear Leaf Blister Mite (*Eriophyes pyri* Pag.)

The pear blister mite attacks the foliage of apple and pear but rarely causes any serious injury to apple foliage. On pear it is often a serious pest, causing a slowing up of tree growth, making undersized pear stock. It produces on the foliage small reddish or greenish galls or blisters which, after a time, turn brown, spotting the leaves with dead areas, as shown on Plate VII, e. When the galls are abundant, the tissues become dead, and the injured leaves have a brownish, shriveled appearance and often drop.

This mite is of European origin, but is now widely distributed wherever pears are grown.

The winter is passed in the adult stage under the bud scales. The adults are very small, elongate, whitish insects. In spring when the leaves are unfolding, the mites enter the leaves through the lower epidermis, and their activities soon produce their characteristic galls, in which they live and multiply. After reaching maturity, the mites desert the old galls, make new ones, and produce a new generation. The process continues until cold weather, when the adults migrate to the bud scales for the winter.

Spraying while the trees are dormant with lime-sulphur solution as for San José scale will hold this mite in check. Summer sprays are of doubtful value, the mites being inside the leaves and protected from the action of the sprays.

(Report for 1910, page 700).

European Red Mite (*Paratetranychus pilosus* Can. & Fanz.)

The work of the European red mite was first noticed on orchard trees in Connecticut in 1920. Since then it has caused considerable injury to orchard trees throughout the State.

The presence of mites on the foliage is usually indicated by the leaves turning brown, if the infestation is severe. A light infestation gives the foliage a sickly color and interferes with the proper functioning of the leaves.

The mite has been found on apple, cherry, plum, peach, pear, rose, and elm, although most of the real injury in Connecticut has been noticed on apple.

The eggs of the European red mite may be found on the branches and twigs of infested trees during the late fall and winter, as are shown on Plate VII, d. They are reddish in color and .15 mm. in diameter. When plentiful, they give the twigs the appearance of being covered with brick dust. The eggs hatch during the latter part of April or early in May, and the young mites make their way to the young leaves, where they begin to feed. They reach maturity in about three weeks and begin to lay eggs for the next brood. There are several broods in a season.

The best-known remedy is to spray in early spring, just before the eggs hatch, with one of the miscible oils. Lime-sulphur may be used, but is not as effective as an oil spray. Care must be taken to spray thoroughly, hitting all the eggs. If many of the eggs are missed in spraying, they will hatch and breed fast enough, under favorable conditions, to give rise to a serious infestation later in the summer. If mites become plentiful during the summer, a spraying of linseed oil emulsion will be effective, using one gallon of linseed oil and one and one-quarter pounds of soap to one hundred gallons of water.

(Bulletin 252).

INSECTS INJURING DECIDUOUS SHADE AND FOREST TREES

Key

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   Mining in leaves of locust.....Locust Leaf Miner, p. 143
   Making blotch mines in birch leaves, Imported Birch Leaf Miner, p. 143
2. Skeletonizing the leaves 3
   Devouring the leaves, except the larger veins 5
3. On poplar and willow 4
   On birch .....Birch Skeletonizer, p. 144
   On elm .....Elm Leaf Beetle, p. 144
4. Small, dark blue or green beetles; mostly bright green, 2-4 mm. long .....Willow Flea Beetle, p. 145
   Mostly dull blue, 4-5 mm. long, Imported Willow Leaf Beetle, p. 145
   Larger beetles, 7-10 mm. long, light brown, marked with black longitudinal lines, on poplar....Cottonwood Leaf Beetle, p. 145
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   Not forming webs or nests 7
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   Caterpillars gray or brown, with two rows of dorsal tubercles; first five pairs blue, remaining six pairs red..Gipsy Moth, p. 122

B. Tunneling in the Wood:

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Scales brown, with conspicuous secretion of white wax 20
Scales greenish-yellow, in pits on the bark of English oak, Pit-making Oak Scale, p. 151

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Scales small (2-6 mm.), reddish-brown, on maple, Terrapin Scale, p. 152
Larger than preceding, often clustered on many different kinds of trees and shrubs .....European Fruit Lecanium, p. 123

20. Chocolate brown with white wax fringe in crevices of bark on elm .....European Elm Scale, p. 153
Medium brown on twigs of maple; white ovisac develops and becomes very prominent under posterior portion of body, Cottony Maple Scale, p. 153

21. Gray or dirty white on elm twigs.....Elm Scurfy Scale, p. 154
Gray or brownish, often same color as bark, on a great variety of trees and shrubs.....Oyster-shell Scale, p. 123

Larch Case Bearer (*Coleophora laricella* Hubn.)

The young larvae of the larch case bearer tunnel out the outer half of each needle, and when it is completely hollowed out, cut it off at the base of the excavated portion and use the latter as a case, living in it and carrying it about while feeding. They spend the winter in these cases, fastening them to the twigs by silken threads. When warm weather comes in the spring, the larvae dislodge their cases and migrate to the leaves, upon which they feed. They also cut off other needles to enlarge their cases and continue to do this until May, when they pupate within the cases. The adults

emerge the latter part of May and lay their eggs upon the leaves during the early part of June. The adult is a small moth with a wing expanse of about 9 mm. It is silvery grayish-brown in color with narrow front and rear wings having a long fringe.

There is no practical method of controlling this insect in forests or large plantations, but on shade or ornamental trees spraying is effective. If the trees are sprayed with lime-sulphur at the rate of one part to seven parts of water before the new leaves start in the spring, many larvae will be killed in their hibernating quarters. Spraying with arsenate of lead seems to have no effect upon this insect.

(Report for 1923, page 288).

Locust Leaf Miner (*Chalepus dorsalis* Thunb.)

The adult of this insect is a beetle about one-fourth of an inch in length, with head, legs, and an area along the middle of the wing-covers, black; the thorax and remaining portion of the wing-covers are orange-red.

The eggs are laid on the under sides of the leaves in May, and the larvae are miners within the leaves, and pupate there. The beetles emerge from the mines in July and fly about, soon laying eggs for the second brood, which reaches maturity in the fall. The beetles hibernate under the dead bark of trees, cracks and crevices, and under rubbish. Though the black locust is the preferred food plant and is therefore the most severely injured, this insect also attacks dogwood, elm, oak, beech, cherry, and several other species of trees.

Locust trees may be protected from this insect by spraying with lead arsenate to which a little molasses has been added.

(Ohio Bulletin 332, page 231).

Imported Birch Leaf Miner (*Fenusa pumila* Klug)

The adult of this insect is a small black sawfly which has somehow been introduced from Europe. First noticed in Connecticut in 1923, the adults were reared and identified in 1924, and the insect has now spread throughout New England and eastern New York. There are apparently three generations each year, the winter being passed as pupae in the ground. The larvae make blotch mines on the tender or terminal leaves, as are shown on Plate VIII, a, especially on sprouts or low trees of the gray birch, the paper birch, and the European white birch. Several larvae in a leaf unite in mining the entire leaf. No remedy is known.

(Report for 1924, page 340).

BIRCH SKELETONIZER (*Bucculatrix canadensisella* Chambers)

This is a native American insect of periodical abundance, and there is an annual generation which hibernates in ribbed cocoons on old leaves on the ground. The adult moths emerge and lay eggs in June and July. The eggs hatch in 15 days, and the young larvae for the first three instars (on the average, about four weeks) mine in the leaves. They then emerge and feed upon the under side of the leaves, skeletonizing them. They molt in white, circular or oval flattened cases on the leaves. The chief food plants are the gray, paper, yellow, and European white birches. The larvae and their work are shown on Plate VIII, b.

The remedy is to spray with lead arsenate.

(Bulletin 288).

ELM LEAF BEETLE (*Galerucella xanthomelaena* Schr.)

The work of the elm leaf beetle is found in the nurseries of the State nearly every year. Some seasons it is serious and must

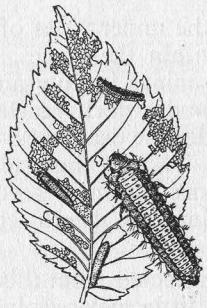


FIG. 25. Larvae and work of the elm leaf beetle.

interfere with the growth of the trees. It is another insect of European origin but has been in this country for nearly ninety years, and is distributed generally throughout the eastern United States. In the early nineties many fine old elms were destroyed by this beetle in southern New England.

The beetles live over the winter in houses, barns, church belfries and out-buildings. They leave their winter quarters in early spring, mate, and, as soon as the leaves unfold, eat small round holes in them. In May or early June, the females lay small clusters of yellowish eggs on the under side of the leaves. Each female may lay five or six hundred eggs. In about a week the eggs hatch and the young larvae or grubs feed on the under side of the leaves, as shown in Fig. 25, and on Plate IX, b, become

full grown in about three weeks, and crawl down the trees to pupate on the ground. The pupa stage lasts about ten days. Then the adult beetles emerge and lay eggs for the second generation, which seldom does much damage in Connecticut, and go early into winter quarters.

There is no reason why this insect should be a serious pest in nurseries because it is easily killed by an application of arsenate of lead spray, using two pounds to fifty gallons of water. The best time to apply this is soon after the eggs have hatched, which is around the first of June.

(Bulletin 155).

WILLOW FLEA BEETLE (*Crepidodera helxines* Linn.)

This is a small, bright green or occasionally blue, metallic, jumping beetle, with rather prominent punctures on the wing-covers, and about one-tenth of an inch in length. It is often rather abundant on willows in nurseries, and the beetles eat many round holes in the leaves. It lives through the winter in the adult stage, but its life history is not well known. Spraying the foliage with lead arsenate is the remedy.

(Kentucky Bulletin 120, page 61).

IMPORTED WILLOW LEAF BEETLE (*Plagiodera versicolora* Laich.)

This insect has recently become established in the United States in the vicinity of New York City. It was first found in Connecticut at Greenwich in 1921. At that time the beetles and larvae were quite numerous and were defoliating willows. Since then the insect has spread over the State and can be found in nearly all nurseries where willows are grown. The beetles appear late in April or early May and feed for some time; then deposit eggs. The beetles are moderately stout, about one-eighth of an inch long, and of a dark, metallic-blue color. When the eggs hatch, the young, bluish-black grubs feed on the under side of the leaves, often skeletonizing them. This insect and its work is shown on Plate IX, c.

Spraying with lead arsenate is effective.

(Report for 1921, page 195).

COTTONWOOD LEAF BEETLE (*Lina scripta* Fabr.), SPOTTED WILLOW LEAF BEETLE (*Lina lapponica* Linn.)

These insects are well-known pests of poplars and willows. In Connecticut most of the injury is done to Lombardy and Carolina poplars. Both species of beetles cause injury, but *Lina scripta* is the more common in this State.

The life history, habits, and the control measures are about the same for both species, so they may be treated together in this paper.

The beetles appear early in the spring when leaf growth starts, and begin to feed on the foliage. In a short time oviposition takes place, and the reddish-yellow eggs are laid in clusters on the under side of the leaves. From these hatch small black grubs which skeletonize the under surface of the leaves. As they grow larger they eat out ragged holes in the leaves and often leave only the midribs. When full grown they pupate on the leaves and soon the adults emerge. There are three broods in a season.

Spraying with arsenate of lead, using three pounds to a hundred gallons of water, will control this pest. An effort should be made to spray the under side of the leaves, as the young grubs feed only on the lower surface until they are about half grown. The smooth surface of the poplar and willow leaves causes the spray to roll off or collect in drops, but this may be overcome by adding a spreader like calcium caseinate, mixing one pound with a hundred gallons of the spray mixture.

(Ohio Bulletin 332, pages 259, 261).

Fall Webworm. See page 120

Poplar Tent-Maker (*Melalopha inclusa* Hubn.)

The caterpillars feed gregariously upon the foliage of various kinds of poplars and willows and make small nests upon the twigs which resemble those of the brown-tail moth. Unlike them, however, the caterpillars do not remain in the webs through the winter.

There are probably two generations each year, as the moths are present in March, April, and May, and again in July and August. The full-grown caterpillar is about an inch and a half long, dark brown, with narrow yellow stripes extending lengthwise. The head and legs are black, the under surface of the body honey-yellow. The fourth and eleventh segments each bear a closely set pair of high, pointed tubercles dark brown in color and somewhat hairy.

Spraying with lead arsenate is the remedy.

(Report for 1911, page 310).

Larch Sawfly (*Lygaeonematus erichsoni* Hart.)

The larch sawfly was first noticed in this country in Massachusetts in 1881. Since that time it has caused considerable injury to larch plantations. In Connecticut it has been reported from the

northern parts of the State where larch grows naturally. Both the adults and the larvae injure trees, the adults injuring the terminal twigs by inserting eggs, and the larvae eating the leaves. The adult female selects the young, green, terminal shoot in which to deposit eggs, causing it to die or severely injuring and distorting it. The eggs are laid in May and hatch in about ten days. The young larvae feed on the leaves and are full grown in three or four weeks. They then make cocoons under rubbish on the ground, where they spend the winter. The adults emerge the following spring. Larvae and cocoons are shown on Plate IX, a.

On small trees in nurseries, injury may be prevented by spraying with three pounds of arsenate of lead in fifty gallons of water. In woodlands the insect is hard to control because of the size of the trees and the difficulty in spraying. In Connecticut the best time to spray is early in June soon after the eggs have hatched.

(Report for 1915, page 125).

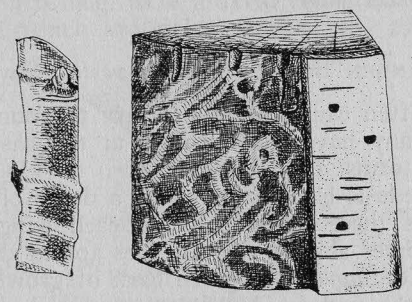


Fig. 26. Work of the bronze birch borer.

Cankerworms. See page 120

Tussock Moths. See page 121

Gipsy Moth. See page 122

Leopard Moth. See page 120

Bronze Birch Borer (*Agrilus anxius* Gory)

Many cut-leaf white birches in Connecticut have died during the past few years as a result of the attack of the bronze birch borer. The European white birch, *Betula alba,* is the species chiefly injured. Our native birches are seldom, though occasionally attacked by the insect.

Thinning of the foliage in the top of the tree is an indication of the presence of the borer. Later, the top branches die, and the following season the process continues until the tree is killed. A careful examination shows ridges or swellings on the branches one-half to one inch in diameter before anything is wrong with the foliage. Where the beetles have emerged there may be semi-circular exit holes. Injured wood is shown in Fig. 26.

There is one annual generation each year. The larvae live through the winter in cells just under the bark and pupate early in May. The beetles emerge late in May or early in June and lay eggs in the crevices of the bark. The small larvae hatching from the eggs tunnel first near the bark and, as they grow larger, into the wood.

Infested trees should be cut and burned before June 1 to prevent the flight of the beetles from infested trees to healthy ones. As the adults feed to some extent upon the foliage, spraying with lead arsenate early in June is recommended.

(Report for 1922, page 359).

Linden Borer (*Saperda vestita* Say)

This insect often causes serious injury to young linden trees. In nurseries many have been injured at the base so that they break in wind-storms. See Plate X, b.

The adult beetle is black, covered by a dense olive pubescence, and usually has three black spots on each wing-cover, though these are sometimes absent. The beetles appear during the summer and after feeding on the green bark of growing shoots, leaf stems, and on the under side of leaves, they begin to lay their eggs. The females with their jaws make slight incisions in the bark where they lay their eggs. The grubs on hatching mine under the bark and into the wood. The injury takes place at or near the ground—never more than a foot from it—and sometimes in the larger roots.

The only remedy is to kill the borers. This may be done with a pointed knife or a wire. The borer may be extracted by means of a small wire with a barbed point like a harpoon.

(Report for 1915, page 186).

Locust Borer (*Cyllene robiniae* Forst.)

The adult is one of the long-horned beetles about three-fourths of an inch long, black in color, with bright yellow bands extending across the body. The insect is very destructive to our common locust, *Robinia pseudoacacia,* and also to the rose acacia, *Robinia hispida.* The beetles appear in September, when they may be found feeding on the blossoms of goldenrod. Eggs are

laid about that time in clusters or singly, on the roughened bark of trunks and branches. The young larvae hatching from them tunnel into the bark, where they spend the winter. In spring they resume feeding and go into the heart-wood. An enlargement forms at the entrance of the burrow, and in time the trunks of young trees become much deformed; on older trees the branches are injured.

Successful and practical measures for the control of this insect have never been found. If only a few trees are involved, the larvae may be dug from their burrows. Repellent washes applied to the trunks of trees during the egg-laying period have proven expensive and only moderately effective.

(Ohio Bulletin 332, page 316).

Poplar and Willow Borer (*Cryptorhynchus lapathi* Linn.)

This insect is one of the snout beetles or weevils and is about one-third of an inch long, dark gray in color, except the tips of the wing-covers, which are paler. (See Fig. 27). Injury is

Fig. 27. Poplar and willow borer, twice enlarged.

caused by both adults and larvae. The adult punctures the bark of the trees and the grubs bore into the trunk and branches. The injury, shown on Plate X, a, is greatest to nursery stock and newly set trees; after the trees are older and well established, less injury occurs.

The winter is passed in the larval stage within the host plant. The adults appear late in July and are most abundant in August. Mating and egg-laying take place about ten days after emergence.

Infestation is indicated by dead patches of bark, dead or dying trees or limbs with irregular swellings or galls formed over tunnels.

One remedy is to cut out and burn all infested wood before May or June, to prevent the grubs from reaching maturity. Probably the insect can be controlled by thoroughly coating the bark in July with arsenate of lead. Painting the trunks of trees early in April with Carbolineum or some other repellent has also been recommended.

(Ohio Bulletin 332, page 319).

Sucking Insects

Mites

Though "mites" or "red spider" are not insects, there are several species which injure the leaves of trees, causing them to turn dull and brown the latter part of the season. Mites belong to the Order Acarina (Class Arachnida) and usually have four pairs of legs, thus differing from insects (Class Insecta) which usually have three pairs of legs in the adult stage.

In mite infestations pale, brownish spots are noticed on the leaves, which may later cover the entire foliage. When these spots are examined with a magnifying glass, tiny globular eggs, eggshells, mites, and their cast skins may be seen.

One of the common mites in nurseries, especially on oak and maple, is *Paratetranychus bicolor* Banks. The European red mite, *Paratetranychus pilosus* C. & F. (see page 140), which is an important pest of fruit trees, also occurs on elm and probably on other kinds of shade trees. The common "red spider" of greenhouses, *Tetranychus bimaculatus* Harvey (*telarius* Linn.) may injure the foliage of almost any tree species. With *T. bimaculatus,* evidently the adults hibernate, but with *P. bicolor* and *P. pilosus,* reddish or brownish eggs are laid in the fall on the bark of the trunk and branches. On hatching in spring, the young mites find their way to the leaves.

The remedies are: a dormant spray of a miscible oil (1 - 15) to kill the overwintering eggs; a summer spray of linseed oil emulsion to kill the mites. This emulsion may be made as follows:

1 gallon raw linseed oil
1.5 pounds soap flakes
1 gallon water

Dissolve the flakes in the water, stir in the linseed oil, and dilute to make 100 gallons.
(Bulletin 252).

Green Aphids

There are many species of green aphids attacking deciduous trees during the growing season. In fact, nearly every tree species has one or more species of aphids infesting its leaves. The aphids may occur in the winged or wingless forms. They suck the sap through their long pointed beaks and excrete a sticky substance called "honey dew," which drips upon the foliage, giving the leaves a varnished appearance. In the honey dew a black fungus or sooty mold grows, giving the leaves a blackened appearance. Ants feed upon the honey dew and are usually present on aphid-infested trees, but the ants do no harm to the trees. The presence of aphids may be noticed also in some cases by the curled leaves or the abnormal dropping of the leaves.

Aphids may be killed by spraying with a contact spray like nicotine solution and soap, but they must be hit by it. As they are mostly on the under leaf surface, the spray should be directed there. Applications should also be made before the aphids are destructively abundant and before the leaves are curled or seriously injured.

Beech Woolly Aphid (*Phyllaphis fagi* Linn.)

Trees of the European beech, *Fagus sylvatica,* especially the purple-leaved form, are usually infested in Connecticut by a white woolly aphid which appears on the under side of the leaves in early summer. The woolly appearance is due to slender wax filaments secreted by the aphids.

They may be controlled like other aphids with a spray of nicotine solution and soap.

Willow Aphids

Large reddish brown aphids are often present in large numbers on the twigs of willows, where they lay eggs late in the season. These belong to the genus *Chaitophorus,* two species—*viminalis* Monell and *nigrae* Oest.—occurring in Connecticut. There is also an even larger species, *Longistigma caryae* Harris, which occurs on oak, hickory, maple, elm, poplar, linden, and sycamore. The remedy is that given above.

Oak Gall Scale (*Kermes* sps.)

Hard, globular scales occur on oak trees in nurseries and are usually gray or brown in color. There are several species, some smooth and shiny, some dull, and some pubescent. The partially grown females winter in the crevices of the bark, and some species in the spring go to the leaves. The young appear in July or August. The bodies of the females often remain on the twigs for nearly a year after they die. Shown on Plate XV, e.

Spraying the dormant trees in early spring with a miscible oil (1 - 15) is effective.

Pit-Making Oak Scale (*Asterolecanium variolosum* Ratz.)

This scale infests several species of oak but is most frequently encountered on English or golden oak, *Quercus robur.* It has a

smooth, glassy, convex shell about one-sixteenth of an inch in diameter and is of a beautiful greenish-golden color. A little pit is formed around each insect, from whence its common name arises. It is also called the golden oak scale. It is believed to be single-brooded, but this point has not been determined for Connecticut. The insect passes the winter in the egg-stage under the old shells, and the young appear in May and June. The insect is shown on Plate XI, c.

A dormant spray of a miscible oil (1 - 15) is probably the best means of control.

(Ohio Bulletin 332, page 306).

Tulip Tree Scale (*Toumeyella liriodendri* Gmel.)

This is our largest soft scale, the females being brown, hemispherical, and nearly one-third of an inch in diameter, shown in

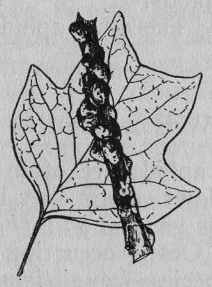


Fig. 28. Tulip tree scale.

Fig. 28, and on Plate XI, d. The males are oval, gray, and flattened, and about an eighth of an inch in length. The scales usually occur on the lower branches of the tulip tree, and there is a single generation each year, the young appearing in September. The remedy is to spray as soon as the leaves fall, using a miscible oil or a nicotine solution.

(Report for 1921, page 176).

Terrapin Scale (*Lecanium nigrofasciatum* Pergande)

This is a small, oval, and very convex soft scale, reddish-brown in color, which infests the small twigs of maple trees (see Plate XI, b), especially the red and silver maples. On large trees it is more apt to be on the lower branches, and though not particularly a nursery pest, it is occasionally found on the nursery trees of larger size. The eggs are formed under the old shells in June and hatch late in June or early in July. Only the females live through

the winter, and they are in a partially grown state. The scales suck the sap from the twigs in fall and spring, becoming mature about June 1.

The remedies are contact insecticides, especially miscible oils (1 - 15), applied when the trees are dormant.

(Report for 1921, page 183).

European Fruit Lecanium. See page 123

European Elm Scale (*Gossyparia spuria* Mod.)

This is a chocolate-brown scale, oval in shape, with a fringe of white wax around the margin, shown on Plate XI, a. It usually occurs in the crevices of the bark of trunk and larger branches. There is one generation each year, the insect hibernating on the bark in a partially grown state. The young appear in June. The standard contact sprays will kill this scale at almost any time of the year, though more thorough applications can be made when the trees are dormant.

(Report for 1905, page 235).

Cottony Maple Scale (*Pulvinaria vitis* Linn.)

This insect is perhaps the most conspicuous of all the scale insects on account of the abundant secretion of wax surrounding the eggs. During the winter it occurs on the bark and resembles any other large, brown, soft scale, but about the time the trees begin to grow, the posterior end of the insect becomes raised, and the egg-sac begins to protrude, as shown on Plate XI, e. When fully developed it is as long as the insect itself and resembles a tuft of cotton. Each female deposits about three thousand eggs, which hatch in late June or early July. The young at first go to the leaves and establish themselves mostly on the under side along the midrib and veins. Before the foliage drops, they return to the twigs and settle on the bark for the winter.

In Connecticut this insect has occurred abundantly only in the vicinity of Stamford and attacks silver and red maples, though all other kinds are also infested in some portions of the Middle West, where there are periodical outbreaks every eight or ten years. It occurs in Connecticut nurseries on a variety of trees, shrubs, and vines, but is seldom sufficiently abundant to cause injury. It is perhaps the most common on maple.

The remedy is to spray the dormant trees in early spring, using one of the miscible oils (1 - 15).

(Report for 1921, page 179).

Elm Scurfy Scale (*Chionaspis americana* Johnson)

This scale, which occurs on the twigs and branches of elm, is dirty-white or gray in color and somewhat resembles the oyster-shell scale. It passes the winter in the form of purplish eggs under the old shells, and there are two generations each season. Small branches are killed in severe infestations, and the general vitality of the tree is lowered.

Spraying the dormant trees with liquid lime-sulphur (1 - 8) or with one of the miscible oils (1 - 15) will control this insect.

(Ohio Bulletin 332, page 290).

Oyster-Shell Scale. See page 123

INSECTS INJURING SHRUBS AND VINES

Key

A. Feeding upon the leaves:

1. Conspicuous caterpillars, bearing horns or spines 2
   Conspicuous caterpillars, without distinct horns or spines..... 4
2. Caterpillars with horns or fleshy protuberances..... 3
   Caterpillars 2-3 inches long, covered with branched stinging spines, pale green with reddish band along each side, Io Caterpillar, p. 155
   Caterpillars one inch long or less, each end with a pair of prominent tubercles bearing stinging spines; color brown with green saddle.....Saddle-back Caterpillar, p. 155
3. Green caterpillars with single horn on tail, on grape or Virginia creeper.....Sphinx Caterpillars or Horn Worms, p. 156
   Brown caterpillars with fleshy protuberances on each side of thoracic segments, on Dutchman's pipe vine, Pipe-Vine Caterpillar, p. 156
4. Large fleshy caterpillars, 3-4 inches long, bluish-green, with prominent tubercles, usually feeding on rosaceous plants, Cecropia Caterpillar, p. 156
   Smaller (1-2 inches), finely cross-striped with black, white and orange, feeding upon Virginia creeper, Eight-spotted Forester, p. 157
5. Small, green, slug-like caterpillars on rose....Rose Sawflies, p. 157
   Larger, gray, slug-like caterpillars on *Lonicera*, Honeysuckle Sawflies, p. 158

B. Borers in stems:

6. White grub, about one inch long, tunneling in lilac or privet, Lilac Borer, p. 158
   Very small, flat-headed white grub, forming swellings on rose stems.....Rose Stem Girdler, p. 158

C. Forming galls on leaves:

7. Shiny, semi-transparent galls on leaves and tendrils of grape, Grape-vine Tomato Gall, p. 158
   Small pocket galls on leaves.....Eriophyid Mites, p. 159

D. Sucking sap from leaves or bark:

8. Scale insects protected by shells, mostly on bark..... 9
   Green plant lice on leaves.....Aphids, p. 150
9. Female scale, circular or nearly so 10
   Female scale, pear-shaped, dark gray, on Euonymus, Euonymus Scale, p. 159
10. Female scales, 2-3 mm., snow-white, exuviae marginal, light yellow, eggs purple, on rose and blackberry.....Rose Scale, p. 159
    Same size, scale whitish but more or less covered with bark of host, exuviae marginal, orange-yellow; on cherry, privet, and *Catalpa bungei*.....White Peach Scale, p. 159
    Female scales less than 2 mm., dark gray, exuviae central, yellow, San José Scale, p. 137

Io Caterpillar (*Automeris io* Fabr.)

This caterpillar is from two to three inches long when fully grown, pale green, with a reddish and white stripe along each side, each segment bearing a number of tubercles arranged crosswise in a row, as shown on Plate XII, c. Each tubercle has a number of spreading, stinging spines which cause an intense itching or rash on coming in contact with the human skin. Apparently there is only one generation each year, and the insect passes the winter in its cocoon among the leaves on the ground. The moths emerge in June and July. The female has a wing-spread of about three inches, and the male about two and one-half inches. The ground color is yellow with reddish markings, and in the female the entire fore wings are tawny. On each rear wing in both sexes there is a bluish eye spot margined with black, and with a white dash in the center; between the spot and the wing-margin are two concentric rings, one red and the other black.

The caterpillar feeds upon many kinds of shrubs and trees. Spraying with lead arsenate is the remedy.

(Ohio Bulletin 332, page 270).

Saddle-Back Caterpillar (*Sibine stimulea* S. & A.)

The caterpillars of this species are often gregarious and feed upon a large number of plants. They are nearly an inch long, without true legs, and are brown and green in color. Both ends of the body and the long tubercles are brown, but the middle of the body looks as though covered by a bright green blanket with an oval opening on the back, as shown on Plate XII, a. This gives it the common name "saddle-back." On the prominent brown tubercles, and laterally on the smaller green ones, there are branched, stinging spines which to the touch are quite painful for an hour or two. The reddish-brown moth has a wing-spread of about one and one-half inches. There is one generation annually.

Spraying with lead arsenate will prevent defoliation.

(Report for 1914, page 188).

Sphinx Caterpillars or Horn Worms

Grape vines, Virginia creeper, and Boston ivy are often eaten by caterpillars of this group. Most of them may be distinguished by the sharp horn on the back near the tail, as shown in Fig. 29, and several species belonging to different genera may be encountered. All belong to the family Sphingidae.

The abbot sphinx, *Sphecodina abbotti* Swains., has in place of the horn a shiny spot or tubercle. This caterpillar is brown, veined

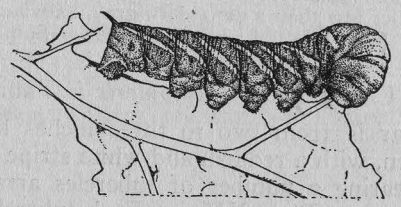


Fig. 29. A sphinx caterpillar or horn worm.

with a darker brown, but a form occurs having a large green patch on the dorsal portion of each segment.

All sphinx moths have large bodies and long narrow wings. They fly at dusk, poise with vibrating wings before deep-throated flowers, and for this reason are called "humming-bird moths."

Hand picking is the usual remedy, but if the caterpillars are injuriously abundant in nursery or vineyard, spraying with lead arsenate will prevent defoliation of the vines.

Pipe-Vine Caterpillar (*Papilio philenor* Linn.)

Wherever the Dutchman's pipe, *Aristolochia sipho,* is grown, the leaves may be eaten by the pipe-vine caterpillar. This caterpillar is velvety dark brown or black, marked with orange spots and bearing a number of long black and orange protuberances, and is shown with cocoon on Plate XII, d. When fully grown it is two inches or more in length. The adult is a swallow-tail butterfly having a wing-spread of 3-3.5 inches, velvety black with metallic bluish or greenish reflections. There are two generations each year.

Spraying the vines with lead arsenate is probably the best remedy.

(Holland's Butterfly Book, page 315).

Cecropia Caterpillar (*Samia cecropia* Linn.)

This is one of the largest caterpillars commonly found feeding upon nursery stock and is from 3-4 inches long when full grown

and about three-fourths of an inch thick. It has a peculiar bluish-green color with a cross row of tubercles on each segment; those on the second, third and fourth segments are red, the other dorsal ones yellow, with pale blue tubercles along the sides near the breathing pores. (Shown on Plate XII, e). The cocoon is brown and fastened lengthwise to a twig. The moth has a wing-spread of 4-6 inches, is gray and prettily marked with black, red, and creamy-white, with a lunule on each wing. There is only one generation each year, and it passes the winter in the cocoon.

The caterpillar feeds upon spiraea and other plants of the rose family, but is also found upon box-elder and willow.

Hand-picking is perhaps the only remedy needed in Connecticut, but where abundant, the caterpillars may be controlled by spraying with lead arsenate.

(Ohio Bulletin 332, page 266).

Eight-Spotted Forester (*Alypia octomaculata* Fabr.)

The caterpillars of this insect occasionally defoliate Virginia creeper and also feed upon grape, barberry, and rose. They feed in July, and are between one and two inches in length. Their general color is brown with a bluish tinge. Each segment is narrowly banded crosswise with black and white, with a broader band of orange dotted with small black dots. Head and cervical shield are orange with black dots. The moth is black with two round yellow spots on each fore wing and two smaller white spots on each rear wing. The insect passes the winter in the chrysalid stage in the soil, and there is only one annual generation. Caterpillars and moths are shown on Plate XII, b.

Hand-picking and spraying with lead arsenate are the remedies.

(Report for 1916, page 118).

Rose Sawflies (*Caliroa aethiops* Fabr. and others)

Small, greenish slugs often feed upon rose leaves, skeletonizing them. Several species may be involved, one of the most common being named above. This has only one annual generation, but some of the other species probably have more. The adults are four-winged flies, and on account of the toothed ovipositor in the female they are called sawflies.

The larvae or slugs are easily killed by spraying with lead arsenate, with nicotine solution and soap, or fresh hellebore applied as a spray or dust.

(U. S. Farmers' Bulletin 1252).

Honeysuckle Sawflies (*Abia americana* Cress., and *A. inflata* Nort.)

The leaves of various species of bush and climbing honeysuckles are sometimes eaten by the larvae of at least the two species of sawflies named above. In one case the climbing honeysuckle on a wire fence was defoliated. The larvae were grayish-green with orange spots, and presumably there is only one generation each year.

Defoliation may be prevented by spraying with lead arsenate.

Lilac Borer (*Podosesia syringae* Harris)

Lilac and privet are often injured by white grubs burrowing in the stems. Sometimes the stems break over, and in other cases they remain standing and present an unthrifty appearance. The adult is a wasp-like, clear-wing moth of the family Sesiidae, and there is one generation each year. (See Plate XIII, a).

The best means of control is to cut out and burn the infested stems.

(Report for 1905, page 260).

Rose Stem Girdler (*Agrilus viridus* var. *fagi* Ratz.)

Recently an European insect has appeared in Connecticut, called the rose stem girdler, which causes the formation of swellings on the stems of various species and varieties of rose, as shown on Plate XIII, b. *Rosa rugosa* and *R. hugonis* have been noticed with these swellings, which are the result of the plant making an attempt to heal the wounds around the galleries of the larvae.

The adult is a metallic, coppery beetle, about one-third of an inch long, which lays eggs singly on the bark in June and July. The larva is a slender white, flat-headed grub.

The only known remedy is to cut and burn the infested stems in winter or early spring before the beetles emerge.

(Report for 1925, page 325).

Grape-vine Tomato Gall (*Lasioptera vitis* O.S.)

The leaves, peduncles, tendrils, and tender shoots of grape vines are often marked and seriously distorted by irregular water thickenings or swellings which are sometimes red and sometimes green, as shown on Plate XV, b. The adult is a two-winged fly which places its eggs on or in the succulent tissues. The larvae develop in cells in the center of the galls.

The only known method of control is to clip off and burn the infested tips.

(Report for 1916, page 146).

Eriophyid Mites (Family Eriophyidae)

The leaves of shrubs and young trees often exhibit minute galls, usually on the upper surface, caused by mites of the family Eriophyidae. A common form makes elongated pocket galls on the pearl bush, *Exochorda grandiflora*. Other forms are found on elder, birch, maple, and elm. These mites do not seriously affect the vitality of the host but render its appearance unsightly. (Shown on Plate XV, d).

Probably the best control is a dormant spray of liquid lime-sulphur in early spring just before the leaves appear.

Aphids (Family Aphididae). See page 150

Euonymus Scale (*Chionaspis euonymi* Comst.)

Some kinds of Euonymus, as well as bitter-sweet, are infested and seriously injured, even sometimes killed, by this scale. The females are pear-shaped, dark gray, and occur on leaves or tender shoots. The males are smaller, elongate, with parallel margins, and are snowy white. There are said to be two broods each year, the insect passing the winter as eggs under the shells of the mother scale. This scale is shown on Plate XV, a.

The remedies are to prune off and burn the worst-infested stems. The remaining portions may then be sprayed in early April with a miscible oil (1 - 15), or in summer with kerosene emulsion containing 15 per cent or more of kerosene.

(Report for 1921, page 185).

Rose Scale (*Aulacaspis rosae* Bouché)

Rose, blackberry, and some other plants are often infested by a whitish scale, nearly circular, and a little less than one-eighth of an inch in diameter. These are the female scales which, during the winter, cover purple eggs. The male is long and narrow, with three ridges lengthwise, and is also white. This scale is shown on Plate XIV, a.

Cutting and burning the worst-infested stems is recommended; then spray while the plants are dormant, using either liquid lime-sulphur (1 - 9) or a miscible oil (1 - 15).

(Ohio Bulletin 332, page 295).

White Peach Scale (*Aulacaspis pentagona* Targ.-Tozz.)

This has also been called the West Indian peach scale, and though closely related to the rose scale, is much less conspicuous on account of the bark, dirt, and extraneous matter on the shells.

In Connecticut it has been found on cherry, privet, and *Catalpa Bungei,* but is not believed to be an important or serious pest. It is shown on Plate XIV, b.

Spraying with a miscible oil or with lime-sulphur when the plants are dormant is believed to be an effective means of control.

(Report for 1913, page 240).

San José Scale. See page 137

INSECT PESTS OF EVERGREEN TREES AND SHRUBS

Key

A. Chewing insects devouring leaves and buds:
- 1. Larvae devouring the leaves..... 2
- Larvae mining within the leaves..... 3
- 2. Larvae an inch or more in length, white, buff, or green, dotted, striped or mottled with brown or black, feeding gregariously, without webs, on pines.....Pine Sawflies, p. 161
- Larvae one-half inch long, striped lengthwise with light and dark brown, webbing together the twigs of juniper, Juniper Webworm, p. 161
- 3. Minute larvae mining within the leaves of arborvitae, Arborvitae Leaf-Miner, p. 161
- Maggots mining within the leaves of box, Boxwood Leaf-Miner, p. 162
- 4. Destroying the terminal buds of pine, causing crooked growth, European Pine Shoot Moth, p. 162
- Destroying the terminal buds of spruce....Spruce Budworm, p. 162

B. Attacking roots or stems:
- 5. Gnawing the bark of the stems of coniferous seedlings, Pales Weevil, p. 163
- Gnawing the bark of the roots of hemlock and *Taxus,* Otiorhynchid Weevils, p. 163
- Eating off the roots of seedlings.....White Grubs, p. 164
- 6. Boring in the leaders of white pine, causing them to wilt in July, White Pine Weevil, p. 164
- Boring in the stems of rhododendron, Rhododendron Borer, p. 165

C. Sucking juices from leaves or bark:
- 7. Woolly aphids: wax secretion prominent 8
- Wax secretion slight, forming cone-shaped galls on spruce, Spruce Gall Aphids, p. 165
- 8. Cotton-like tufts of wax in axils of leaves and white patches on bark of white pine.....Pine Bark Aphid, p. 166
- Cottony wax secretion on leaves of larch, Larch Woolly Aphid, p. 166
- Cottony wax secretion on leaves of Douglas fir, Douglas-Fir Woolly Aphid, p. 166
- 9. Elongated white scales on pine leaves.....Pine Leaf Scale, p. 166
- Circular scales on leaves of juniper.....Juniper Scale, p. 167
- 10. Lace-like insects on under side of leaves of rhododendron and *Kalmia*.....Rhododendron Lace Bug, p. 167
- Red spiders on leaves.....Spruce Mite, p. 167

Pine Sawflies (Family Tenthredinidae)

Different kinds of pine trees are sometimes defoliated by sawfly larvae which usually feed gregariously and are whitish, greenish, or buff, variously dotted or otherwise marked with black or brown. They have the habit of coiling the tail around a leaf as a means of holding on to the food plant. One of the commonest species in nurseries is the imported pine sawfly, *Diprion simile* Hartig. The larvae are slightly more than an inch long, greenish yellow, more or less striped dorsally with brown, and the sides curiously spotted and reticulated, as shown on Plate XIV, c. This species feeds upon the white, Bhotan, Scotch, Austrian, Korean, Mugho, and several other kinds of pines, and there are two full generations each season. Some of the brown cocoons are fastened to the twigs and some are placed upon the ground under the trees. Other species feeding on pine in Connecticut are: *Neodiprion lecontei* Fitch, on white, jack, red, Scotch, Austrian, and Mugho pines; *N. pinetum* Norton, on white pine, and *N. pinus-rigidae* Norton, on pitch pine.

The remedy is to spray with lead arsenate.

(Report for 1915, page 118).

Juniper Webworm (*Dichomeris marginellus* Fabr.)

Juniper twigs are webbed together by the larvae of this insect, which feeds upon the leaves inside the nest. (See Plate XIV, d). Low juniper in ornamental plantings is often defoliated, but apparently *Juniperus hibernica* is greatly preferred. The caterpillars are about half an inch long, light brown, with longitudinal stripes of darker brown. The adult is a moth with a wing-spread of 15 mm., dark brown, with white front and rear margins on the fore-wings. The larvae pupate in the webs, and the moths appear early in June, but the life history has not been carefully worked out, and it is possible that there is more than one generation each year.

Spraying heavily with lead arsenate is a satisfactory remedy.

(Report for 1915, page 137).

Arborvitae Leaf-Miner (*Argyresthia thuiella* Pack.)

Small larvae mining in the leaves often give a brown or dead appearance to arborvitae. (See Plate XVI, b). The adult is a tiny moth which lays eggs on the leaves in June. There is one annual generation, and the insect spends the winter in the cocoon in the mine.

Though remedial measures are of somewhat questionable value, it is thought that a heavy application of nicotine solution and soap or of fish-oil emulsion may kill some of the eggs or larvae and thus prevent severe injury to the foliage by the insects.

(Report for 1921, page 157).

Boxwood Leaf Miner (*Monarthropalpus buxi* Labou)

The adult of this insect is a yellow midge or two-winged fly which lays eggs in the leaves in May, and the maggots feed and develop between the upper and lower epidermal layers, causing a blistering and distortion of the leaves, often called galls. (Shown on Plate XVI, a). The foliage is usually thin on infested plants. The maggots live over winter in the leaves and pupate in spring.

The remedy is to spray the plants with a cheap molasses, one part in four parts of water, with the addition of nicotine sulphate, one part in 500 parts of the spray material. The first application should be made when the adults first begin to emerge from the infested leaves, and the plants should be kept covered for three weeks. One application each week will answer in fair weather, but the plants should be sprayed after each rain.

(Report for 1923, page 312; Maryland Bulletin 272).

European Pine Shoot Moth (*Rhyacionia* (*Evetria*) *buoliana* Schiff.)

This is a serious pest of all kinds of pines in Europe and is now present in Fairfield County, Connecticut, where it seems to prefer the red pine. The adult is a small orange moth which in August lays eggs singly on the newly formed terminal buds which are ready for next year's growth. The young larvae soon eat their way into the buds and excavate cells in which they spend the winter. The following spring the larva leaves its winter home and bores into the next bud, and thus destroys as many buds as may be needed for food. It also attacks the young shoots, feeding on one side, causing them to become curved and deformed. When mature, the larva pupates in an excavated shoot, and three weeks later the moth emerges. Apparently there is only one generation each year. Distorted and crooked growth called "bayonet shoots" follows the attack of this insect.

No remedy is known other than to prune and burn the infested buds and shoots.

(U. S. D. A. Bulletin 170).

Spruce Budworm (*Harmologa fumiferana* Clem.)

Spruce and balsam trees are often severely injured by this insect. The moths emerge in June and July and the females lay upon the needles their eggs, which hatch in ten days, but the larvae do little or no feeding until the following spring. They pass the winter in protective cases which they spin in crevices on the tree or other convenient shelters. The young caterpillars feed for about three weeks in the spring at the base of needles upon the terminal shoots, moving about freely. The severed needles are

loosely attached to the twigs by the silk threads spun by the larvae. When fully grown each larva is about three-fourths of an inch long, and it then pupates upon the tree. The adult moth is gray with brown markings and white spots. There is only one annual generation.

Spraying heavily with lead arsenate will doubtless prove effective in the nursery and on small ornamental trees.

(Manual of Tree and Shrub Insects, page 285).

Pales Weevil (*Hylobius pales* Herbst)

This insect is a Curculionid or snout beetle less than half an inch in length. In color it varies from dark reddish-brown to black, and usually has gray or whitish hairs so arranged as to form small spots on the wing-covers. This beetle is believed to be responsible for the failure of much of the forest planting where conifers are used and has also injured seedlings in nurseries by eating off the bark of the stems, thus in effect girdling the young trees. Nearly all kinds of coniferous trees are attacked, and the feeding is done at night. There is only one generation each year, and the beetles hibernate in the soil at the base of the trees. The eggs are laid and the larvae feed in pine stumps and logs.

As a control measure, seedlings or nursery stock should not be grown in close proximity to pine logs, stumps, or lumber.

(Harvard Forest Bulletin 3).

Otiorhynchid Weevils (*Otiorhynchus sulcatus* Fabr. and *O. ovatus* Linn.)

Taxus plants are occasionally injured in nurseries by the grubs or larvae of *Otiorhynchus sulcatus* Fabr., a black snout beetle with faint gray spots, half an inch in length, commonly called the black vine weevil, and shown on Plate XVIII, b.

A case of injury occurred in a nursery in 1913: The smaller roots had been devoured, and the larger ones and the main stem had been girdled. In 1909, hemlock trees from 12 to 18 inches tall showed signs of unthriftiness, failed to grow, and some of them dropped their leaves. At the roots were grubs, pupae, and adults of *Otiorhynchus ovatus*, commonly known as the strawberry crown girdler. This species is about one-fourth of an inch long and is brown without color markings. This smaller species had girdled the main stem and larger roots.

Treating the soil with an emulsion of carbon disulphide, as is done to kill the grubs of the Japanese beetle and the Asiatic beetle, may be recommended in severe infestations.

(Report for 1909, page 370; 1913, page 230).

White Grubs (*Phyllophaga* or *Lachnosterna* sps.)

The larvae of May or June beetles occasionally eat off the roots of coniferous trees in nurseries. There are probably several species involved, and most of them require three years to complete the life cycle. The injury is usually the most severe the third season, when the grubs are large and voracious. Shown in Figs. 30 and 31.

In some cases it may be possible to treat the soil about the plants with an emulsion of carbon disulphide.

(Report for 1912, page 288).

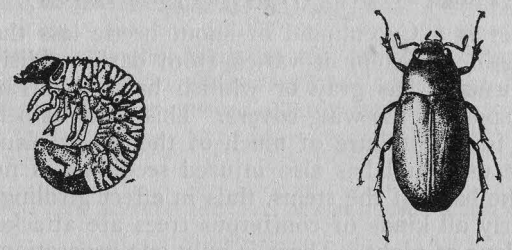


Fig. 30. White grub and its adult, the common June beetle.

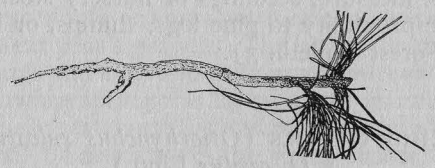


Fig. 31. Pine seedling with roots eaten off by white grubs.

White Pine Weevil (*Pissodes strobi* Peck)

The white pine weevil probably causes more injury to white pine trees in Connecticut than any other insect, and perhaps more than all other insects together. It also injures spruce trees. There is one annual generation, and the beetles hibernate somewhere during the winter and appear on the pine trees about May 1. They make punctures in the bark of the leaders or terminal shoots of the preceding season's growth. In some of these punctures eggs are laid and soon hatch. The grubs feed in the cambium and sometimes in the pith, becoming mature in about six weeks, when they excavate cells in the wood in which they pupate. Late in July and continuing until September, the adult beetles emerge. The infested leaders wilt in July and later turn brown and die. In time a lateral branch will grow upright and take the place of

the leader, but this makes crooked and ill-shaped trees. The injury caused by this insect is shown in Fig. 32 and on Plate XVIII, c.

Trees may be partially protected by spraying the leaders about May 1 with either lead arsenate or liquid lime-sulphur (1-9).

(Report for 1919, page 144).

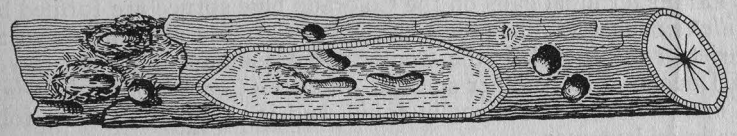


Fig. 32. Pupal cases, larval cells, and exit holes of the white pine weevil. About twice natural size.

Rhododendron Borer (*Sesia rhododendri* Beut.)

Serious injury to rhododendrons in ornamental plantings has been caused by the rhododendron borer in Connecticut, though the work of the insect has not been very noticeable in nurseries. The adult is a wasp-like clear-wing moth which lays eggs in late May or June on the twigs. The larva soon after hatching tunnels into the sapwood of the stem, where it forms irregular galleries from one to two inches long, usually just below a crotch. Larvae are yellowish-white, about half an inch long, and usually become full grown by October but remain in their galleries through the winter and pupate there in the spring. Two weeks later the moths appear, and there is only one annual generation.

The injured stems cannot supply the necessary moisture and the leaves turn brown and die. The stems are often broken at the point of injury. *Rhododendron maximum* is perhaps more severely injured than other species, but hybrid rhododendrons are also attacked. The injury is shown on Plate XVII, a.

There is no remedy except to cut out the borers and to prune off and burn infested stems and branches.

(Report for 1922, page 347).

Spruce Gall Aphids (*Adelges, Chermes,* sps.)

One of the commonest pests in nurseries is the spruce gall aphid, *Adelges abietis* Linn., which forms cone-shaped galls at the base of the new growth on Norway spruce, and sometimes black, red, and white spruce trees are infested to a less extent. There are two broods each season, the winter being passed by the immature females on the twigs. They reach maturity and lay on the leaves masses of eggs which hatch soon after the new shoots appear in May. The young aphids crawl to the base of the shoots and at-

tach themselves where the irritation resulting from their feeding causes the needles to swell at the base until they touch each other. Thus pockets are formed in which the young aphids are enclosed, and the result is one continuous gall, shaped like the cone of the tree. These galls break open in August, and the aphids go to the leaves and soon transform to mature females which lay eggs for the second brood. One of the galls is shown on Plate XVII, c.

Larger terminal galls on the Colorado blue spruce are formed by *Gillettea cooleyi* Gill., (see Plate XVII, b), and a form known as variety *coweni* Gill. is the woolly aphid common upon the leaves of Douglas fir. Another species, *Adelges* (*Chermes*) *strobilobius*, is known as the larch woolly aphid, and is common on larch foliage in midsummer.

The remedy is to spray the trees early in April with a miscible oil (1 - 25), to kill the overwintering females. The summer forms on leaves may be killed by spraying with nicotine solution and soap.

(Report for 1926, page 223).

Pine Bark Aphid [*Adelges* (*Chermes*) *pinicorticis* Fitch]

Small, cotton-like tufts of wax in the axils of the leaf clusters are common on small white pine trees, and on larger ones large white patches on the bark are often seen. The pine bark aphid is the cause, but its life history is not fully known. Eggs hatch about May 1, and the young settle along the twigs and suck the sap from the bark, soon becoming covered with slender filaments of wax, giving them the appearance of small tufts of cotton, as shown on Plate XVIII, a.

Trees can be entirely cleared of this insect by a thorough spraying in June with kerosene emulsion, and probably nicotine solution and soap will prove equally effective.

(Report for 1919, page 155).

Pine Leaf Scale (*Chionaspis pinifoliae* Fitch)

Often small pine trees show elongated white scales on the leaves. This is the pine leaf scale which infests Mugho, Austrian, jack, red, Scotch, stone, and white pines, sometimes killing them. There are two generations each year, and purple eggs under the female shells carry the species through the winter. These eggs begin to hatch in May, but the hatching period is a long one, and the two broods are not distinct but overlap.

Illustrations of this scale are shown on Plate XV, c.

Control measures for this insect have not been given a thorough trial in Connecticut, but it can doubtless be held in check by dormant spray applications of liquid lime-sulphur (1 - 9), or of miscible oil (1 - 15) in April, and of nicotine solution and soap between June 1 and August 1.

(Report for 1921, page 181).

Juniper Scale (*Diaspis carueli* Targ.-Tozz.)

Small, circular, whitish scales 1-2 mm. in diameter are often present and sometimes very abundant on the leaves of juniper, resulting in a yellow and sickly appearance.

Spraying with a miscible oil (1 - 25) in spring, before the new growth starts, will probably control this insect.

(Report for 1920, page 212).

Rhododendron Lace Bug (*Leptobyrsa rhododendri* Horvath)

This is a sucking bug belonging to the family Tingidae and commonly called lace bug. It is on the under side of the leaves of rhododendron, especially *R. maxima*, and *Kalmia latifolia* or mountain laurel. Apparently there is only one brood each year. The eggs are laid along the midrib, and there is much brownish discoloration from the excrement. The injured leaves show whitish spots on the upper surface. (See Plate XX, d).

Spraying the under sides of the leaves with nicotine solution and soap when the bugs are present has been effective.

(Report for 1921, page 200).

Spruce Mite (*Paratetranychus ununguis* Jacobi)

Spruce trees and other evergreens are often severely injured by mites. Such injury is noticed somewhere in the State each year, though it is usually more severe and more widespread in seasons of drought. The leaves are peppered with small whitish spots, covered with brownish eggs and egg-shells, and are usually more or less webbed together. The greenish-yellow living mites and their cast skins are also abundant.

Spraying in spring before the new growth starts with a miscible oil (1 - 15) to kill the eggs, and the application of liquid lime-sulphur (1 - 50) or linseed oil emulsion to kill the mites in midsummer, are recommended. Some of the oil preparations are apt to remove the bloom from some of the varieties of blue spruce.

(Report for 1922, page 340).

INSECTS INJURING PERENNIAL PLANTS

Key

A. Chewing Insects:

1. Attacking the leaves 2
   Attacking the stem or root 5
2. Devouring the leaves 3
   Mining within the leaves of columbine, Columbine Leaf-Miner, p. 168
3. Perforating or devouring portions of the entire thickness of the leaves 4
   Minute jumping insects feeding on surface of leaves of seedlings, Garden Spring-Tail, p. 169
4. Feeding at night, hiding during the day:
   Larvae with true legs, curled up in soil around base of plant, Climbing Cutworms, p. 130
   Gray or brown slugs without legs, hiding under rubbish and leaving a slimy trail ..... Garden Slugs, p. 170
5. Cutting off the stem near the surface of the ground:
   Larvae curled up in soil near the plant ..... Cutworms, p. 169
   Striped larva boring lengthwise in stem ..... Stalk Borer, p. 170
   Pink larva burrowing in rootstocks of iris .. Iris Root Borer, p. 171

B. Sucking Insects:

6. Visible insects attacking leaves or shoots at tip 7
   Reddish mites with eggs and shells injuring leaf surface, Red Spider, p. 150
   Microscopic, glassy mites, curling leaves of larkspur and some other plants ..... Cyclamen Mite, p. 172
7. Exceedingly active flying bugs, with nymphs on leaves 8
   Rather inactive plant-lice on leaves or stems ..... Aphids, p. 150
8. Greenish-yellow bugs; adult with four black stripes, on terminal leaves ..... Four-lined Plant Bug, p. 172
   Grayish or brownish bugs on terminal leaves, Tarnished Plant Bug, p. 139

Columbine Leaf-Miner (*Phytomyza aquilegiae* Hardy)

In June, whitish serpentine mines begin to appear in the lower leaves of columbine. There are often several miners in a leaf, and the mines may continue to increase in size until the entire leaf is involved. Later the small leaves around the flower stalks are infested. There are several generations, the winter being passed as pupae in the ground. The eggs are laid in the under sides of the leaves and hatch in less than a week. The larvae mine between the upper and lower epidermal layers of the leaf, becoming mature in about two weeks, and emerge from the mines through crescent-shaped openings. They attach themselves to the leaf and pupate. In two weeks the adults emerge. They are small, dark brown flies about 2 mm. long. Injured leaves are shown on Plate XX, a.

Cultivating the ground around the plants in late fall or early spring will reduce the infestation. Removing and destroying the mined leaves when the infestation first appears will aid in the control of this pest.

(Report for 1894, page 145; New Jersey Department of Agriculture, Circular 36, page 13).

Garden Spring-Tail (*Sminthurus hortensis* Fitch)

Small seedling plants, particularly in hotbeds or cold frames, are often injured in early spring by minute, purplish, jumping insects which eat off the surface tissue from the leaves. These tiny insects are purple, spotted with yellow, and jump like fleas. Each has a globular-shaped body and rather large head with narrow neck. A forked tail-like appendage used in jumping extends rearward from the under side of the body, as shown in Fig. 33.

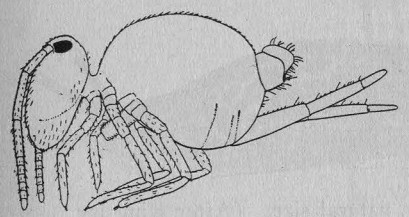


Fig. 33. Garden spring-tail.

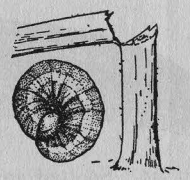


Fig. 34. Cutworm and characteristic injury to plant.

This insect may be controlled by spraying or dusting the plants with nicotine.

(Bulletin 6, Tobacco Experiment Station, page 86 T).

Cutworms (Noctuidae, several species)

Perennial plants, especially the seedlings and tender shoots, are often cut off near the ground by cutworms, as shown in Fig. 34. There are also other kinds of cutworms which climb and feed upon the leaves. Most of the cutworms are single-brooded and live through the winter as partially grown larvae. The adult moths emerge and lay their eggs in late summer. All cutworms are the larvae of rather inconspicuous gray or brown moths of the family Noctuidae, and there are perhaps a dozen or more species that are classed as cutworms.

Injury from the climbing cutworms may be lessened by spraying the foliage with lead arsenate. The cutworms, which cut off the

stems of plants, can best be controlled with a poisoned bait distributed about the field a few days before the injury becomes serious. A formula for this bait is as follows:

Wheat bran	5 lbs.
White arsenic or Paris Green	4 oz.
Cheap molasses	1 pint
Orange or lemon	1 fruit
Water	7 pints

Cut the fruit into small pieces and mix together to form a rather dry mash and scatter around the field.

Garden Slugs (Family Limacidae)

The leaves of garden plants are often eaten by slugs, which are closely related to snails but without the usual shell. One of the commonest species is the gray field slug, *Agriolimax agrestis* Linn., and another and more striking species is the giant or spotted garden slug, *Limax maximus* Linn., shown in Fig. 35.

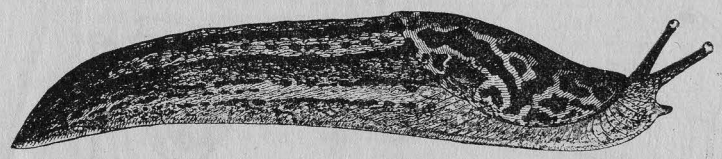


Fig. 35. Spotted garden slug, natural size. (After Kingsley, Riverside Natural History).

These animals feed at night on the tender leaves of garden and greenhouse plants, eating holes through the leaves or notches in the margins. They hide under rubbish during the day and leave a slimy trail wherever they crawl.

Plants may be protected by spraying or dusting with lead arsenate. As a rule, beds may be protected by surrounding them with a layer of air-slaked lime, but fine soot or coal ashes will answer the purpose, as the slugs do not like to crawl through such dry material.

(Report for 1918, page 333).

Stalk Borer (*Papaipema nebris* Guen.)

The stalk borer may be found in any kind of herbaceous stem and attacks vegetables, annual and perennial flowering plants, and weeds. (See Fig. 36). Among the perennials it is often found in hollyhock, lily, larkspur, peony, and chrysanthemum. There is a single generation each year, and the insect passes the winter as an egg on the stem of dead grass. The eggs hatch in May and the

larvae begin to tunnel in grass stems, later migrating to other plants. By August or early September, the larvae mature and pupate in the burrows; a month later the adults emerge. The moth has a wing-spread of about one and three-eighths inches and is brown, with conspicuous white discal spots on the fore wings. Larva and adult are shown on Plate XX, b and c.

Heretofore the only remedy has been to cut out the borer, burn the infested stalks, or inject carbon disulphide into the burrow and plug the opening. Burning the grass and weeds around the fields

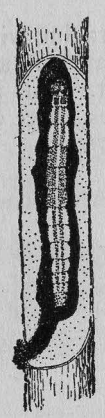


Fig. 36. Stalk borer.

in late fall or early spring is now known to have a tendency to reduce the number of stalk borers by killing the eggs.

(Report for 1919, page 180. New Hampshire Technical Bulletin 34).

Iris Root Borer (*Macronoctua onusta* Grote)

The rootstocks of iris plants are injured by a pink larva tunneling in them, often devouring the entire rootstock and killing the plant. This is the larva of a brown moth with a wing-spread of about two inches, which probably has only one generation each year. The adults emerge in September or October and lay eggs upon the iris leaves. These eggs hatch in spring, and the young borers find their way into the rootstock, where they feed and increase in size, becoming fully grown in August. They then pupate in the ground, and later the adults emerge. Larva and moth are shown on Plate XIX, b and c.

Gathering and burning the leaves in late fall or early spring to destroy the eggs is the only remedy known.

(Report for 1918, page 331).

RED SPIDER (*Tetranychus bimaculatus* Harv.) See page 150

CYCLAMEN MITE (*Tarsonemus pallidus* Banks)

This mite often injures larkspur and several annual plants in the garden, as well as cyclamen, snapdragon, and chrysanthemum in the greenhouse. The new leaves become thickened and more or less curled, as shown on Plate XIX, a. Buds are also distorted and fail to open properly. The mites are almost too small to be seen by the naked eye, but under the magnifying glass they are white and glassy.

Frequent and thorough spraying with nicotine solution and soap, one part in 500 parts of water, if started when the injury first appears, will control this pest. This treatment should be repeated each week and, in severe cases, twice each week.

(Report for 1914, page 176).

APHIDS (Family Aphididae). See page 150

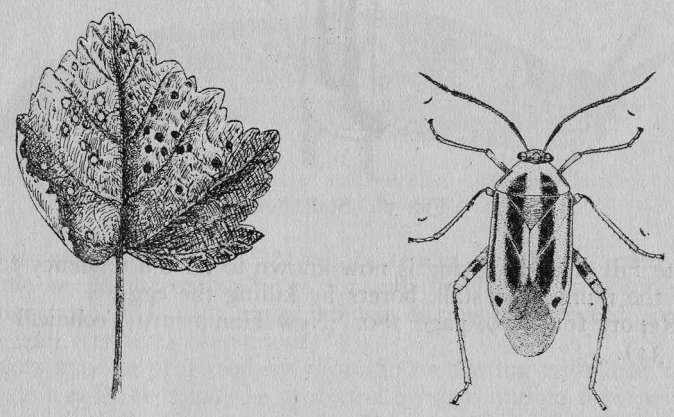


FIG. 37. Four-lined plant bug and injured currant leaf.

FOUR-LINED PLANT BUG (*Poecilocapsus lineatus* Fabr.)

This greenish-yellow bug is about three-eighths of an inch long in the adult stage and has four black stripes on its back. In early spring when first hatched, it is bright red, with large black spots on the thorax. The eggs are laid by the adult bugs late in June or early July, but do not hatch until the following spring. The young nymphs feed for about three weeks and reach the adult or winged stage about the middle of June. There is but one generation each year. This insect has a wide range of food plants, being particularly injurious to dahlia, rose, currant, gooseberry, and mint.

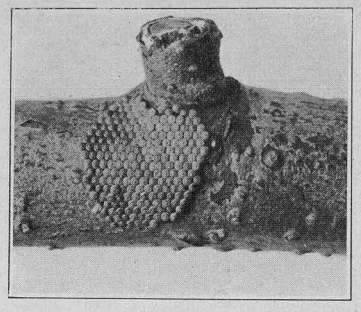
It gets its nourishment by sucking the juices from the tenderest leaves near the ends of the shoots. The injured leaves turn brown in spots, which later become transparent, and in heavy infestations the entire leaf turns brown. (See Fig. 37).

The adults are shy and very active when alarmed and very difficult to capture. As they fly readily, they are not easily killed by sprays. The nymph, having no wings, may be killed by a spray of nicotine and soap, and some of the adults will likewise be hit and killed.

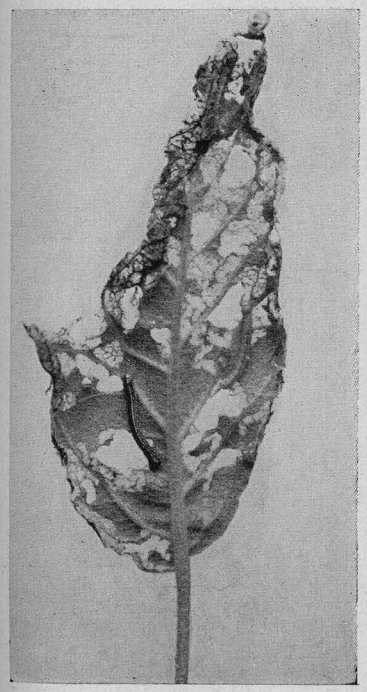
(Report for 1914, page 189).

TARNISHED PLANT BUG (*Lygus pratensis* Linn.) See page 139

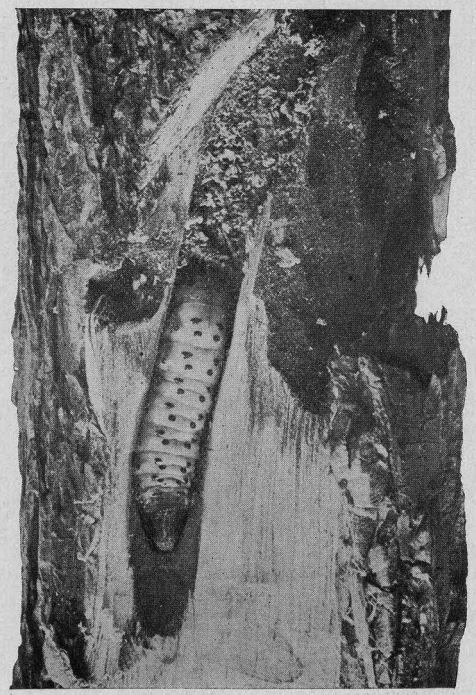
a. Adult female and egg-mass of fall cankerworm. Twice natural size.



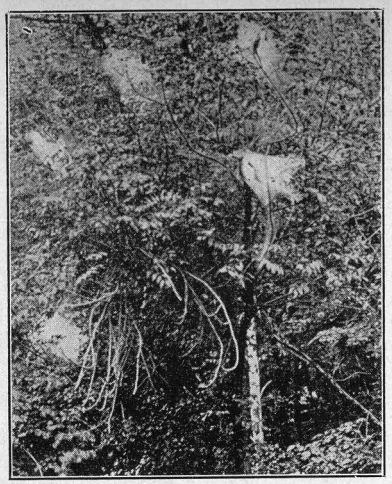
b. Egg-mass of fall cankerworm on twig. Four times enlarged.



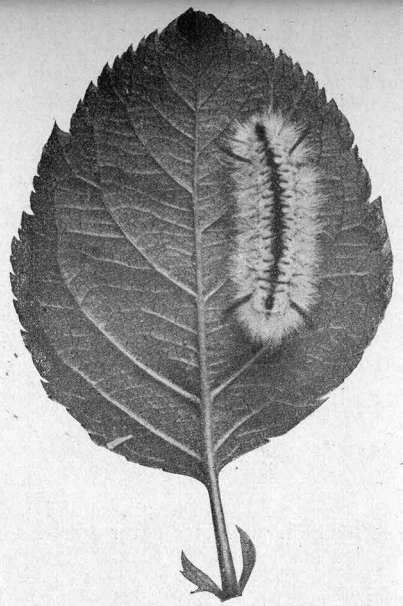
c. Apple leaf partly devoured by cankerworms.



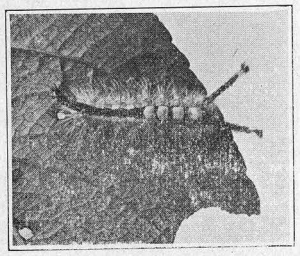
d. Leopard moth larva in its burrow. Natural size.



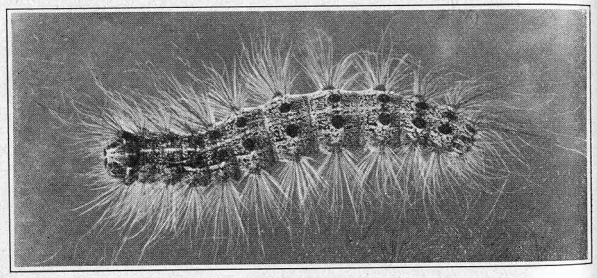
a. Nests of fall web-worm. (After Slingerland).



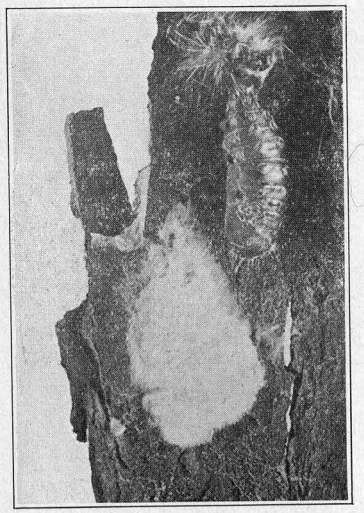
b. Hickory tussock moth. Fully grown caterpillar on leaf. Natural size.



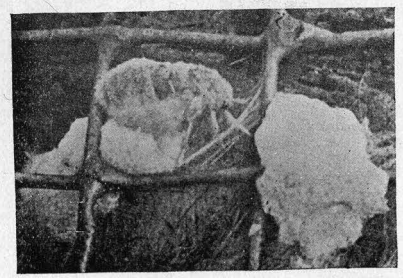
c. White-marked tussock moth caterpillar. Natural size.



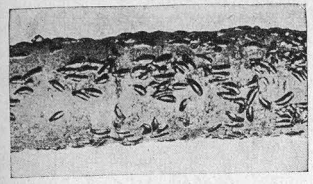
d. Gipsy moth caterpillar. Natural size.



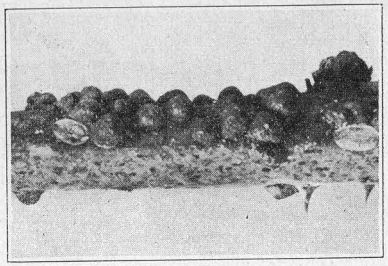
e. Gipsy moth egg-mass and pupa. Natural size.



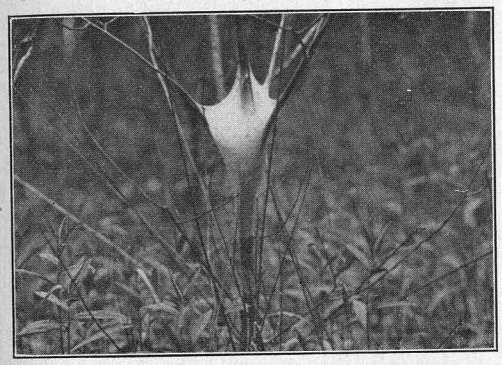
f. White-marked tussock moth. Natural size. Female moth and egg-masses.



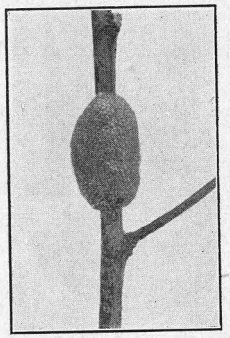
a. Oyster-shell scale on poplar. Natural size.



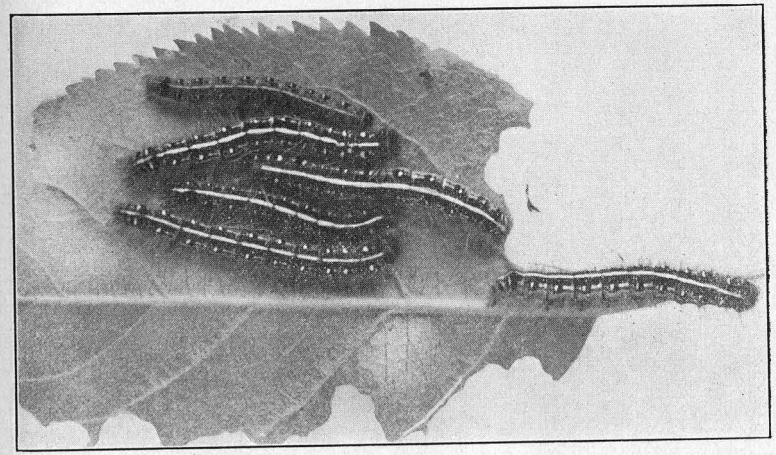
b. European fruit lecanium on blackberry. Natural size.



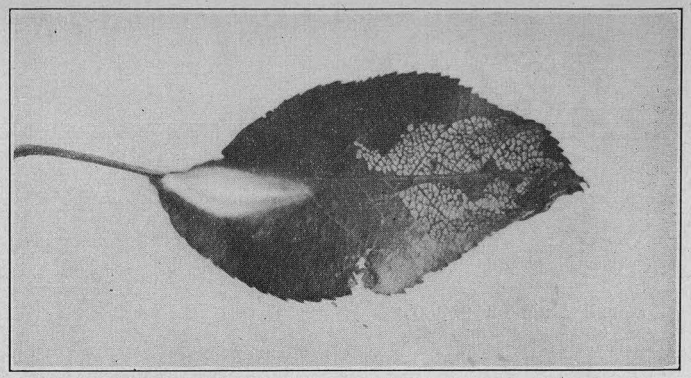
c. Nest of tent caterpillar.



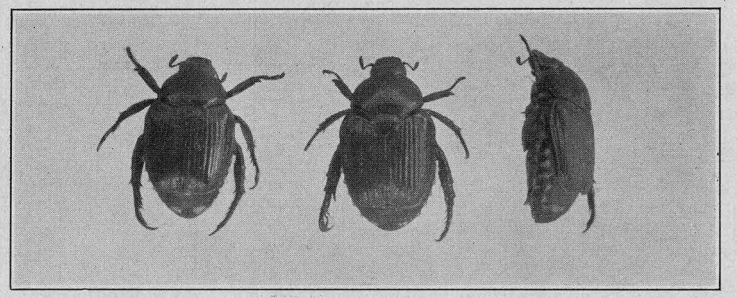
d. Egg-mass of tent caterpillar on twig. Natural size.



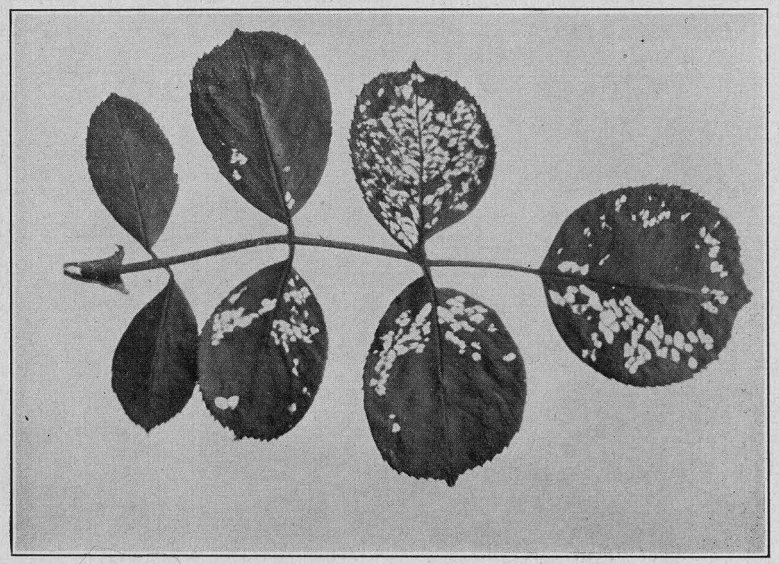
e. Tent caterpillars, partially grown. Natural size.



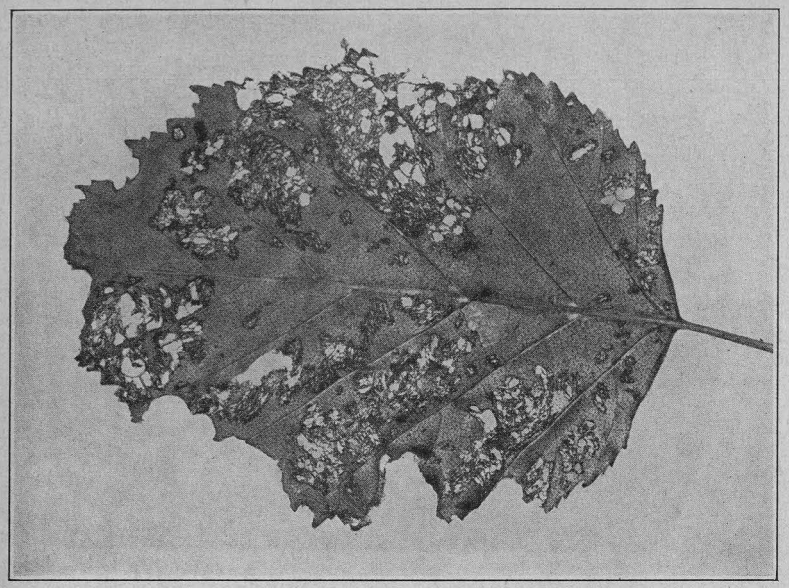
a. Apple and thorn skeletonizer; apple leaf eaten by caterpillar, and cocoon. Somewhat reduced.



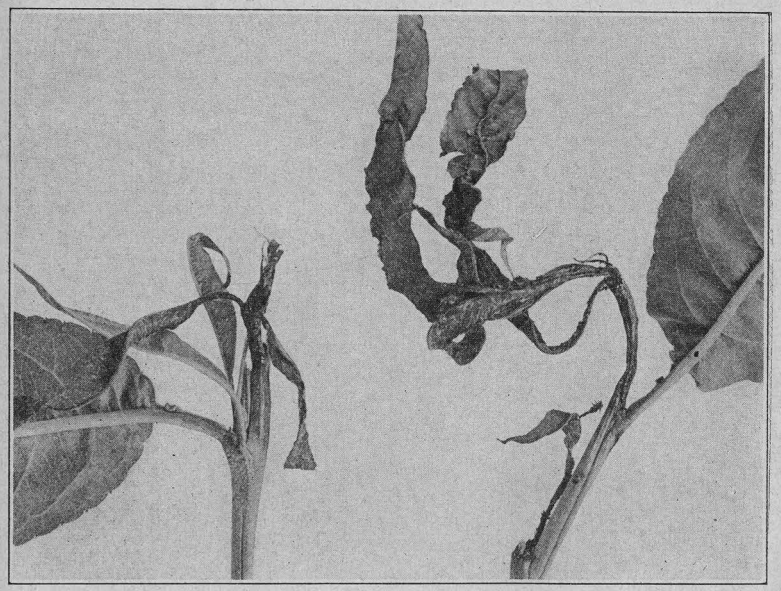
b. Japanese beetle; adults twice enlarged.



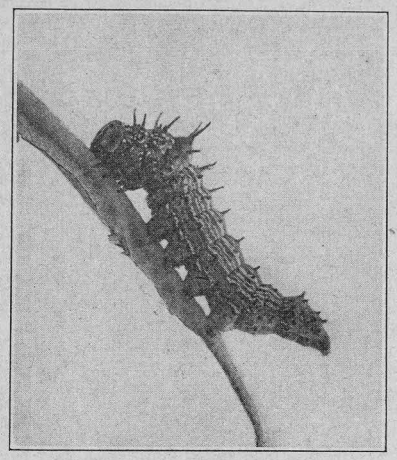
c. Rose leaves eaten by Japanese beetles. Natural size.



a. Birch leaf injured by the rose chafer. Natural size.



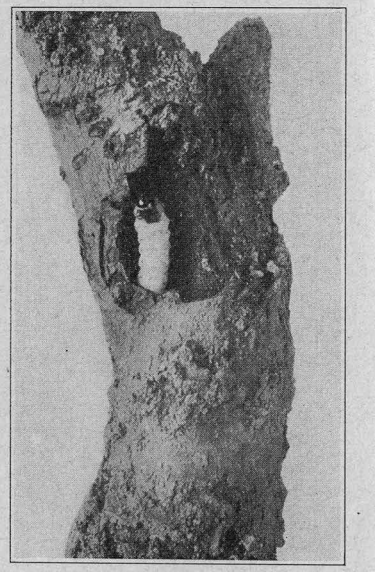
b. Peach twigs injured by larvae of the Oriental peach moth. Natural size.



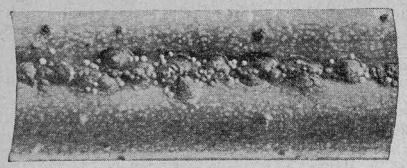
a. Red-humped caterpillar. Enlarged one and one-half times.

b. Yellow-necked caterpillars. Natural size.

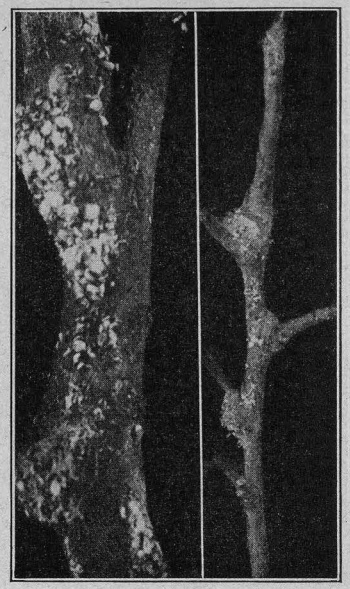
c. Budded fruit trees, showing where buds were destroyed by climbing cutworms. Natural size.



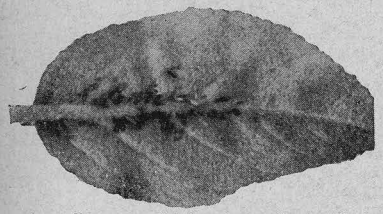
d. Peach borer in base of young tree.



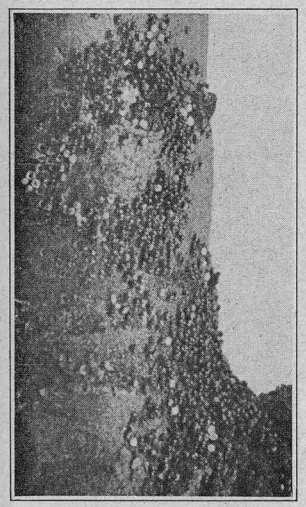
a. San José scale on peach twig. Twice natural size.



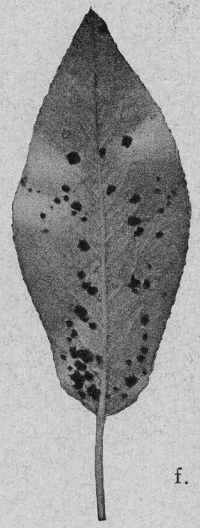
c. Woolly aphids on twigs, showing galls and white flocculent appearance.



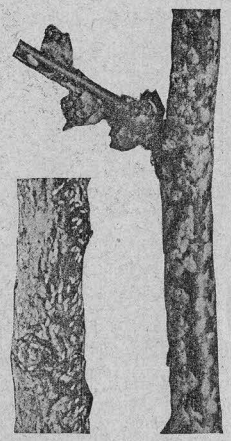
b. Green aphids on apple leaf. Natural size.



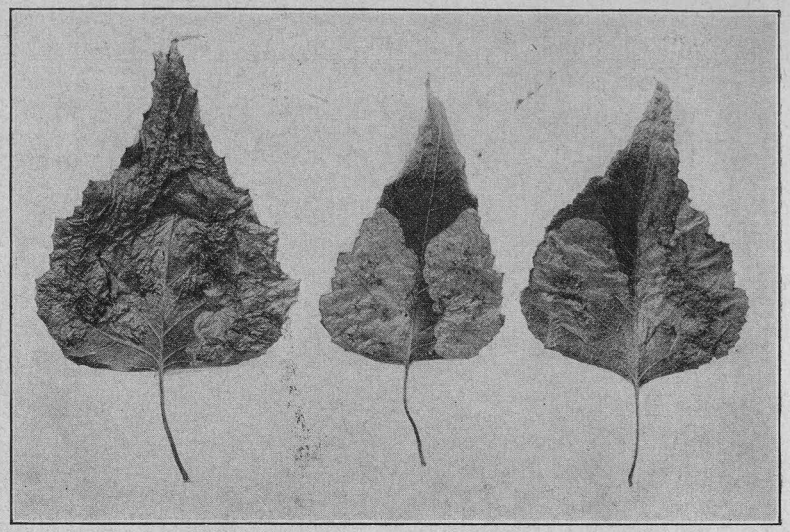
d. Eggs of European red mite. Ten times enlarged.



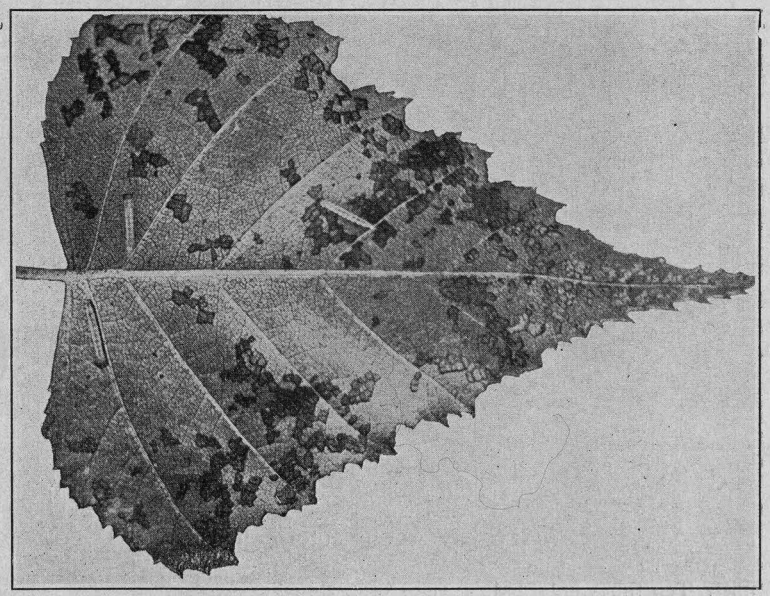
e. Leaf showing work of pear leaf blister mite. Natural size.



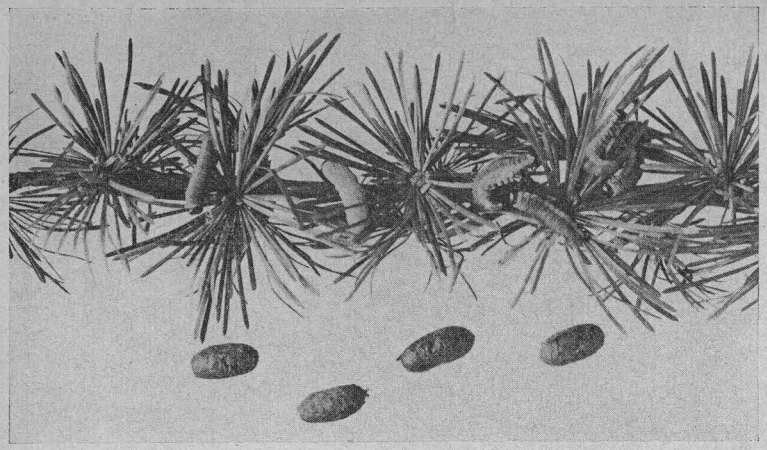
f. Scurfy scale on currant; males at left; females at right.



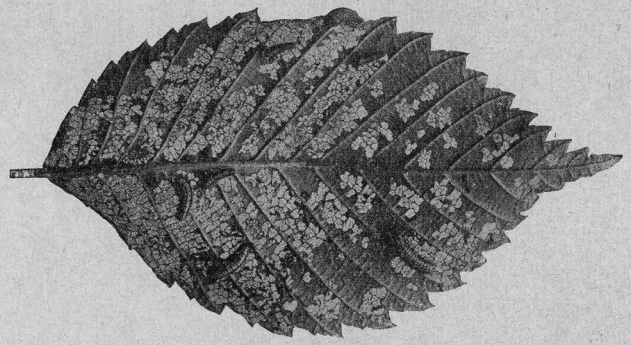
a. Leaves of gray birch injured by the imported birch leaf miner.



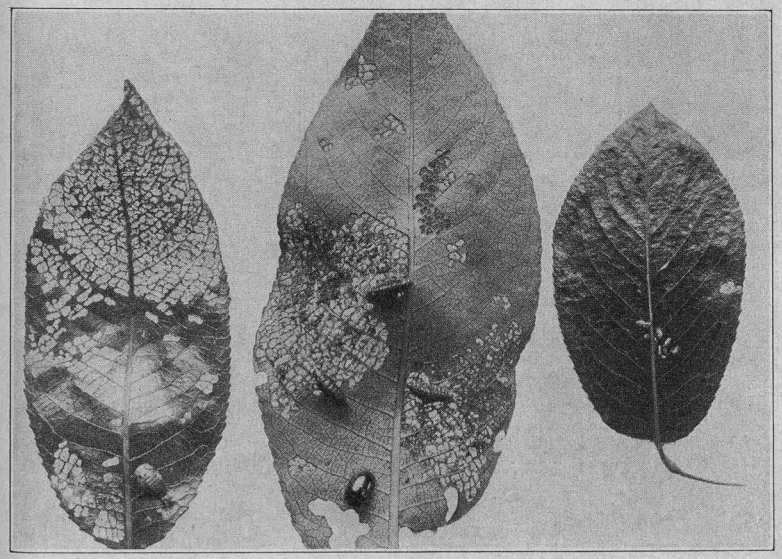
b. Larvae of birch skeletonizer on leaf of gray birch. Slightly enlarged.



a. Larvae and pupae of the larch sawfly. Natural size.

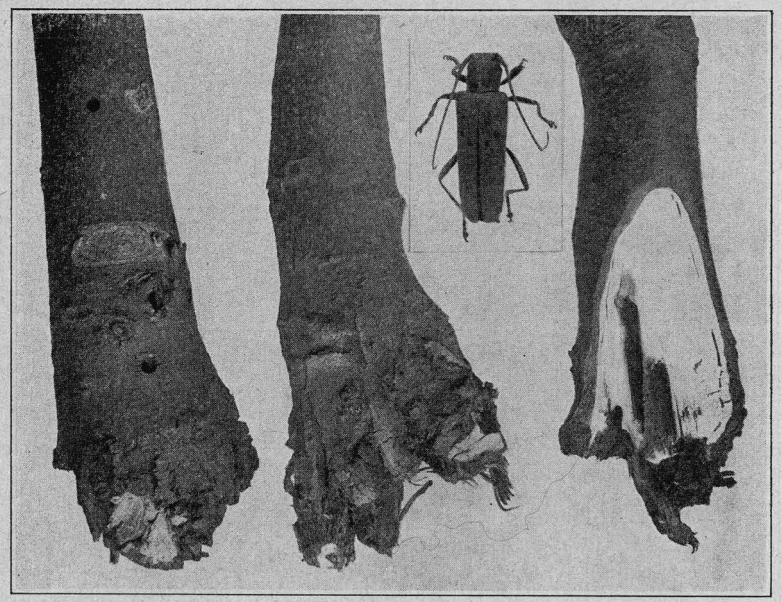


b. Elm leaf beetle larvae and their work. Natural size.

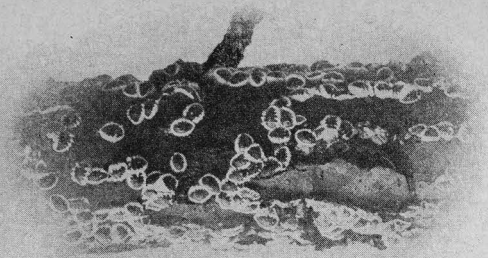


c. Larvae, pupa and adult of imported willow leaf beetle and injury to willow leaves. Slightly enlarged.

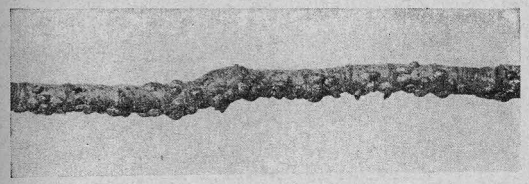
a. Work of poplar and willow borer. Natural size.



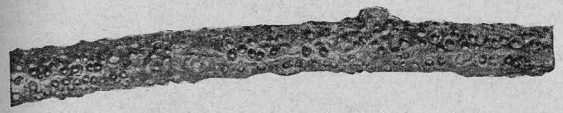
b. Linden borer, natural size, and its injury to young linden trees, greatly reduced.



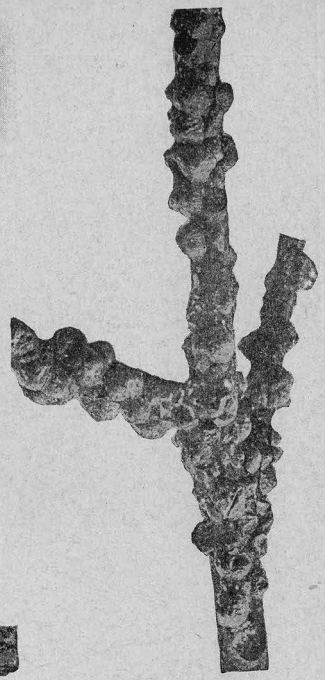
a. European elm scale. Natural size.



b. Terrapin scale. Natural size.



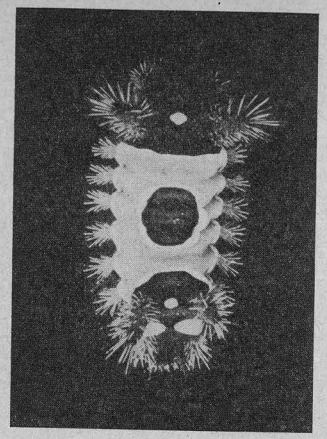
c. Pit-making oak scale. Natural size.



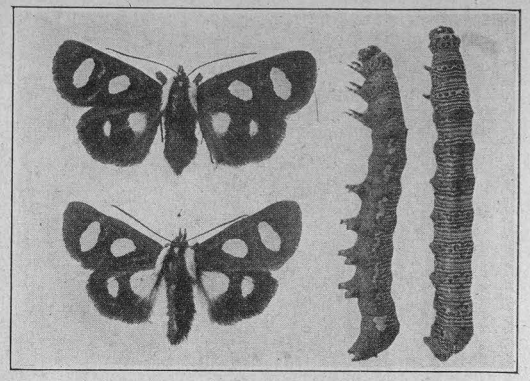
d. Tulip tree scale. Natural size.

e. Cottony maple scale. Natural size.

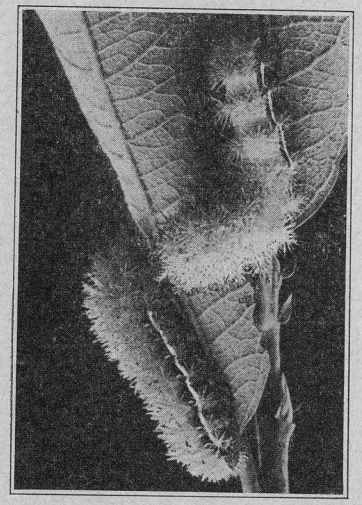
PLATE XII.



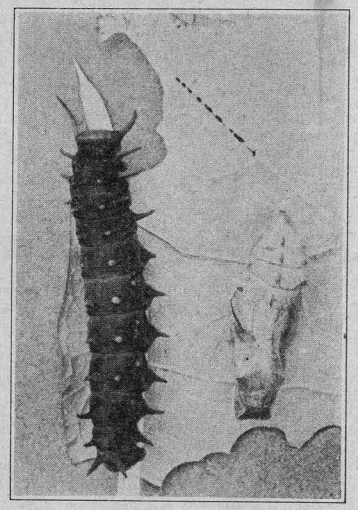
a. Saddle-back caterpillar. Twice enlarged.



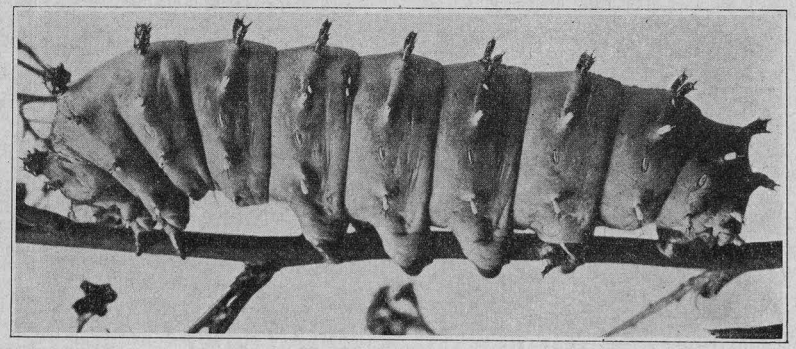
b. Eight-spotted forester. Adults and larvae, natural size.



c. Io caterpillars. Natural size.

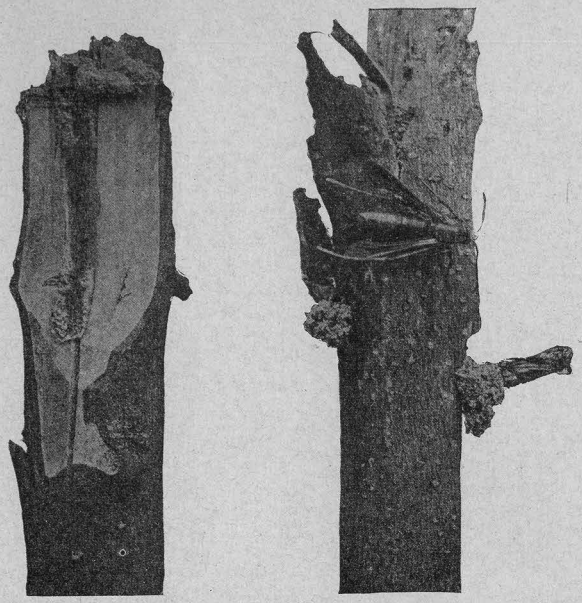


d. Pipe-vine caterpillar. Natural size.

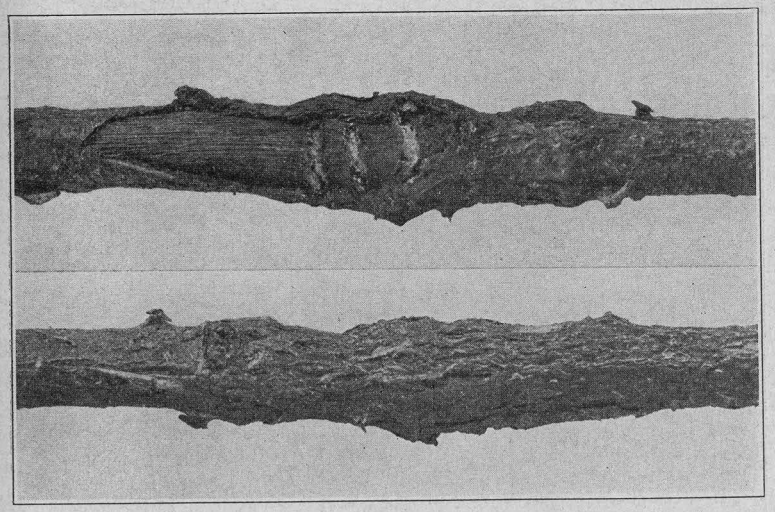


e. Cecropia caterpillar. Natural size.

PLATE XIII.

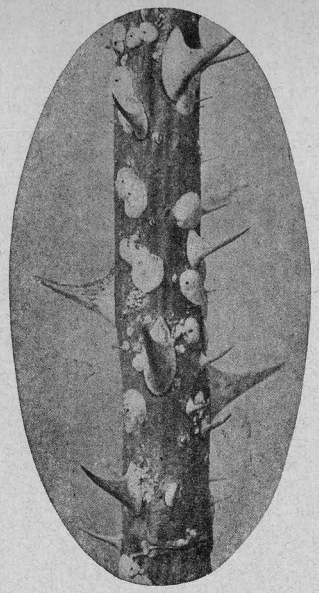


a. Lilac borer, showing adult pupa case and injured privet stem. Natural size.

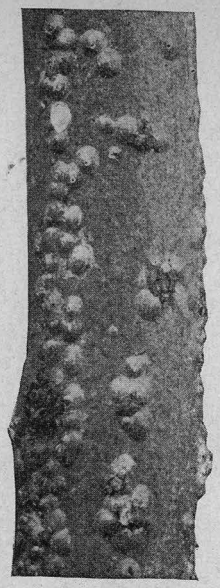


b. Galls of rose stem girdler, twice enlarged.

PLATE XIV.



a. Rose scale, twice enlarged.

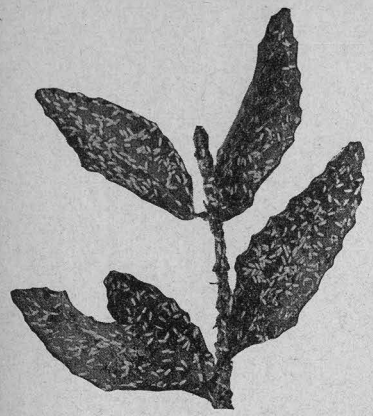


b. White peach scale, twice enlarged.

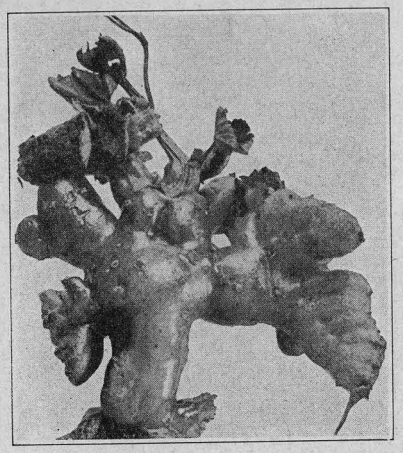
c. Imported pine sawfly larvae feeding on leaves. Natural size.

d. Work of juniper webworm.

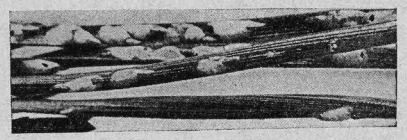
PLATE XV.



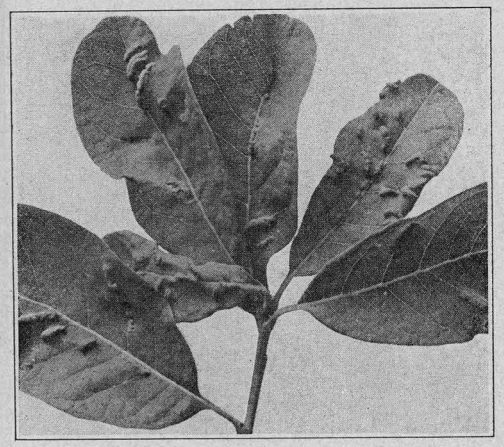
a. Euonymus scale, mostly males. A few larger, gray females are present.



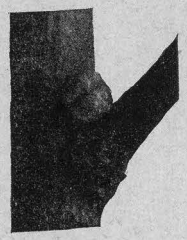
b. Grape-vine tomato gall.



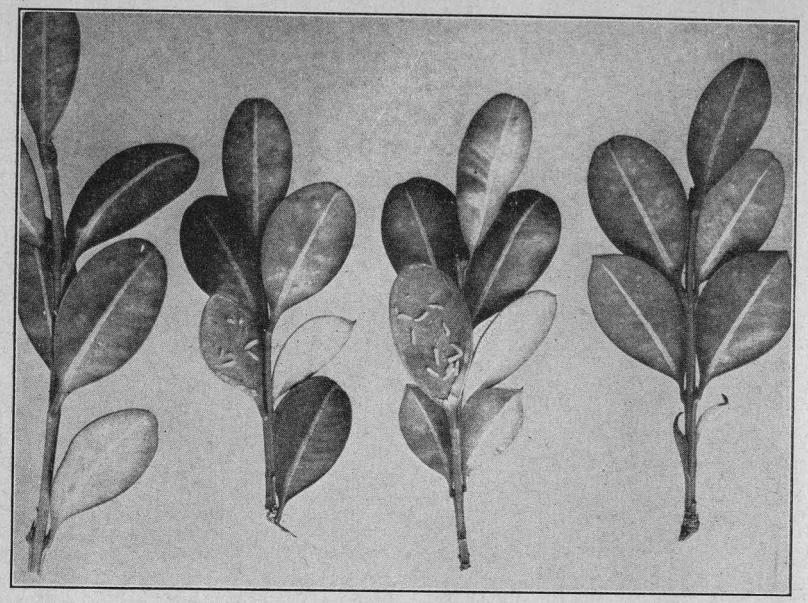
c. Pine leaf scale, twice enlarged.



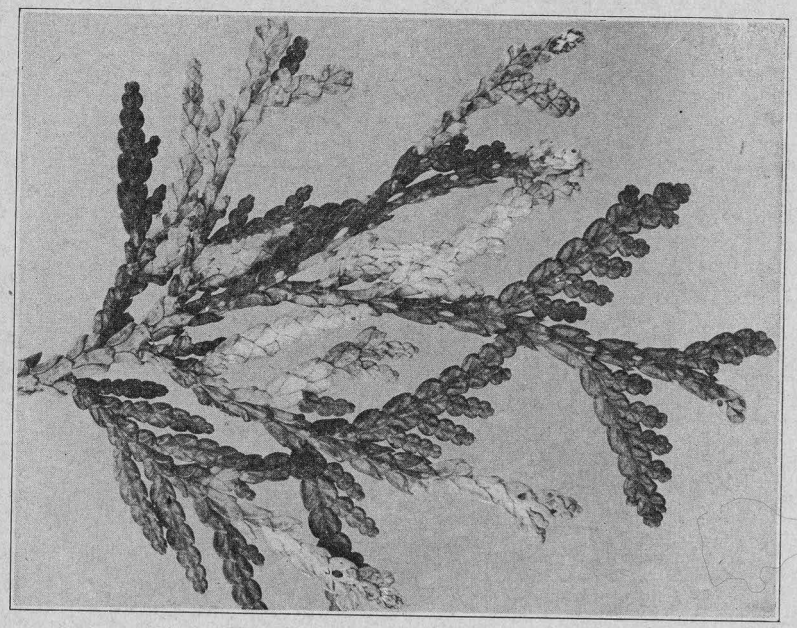
d. Mite galls on leaves of Exochorda.



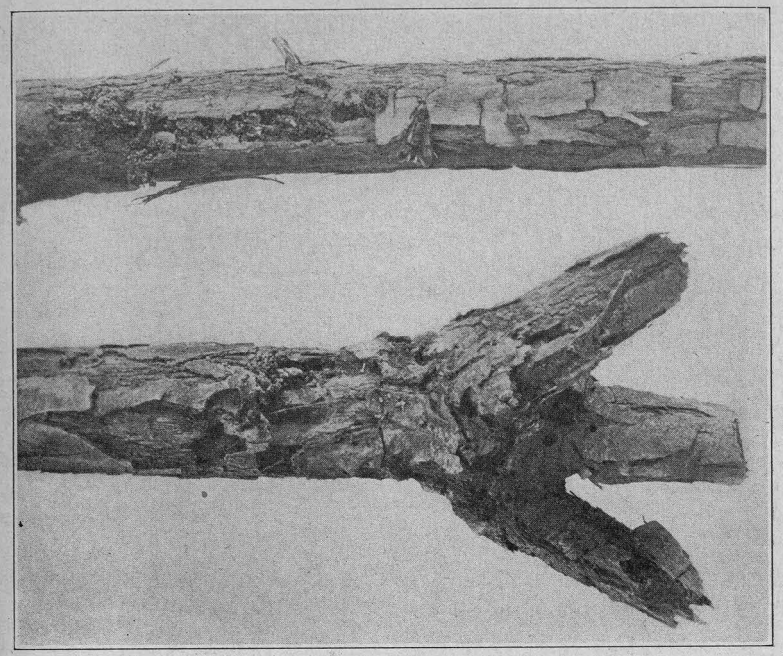
e. Oak gall scale.



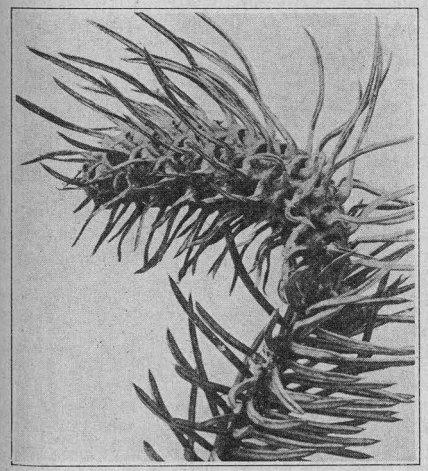
a. Boxwood leaf miner. White spots on leaves indicate infestation. Lower epidermis has been removed from two leaves, showing maggots. Natural size.



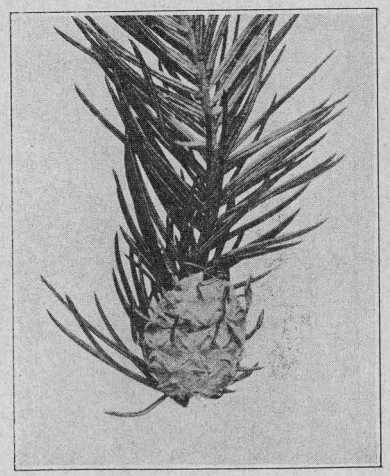
b. Work of arborvitae leaf miner, twice enlarged.



a. Rhododendron borer, Appearance of infested stems showing adult. Natural size.

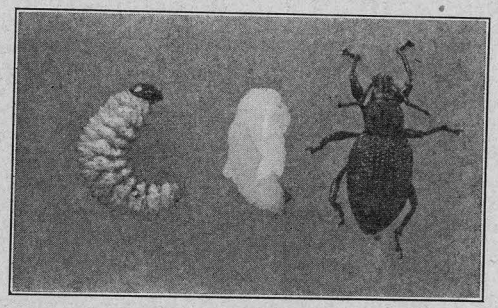


b. Gall of blue spruce. Natural size.

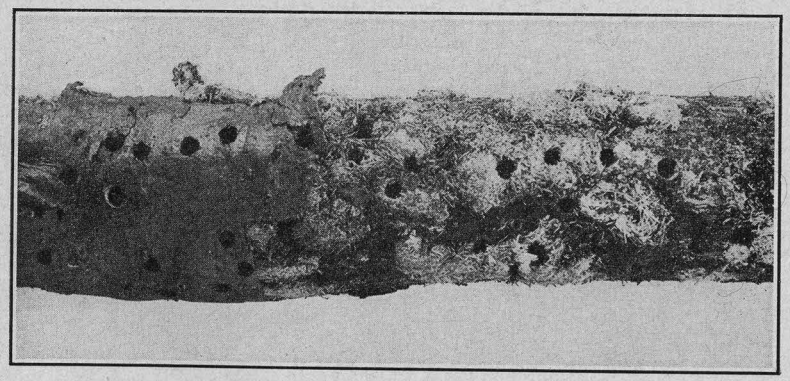


c. Spruce gall. Natural size.

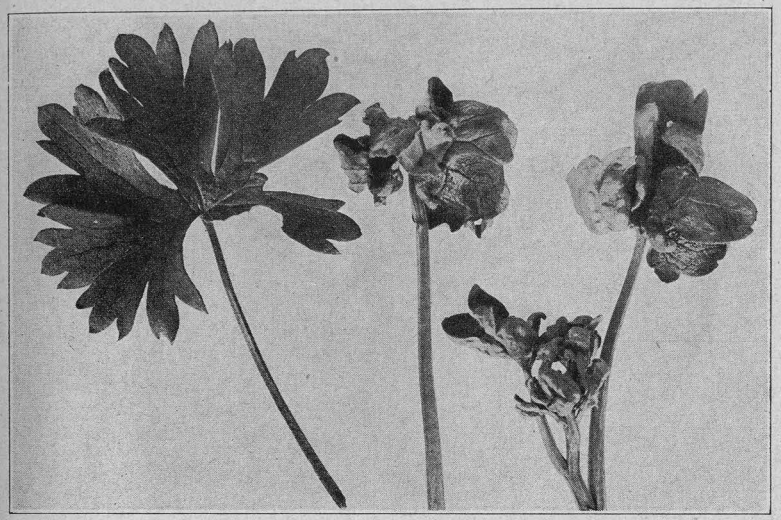
a. Pine bark aphid in small tufts on twigs and leaves. Natural size.



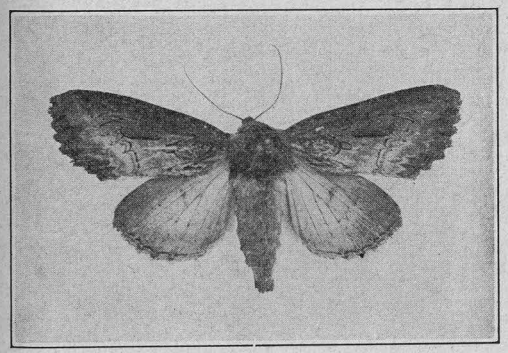
b. *Otiorhynchus sulcatus* Fabr. Larva, pupa, and adult. Twice enlarged.



c. Exit holes of white pine weevil. Natural size.

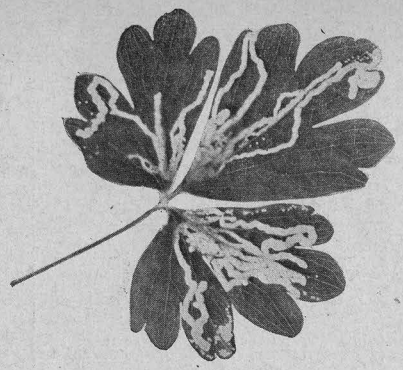


a. Larkspur leaves curled by cyclamen mites; healthy leaf at left. Somewhat reduced.

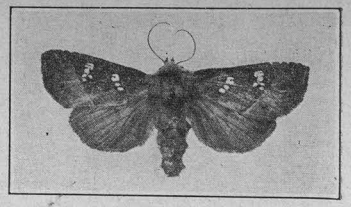


b. Adult of iris root borer. Natural size.

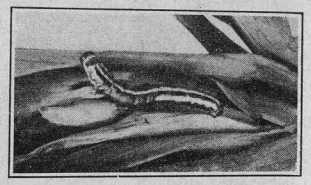
c. Iris root borer. Natural size.



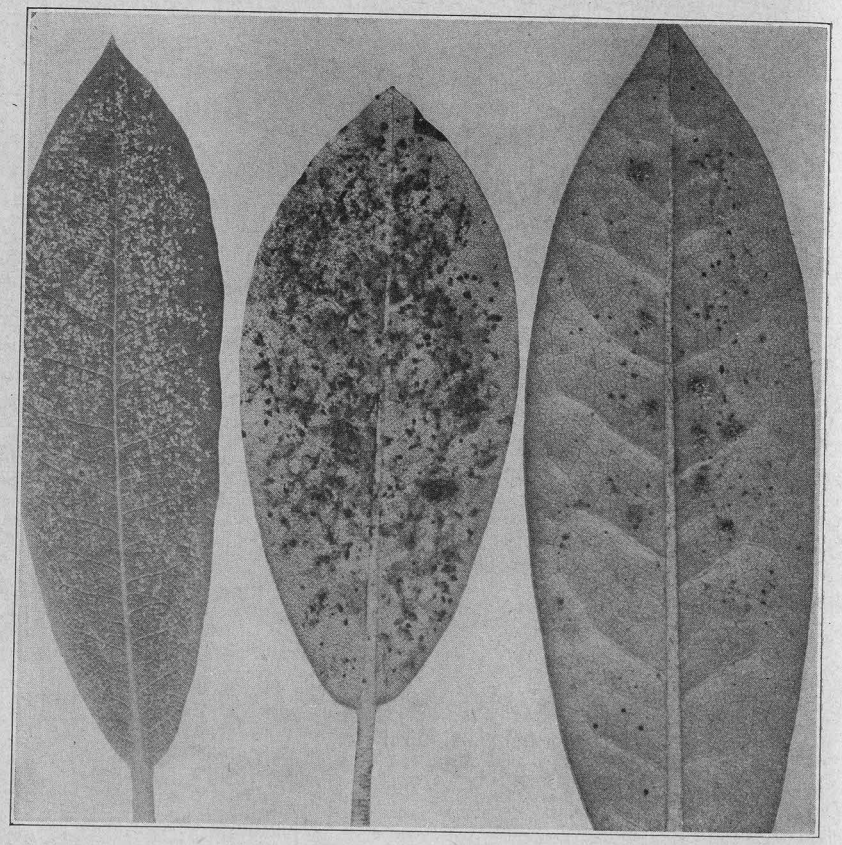
a. Work of columbine leaf miner. Natural size.



b. Adult of stalk borer. Natural size.



c. Immature stalk borer in corn. Natural size.



d. Rhododendron leaves injured by rhododendron lace bug, which may be seen on lower surface at right. Leaf at left shows appearance on upper surface.

BULLETIN 293 FEBRUARY, 1928

Connecticut Agricultural Experiment Station
New Haven, Connecticut

The Quality of Vegetable Seed Bought by Market Gardeners in Connecticut in 1927

E. M. STODDARD AND A. D. McDONNELL

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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THE QUALITY OF VEGETABLE SEED BOUGHT BY MARKET GARDENERS IN CONNECTICUT IN 1927

By E. M. STODDARD and A. D. MCDONNELL

For many years this Station has examined seed for germination and purity. The samples were usually sent in voluntarily by growers and dealers, but this method of obtaining material did not supply sufficient number or distribution of samples to furnish good information on the quality of seed sold in the state. More recently the Sampling Agent has collected vegetable seed from various sources in sufficient quantity to warrant publication of the results as an index to the quality of such seed as sold in Connecticut. In Bulletin 283 (1927) the data on two years' collections of packet seed were given, and at this time we present the data on vegetable seed sold in bulk to market gardeners throughout the State. These samples were obtained from market gardeners and represented seed stocks they had purchased for planting in 1927. The collection was started late and not as many samples could be obtained as we had hoped, but a fairly well distributed lot of 172 samples was collected, which are listed in Table I. This seed is not as good as one might suppose it would be, but compares favorably with similar seed sold in other states, and is for the most part an improvement on the packet seed previously reported in Bulletin 283.

The tests made were for germination only, there being no consideration given to other features relative to the value of the sample.

The standard methods of procedure were followed in making the tests. In brief, 200 seeds were selected from each sample and put in a standard germinating chamber in duplicate lots of 100 seeds each, the smaller seeds being put between blotting paper and the larger seeds, such as corn, peas and beans between paper towels. We find by comparative tests that the paper towels give as good results as cloths and do away with the inconvenience of washing and sterilizing the cloths. The substratum was moistened as necessary with tap water. Each sample was kept in the germinating chamber for the standard number of days required for such seeds, and if the germination of the duplicate samples varied more than 10% a retest was made and the resulting percentages used.

TABLE I. GERMINATION TESTS OF BULK VEGETABLE SEED, 1927.

Test Number	Variety of Seed	Per cent of Germination	Grower
	Beans		
3311	Black Valentine	*84	E. B. Clark Seed Co., Milford, Ct.
3317	Black Valentine	*89	Comstock Ferre Co., Wethersfield, Ct.
3315	Bountiful	98	Frank S. Platt Co., New Haven, Ct.
3316	Cracker Jack	98	Frank S. Platt Co., New Haven, Ct.
3313	Davis White Kidney Wax	97.5	S. D. Woodruff & Sons, Orange, Ct.
3310	Dwarf Wonder of France	95.5	J. Breck Seed Co., Boston, Mass.
3302	Fordhook Bush Lima	*83	S. D. Woodruff & Sons, Orange, Ct.
3305	Golden Cluster Wax	96	Jos. Harris Seed Co., Coldwater, N. Y.
3304	Green Pod Long	97	E. B. Clark Seed Co., Milford, Ct.
3309	Hodson's Wax	99	Frank S. Platt Co., New Haven, Ct.
3303	Round Pod Kidney	96.5	S. D. Woodruff & Sons, Orange, Ct.
3308	Stringless Refugee	*82.5	Jos. Harris Seed Co., Coldwater, N. Y.
3314	Stringless Refugee	98	F. H. Woodruff & Sons, Milford Ct.
3306	White Kid Wax	94	Jos. Harris Seed Co., Coldwater, N. Y.
3307	Yellow Bountiful	98	Frances Stokes & Co., Philadelphia, Pa.
3312	Round Pod Kidney Wax	93	S. D. Woodruff & Sons, Orange, Ct.
	Beets		
3281	Coal Black	89.5	Francis Brill & Co., Hempsted, N. Y.
3278	Crosby's Egyptian	86	Jos. Harris Seed Co., Coldwater, N. Y.
3276	Detroit Dark Red	94	E. B. Clark Seed Co., Milford, Ct.
3282	Detroit Dark Red	88.5	F. H. Woodruff & Sons, Milford, Ct.
3468	Detroit Dark Red	82	F. H. Woodruff & Sons, Milford, Ct.
3286	Detroit Dark Red	*77.5	Frank. S. Platt Co., New Haven, Ct.
3277	Early Wonder	88.5	J. W. Simon & Son, Philadelphia, Pa.
3283	Early Wonder	90	E. B. Clark Seed Co., Milford, Ct.
3284	Early Wonder	*74.5	S. D. Woodruff & Sons, Orange, Ct.
3279	Egyptian	*43.5	David L. Clark & Son, Milford, Ct.
3280	Mangel, Mammoth Long Red	*37.5	Frances Stokes & Co., Philadelphia, Pa.
3275	Woodruff's Early Wonder	*73	F. H. Woodruff & Sons, Milford, Ct.
	Cabbage		
3268	Copenhagen Market	*73	Jos. Harris Seed Co., Coldwater, N. Y.
3270	Copenhagen Market	85	Alex. Forbes & Co., Newark, N. J.
3269	Danish Round Head	*68	C. P. Strandholm, Copenhagen, Denmark
3267	Early Jersey Wakefield	95	Frances Stokes & Co., Philadelphia, Pa.
3272	Early Jersey Wakefield	88.5	Jos. Harris Seed Co., Coldwater, N. Y.
3266	Golden Acre	*84	Frank. S. Platt Co., New Haven, Ct.
3274	Golden Acre	*71	Comstock Ferre Co., Wethersfield, Ct.
3271	Penn. State Bullhead	89	Frances Stokes & Co., Philadelphia, Pa.
3273	Perfection Savoy	86.5	Cadwell & Jones, Hartford, Ct.
	Carrot		
3291	Bagley	89.5	F. H. Woodruff & Sons, Milford, Ct.
3297	Bagley	*56.5	E. B. Clark Seed Co., Milford, Ct.
3292	Chantenay	72	Frank S. Platt Co., New Haven, Ct.

*Below standard.

TABLE I. GERMINATION TESTS OF BULK VEGETABLE SEED, 1927.—*Continued.*

Test Number	Variety of Seed	Per cent of Germination	Grower
	Carrot (*Continued*)		
3299	Chantenay	*35.5	E. B. Clark Seed Co., Milford, Ct.
3300	Chantenay	67	E. B. Clark Seed Co., Milford, Ct.
3301	Chantenay	60	Jos. Harris Seed Co., Coldwater, N. Y.
3295	Danvers	61.5	Frances Stokes Co., Philadelphia, Pa.
3288	Danver's Half Long	63.5	J. W. Simon & Son, Philadelphia, Pa.
3290	Danver's Half Long	*56.5	Cadwell & Jones, Hartford, Ct.
3292	Danver's Half Long	67	C. J. Hart Seed Co., Wethersfield, Ct.
3298	Danver's Half Long	65.5	F. W. Eberle Seed Co., Albany, N. Y.
3294	Hutchingson	89	Jos. Harris Seed Co., Coldwater, N. Y.
3287	Oxheart	*42	Comstock Ferre Co., Wethersfield, Ct.
3296	Pride of Denmark	*59	Jos. Harris Seed Co., Coldwater, N. Y.
3289	Rubicon	60.5	F. W. Eberle Seed Co., Albany, N. Y.
	Celery		
3408	Early Blanching	87.5	E. B. Clark Seed Co., Milford, Ct.
3407	French Success	80	J. W. Simon & Son, Philadelphia, Pa.
3404	Golden Plume or Wonderful	*70	Jos. Harris Seed Co., Coldwater, N. Y.
3406	Golden Self Blanching	*29	Jos. Harris Seed Co., Coldwater, N. Y.
3405	Newark Market	*75.5	Alex. Forbes & Co., Newark, N. J.
3402	Wonderful	*58	F. H. Woodruff & Sons, Milford, Ct.
3403	Woodruff's Wonderful	*64	F. H. Woodruff & Sons, Mllford, Ct.
	Corn (Sweet)		
3359	Alfa Sweet	90	Jos. Harris Seed Co., Coldwater, N. Y.
3368	Columbia	95.5	S. D. Woodruff & Sons, Orange, Ct.
3354	Columbia Sweet	91	Comstock Ferre Co., Wethersfield, Ct.
3369	Columbia White	94.5	S. D. Woodruff & Sons, Orange, Ct.
3466	Country Gentleman	*80	Comstock Ferre Co., Wethersfield, Ct.
3358	Cromer's Special Sweet	*88.5	David L. Clark & Son, Milford, Ct.
3365	Early Bantam Sweet	*88.5	Frank S. Platt & Co., New Haven, Ct.
3353	Extra Early Dighton Sweet	97	S. D. Woodruff & Sons, Orange, Ct.
3364	Giant Bantam Sweet	93	Cadwell & Jones, Hartford, Ct.
3362	Golden Bantam	92.5	Comstock Ferre & Co., Wethersfield, Ct.
3363	Golden Bantam Sweet	95.5	Cadwell & Jones, Hartford, Ct.
3370	Golden Early Market	96	Gill Bros. Seed Co., Portland, Ore.
3360	Howling Mob	92	Frank S. Platt Co., New Haven, Ct.
3361	Howling Mob Sweet	94	Cadwell & Jones, Hartford, Ct.
3371	Long Island Beauty	*62.5	David L. Clark & Son, Milford, Ct.
3357	Malcom Sweet	95	David L. Clark & Son, Milford, Ct.
3465	Stowell's Evergreen	*62	Comstock Ferre & Co., Wethersfield, Ct.
3356	Whipple's	98.5	Frank S. Platt Co., New Haven, Ct.
3355	Whipple's Sweet	99.5	David L. Clark & Son, Milford, Ct.
	Cucumber		
3320	Early Fortune	98	F. C. Stokes Seed Co., Philadelphia, Pa.
3321	Davis Perfect	*60.5	Jos. Harris Seed Co., Coldwater, N. Y.

*Below standard.

TABLE I. GERMINATION TESTS OF BULK VEGETABLE SEED, 1927.—*Continued.*

Test Number	Variety of Seed	Per cent of Germination	Grower
	Cucumber (*Continued*)		
3322	Davis Perfect	*55	Comstock Ferre Co., Wethersfield, Ct.
3323	Davis Perfect	*83	Jos. Harris Seed Co., Coldwater, N. Y.
3319	White Spine	85.5	W. F. Cobb & Co., Franklin, Mass.
	Egg Plant		
3324	Black Beauty	88.5	Jos. Harris Seed Co., Coldwater, N.Y.
	Lettuce		
3446	Big Boston	99.5	Frank S. Platt Co., New Haven, Ct.
3445	Black Seeded Tennis Ball	*39.5	Frank S. Platt Co., New Haven, Ct.
3435	Black Seeded Tennis Ball	*88.5	F. H. Woodruff & Sons, Milford, Ct.
3448	Early May King	98	F. H. Woodruff & Sons, Milford, Ct.
3442	Eberle Supreme	93.5	F. W. Eberle Seed Co., Albany, N. Y.
3450	Market Gardeners' Private Stock	*82.5	J. W. Simon & Son, Philadelphia, Pa.
3434	May King	*89.5	F. W. Eberle Seed Co., Albany, N. Y.
3467	May King	*82	Jos. Harris Seed Co., Coldwater, N. Y.
3441	May King	*81	F. W. Eberle Seed Co., Albany, N. Y.
3428	New York	92.5	Olds & Whipple, Hartford, Ct.
3429	New York	96	Comstock Ferre & Co., Wethersfield, Ct.
3430	New York	93.5	F. W. Eberle Seed Co., Albany, N. Y.
3431	New York	96.5	Comstock Ferre & Co., Wethersfield, Ct.
3432	N. Y. or Iceberg	93.5	F. W. Eberle Seed Co., Albany, N. Y.
3439	Salamander	98	F. W. Eberle Seed Co., Albany, N. Y.
3443	Salamander	97	Alex. Forbes Seed Co., Newark, N. J.
3444	Salamander	98	Comstock Ferre & Co., Wethersfield, Ct.
3449	Simon's Cabbage Head	97	J. W. Simon & Son, Philadelphia, Pa.
3438	Special Stock	92	F. H. Woodruff & Sons, Milford, Ct.
3433	Supreme	90	F. W. Eberle Seed Co., Albany, N. Y.
3440	Unrivalled	98.5	F. W. Eberle Seed Co., Albany, N. Y.
3447	Unrivalled	98	Comstock Ferre & Co., Wethersfield, Ct.
3436	Wonderful	90	Jos. Harris Seed Co., Coldwater, N. Y.
	Muskmelon		
3419	Abbot's Pearl Pink Meat	*57.5	Ebbert Seed Co., Rocky Ford, Colo.
3417	Bender's Surprise	97.5	Cadwell & Jones, Hartford, Ct.
3424	Bender's Surprise	94	Frances C. Stokes & Co., Philadelphia, Pa.
3427	Bussee Gem	*69	W. Atlee Burpee Co., Philadelphia, Pa.
3459	Cal. Cream	*70	Henry Field Seed Co., Shenandoah, Ia.
3425	Hearts of Gold	*80.5	Frances C. Stokes & Co., Philadelphia, Pa.
3420	Knight	97	Frances C. Stokes & Co., Philadelphia, Pa.
3426	Lake Champion	*83.5	J. W. Simon & Son, Philadelphia, Pa.
3458	Osage	*48.5	S. D. Woodruff & Sons, Orange, Ct.
3418	Ticonderoga	*70	Unknown
3423	Yorko	94.5	J. Breck Seed Co., Boston, Mass.

*Below standard.

TABLE I. GERMINATION TESTS OF BULK VEGETABLE SEED, 1927.—*Continued.*

Test Number	Variety of Seed	Per cent of Germination	Grower
	Onion		
3416	Danvers	92	Frances Stokes Seed Co., Philadelphia, Pa.
	Parsnip		
3391	Harris Model	*55	Jos. Harris Seed Co., Coldwater, N. Y.
3464	Harris Model	67	Jos. Harris Seed Co., Coldwater, N. Y.
3394	Hollow Crown	*47	Frank S. Platt Co., New Haven, Ct.
3393	Woodruff's Rival	65	S. D. Woodruff & Sons, Orange, Ct.
	Pea		
3456	World's Record	*80.5	Frank S. Platt Co., New Haven, Ct.
	Pepper		
3395	Bull Nose	*64.5	Frank S. Platt Co., New Haven, Ct.
3396	Golden Dawn	83	Jos. Harris Seed Co., Coldwater, N. Y.
3397	Simon's World Beater	71.5	J. W. Simon & Son, Philadelphia, Pa.
3398	Simon's Jersey Giant	78	J. W. Simon & Son, Philadelphia, Pa.
3399	World Beater	90	F. H. Woodruff & Sons, Milford, Ct.
	Radish		

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

ERRATUM SLIP — BULLETIN 293

Attention is called to Test Number 3427 (p. 182) which should read "Burrell's Gem."

This sample was **not** from stock purchased in 1927 and therefore should be disregarded.

TABLE I. GERMINATION TESTS OF BULK VEGETABLE SEED, 1927.—*Continued.*

Test Number	Variety of Seed	Per cent of Germination	Grower
	Cucumber (*Continued*)		
3322	Davis Perfect	*55	Comstock Ferre Co., Wethersfield, Ct.
3323	Davis Perfect	*83	Jos. Harris Seed Co., Coldwater, N. Y.
3319	White Spine	85.5	W. F. Cobb & Co., Franklin, Mass.
	Egg Plant		
3324	Black Beauty	88.5	Jos. Harris Seed Co., Coldwater, N.Y.
	Lettuce		
3446	Big Boston	99.5	Frank S. Platt Co., New Haven, Ct.
3445	Black Seeded Tennis Ball	*39.5	Frank S. Platt Co., New Haven, Ct.
3435	Black Seeded Tennis Ball	*88.5	F. H. Woodruff & Sons, Milford, Ct.
3448	Early May King	98	F. H. Woodruff & Sons, Milford, Ct.
3442	Eberle Supreme	93.5	F. W. Eberle Seed Co., Albany, N. Y.
3450	Market Gardeners' Private Stock	*82.5	J. W. Simon & Son, Philadelphia, Pa.
3434	May King	*89.5	F. W. Eberle Seed Co., Albany, N. Y.
3467	May King	*82	Jos. Harris Seed Co., Coldwater, N. Y.
3441	May King	*81	F. W. Eberle Seed Co., Albany, N. Y.
3428	New York	92.5	Olds & Whipple, Hartford, Ct.

TABLE I. GERMINATION TESTS OF BULK VEGETABLE SEED, 1927.—*Continued.*

Test Number	Variety of Seed	Per cent of Germination	Grower
	Onion		
3416	Danvers	92	Frances Stokes Seed Co., Philadelphia, Pa.
	Parsnip		
3391	Harris Model	*55	Jos. Harris Seed Co., Coldwater, N. Y.
3464	Harris Model	67	Jos. Harris Seed Co., Coldwater, N. Y.
3394	Hollow Crown	*47	Frank S. Platt Co., New Haven, Ct.
3393	Woodruff's Rival	65	S. D. Woodruff & Sons, Orange, Ct.
	Pea		
3456	World's Record	*80.5	Frank S. Platt Co., New Haven, Ct.
	Pepper		
3395	Bull Nose	*64.5	Frank S. Platt Co., New Haven, Ct.
3396	Golden Dawn	83	Jos. Harris Seed Co., Coldwater, N. Y.
3397	Simon's World Beater	71.5	J. W. Simon & Son, Philadelphia, Pa.
3398	Simon's Jersey Giant	78	J. W. Simon & Son, Philadelphia, Pa.
3399	World Beater	90	F. H. Woodruff & Sons, Milford, Ct.
	Radish		
3413	Early Scarlet	93.5	E. B. Clark Seed Co., Milford, Ct.
3412	Early Scarlet Globe	93.5	Frank S. Platt Co., New Haven, Ct.
3414	Giant Crimson	85.5	Frances Stokes Co., Philadelphia, Pa.
3460	Scarlet Globe	*56	S. D. Woodruff & Sons, Orange, Ct.
3411	Scarlet Globe	*74	F. H. Woodruff & Sons, Milford, Ct.
	Salsify		
3457	Mammoth Sandwich Island	48.5	Cadwell & Jones, Hartford, Ct.
	Spinach		
3342	Bloomsdale Savoy	*50.5	E. B. Clark Seed Co., Milford, Ct.
3333	Giant Thick Leaf	86.5	E. B. Clark Seed Co., Milford, Ct.
3338	Hot Weather	*51	F. H. Woodruff & Sons, Milford, Ct.
3463	Juliana	*37	J. W. Simon & Co., Philadelphia, Pa.
3335	King of Denmark	69	Comstock Ferre Co., Wethersfield, Ct.
3462	King of Denmark	*46.5	E. B. Clark Seed Co., Milford, Ct.
3334	Large Viroflay	*37	Comstock Ferre Co., Wethersfield, Ct.
3330	Long Season	*49	F. W. Eberle Seed Co., Albany, N. Y.
3337	Long Standing	*55.5	W. F. Cobb & Co., Franklin, Mass.
3461	Princess Juliana	*60	Peter Henderson & Co., New York, N. Y.
3336	Princess Juliana	*57	Comstock Ferre Co., Wethersfield, Ct.
3340	Round Thick Leaf	*64.5	F. H. Woodruff & Sons, Milford, Ct.
3343	Viroflay	*58.5	S. D. Woodruff & Sons, Orange, Ct.
3339	Woodruff's Hot Weather	*56.5	F. H. Woodruff & Sons, Milford, Ct.
	Squash		
3400	Black Michigan	*88	Unknown
3401	Giant Summer Crookneck	*89.5	F. H. Woodruff & Sons, Milford, Ct.

*Below standard.

TABLE I. GERMINATION TESTS OF BULK VEGETABLE SEED, 1927.—*Concluded.*

Test Number	Variety of Seed	Per cent of Germination	Grower
	Tomato		
3375	Bonny Best	91.5	Vaughan's Seed Store, New York, N. Y.
3383	Canadian	92.5	Jos. Harris Seed Co., Coldwater, N. Y.
3378	Earliana	*81	Comstock Ferre Co., Wethersfield, Ct.
3379	Earliana	94.5	Jos. Harris Seed Co., Coldwater, N. Y.
3380	Earliana	96.5	Jos. Harris Seed Co., Coldwater, N. Y.
3381	Earliana	92.5	Vaughan's Seed Store, New York, N. Y.
3384	Earliana	94.5	Jos. Harris Seed Co., Coldwater, N. Y.
3382	Early Prolific	94.5	F. W. Eberle Seed Co., Albany, N. Y.
3387	Greater Baltimore	86.5	Comstock Ferre Co., Wethersfield, Ct.
3388	Greater Baltimore	93.5	F. H. Woodruff & Sons, Milford, Ct.
3376	John Baer	91.5	Vaughan's Seed Store, New York, N. Y.
3377	John Baer	89	Jos. Harris Seed Co., Coldwater, N. Y.
3389	Marglobe	96	Frances C. Stokes & Co., Philadelphia, Pa.
3386	Marvana	*62.5	Jos. Harris Seed Co., Coldwater, N. Y.
3373	Matchless	*80.5	Thos. Griswold & Co., So. Wethersfield, Ct.
3374	Matchless	87	Vaughan's Seed Store, New York, N. Y.
3385	New Dwarf Stone	96.5	Jos. Harris Seed Co., Coldwater, N. Y.
3390	Stone	87	Cadwell & Jones, Hartford, Ct.
	Turnip		
3344	Early White Milan	*78	Comstock Ferre Co., Wethersfield, Ct.
3345	Yellow Globe	*65	Comstock Ferre Co., Wethersfield, Ct.
	Watermelon		
3409	Kleckly Sweet	*39	Frances C. Stokes & Co., Philadelphia, Pa.

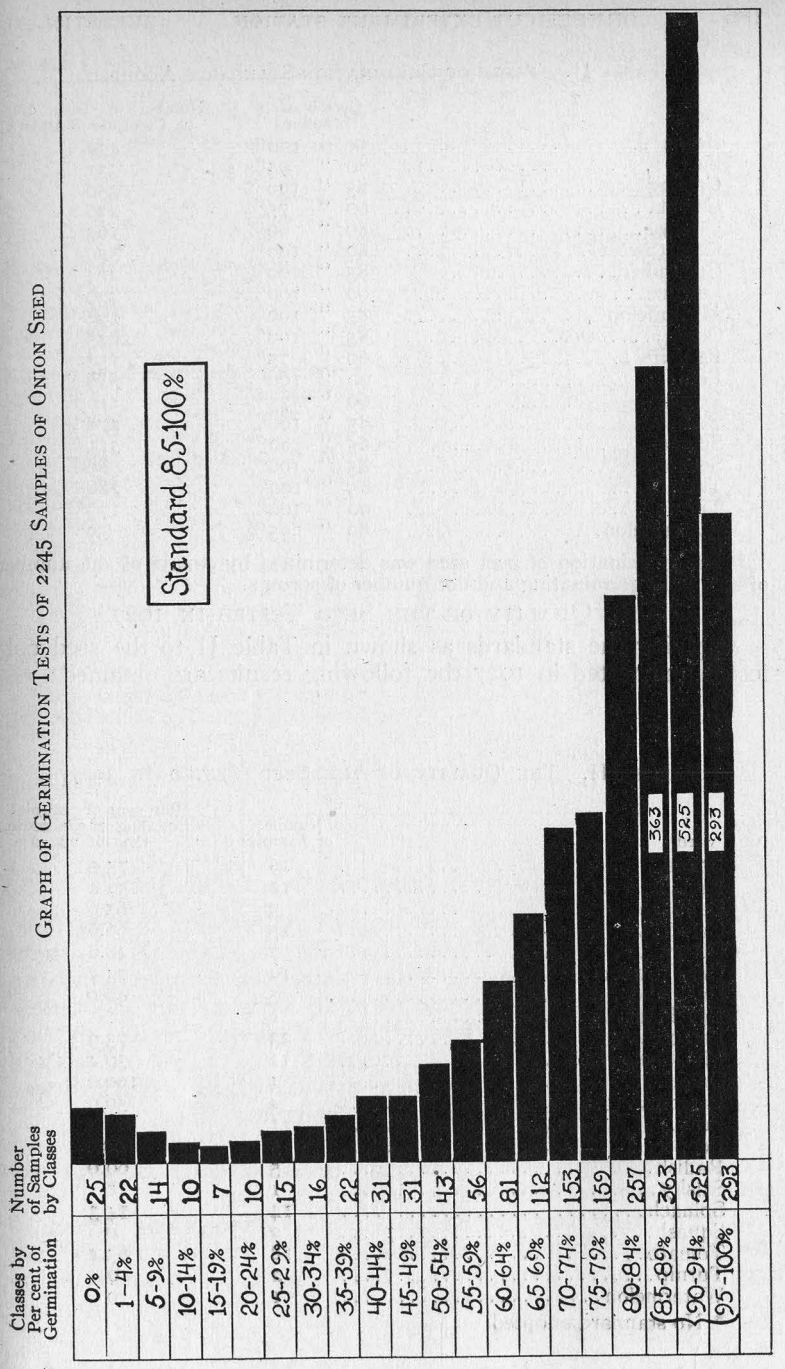
*Below standard.

GERMINATION STANDARDS FOR VEGETABLE SEED.

In the absence of official standards of germination for vegetable seeds we have adopted a table of standards (Table II). These standards were obtained by plotting a frequency curve of all the germination tests made of the several seeds in our laboratory and the published data of four other seed laboratories for the last twenty-three years (1905-1927 inclusive) and taking the classes included in the peak of the curve as a standard. No standard was adopted without data from at least 50 samples.

After collecting much additional data we found it necessary to change slightly a few of the standards adopted in Bulletin 283 published by this Station in January, 1927.

In view of the fact that the data used covered a long period of time and was taken from various parts of the country, we feel that the standards adopted are a fair measure of germination for good seed of the various kinds. The following graph of onion seed illustrates the method used:



GRAPH OF GERMINATION TESTS OF 2245 SAMPLES OF ONION SEED

TABLE II. TABLE OF GERMINATION STANDARDS ADOPTED.

Seed	Germination Standard	Number of Tests Used to Compute Standard
Beans	90 to 100%	439
*Beet	80 " 95%	331
Cabbage	85 " 100%	350
Carrot	60 " 75%	236
Celery	80 " 90%	163
Corn (Sweet)	90 " 100%	559
Cucumber	85 " 100%	224
Lettuce	90 " 100%	439
Muskmelon	85 " 100%	194
Onion	85 " 100%	2245
Parsnip	60 " 75%	154
Peas	90 " 100%	519
Pepper	60 " 75%	116
Radish	85 " 100%	478
Spinach	65 " 80%	311
Squash	85 " 100%	89
Tomato	85 " 100%	288
Turnip	90 " 100%	177
Watermelon	80 " 95%	59

* The germination of beet seed was determined by counts of the number of seed balls germinating and not number of sprouts.

THE QUALITY OF THE SEED TESTED IN 1927.

Applying the standards as shown in Table II to the seed collected and tested in 1927 the following results are obtained:

TABLE III. THE QUALITY OF THE SEED TESTED IN 1927.

Seed	Number of Samples	Per cent of Samples Equaling or Exceeding the Standard
Beans	16	75.0
Beet	12	59.4
Cabbage	9	65.6
Carrot	15	66.6
Celery	7	28.6
Corn (Sweet)	19	73.7
Cucumber	5	40.0
Egg Plant	1	*
Lettuce	23	73.9
Muskmelon	11	36.4
Onion	1	100.0
Parsnip	4	50.0
Peas	1	0
Pepper	5	100.0
Radish	5	60.0
Salsify	1	*
Spinach	14	14.3
Squash	2	0
Tomato	18	83.4
Turnip	2	0
Watermelon	1	0

* No standard adopted.

BULLETIN 294 FEBRUARY, 1928

Connecticut Agricultural Experiment Station
New Haven, Connecticut

TWENTY-SEVENTH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

1927

W. E. BRITTON, Ph.D.
State Entomologist

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to other applicants as far as the editions permit.

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Paul J. Anderson, Ph.D., *Pathologist in Charge.*
N. T. Nelson, Ph.D., *Assistant Physiologist.*
T. R. Swanpack, B.S., *Scientific Assistant.*

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AUTHORSHIP

For bibliographical purposes all material published in this Report (Bulletin 294), unless otherwise indicated, should be credited to W E. Britton.

ILLUSTRATIONS

The illustrations in this Report (Bulletin 294) are from the following sources: Figs. 38, 39, and 48, outline maps shaded by B. H. Walden; Figs. 40 to 47 are maps, charts, and one (Fig. 43) illustrating insects drawn by Dr. Philip Garman. Plates are all from photographs: XXI, XXII a, XXIII, and XXIV, by W. E. Britton; XXII b, by N. E. Guertin; XXV by M. P. Zappe; XXVII c, by P. Garman; XXXIII to XXXVI by R. C. Botsford; all others by B. H. Walden.

TWENTY-SEVENTH 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 transmit herewith my twenty-seventh annual report as State Entomologist of Connecticut. This report contains an account of each of the activities of the Department of Entomology of the Station, including the inspection and control operations prescribed by Statute, and the various lines of research in which the members of the Department staff have been engaged during the year of 1927.

Respectfully submitted,

W. E. Britton,

State and Station Entomologist.

SUMMARY OF INSPECTION AND OFFICE WORK

305 samples of insects received for identification.
208 nurseries inspected.
206 regular certificates granted.
206 duplicate certificates furnished to be filed in other states.
2 special raspberry certificates granted.
80 nursery dealers' permits issued.
213 shippers' permits issued to nurserymen in other states.
190 parcels of nursery stock inspected and certified.
230 bales of mountain laurel and other decorative material inspected and certified for shipment.
20,000 narcissus bulbs inspected and certified.
259 shipments of seed corn inspected and certified.
34 orchards and gardens examined.
31 shipments, containing 321 cases, 3,229,915 plants, imported nursery stock inspected.
22 shipments, or 70 per cent, found infested with insects or plant diseases.
803 apiaries, containing 8,133 colonies, inspected.
9 apiaries and 23 colonies found infested with European foul brood.
25 apiaries and 57 colonies found infested with American foul brood.
3,336 letters written on official work.
789 circular letters sent out.
385 post cards.
51 reports to Federal Horticultural Board.
2,146 bulletins, etc., mailed on request or to answer inquiries.
86 packages sent by mail or express.
62 lectures and addresses at meetings.

PUBLICATIONS OF THE ENTOMOLOGICAL DEPARTMENT, 1927

By W. E. Britton:

Twenty-sixth Report of the State Entomologist of Connecticut (Bulletin 285), 124 pages, 11 figures, 16 plates; 9,600 copies distributed in April, 1927.
The Asiatic Beetle Quarantine, Bulletin of Immediate Information No. 55, 4 pages, 2 figures, November 10, 1926; 2,000 copies.
The Japanese Beetle Quarantine, Bulletin of Immediate Information No. 56, 4 pages, 1 figure, November 10, 1926; 2,000 copies.
Regulations Concerning the Transportation of Nursery Stock in the United States and Canada, Bulletin of Immediate Information No. 57, 32 pages, November 20, 1926; 1,775 copies.
The Japanese Beetle Quarantine, Bulletin of Immediate Information No. 58, 8 pages, May 16, 1927; 2,500 copies.
The European Corn Borer Quarantine, Bulletin of Immediate Information No. 59, 5 pages, 1 figure, June 1, 1927; 1,500 copies.
Twelfth Biennial Report of the Commissioners of the State Geological and Natural History Survey, Bulletin No. 38, 23 pages, 1 plate, April, 1927.
Mosquito Expugnatus Est, Homo Victor. Engineering News-Record, Vol. 97, page 922, Dec. 3, 1926.
Book Review: Blatchley's Heteroptera of Eastern North America. Entomological News, Vol. xxxviii, page 90, March, 1927.
Organization of a Co-operative Campaign Against the Asiatic Beetle. Journal Economic Entomology, Vol. 20, page 359, April, 1927.
The Japanese Beetle in Connecticut. Proceedings 36th Annual Meeting Connecticut Pomological Society, page 45, April, 1927.
Report of Committee on Injurious Insects. Proceedings 36th Annual Meeting Connecticut Pomological Society, page 40, April, 1927.

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

Inspection of Nurseries in 1926, 13 pages (reprinted from the Report), 300 copies, April, 1927.

By W. E. Britton and P. J. Anderson:

Tobacco Insects in 1926, Tobacco Station Bulletin, 8, page 52T, 3 pages, April, 1927.

By Philip Garman:

The Problem of Curculio Control in Connecticut Apple Orchards. Journal Economic Entomology, Vol. 20, page 196, February, 1927.
The Oriental Peach Moth in Connecticut and Results of Control Work in 1926. Proceedings 36th Annual Meeting Connecticut Pomological Society, page 46, April, 1927.
Feeding Habits Among Insects and Their Relation to Control Measures. American Produce Grower, Vol. II, No. 4, pages 3 and 26, April, 1927.
The Odonata or Dragonflies of Connecticut, Bulletin No. 39, State Geological and Natural History Survey, 331 pages, 67 figures, 22 plates; 3,000 copies, July, 1927.

By R. B. Friend:

The Birch Leaf Skeletonizer, *Bucculatrix canadensisella* Chambers (Bulletin 288), 94 pages, 29 figures, 2 plates; 2,500 copies, June, 1927.

The Spruce Gall Aphid (*Adelges abietis* Linn.) and Its Control, 6 pages, 4 plates (reprinted from the Report); 1,000 copies, April, 1927.
The Asiatic Beetle, *Anomala orientalis* Waterh. Journal Economic Entomology, Vol. 20, page 362, April, 1927.

By J. Peter Johnson:

Soil Treatment and Scouting for the Control of the Asiatic Beetle. Journal Economic Entomology, Vol. 20, page 373, April, 1927.

By M. P. Zappe:

Spraying Practices. Proceedings 36th Annual Meeting Connecticut Pomological Society, page 23, April, 1927.

By R. C. Botsford:

Results Obtained in Anti-Mosquito Work in Connecticut in 1926. Proceedings 14th Annual Meeting of the New Jersey Mosquito Extermination Association, page 115, 4 pages, June, 1927.

INSECT PEST ACCOUNT

Report of Receipts and Expenditures of the State Entomologist

From July 1, 1926 to June 30, 1927

Receipts

Insect Pest Appropriation, biennial period ending June 30, 1927	$35,000.00	
Additions, miscellaneous receipts*	50.68	
Deficiency appropriation, Board of Control and General Assembly of 1927	13,500.00	
	$48,550.68	
Expended to July 1, 1926	22,108.11	
Balance available, July 1, 1926		$26,442.57

Disbursements

Salaries	$15,570.31
Labor	2,967.96
Stationery and office supplies	101.62
Scientific supplies (chemicals)	34.79
" " (other laboratory supplies)	32.21
" " (photographic)	43.58
Feeding stuffs	.55
Insecticides, etc.	2,586.60
Lumber and small hardware	9.48
Fuel oil	459.53
Miscellaneous supplies	175.86
Automobile oil	38.38
Telephone and telegraph	69.36
Postage	96.95

Travel (outlying investigations)	715.72	
" (meetings, conferences, etc.)	259.95	
" (gasoline for automobiles)	427.25	
Freight, express and parcel post	149.00	
Publications (zinc cut)	2.50	
Coal	5.10	
Electricity	4.00	
Water	34.60	
Furniture and fixtures (new)	112.85	
" " " (repairs)	3.47	
Library (books and periodicals)	45.21	
Scientific equipment (new)	143.06	
" " (repairs)	3.50	
Tools, machinery and appliances (new)	960.98	
" " " " (repairs)	41.65	
Automobiles (repairs)	475.86	
New buildings and structures	9.91	
Buildings (repairs and alterations)	16.04	
Rent of land and building	416.63	
Insurance (automobile)	225.41	
Miscellaneous contingent expenses	202.70	
Total disbursements		$26,442.57

* Use of automobiles at 6 cents per mile	$42.48
Sale of honey	8.20
	$50.68

DEPARTMENT STAFF AND WORK

W. E. Britton, Ph. D., *State and Station Entomologist.*

B. H. Walden, B.Agr., *Photographic and General Work*
M. P. Zappe, B.S., *Inspection and General Work*
Philip Garman, Ph.D., *Research Work*
Roger B. Friend, Ph.D., *Research Work*
} *Assistant Entomologists.*

J. Peter Johnson, B.S., *Deputy in Charge of Asiatic and Japanese Beetle Quarantines.*
John T. Ashworth, *Deputy in Charge of Gipsy Moth Work.*
James A. McEvoy, *Assistant in Gipsy Moth Work.*
Robert C. Botsford, *Deputy in Charge of Mosquito Work.*
Miss Grace A. Foote, B.A., *Secretary.*

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

Mr. Walden has continued to serve as chief photographer, has had charge of exhibits for the department, has been in charge of the office during the absence of the Entomologist, and has assisted in scoring fruit and in the general work of the department. He has also continued his researches on the imported currant worm, *Pteronidea ribesi* Scop.

Mr. Zappe has continued in charge of the inspection of nursery stock, and of the clean-up work around infestations of the European corn borer, in co-operation with the Federal Bureau of Entomology. He has collaborated with Dr. Garman in the study of the plum curculio in apple orchards, and with Mr. E. M. Stoddard of the Botany Department, in dusting and spraying experiments in apple orchards.

Dr. Garman has continued his studies on the life history and control of the Oriental peach moth, *Laspeyresia molesta* Busck. In co-operation with Mr. Zappe, he has also continued the investigations of the plum curculio, *Conotrachelus nenuphar* Hbst., in apple orchards begun in 1923. Dr. Garman has kept in touch with the European red mite situation and with the chemistry of insecticides. He has also given much of his time to revising the manuscript and reading the proof of his paper on *The Odonata or Dragonflies of Connecticut,* which has been published during the year as Bulletin No. 39 of the State Geological and Natural History Survey.

Dr. Friend has completed graduate work in Yale University and received the degree of doctor of philosophy in June. His thesis was "The Biology of the Birch Leaf Skeletonizer, *Bucculatrix canadensisella* Chambers," and was published during the summer as Bulletin 288 of this Station. Dr. Friend has also been in charge of the investigations on the life history and habits of the Asiatic beetle, *Anomala orientalis* Waterhouse, which are now nearly complete, and the results are being co-ordinated and tabulated for publication. He has also given some time to a study of the methods of control of certain insect pests of vegetable crops, and to the life history of the birch leaf miner, *Fenusa pumila* Klug.

Mr. John T. Ashworth has continued to serve as deputy in charge of gipsy moth work with headquarters at Danielson. He has been assisted by Mr. James A. McEvoy, and, as in former years, the work has been conducted with vigor and efficiency in co-operation with the Federal Bureau of Entomology.

Mr. Robert C. Botsford has continued to serve as deputy in charge of mosquito elimination work and has supervised important new ditching projects in Westport and Westbrook besides maintaining the ditches in the other areas accepted for State maintenance.

Mr. J. Peter Johnson has been in charge of the quarantine and soil treatment work against the Asiatic beetle, and of the Federal and State quarantines against the Japanese beetle. Mr. Johnson is an agent of the Federal Bureau of Entomology, and from June 15 to December 31, maintained an office in Stamford, with a force of men sufficient to make the necessary inspections, issue certificates, and patrol all the principal highways leading northward and eastward out of the quarantined area.

Mr. B. W. McFarland has been employed throughout the season to assist in the Asiatic beetle work, and Mr. Charles R. Biecher assisted in the insectary from June 1 until September 1.

Mr. J. Leslie Rogers was employed from June 12 to September 20, when he returned to college. He and Messrs. J. F. Townsend, A. P. Harger, and H B. Bender assisted Mr. Zappe in nursery inspection between July 1 and October 1. Mr. Townsend worked scouting for the Asiatic beetle and also on the corn borer clean-up operations.

Messrs. A. W. Yates, Hartford, and H. W. Coley, Westport, have served as apiary inspectors as in former seasons, on a *per diem* basis.

Miss Grace A. Foote has served as secretary throughout the year. During the vacation period, Miss Helen N. Fox was employed to do the necessary work of the office.

The Entomologist here desires to express his appreciation of the earnest, faithful, and efficient efforts of all members of the department staff. Without such service the work could not have been done.

The Entomologist has continued to direct the work of the department and has given his personal attention to the office correspondence. During the year he has been made responsible for the conduct of the mosquito elimination work, with Mr. Botsford in immediate charge. He has also continued to serve as Associate Editor of the *Journal of Economic Entomology,* and as Insect Pest Reporter in Connecticut for the Insect Pest Survey of the Bureau of Entomology. He is also Chairman of the Tree Protection Examining Board, and Superintendent of the Geological and Natural History Survey of Connecticut and has devoted some of his time to these matters.

The chief activities of the department are described in some detail in the following pages of this Report.

ENTOMOLOGICAL FEATURES OF 1927

The season of 1927 was a peculiar one in many respects. Spring and early summer were cool, with rather light rainfall. A few hot days came in July, and the precipitation was abundant in July, August, and September. In general, aphids were unusually abundant on all kinds of trees and plants—more abundant than in any season within the memory of the Entomologist.

Fruit Insects

Though not particularly prevalent in orchards in May and June, the green apple aphid, *Aphis pomi* De G., later became so very abundant that it attacked and injured the fruit. Specimens of this aphid were received from Woodmont, Windsor, and Litchfield, and it was found in 36 nurseries at the time of the annual inspection. The rosy apple aphid, *Anuraphis roseus* Baker, was rather

scarce in the orchards visited until about July 1, when it was found to have increased rapidly. This insect was sent to the Station from Westport and West Haven. The observations made in Connecticut orchards by Messrs. Zappe, Stoddard, and Dr. Garman, indicate that lady beetles and Syrphid flies were present in nearly all cases and were expected to control the aphids, but for some unknown reason failed to hold them in check.

The woolly apple aphid, *Eriosoma lanigerum* Hausm., was present as usual in orchards and nurseries, and was sent to the Station from Hamden, June 15, from New Haven, June 16 and 20, and was observed in 43 nurseries.

Work of the currant aphid, *Myzus ribis* Linn., was received from West Cornwall, June 22, from Litchfield, July 7, and was observed in five nurseries. The cherry aphid, *Myzus cerasi* Fabr., was sent in from Wallingford, July 12, and was likewise observed in five nurseries. The mealy plum aphid, *Hyalopterus arundinis* Fabr., was prevalent on European plum but did not infest the Japanese plum.

Leafhoppers were extremely abundant on apple during the season and undoubtedly caused considerable injury both in orchards and nurseries. Though several species are probably involved, generally the most abundant kind in the orchard is the rose leafhopper, *Empoa rosae* Linn., and the predominant one in nurseries is the apple leafhopper, *Empoasca mali* Le B. Though not specifically identified in all cases, leafhoppers seemed to be more abundant than usual and caused the mottling of leaves in many apple orchards. They were also present on apple stock in 60 nurseries.

The pear psylla, *Psylla pyricola* Först, was also abundant on pear trees. It was received from New Haven, North Haven and Litchfield, and observed in 24 nurseries. The first adult was observed by Mr. Stoddard on March 16. A dormant spray of lime-sulphur (1-9) with nicotine in spring is probably the best treatment to kill the eggs. Summer sprays of nicotine and soap may be necessary to hold the insect in check and to clean up the fruit.

The San José scale, *Aspidiotus perniciosus* Comst., was not particularly prominent during the season. It was received only once at the Station (from Danbury) and was found in 16 nurseries.

The European red mite, *Paratetranychus pilosus* C. & F., seems to be on the increase in Tolland County and probably throughout the State. Specimens were received from Nichols and Glastonbury, and the pest was observed in many orchards and in 11 nurseries. Spraying the dormant trees with a miscible oil is the best treatment to kill the eggs.

The pear leaf blister mite, *Eriophyes pyri* Pagnst., was rather prevalent, having been received at the Station twice from New Haven, and found in 39 nurseries.

The apple and thorn skeletonizer, *Hemerophila pariana* Clerck, was seemingly more abundant than in 1925 and 1926. During the last two months the adults have been rather common, resting on window screens around New Haven. This insect was found in 22 nurseries. It is easily controlled by spraying with lead arsenate.

The fall cankerworm, *Alsophila pometaria* Harris, which is always locally abundant, was present in moderate numbers in New Haven and Hamden, and was received from Westport, Colchester, and East Lyme. A fairly large area at "Point O' Woods" in East Lyme was almost completely defoliated, including fruit trees and the native growth in woodland and along the roadside. The caterpillars died in large numbers from a wilt disease, and a large native ground beetle, *Calosoma scrutator* Fabr., fed upon the cankerworms.

The Eastern tent caterpillar, *Malacosoma americana* Fabr., was very abundant over the greater portion of the State. Specimens were received from West Haven, Waterbury, and Middletown. Many caterpillars when nearly full grown carried the eggs of Tachinid parasites, and thousands died from a wilt disease. It is almost certain that this insect will continue to decrease during the next few years.

The fall webworm, *Hyphantria cunea* Drury, was present in usual abundance throughout the State, and the nests could be seen on all kinds of fruit, shade and woodland trees, in late summer.

The codling moth, *Carpocapsa pomonella* Linn., was present throughout the State as usual, and was sent in from Danbury. The plum curculio, *Conotrachelus nenuphar* Hbst., was perhaps rather more troublesome than usual, and specimens were received showing injury to peach from South Britain, and to apple from Danbury and West Haven. Both these insects are best controlled by frequent applications of lead arsenate. Other leaf feeders on apple received from correspondents are: the white-marked tussock moth, *Hemerocampa leucostigma* S. & A., from Shelton, and on raspberry from Bristol; the red-banded leaf roller, *Eulia velutinana* Walker, from Plantsville; the apple bucculatrix, *Bucculatrix pomofoliella* Clem., from Shelton; the yellow-necked caterpillar, *Datana ministra* Drury, from Plantsville and Old Lyme; the red-humped caterpillar, *Schizura concinna* S. & A., from Hamden; the green fruit worm, *Xylina antennata* Walker, from New Haven; the bud moth, *Tmetocera ocellana* Schiff., from Danbury, and the snow-white linden moth, *Ennomos subsignarius* Hubn., from Glastonbury.

The Oriental peach moth, *Laspeyresia molesta* Busck, is now distributed throughout the State, and there seems to have been a general increase in Fairfield, New Haven, and Hartford Counties. Larvae in quince were received from Middletown in October. There seems to be no satisfactory control for this insect.

The pear midge, *Contarinia pyrivora* Riley, has been prevalent in certain localities. We have observed it in New Haven, and specimens were received from Norwalk and Rockville in June. The pear slug or sawfly, *Eriocampoides limacina* Retz., has been very abundant on pear and cherry in orchards, and was found in 24 nurseries.

The apple maggot, *Rhagoletis pomonella* Walsh, has been rather more abundant than usual, especially in New Haven and Tolland Counties, and was not wholly controlled by careful spraying.

The European fruit scale, *Lecanium corni* Bouché, was received from Wethersfield in June on Japanese plum. The raspberry sawfly, *Monophadnoides rubi* Harris, was very abundant locally, and small plantations in Hamden and West Haven were entirely defoliated in June.

There has been no prominent increase in the spread of the gipsy moth, *Porthetria dispar* Linn., though a small infestation was discovered in Woodbridge and another in Oxford. The towns of Goshen and Litchfield have been removed from Federal and State quarantine. No noticeable defoliation has occurred in Connecticut, though more than 130,000 acres of woodland in Massachusetts, and about 5,000 acres each in New Hampshire and Maine were stripped by the caterpillars in 1927.

The Japanese beetle, *Popillia japonica* Newm., which was discovered in Connecticut at Stamford, in September, 1926, has now reached Bridgeport, where several hundred beetles, well distributed over the city, were found by Federal scouts.

Vegetable Insects

I am indebted to Prof. A. E. Wilkinson for much of the data regarding vegetable insects used in the following pages:

Cutworms were more than usually troublesome all through the State on a variety of crops, causing damage estimated to be from 5 to 25 per cent in various localities. There are several different species of cutworms, all being the larvae of noctuid moths and varying somewhat in their habits. We have not had material for identification so cannot be certain of the species responsible for the injury. In one instance, however, in a greenhouse in Danbury, April 7, carnations had from two to five cutworms per plant, and we are safe in ascribing this damage to the variegated cutworm, *Lycophotia margaritosa saucia* Hbn., which has the habit of climbing, and eating holes in the buds, often causing much damage to plants under glass. Other kinds of cutworms are present in the open field, and we have records of injury as follows: to peas, Thomaston, May 6; to cabbage and early cauliflower, Stratford, May 3, Thomaston, May 6; Lebanon, Black Hall, Groton, and South Windsor, May 11; Southington and Farmington, May 13;

Hampton, Danielson, Brooklyn, Canterbury, Wauregan, Pomfret Center, May 17; Putnam, Woodstock, East Woodstock, May 18; to asparagus, Norwich, May 12, and Southington, May 13; to peppers, Plainville, May 13; to beets and tomatoes, Woodstock and Putnam, May 18. At a meeting at Hartford on May 12, twelve men asked for cutworm remedies; they were from Burnside, Wapping, East Hartford, West Avon, Rocky Hill, Wethersfield, and Windsor. Cutworms were present in all house gardens at Storrs, June 2. On May 20, specimens were received from Mystic of the larvae of *Feltia venerabilis* Walker, another of the climbing cutworms which does not cut off the stem. These larvae were feeding upon various vegetable plants. In such a case, spraying with lead arsenate is the remedy. For those kinds that cut off the stems, it is best to distribute some poisoned bait around the field several days before the plants are set, or before the seedlings reach the size to be injured. A formula for this bait is as follows:

Wheat bran	5 lbs.
White arsenic or Paris green	4 oz.
Cheap molasses	1 pint
Orange or lemon	1 fruit
Water	7 pints

Cut the fruit into small pieces and mix all together to form a rather dry mash, and scatter around the field. Mr. Peckham wrote that cutworms bothered him so little that he never reset a plot of any transplanted crop on account of them.

The Colorado potato beetle, *Leptinotarsa decemlineata* Say, seems to have been very abundant in some localities and very scarce in others. Severe injury was reported in four fields at Westport, July 6, two fields at Brookfield, and one field at East Danbury, July 7. Certain fields in Hamden were quite free from attack. Of course spraying or dusting with lead arsenate is the remedy.

The striped cucumber beetle, *Diabrotica vittata* Fabr., was troublesome on cucumbers, squashes and melons at the Station farm at Mount Carmel. They were reported as injuring melons and early squash at Cannondale, July 7, where from two to four leaves had been injured in every hill; also early squash at Westport and Ridgefield, and cucumbers at Westport, July 6 and 7. They may be controlled by a spray of lead arsenate and Bordeaux mixture, by a dust of calcium arsenate and lime or by one of the fluosilicates.

Asparagus beetles, *Crioceris asparagi* Linn., and *C. 12-punctata* Linn., were as abundant as usual. They were reported as few from Norwich and Pawcatuck, May 11, and Southington, May 13. They were reported as abundant and causing considerable damage at Westport, July 6, and at Ridgefield, July 7. In my own garden, I was able to kill the grubs readily by a spray of Black Leaf 40 (2 teaspoons in a gallon of water).

The green cabbage worm, *Pontia rapae* Linn., was present in the usual abundance and was reported from Westport, Ridgefield, and East Danbury on July 7. It was also plentiful in Hamden.

Reports were few regarding injury by the cabbage maggot, *Hylemyia brassicae* Bouché. An acre field of cabbage and cauliflower at Westport, July 6, showed about 60 per cent injury, and some injury to cabbage and cauliflower was reported from Cheshire as early as May 31. There were 150,000 plants around New Haven, with a loss of 60 per cent on account of the cabbage maggot.

The zebra caterpillar, *Mamestra picta* Harris, was found feeding upon cabbage leaves at Westport, July 6.

The garden flea hopper, *Sminthurus hortensis* Fitch, caused considerable injury to young seedlings. On April 21, the hoppers injured tobacco plants in frames at Hockanum, and May 4, vegetable plants in frames at Westport. They also attacked spinach, lettuce, beans, and cucurbits at the Station farm at Mount Carmel. They were easily controlled by dusting with lead arsenate.

The gray field slug, *Limax agrestis* Linn., was received from Middletown, July 7.

The seed corn maggot, *Hylemyia cilicrura* Rond., was received from Franklin July 21, where it caused injury to potato. Many fields of early sweet corn had to be planted over, and in some cases, planted over twice on account of this insect. The margined blister beetle, *Epicauta marginata* Fabr., feeding on potato in New Haven, was sent to the Station July 26.

The carrot rust fly, *Psila rosae* Fabr., is present in Connecticut. Parsnips injured by this insect were received from Winsted, March 25, and others were dug from my own garden at nearly the same date. No good means of control can be recommended. The squash borer, *Melittia satyriniformis* Hubn., was present as usual and caused considerable injury. Specimens were received from West Haven, August 8. At the Station farm at Mount Carmel, Dr. Friend was able to obtain a good crop of Hubbard squashes by the method of cutting out the borers and covering the vines so that they could make new roots.

The stalk-borer, *Papaipema nitela* Guen., was very common, and though it may burrow in any herbaceous stem, nearly all specimens sent to the Station were in corn. The records follow: Trumbull, July 6; Hamden, July 21; Higganum, July 23; South Britain, July 25; Salem, July 28; Clintonville, August 9; Pomfret, August 19. Little can be done for the control of this pest other than to destroy each borer when discovered.

The corn ear worm, *Heliothis obsoleta* Fabr., was reported only a few times and evidently was less abundant than in some seasons.

One grower reported finding it on his corn much earlier in the season than he had ever seen it before.

The onion maggot, *Phorbia ceparum* Meigen, was reported as causing 20 per cent injury to sets in Westport, July 6. On the same date a field of sets in Westport showed that the onion thrips, *Thrips tabaci* Lindeman, had just begun to cause injury.

Aphids on carrots and parsnips were reported from Westport on July 6, and on carrots and beets from Brookfield and East Danbury on July 7. As specimens were not received or identified, the specific nature or names of the aphids cannot be given. Mr. Peckham reports a total loss of two acres of young carrots from aphid attack and the yield from three acres of parsnips reduced 50 per cent.

The potato aphid, *Macrosiphum solanifolii* Ashm., was sufficiently abundant to curl the leaves of potato at Westport July 6 and probably the same species on tomato was observed at Cannondale July 7. Reports were received of this aphid on potato at Milford, July 19, and later from Middletown, Canterbury, Hebron, Hartford, East Hartford, Wethersfield, and Norwich.

The spinach aphid, *Myzus persicae* Sulz., was also abundant on nearly all kinds of truck crops. Aphids were reported from Norwich as attacking ruta bagas but the plants were not seriously injured by them.

These aphids can all be controlled artificially by nicotine applied either as a spray or as a dust. Treatment at the right time may be profitable on certain crops, but in other cases the treatment may cost more than the value of the crop, or the plants may have been so seriously injured before treatment that they do not recover. Consequently treatment cannot be recommended in all cases, but depends upon conditions, and the final decision whether or not it will pay to spray or dust must rest with the grower.

The pea aphid, *Illinoia pisi* Kalt., caused much injury to peas in various portions of the State. Damage varying from 15 to 20 per cent was reported by Mr. Wilkinson from Westport, Ridgefield, and East Danbury, on July 7.

Shade and Forest Tree Insects

The fall canker worm, *Alsophila pometaria* Harris, has already been mentioned under "Fruit Insects" as being unusually abundant at "Point O' Woods," East Lyme, where the native woodland growth was almost completely stripped of leaves over a small area.

The fall webworm, *Hyphantria cunea* Drury, has also been mentioned under "Fruit Insects" as occurring in usual numbers throughout the State. Specimens were received from Lyme, August 13, and from New Haven, August 18. It was also observed in many portions of the State but particularly in Granby and Putnam.

The elm leaf beetle, *Galerucella xanthomelaena* Schrank, was not so prevalent as usual, though some feeding by the larvae was noticed on small trees in New Haven. Specimens were received from New Haven, July 18, and from Norwich, August 2. As there was abundant moisture during the time of pupation in both 1926 and 1927, there was ample opportunity for the white fungus to attack the pupae, and probably the elm leaf beetle will not be prominent in 1928.

The European elm case bearer, *Coleophora limosipennella* Dup., was received from Norwich, August 2. The small caterpillars make rectangular mines in the leaf, and these areas turn brown, giving the leaves a spotted appearance. Spraying with lead arsenate is probably the best remedy.

The birch skeletonizer, *Bucculatrix canadensisella* Chamb., was less abundant in 1927 than in 1926, and is apparently on the wane, though the larvae were present on birch trees around New Haven. No trees were observed which had turned brown from its attack.

The imported birch leaf miner, *Fenusa pumila* Klug, was present throughout the State and was observed in New Haven, Hamden, Southbury, Woodbury, Sherman and Granby. Specimens were received from New Haven, August 17.

The leopard moth, *Zeuzera pyrina* Linn., is frequently observed in shade trees, though not nearly as destructive as it was fifteen years ago. Specimens were received from East Haven, November 14.

The white-marked tussock moth, *Hemerocampa leucostigma* S. & A., was present as usual throughout the State, though not especially abundant. Specimens were received from New Haven, August 1.

The white pine weevil, *Pissodes strobi* Peck, was present in usual numbers throughout the State and killed the leaders of many young white pine trees growing in sunny places. Trees growing under shade are less apt to be injured. Specimens were received from Stafford Springs, September 10.

Pine sawflies were observed in a number of cases. Specimens of the imported pine sawfly, *Diprion simile* Hartig, were received from New Haven, September 15, on Scotch pine. Another species, *Neodiprion pinetum* Norton, was received from Mount Carmel, October 8. Spraying with lead arsenate is the remedy.

Specimens of the pitch-mass borer, *Parharmonia pini* Kellicott, were received from Farmington, September 30. It seldom causes serious injury, and no practical method of control has been discovered.

The European pine shoot moth, *Rhyacionia buoliana* Schiff., is apparently spreading in the State and is found chiefly on red pine.

What seemed to be this pest was received from Stafford Springs, September 27, and from Rainbow, November 23.

Another pine insect, *Tetralopha robustella* Zell., on red pine, was received from New Haven, September 29. The larvae are brown, striped lengthwise with darker brown, and they live in silken tubes in globular masses of frass. The masses are sometimes two inches or more in diameter. This insect is regarded as being somewhat rare, and can hardly be considered a pest.

The locust leaf miner, *Chalepus dorsalis* Thunb., was more abundant than usual, and black locust and rose acacia throughout the State had the leaves mined by the larvae. These leaves afterward turned brown as though scorched by a fire. This injury was more noticeable in Windham County than elsewhere.

The imported willow leaf beetle, *Plagiodera versicolora* Laich., was received from Greenwich, September 10. This insect has now spread throughout the State and willow leaves are skeletonized by the larvae. A spray of lead arsenate is the remedy.

The poplar and willow curculio, *Cryptorhynchus lapathi* Linn., was received from New Haven, June 7. The larvae were very abundant in some large "pussy willows" growing in the back yard. The trees were ruined.

Girdled pine twigs were received from Eastford, May 16. Apparently this was the work of the pales weevil, *Hylobius pales* Herbst.

The terrapin scale, *Lecanium nigrofasciatum* Perg., on the small twigs of silver maple, was received from Waterbury, October 26.

The tulip tree scale, *Toumeyella liriodendri* Gmel., is common on the lower branches of the tulip tree, sometimes killing the branches. Specimens were received from Hamden, July 26, and from Middlebury, October 26. The young are hatched in September and may easily be killed by a spray of lime-sulphur or a miscible oil applied as soon as the leaves drop.

The European lecanium, *Lecanium corni* Bouché, a species now common in the United States, infesting nearly all kinds of trees and shrubs, was received from Hazardville, June 21, on oak.

The pit-making oak scale, *Asterolecanium variolosum* Ratz., a species imported from Europe and usually found on golden oak, *Quercus robur,* in nurseries, or planted on private grounds, was received March 12 from Woodbridge, on the native chestnut oak.

The somewhat rare spruce bud scale, *Physokermes piceae* Schr., was received from Kensington, June 7.

The elm scale, *Gossyparia spuria* Modeer, continues to be prevalent on young trees, and is found in nurseries. Specimens were received from New Haven, June 27.

One of the oak gall scales, *Kermes* sp., was received from New Haven, July 25, and was found to be quite abundant on oaks in one nursery.

The pine leaf scale, *Chionaspis pinifoliae* Fitch, was received from Hartford, January 21, and from Norwalk, September 19.

The spruce gall aphid, *Adelges abietis* Linn., is very prevalent on Norway spruce trees in nurseries, ornamental and forest plantings. Specimens were received from New Haven, April 13; Southington, April 16; Winsted, June 4; Avon, July 2, and Naugatuck, July 6. Another species which may be called the blue spruce gall aphid, *Gillettea cooleyi* Gillette, makes large galls on the Colorado blue spruce. Specimens were received from Thompson, May 28. A variety of the latter, known as *Gillettea cooleyi* var. *coweni* Gillette, infests Douglas fir but does not form galls. Specimens were received from Middlebury, July 2.

The larch woolly aphid, *Adelges strobilobius* Kalt., was received from Danbury, July 6. The pine bark aphid, *Adelges pinicorticis* Fitch, was received from Derby, May 1, and Hamden, June 1. Both of these insects are woolly aphids and do not form galls, though closely related to the gall-forming species.

Aphids were exceedingly abundant on nearly all kinds of trees and shrubs. The beech woolly aphid, *Phyllaphis fagi* Linn., was received from Milford, June 17. In general, a nicotine spray is perhaps the best method of controlling aphids.

The spruce mite, *Paratetranychus ununguis* Jacobi, is the cause of much injury to spruce and other conifers, and seems to be increasing in prevalence. Specimens were received from Old Lyme, July 9. One of the best remedies is to spray thoroughly with linseed oil emulsion.

The maple leaf bladder gall, *Phyllocoptes quadripes* Shimer, is common on leaves of the silver maple, and specimens were received from Norwalk, May 23, Hamden, May 31, and Danbury, June 23. Spraying the dormant trees in early spring with lime-sulphur is a remedy.

Insects Attacking Ornamental Shrubs and Plants

Aphids were abundant on nearly all kinds of ornamental plants during the summer.

The juniper webworm, *Dichomeris marginellus* Fabr., caused injury to low junipers here and there, and specimens were received from Cheshire, April 19. Spraying heavily with lead arsenate is the remedy.

The abbot sphinx, *Sphecodina abbotii* Swain., was observed in several localities, the larvae feeding upon Virginia creeper. Specimens were received from Cos Cob, July 23, and from New Haven and Putnam, August 2. Hand picking is the usual method of control, but a spray of lead arsenate will protect the vines from being defoliated.

The stalk borer, *Papaipema nebris* Guen., which has been mentioned under vegetable insects, is also injurious to dahlia, lily, larkspur, hollyhock, and other herbaceous stems. Specimens in dahlia were received from South Kent, August 4.

The iris borer, *Macronoctua onusta* Grote, was present in about the usual numbers. The Entomologist found it in his own garden, and specimens were received from Old Saybrook, July 6. The remedy is to gather and burn the old leaves in late fall or early spring, to kill the eggs.

The black vine weevil, *Brachyrhinus* (*Otiorhynchus*) *sulcatus* Fabr., caused some injury to Taxus plants in a nursery at New Canaan where it was observed on August 10. The larvae feed upon the roots and on this date the adults were emerging and were feeding somewhat upon the leaves.

Serious injury to boxwood by the boxwood leaf miner, *Monarthropalpus buxi* Labou., was reported from Westport, on June 13. The adults were just emerging. One of the best remedies seems to be molasses and nicotine solution, using cheap molasses, one part in four parts water, and adding nicotine sulphate at the rate of one part in 500 parts of the spray material. The first application should be made at the time the first adult flies emerge, and the foliage should be kept covered for three weeks, spraying after each rain and directing the spray against the under side of the leaves. An application once each week is sufficient in fair weather.

The strawberry leaf roller, *Ancylis comptana* Frölich, was very abundant and caused injury to roses in many localities in the State. Unopened buds and tender leaves were eaten by the larvae during June and July. In some gardens around New Haven, a large proportion of the rose buds were injured by this insect. Probably spraying with lead arsenate would be effective.

The common red spider, *Tetranychus bimaculatus* Harvey, was quite prevalent on hardy phlox during the summer and caused the leaves to turn yellow and later many turned brown and dropped. Specimens were received from Old Saybrook, July 6, East Haven, July 7, and Plainfield, July 16. In severe cases it may be advisable to underspray with linseed oil emulsion.

The cyclamen mite, *Tarsonemus pallidus* Banks, continues to be a troublesome pest in garden and greenhouse. It attacks cyclamen, snapdragon, and chrysanthemum in the greenhouse and injures larkspur and garden balsam, *Impatiens Balsamina,* in the flower garden. Specimens on larkspur were received from East Haven on August 11. This pest may be controlled, though perhaps not wholly eradicated, by spraying twice a week until the plants blossom with nicotine solution, one part in 500 parts water, with a little soap added.

The rhododendron lace bug, *Leptobyrsa rhododendri* Horvath, was received from Norfolk, September 29. This insect is now

rather prevalent on rhododendron and mountain laurel, and sucks the sap from the under sides of the leaves. The remedy is to spray with nicotine solution and soap soon after the young nymphs appear.

Miscellaneous Insects

The Asiatic beetle, *Anomala orientalis* Waterhouse, still exists in the Westville section of New Haven, though the pest has been greatly reduced by the soil treatment. It has developed during the past season in certain lawns not injured heretofore. As the insect is rather abundant in Westchester County and on Long Island, New York, the idea of eradicating it from New Haven seems less important than formerly when the local area was the only known infestation in the United States. The eradication program, on account of its great cost, will probably be modified toward a plan of experiment and control.

A species of silver fish or bristle-tail, *Thermobia domestica* Pack., causes considerable damage in dwelling houses, particularly by eating the paste from book covers. Specimens were received from Greenwich, October 24.

The European hen flea, *Ceratophyllus gallinae* Schrank, caused considerable discomfort by biting human beings in Madison. This is the first record of the occurrence of this insect in Connecticut, though it has been recognized in other states and is probably widely distributed in this country. The matter is discussed more fully on another page of this report.

Convention of Entomological Workers

The fourth annual convention of entomologists working in Connecticut was held at the Station on Friday, November 4, 1927. The program was similar to those of preceding conventions and included subjects of vital interest to Connecticut entomologists. Those from outside the State who gave papers or addresses were: Dr. H. C. Huckett, Riverhead, N. Y., A. F. Burgess, Melrose Highlands, Mass., D. W. Jones, Arlington, Mass., J. L. King, Moorestown, N. J., and Professor C. C. Hamilton, New Brunswick, N. J. About 43 attended this meeting. Luncheon was obtained at the Yale Dining Hall. The program was as follows:

Program

A. M.

10:00 Greeting.
W. L. Slate, Director Experiment Station, New Haven.

10:15 Present Organization of Entomological Work in Connecticut.
Dr. W. E. Britton, New Haven.

10:30 A Contribution to Our Knowledge of Cucumber Beetles.
Dr. H. C. Huckett, Riverhead, N. Y.

10:45 Notes on the Life History of the Asiatic Beetle.
Dr. R. B. Friend, New Haven.
11:00 A General Survey of Gipsy Moth Conditions.
A. F. Burgess, Melrose Highlands, Mass.
11:40 Gipsy Moth Conditions in Connecticut.
John T. Ashworth, Danielson.
11:50 Spread of the European Corn Borer and the Establishment of Imported Parasites.
D. W. Jones, Arlington, Mass.
12:30 Present Status of the European Corn Borer in Connecticut.
M. P. Zappe, New Haven.

P. M.

12:45 Luncheon.
2:00 The Japanese Beetle and the Parasites Which Have Been Established in This Country.
J. L. King, Moorestown, N. J.
2:45 Japanese Beetle Conditions in Connecticut.
J. Peter Johnson, New Haven.
3:00 Some Notes on the Life History, Habits, and Methods of Control of *Aserica castanea*.
Prof. C. C. Hamilton, New Brunswick, N. J.
3:45 The Plum Curculio in Connecticut Apple Orchards.
Dr. Philip Garman, New Haven.
4:00 Mosquito Elimination Work of the Season in Connecticut.
R. C. Botsford, New Haven.

The following were present: John T. Ashworth, Danielson, Conn.; C. H. Batchelder, Arlington, Mass.; George R. Biecher, West Haven, Conn.; H. L. Blaisdell, Melrose Highlands, Mass.; R. C. Botsford, New Haven, Conn.; A. I. Bourne, Amherst, Mass.; W. E. Britton, New Haven, Conn.; A. F. Burgess, Melrose Highlands, Mass.; W. A. Collins, New Milford, Conn.; I. D. Dobroscky, Yonkers, N. Y.; W. O. Filley, New Haven, Conn.; R. B Friend, New Haven, Conn.; Philip Garman, New Haven, Conn.; C. C. Gillette, Storrs, Conn.; Harold C. Hallock, Westbury, N. Y.; C. C. Hamilton, New Brunswick, N. J.; Mr. and Mrs. Albert Hartzell, Yonkers, N. Y.; H. W. Hicock, New Haven, Conn.; August E. Hooghkirk, New Haven, Conn.; Mr. and Mrs. J. L. Horsfall, Yonkers, N. Y.; H. C. Huckett, Riverhead, N. Y.; Mr. and Mrs. D. W. Jones, Arlington, Mass.; J. Peter Johnson, New Haven, Conn.; G. H. Lamson, Jr., Storrs, Conn.; J. L. King, Moorestown, N. J.; J. A. Manter, Storrs, Conn.; S. E. May, Canaan, Conn.; J. A. McEvoy, Putnam, Conn.; B. W. McFarland, New Haven, Conn.; W. B. Mix, Greenwich. Conn.; W. D. Munson, South Britain, Conn.; R. C. Newton, Storrs, Conn.; O. C. Otis, Winsted, Conn.; C. C. Plummer. Storrs, Conn.; F. C. Rich, Ansonia, Conn.; Milton E. Rydberg, Yonkers, N. Y.; J. F. Townsend, New Haven, Conn.; B. H. Walden, New Haven, Conn.; R. A. Vickery, Stratford, Conn.; M. P. Zappe, New Haven, Conn.

INSPECTION OF NURSERIES IN 1927

W. E. Britton and M. P. Zappe

The regular annual inspection of nurseries was commenced July 1 and finished in September, except for a few new nurseries which were inspected afterwards, the final inspection for 1927 being made

on December 2. As in former years, this work was in charge of Mr. Zappe, who was assisted by Messrs. J. L. Rogers, J. F. Townsend, A. P. Harger, and H. B. Bender. In a few cases assistance was rendered by E. M. Stoddard, B. H. Walden, John T. Ashworth, and W. E. Britton.

Mr. Bender is a botanist who was employed temporarily for the purpose, in order to give special attention to such plant diseases as might occur in the nurseries.

In addition to the inspections made by the nursery inspectors, the gipsy moth scouts were instructed to make careful examinations for gipsy moth eggs in and around all nurseries in the infested area, and in case any were found, to report at once to the office. No gipsy moth infestations were discovered in or near any nursery in 1927. Also the pine blister rust scouts under Mr. J. E. Riley examined all nurseries where the blister rust was reported by the nursery inspectors.

On the whole, the nurseries were in as good condition as usual except that aphids were unusually abundant and were present on many kinds of plants not usually found infested. Some nurserymen have not yet obtained satisfactory control of the spruce gall aphid, though each has been supplied with literature giving the life history of the insect and methods of treatment, based upon the experiments of Dr. R. B. Friend of this Station.

In 37 nurseries no important pests were found. Following is a list of insects and plant diseases found in nurseries during the annual inspection of 1927, together with the number of nurseries infested by each:

Pests Found in Nurseries in 1927

Number of nurseries uninfested 37

INSECTS

Name	No. Nurseries	Name	No. Nurseries
Aphids, apple, green	36	Aphids, on pear	4
woolly	43	pine	1
Aralia	11	plum	6
on ash	1	raspberry	1
birch	10	rose	8
cherry	5	spiraea	9
Crataegus	6	spruce	4
currant	5	sumac	2
elm	1	syringa	1
Euonymus	1	tulip tree	1
honeysuckle	1	*Viburnum*	4
hydrangea	1	walnut	2
larch	1	willow	6
lupine	1	spruce gall, *Adelges abietis*	64
maple	4	*Gillettea cooleyi*	18
mountain ash	9	larch woolly, *Adelges*	2
oak	2	pine bark	21
peach	1	woolly, on purple beech	1

Name	No. Nurseries
Apple and thorn skeletonizer	22
Birch leaf miner	34
Borer, bronze birch	2
in apple	1
ash	1
lilac	1
linden	1
poplar	9
rose	1
willow	4
Curculio, walnut	2
Currant worm, imported	4
Elm leaf beetle	4
European pine shoot moth	1
Fall webworm	15
Janus abbreviatus	3
Juniper webworm	16
Lace bug, on quince	1
rhododendron	32
Leafhoppers, on apple	60
boxwood	2
cherry	1
Crataegus	1
elm	1
lilac, Persian	1
maple	3
mountain laurel	2
pear	1
quince	1
rose	9
Leaf miner in alder	1
arborvitae	7
boxwood	5
Catalpa bungei	7
columbine	1
elm	1
magnolia	1
maple	2
Mealy bug on *Taxus*	1
Midge on silver maple	4
Mite, European red	11
pear leaf blister	39
spruce	43
on *Amelanchier*	1
arborvitae	11
ash	1
birch	1
box elder	1
Clethra alnifolia	1
fir	1
juniper	5

Name	No. Nurseries
Mite, on maple	4
oak	6
phlox	4
pine	1
plum	1
Mite, on *Retinospora*	2
walnut	1
willow	1
galls on buttonbush	1
Oriental peach moth	23
Pear psylla	24
slug	24
Pine tube moth	1
Poplar flea beetle, *Crepidodera helxines*	2
leaf beetle, *Lina scripta*	2
Red-humped caterpillar	4
Rose, leaf tyers on	1
Sawfly, imported, *Diprion simile*	6
Scale, elm	7
elm scurfy	3
euonymus	3
juniper	2
Lecanium on arborvitae	1
maple	1
oak	1
oak gall	1
oyster-shell	45
pine leaf	6
rose	8
San José	16
scurfy	1
terrapin	1
tulip tree	4
on magnolia	1
Retinospora	1
Shot-hole borer	1
Sphinx caterpillars	1
Spiny elm caterpillar	1
Spittle bug on arborvitae	1
juniper	2
Stalk borer	1
Tarnished plant bug	3
Tent caterpillar	1
Tulip tree leaf gall	1
White pine weevil	17
Willow curculio	1
leaf beetle, imported *Plagiodera versicolora*	11
Yellow-necked caterpillar	1

PLANT DISEASES

Name	No. Nurseries
Anthracnose on cherry	8
currant	24
grape	5
Apple scab	44
Black knot	1
rot on apple	49
cherry	1
quince	6
Brown rot	9
Canker, poplar	39
Crown gall	6
Fire Blight	6
Leaf blotch on rose	77
on *Ampelopsis*	1
spot on *Catalpa*	30
cherry	1
elm	2
horse chestnut	2
iris	11
linden	1
maple	7
—tar spot—	1
mountain ash	5
pear	1
phlox	15

Name	No. Nurseries
Leaf spot on strawberry	24
Mildew on apple	31
Catalpa	33
cherry	1
dogwood	1
grape	32
honeysuckle	1
lilac	13
peach	2
pear	2
phlox	9
raspberry	1
Rhus canadensis	1
rose	35
Symphoricarpus	1
Raspberry cane blight	1
mosaic	21
Rust on apple	72
cedar	12
Crataegus	3
juniper	17
quince	5
willow	1
White pine blister, on *Ribes*	9

From an examination of the preceding list, it will be seen that of the insects, the spruce gall aphid was found in more nurseries (64) than any other, though followed rather closely by apple leafhoppers (60), oyster-shell scale (45), woolly apple aphid (43), spruce mite (43), pear leaf blister mite (39), green apple aphid (36), birch leaf miner (34), rhododendron lace bug (32), pear psylla (24), pear slug (24), Oriental peach moth (23), apple and thorn skeletonizer (22), pine bark aphid (21), *Gillettea cooleyi* (18), white pine weevil (17), San José scale (16), juniper webworm (16), and fall webworm (15).

Of the plant diseases found in nurseries, leaf blotch on rose headed the list (77). Others in order of number of nurseries found infested were as follows: rust on apple (72), black rot on apple (49), apple scab (44), poplar canker (39), mildew on rose (35), mildew on *Catalpa* (33), mildew on grape (32), mildew on apple (31), leaf spot on *Catalpa* (30), anthracnose on currant (24), leaf spot on strawberry (24), raspberry mosaic (21), rust on juniper (17), leaf spot on phlox (15), mildew on lilac (13), rust on cedar (12), and white pine blister rust on *Ribes* (9).

On account of the abundant rainfall certain fungous diseases like mildews were apparently more abundant than usual.

In order to show the prevalence of certain nursery pests in 1927 as compared with 1926 and the preceding seasons, the record of them for the past seven years is given in the following table:

SEVEN-YEAR RECORD OF CERTAIN NURSERY PESTS

	1921	1922	1923	1924	1925	1926	1927
Oyster-shell scale	36	44	42	44	38	39	45
San José scale	28	19	20	32	32	19	16
Spruce gall aphids*	31	21	28	40	27	42	82
White pine weevil	1	19	17	5	5	8	17
Apple and thorn skeletonizer		1	18	2	8	9	22
Poplar canker	21	31	34	25	34	32	39
Pine blister rust (on *Ribes*)	2	9	6	8	7	9	9
Nurseries uninfested	36	36	32	33	34	46	37

*Includes both *Adelges abietis* and *Gillettea cooleyi*.

It should be understood that the figures in the preceding table are not strictly comparable because of the greater number of nurseries since the new law went into effect in 1925. Thus though the number of infested nurseries is greater, the actual percentage may be considerably less.

NUMBER AND SIZE OF NURSERIES

The number of nurseries in Connecticut has increased each year. The list for 1926 contained 162 names. The list for 1927 contains 191 names. Of the 191 separate nurseries in the State, a classification on account of size may be made as follows:

Nurseries containing 50 acres or more	15
" " between 10 and 50 acres	19
" " " 5 and 10 "	27
" " " 2 and 5 "	52
" " 1 acre or less	78
	191

During the year 1927, 208 nursery inspections were made. The list of nursery firms on the following pages contains 191 names; 15 were inspected twice, once in the spring and again in the fall, and two other nurseries which were inspected failed to qualify in order to receive certificates. Thus 206 regular certificates have been issued, and 206 duplicate certificates have been furnished for filing in other states.

The owners of two small nurseries failed to register before July 1, so, according to Section 2, Chapter 265, Public Acts of 1925, each was charged five dollars as the estimated cost of inspection. This would have been more had it been necessary to make a special trip to inspect each nursery. The total amount of ten dollars ($10.00) was sent to the State Treasurer on March 31.

The total area of Connecticut nurseries is about 2,654 acres. The figures were taken from the owners' estimates on the registration cards, except in cases where the acreage was not given on the cards it was estimated by the inspector. All nurseries of less than an acre are listed as one acre, and where fractions are given, the next whole number is recorded. This list of nursery firms for 1927 is as follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1927

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Alius, Adolf	Stamford	1	Aug. 19	386
Allen, Henry L.	North Stonington	1	Aug. 29	413
Amelunxen & De Wyn	Yalesville	3	Aug. 16	370
Babski, J. S.	Southington	2	Apr. 9	337
Barnes Bros. Nursery Co.	Yalesville, No. Haven and Durham	150	Aug. 11	352
Barnes Eastern Nurseries	Wallingford	15	Aug. 16	366
Barnes Nursery & Orchard Co.	Wallingford	50	Oct. 17	503
Barton, Robert	Hamden	1	Sept. 10	468
Benbow, A.	Norfolk	1	Sept. 22	489
Berkshire Nurseries (C. B. Myers, Mgr.)	Milford	1	Sept. 10	470
Bertana, Louis	Glenbrook	1	Aug. 19	387
Bertolf Bros.	Greenwich	45	July 22	345
Birchell, George A. (2)	Stonington	1	Aug. 29	414
Booy, H. W.	Yalesville	3	Aug. 16	369
Botsford, R. C.	East Haven	1	Sept. 9	448
Brainard Nursery & Seed Co.	Thompsonville	10	Aug. 26	410
Braley & Co., S. A.	Burnside	3	Aug. 16	367
Branford Nurseries	Branford	4	Aug. 31	429
Bretschneider, A.	Danielson	1	Aug. 30	420
Bridgeport Hydraulic Co.	Bridgeport	200	Nov. 2	510
Bristol Nurseries, Inc.	Bristol	50	Aug. 19	383
Brooklawn Conservatories	Bridgeport	1	Nov. 16	513
Brouwer's Nurseries	New London	2	Aug. 22	400
Brown, E. M.	Hartford	1	Sept. 7	441
Buckley, Walter E.	Groton	1	Aug. 29	417
Bulpitt, Henry F.	Darien	5	Aug. 19	385
Burke, P. J.	Rockville	1	Aug. 16	368
Burr, Morris L.	Westport	1	Aug. 15	363
Burr & Co., C. R.	Manchester, Ellington, and Durham	320	Aug. 5	347
Burroughs, Thomas E.	Deep River	4	Aug. 13	355
Burwell, E. E.	New Haven	1	Sept. 9	450
Cant, Alexander	Springdale	1	Sept. 7	439
Cardarelli, E. J.	Cromwell	2	Aug. 31	428
Carolla, John (2)	Hamden	1	Nov. 23	520
Case, Louis L.	Simsbury	1	Sept. 9	451
Chapman, Anna L.	North Stonington	1	Sept. 7	445
Chapman, C. B.	Groton	1	Aug. 22	399
Chippendale Nurseries (2)	Old Lyme	1	Aug. 22	402
Clark, Raymond H.	Milford	1	Sept. 10	467
Clinton Nurseries (Warren W. Richards, Prop).	Clinton	6	Nov. 29	523
Clyne, George A. (2)	Middlebury and Woodbury	20	Oct. 19	507
Conine Nursery Co.	Stratford	50	Aug. 8	350
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Sept. 20	484

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Conn. Agr. Expt. Station (W. O. Filley, Forester)	New Haven, Hamden, Cheshire and Norwich	5	Sept. 10	466
Conn. Valley Nurseries	Manchester	2	Aug. 8	351
Cooper's (Stratford Florist Co.)	Stratford	1	Dec. 6	527
Corrigan, James J	West Haven	1	Sept. 7	446
Cragholme Nursery (2)	Greenwich	6	Aug. 25	408
Cromie, G. A	New Haven	2	Oct. 17	504
Dallas, Inc., Alexander	Waterbury	3	Nov. 19	518
Dawson, William A	Willimantic	1	Sept. 19	482
Dowd, Inc., F. C	Madison	2	Dec. 30	533
Dunlap, Daniel S	Cromwell	3	Aug. 15	362
Eager, Edward M	Bridgeport	1	Sept. 27	493
East Rock Nursery Co (S. Palmieri, Prop.)	New Haven	1	Sept. 30	497
Eells & Sons	Manchester	1	Aug. 22	397
Elfgren, I. P. & Sons	East Killingly	1	Aug. 22	395
Elm City Nursery Co. (Woodmont Nurseries, Inc.)	Woodmont, Milford and Orange	120	Sept. 8	447
Elm Grove Cemetery Association	Mystic	1	Sept. 13	473
Ensign-Bickford Co., (S. W. Eddy, Supt.)	Avon	10	Oct. 26	508
Evergreen Nursery Co	Wilton	15	Aug. 18	381
Fairty, C. H. (2)	New Canaan	2	Nov. 23	522
Farmington Valley Nursery (Harry D. Wilcox, Prop.)	Avon	2	Sept. 27	494
Flower City Rose Co	Manchester	1	Aug. 20	390
Fraser's Nurseries & Dahlia Gardens	Willimantic	2	Sept. 29	495
Galligan, C. W	North Haven	2	Sept. 16	480
Gardner, R. H	Rocky Hill	60	Aug. 15	358
Geduldig's Greenhouses	Norwich and Ledyard	3	Sept. 10	460
Giuliano, John S	Wethersfield	1.	Sept. 9	454
Glen Terrace Nurseries (Jas. H. Everett, Prop.)	Mt. Carmel	24	Dec. 5	526
Golden Hill Nurseries (Andrew Johnson, Prop.)	Shelton	2	Sept. 21	488
Goodwin Nurseries (2)	Bloomfield	7	Sept. 7	440
Hansen, Peter	Fairfield	2	Aug. 30	419
Hawes, F. M	West Hartford	1	Sept. 15	477
Hearn, Thomas H	Washington	2	Sept. 21	486
Heath & Co	Manchester	2	Aug. 5	349
Hill Top Nursery (F. W. Langstroth, Prop.)	Danbury	4	Aug. 30	425
Hilliard, H. J	Sound View	1	Sept. 9	455
Hiti Nurseries (J. H. Bowditch, Prop.)	Pomfret Center	8	Aug. 16	365
Holcomb, Irving	Granby	1	Aug. 18	380
Holdridge, S. E	Ledyard	4	Aug. 12	354
Horan & Son, James	Bridgeport	1	Nov. 10	511
Houston, Byron D	Mansfield	15	Oct. 28	509
Hoyt's Sons Co., Inc., Stephen	New Canaan	500	Aug. 17	377
Hull, Curtis M	Wallingford	1	Aug. 16	375
Hunt & Co., W. W	Hartford	8	Aug. 31	427

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Huntoon, Gerald W	Rocky Hill	1	Aug. 22	405
Intravaia, Joseph	Middletown	2	Aug. 19	384
Jennings, G. S	Southport	1	Aug. 15	364
Johnson, Tom (2)	Stratford	1	Aug. 30	423
Jones, William	Norwalk	1	Aug. 29	411
Judd, T. H. (2)	Danbury	1	Dec. 31	534
Kauser, Alice (2)	Norwalk	1	Aug. 17	379
Kelley & Son, James J	New Canaan and Darien	6	Nov. 17	516
Kerner, Eugene	Woodbury	8	Dec. 21	529
Keystone Nurseries (H. H. Kellner, Prop.)	Danbury	1	Sept. 12	471
Leghorn, John	Cromwell	7	Aug. 15	361
Lewis & Valentine, Inc	Darien	11	Sept. 10	463
Liljenstein, Carl (2)	New London	1	Aug. 22	401
Lundberg, E. A. (2)	Springdale	1	Aug. 22	404
Lynch, Mrs. John H	Ridgefield	5	Dec. 28	532
Malavasi, Sam	Woodbridge	3	Sept. 9	457
Mallett Co., George A	Bridgeport	5	Sept. 7	443
Maplewood Nursery Co. (T. H. Peabody, Mgr.)	Norwich	2	Nov. 21	519
Marigold Farm (Henry Kelley, Prop.)	New Canaan	10	Sept. 20	483
Marshall, Robert	Wethersfield	1	Sept. 10	461
Mayapple Nurseries (Paul M. Barrows, Prop.)(2)	Stamford	1	Sept. 10	462
Maynard & Gadbois (2)	Old Lyme	1	Sept. 7	442
McConville, John	Manchester	1	Aug. 22	396
Meier, A. R. (2)	West Hartford	1	Nov. 23	521
Merwin Lane Nursery (J. W. Marvin, Jr., Prop.)	Fairfield	5	Aug. 23	406
Middeleer, Inc	Darien	10	Sept. 7	444
Millane Nurseries	Cromwell	5	Sept. 9	456
Minge, G. H	Rocky Hill	1	Aug. 26	409
Moraio Bros	Stamford	2	Nov. 16	514
Morgan, W. F. (Westerly, R. I.)	North Stonington	3	Aug. 29	416
Moulthrop, William	Watertown	3	Sept. 10	464
Mount Airy Gardens (R. L. Wilson, Prop.) (2)	North Stamford	1	Aug. 22	403
Mount Carmel Nursery	Mount Carmel	1	Dec. 24	531
New Britain Board of Water Commissioners	New Britain and Southington	50	Sept. 15	478
New Haven Nurseries (Louis A. Soldan, Mgr.)	New Haven	1	Nov. 30	524
New Haven Park Commission (G. X. Amrhyn, Supt.)	New Haven	20	Oct. 5	487
New London Cemetery Association	New London	1	Aug. 29	412
New York, New Haven & Hartford Railroad Co. (C. A. Haggerty)	Stamford	6	Dec. 6	528
Nicolson & Thurston	Litchfield	1	Sept. 2	433
North-Eastern Forestry Co	Cheshire	56	Aug. 4	346
Norwood Nursery	Hamden	1	Aug. 30	421
Oakland Nurseries	Manchester	2	Aug. 5	348

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Old Orchard Nursery (R. G. Hanford, Prop.)	Norwalk	2	Sept. 20	485
Ostergren, Herbert	Cromwell	2	Aug. 16	373
Outpost Nurseries	Ridgefield	75	Aug. 13	356
Ouwerkerk, D. K.	Yalesville	6	Aug. 16	371
Park Gardens	Bridgeport	1	Nov. 17	517
Pedersen, Anthon	Stamford	1	Sept. 17	481
Pequod Nursery Co.	Yalesville	15	Aug. 11	353
Phelps & V. T. Hammer Co. The J. W.	Branford	2	Dec. 24	530
Pierson, Inc., A. N.	Cromwell	110	Aug. 15	357
Polish Orphanage Farm	New Britain	1	Sept. 26	492
Pomeroy, Edwin C.	New Milford	5	Sept. 2	432
Prospect Nurseries, Inc. (S. C. Hubbard, Prop.)	Cromwell	5	Aug. 15	360
Prudence Seymour Gardens (Mary T. Parfitt, Prop.)	New Milford	1	Sept. 2	435
Reynolds, Stephen	South Norwalk	2	Aug. 22	393
Richmond Gordon L.	New Milford	1	Sept. 9	449
Ridgefield Florist & Nursery Co. (W. Pinchbeck, Prop.)	Ridgefield	3	Sept. 6	437
Rockfall Nursery Co., (Philip Marotta, Mgr.)	Rockfall	75	Sept. 3	436
Rottenberg, Julius	Newington Junction	1	Sept. 13	475
Rushworth, Edwin	Yalesville	1	Aug. 16	372
Russell, C. B.	Newington	1	Nov. 12	512
Sage, Hollister	Woodbury	1	Sept. 9	458
Sargeant, A. R.	Tolland	2	Aug. 15	359
Saxe & Floto	Waterbury	1	Sept. 9	459
Schaeffer Bros.	Ledyard	4	Aug. 22	398
Scheepers, Inc., John	Stamford	14	Aug. 22	392
Schoonman, W. J.	New London	5	Oct. 5	499
Schulze, Charles T.	Bethel	1	Sept. 2	431
Scott's Nurseries	Bloomfield	5	Dec. 2	525
Shelton, P. S.	Fairfield	2	Aug. 30	426
Sierman, C. H.	Hartford	8	Sept. 13	474
Simonson, H. C.	Plainville	2	Sept. 10	465
Snelgrove, S. J.	Windsor	2	Aug. 22	394
South Wilton Nurseries (J. C. Van Heiningen, Prop.)	South Wilton	3	Aug. 20	389
Southport Nursery (Coari & Sons, Props.)	Southport	20	Aug. 22	391
Spring Nurseries (Wallace Barnes Co.)	Bristol	2	Sept. 9	452
State of Connecticut (A. F. Hawes, State Forester)	Simsbury	4	Sept. 9	453
State Street Nursery (John Natyzon, Prop.)	New Haven	2	Sept. 22	490
Steck, Charles A.	Newtown	6	Nov. 17	515
Steck, Charles A. Jr.	Bethel	5	Aug. 25	407
Stratfield Nurseries (George R. Godfrey, Prop.)	Bridgeport	20	Oct. 11	501
Stratford Rose Nursery (John Barrow, Prop.)	Stratford	1	Aug. 30	422
Sunridge Nurseries	Greenwich	7	Oct. 18	506
Szirbik & Co., George	New Haven	1	Sept. 12	472
Tanner's Nursery Co.	Manchester	2	Sept. 1	430

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Thomas Nursery	Hamden	1	Sept. 6	438
Upson, R. E.	Marion	3	Sept. 24	491
Vanderbrook & Son, Charles L.	Manchester	18	Aug. 17	376
Van Wilgen Nurseries	Branford	7	Oct. 7	500
Vasileff, Nicholas	Greenwich	3	Oct. 17	502
Verkade's Nurseries	New London	15	Aug. 29	418
Vidal-Mackintosh, Inc.	Stamford	1	Sept. 30	498
Wallace, A. T.	Wallingford	8	Aug. 16	374
Wayside Farm Gardens (Miss I. E. Aldrich, Prop.)	Thomaston	2	Sept. 2	434
Wegner, C. F.	Noroton Heights	2	Sept. 13	476
Wheeler, C. B.	North Stonington	1	Aug. 29	415
Wild's Nursery, Henry	Greenwich and Norwalk	27	Aug. 18	382
Williams & Holmes	Huntington	1	Aug. 30	424
Wilson & Co., C. E.	Manchester	80	Aug. 20	388
Woodruff, C. V.	Orange	1	Sept. 10	469
Wyllie, David	Whitneyville	1	Sept. 29	496
Yale Landscape Department	New Haven	4	Oct. 17	505
Yale School of Forestry	New Haven	2	Sept. 16	479
Zack & Co., H. J.	Deep River	6	Aug. 17	378
Total 191 nurseries		2654 acres		

Bulletin No. 292, "Some Insects Infesting Nursery Stock in Connecticut," has recently been published and sent to all nurserymen receiving certificates in 1927. This bulletin contains brief descriptions and illustrations of the more common insect pests of nursery stock in Connecticut.

Inspection of Raspberry Plantations

Certain nurserymen and raspberry growers applied for special inspections and certificates in order to enable them to sell plants free from mosaic. Such inspections and certificates are required if raspberry plants are to be shipped into the states of Michigan, Minnesota, New York, and Vermont. Two nursery firms made application for the special inspection and certificates for their raspberry plants, and the inspections were duly made. Certain varieties contained too much mosaic and could not be included, but the following certificates were granted:

Special Certificates on Raspberry Plants

Name of Firm	Address	Variety	Date of Issue	Certificate Number
Barnes Nursery & Orchard Co	Wallingford	Cuthbert Erskine Park Latham	Oct. 24	16
Conine Nursery Co.	Stratford	La France St. Regis	Oct. 24	15

Nursery Dealers

Chapter 265, Public Acts of 1925, provides that dealers in nursery stock must register each year, on or before March 1, with the State Entomologist, and cite the principal sources of their nursery stock. All dealers' permits are for the remainder of the calendar year and expire on December 31. During the year 80 such dealers have registered and received permits. The list of dealers is on file in the office of the State Entomologist but is not printed in this Report.

Out-of-State Nurserymen

Nurserymen in other states wishing to ship stock into Connecticut are required to file with the State Entomologist signed copies of their nursery inspection certificates and make application for permits to ship stock into the State. These permits are valid only for the periods covered by the certificates placed on file. During the year 213 permits have been issued to nurserymen in other states, but the list of firms receiving them is not printed in this Report.

Parcel Certificates

In addition to the regular inspection and certification of nursery stock, occasionally individuals wish to send shrubs and plants to their friends, and sometimes nurserymen need to ship packages before receiving their regular certificates. Consequently 190 separate parcels of nursery stock have been inspected and package certificates furnished.

Inspection of Narcissus Bulbs

On account of Federal quarantine No. 62, narcissus bulbs grown in Connecticut cannot be shipped into other states unless given two inspections, one in the field in May, and the other after the bulbs have been dug for shipment. In case they are found to be infested with bulb flies or eelworms, they must then be treated. During the year 20,000 such bulbs were inspected and certified.

Inspection of Laurel and Decorative Materials

Considerable decorative material is gathered each year in Connecticut woodlands and shipped into New York City. This is mostly mountain laurel, *Kalmia latifolia*. If gathered within the gipsy moth quarantined area, it is examined by Federal inspectors, and if found clean, is certified for shipment. Much of it is collected outside the quarantined area and yet cannot enter New York without being certified. During the year 230 such certificates were issued.

Inspection of Shelled Seed Corn

On account of the European corn borer having been found in a small portion of Connecticut, certain states would not allow shelled sweet corn for seed to enter unless it had been inspected and certified to be free from bits of cob large enough to carry borers. Therefore a large quantity of such seed corn was inspected as it came through the cleaning mill, and 259 certificate tags were issued.

INSPECTION OF IMPORTED NURSERY STOCK

W. E. Britton and M. P. Zappe

For the past eight years the only nursery stock allowed to enter Connecticut from foreign countries has been entirely rose and fruit tree seedlings for propagation. This material is released at ports of entry; notice of its arrival is sent to this office, and it is inspected at its destination. All other plant material must go to Washington, where it is inspected, and if necessary, fumigated or destroyed. The imported nursery stock entering Connecticut in 1927 was inspected by Mr. Zappe, assisted at rush times by Messrs. B. H. Walden, B. W. McFarland, and J. P. Johnson. The number of shipments, cases, and plants was slightly less than in 1926, but the number of plants has been exceeded only in 1924 and 1926, as the following table shows:

Year	No. of shipments	No. of cases	No. of plants
1920	17	87	814,491
1921	21	126	1,228,560
1922	30	159	1,997,595
1923	35	179	1,981,895
1924	33	313	3,489,170
1925	27	277	2,977,346
1926	32	347	3,443,357
1927	31	321	3,229,915

Though the greatest number of shipments came from Holland, the greatest number of cases and plants came from France, as the following table indicates:

Sources of Imported Nursery Stock, 1926-1927

Country	No. of shipments	No. of cases	No. of plants
France	10	169	2,090,900
Holland	14	141	1,048,515
England	7	11	90,500
	31	321	3,229,915

These 31 shipments were imported by 11 different Connecticut firms, 18 shipments being consigned to two firms. Of the total number of shipments, 20 shipments contained only rose stocks,

6 shipments contained only fruit stocks, and 5 shipments contained both rose and fruit stocks.

Of this plant material inspected, 1,635,915, or about 51 per cent, were rose stocks, and 1,594,000, or about 49 per cent, were fruit seedlings. The number of each variety is shown in the following table:

KINDS OF STOCK IMPORTED

Variety	Number of Plants	Total
FRUIT STOCKS		
Apple (all kinds)	517,000	
Cherry (all kinds)	689,500	
Hazel (*Corylus avellana*)	2,000	
Pear	103,000	
Plum	232,500	
Quince	50,000	1,594,000
ROSE STOCKS		
Rosa manetti	1,206,015	
Rosa multiflora japonica	308,900	
Rosa rugosa	121,000	1,635,915
Total		3,229,915

The following table shows the quantities of stock inspected, by months:

Month	No. of shipments	No. of cases	No. of plants
December	5	12	79,500
January	19	277	2,831,915
February	4	26	218,500
March	3	6	100,000
	31	321	3,229,915

The time required to inspect this stock is equivalent to one man working 47 days, and this time, together with the cost of travel and other necessary expenses, amounts to about $500.

In addition to the material enumerated and tabulated on the foregoing pages there were 27 shipments of tree seeds which were not inspected in Connecticut. Regarding all shipments of imported stock, 51 reports were made to the Federal Horticultural Board.

Of the 31 shipments inspected, 22 shipments, or about 70 per cent, were found infested with insects or plant diseases, some of which are well-known pests. Details regarding these infestations are given below.

PESTS FOUND ON IMPORTED NURSERY STOCK

22 Shipments Infested

INSECTS

Acronycta rumicis Linn., on cherry (1 shipment). Andre Choplin, Maze. France.

Agrilus viridis var. *fagi* Ratz., work of, on Manetti (1 shipment). Felix & Dykhuis, Holland.

Aporia crataegi Linn., nests on apple (1 shipment). Andre Chopin, Maze, France.

Calophasia lunula Hubn. (3 shipments) on quince. A. Fermaud, Angers, France. On apple, pear and plum, Andre Choplin, Maze, France.

Emphytus cinctus Linn. (14 shipments). A Fermaud, Angers, France; Hemeray Aubert, Orleans, France; Oudyk Bros. Nurseries, Boskoop, Holland; C. Klijn & Co., Boskoop, Holland; Chas. Walter Slocock, Woking, Surrey, England; Fa. As. Ouwerkerk, Boskoop, Holland; P. Ouwerkerk, Boskoop, Holland; Louis Leroy's Nursery, Angers, France.

Euproctis chrysorrhoea Linn., on apple (1 shipment) winter nest. Andre Choplin, Maze, France.

Hymenopterous pupae (1 shipment). A. Fermaud, Angers, France.

Lepidopterous pupae, unidentified (7 shipments). Louis Sebire & Sons, Ussy, Calvados, France; butterfly, Andre Choplin, Maze, France; Louis Leroy, Angers, France; A. Fermaud, Angers, France.

Lymantid larva on apple (1 shipment). Andre Choplin, Maze, France.

Noctuid moth on pear (1 shipment). A. Fermaud, Angers, France.

Notolophus antiqua Linn. on apple (1 shipment). Louis Sebire & Sons, Ussy, Calvados, France.

Papilio podalirius Linn. (2 shipments) cocoons on apple and cherry. Andre Choplin, Maze, France.

Sitona sp. weevil in spider's web. (1 shipment). A. Fermaud, Angers, France.

Spider's eggs (3 shipments) on cherry. Andre Choplin, Maze, France; on quince, Louis Leroy's Nursery, Angers, France.

Vanessa sp. on rose (1 shipment). A. Fermaud, Angers, France.

Woolly aphid on apple (2 shipments). Louis Sebire & Sons, Ussy, Calvados, France; on rose, Oudyk Bros., Boskoop, Holland.

PLANT DISEASES

Crown gall on rose (2 shipments). Walter C. Slocock, Woking, Surrey, England; R. H. Bath, Ltd., Wisbeck, England.

INSPECTION OF APIARIES IN 1927

In 1927, as for several years past, the apiaries have been inspected by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford, on a *per diem* basis. Mr. Coley covers the southern half of the State (Fairfield, New Haven, Middlesex, and New London Counties), and Mr. Yates the northern half (Litchfield, Hartford, Tolland, and Windham Counties).

This work in 1927 required 136 man days and with traveling expenses cost $1,905. In all, 803 apiaries, containing 8,133 colonies, were inspected in 1927, as against 814 apiaries, containing 7,923 colonies, in 1926. The apiaries averaged 10.1 colonies each in 1927, and 9.7 each in 1926.

The following table shows the number of apiaries and colonies inspected and the average number of colonies per apiary, as well as the cost per apiary and colony for each year since the inspection work was commenced in 1910:

EIGHTEEN-YEAR RECORD OF APIARY INSPECTION IN CONNECTICUT

Year	No. of Apiaries	No. of Colonies	Average No. Colonies Per Apiary	Average Cost of Inspection Per Apiary	Per Colony
1910	208	1,595	7.6	$2.40	.28
1911	162	1,571	9.7	1.99	.21
1912	153	1,431	9.3	1.96	.21
1913	189	1,500	7.9	1.63	.21
1914	463	3,882	8.38	1.62	.19
1915	494	4,241	8.58	1.51	.175
1916	467	3,898	8.34	1.61	.19
1917	473	4,506	9.52	1.58	.166
1918	395	3,047	7.8	1.97	.25
1919	723	6,070	11.2	2.45	.29
1920	762	4,797	6.5	2.565	.41
1921	751	6,972	9.2	2.638	.24
1922	797	8,007	10.04	2.60	.257
1923	725	6,802	9.38	2.55	.27
1924	953	8,929	9.4	2.42	.25
1925	766	8,257	10.7	2.45	.22
1926	814	7,923	9.7	2.35	.24
1927	803	8,133	10.1	2.37	.234

In 1927, apiaries were inspected in 135 towns, as against 137 towns in 1926, and 118 towns in 1925.

Inspections were made in the following 17 towns in 1927, which were not visited in 1926: Fairfield County—Monroe, Shelton, Stratford, and Trumbull; New Haven County—Ansonia, Milford, Oxford, Seymour, West Haven; Middlesex County—Essex; New London County—New London; Litchfield County—Plymouth; Hartford County—Marlborough, Windsor Locks; Tolland County—Hebron; Windham County—Chaplin, Thompson.

On the other hand, the following 19 towns, where inspections were made in 1926, were not visited by the inspectors in 1927: Fairfield County—Norwalk; New Haven County—Branford, East Haven, Meriden, Middlebury, North Branford, Orange; Middlesex County—Killingworth; New London County—East Lyme, Lyme, Old Lyme, Preston, Sprague; Litchfield County—Cornwall, Goshen; Hartford County—Enfield, Southington; Windham County—Pomfret, Sterling.

There are several towns where no recent inspections have been made. In Southbury (New Haven County) the last inspection was made in 1916. In Warren (Litchfield County) no apiaries have been inspected since 1919, though the inspector has made inquiries and failed to learn of any beekeepers in the town. In New Fairfield and Sherman (Fairfield County) the last inspections were made in 1920, and Bethany (New Haven County) and Bridgeport (Fairfield County) have not been inspected since 1922. Inspections have not been made since 1924 in Hamden, New Haven and Wolcott (New Haven County), Weston (Fairfield County), and Eastford (Windham County). In 1925 the last inspections were made in Cheshire (New Haven County), Saybrook (Middlesex County), and South Windsor (Hartford County).

European Foul Brood

This is a disease of the young larvae, caused by a bacterial germ known as *Bacillus pluton,* and commonly called European foul brood. Usually it is more troublesome in early summer than at other times during the year, the cell contents are not ropy or gelatinous, and though often with the odor of fermentation, it is not very offensive. Requeening with Italian queens and uniting two or more weak colonies to make them strong are common methods of control.

Of the 803 apiaries and 8,133 colonies inspected in 1927, 9 apiaries and 23 colonies were found infested with European foul brood. This infestation amounts to 1.12 per cent of the apiaries and .282 per cent of the whole number of colonies inspected during the season—the lowest percentages ever found in Connecticut since the beginning of the inspection work.

The following table gives a complete record of percentages of infestation of European foul brood in Connecticut since the inspection work began in 1910:

RECORD OF EUROPEAN FOUL BROOD

Year	Percentage of Infestation Apiaries	Colonies	Year	Percentage of Infestation Apiaries	Colonies
1910	75.9	49.7	1919	6.6	1.2
1911	51.8	27.4	1920	4.3	1.5
1912	47.7	23.5	1921	3.91	1.26
1913	44.4	24.5	1922	4.14	.85
1914	32.6	13.9	1923	2.34	.36
1915	26.1	10.3	1924	1.78	.526
1916	18.8	7.05	1925	2.48	.507
1917	16.7	4.86	1926	3.19	.858
1918	9.8	3.3	1927	1.12	.282

During 1927, European foul brood was discovered only in the following seven towns: Plymouth in Litchfield County; Bristol, Farmington, Granby, Plainville, and Windsor Locks in Hartford County; and Stafford in Tolland County. No apiaries infested with this disease were found in Fairfield, New Haven, Middlesex, New London, or Windham Counties.

American Foul Brood

American foul brood is also a disease of the larvae caused by the bacterial organism known to science as *Bacillus larvae,* but it attacks the brood at a later stage of development than does the European foul brood. It usually shows when the larvae are nearly mature or pupating after the cells are sealed. The diseased cells are shrunken, and if broken open, the contents have a peculiar

ropy or stringy consistency and give off a very offensive odor. Formerly the treatment was to shake the bees into clean hives, destroy the infected combs, and disinfect the old hives. Now the diseased combs may be sterilized by soaking them in an alcohol-formalin solution containing twenty per cent of formalin, after which they may be used with safety.

Of the 803 apiaries and 8,133 colonies inspected in 1927, 25 apiaries and 57 colonies were infested with American foul brood. This infestation is equivalent to 3.11 per cent of the apiaries and .7 per cent of the colonies inspected in 1927. This record for 1927 is a greater percentage of infested apiaries than is usually found and was exceeded only in 1925; it is the highest percentage of colonies ever found infested with this disease.

The following table shows a complete record regarding American foul brood since apiary inspection was started in Connecticut in 1910:

RECORD OF AMERICAN FOUL BROOD

Year	Percentage of Infestation Apiaries	Colonies	Year	Percentage of Infestation Apiaries	Colonies
1910	0	0	1919	3	1.1
1911	0	0	1920	1.18	.25
1912	0	0	1921	2.5	.56
1913	0	0	1922	1.38	.27
1914	1.07	.7	1923	.985	.323
1915	.8	.18	1924	1.04	.22
1916	1.07	.15	1925	3.26	.424
1917	.42	.17	1926	1.72	.29
1918	1.01	.32	1927	3.11	.70

During 1927, American foul brood was found in the following 16 towns: Derby, Madison, Naugatuck, Prospect, and Wallingford, in New Haven County; Durham in Middlesex County; Norwich in New London County; Bethlehem, Litchfield, North Canaan, Plymouth, Torrington, Washington, and Winchester, in Litchfield County; Bristol in Hartford County; and Ellington in Tolland County.

Sacbrood

Sacbrood or pickled brood is a disease often mistaken for American or European foul brood. The cause is considered to be a filterable virus. The larvae die about the time the cells are capped and lie on their backs with heads turned upward. The body is swollen and contents watery, but there is no ropiness, and the entire cell contents may easily be removed intact as if enclosed in a sac. The color is variable, though often light yellow or brown, with head nearly black. The usual treatment is to make strong colonies by uniting the weak ones. In certain rare cases where whole apiaries become infected, new queens should be supplied to all the colonies.

The following table shows the record of sacbrood since apiary inspection in Connecticut started in 1910:

RECORD OF SACBROOD

Year	Percentage of Infestation Apiaries	Colonies	Year	Percentage of Infestation Apiaries	Colonies
1910	0	0	1919	1.24	.19
1911	..	.51	1920	1.18	.229
1912	..	Several	1921	1.06	.157
1913	..	2.8	1922	1.37	.187
1914	2.59	.721	1923	.53	.086
1915	2.02	.47	1924	1.78	.52
1916	.428	.051	1925	3.39	.836
1917	1.48	.199	1926	1.1	.138
1918	.253	.032	1927	.03	.0036

During the year, sacbrood was found in the following three towns: Essex and Portland in Middlesex County, and Voluntown in New London County.

Statistics of Inspection

The statistics of apiary inspection by towns and counties may be found in the following pages, with summary on page 230.

Inspection of Apiaries, 1927

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood
Fairfield County:							
Bethel	4	0	37	0	0	0	0
Brookfield	3	0	68	0	0	0	0
Danbury	12	0	146	0	0	0	0
Darien	1	0	42	0	0	0	0
Easton	3	0	87	0	0	0	0
Fairfield	7	0	93	0	0	0	0
Greenwich	21	0	220	0	0	0	0
Monroe	6	0	89	0	0	0	0
New Canaan	3	0	25	0	0	0	0
Norwalk	2	0	41	0	0	0	0
Redding	3	0	51	0	0	0	0
Ridgefield	5	0	48	0	0	0	0
Shelton	2	0	27	0	0	0	0
Stamford	8	0	161	0	0	0	0
Stratford	1	0	28	0	0	0	0
Trumbull	2	0	32	0	0	0	0
Westport	2	0	18	0	0	0	0
Wilton	9	0	179	0	0	0	0
	94	0	1392	0	0	0	0
New Haven County:							
Ansonia	7	0	41	0	0	0	0
Beacon Falls	2	0	48	0	0	0	0
Derby	3	1	21	1	1	0	0
Guilford	4	0	37	0	0	0	0
Madison	3*	2	18	4	4	0	0
Milford	5	0	48	0	0	0	0

* One apiary inspected three times.

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
New Haven County—*Continued*							
Naugatuck	6	2	64	2	2	0	0
North Haven	2	0	31	0	0	0	0
Oxford	2	0	38	0	0	0	0
Prospect	5	1	39	4	4	0	0
Seymour	3	0	13	0	0	0	0
Wallingford	17**	4	107	7	7	0	0
Waterbury	6	0	42	0	0	0	0
West Haven	1	0	8	0	0	0	0
	66	10	555	18	18	0	0

** Two apiaries inspected twice.

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
Middlesex County:							
Chester	5	0	45	0	0	0	0
Clinton	4	0	59	0	0	0	0
Cromwell	6	0	59	0	0	0	0
Durham	7	1	163	1	1	0	0
East Haddam	5	0	178	0	0	0	0
East Hampton	13	0	218	0	0	0	0
Essex	5	1	50	1	0	0	1
Haddam	5	0	58	0	0	0	0
Middlefield	2	0	53	0	0	0	0
Middletown	5	0	77	0	0	0	0
Old Saybrook	5	0	74	0	0	0	0
Portland	6	1	61	1	0	0	1
Westbrook	1	0	8	0	0	0	0
	69	3	1103	3	1	0	2

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
New London County:							
Bozrah	1	0	15	0	0	0	0
Colchester	6	0	54	0	0	0	0
Franklin	2	0	77	0	0	0	0
Griswold	3	0	94	0	0	0	0
Groton	1	0	32	0	0	0	0
Lebanon	6	0	116	0	0	0	0
Ledyard	3	0	40	0	0	0	0
Lisbon	2	0	28	0	0	0	0
Montville	6	0	60	0	0	0	0
New London	3	0	15	0	0	0	0
No. Stonington	3	0	35	0	0	0	0
Norwich	10	2	248	6	6	0	0
Salem	1	0	8	0	0	0	0
Stonington	9	0	68	0	0	0	0
Voluntown	4	1	31	1	0	0	1
Waterford	3	0	52	0	0	0	0
	63	3	973	7	6	0	1

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
LitchfieldCounty:							
Barkhamsted	2	0	4	0	0	0	0
Bethlehem	10	2	45	7	7	0	0
Bridgewater	6	0	94	0	0	0	0
Canaan	2	0	4	0	0	0	0
Colebrook	2	0	28	0	0	0	0
Harwinton	7	0	22	0	0	0	0
Kent	4	0	85	0	0	0	0
Litchfield	4	1	55	1	1	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
Litchfield County—*Continued*							
Morris	4	0	24	0	0	0	0
New Hartford	4	0	11	0	0	0	0
New Milford	6	0	46	0	0	0	0
Norfolk	5	0	25	0	0	0	0
North Canaan	8	1	79	1	1	0	0
Plymouth	9*	5	53	13	4	9	0
Roxbury	4	0	29	0	0	0	0
Salisbury	8	0	64	0	0	0	0
Sharon	4	0	118	0	0	0	0
Thomaston	11	0	60	0	0	0	0
Torrington	9	1	78	2	2	0	0
Washington	6	1	122	5	5	0	0
Watertown	9	0	56	0	0	0	0
Winchester	12	1	66	3	3	0	0
Woodbury	3	0	69	0	0	0	0
	139	12	1237	32	23	9	0

*1 colony inspected twice.

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
Hartford County:							
Avon	3	0	22	0	0	0	0
Berlin	12	0	159	0	0	0	0
Bloomfield	5	0	147	0	0	0	0
Bristol	13	2	62	5	1	4	0
Burlington	6	0	20	0	0	0	0
Canton	6	0	34	0	0	0	0
East Granby	2	0	20	0	0	0	0
East Hartford	3	0	29	0	0	0	0
East Windsor	13	0	58	0	0	0	0
Farmington	13	1	59	3	0	3	0
Glastonbury	14	0	151	0	0	0	0
Granby	10	1	78	3	0	3	0
Hartford	4	0	11	0	0	0	0
Hartland	1	0	60	0	0	0	0
Manchester	7	0	67	0	0	0	0
Marlborough	2	0	35	0	0	0	0
New Britain	11	1*	90	1*	0	0	0
Newington	7	0	53	0	0	0	0
Plainville	8	1	29	1	0	1	0
Rocky Hill	3	0	33	0	0	0	0
Simsbury	10	0	75	0	0	0	0
Suffield	10	0	86	0	0	0	0
West Hartford	8	0	77	0	0	0	0
Wethersfield	10	0	49	0	0	0	0
Windsor	11	0	84	0	0	0	0
Windsor Locks	6	1	24	1	0	1	0
	198	7	1612	14	1	12	0

*Bee paralysis

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Foul Brood Sacbrood
Tolland County:							
Andover	3	0	21	0	0	0	0
Bolton	3	0	14	0	0	0	0
Columbia	5	0	14	0	0	0	0
Coventry	13	0	126	0	0	0	0
Ellington	14	2	75	8	8	0	0
Hebron	5	0	23	0	0	0	0
Mansfield	16	0	79	0	0	0	0