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Forty-seventh Annual Report

OF

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

Being the annual report for the year ended October 31

1923

PRINTED IN COMPLIANCE WITH STATUTE

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THE BOARD OF CONTROL

PRESS OF
THE WILSON H. LEE COMPANY
NEW HAVEN, CONN.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

October, 1923.

BOARD OF CONTROL.

His Excellency, Charles A. Templeton, *ex-officio, President.*

James H. Webb, *Vice-President* ..... Hamden
George A. Hopson, *Secretary* ..... Mount Carmel
W. L. Slate, Jr., *Director and Treasurer* ..... New Haven
Joseph W. Alsop ..... Avon
Charles R. Treat ..... Orange
Elijah Rogers ..... Southington
Edward C. Schneider ..... Middletown

STAFF.

E. H. JENKINS, PH.D., *Director Emeritus.*

Administration.
W. L. SLATE, JR., B.SC., *Director and Treasurer.*
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MISS J. V. BERGER, *Stenographer and Bookkeeper.*
MISS MARY BRADLEY, *Secretary.*
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E. M. BAILEY, PH.D., *Chemist in Charge.*
R. E. ANDREW, M.A.
C. E. SHEPARD
OWEN L. NOLAN
HARRY J. FISHER, A.B.
} *Assistant Chemists.*
FRANK SHELDON, *Laboratory Assistant.*
V. L. CHURCHILL, *Sampling Agent.*
MISS MABEL BACON, *Stenographer.*

Biochemical Laboratory.
T. B. OSBORNE, PH.D., SC.D., *Chemist in Charge.*

Botany.
G. P. CLINTON, SC.D., *Botanist in Charge.*
E. M. STODDARD, B.S., *Pomologist.*
MISS FLORENCE A. MCCORMICK, PH.D., *Pathologist.*
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W. E. BRITTON, PH.D., *Entomologist in Charge; State Entomologist.*
B. H. WALDEN, B.AGR.
M. P. ZAPPE, B.S.
PHILIP GARMAN, PH.D.
} *Assistant Entomologists.*
JOHN T. ASHWORTH, *Deputy in Charge of Gipsy Moth Work.*
R. C. BOTSFORD, *Deputy in Charge of Mosquito Elimination.*
MISS GLADYS M. FINLEY, *Stenographer.*

Forestry.
WALTER O. FILLEY, *Forester in Charge.*
A. E. MOSS, M.F., *Assistant Forester.*
H. W. HICOCK, M.F., *Assistant Forester.*
MISS PAULINE A. MERCHANT, *Stenographer.*

Plant Breeding.
DONALD F. JONES, S.D., *Geneticist in Charge.*
P. C. MANGELSDORF, M.S., *Assistant.*

Soil Research.
M. F. MORGAN, M.S., *Investigator.*

Tobacco Sub-station at Windsor
C. M. SLAGG, M.S., *in Charge.*

TABLE OF CONTENTS.

ERRATA.

Page 55. *Delete* 3d line from bottom:

21336 Armour's Corn Grower, 2-8-4 ..... 2.73

Page 64. Table XVI. Sample No. **21336**, Armour's Corn Grower. The "Grade" should read 2-8-2 instead of 2-8-4. This brand substantially meets its guaranty and should be deleted from the Table of Deficient Brands, p. 55.

Report of the Board of Control
OF
THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

To His Excellency, Charles A. Templeton, Governor of Connecticut:

In accordance with Statute, the Board of Control of The Connecticut Agricultural Experiment Station herewith submits its annual report for the year ending October 31, 1923. The financial reports, however, cover the State fiscal year ending June 30, 1923.

The work of the Station for the year is discussed in detail in the Report of the Director (Bulletin 254) and the other reports and bulletins which are herewith submitted.

By far the most important event of the year has been the resignation of Dr. Jenkins. The following resolution was adopted by the Board and made a part of the permanent record:

"With great reluctance and sincere regret the Board accepts the resignation of Edward H. Jenkins, Ph.D., from the office of Director.

For nearly half a century Dr. Jenkins has been identified with the work of the Station, and has contributed invaluable services which have resulted in the position of distinction and esteem to which it has now attained.

Graduated from Yale College with the Class of 1872, Dr. Jenkins immediately began post-graduate studies under Professor Johnson, and after continuing his studies abroad received the degree of Ph.D. from Yale University in 1879.

Upon the establishment of the Station in 1877, with Professor Johnson as its first director, Dr. Jenkins was retained by him as his chief assistant, and in 1883 was appointed to the position of vice-director. In this latter position he soon became responsible for the work of the Station, as Professor's Johnson duties at the University, and later the infirmity of years, prevented him from devoting his entire activities to the work. Upon the retirement of Professor Johnson in 1900, Dr. Jenkins was appointed Director, and in 1902 was made Treasurer of the Station and of the Lockwood Fund.

The confidence and esteem which is now extended to the Station by the authorities and people of the State is in a very large degree due to the eminent personal qualities of the retiring director and to his wise and prudent administration of its affairs. It is no exaggeration to say that this institution stands to-day as a noble monument to the life work of Dr. Jenkins, to the upbuilding of which he has devoted talents of the highest order and the most faithful and distinguished service. He has deservedly won the grateful regard of the people he has served and the affection and esteem of all who have been associated with him as members of this Board or served with him upon the staff of the Station.

The Board was unable to persuade Dr. Jenkins to longer carry the duties of Director, and with great reluctance and in compliance with his most urgent solicitation has accepted his resignation and appointed him Director Emeritus. It is the earnest hope of his associates that he may be long spared to exercise a parental oversight over the affairs of the Station and to enjoy the rest and freedom he so richly deserves."

Respectfully submitted,

GEORGE A. HOPSON,
Secretary.

Report of the Treasurer

July 1, 1922—June 30, 1923

E. H. JENKINS, in account with THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION for the fiscal year ended June 30, 1923.

RECEIPTS.

Balance on hand, July 1, 1922:			
Analysis Fees		$6,224.70	
Miscellaneous Receipts		703.61	
			$6,928.31
State Appropriation (General)		$41,000.00	
" " (General) (Additions)		1,012.29	
" " (Food and Drug)		7,500.00	
" " (Insect Pest)		12,500.00	
" " (Insect Pest) (Additions)		525.34	
United States Appropriation (Hatch)		7,500.00	
" " " (Adams)		7,500.00	
Fertilizer Analysis Fees		12,000.00	
Lockwood Trust Income (including sales of Mount Carmel Farm Produce)		8,300.00	
		$97,837.63	
Miscellaneous Receipts:			
Connecticut State Department of Health (rent)	$200.00		
Sales of gasoline	312.37		
Sales of automobile oil	5.64		
Mileage for use of automobiles	66.16		
Miscellaneous	25.38		
Interest on Bank Deposits	212.74		
		822.29	
			$98,659.92
			$105,588.23
Less Miscellaneous Receipts Deposited with State Treasurer			1,299.82
			$104,288.41

DISBURSEMENTS.

Salaries	$52,226.37	
Labor	10,171.20	
Publications	378.25	
Postage	207.56	
Stationery	818.13	
Telephone and telegraph	241.84	
Freight and express	183.21	
Gas, electricity, etc	1,721.45	
Coal	2,311.20	
Water	96.70	
Chemicals	1,283.03	
Laboratory supplies	1,200.47	
Seeds, plants, etc	136.31	
Agricultural and Horticultural supplies	103.35	
Food samples	56.83	
Ice	66.95	
Photographic supplies	151.83	
Automobile oil	47.88	
Miscellaneous supplies	582.89	
Fertilizers	760.10	
Feeding stuffs	90.49	
Library (books and periodicals)	891.82	
Library (binding)	336.10	
Tools, machinery and appliances (new)	1,004.38	
Tools, machinery and appliances (repairs)	86.41	
Automobiles (new)	1,369.75	
Automobiles (repairs)	548.62	
Furniture and fixtures (new)	2,947.08	
Furniture and fixtures (repairs)	78.48	
Scientific apparatus (new)	1,379.23	
Scientific apparatus (repairs)	25.03	
Traveling by the Board	334.81	
Traveling by the staff	1,271.60	
Gasoline for automobiles	686.08	
Traveling in connection with Adams Fund investigations	26.49	
Insurance (fire, burglary and automobile)	763.25	
Insect Pest Appropriation to State Entomologist	13,025.34	
Contingent	431.25	
Buildings and land (new)	80.02	
Buildings and land (betterments)	3,183.01	
Buildings and land (repairs)	2,757.54	
Total disbursements		$104,062.33
Balance on hand, June 30, 1923 (Miscellaneous receipts)		226.08
		$104,288.41

NEW HAVEN, CONN., Oct. 18, 1923

This is to certify that we have audited the accounts of E. H. Jenkins, Treasurer of The Conn. Agr. Experiment Station for the fiscal year ending June 30th, 1923, and have found them correct.

WILLIAM P. BAILEY,
LEWIS W. PHELPS,
Auditors of Public Accounts.

REPORT OF
E. H. JENKINS, Director
IN ACCOUNT WITH
Mosquito Elimination Appropriation
For the year ended June 30, 1923

RECEIPTS.

Balance on hand, July 1, 1922 (Petty Cash Fund)	$500.00	
From State Comptroller, for vouchers sent by E. H. Jenkins, Director	7,732.71	
		$8,232.71

EXPENDITURES.

Salaries	$2,400.00	
Labor	4,115.99	
Stationery	60.17	
Telephone and telegraph	1.40	
Team and horse hire and carting	107.50	
Miscellaneous Supplies	77.75	
Oil for mosquitoes	164.00	
Automobile supplies	3.85	
Automobile oil	8.40	
Automobile repairs	167.22	
Tools, machinery and appliances (new purchases)	51.68	
Tools, machinery and appliances (repairs)	46.00	
Tile, lumber and cement	19.14	
Automobile insurance	16.46	
Travel	331.68	
Travel (gasoline for automobiles)	161.47	
Total		$7,732.71
Balance on hand, June 30, 1923 (Petty Cash Fund)		500.00
		$8,232.71

Of the total amount expended in the year as above ($7,732.71), there was spent for

Supervision		$3,314.23
*Maintenance:		
Madison	$382.25	
Guilford	502.25	
Branford	752.50	
East Haven	38.00	
New Haven	412.05	
West Haven	118.00	
Fairfield	1,848.58	
Groton	40.00	
Stamford	276.85	
Orange	48.00	
		4,418.48
		$7,732.71

* Of the expense of maintenance in the towns, three-quarters is to be paid by the towns, as follows: Madison, $286.69; Guilford, $376.68; Branford $564.38; East Haven, $28.50; New Haven, $309.04; West Haven, $88.50; Fairfield, $1,386.43; Groton, $30.00; Stamford, $207.64; Orange, $36.00. Total, $3,313.86.

BULLETIN 250 **NOVEMBER, 1923**

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

Fertilizer Report for 1923

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

CONTENTS.

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

November, 1923.

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Edward C. Schneider.....Middletown

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Miss J. V. Berger, *Stenographer and Bookkeeper.*
Miss Mary Bradley, *Secretary.*
William Veitch, *In charge of Buildings and Grounds.*

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M. F. Morgan, M.S., *Investigator.*

Tobacco Sub-station at Windsor.
C. M. Slagg, M.S., *in Charge.*

The Wilson H. Lee Co.

Report on Commercial Fertilizers, 1923.

E. M. Bailey, *Chemist in Charge, Analytical Laboratory.*

PROVISIONS OF THE FERTILIZER LAW.

The provisions of the fertilizer law as it affects dealers in commercial fertilizers in this State have been explained in previous bulletins of this Station and the text of the law may be found in Chapter 204 of the Public Acts of 1919. Certain points of interest and importance to both buyers and sellers of fertilizers may, however, be briefly restated.

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."

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.

The status of cottonseed meal under the fertilizer law has been clearly stated in a 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.

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

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

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 precentage 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 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 wlll 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 fertilizer 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."

The Station is called upon each year to analyze a large number of samples, drawn and submitted by individuals, representing fertilizers bought by them for their own use. The purpose of the sender is to find out whether the mixture contains the amounts of plant food which are guaranteed, and, if it does not, to secure evidence upon which to base a claim against the seller for the shortage. *It is, therefore, necessary that the sample be taken essentially in the way prescribed by law and in the presence of a witness so that there can be no question about the fairness of the sample.* The Station will supply to any applicant a form upon which the sender should give the necessary information and submit it with the sample. This makes the sample of public interest and value, which is the only justification for doing the work at State expense; and it is also the sender's protection in case the validity of the sample is questioned.

REGISTRATIONS.

Late Registrations for 1922.

To the brands registered for 1922 in our last report should be added:

Atlantic Packing Co., New Haven, Conn.
Dry Ground Fish

Marianna Cotton Oil Co., Inc., Memphis, Tenn.
White Mule Brand 36% Protein Cotton Seed Meal
White Mule Brand 41% Protein Cotton Seed Meal
White Mule Brand 43% Protein Cotton Seed Meal

Registrations for 1923.

For 1923, 61 individuals and firms registered at this Station for sale in this State 436 brands of fertilizers. As required by Statute the brands so registered are listed as follows:

American Agricultural Chemical Co., 2 Rector St., New York, N. Y.
Agrico Tobacco Manure
Castor Pomace
Complete Potato Mixture
Crescent Complete Manure
Double A Tobacco Fertilizer
Double Manure Salts

Dry Ground Fish, 8-6
Dry Ground Fish, 10-6
Fine Ground Bone
Fish and Potash
Five Four Three Tobacco Fertilizer
Grass and Lawn Top Dressing
Ground Tankage
High Grade Acid Phosphate
Muriate of Potash
Nitrate of Soda
Pulverized Sheep Manure
7% Potash Fertilizer
Sulphate of Ammonia
Sulphate of Potash
Universal Phosphate
Bradley's Complete Manure for Potatoes and Vegetables
Bradley's Complete Manure for Top Dressing Grass and Grain
Bradley's Complete Tobacco Manure
Bradley's Corn Phosphate
Bradley's Fish Compound
Bradley's New Method Fertilizer
Bradley's Potato Manure
Bradley's Potato Fertilizer
Bradley's Superior Tobacco Compound
Bradley's Valley Tobacco Fertilizer
Bradley's XL Superphosphate of Lime
Listers Celebrated Tobacco Fertilizer
Listers Complete Tobacco Manure
Listers Corn and Potato Fertilizer
Listers Eastern Pride Fertilizer
Listers Potato Manure
Listers Squirrel Brand Fertilizer
Listers Standard Pure Superphosphate of Lime
Listers Success Fertilizer
National Complete Tobacco Fertilizer
National Eureka Potato Fertilizer
National Market Garden Fertilizer
National Potato and Corn Phosphate
National Premier Truck Manure
National Special Tobacco
National Top Dressing Compound
National Universal Phosphate
National XXX Fish and Potash
National White Ash Tobacco Grower
Quinnipiac Climax Phosphate
Quinnipiac Corn Manure
Quinnipiac Fish and Potash Phosphate
Quinnipiac Market Garden Manure
Quinnipiac Phosphate
Quinnipiac Potato Phosphate
Quinnipiac Prime Tobacco Manure
Quinnipiac Seed Leaf Tobacco Manure
Quinnipiac Superior Top Dressing Manure
Quinnipiac Wrapper Leaf Brand Tobacco Manure
Wheeler's Ammoniated Fish Manure
Wheeler's Corn Fertilizer
Wheeler's Cuban Tobacco Grower
Wheeler's Early Market Compound
Wheeler's Potato Manure
Wheeler's Royal Wheat Grower
Wheeler's Universal Mixture

American Cotton Oil Co., 65 Broadway, New York, N. Y.

"Aco" Brand Cotton Seed Meal
Longhorn Brand Cotton Seed Meal
Surety Brand Cotton Seed Meal

Apothecaries Hall Co., Waterbury, Conn.

Acid Phosphate
Animal Tankage
Bone and Meat Tankage
Bone Meal
Castor Pomace
Fish
Liberty Corn, Fruit and All Crops
Liberty Fish, Bone and Potash
Liberty High Grade Market Gardeners
Liberty High Grade Tobacco Special
Liberty Market Gardeners Special
Liberty Tobacco Special
Liberty Top Dresser for Grass and Grain
Muriate Potash
Nitrate Potash
Nitrate Soda
Precipitated Bone
Sulphate Potash

Armour Fertilizer Works, 305 Broadway, New York, N. Y.

Armour's Big Crop Acid Phosphate 16%
Armour's Big Crop Fertilizer 8-6-6
Armour's Big Crop Fertilizer 5-8-5
Armour's Big Crop Fertilizer 5-8-7
Armour's Big Crop Fertilizer 4-8-4
Armour's Big Crop Fertilizer 4-6-10
Armour's Big Crop Fertilizer 3-8-4
Armour's Big Crop Fertilizer 2-12-2
Armour's Big Crop Tobacco Special 5-4-5
Armour's Corn Grower 2-8-2
Armour's Nitrate of Soda
Bone Meal 3-48
Ground Tankage 9-15
Muriate of Potash
Raw Bone Meal 4½-47
Sheep Manure

Ashcraft-Wilkinson Co., Trust Co. of Georgia Bldg., Atlanta, Ga.

Helmet Brand Prime Cotton Seed Meal
Monarch Brand Prime Cotton Seed Meal
Paramount Brand Good Cotton Seed Meal

Atlantic Grass Seed Co., Inc., 46 West Broadway, New York, N. Y.

Wonderlawn Grass Grower

Atlantic Packing Co., New Haven, Conn.

Atlantic 5-8-7
Atlantic 4-8-6
Atlantic Grain Fertilizer 2-8-2
Atlantic Potato Phosphate 3-8-4
Atlantic Special Vegetable 4-8-4
Atlantic Tobacco Grower 5-4-5
Atlantic Tobacco Manure 5-8-6

Baker Castor Oil Co., 120 Broadway, New York, N. Y.
Castor Pomace

Barrett Co., 40 Rector St., New York, N. Y.
Arcadian Sulphate of Ammonia

Berkshire Fertilizer Co., Bridgeport, Conn.
Acid Phosphate
Berkshire Ammoniated Bone Phosphate
Berkshire Complete Fertilizer
Berkshire Complete Tobacco
Berkshire 5-8-7
Berkshire Grass Special
Berkshire Market Garden
Berkshire Potato and Vegetable
Berkshire Tobacco Special
Berkshire Tobacco Starter
Castor Pomace
Double Manure Salts
Dry Ground Fish
Fine Ground Bone
Ground Sheep Manure
Muriate of Potash
Nitrate of Soda
Sulphate of Potash

Blish Hardware Co., F. T., South Manchester, Conn.
Complete Market Garden
Complete Tobacco Fertilizer
Potato Phosphate
Top Dressing for Grass

Boardman, F. E., Middletown, Conn.
Boardman's Fertilizer for Potatoes and General Crops
Boardman's Tobacco Fertilizer

Bowker Fertilizer Co., 60 Trinity Place, New York, N. Y.
Bowker's All Round Fertilizer
Bowker's Connecticut Valley Tobacco Fertilizer
Bowker's Corn, Grain and Grass Phosphate
Bowker's Fisherman's Brand Fish and Potash
Bowker's Market Garden Fertilizer
Bowker's Potato and Vegetable Phosphate
Bowker's 16% Acid Phosphate
Bowker's Square Brand Farm and Garden Phosphate
Bowker's Sure Crop Phosphate
Stockbridge Early Crop Manure
Stockbridge Potato and Vegetable Manure
Stockbridge Premier Tobacco Grower
Stockbridge Tobacco Manure
Stockbridge Top Dressing and Forcing Manure
Stockbridge Truck Manure

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

Brodé Corporation, F. W., 119 Madison Ave., Memphis, Tenn.
"Owl Brand 36%" Cotton Seed Meal
"Owl Brand 43%" High Grade Cotton Seed Meal

Buckeye Cotton Oil Co., Cincinnati, Ohio.
"Buckeye" Good Cotton Seed Meal Good Quality

Chittenden Co., E. D., Bridgeport, Conn.
Chittenden's Acid Phosphate
Chittenden's Castor Pomace
Chittenden's Complete Grain
Chittenden's Dry Ground Fish
Chittenden's Ground Bone 3-50
Chittenden's High Grade Tobacco
Chittenden's Nitrate of Soda
Chittenden's Potato Special 4% Potash
Chittenden's Potato Special 6% Potash
Chittenden's Tobacco Special

Clark Seed Co., Everett B., Milford, Conn.
Clark's 3-8-2
Clark's 4-8-4
Clark's Special Mixture with 6% Potash
Nitrate of Soda
Special Mixture Tip Top Brand
16% Acid Phosphate

Coe-Mortimer Co., 2 Rector St., New York, N. Y.
Country Club Golf and Lawn Fertilizer "Brand A"
Country Club Golf and Lawn Fertilizer "Brand B"
E. Frank Coe's Celebrated Special Potato Fertilizer
E. Frank Coe's Columbian Corn and Potato Fertilizer
E. Frank Coe's Connecticut Wrapper Grower
E. Frank Coe's Fish and Potash Guano
E. Frank Coe's Gold Brand Excelsior Guano
E. Frank Coe's New Englander Special
E. Frank Coe's Red Brand Excelsior Guano
E. Frank Coe's 16% Superphosphate
E. Frank Coe's Special Grass Top Dressing
E. Frank Coe's Standard Potato Fertilizer
E. Frank Coe's Sure Burn Tobacco Grower
E. Frank Coe's Tobacco Leaf Fertilizer

Connecticut Fat Rendering & Fertilizing Corp., West Haven, Conn.
Tankage

Consolidated Rendering Co., 40 North Market St., Boston, Mass.
Ground Bone (3-24)
Ground Bone (2.5-26)
High Grade Acid Phosphate
Muriate Potash
Nitrate Soda
Sulphate Ammonia
Sulphate Potash
Tankage 6-30
Tankage 9-20

Consumers Chemical Corporation, 120 Broadway, New York, N. Y.
Kainit
Nitrate of Soda

DuPont de Nemours & Co., E. I., Wilmington, Del.
Nitrate of Soda

Eastern States Farmers' Exchange, 292 Worthington St., Springfield, Mass.
Eastern States 2-8-2
Eastern States 4-8-4
Eastern States 4-8-7
Eastern States 3-12-3 No-Filler
Eastern States 5-8-7 No-Filler
Eastern States 5-10-5 No-Filler
Eastern States 7-8-3 No-Filler
Eastern States 16% Acid Phosphate
Eastern States Ground Tankage 7-15
Eastern States Muriate of Potash
Eastern States Nitrate of Soda
Eastern States Formula A
Eastern States Formula B
Eastern States Formula C

Essex Fertilizer Co., 39 North Market St., Boston, Mass.
Essex Fish Fertilizer for All Crops 3-8-4
Essex Market Garden for Potatoes, Roots and Vegetables 4-8-4
Essex Potato Phosphate for Potatoes and Vegetables 4-8-7
Essex 2-8-2 for Farm and Garden
Essex 4-6-10 for Potatoes and Vegetables
Essex Tobacco Manure 5-4-5
Essex Tobacco Manure 5-8-6

Frisbie Co., L. T., New Haven, Conn.
Castor Pomace
Dry Ground Fish
Frisbie's Bone Meal
Frisbie's Corn and Grain Fertilizer 2-8-2
Frisbie's 5-8-7
Frisbie's 5-10-5
Frisbie's Market Garden 4-8-6
Frisbie's Special 3-8-4
Frisbie's Special Vegetable and Potato Grower 4-8-4
Frisbie's Tobacco Grower 5-4-5
Frisbie's Tobacco Manure 5-8-6
Frisbie's Top Dresser 7-5-4

Humphreys-Godwin Co., Inc., Memphis, Tenn.
Bull Brand Cotton Seed Meal.
Danish Brand Cotton Seed Feed
Dixie Brand Cotton Seed Meal

International Agricultural Corporation (Buffalo Fertilizer Works), 126 State St., Boston, Mass.
Buffalo Complete Tobacco
Buffalo Economy
Buffalo High Grade Manure
Buffalo New England Special
Buffalo Tobacco Producer
Buffalo Top Dresser and Starter

Jones Phosphate Co., Robin, Nashville, Tenn.
Ground Rock Phosphate

Joynt, John, Lucknow, Ontario, Canada
The Joynt Brand Canada Unleached Hardwood Ashes

Lovitt & Co., L. B., Memphis, Tenn.
"Lovitt Brand" Cotton Seed Meal
"Neal's Choice" Cotton Seed Meal
"Thirty-Six Brand" Cotton Seed Meal

Lowell Fertilizer Company, 40 North Market St., Boston, Mass.
Lowell Animal Brand 3-8-4
Lowell Bone Fertilizer 2-8-2 for Corn, Grain, Grass and Vegetables
Lowell 5-8-7 for Potatoes and Vegetables
Lowell 4-8-4 for Potatoes, Corn and Vegetables
Lowell 4-6-10 for Potatoes and Vegetables
Lowell Tobacco 5-4-5 for Tobacco, Fruits and Vines
Lowell Tobacco Manure 5-8-6
Lowell Potato Phosphate for Potatoes and Vegetables 4-8-7
Lowell Top Dressing 7-5-2

Mapes Formula & Peruvian Guano Co., 143 Liberty St., New York, N. Y.
The Mapes Connecticut Valley Special
The Mapes Corn Manure
The Mapes C. S. Tobacco Manure
The Mapes General Tobacco Manure
The Mapes General Truck Manure
The Mapes General Use Manure
The Mapes Grain Brand
The Mapes Onion Manure
The Mapes Potato Manure
The Mapes Tobacco Ash Constituents
The Mapes Tobacco Manure Wrapper Brand
The Mapes Tobacco Starter Improved
The Mapes Top Dresser

Marianna Sales Co., Falls Building, Memphis, Tenn.
White Mule Brand 36% protein Cottonseed Meal
White Mule Brand 41% protein Cottonseed Meal
White Mule Brand 43% protein Cottonseed Meal

Meech & Stoddard, Inc., Middletown, Conn.
Bixota 5-8-7
Bixota 4-8-4
Bixota 3-8-3
Bixota 2-8-2

Mitchell, Walter L., 699 Forest St., New Haven, Conn.
Mitchell's 16% Acid Phosphate
Mitchell's Phosphoflour
Mitchell's Two-Speed Phosphate

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

Nature's Plant Food Company of Maine, 43 Commercial St., Boston, Mass.
Nature's Plant Food

Neal & Company, Inc., R. N., Memphis, Tenn.
"Triangle" 41% Cottonseed Meal

New England Fertilizer Company, 40A North Market St., Boston, Mass.
New England Corn Phosphate 2-8-2 for Grain and Vegetables
New England 4-8-4 for Potatoes and Vegetables
New England Superphosphate 3-8-4
New England Potato Phosphate 4-8-7 for Potatoes and Vegetables
New England Tobacco 5-4-5 for Tobacco, Fruits and Vines
New England Tobacco Manure 5-8-6
New England 2-8-3 for Vegetables and Grain

Nitrate Agencies Company, 85 Water St., New York, N. Y.
Naco Brand Acid Phosphate
Naco Brand Castor Pomace
Naco Brand Fish
Naco Brand Muriate of Potash
Naco Brand Nitrapo
Naco Brand Nitrate of Soda
Naco Brand Number 7
Naco Brand Number 12 Peruvian Guano Mixture
Naco Brand Number 14 Peruvian Guano Mixture
Naco Brand Number 19 Peruvian Guano Mixture
Naco Brand Number 24 Peruvian Guano Mixture
Naco Brand Peruvian Guano
Naco Brand Raw Bone
Naco Brand Steamed Bone
Naco Brand Sulphate of Ammonia
Naco Brand Sulphate of Potash
Naco Brand Tankage

Nothern, W. C., Box 414, Memphis, Tenn.
Bee Brand Cottonseed Meal

Olds & Whipple, Inc., Hartford, Conn.
Double Manure Salts
High Grade Sulphate of Potash
Nitrate of Soda
O & W Acid Phosphate
O & W Bone Phosphate and Potash Compound
O & W Castor Pomace
O & W Complete Corn, Onion and Potato Fertilizer
O & W Complete Corn, Potato and Onion Fertilizer
O & W Complete Tobacco Fertilizer
O & W Dry Ground Fish
O & W Fish and Potash
O & W H G Starter and Potash Compound
O & W High Grade Potato Fertilizer
O & W High Grade Tobacco Starter
O & W Precipitated Bone
O & W Pure Bone Meal
O & W Top Dressing
Sulphate of Ammonia

Pacific Manure & Fertilizer Company, 429 Davis St., San Francisco, Cal.
Groz-It Brand Pulverized Sheep Manure

Parmenter & Polsey Fertilizer Company, 41 North Market St., Boston, Mass.
Parmenter & Polsey 5-4-5 for Tobacco, Fruit and Vines
Parmenter & Polsey 4-8-4 for Potatoes, Corn and Vegetables
Parmenter & Polsey Plymouth Rock Brand 3-8-4 for all Crops
Parmenter & Polsey Potato Phosphate for Potatoes and Vegetables 4-8-7
Parmenter & Polsey 2-8-2 for Farm and Garden

Phoenix Cotton Oil Co., Memphis, Tenn.
Phoenix 36% protein Cotton Seed Meal
Phoenix 41% protein Cotton Seed Meal
Phoenix 43% protein Cotton Seed Meal

Platt Company, The Frank S., New Haven, Conn.
Platco Special 4-8-6

Potash-Marl, Inc., 15 East 40th St., New York, N. Y.
Potash-Marl

Premier Poultry Manure Company, 431 So. Dearborn St., Chicago, Ill.
Premier Brand Pulverized Poultry Manure.

Pulverized Manure Company, 828 Exchange Ave., Union Stock Yards, Chicago, Ill.
Wizard Brand Manure
Wizard Brand Sheep Manure

Rogers & Hubbard Company, The, Portland, Conn.
Acid Phosphate
Castor Pomace
Cotton Seed Meal
Garden Fertilizer
Ground Fish
Hubbard's "Bone Base" Fertilizer for Oats and Top Dressing
Hubbard's "Bone Base" Fertilizer for Seeding Down
Hubbard's "Bone Base" Soluble Corn and General Crops Manure
Hubbard's "Bone Base" Soluble Potato Manure
Hubbard's Pure Raw Knuckle Bone Flour
Hubbard's Strictly Pure Fine Bone
Nitrate of Soda
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 Soluble Tobacco Manure
Rogers & Hubbard's Tobacco Grower, Vegetable Formula
Sulphate of Ammonia
Sulphate of Potash

Royster Guano Company, F. S., 1604 Munsey Building, Baltimore, Md.
Dry Ground Fish
Muriate of Potash
Nitrate of Soda
Royster's Bully Guano
Royster's Fine Ground Bone Meal
Royster's Fish, Flesh and Fowl

Royster's Pure Raw Bone Meal
Royster's Quality Trucker
Royster's 16% Acid Phosphate
Royster's Top Dresser
Royster's Trucker's Delight
Royster's Valley Tobacco Formula
Sulphate of Potash

Sanderson Fertilizer & Chemical Co., New Haven, Conn.

Sanderson's Acid Phosphate
Sanderson's Atlantic Coast Bone, Fish and Potash
Sanderson's Castor Pomace
Sanderson's Complete Tobacco Grower
Sanderson's Corn Superphosphate
Sanderson's Dry Ground Fish
Sanderson's Fine Ground Bone
Sanderson's Formula A
Sanderson's Formula B
Sanderson's Kelsey's Bone, Fish and Potash
Sanderson's Nitrate of Soda
Sanderson's Potato Manure
Sanderson's South American Sheep and Goat Manure
Sanderson's Tobacco Grower
Sanderson's Top Dressing for Grass and Grain

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

Swift-Sure Bone Meal
Swift-Sure Cotton Seed Mixture
Swift-Sure Super Phosphate Crop Grower
Swift-Sure Super Phosphate Potato No. 1
Swift-Sure Super Phosphate Tobacco and General Use
Swift-Sure Super Phosphate Tobacco Starter

Springfield Rendering Company, Springfield, Mass.

Springfield Animal Brand, 3-8-4
Springfield 4-8-6
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

Virginia-Carolina Chemical Company, 120 Broadway, New York, N. Y.

V-C Aroostook Potato Grower
V-C Champion Brand
V-C Double Owl Brand
V-C Eureka Brand
V-C Fish, Phosphate and Potash Brand
V-C Indian Chief Brand
V-C Olympic Brand
V-C Owl Brand
V-C Perfection Brand
V-C Plymouth Brand
V-C Royal Brand
V-C Tip Top Brand
V-C Universal Brand

Westervelt & Co., A. C., Memphis, Tenn.

Sun Brand Cottonseed Meal

Whitman & Pratt Rendering Co., Boston, Mass.

Whitman & Pratt's 4-8-4 Brand

Wilcox Fertilizer Company, Mystic, Conn.

Wilcox Acid Phosphate
Wilcox Corn Special
Wilcox Dry Ground Fish
Wilcox Fish and Potash
Wilcox 5-8-7 Fertilizer
Wilcox 4-8-4 Fertilizer
Wilcox Grass and Truck Fertilizer
Wilcox Ground Packing-House Tankage
Wilcox Ground Steamed Bone
Wilcox Nitrate of Soda
Wilcox Potato and Vegetable Phosphate
Wilcox Tobacco Special

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

"Woodruff's Home Mixed"

Worcester Rendering Company, Auburn, Mass.

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

INSPECTION OF 1923.

During the year, Mr. Churchill, the sampling agent of the Station, has visited 93 towns and villages in the State and has taken 548 official samples of fertilizers which number includes all the registered brands which were found on sale. These together with samples submitted by purchasers or others interested may be classified as follows:

CLASSIFICATION OF FERTILIZERS ANALYZED.

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA.

Twenty-four samples were examined and results are given in Table I.

Chemically pure nitrate of soda contains 16.47 per cent. of nitrogen but commercial nitrate of soda or "Chili saltpeter" contains from 15 to 16 per cent. which is equivalent to 91 to 97 per cent. nitrate of soda. The impurities in the commercial article are chiefly common salt and water. Plants respond quickly to nitrogen in this form because it is directly assimilable. The residue which nitrate of soda leaves in the soil is alkaline.

At the prices quoted for this material, nitrogen has cost from 17.2 cents to 24.4 cents per pound, the average cost being 20.6 cents.

SULPHATE OF AMMONIA.

Nine samples were analyzed and the results are given in Table II.

21235. Sold by Apothecaries Hall Co., Waterbury. Sent by Hatheway & Steane, Hartford.

20972. Sold by The Barrett Co., New York. Sent by Hatheway & Steane, Hartford.

21175. Sold by The Barrett Co., New York. Sent by Berkshire Fertilizer Co., Bridgeport.

21276. Sold by American Agricultural Chemical Co., New York. Stock of M. H. Edwards, Collinsville.

21056. Sold by Olds & Whipple, Inc., Hartford. Stock of Harold M. Newberry, East Windsor Hill.

21427. Sold by Olds & Whipple, Inc., Hartford. Sampled at the factory.

20883. Sold by The Barrett Co., New York. Sent by Hatheway & Steane, Hartford.

20922. Sold by Consolidated Rendering Co., Boston. Sampled at the factory, New Haven.

21463. Sold by The Rogers & Hubbard Co., Portland. Sampled at the factory.

TABLE I. ANALYSES OF NITRATE OF SODA.

Station No.	Manufacturer or Jobber.	Purchased, Sampled or Sent by	Per cent Nitrogen. Guaranteed.	Per cent Nitrogen. Found.	Cost per ton.	Nitrogen costs cents per pound.
20450	W. L. Grace Co., New York	American Sumatra Tobacco Co., Bloomfield	15.00	15.96	....	....
20451	W. L. Grace Co., New York	American Sumatra Tobbaco Co., Bloomfield	15.00	15.98	....	....
20452	W. L. Grace Co., New York	American Sumatra Tobacco Co., Bloomfield	15.00	16.00	....	....
21031	Apothecaries Hall Co., Waterbury	J. E. Shepard, So. Windsor	15.00	15.54	$56.50	18.2
21159	L.T. Frisbie, New Haven	A. E. Plant Sons Co., Branford	15.63	15.64	59.00	18.9
20951	Sanderson Fertilizer and Chemical Co., New Haven	Station Agent at the factory	15.00	15.54	59.47	19.1
21250	Manufacturer unknown.	Walter T. Clark, County Agent, Norwich	....	15.40	59.50	19.3
20906	Berkshire Fertilizer Co., Bridgeport	Station Agent at the factory	14.80	15.78	62.00	19.6
20956	Apothecaries Hall Co., Waterbury	Conn. School for Boys, Meriden	15.00	15.54	61.00	19.6
21279	E. B. Clark Seed Co., Milford	Station Agent at the factory	....	15.38	62.00	20.2
20936	The Rogers & Hubbard Co., Portland	Station Agent at the factory	15.00	15.92	65.00	20.4
21243	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	....	15.92	66.50	20.9
20942	Olds & Whipple, Inc., Hartford	Station Agent at the factory	15.00	15.44	66.50	21.5
21004	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	15.00	15.44	66.50	21.5
21300	Eastern States Farmers' Exchange, Springfield.	C. M. Beeman, Granby	14.80	14.96	66.55	22.2
21474	F. S. Royster Guano Co., Baltimore	Plumb Bros., Waterbury	15.00	15.62	70.00	22.4
21286	E. D. Chittenden Co., Bridgeport	J. E. Stoddard, Abington	15.00	15.52	70.00	22.5
20908	Apothecaries Hall Co., Waterbury	Station Agent at the factory	15.00	15.08	70.00	23.2
21540	Consumers Chemical Corp., New York	E. O. Chapman, No. Haven	14.80	15.48	73.00	23.6

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

Station No.	Manufacturer or Jobber.	Purchased, Sampled or Sent by	Per cent Nitrogen. Guaranteed.	Per cent Nitrogen. Found.	Cost per ton.	Nitrogen costs cents per pound.
21147	American Agricultural Chemical Co., New York	Bristol Grain & Supply Co., Bristol	15.00	15.60	$75.00	24.0
21169	Armour Fertilizer Works, New York	John O. Fox, Putnam	14.81	15.18	74.00	24.4
20918	Manufacturer unknown.	The Meriden Farmers' Exchange, Meriden	....	15.29	....	....
20923	Consolidated Rendering Co., Boston	Station Agent at the factory, New Haven	15.50	15.20	....	....
21119	Wilcox Fertilizer Co., Mystic	Station Agent at the factory	15.00	15.36	....	....

TABLE II. ANALYSES OF SULPHATE OF AMMONIA.

Station No.	Per Cent of Nitrogen Guaranteed.	Per Cent of Nitrogen Found.	Cost per ton.	Nitrogen costs cents per pound.
21235	....	21.00	$70.00	16.7
20972	....	20.78	70.00	16.8
21175	20.75	21.00	80.00	19.0
21276	20.16	20.60	80.00	19.4
21056	20.56	20.92	83.60	20.0
21427	20.56	20.78	83.60	20.1
20883	20.75	21.00	....	...
20922	20.50	20.56	....	...
21463	20.50	20.54	....	...

Pure ammonium sulphate contains 21.2 per cent of nitrogen, but the article of commerce usually contains about 20.5 per cent. Four of the samples examined this year were of a high degree of purity containing, or closely approaching, 21 per cent.

Like nitrate of soda, ammonium sulphate is readily soluble in water and quickly diffuses through the soil. Since it does not leach out from the soil so rapidly as does nitrate of soda and because its assimilation by plants is somewhat slower it has an advantage over nitrate of soda in wet seasons and it sustains growth over a longer period.

Prices, so far as quoted to us, ranged from $70 to $83.60 per ton making the cost of nitrogen per pound from 16.7 cents to 20.1 cents the average being 18.7 cents.

CASTOR POMACE.

Seventy-one samples have been analyzed and results are given in Table III.

Castor pomace is the residue left after extracting the oil from the castor bean. Live stock will eat the pomace greedily and since it contains a deadly poison care should be taken not to store it where it will be accessible to farm animals.

This material has been used in increasing quantities in the last two years as a source of organic nitrogen in mixed fertilizers as a supplement to cottonseed meal. It contains from 4.5 to 5.5 per cent of nitrogen the availability of which is about equal to that of dried blood and cottonseed meal. Besides nitrogen, it contains on the average about 1 per cent of potash (K_2O), and 2 per cent of phosphoric acid (P_2O_5), the latter largely or entirely available.

The average nitrogen content of samples analyzed during the past year is 5.1 per cent and the average ton price, so far as prices are recorded with us confidentially or otherwise, is $34.51. *Thus the cost of nitrogen per pound in this material has been 33.8 cents, no allowance being made for the phosphoric acid and potash which it contains.*

COTTONSEED MEAL.

The standard commercial grades of cottonseed meals used for feeding purposes, and the grades chiefly sold for fertilizer, are guaranteed as follows:

36 per cent protein containing *5.76 per cent nitrogen* equivalent to *7.00 per cent ammonia.*

41 per cent protein containing *6.56 per cent nitrogen* equivalent to *8.00 per cent ammonia.*

43 per cent protein containing *6.88 per cent nitrogen* equivalent to *8.3 per cent ammonia.*

One hundred and seventy-nine samples of cottonseed meal have been analyzed and results are given in Table V. These samples belong largely to the three groups just named. Three have odd guaranties and in twelve cases no statement of guaranty could be secured.

Information as to prices was not afforded in some cases and in others it was confidential, but the cost per pound of nitrogen has been calculated based upon the average of such ton prices as were quoted to us whether confidentially or otherwise.

Samples which failed to meet their guaranties by more than 0.1 per cent of nitrogen (equivalent to 0.63 per cent of protein), are noted in the subjoined summary as deficient. If a tolerance of 1 per cent protein (0.16 per cent nitrogen), is allowed the number of deficient samples is somewhat reduced viz. to 29.

These data appear in summary form in Table IV.

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.	Cost per ton.
	The American Agricultural Chemical Co., New York City.				
20996	.....	Station Agent from Geo. S. Phelps & Co., Thompsonville.....	4.99	4.53	$39.00
	Apothecaries Hall Co., Waterbury, Conn.				
20772	N. Y., N. H. & H. R. R. 75598.....	Spencer Bros., Inc., Suffield..	5.11	4.52	34.00
20773	48664.....	Spencer Bros., Inc., Suffield..	4.88	4.52	34.00
20855	33443.....	Hatheway & Steane, Hartford	5.72	4.52	31.75
20856	67113.....	Hatheway & Steane, Hartford	4.88	4.52	31.75
20881	516550.....	Hatheway & Steane, Hartford	5.27	4.52	.....
20882	51578.....	Hatheway & Steane, Hartford	5.79	4.52	.....
20899	P. & R. 16482.....	Spencer Bros., Inc., Suffield..	5.10	4.52	34.00
20900	L. & N. 95777.....	Spencer Bros., Inc., Suffield..	4.57	4.52	34.00
20973	101264.....	Hatheway & Steane, Hartford	5.24	4.52	31.75
21041	.....	Station Agent from J. P. Norton, Broad Brook.....	4.70	4.52	32.50
	Baker Castor Oil Co., New York City.				
20442	534799.....	American Sumatra Tobacco Co., Bloomfield.....	4.33	4.52	.....
20443	87488.....	American Sumatra Tobbaco Co., Bloomfield.....	5.91	4.52	.....
20444	561220.....	American Sumatra Tobbaco Co., Bloomfield.....	4.84	4.52	.....
20445	3511.....	American Sumatra Tobacco Co., Bloomfield.....	4.95	4.52	.....
20446	160747.....	American Sumatra Tobacco Co., Bloomfield.....	5.95	4.52	.....
20447	28397.....	American Sumatra Tobacco Co., Bloomfield.....	6.30	4.52	.....
20448	303027.....	American Sumatra Tobacco Co., Bloomfield.....	5.15	4.52	.....
20449	20267.....	American Sumatra Tobacco Co., Bloomfield.....	5.62	4.52	.....
20517	90623.....	American Sumatra Tobacco Co., Bloomfield.....	4.88	4.52	.....
20518	556528.....	American Sumatra Tobacco Co., Bloomfield.....	4.96	4.52	.....
20519	22130.....	American Sumatra Tobacco Co., Bloomfield.....	4.79	4.52	.....

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.	Cost per ton.
	Baker Castor Oil Co.				
20520	61212	American Sumatra Tobacco Co., Bloomfield	5.03	4.52	.....
20521	10154	American Sumatra Tobacco Co., Bloomfield	4.98	4.52	.....
20522	19928	American Sumatra Tobacco Co., Bloomfield	4.90	4.52	.....
20523	153529	American Sumatra Tobacco Co., Bloomfield	5.19	4.52	.....
20524	74483	American Sumatra Tobacco Co., Bloomfield	5.18	4.52	.....
20593	81821	American Sumatra Tobacco Co., Bloomfield	4.96	....	.....
20594	48966	American Sumatra Tobacco Co., Bloomfield	5.17	....	.....
20595	34679	American Sumatra Tobacco Co., Bloomfield	5.18	....	.....
20596	40277	American Sumatra Tobacco Co., Bloomfield	5.68	....	.....
20597	535120	American Sumatra Tobacco Co., Bloomfield	5.10	....	.....
20598	88536	American Sumatra Tobacco Co., Bloomfield	5.29	....	.....
20599	83939	American Sumatra Tobacco Co., Bloomfield	5.38	....	.....
20646	.....	American Sumatra Tobacco Co., Bloomfield	5.12	....	.....
20658	534842	American Sumatra Tobacco Co., Bloomfield	5.16	4.52	.....
20679	22834	American Sumatra Tobacco Co., Bloomfield	5.36	4.52	.....
20680	14609	American Sumatra Tobacco Co., Bloomfield	4.68	....	.....
20752	85576	American Sumatra Tobacco Co., Bloomfield	5.12	4.52	.....
20753	76289	American Sumatra Tobacco Co., Bloomfield	5.10	4.52	.....
20754	14285	American Sumatra Tobacco Co., Bloomfield	5.14	4.52	.....
20755	7568	American Sumatra Tobacco Co., Bloomfield	5.08	4.52	.....
20756	83221	American Sumatra Tobacco Co., Bloomfield	4.46	4.52	.....
20784	13931	American Sumatra Tobacco Co., Bloomfield	4.55	4.52	.....
20997	.....	Station Agent from E. J. Bantle, Glastonbury	4.44	4.50	$37.00

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.	Cost per ton.
	Baker Castor Oil Co.				
21033	549580	Station Agent from J. E. Shepard, South Windsor	4.99	4.50	$31.00
21034	114242	Station Agent from J. E. Shepard, South Windsor	4.86	4.50	31.00
21035	41436	Station Agent from J. E. Shepard, South Windsor	4.80	4.50	31.00
	Berkshire Fertilizer Co., Bridgeport.				
20713	32002	Station Agent from J. E. Shepard, South Windsor	5.04	....	34.20
21358	.....	Station Agent from Paul Rostek, Melrose	4.99	5.00	38.00
	E. D. Chittenden Co., Bridgeport.				
21199	.....	Station Agent from E. J. Bantle, Glastonbury	5.50	4.50	36.00
	L. T. Frisbie Co., New Haven, Conn.				
20926	.....	Station Agent from factory	5.28	4.52	.....
	Olds & Whipple, Inc., Hartford, Conn.				
20867	N. Y. C. 257636	J. E. Shepard, South Windsor	4.54	4.50	32.40
20889	537458 and 560869	Clark Bros., Windsor	5.00	4.94	.....
20897	P. R. R. 549580	J. E. Shepard, South Windsor	4.18	4.50	.....
20934	P. R. R. 558771	Daly Bros., Warehouse Pt.	5.60	4.50	33.00
20981	20629	J. E. Shepard, South Windsor	5.14	4.50	31.00
20982	561351	J. E. Shepard, South Windsor	4.90	4.50	31.00
20983	92785	J. E. Shepard, South Windsor	5.03	4.50	31.00
20984	41703	J. E. Shepard, South Windsor	5.40	4.50	31.00
21006	.....	Harold M. Newberry, East Windsor Hill	5.21	4.94	36.10
21058	.....	Harold M. Newberry, East Windsor Hill	5.10	4.94	36.10
21076	122078	J. E. Shepard, South Windsor	4.99	4.94	31.00
21077	31265	J. E. Shepard, South Windsor	4.78	4.94	31.00
21213	.....	L. Wetstone, Hartford	5.62	4.94	36.00
21214	.....	L. Wetstone, Hartford	5.83	4.94	36.00
21244	.....	Harold M. Newberry, East Windsor Hill	5.06	4.94	34.20
21425	.....	Station Agent from W. H. Carrier, Glastonbury	5.70	4.94	36.00

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.	Cost per ton.
	The Rogers & Hubbard Co., Portland.				
20937	.....	Station Agent from factory...	4.84	5.10	$38.00
	Sanderson Fertilizer & Chemical Co., New Haven, Conn.				
20952	.....	Station Agent from factory...	5.05	4.53	32.94
	Manufacturer unknown				
20692	13042.....	Conn. Sumatra Tobacco, Buckland.....	4.40	....	.....
21411	.....	J. Stuart Halpine, Burnside..	5.16	....	.....

TABLE IV. SUMMARY OF DATA ON COTTONSEED MEAL.

GROUP.	Number of Samples.	Number Deficient.	Average Nitrogen %	Average Cost per Ton.	Average Cost of Nitrogen, cents per Pound.
36 per cent (5.76 N)	16	2	5.84	$52.46[1]	44.9
41 per cent (6.56 N)	125	32	6.58	44.33[2]	33.7
43 per cent (6.88 N)	23	4	6.83	56.73[3]	41.5
Odd per cent	3	0	...	....	...
No guaranty	12	..	...	....	...
Totals and averages	179	38	6.53	$51.88[4]	39.7

During the past year the 41 per cent protein meal has been the one chiefly sold and nitrogen has been purchased at the best advantage in this grade. Again it will be noted that nitrogen has cost most in the lowest grade product. The average nitrogen content of all the samples examined is close to the guaranty for the medium grade.

[1] Based on 15 quotations.
[2] Based on 89 quotations.
[3] Based on 21 quotations.
[4] Based on 128 quotations.

TABLE V. ANALYSES OF COTTONSEED MEAL.

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	American Cotton Oil Co., Atlanta, Ga.				
20871	Aco. 202054.....	Hatheway & Steane, Hartford	6.85	6.59	.....
20872	Aco. 31401.....	Hatheway & Steane, Hartford	6.53	6.59	.....
20873	Aco. 30394.....	Hatheway & Steane, Hartford	7.08	6.59	.....
20875	Aco. 35614.....	Hatheway & Steane, Hartford	6.84	6.59	.....
20970	Aco. 54850.....	Hatheway & Steane, Hartford	6.78	6.59	$55.75
20887	Longhorn, 150715.....	Clark Bros., Windsor.....	7.04	6.88	.....
20888	Longhorn, 508164.....	Clark Bros., Windsor.....	7.03	6.88	.....
20467	Surety P. A. 22747.....	The Coles Co., Middletown..	5.98	5.75	60.00
20513	Surety. P. R. R. 52412.	The Coles Co., Middletown..	5.80	5.75	60.00
21519	Surety. N. C. & St. L., 3166.....	The Coles Co., Middletown..	5.81	5.75	50.00
	Ashcraft-Wilkinson Co., Atlanta, Ga.				
20573	Paramount. N. Y. C., 217460.....	The Coles Co., Middletown..	6.00	5.76	60.00
21405	Paramount. 4577.....	Geo. S. Phelps & Co., Thompsonville.....	5.70	5.76	48.15
21406	Paramount. 90630.....	Geo. S. Phelps & Co., Thompsonville.....	5.81	5.76	48.15
21407	Paramount. 97602.....	Geo. S. Phelps & Co., Thompsonville.....	5.90	5.76	48.15
21502	Paramount.....	Station Agent from Geo. S. Phelps & Co., Thompsonville.....	6.03	5.76	52.00
	F. W. Brodé Corp. Memphis, Tenn.				
21509	Owl Brand 36 per cent..	Station Agent from Bristol Grain & Supply Co., Bristol	5.42	5.75	55.00
21516	Owl Brand 43 per cent..	Station Agent from C. M. Beeman, Granby.....	6.84	6.70	60.90
	Buckeye Cotton Oil Co., Cincinnati, Ohio.				
21510	Buckeye Good C. S. Meal.....	Station Agent from G. S. Phelps & Co., Thompsonville.....	5.69	5.76	52.00
	Eastern Cotton Oil Co., Elizabeth City, N. C.				
21215	Ideal.....	L. Wetstone, Hartford.....	6.35	6.88	57.00

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen		Cost per ton.
			Found.	Guaranteed.	
	Humphreys-Godwin Co., Memphis, Tenn.				
20527	Bee. 31758	American Sumatra Tobacco Co., Bloomfield	6.76	6.58	.....
20531	Bee. 42022	American Sumatra Tobacco Co., Bloomfield	6.56	6.58	.....
20532	Bee. 32442	American Sumatra Tobacco Co., Bloomfield	6.65	6.58	.....
20533	Bee. 304470	American Sumatra Tobacco Co., Bloomfield	7.16	6.58	.....
20552	Bee. 173150	American Sumatra Tobacco Co., Bloomfield	6.95	6.58	.....
20556	Bee. 76518	American Sumatra Tobacco Co., Bloomfield	6.58	6.58	.....
20563	Bee. 31758	American Sumatra Tobacco Co., Bloomfield	6.82	6.58	.....
20592	Bee. 11031	American Sumatra Tobacco Co., Bloomfield	6.60	6.58	.....
20641	Bee. 34277	American Sumatra Tobacco Co., Bloomfield	6.84	6.58	.....
20839	Bull. C.B.&J. 134035	Spencer Bros., Inc., Suffield	7.00	6.87	$59.00
20840	Bull. M. P. 27424	Spencer Bros., Inc., Suffield	6.95	6.87	59.00
20898	Bull. N.& W. 120204	Spencer Bros., Inc., Suffield	6.92	6.87	57.00
21005	Bull	Harold M. Newberry, East Windsor Hill	6.89	6.87	56.50
21053	Bull. N. Y. C. 252455	Spencer Bros., Inc., Suffield	6.83	6.87	59.00
21057	Bull	Harold M. Newberry, East Windsor Hill	6.38	6.87	56.50
21072	Bull. M. C. 94575	Henry Adams & Son, Suffield	7.15	6.87	57.00
21513	Bull	Station Agent from Geo. T. Soule, New Milford	7.00	6.87	60.00
21508	Danish	Station Agent from A.E.Hall, Wallingford	6.32	5.75	50.00
20528	Dixie, 39334	American Sumatra Tobacco Co., Bloomfield	6.84	6.56	.....
20529	Dixie, 120253	American Sumatra Tobacco Co., Bloomfield	6.46	6.56	.....
20530	Dixie, 40082	American Sumatra Tobacco Co., Bloomfield	5.96	6.56	.....
20551	Dixie, 48634	American Sumatra Tobacco Co., Bloomfield	6.44	6.56	.....
20553	Dixie, 34042	American Sumatra Tobacco Co., Bloomfield	6.65	6.56	.....
20554	Dixie, 174396	American Sumatra Tobacco Co., Bloomfield	6.28	6.56	.....
20555	Dixie, 302401	American Sumatra Tobacco Co., Bloomfield	6.59	6.56	.....
20557	Dixie, 1574	American Sumatra Tobacco Co., Bloomfield	6.28	6.56	.....

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen.		Cost per ton.
			Found.	Guaranteed.	
	Humphreys-Godwin Co., Memphis, Tenn.				
20558	Dixie, 2673	American Sumatra Tobacco Co., Bloomfield	6.58	6.56	.....
20559	Dixie, 20228	American Sumatra Tobacco Co., Bloomfield	6.67	6.56	.....
20560	Dixie, 866	American Sumatra Tobacco Co., Bloomfield	6.29	6.56	.....
20561	Dixie, 85231	American Sumatra Tobacco Co., Bloomfield	6.53	6.56	.....
20562	Dixie, 26101	American Sumatra Tobacco Co., Bloomfield	6.14	6.56	.....
20576	Dixie, 19903	American Sumatra Tobacco Co., Bloomfield	6.62	6.56	.....
20579	Dixie, 21873	American Sumatra Tobacco Co., Bloomfield	6.56	6.56	.....
20580	Dixie, 12006	American Sumatra Tobacco Co., Bloomfield	6.84	6.56	.....
20582	Dixie, 28527	American Sumatra Tobacco Co., Bloomfield	6.50	6.56	.....
20585	Dixie, 29824	American Sumatra Tobacco Co., Bloomfield	6.59	6.56	.....
20586	Dixie, 563728	American Sumatra Tobacco Co., Bloomfield	6.80	6.56	.....
20588	Dixie, 256339	American Sumatra Tobacco Co., Bloomfield	6.44	6.56	.....
20589	Dixie, 29854	American Sumatra Tobacco Co., Bloomfield	6.58	6.56	.....
20590	Dixie, 205778	American Sumatra Tobacco Co., Bloomfield	6.26	6.56	.....
20591	Dixie, 13800	American Sumatra Tobacco Co., Bloomfield	6.52	6.56	.....
20613	Dixie, 174396	American Sumatra Tobacco Co., Bloomfield	6.15	6.56	.....
20614	Dixie, 26101	American Sumatra Tobacco Co., Bloomfield	6.71	6.56	.....
20615	Dixie, 48634	American Sumatra Tobacco Co., Bloomfield	6.54	6.56	.....
20616	Dixie, 4965	American Sumatra Tobacco Co., Bloomfield	6.50	6.56	.....
21617	Dixie, 1574	American Sumatra Tobacco Co., Bloomfield	6.15	6.56	.....
20618	Dixie, 866	American Sumatra Tobacco Co., Bloomfield	6.30	6.56	.....
20619	Dixie, 154534	American Sumatra Tobacco Co., Bloomfield	6.78	6.56	.....
20620	Dixie, 40082	American Sumatra Tobacco Co., Bloomfield	6.53	6.56	.....

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
20621	Dixie, 64985	American Sumatra Tobacco Co., Bloomfield	6.43	6.56	.....
20622	Dixie, 67498	American Sumatra Tobacco Co., Bloomfield	6.50	6.56	.....
20635	Dixie, 112102	American Sumatra Tobacco Co., Bloomfield	6.65	6.56	.....
20636	Dixie, 793	American Sumatra Tobacco Co., Bloomfield	6.92	6.56	.....
20637	Dixie, 56540	American Sumatra Tobacco Co., Bloomfield	6.57	6.56	.....
20638	Dixie, 23626	American Sumatra Tobacco Co., Bloomfield	6.31	6.56	.....
20639	Dixie, 20158	American Sumatra Tobacco Co., Bloomfield	6.72	6.56	.....
20640	Dixie, 28103	American Sumatra Tobacco Co., Bloomfield	7.11	6.56	.....
20642	Dixie, 27910	American Sumatra Tobacco Co., Bloomfield	6.70	6.56	.....
20643	Dixie, 88310	American Sumatra Tobacco Co., Bloomfield	6.68	6.56	.....
20644	Dixie, 47781	American Sumatra Tobacco Co., Bloomfield	6.77	6.56	.....
20645	Dixie, 17844	American Sumatra Tobacco Co., Bloomfield	6.76	6.56	.....
20651	Dixie, 39499	American Sumatra Tobacco Co., Bloomfield	6.73	6.56	.....
20652	Dixie, 42810	American Sumatra Tobacco Co., Bloomfield	6.68	6.56	.....
20653	Dixie, 3873	American Sumatra Tobacco Co., Bloomfield	6.78	6.56	.....
20654	Dixie, 95922	American Sumatra Tobacco Co., Bloomfield	6.78	6.56	.....
20655	Dixie, 110197	American Sumatra Tobacco Co., Bloomfield	6.67	6.56	.....
20656	Dixie, 205778	American Sumatra Tobacco Co., Bloomfield	6.56	6.56	.....
20657	Dixie, 256339	American Sumatra Tobacco Co., Bloomfield	6.40	6.56	.....
20672	Dixie, 248050	American Sumatra Tobacco Co., Bloomfield	6.72	6.56	.....
20673	Dixie, 21436	American Sumatra Tobacco Co., Bloomfield	6.62	6.56	.....
20674	Dixie, 27643	American Sumatra Tobacco Co., Bloomfield	6.74	6.56	.....
20675	Dixie, 43404	American Sumatra Tobacco Co., Bloomfield	6.50	6.56	.....

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
20676	Dixie, 81041	American Sumatra Tobacco Co., Bloomfield	6.59	6.56	.....
20677	Dixie, 203924	American Sumatra Tobacco Co., Bloomfield	6.54	6.56	.....
20678	Dixie, 220940	American Sumatra Tobacco Co., Bloomfield	7.11	6.56	.....
20717	Dixie, 238672	American Sumatra Tobacco Co., Bloomfield	6.54	6.56	.....
20718	Dixie, 302630	American Sumatra Tobacco Co., Bloomfield	6.56	6.56	.....
20719	Dixie, 99325	American Sumatra Tobacco Co., Bloomfield	6.38	6.56	.....
20720	Dixie, 18300	American Sumatra Tobacco Co., Bloomfield	6.60	6.56	.....
20721	Dixie, 104508	American Sumatra Tobacco Co., Bloomfield	6.58	6.56	.....
20722	Dixie, 121633	American Sumatra Tobacco Co., Bloomfield	6.36	6.56	.....
20723	Dixie, 238316	American Sumatra Tobacco Co., Bloomfield	6.31	6.56	.....
20724	Dixie, 305782	American Sumatra Tobacco Co., Bloomfield	6.62	6.56	.....
20725	Dixie, 2813	American Sumatra Tobacco Co., Bloomfield	6.54	6.56	.....
20726	Dixie, 423777	American Sumatra Tobacco Co., Bloomfield	6.29	6.56	.....
20727	Dixie, 242674	American Sumatra Tobacco Co., Bloomfield	6.87	6.56	.....
20728	Dixie, 40103	American Sumatra Tobacco Co., Bloomfield	6.70	6.56	.....
20729	Dixie, 24458	American Sumatra Tobacco Co., Bloomfield	6.59	6.56	.....
20730	Dixie, 15534	American Sumatra Tobacco Co., Bloomfield	6.41	6.56	.....
20731	Dixie, 229698	American Sumatra Tobacco Co., Bloomfield	6.27	6.56	.....
20732	Dixie, 122719	American Sumatra Tobacco Co., Bloomfield	6.74	6.56	.....
20733	Dixie, 50369	American Sumatra Tobacco Co., Bloomfield	6.57	6.56	.....
20757	Dixie, 55296	American Sumatra Tobacco Co., Bloomfield	6.37	6.56	.....
20777	Dixie, 21239	American Sumatra Tobacco Co., Bloomfield	6.52	6.56	.....
20778	Dixie, 236413	American Sumatra Tobacco Co., Bloomfield	6.52	6.56	.....

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
20779	Dixie, 20650	American Sumatra Tobacco Co., Bloomfield	6.50	6.56	.....
20780	Dixie, 191653	American Sumatra Tobacco Co., Bloomfield	6.56	6.56	.....
20781	Dixie, 35903	American Sumatra Tobacco Co., Bloomfield	6.57	6.56	.....
20782	Dixie, 107284	American Sumatra Tobacco Co., Bloomfield	6.38	6.56	.....
20783	Dixie, 21049	American Sumatra Tobacco Co., Bloomfield	6.61	6.56	.....
20794	Dixie, 25137	American Sumatra Tobacco Co., Bloomfield	6.59	6.56	.....
20795	Dixie, 73426	American Sumatra Tobacco Co., Bloomfield	6.68	6.56	.....
20796	Dixie, 3027	American Sumatra Tobacco Co., Bloomfield	6.68	6.56	.....
20797	Dixie, 45769	American Sumatra Tobacco Co., Bloomfield	6.67	6.56	.....
20798	Dixie, 21710	American Sumatra Tobacco Co., Bloomfield	6.66	6.56	.....
20799	Dixie, 194528	American Sumatra Tobacco Co., Bloomfield	6.62	6.56	....
20800	Dixie, 70649	American Sumatra Tobacco Co., Bloomfield	6.57	6.56	.....
20844	Dixie, 103931	Hatheway & Steane, Hartford	6.78	6.56	.....
20847	Dixie, 140952	Hatheway & Steane, Hartford	6.42	6.56	$55.75
20848	Dixie, 38058	Hatheway & Steane, Hartford	6.38	6.56	55.75
20850	Dixie, 17640	Hatheway & Steane, Hartford	6.59	6.56	.....
20870	Dixie, 5622	Hatheway & Steane, Hartford	6.55	6.56	.....
20874	Dixie, 112821	Hatheway & Steane, Hartford	6.71	6.56	.....
20931	Dixie, 223492	American Sumatra Tobacco Co., Bloomfield	6.37	6.56	.....
20932	Dixie, 13384	American Sumatra Tobacco Co., Bloomfield	6.30	6.56	.....
20933	Dixie, 11031	American Sumatra Tobacco Co., Bloomfield	6.58	6.56	.....
20969	Dixie, 1549	Hatheway & Steane, Hartford	6.71	6.56	55.75
21062	Dixie	Station Agent from J. P. Norton, Broad Brook	6.60	6.56	54.50
21533	Dixie	Station Agent from Fassler & Silberman, Hartford	6.50	6.56	.....
21534	Dixie	Station Agent from Fassler & Silberman, Hartford	6.64	6.56	.....
21535	Dixie	Station Agent from Fassler & Silberman, Hartford	6.14	6.56	.....

TABLE V. ANALYSES OF COTTONSEED MEAL—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
21536	Dixie	Station Agent from Fassler & Silberman, Hartford	6.61	6.56	.....
21538	Dixie	Station Agent from Fassler & Silberman, Hartford	6.42	6.56	.....
20587	Owl. 41, 110197	American Sumatra Tobacco Co., Bloomfield	6.31	6.56	.....
20577	111894	American Sumatra Tobacco Co., Bloomfield	6.76	....	.....
20578	90546	American Sumatra Tobacco Co., Bloomfield	6.14	....	.....
20581	194870	American Sumatra Tobacco Co., Bloomfield	6.44	6.56	.....
20583	35004	American Sumatra Tobacco Co., Bloomfield	6.58	6.56	.....
20584	36735	American Sumatra Tobacco Co., Bloomfield	6.30	6.56	.....
20885	28201	American Sumatra Tobacco Co., Bloomfield	6.15	6.56	.....
20886	109077	American Sumatra Tobacco Co., Bloomfield	6.36	6.56	.....
	L. B. Lovitt & Co., Memphis, Tenn.				
21066	Thirty-six	Station Agent from W. C. Child, Woodstock	5.80	5.75	$41.50
21512	Neal's Choice	Station Agent from Willimantic Grain Co., Willimantic	7.04	6.88	60.00
	Lyle & Lyle, Huntsville, Alabama.				
20090	Economy, P. R. R., 83450	The Coles Company, Middletown	5.77	5.76	53.00
	Marianna Cotton Oil Co., Marianna, Ark.				
21107	White Mule, 41%	Station Agent from C. M. Beeman, Granby	6.59	6.58	57.00
21514	White Mule, 43%	Station Agent from Geo. E. Ackley Co., New Milford	7.00	6.88	60.00
21517	White Mule, 41%	Station Agent from E. H. Rollins, Granby	6.57	6.58	57.00
21715	White Mule Brand	P. Schwartz Co., New London	5.85	5.75	53.00

TABLE V. ANALYSES OF COTTONSEED MEAL—*Concluded.*

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent Nitrogen. Found.	Per cent Nitrogen. Guaranteed.	Cost per ton.
	W. C. Nothern, Memphis, Tenn.				
20631	Bee. S. P. 69010	E. N. Austin, Suffield	6.23	6.88	$58.00
20743	Bee	Station Agent from E. N. Austin, Suffield	6.63	6.88	58.00
	Olds & Whipple, Hartford.				
20834	41903	L. B. Haas & Co., Hartford	6.77	6.88	45.15
20835	41903	L. B. Haas & Co., Hartford	6.99	6.88	45.15
20836	16261	L. B. Haas & Co., Hartford	7.02	6.99	58.23
20837	80685	L. B. Haas & Co., Hartford	6.95	6.99	58.23
20845	35645	Hatheway & Steane, Hartford	6.70	6.56	.....
20846	130210	Hatheway & Steane, Hartford	6.67	6.56	.....
20849	16035	Hatheway & Steane, Hartford	6.56	6.56	.....
	Pheonix Cotton Oil Co., Memphis, Tenn.				
21052	Phoenix, C. M. & St. P. 701595	Spencer Bros., Inc., Suffield	6.86	6.87	58.00
21216	Phoenix, S. F. 130089	L. Wetstone, Hartford	6.62	6.87	57.00
21217	Phoenix, N. Y. C. 230924	L. Wetstone, Hartford	6.91	6.87	57.00
21218	Phoenix. Erie 110189	L. Wetstone, Hartford	6.83	6.87	57.00
21314	Phoenix	E. N. Austin, Suffield	6.83	6.87	55.00
21551	Phoenix	Station Agent from E. N. Austin, Suffield	6.74	6.87	60.00
	The Rogers & Hubbard Co., Portland.				
21507	.....	Station Agent from Factory.	6.03	5.75	.....
	A. C. Westervelt & Co., Memphis, Tenn.				
21518	Sun	Station Agent from Geo. W. Case, New Hartford	5.58	5.75	56.00
	Manufacturer Unknown				
20690	104578	Conn. Sumatra Tobacco Co., Buckland	6.99	....	.....
20691	10064	Conn. Sumatra Tobacco Co., Buckland	6.52	....	.....
20707	16345	Conn. Sumatra Tobacco Co., Buckland	6.75	....	.....
20708	28887	Conn. Sumatra Tobacco Co., Buckland	6.73	....	.....
19962	41961 A. C. L.	The Coles Company, Middletown	5.77	....	.....

LINSEED MEAL.

Three samples, all purchased from Olds & Whipple, Inc., Hartford, were submitted by Hatheway & Steane, Hartford. The samples were **20880**, **20967** and **20968** and were found to contain 5.20, 5.27 and 5.16 per cent. of nitrogen respectively. *The selling price was $54.50 per ton, at which price nitrogen cost about 52 cents per pound. This estimate, however, is based upon very limited data; probably the use of linseed meal in fertilizers has not been extensive.*

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

RAW ROCK PHOSPHATE.

One sample was analyzed as follows:

21531. Mitchell's Phosphoflour. Sold by W. L. Mitchell, New Haven. Stock of J. W. Alsop, Avon.

Analysis:

Station No.	**21531**
Total phosphoric acid:	
found	29.60%
guaranteed	28.00

PRECIPITATED BONE PHOSPHATE.

Sixteen samples of precipitated bone were analyzed and analyses are given in Table VI.

So-called precipitated bone phosphate is a by-product in the manufacture of gelatin. Bones are treated with acid to extract mineral substances and when this acid solution is treated with milk of lime the phosphorus is precipitated largely or entirely as di-calcium phosphate, which is the precipitated bone phosphate of commerce. Phosphoric acid in this material is practically all "available."

The samples examined this year have equaled or exceeded their guaranties in all cases and the cost of "available" phosphoric acid at the average of prices quoted ($54.65), has been 6.9 cents per pound.

TABLE VI. ANALYSES OF PRECIPITATED BONE PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. "Available." Found.	Phosphoric Acid. "Available." Guaranteed.	Cost per ton or per unit of phosphoric acid.
	Sampled by Station:		%	%	%	%	
21067	American Agricultural Chemical Co., New York City	J. P. Norton, Broad Brook	0.10	36.60	36.50	36.00	$52.25
21042	Apothecaries Hall Co., Waterbury	Sampled at Factory, East Windsor	0.60	40.70	40.10	36.00	50.00
20943	Olds & Whipple, Inc., Hartford	Sampled at Factory	0.90	39.00	38.10	38.00	54.15
	Sampled by Purchaser:						
20758	American Glue Co., Boston, Mass.	American Sumatra Tobacco Co., Bloomfield	1.21	40.76	39.55	...	...
20453	H. Fasting, New York	American Sumatra Tobacco Co., Bloomfield	0.05	38.94	38.89	38.00	...
20454	H. Fasting, New York	American Sumatra Tobacco Co., Bloomfield	0.07	38.94	38.87	38.00	...
20455	H. Fasting, New York	American Sumatra Tobacco Co., Bloomfield	0.10	38.96	38.86	38.00	...
20456	H. Fasting, New York	American Sumatra Tobacco Co., Bloomfield	0.04	38.96	38.92	38.00	...
20457	H. Fasting, New York	American Sumatra Tobacco Co., Bloomfield	0.03	39.04	39.01	38.00	...
20458	H. Fasting, New York	American Sumatra Tobacco Co., Bloomfield	none	39.32	39.32	38.00	...
20602	H. Fasting, New York	American Sumatra Tobacco Co., Bloomfield	0.46	41.80	41.34	...	...
20977	Olds & Whipple, Hartford	Hatheway & Steane, Hartford	0.45	38.50	38.05	38.00	52.31
21008	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	1.10	40.15	39.05	38.00	57.00
21060	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	3.60	45.25	41.65	38.00	56.50
21246	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	1.95	42.20	40.25	38.00	1.50
20710	....	Conn. Sumatra Tobacco Co., Buckland	0.40	41.88	41.48	...	...

DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

Twenty-one samples were examined and analyses are given in Table VII.

This material is made by treating rock phosphate with sulphuric acid which results in a conversion of the phosphorus largely into "available" form. In acid phosphates most of the available phosphoric acid is soluble in water.

This commercial product is generally guaranteed to contain 16 per cent. of phosphoric acid in "available" forms, i. e., soluble in water and soluble in ammonium citrate solution. All of the samples examined during the past season substantially met or exceeded their guaranties except **21287** which was deficient by 0.48 per cent. No. **21257** contained the guaranteed amount of available phosphoric acid (10 per cent.), but a considerable proportion of the total was in insoluble form.

The prices quoted for "acid phosphate" ranged from $16.00 to $30.00, the average being $23.45. At these prices the cost per pound of "available" phosphoric acid has been from 4.9 to 9.5 cents, the average being 7.2 cents.

TABLE VII. ANALYSES OF ACID PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid.				Cost per ton.	"Available" phosphoric acid costs cents per pound.	Station No.
			Citrate-insoluble.	Total.	"Available" Found.	"Available" Guaranteed.			
	Sampled by Station:		%	%	%	%			
20988	American Agricultural Chemical Co., New York	J. H. Paddock, Wallingford	0.83	17.33	16.50	16	$28.00	8.5	20988
20909	Apothecaries Hall Co., Waterbury	Sampled at Factory	0.60	17.03	16.43	16	25.00	7.6	20909
21044	Armour Fertilizer Works, New York	Rockville Grain & Coal Co., Rockville	0.54	16.39	15.85	16	30.00	9.5	21044
21324	Armour Fertilizer Works, New York	A. E. Shedd, Norwich	0.59	16.61	16.02	16	16.50	5.1	21324
20928	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory	0.53	17.60	17.07	16	24.70	7.2	20928
21180	Bowker Fertilizer Co., New York	C. A. Templeton, Inc., Waterbury	0.93	17.28	16.35	16	25.00	7.6	21180
21287	E. D. Chittenden Co., Bridgeport	J. E. Stoddard, Abington	0.61	16.13	15.52	16	26.00	8.4	21287
21296	E. B. Clark Seed Co., Milford	Geo. R. Russell, Branford	0.20	16.85	16.65	16	19.50	5.9	21296
21201	Coe-Mortimer Co., New York	Morrison & Dunham, Bethel	1.05	17.13	16.08	16	29.00	9.0	21201
20920	Consolidated Rendering Co., Boston, Mass	Sampled at Factory, New Haven	0.08	17.68	17.60	16	.....	...	20920
21292	Eastern States Farmers' Exchange, Springfield, Mass	G. R. Stannard, Branford	0.18	16.73	15.95	16	26.50	8.3	21292
21257	W. L. Mitchell, New Haven	A. E. Shedd, Norwich	11.35	23.45	12.10	10	18.25	7.5	21257
21532	W. L. Mitchell, New Haven	Hanson Bros., New Haven	1.20	17.50	16.30	16	19.00	5.8	21532
21396	Nitrate Agencies Co., New York	W. E. Coe, Stamford	1.35	17.40	16.05	16	.....	...	21396
20944	Olds & Whipple, Inc., Hartford	Sampled at Factory	0.45	16.55	16.10	16	21.85	6.8	20944

TABLE VII. ANALYSES OF ACID PHOSPHATE—*Concluded.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid.				Cost per ton.	"Available" phosphoric acid costs cents per pound.	Station No.
			Citrate-insoluble.	Total.	"Available" Found.	"Available" Guaranteed.			
			%	%	%	%			
20939	The Rogers & Hubbard Co., Portland	Sampled at Factory	0.10	17.53	17.43	16	$23.50	6.7	20939
21478	F. S. Royster Guano Co., Baltimore, Md.	A. D. Bridges' Sons, Inc., Hazardville	1.20	17.25	16.05	16	28.00	8.7	21478
20950	Sanderson Fertilizer & Chemical Co., New Haven	Sampled at Factory	0.78	17.68	16.90	16	21.91	6.5	20950
21493	Virginia-Carolina Chemical Co., New York	F. A. Beckwith, Niantic	1.08	18.03	16.95	16	.....	...	21493
21118	Wilcox Fertilizer Co., Mystic	Sampled at Factory	0.18	17.50	17.32	17	.....	...	21118
	Sampled by Purchaser:								
21157	L. T. Frisbie Co., New Haven	The A. E. Plant Sons Co., Branford	0.13	16.38	16.25	16	16.00	4.9	21157

III. RAW MATERIALS CONTAINING POTASH AS THE CHIEF ACTIVE INGREDIENT.

Analyses of these materials are given in Tables VIII and IX.

CARBONATE OF POTASH.

Four samples, all drawn by the purchasers, were examined.

This material is generally from 88 to 95 per cent pure and contains from 60 to 65 per cent of actual potash (K_2O). Of the samples examined this year two were somewhat below average quality. No prices were quoted to us for this source of potash.

MURIATE OF POTASH.

Eight samples were analyzed all but one of which were drawn by the Station agent.

This is the potash salt which is chiefly imported for agricultural purposes and is about 80 per cent pure, equivalent to 50.5 per cent of actual potash (K_2O). Because it readily absorbs moisture it is frequently guaranteed 48 per cent potash.

All the samples examined exceeded their guaranties except **21301** which was somewhat deficient. *So far as prices are known the cost per pound of actual potash ranged from 4 to 6.2 cents, the average being 5.0 cents.*

HIGH GRADE SULPHATE OF POTASH.

Thirteen samples were examined: one, however, **20751**, was merely tested qualitatively to determine whether or not it was a sulphate.

The commonest grade of this potash salt is the one containing about 48 per cent of actual potash or about 90 per cent sulphate of potash. Nos. **21722** and **21009** were the only samples which failed to satisfy their guaranties.

No. **21253** contained less than 48 per cent but no statement of guaranty was given. This sample contained a little ammonia, probably in the form of ammonium sulphate. At the price given us, potash in this lot cost 7.9 cents per pound, which is the extreme figure found this year. *Excluding this sample, the cost per pound of potash from this source has ranged from 3.9 to 6.1 cents and averaged 5.3 cents.*

KAINIT.

Only one sample was analyzed. *It fully met its guaranty and at the price quoted ($20.00), potash cost the purchaser 8 cents per pound.*

The potash in kainit is combined largely or entirely with chlorine and a considerable amount of common salt (sodium chloride) is also present. For this reason the use of kainit is avoided in mixed fertilizers intended for tobacco in this State where wrapper leaf is largely grown.

TABLE VIII. ANALYSES OF POTASH SALTS.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Cost per ton.	Potash costs cents per pound.	Station No.
	Carbonate of Potash.						
	Sampled by Purchaser:						
20966	Olds & Whipple, Inc., Hartford..	Hatheway & Steane, Hartford.....	63.92	.....	.....	.....	20966
20759	Suberfos Co., New York City...	American Sumatra Tobacco Co., Bloomfield	64.44	.....	.....	.....	20759
20734	86861.....	American Sumatra Tobacco Co., Bloomfield	56.68	.....	.....	.....	20734
20760	6469.....	American Sumatra Tobacco Co., Bloomfield	57.92	.....	.....	.....	20760
	Muriate of Potash.		%	%			
	Sampled by Station:						
21269	American Agricultural Chemical Co., New York.....	W. B. Martin, Rockville.....	49.73	48.00	$54.00	5.4	21269
21040	Apothecaries Hall Co., Waterbury	Sampled at Factory.....	52.26	50.00	65.00	6.2	21040
21168	Armour Fertilizer Co., New York City.....	John O. Fox, Putnam.....	48.50	48.00	55.00	5.7	21168
21325	Armour Fertilizer Co., New York City.....	A. E. Shedd, Norwich.....	49.98	48.00	39.50	4.0	21325
20927	Berkshire Fertilizer Co., Bridgeport.....	Sampled at Factory.....	53.30	50.00	45.00	4.2	20927
20925	Consolidated Rendering Co., Boston, Mass.....	Sampled at Factory, New Haven.....	52.60	50.00	.....	.....	20925
21301	Eastern States Farmers' Exchange, Springfield, Mass.....	Minor Ives, So. Meriden.....	46.06	50.00	.....	.....	21301
	Sampled by Purchaser:						
21160	L. T. Frisbie Co., New Haven..	A. E. Plant Sons Co., Branford.....	51.67	48.00	43.00	4.2	21160

TABLE VIII. ANALYSES OF POTASH SALTS—*Concluded.*

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Cost per ton.	Potash costs cents per pound.	Station No.
	High Grade Sulphate of Potash.		%	%			
	Sampled by Station:						
21068	Apothecaries Hall Co., Waterbury	J. P. Norton, Broad Brook	48.46	48.00	$53.00	5.5	21068
20946	Olds & Whipple, Inc., Hartford	Sampled at Factory	49.42	48.00	53.00	5.4	20946
20995	American Agricultural Chemical Co., New York	Geo. S. Phelps & Co., Thompsonville	50.05	48.00	60.00	6.0	20995
20953	Apothecaries Hall Co., Waterbury	Sampled at Factory	50.80	48.00	55.00	5.4	20953
20929	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory	50.80	48.00	55.00	5.4	20929
20921	Consolidated Rendering Co., Boston, Mass	Sampled at Factory, New Haven	49.90	48.00	.....	.....	20921
21400	Nitrate Agencies Co., New York City	E. N. Austin, Suffield	49.12	48.00	60.00	6.1	21400
21722	Rogers & Hubbard Co., Portland	Sampled at Factory	44.58	48.00	.....	.....	21722
	Sampled by Purchaser:						
20742	Apothecaries Hall Co., Waterbury	J. E. Shepard, So. Windsor	48.88	48.00	48.00	4.9	20742
21009	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	45.80	48.00	36.10	3.9	21009
21247	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	50.50	48.00	53.20	5.3	21247
21253	.....	Walter Clark, Norwich, Conn	46.64	.....	74.00	7.9	21253
	Kainit.						
	Sampled by Station:						
21539	Consumers Chemical Corp., New York City	E. C. Chapman, North Haven	12.57	12.40	20.00	8.0	21539

TABLE IX. ANALYSES OF DOUBLE MANURE SALTS.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Magnesia.	Chlorine.	Cost per ton.	Potash costs cents per pound.	Station No.
	Sampled by Station:		%	%	%	%			
21271	American Agricultural Co., New York	W. H. Carrier, Glastonbury	26.21	25.00	9.00	2.28	$42.00	8.0	21271
20930	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory	26.84	26.00	9.99	2.33	.....	.....	20930
20947	Olds & Whipple, Inc., Hartford	Sampled at Factory	27.50	26.00	9.49	2.08	32.00	5.8	20947
	Sampled by Purchaser:								
20851	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	24.24	26.00	9.60	4.32	.....	.....	20851
20852	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	36.22	26.00	6.08	4.83	.....	.....	20852
20868	Olds & Whipple, Inc., Hartford	J. E. Shepard, South Windsor	30.26	26.00	11.66	2.84	28.82	4.8	20868
20877	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	27.14	26.00	12.44	1.31	.....	.....	20877
20878	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	26.84	26.00	8.46	4.10	.....	.....	20878
20879	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	39.88	26.00	4.65	3.36	.....	.....	20879
20978	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford	34.86	26.00	5.19	3.01	.....	.....	20978
21061	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill	25.71	26.00	13.50	1.87	36.10	7.00	21061

DOUBLE SULPHATE OF POTASH AND MAGNESIA OR "DOUBLE MANURE SALTS."

Eleven samples were analyzed. Three were sampled by the Station agent and eight were submitted by the purchasers.

This salt was a familiar source of potash before the war. A few samples were found among our dealers in 1922 and a larger number were collected this year. Potash from this source is favored by tobacco growers not only because it is relatively free from chlorine but because it also carries a considerable amount of magnesium.

Last year a product called "Manure Salts" appeared on the market which was mistaken by some purchasers for the "Double Sulphate" or "Double Manure Salts." It was found that the "Manure Salts" was quite a different article; it contained much chlorine and little magnesia. No samples of the product were found during the past season.

Potash in the double sulphate is generally guaranteed at 26 per cent and the samples examined have exceeded that figure except in two cases *viz.*, **20851** and **21061**, where deficiencies of 1.76 and 0.29 per cent respectively were found. Samples **20852**, **20879**, **20978** and probably also **20868** contained high percentages of potash due to accidental mixture with high grade sulphate.

Prices are not available in all cases but, excluding **20868** *for the reason just given, the range has been from 5.8 to 8.0 cents per pound for actual potash. The average, excluding the four abnormally high samples, based upon the average of three prices is 7 cents per pound.*

IV. RAW MATERIALS CONTAINING NITROGEN AND POTASH.

Two samples of "Nitrapo", Nos. **20648** and **21401**, both purchased from the Nitrates Agencies Co., New York, by E. N. Austin, Suffield, were analyzed. One of the samples was drawn by the Station agent and the other was submitted by the purchaser.

Two samples called Nitrate of Potash were examined but they were not pure nitrate of potash, but "Nitrapo" or material of the same type. One of these, **20954**, was sampled by the Station agent from the stock of Apothecaries Hall Co., Waterbury. The other, **20610**, was submitted by H. M. Rogers, Southington.

Analyses are as follows:

TABLE X. ANALYSES OF "NITRAPO".

Station No.	20648 %	21401 %	20954 %	20610 %
Nitrogen:				
found	14.88	14.84	14.80	15.28
guaranteed	14.80	14.80	15.00	.....
Potash:				
found	15.67	15.01	14.07	9.49
guaranteed	15.00	15.00	12.00	.....

V. RAW MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

DRY GROUND FISH.

Forty-nine samples of dry ground fish have been analyzed during the year. Of these seventeen were sampled by the Station agent and thirty-two were submitted by purchasers. Analyses are given in Table XI.

This material is generally guaranteed to contain 8.23 per cent of nitrogen and 5 to 6 per cent of phosphoric acid. In a number of cases guaranties were not furnished, but in none of these were the nitrogen and phosphoric acid found less than the amounts usually guaranteed. Of those samples with guaranties, eight were deficient in nitrogen by amounts exceeding 0.1 per cent. The difficient samples were as follows:

Station No.	Deficiency in Nitrogen
21266	0.21%
21219	0.17
20436	0.84
20437	0.17
20439	0.26
20564	0.22
20565	0.12
20791	0.14

None of the samples were deficient in phosphoric acid.

The price has varied between the rather wide limits of $58.00 and $80.00 only one quotation of the high figure being recorded. The average of prices quoted confidentially or otherwise, is $64.90.

The averages for nitrogen and phosphoric acid are 8.64 and 7.86 per cent respectively which makes the cost per pound of nitrogen 31.5 cents, allowing 6 cents per pound for total phosphoric acid.

CHLORINE CONTENT OF DRY GROUND FISH.

Chlorine was determined in forty-eight of the samples examined this year. Two samples, **20704** and **21402** were found to contain 3.25 per cent and 2.63 per cent chlorine respectively. Excluding these two, the remaining samples may be summarized as follows:

Maximum	0.74%
Minimum	0.14
Average	0.25

The salt content of this product does not appear to be a matter of serious consideration, at least so far as the domestic product is concerned. We understand that fish manures from foreign sources may run higher in this particular, but we have no information as to whether or not the two samples already mentioned which contained excessive amounts of salt were imported products.

TABLE XI. ANALYSES OF

DRY GROUND FISH.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Nitrogen.				Phosphoric Acid.			Cost per ton.	Station No.
			As ammonia.	As organic.	Total found.	Total guaranteed.	Citrate-insoluble.	Total found.	Total guaranteed.		
	Sampled by Station:		%	%	%	%	%	%	%		
21071	American Agricultural Chemical Co., New York	A. E. Potwine, Warehouse Pt.	0.29	7.97	8.26	8.23	....	8.83	6.00	$78.00	21071
21266	American Agricultural Chemical Co., New York	J. P. Norton, Broad Brook	0.10	7.92	8.02	8.23	....	7.88	6.00	75.00	21266
20961	Apothecaries Hall Co., Waterbury.	Sampled at factory, East Windsor	0.49	9.11	9.60	8.20	....	6.40	5.50	80.00	20961
20542	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.20	8.70	8.90	....	....	7.09	....	....	20542
20543	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.24	8.30	8.54	....	....	7.62	....	....	20543
20544	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.19	8.38	8.57	....	....	8.24	....	....	20544
20907	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory	1.62	6.54	8.16	8.23	....	8.80	6.00	65.00	20907
21198	E. D. Chittenden Co., Bridgeport.	E. J. Bantle, Glastonbury	0.19	7.91	8.10	8.12	....	7.50	6.00	71.00	21198
20924	L. T. Frisbie Co., New Haven	Sampled at Factory	0.26	8.10	8.36	8.22	....	8.43	6.40	....	20924
21402	Nitrate Agencies Co., New York	E. N. Austin, Suffield	0.50	8.72	9.22	9.04	....	5.70	5.26	70.00	21402
20945	Olds & Whipple, Inc., Hartford	Sampled at Factory	0.10	9.40	9.50	8.23	2.68	8.20	5.00	71.25	20945
21032	Olds & Whipple, Inc., Hartford	J. E. Shepard, South Windsor	0.20	8.26	8.46	8.23	....	7.40	5.00	60.00	21032
21537	Olds & Whipple, Inc., Hartford	Fassler & Silberman, Hartford	0.18	8.22	8.40	8.23	1.63	6.83	5.00	....	21537
20938	Rogers & Hubbard Co., Portland	Sampled at Factory	0.28	8.82	9.10	9.00	....	7.73	....	75.00	20938
21470	F. S. Royster Guano Co., Baltimore	O. R. Morgan, Glastonbury	0.18	8.09	8.27	8.23	1.20	6.28	5.00	....	21470
21219	Sanderson Fertilizer & Chemical Co., New Haven	G. A. Frink, Wapping	0.23	7.83	8.06	8.23	....	8.90	6.00	78.00	21219
20958	Wilcox Fertilizer Co., Mystic	Spencer Bros., Inc., Suffield	0.93	8.39	9.32	9.04	0.98	7.38	6.00	70.00	20958
	Sampled by Purchaser:										
20436	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.25	7.13	7.38	8.22	....	12.54	....	....	20436
20437	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.18	7.87	8.05	8.22	....	8.49	....	....	20437
20438	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.30	8.22	8.52	8.22	....	6.87	....	....	20438
20439	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.20	7.76	7.96	8.22	....	9.79	....	....	20439
20440	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.19	8.37	8.56	8.22	....	7.84	....	....	20440
20441	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.21	8.50	8.71	8.22	....	7.23	....	....	20441
20525	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.24	8.55	8.79	8.22	....	8.42	....	....	20525
20526	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.24	9.00	9.24	8.22	....	6.47	....	....	20526
20564	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.30	7.70	8.00	8.22	....	10.89	....	....	20564
20565	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield	0.26	7.84	8.10	8.22	....	9.95	....	....	20565

TABLE XI. ANALYSES OF

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.
	Sampled by Purchaser:	
20566	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20567	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20568	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20600	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20601	Atlantic Packing Co., New Haven.	American Sumatra Tobacco Co., Bloomfield
20761	79054	American Sumatra Tobacco Co., Bloomfield
20714	Berkshire Fertilizer Co., Bridgeport	J. E. Shepard, South Windsor
20791	Berkshire Fertilizer Co., Bridgeport	J. E. Shepard, South Windsor
21158	L. T. Frisbie Co., New Haven	A. E. Plant Sons Co., Branford
20704	Nitrate Agencies Co., New York	E. N. Austin, Suffield
20841	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford
20842	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford
20843	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford
20876	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford
20971	Olds & Whipple, Inc., Hartford	Hatheway & Steane, Hartford
21007	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill
21059	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill
21245	Olds & Whipple, Inc., Hartford	Harold M. Newberry, East Windsor Hill
20693	75301	Conn. Sumatra Tobacco Co., Buckland
20694	78899	Conn. Sumatra Tobacco Co., Buckland
20709	47472	Conn. Sumatra Tobacco Co., Buckland
21579		L. T. Frisbie Co., New Haven

DRY GROUND FISH—*Concluded.*

Nitrogen.				Phosphoric Acid.				
As ammonia.	As organic.	Total found.	Total guaranteed.	Citrate-insoluble	Total found.	Total guaranteed.	Cost per ton.	Station No.
%	%	%	%	%	%	%		
0.26	8.50	8.76	8.22	....	8.06	....	....	20566
0.18	9.14	9.32	8.22	....	7.61	....	....	20567
0.16	8.84	9.00	8.22	....	8.01	....	....	20568
0.20	8.06	8.26	....	....	7.52	....	....	20600
0.22	8.81	9.03	....	....	7.71	....	....	20601
0.64	8.94	9.58	....	....	8.21	....	....	20761
0.18	8.12	8.30	....	....	7.82	....	$65.00	20714
0.19	7.89	8.08	8.22	....	7.85	....	65.00	20791
0.22	8.33	8.55	8.22	....	7.55	6.40	58.00	21158
0.47	8.81	9.28	....	....	5.95	....	66.00	20704
0.25	8.42	8.67	8.23	....	7.29	5.00	60.00	20841
0.24	8.16	8.40	8.23	....	7.32	5.00	60.00	20842
0.26	8.28	8.54	8.23	....	6.98	5.00	60.00	20843
0.22	8.48	8.70	8.23	....	7.02	5.00	....	20876
0.18	8.41	8.59	8.23	....	7.93	5.00	60.00	20971
0.20	9.12	9.32	8.24	....	8.25	5.00	74.10	21007
0.16	8.96	9.12	8.23	....	8.23	5.00	74.10	21059
0.17	9.67	9.84	8.23	....	7.23	5.00	72.20	21245
0.26	8.42	8.68	....	....	7.62	....	....	20693
0.22	8.55	8.77	....	....	7.27	....	....	20694
0.28	8.12	8.40	....	....	7.36	....	....	20709
....	....	8.22	8.22	....	8.68	6.40	60.00	21579

TABLE XII. ANALYSES OF TANKAGE.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. As ammonia.	Nitrogen. As organic.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Cost per ton.	Station No.
	Bone and Meat Tankage *Sampled by Station.*		%	%	%	%	%	%	%	%		
21162	Apothecaries Hall Co., Waterbury	J. A. Glasnapp, West Cheshire	none	3.27	3.27	3.29	23.90	20.00	54	46	$40.00	21162
	Slaughter House Tankage *Sampled by Station:*											
21273	American Agricultural Chemical Co., New York City	Robt. Greenbacker, Meriden	0.32	4.58	4.90	4.94	16.20	13.73	51	49	.....	21273
21323	Armour Fertilizer Works, New York City	A. E. Shedd, Norwich	0.68	4.16	4.84	4.94	13.47	13.73	46	54	39.00	21323
20910	Apothecaries Hall Co., Waterbury	Sampled at Factory	0.20	9.64	9.84	7.81	3.38	7.00	56	44	65.00	20910
20919	Conn. Fat Rendering and Fertilizer Corp., New Haven	Sampled at Factory	none	3.74	3.74	3.29	22.28	.....	57	43	45.00	20919
21193	Consolidated Rendering Co., Boston, Mass.	Sampled at Factory, New Haven	0.16	7.05	7.21	7.41	9.65	9.15	37	63	.....	21193
21194	Consolidated Rendering Co., Boston, Mass	Sampled at Factory, New Haven	0.21	4.49	4.70	4.92	13.00	14.00	38	62	.....	21194
21328	Consolidated Rendering Co., Boston, Mass.	C. E. Lyman, Middlefield	0.16	5.46	5.62	4.92	15.80	14.00	33	67	.....	21328
21117	Wilcox Fertilizer Co., Mystic	Sampled at Factory	0.33	6.73	7.06	6.58	11.73	10.00	66	34	.....	21117
21121	Worcester Rendering Co., Auburn, Mass	A. D. Briggs, Pomfret	0.20	7.53	7.73	5.74	10.98	10.00	48	52	.....	21121

TANKAGE.

Ten samples, all drawn by the Station agent have been examined and results are given in Table XII.

Only one of these samples was sold as "bone and meat" tankage but most of the others, by their phosphoric acid content, show the presence of a considerable proportion of bone. Tankage with high phosphoric acid is relatively low in nitrogen.

The utility of the plant food in this material depends to an important degree upon its mechanical condition. In five of the samples examined more than one-half of the material was finer than one-fiftieth of an inch. The fertilizer ingredients in these will be more readily utilized than in the case of coarser products.

There is no consistent comparison in the cost of plant food in the several grades of this product. Taking the four cases in which prices are given, three of them representing goods of about the same degree of fineness, and assuming a uniform value of 6 cents per pound for total phosphoric acid, the cost per pound of nitrogen in **20910** which contains the least bone, is 31 cents. In the other three, which contain relatively large amounts of bone, nitrogen has cost from 17.3 to 24.5 cents per pound.

GROUND BONE.

Twenty-eight samples of ground bone were examined, thirteen of which were drawn by the Station agent and fifteen were submitted by purchasers. The results appear in Table XIII.

Ground bone is a very desirable form of plant food where immediate availability is not essential. It is used to advantage for seeding down and for certain crops which require a long season in which to mature. Like tankage the mechanical condition of the bone meal is important. Of the twenty-eight samples analyzed this year, in twenty-one 50 per cent or more of the material was finer than 1/50th of an inch; in ten, 70 per cent or more was of that degree of fineness. Three samples were very coarse, 30 per cent or less passing 1/50th mesh.

Two samples, **21181** and **21251** were deficient in nitrogen by 0.16 per cent in each case. Samples **20915** and **21054** failed to meet their guaranties for phosphoric acid by 1.30 and 3.68 per cent respectively.

The average nitrogen content of all samples is 3.91 per cent and the average amount of phosphorc acid found is 24.67 per cent. *At the average of prices quoted ($48.41), allowing 22 cents per pound for nitrogen, phosphoric acid from this source has cost 6.3 cents per pound.*

TABLE XIII. ANALYSES OF

Station No.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station:	
21025	American Agricultural Chemical Co., New York	Bristol Grain & Supply Co., Bristol
21039	Apothecaries Hall Co., Waterbury.	Sampled at Eactory
21181	Armour Fertilizer Works, New York	John O. Fox, Putnam
21013	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory
21545	E. D. Chittenden Co., Bridgeport	J. E. Stoddard, Abington
20915	Consolidated Rendering Co., Boston	Cheshire Reformatory, Cheshire
21195	Consolidated Rendering Co., Boston	Sampled at Factory, New Haven
21101	L. T. Frisbie Co., New Haven	Jordan Hardware Co., Willimantic
20941	Olds & Whipple, Inc., Hartford	Rackliffe Bros. Co., New Britain
21455	Rogers & Hubbard Co., Portland	Cadwell & Jones, Hartford
21461	Rogers & Hubbard Co., Portland	Willimantic Grain Co., Willimantic
21473	F. S. Royster Guano Co., Baltimore	Plumb Bros., Waterbury
21483	Sanderson Fertilizer & Chemical Co., New Haven	G. W. Thorpe, West Cheshire
21134	M. L. Shoemaker & Co., Philadelphia	Olds & Whipple Co., Inc., Hartford
21114	Wilcox Fertilizer Co., Mystic	Lyon & Ewald, New London
	Sampled by Purchaser:	
19947	Apothecaries Hall Co., Waterbury.	H. H. Newell, Marion
20534	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford
20535	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford
20536	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford
20537	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford
20853	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford
20854	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford
20869	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford
20974	Apothecaries Hall Co., Waterbury.	Hatheway & Steane, Hartford
21054	Apothecaries Hall Co., Waterbury.	J. E. Shepard, South Windsor
21251	Armour Fertilizer Works, New York	Walter T. Clark, Norwich
20695	78653	Conn. Sumatra Tobacco Co., Buckland
20935		John H. Fay, Middletown

GROUND BONE.

Nitrogen.		Phosphoric Acid.		Mechanical Analysis.			
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.	Station No.
%	%	%	%	%	%		
3.02	2.47	23.90	22.88	28	72	$55.00	21025
3.77	3.29	25.80	20.00	58	42	55.00	21039
2.31	2.47	27.30	22.00	68	32	55.00	21181
1.85	1.64	26.30	25.00	55	45	40.00	21013
2.39	2.47	26.18	22.00	41	59	50.00	21545
2.36	2.05	24.70	26.00	77	23	42.00	20915
3.17	2.46	26.35	24.00	78	22	.....	21195
3.05	2.46	26.30	20.00	64	36	54.00	21101
2.86	2.50	24.40	22.00	51	49	53.85	20941
3.98	3.82	25.85	24.70	47	53	66.00	21455
3.72	3.29	24.90	20.50	72	28	56.00	21461
2.72	2.47	25.85	22.90	52	48	55.00	21473
2.62	2.47	25.70	22.88	28	72	53.00	21483
5.58	4.53	22.40	20.00	91	9	61.75	21134
2.30	2.05	28.30	25.18	62	38	55.00	21114
3.82	....	26.22	.....	72	28	45.00	19947
4.03	....	23.72	.....	70	30	39.50	20534
3.53	....	25.50	.....	74	26	39.50	20535
3.62	....	25.50	.....	77	23	39.50	20536
4.20	....	23.84	.....	79	21	39.50	20537
4.03	3.29	24.54	20.00	54	46	39.50	20853
4.38	3.29	24.15	20.00	48	52	39.50	20854
3.98	3.29	21.59	20.00	53	47	55.75	20869
3.60	3.29	24.70	20.00	59	41	39.50	20974
4.00	....	19.20	22.88	30	70	42.00	21054
2.54	3.70	26.15	21.50	70	30	39.50	21251
3.45	....	19.83	.....	69	31	.....	20695
3.85	....	21.70	.....	....	....	.....	20935

VI. MIXED FERTILIZERS.

FERTILIZERS CONTAINING PHOSPHORIC ACID AND POTASH.

Two non-nitrogenous fertilizers containing phosphoric acid and potash were analyzed.

21132. *Olympic* brand, made by the Virginia-Carolina Chemical Co. and sampled by the Station agent from the stock of E. O. Chapman, North Haven.

21428. *Bone Phosphate and Potash Compound* made by Olds & Whipple, Inc., Hartford and sampled by the Station agent at the factory.

TABLE XIV. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:			
	Berkshire Fertilizer Co., Bridgeport.			
21335	Berkshire Tobacco Starter....	6-4-0	Thompsonville.....	$53.00
	F. T. Blish Hardware Co., South Manchester.			
21498	Top Dressing for Grass.....	7-4-0	Factory.....	45.75
	Olds & Whipple, Inc., Hartford			
21392	Top Dressing for Grass.....	7-4-0	New Britain.....	49.16
21397	High Grade Tobacco Starter..	10-3-0	Pine Meadow.....	.....
	Sanderson Fertilizer & Chemical Co., New Haven.			
21490	Tobacco Grower.....	5-4-0	Tariffville.....	.....
	M. L. Shoemaker & Co., Philadelphia, Pa.			
21133	Swift-Sure Superphosphate Tobacco Starter 4-10-0.....	4-10-0	Hartford.....	46.00
21318	Swift-Sure Superphosphate Tobacco Starter 4-10-0.....	4-10-0	Windsor Locks.....	51.00

Analyses are as follows:

Station No.	21132	21428
	%	%
Phosphoric acid:		
citrate-insoluble	1.47	0.30
total	13.28	5.33
available, found	11.81	5.03
guaranteed	12.00	4.00
Potash:		
as muriate	5.81	1.58
total, found	5.81	16.74
guaranteed	6.00	15.00
Cost per ton	$33.00	$42.75

CONTAINING NITROGEN AND PHOSPHORIC ACID.

Nitrogen						Phosphoric Acid.			
		Organic.							
In nitrates.	In ammonia.	Water-soluble.	Water-insoluble.	Total.	Ammonia equivalent to total nitrogen.	Citrate-insoluble.	Total.	So-called Available.	Station No.
2.41	0.04	0.01	2.84	5.30	6.4	0.50	5.03	4.53	21335
3.87	0.13	0.25	1.27	5.52	6.7	1.73	6.28	4.55	21498
4.09	....	0.36	1.23	5.68	6.9	1.35	6.00	4.65	21392
0.28	1.00	3.28	5.68	10.24	12.5	0.33	4.25	3.92	21397
0.98	0.10	0.01	3.20	4.29	5.2	0.18	4.58	4.40	21490
1.33	0.03	0.29	1.42	3.07	3.7	2.95	14.18	11.23	21133
1.32	0.08	0.54	1.31	3.25	4.0	3.70	14.40	10.70	21318

MIXED FERTILIZERS CONTAINING NITROGEN AND PHOSPHORIC ACID.

Only seven of the nitrogenous superphosphates examined this year were without potash. The analyses of these are given in Table XIV.

It has become widely established in trade practice to designate the grade or quality of mixed fertilizers by stating as a part of the brand name, or instead of it, the guaranteed amounts of plant food contained in the mixture. Thus, Berkshire Tobacco Starter, 6-4-0 means that the mixture carries 6 per cent of ammonia (NH_3), 4 per cent of available phosphoric acid (P_2O_5), and no potash (K_2O). In order to enable the purchaser to more readily compare the results of our analyses with the claims of the manufacturer our tables of analyses of mixed fertilizers have been somewhat revised. The figures in the column headed "Grade" represent the manufacturer's claim or guaranty as to ammonia, available phosphoric acid and potash in the order named and the corresponding ingredients found by our analysis appear in the tables in bold face type. To apply the interpretation in the instance just cited, Table XIV, No. **21335,** Berkshire Tobacco Starter claimes to contain 6 per cent of ammonia, 4 per cent of available phosphoric acid and no potash; and it appears from the analysis that 6.4 per cent of ammonia and 4.53 per cent of available phosphoric acid were found. No tests were made for potash as none was declared.

Two samples were found deficient in ammonia; they were:

21498. Blish Hardware Co. Top Dressing for Grass 7-4-0, ammonia deficiency 0.3 per cent.

21133. Shoemaker Swift-Sure Superphosphate Tobacco Starter 4-10-0, ammonia deficiency 0.3 per cent.

A second sample, **21318,** of the last named brand was found to fully meet its guaranty.

MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH.

Analyses of two hundred and seventy samples of fertilizers of this class are given in Table XVI. Nine of these were sampled by purchasers and the remainder were official samples drawn by the Station agent.

To facilitate the comparison between composition guaranteed and that found the same change in the arrangement of analyses has been made as has already been described under the preceding heading, Mixed Fertilizers Containing Nitrogen and Phosphoric Acid.

Samples Failing to Meet Guaranties.

A large proportion of the fertilizers in this group have failed to meet their guaranties in all respects. Of the two hundred and

sixty-one officially drawn samples, one hundred and eighteen, or about 45 per cent, were deficient with respect to one or more of the guaranteed ingredients, deficiencies of 0.12 per cent or less in ammonia, 0.20 per cent or less in available phosphoric acid and 0.15 per cent or less in potash being disregarded in arriving at these figures. The number of ammonia deficiencies was greater than the numbers of phosphoric acid and potash deficiencies combined. Ninety-four samples, or 36 per cent were deficient in one ingredient; twenty-four, or 9.2 per cent were deficient in two ingredients; but none were found lacking in all of the ingredients guaranteed.

While it is true that many of these deficiencies are not large, perhaps even within the range of analytical differences which occur between experienced analysts, nevertheless it seems clear that manufacturers too often fix guaranties with an insufficient margin of safety.

From the purchaser's standpoint, however, there may be a compensating consideration because, in many cases, a shortage in one item of plant food is accompanied by an over-run in one or both of the other items and a loss in money value does not necessarily occur. If ammonia, available phosphoric acid and potash are valued at about the average of what they have cost in the various raw materials which we have examined, viz; 30, 7 and 5.5 cents per pound respectively, the number of brands thus shown to be deficient in money value is reduced to seventy-seven. Of these seventy-seven the shortage in money value in thirty-one brands is less than one dollar per ton; but in forty-five brands, or about 17.0 per cent of the official samples in this group, the shortage is one dollar or more per ton. This proportion is much greater than usual. The deficient brands are listed in Table XV.

Table XV. Deficient Brands, 1923.

No.	Brand.	Approximate deficiency in money value per ton.
21154	A. A. C. Co.'s AA 5-4-5	$1.24
21145	A. A. C. Co.'s Lister's Potato Manure 4-8-7	1.33
21027	A. A. C. Co.'s National Complete Tobacco 5-4-5	1.81
21329	A. A. C. Co.'s National Complete Tobacco 5-4-5	1.37
21151	A. A. C. Co.'s National Market Garden 3-8-4	1.08
21167	A. A. C. Co.'s National XXX Fish and Potash 3-10-3	1.31
21340	A. A. C. Co.'s Quinnipiac Superior Top Dressing 6-6-4	2.91
21012	Armour's Big Crop Fertilizer 4-6-10	1.45
21433	Armour's Big Crop Fertilizer 4-6-10	2.66
21322	Armour's Big Crop Fertilizer 4-8-4	1.28
21011	Armour's Big Crop Fertilizer 5-8-5	1.75
21321	Armour's Big Crop Fertilizer 5-8-7	9.52[1]
21288	Armour's Big Crop Fertilizer 8-6-6	2.39
~~21336~~	~~Armour's Corn Grower, 2-8-4~~	~~2.73~~
21183	Atlantic, 4-8-6	3.47
21552	Atlantic, 4-8-6	1.33

[1] See "Analyses Requiring Special Notice" p 56.

TABLE XV. DEFICIENT BRANDS, 1923—*Concluded.*

No.	Brand.	Approximate deficiency in money value per ton.
21345	Atlantic, Tobacco Grower, 5-4-5	1.74
21284	Bowker's Market Garden 4-8-4	1.01
21289	Bowker's Stockbridge Early Crop 5-8-7	1.58
21285	Bowker's Stockbridge Potato and Vegetable 4-6-10	2.49
21436	Clark's Special Mixture 5-8-5	1.71
21088	Coe-Mortimer, E. F. Coe's Special Potato 4-8-4	4.16
21086	Coe-Mortimer, E. F. Coe's Gold Brand Guano 3-8-4	1.89
21528	Eastern States Formula A 7. 3-2-7. 6	1.71
21092	Frisbie's Market Garden 4-8-6	1.21
21267	Frisbie's Market Garden 4-8-6	1.61
21099	Vegetable and Potato 4-8-4	1.91
21352	Frisbie's Tobacco Manure 5-8-6	2.82
21376	Buffalo Top Dresser 7-6-5	1.56
21098	Lowell Animal Brand 3-8-4	1.24
21553	Mapes Top Dresser 10-4-2	3.20
21403	Nature's Plant Food, 1. 2-3-2	3.75
21420	Frank S. Platt, Platco Special 4-8-6	2.26
21457	Rogers & Hubbard, Corn and General Crops 3-8-6	1.01
21469	Royster's Quality Trucker 4-8-7	1.75
21476	Royster's Top Dresser 7-6-5	3.52
21486	Sanderson, Kelsey's Bone, Fish and Potash 3-10-3	1.43
21492	Springfield, 4-8-6	1.21
21485	Springfield, Potato, Onion and Vegetable 4-8-4	1.02
21141	Virginia-Carolina, Fish, Phosphate and Potash 2-8-2	1.23
21319	Wilcox 5-8-7	1.12
21501	Wilcox Grass and Truck 5-8-4	1.21
21500	Wilcox Potato and Vegetable 4-8-6	1.08
21503	Woodruff & Sons Home Mixed 4-8-6	6.07
21506	Worcester Potato and Vegetable, 4-8-4	4.31

ANALYSES REQUIRING SPECIAL NOTICE.

Manufacturers or jobbers occasionally request that a second sample be secured and analyzed in case our first analysis has shown a deficiency and, so far as possible, we have granted such requests.

21027. National Complete Tobacco, 5-4-5, was deficient in ammonia and the second sample, **21329,** was likewise deficient.

21021. National Premier Truck Manure, 4-8-7, was deficient in potash and the second sample, **21320,** was also deficient in this respect.

21012. Armour's Big Crop, 4-6-10, was deficient in ammonia and available phosphoric acid on the first analysis. The second sample, **21433,** was deficient in ammonia and potash.

21045. Armour's Big Crop, 4-8-4, was low in available phosphoric and the second sample, **21322,** was low in potash.

21047. Armour's Big Crop, 5-8-7, was low in potash. A second sample, **21321,** was found not to conform at all to a 5-8-7 grade and partial analysis of the duplicate left by our agent with the person whose stock was sampled failed to show any error in sampling. No further samples of this brand could be secured.

Evidently another grade of goods had been put in bags marked 5-8-7 by mistake.

21183. Atlantic, 4-8-6, was deficient in ammonia and potash but the second sample, **21552,** was deficient in ammonia only.

21293. Clark's Special Tip Top, 5-8-5, was deficient in ammonia and the second sample, **21436,** was also deficient in this respect.

21298. Essex Market Garden, 4-8-4, was low in ammonia but the second sample, **21435,** fully met the guaranty in all respects.

21092. Frisbie's Market Garden, 4-8-6, was low in ammonia and the second sample, **21267,** was likewise deficient.

21099. Frisbie's Special Vegetable, 4-8-4, was low in both ammonia and potash but the second sample, **21265,** was deficient in ammonia only.

21352. Frisbie's Tobacco Manure, 5-8-6, was low in ammonia but the second sample, **21574,** met the guaranty.

21380. Mapes Tobacco Ash Constituents, 1-4-15, was deficient in potash; the second sample, **21458,** contained about 2 per cent more potash but it was still under guaranty.

21103. Mapes Top Dresser, 10-4-2, was low in ammonia; the second sample, **21153,** was also low in this respect.

20960. Mapes Tobacco Starter, 5-6-1, was low in ammonia but the second sample, **21268,** satisfied the guaranty.

CLASSIFICATION OF GRADES WITH PARTICULAR REFERENCE TO AMMONIA.

Attention has been called in previous reports to the relatively higher cost of nitrogen in low priced goods carrying low guaranties of ammonia. It was shown, for example[1], that the cost per pound of nitrogen in goods guaranteed 1 per cent ammonia (0.82 per cent nitrogen), was from two and one-half to three times greater than in brands carrying 3 to 5 per cent ammonia (2.47 to 4.11 nitrogen). A gradual reduction in the proportion of low nitrogen brands is shown by summaries for the last three years as follows:

Guaranty.	Percentage of Samples. 1921	1922	1923
1 per cent ammonia (0.82 nitrogen)	10.0	6.0	4.2
2 per cent ammonia (1.65 nitrogen)	20.4	19.1	16.5
3 per cent ammonia (2.47 nitrogen)	23.2	19.1	16.1
4 per cent ammonia (3.29 nitrogen)	20.4	25.9	26.1
5 per cent ammonia (4.11 nitrogen)	21.4	23.0	24.5
6 per cent ammonia (4.94 nitrogen)	4.6	6.9	4.9
7 to 12 per cent ammonia (5.76 to 9.87 nitrogen)			7.7
Total	100.0	100.0	100.0

[1]Conn. Exp. Sta., Bull. 241, p. 110

The number of samples carrying guaranties of from 4 to 5 per cent ammonia comprised over 50 per cent of the total number this year.

The "New England Standard Nine."

At a meeting in Boston in the latter part of December, 1922, New England agronomists and representatives of fertilizer manufacturers discussed and finally adopted a list of high analysis fertilizers which, it was felt, would adequately meet all the reasonable needs of farmers in the New England states. It has long been recognized that the great multiplicity of brands now on the market, many of which differ from one another but very slightly, is an economic disadvantage in that it adds to the cost of manufacture and distribution of fertilizers and serves no real agricultural need. However, competition is keen in the fertilizer business and many brands have established good will values which their manufacturers do not wish to sacrifice. Manufacturers will, therefore, continue to emphasize *brands* until purchasers more generally think in terms of *grades*. It was the sense of this New England conference that the nine grades chosen would satisfy present requirements and that they should be advocated until there is evidence that revision of the list should be made.

The formulas adopted and now known as the "New England Standard Nine" and the number of mixed fertilizers examined by us this year which fall in these respective grades are as follows:

Standard Grade	Number of samples.
0-12-6	1
2-12-4	2
3-10-4	1
3-10-6	0
4-8-4	30
4-8-6	12
5-4-5	23
5-8-7	14
8-6-6	1
Total	84

These figures show that of two hundred and sixty-one "complete" fertilizers and two containing only phosphoric acid and potash, one hundred and seventy-nine do not fall in any of the nine grades here given although many of them approach these grades more or less closely. Only four of the adopted grades are represented by any considerable number of samples and one grade is not represented at all. However, as the purpose of these nine grades becomes better known among manufacturers and users of fertilizers their representation will, no doubt, increase.

Availability of the Organic Nitrogen.

Only three samples showed deficiencies in the quality of the insoluble organic nitrogen by both the alkaline and the neutral methods of evaluation. In these cases, however, the amounts of insoluble organic nitrogen were small (.4 to .5 per cent), and the total nitrogen was in excess of the guaranty in all cases, the excesses being greater than, or practically equal to, the inactive nitrogen found.

TABLE XVI. ANALYSES OF MIXED FERTILIZERS.

Station. No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **American Agricultural Chemical Co., New York.**		
20992	Complete Potato Mixture	3-8-4	New Britain
21156	Crescent Complete Manure	2-8-3	Stamford
21154[1]	Double A Tobacco Fertilizer	5-4-5	Portland
21346	Fish and Potash	3-10-3	South Manchester
21030	Grass and Lawn Top Dressing	6-6-4	North Stonington
20993	7% Potash Fertilizer	4-8-7	New Haven
21275	5-4-3 Tobacco Fertilizer	5-4-3	New Milford
21029	Universal Phosphate	1-8-2	New London
21152	Bradley's Complete Manure for Top Dressing Grass and Grain	6-6-4	Groton
21028	Bradley's Complete Manure for Potatoes and Vegetables	4-8-7	East River
21026	Bradley's Complete Tobacco Manure	5-4-5	Glastonbury
20991	Bradley's Corn Phosphate	2-8-2	Bristol
21153	Bradley's Fish Compound	3-10-3	Meriden
20987	Bradley's New Method Fertilizer	1-8-2	Wallingford
21150	Bradley's Potato Fertilizer	2-8-3	East River
21155	Bradley's Potato Manure	3-8-4	Norwalk
21149	Bradley's Superior Tobacco Compound	7-3-7	Glastonbury
20994	Bradley's X. L. Superphosphate of Lime	3-9-2	Suffield
21272	Listers Celebrated Tobacco Fertilizer	5-4-3	West Suffield
20989	Listers Corn and Potato Fertilizer	2-8-3	Yalesville
21024	Listers Eastern Pride Fertilizer	3-8-4	Yalesville
21145[1]	Listers Potato Manure	4-8-7	Yalesville
21146	Listers Standard Pure Superphosphate of Lime	3-9-2	Yalesville
20990	Listers Success Fertilizer	2-8-2	Yalesville
21027[1]	National Complete Tobacco Fertilizer	5-4-5	Broad Brook
21329[1]	National Complete Tobacco Fertilizer	5-4-5	Broad Brook
21151[1]	National Market Garden Fertilizer	3-8-4	New London
20985	National Potato and Corn Phosphate	2-8-3	Wallingford
21021[2]	National Premier Truck Manure	4-8-7	Broad Brook
21320[2]	National Premier Truck Manure	4-8-7	Silver Lane
21549	National Special Tobacco	5-4-3	Suffield
21022	National Top Dressing Compound	6-6-4	Broad Brook
20986	National Universal Phosphate	1-8-2	Wallingford
21173	National White Ash Tobacco Grower	7-3-7	Warehouse Point
21167[1]	National XXX Fish and Potash	3-10-3	Silver Lane

[1] See Table XV, p. 55.
[2] See Note, p. 56.

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH.

Dealer's cash price per ton.	Nitrogen. In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Total	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Total.	So-called "Available."	Potash. As muriate.	Total.	Station No.
	%	%	%	%	%	%	%	%	%	%	%	
$46.00	0.48	0.84	0.39	0.69	2.40	**2.92**	0.75	8.84	**8.09**	3.97	**3.97**	20992
.....	0.12	0.38	0.51	0.71	1.72	**2.09**	0.63	8.78	**8.15**	2.81	**2.81**	21156
57.25	0.98	0.02	none	2.82	3.82	**4.64**	0.38	4.83	**4.45**	1.16	**5.26**	21154
46.00	0.48	0.71	0.53	0.70	2.42	**2.94**	0.83	10.85	**10.02**	3.03	**3.03**	21346
52.00	2.75	1.21	0.22	0.57	4.75	**5.78**	1.28	7.90	**6.62**	4.13	**4.13**	21030
.....	0.72	1.40	0.60	0.65	3.37	**4.10**	0.90	8.78	**7.88**	7.02	**7.02**	20993
53.00	1.04	none	0.06	3.02	4.12	**5.01**	0.23	4.70	**4.47**	0.33	**3.10**	21275
38.00	none	0.08	0.27	0.56	0.91	**1.11**	0.43	8.89	**8.46**	1.86	**1.86**	21029
50.00	3.14	1.18	0.21	0.59	5.12	**6.22**	1.00	7.35	**6.35**	3.98	**3.98**	21152
48.00	0.60	1.44	0.68	0.65	3.37	**4.10**	1.30	9.35	**8.05**	6.38	**6.38**	21028
57.25	0.96	0.08	none	3.17	4.21	**5.12**	0.35	5.00	**4.65**	0.58	**5.35**	21026
40.00	0.10	0.54	0.38	0.63	1.65	**2.01**	0.78	9.06	**8.28**	1.89	**1.89**	20991
50.00	0.49	0.69	0.46	0.71	2.35	**2.86**	1.13	11.03	**9.90**	3.16	**3.16**	21153
33.00	0.07	0.08	0.09	0.66	0.90	**1.09**	0.80	9.11	**8.31**	2.40	**2.40**	20987
.....	0.07	0.48	0.38	0.73	1.66	**2.02**	1.00	9.28	**8.28**	2.93	**2.93**	21150
45.00	0.48	0.82	0.45	0.73	2.48	**3.02**	0.68	8.93	**8.25**	4.07	**4.07**	21155
67.00	1.17	0.03	0.28	4.40	5.88	**7.15**	0.40	4.18	**3.78**	0.78	**7.67**	21149
40.00	0.70	0.82	0.35	0.64	2.51	**3.05**	0.75	9.89	**9.14**	2.11	**2.11**	20994
48.60	0.98	0.02	0.02	3.11	4.13	**5.02**	0.28	4.90	**4.62**	0.40	**3.29**	21272
40.00	0.02	0.54	0.52	0.59	1.67	**2.03**	0.98	9.12	**8.14**	2.72	**2.72**	20989
.....	0.43	0.86	0.39	0.71	2.39	**2.91**	0.80	8.90	**8.10**	3.99	**3.99**	21024
.....	0.72	1.28	0.39	0.79	3.18	**3.87**	1.18	9.18	**8.00**	6.50	**6.50**	21145
.....	0.49	0.77	0.37	0.71	2.34	**2.84**	0.70	10.00	**9.30**	1.89	**1.89**	21146
38.00	0.11	0.45	0.35	0.56	1.53	**1.86**	0.78	9.40	**8.62**	1.97	**1.97**	20990
59.50	0.52	0.06	0.16	3.06	3.80	**4.62**	0.35	4.78	**4.43**	0.54	**4.88**	21027
56.60	0.68	0.04	0.08	3.05	3.85	**4.68**	0.25	4.61	**4.36**	0.47	**5.05**	21329
50.00	0.68	0.62	0.55	0.54	2.39	**2.91**	0.65	8.51	**7.86**	3.69	**3.69**	21151
.....	0.16	0.56	0.36	0.72	1.80	**2.19**	1.03	9.15	**8.12**	3.00	**3.00**	20985
45.70	0.70	1.36	0.71	0.61	3.38	**4.11**	1.00	9.03	**8.03**	6.56	**6.56**	21021
.....	0.75	1.37	0.61	0.62	3.35	**4.07**	1.03	9.03	**8.00**	6.59	**6.59**	21320
54.00	0.98	0.03	0.11	3.00	4.12	**5.01**	0.30	4.60	**4.30**	0.36	**3.62**	21549
49.30	2.99	1.17	0.45	0.60	5.21	**6.33**	0.83	7.05	**6.22**	4.06	**4.06**	21022
.....	0.11	0.11	0.15	0.62	0.99	**1.20**	0.73	8.99	**8.26**	2.04	**2.04**	20986
68.00	0.95	0.12	0.53	4.10	5.70	**6.93**	0.28	3.95	**3.67**	0.78	**6.92**	21173
.....	0.45	0.75	0.42	0.71	2.33	**2.83**	1.03	10.75	**9.72**	3.09	**3.09**	21167

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	American Agricultural Chemical Co., New York—*Continued.*		
21048	Quinnipiac Corn Manure	2-8-2	North Stonington
21164	Quinnipiac Fish and Potash Phosphate	3-10-3	North Haven
21172	Quinnipiac Market Garden Manure	4-8-7	Gaylordsville
21049	Quinnipiac Phosphate	3-9-2	North Stonington
21046	Quinnipiac Potato Phosphate	2-8-3	North Haven
21165	Quinnipiac Prime Tobacco Manure	7-3-7	Manchester
21166	Quinnipiac Seed Leaf Tobacco Manure	5-4-5	Manchester
21340[1]	Quinnipiac Superior Top Dressing Manure	6-6-4	Melrose
21341	Quinnipiac Wrapper Leaf Brand Tobacco Manure	5-4-3	Windsor
21339	Wheeler's Ammoniated Fish Manure	3-10-3	Northford
21171	Wheeler's Corn Fertilizer	2-8-2	New Milford
21274	Wheeler's Cuban Tobacco Grower	5-4-5	New Milford
21344	Wheeler's Early Market Compound	4-8-7	Huntington
21337	Wheeler's Potato Manure	2-8-3	Thomaston
21338	Wheeler's Royal Wheat Grower	1-8-2	Thomaston
21343	Wheeler's Universal Mixture	3-8-4	Huntington
	Apothecaries Hall Co., Waterbury.		
21050	Liberty Corn, Fruit and All Crops	2-8-2	Willimantic
20940	Liberty Fish, Bone and Potash	3-8-3	Meriden
21019	Liberty High Grade Market Gardeners	5-8-7	Meriden
21163	Liberty High Grade Tobacco Special	8-4-5	East Windsor
21015	Liberty Market Gardeners' Special	4-8-4	Cheshire
21170	Liberty Tobacco Special	5-4-5	East Windsor
21270	Liberty Top Dresser for Grass and Grain	7-8-3	East Windsor
	Armour Fertilizer Works, New York.		
21282	Armour's Big Crop Fertilizer, 2-12-2	2-12-2	Rockville
21020	Armour's Big Crop Fertilizer, 3-8-4	3-8-4	Thompsonville
21012[1]	Armour's Big Crop Fertilizer, 4-6-10	4-6-10	New Haven
21433[1]	Armour's Big Crop, 4-6-10	4-6-10	Guilford
21045[2]	Armour's Big Crop, 4-8-4	4-8-4	Guilford
21322[1]	Armour's Big Crop, 4-8-4	4-8-4	Norwich

[1] See Table XV, p. 55.
[2] See Note, p. 56

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$38.00	0.08	0.52	0.61	0.45	1.66	**2.02**	1.01	8.92	**7.91**	2.08	**2.08**	21048
43.00	0.40	0.78	0.53	0.73	2.44	**2.97**	0.97	10.63	**9.66**	2.97	**2.97**	21164
46.00	0.57	1.43	0.67	0.62	3.29	**4.00**	1.07	9.02	**7.95**	7.22	**7.22**	21172
42.00	0.66	0.72	0.64	0.51	2.53	**3.08**	0.72	9.65	**8.93**	2.05	**2.05**	21049
40.00	0.15	0.58	0.42	0.63	1.78	**2.16**	1.02	9.12	**8.10**	3.26	**3.26**	21046
.....	0.96	0.12	0.65	4.15	5.88	**7.15**	0.33	4.15	**3.82**	1.14	**7.09**	21165
.....	0.94	0.02	0.12	2.96	4.04	**4.91**	0.38	4.73	**4.35**	0.57	**4.86**	21166
50.00	2.33	1.06	0.49	0.50	4.38	**5.33**	0.83	7.58	**6.75**	4.05	**4.05**	21340
48.00	1.10	none	none	3.20	4.30	**5.23**	0.30	4.78	**4.48**	0.39	**3.66**	21341
40.00	0.35	0.73	0.65	0.68	2.41	**2.93**	1.08	11.08	**10.00**	2.95	**2.95**	21339
.....	0.18	0.47	0.34	0.66	1.65	**2.01**	0.93	9.20	**8.27**	2.09	**2.09**	21171
.....	1.68	none	0.04	2.43	4.15	**5.05**	0.28	4.21	**3.93**	0.56	**4.50**	21274
.....	0.69	1.34	0.67	0.57	3.27	**3.98**	1.15	9.20	**8.05**	6.67	**6.67**	21344
.....	0.08	0.38	0.55	0.72	1.73	**2.10**	0.67	8.63	**7.96**	3.00	**3.00**	21337
.....	0.13	0.31	0.26	0.52	1.22	**1.48**	0.60	8.73	**8.13**	2.54	**2.54**	21338
.....	0.50	0.86	0.38	0.73	2.47	**3.00**	0.63	8.90	**8.27**	3.86	**3.86**	21343
34.00	0.15	0.43	0.23	1.43	2.24	**2.72**	1.40	10.28	**8.88**	2.43	**2.43**	21050
61.00	0.11	2.14	0.68		2.93	**3.56**	0.88	9.63	**8.75**	3.01	**3.01**	20940
57.00	0.98	2.70	0.07	0.54	4.29	**5.22**	0.58	9.68	**9.10**	6.78	**6.78**	21019
67.50	0.33	3.22	0.15	2.98	6.68	**8.12**	0.55	6.63	**6.08**	0.60	**5.65**	21163
46.00	0.18	2.82	0.20	0.41	3.61	**4.39**	0.70	9.08	**8.38**	4.36	**4.36**	21015
55.00	0.16	1.12	1.10	2.22	4.60	**5.59**	0.63	6.13	**5.50**	0.54	**6.22**	21170
56.00	0.16	5.14	0.20	0.50	6.00	**7.29**	0.75	10.15	**9.40**	3.20	**3.20**	21270
44.00	0.18	1.00	0.13	0.45	1.76	**2.14**	0.51	12.15	**11.64**	2.03	**2.03**	21282
42.00	0.16	0.52	0.18	0.53	2.39	**2.91**	0.53	8.64	**8.11**	3.93	**3.93**	21020
50.00	1.15	1.03	0.28	0.62	3.08	**3.74**	0.35	6.13	**5.78**	10.38	**10.38**	21012
41.50	0.96	1.02	0.35	0.82	3.15	**3.83**	0.35	6.20	**5.85**	8.70	**8.70**	21433
38.75	1.41	0.98	0.26	0.64	3.29	**4.00**	0.84	8.44	**7.60**	4.06	**4.06**	21045
34.75	1.21	0.95	0.22	0.79	3.17	**3.85**	0.65	8.53	**7.88**	3.81	**3.81**	21322

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	Armour Fertilizer Works, New York —*Continued.*		
21043	Armour's Big Crop Fertilizer Tobacco Special, 5-4-5	5-4-5	Rockville
21011[1]	Armour's Big Crop Fertilizer, 5-8-5	5-8-5	New Haven
21047[2]	Armour's Big Crop Fertilizer, 5-8-7	5-8-7	Madison
21321[1]	Armour's Big Crop, 5-8-7	5-8-7	Norwich
21480[3]	Armour's Big Crop, 5-8-7	5-8-7	Norwich
21288[1]	Armour's Big Crop Grass, 8-6-6	8-6-6	Putnam
21336[1]	Armour's Corn Grower	2-8-[illegible]	Branford
	Atlantic Packing Co., New Haven		
21183[1]	Atlantic, 4-8-6	4-8-6	Norwich
21552[1]	Atlantic, 4-8-6	4-8-6	Factory
21108	Atlantic Grain Fertilizer, 2-8-2	2-8-2	South Windsor
21290	Atlantic Potato Phosphate, 3-8-4	3-8-4	Waterbury
21182	Atlantic Special Vegetable, 4-8-4	4-8-4	Norwich
21345[1]	Atlantic Tobacco Grower, 5-4-5	5-4-5	Glastonbury
21342	Atlantic Tobacco Manure, 5-8-6	5-8-6	East Hartford
	Berkshire Fertilizer Co., Bridgeport.		
21063	Berkshire, 5-8-7	5-8-7	Woodstock
21178	Berkshire Ammoniated Bone Phosphate	1-10-2	Centerbrook
21064	Berkshire Complete Fertilizer	3-8-3	Woodstock
21184	Berkshire Complete Tobacco	5-3-5	New Milford
21177	Berkshire Grass Special	7-4-4	Centerbrook
21065	Berkshire Market Garden	4-8-4	Woodstock
21014	Berkshire Potato and Vegetable	2-8-2	Ansonia
21355	Berkshire Tobacco Special	7-3-5	Suffield
	F. T. Blish Hardware Co., South Manchester.		
21113	Complete Market Garden	4-8-4	Factory
21505	Complete Tobacco Fertilizer	5-3-5	Factory
21112	Potato Phosphate	2-8-2	Factory
	F. E. Boardman, Middletown.		
21185	Boardman's Fertilizer, Potato and General Crops	4-7-4	Factory
21356	Boardman's Tobacco Fertilizer	4-7-4	Middletown

[1] See Table XV, p. 55.
[2] See Note, p. 56.
[3] Duplicate of 21321.

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$64.00	0.89	0.03	0.20	3.55	4.67	5.68	0.43	4.40	3.97	0.62	5.53	21043
52.00	1.50	1.18	0.35	0.86	3.89	4.73	0.63	8.70	8.07	4.79	4.79	21011
50.00	1.46	1.37	0.36	0.85	4.04	4.91	0.70	8.83	8.13	6.76	6.76	21047
39.50	1.02	0.85	0.11	0.69	2.67	3.25	0.60	11.43	10.83	4.29	4.29	21321
.....	.....	.....	.....	.....	2.80	3.40	.....	.....	.....	.....	.....	21480
62.15	1.44	3.16	0.28	1.44	6.32	7.68	0.24	5.90	5.66	6.01	6.01	21288
43.00	0.11	0.81	0.25	0.41	1.58	1.92	0.55	8.53	7.98	1.98	1.98	21336
.....	1.03	0.75	0.54	0.62	2.94	3.57	1.65	9.51	7.86	5.37	5.37	21183
.....	1.03	0.75	0.45	0.76	2.99	3.64	0.73	9.30	8.57	6.03	6.03	21552
.....	0.98	0.06	0.17	0.50	1.71	2.08	0.47	8.11	7.64	2.14	2.14	21108
44.75	1.34	0.06	0.58	0.70	2.68	3.26	0.68	9.33	8.65	3.62	3.62	21290
.....	1.33	0.52	0.34	1.01	3.20	3.89	0.50	8.74	8.24	4.00	4.00	21182
53.30	1.38	0.04	0.44	1.78	3.64	4.43	0.23	5.15	4.92	0.73	5.36	21345
50.00	1.16	0.04	0.69	2.19	4.08	4.96	0.45	9.40	8.95	0.74	6.37	21342
40.50	2.27	0.59	0.38	0.78	4.02	4.89	1.39	9.39	8.00	7.19	7.19	21063
38.00	none	0.24	0.52	0.30	1.06	1.29	1.08	11.85	10.77	2.03	2.03	21178
31.50	0.92	0.54	0.53	0.86	2.85	3.46	1.94	9.81	7.87	3.47	3.47	21064
.....	0.90	0.10	0.14	3.00	4.14	5.03	0.18	4.53	4.35	0.57	5.98	21184
55.00	4.58	0.02	0.58	1.06	6.24	7.59	1.83	5.59	3.76	3.91	3.91	21177
35.25	1.76	0.60	0.41	0.65	3.42	4.16	1.62	9.44	7.82	4.75	4.75	21065
38.00	0.70	0.42	0.56	0.30	1.98	2.41	1.55	9.36	7.81	2.34	2.34	21014
.....	1.24	0.30	0.72	3.41	5.67	6.89	0.18	5.08	4.90	0.90	5.68	21355
41.75	1.91	0.17	0.12	1.39	3.59	4.36	1.66	10.16	8.50	3.50	4.17	21113
53.20	0.82	0.06	0.16	3.24	4.28	5.20	0.20	4.18	3.98	0.77	5.46	21505
33.05	0.76	0.18	none	0.76	1.70	2.07	1.23	9.80	8.57	2.47	2.47	21112
41.00	1.46	0.34	0.44	1.10	3.34	4.06	1.19	8.03	6.84	3.46	3.99	21185
40.50	1.56	0.30	0.35	1.25	3.46	4.21	0.78	8.20	7.42	0.31	4.66	21356

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	Bowker Fertilizer Co., New York.		
21018	Bowker's All Round Fertilizer	3-8-4	Yalesville
21179	Bowker's Corn, Grain and Grass Phosphate	2-8-2	New London
21176	Bowker's Fisherman's Brand Fish and Potash	3-10-3	Plainville
21284[1]	Bowker's Market Garden Fertilizer	4-8-4	New London
21017	Bowker's Potato and Vegetable Phosphate	2-8-3	Plantsville
21368	Bowker's Square Brand Farm and Garden Phosphate	2-8-2	Plainville
21016	Bowker's Sure Crop Phosphate	1-8-2	Plantsville
21289[1]	Stockbridge Early Crop Manure	5-8-7	Rockville
21285[1]	Stockbridge Potato and Vegetable Manure	4-6-10	Willimantic
21360	Stockbridge Premier Tobacco Grower	7-3-7	South Manchester
21281	Stockbridge Tobacco Manure	5-4-5	Thompsonville
21280	Stockbridge Truck Manure	4-8-7	Plantsville
	Amos D. Bridge's Sons, Inc., Hazardville.		
21080	Corn, Onion and Potato and General Purpose	4-8-4	Factory
21081	Special Tobacco Fertilizer	5-3-5	Factory
	The E. D. Chittenden Co., Bridgeport.		
21082	Chittenden's Complete Grain	2-8-3	Broad Brook
21357	Chittenden's High Grade Tobacco	6.5-3-7.5	Broad Brook
21200	Chittenden's Potato Special 4% Potash	4-8-4	Abington
21204	Chittenden's Potato Special 6% Potash	4-8-6	Poquonock
21083	Chittenden's Tobacco Special 3% Potash	5-4-5	Broad Brook
	E. B. Clark Seed Co., Milford.		
21297	Clark's 3-8-2	3-8-2	Factory
21294	Clark's Special Mixture with 4% Potash Fertilizer	4-8-4	Branford
21295	Clark's Special Mixture with 6% Potash	4-8-6	Branford
21293	Clark's Special Mixture Tip Top Brand	5-8-5	Branford
21436[1]	Clark's Special Mixture Tip Top Brand	5-8-5	Factory

[1] See Table XV, p. 55.

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$49.75	0.48	0.84	0.40	0.74	2.46	**2.99**	0.75	8.80	**8.05**	4.27	**4.27**	21018
35.00	0.09	0.37	0.65	0.51	1.62	**1.97**	0.43	8.61	**8.18**	2.10	**2.10**	21179
44.00	0.41	0.76	0.55	0.72	2.44	**2.97**	0.90	10.60	**9.70**	3.05	**3.05**	21176
45.00	0.92	1.20	0.50	0.54	3.16	**3.84**	0.49	8.56	**8.07**	3.86	**3.86**	21284
35.00	0.22	0.52	0.36	0.70	1.80	**2.19**	1.00	9.23	**8.23**	3.46	**3.46**	21017
39.00	0.10	0.50	0.34	0.64	1.58	**1.92**	0.88	9.05	**8.17**	1.89	**1.89**	21368
33.00	0.20	0.38	0.25	0.65	1.48	**1.80**	0.78	9.00	**8.22**	3.09	**3.09**	21016
54.00	0.72	2.06	0.58	0.61	3.97	**4.83**	0.96	8.78	**7.82**	6.72	**6.72**	21289
46.00	0.83	1.20	0.46	0.52	3.01	**3.66**	0.40	6.69	**6.29**	9.22	**9.22**	21285
74.00	0.96	0.06	0.40	4.46	5.88	**7.15**	0.28	4.25	**3.97**	0.70	**7.22**	21360
55.00	0.02	0.04	1.15	2.95	4.16	**5.06**	0.38	4.70	**4.32**	0.70	**5.18**	21281
41.00	0.65	1.35	0.67	0.59	3.26	**3.96**	1.00	8.93	**7.93**	6.93	**6.93**	21280
43.50	1.50	0.09	0.28	1.50	3.37	**4.10**	1.53	9.73	**8.20**	4.23	**4.23**	21080
54.00	1.00	0.08	0.11	3.16	4.35	**5.29**	0.20	4.40	**4.20**	0.70	**6.03**	21081
32.00	0.17	1.02	0.16	0.69	2.04	**2.48**	0.99	8.60	**7.61**	3.13	**3.13**	21082
69.00	1.08	2.10	0.13	1.75	5.06	**6.15**	0.20	4.83	**4.63**	0.62	**7.56**	21357
43.00	1.51	1.11	0.08	0.67	3.37	**4.10**	0.90	9.28	**8.38**	3.97	**3.97**	21200
45.00	0.98	1.64	0.05	0.62	3.29	**4.00**	1.15	9.28	**8.13**	5.76	**5.76**	21204
56.00	0.85	1.71	0.14	1.44	4.14	**5.03**	0.25	6.30	**6.05**	0.70	**5.44**	21083
34.00	0.15	1.53	0.28	0.36	2.32	**2.82**	1.68	11.90	**10.22**	2.74	**2.74**	21297
41.00	0.06	2.46	0.25	0.32	3.09	**3.76**	1.50	10.88	**9.38**	3.34	**3.34**	21294
42.00	0.10	2.40	0.26	0.34	3.10	**3.77**	1.38	9.60	**8.22**	7.12	**7.12**	21295
44.00	0.56	2.56	0.28	0.52	3.92	**4.77**	1.38	9.30	**7.92**	5.51	**5.51**	21293
43.00	2.20	1.00	0.24	0.35	3.79	**4.61**	1.83	10.28	**8.45**	5.00	**5.00**	21436

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	The Coe-Mortimer Co., New York.		
21088[1]	E. Frank Coe's Celebrated Special Potato Fertilizer	4-8-4	Colchester
21089	E. Frank Coe's Columbian Corn and Potato Fertilizer	2-8-3	Colchester
21302	E. Frank Coe's Connecticut Wrapper Grower	5-4-5	Simsbury
21086[1]	E. Frank Coe's Gold Brand Excelsior Guano	3-8-4	Milford
21087	E. Frank Coe's New Englander Special	1-8-2	Saybrook
21197	E. Frank Coe's Red Brand Excelsior Guano	4-8-7	Colchester
21196	E. Frank Coe's Special Grass Top Dressing	6-6-4	Milford
21359	E. Frank Coe's Tobacco Leaf Fertilizer	5-4-3	Bloomfield
	Eastern States Farmers' Exchange, Springfield, Mass.		
21550	Eastern States, 2-8-2	2-8-2	Bloomfield
21085	Eastern States, 3-12-3	3-12-3	Branford
21084	Eastern States, 4-8-4	4-8-4	Branford
21291	Eastern States, 4-8-7	4-8-7	Branford
21203	Eastern States, 5-8-7 No-Filler Fertilizer	5-8-7	Ellington
21202	Eastern States, 5-10-5 No-Filler Fertilizer	5-10-5	Ellington
21299	Eastern States, 7-8-3 No-Filler Fertilizer	7-8-3	Ellington
21528[1]	Eastern States, Formula A	7.3-2-7.6	Granby
21515	Eastern States, Formula B	6.6-3.5-5	Ellington
21527	Eastern States, Formula C	6.5-3-5.5	Ellington
	Essex Fertilizer Co., Boston, Mass.		
21079	Essex 2-8-2 for Farm and Garden	2-8-2	Wallingford
21078	Essex Fish Fertilizer for all Crops, 3-8-4	3-8-4	Wallingford
21351	Essex 4-6-10 for Potatoes and Vegetables	4-6-10	South Manchester
21298	Essex Market Garden for Potatoes, Roots and Vegetables, 4-8-4	4-8-4	South Manchester
21435[2]	Essex Market Garden for Potatoes, Roots and Vegetables, 4-8-4	4-8-4	Wallingford
21350	Essex Potato Phosphate, 4:8-7	4-8-7	South Manchester
21354	Essex Tobacco, 5-4-5	5-4-5	East Granby

[1] See Table XV, p. 55.
[2] See Note, p. 56.

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$47.50	0.73	0.87	0.61	0.51	2.72	**3.31**	0.73	9.03	**8.30**	3.60	**3.60**	21088
39.35	0.04	0.46	0.70	0.50	1.70	**2.07**	0.55	8.33	**7.78**	3.03	**3.03**	21089
.....	1.07	0.03	0.08	2.93	4.11	**5.00**	0.33	4.68	**4.35**	0.54	**5.22**	21302
45.00	0.39	0.81	0.34	0.66	2.20	**2.67**	0.73	9.05	**8.32**	3.67	**3.67**	21086
33.00	0.54	0.46	0.20	0.66	1.86	**2.26**	0.83	8.70	**7.87**	2.57	**2.57**	21087
50.70	0.93	1.23	0.44	0.63	3.23	**3.93**	0.90	8.66	**7.76**	7.40	**7.40**	21197
52.00	2.70	1.14	0.48	0.64	4.96	**6.03**	0.90	7.30	**6.40**	4.51	**4.51**	21196
60.00	1.04	0.04	none	3.12	4.20	**5.11**	0.30	4.84	**4.54**	0.32	**3.32**	21359
.....	0.04	1.10	0.24	0.34	1.72	**2.09**	0.45	8.44	**7.99**	1.95	**1.95**	21550
41.00	0.63	1.21	0.24	0.42	2.50	**3.04**	1.14	13.29	**12.15**	3.00	**3.00**	21085
41.50	0.83	1.78	0.30	0.37	3.28	**3.99**	0.65	8.90	**8.25**	3.65	**4.03**	21084
43.50	0.98	1.82	0.45	0.33	3.58	**4.35**	0.63	9.50	**8.87**	5.89	**5.89**	21291
43.65	0.02	2.56	0.52	0.90	4.00	**4.86**	0.58	10.18	**9.60**	5.91	**5.91**	21203
44.00	0.15	2.53	0.46	1.00	4.14	**5.03**	0.93	11.05	**10.12**	5.02	**5.02**	21202
45.90	0.19	4.53	0.44	0.56	5.72	**6.95**	0.63	9.10	**8.47**	2.93	**2.93**	21299
71.00	1.36	0.46	0.64	2.52	4.98	**6.05**	1.48	8.03	**6.55**	2.58	**7.07**	21528
61.10	0.18	1.22	0.46	3.80	5.66	**6.88**	0.35	4.50	**4.15**	1.04	**5.40**	21515
.....	1.00	0.16	0.21	3.77	5.14	**6.25**	0.18	5.98	**5.80**	1.46	**5.30**	21527
36.00	0.90	0.06	0.25	0.44	1.65	**2.01**	0.63	9.30	**8.67**	2.39	**2.39**	21079
41.00	0.66	1.00	0.19	0.61	2.46	**2.99**	0.43	9.18	**8.75**	4.57	**4.57**	21078
56.00	1.00	0.80	0.57	0.91	3.28	**3.99**	0.50	7.03	**6.53**	10.16	**10.16**	21351
50.00	0.99	0.83	0.63	0.69	3.14	**3.82**	0.73	9.23	**8.50**	3.88	**3.88**	21298
43.00	1.02	0.88	0.47	1.04	3.41	**4.14**	0.65	9.10	**8.45**	4.28	**4.28**	21435
53.00	0.89	1.11	0.34	0.98	3.32	**4.04**	0.60	8.75	**8.15**	6.61	**6.61**	21350
59.75	1.24	0.27	0.70	1.75	3.96	**4.81**	0.85	5.58	**4.73**	0.60	**5.56**	21354

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	L. T. Frisbie Co., New Haven.		
21093	Frisbie's 5-8-7	5-8-7	West Cheshire
20904	Frisbie's 5-10-5	5-10-5	Woodmont
21100	Frisbie's Corn and Grain Fertilizer 2-8-2	2-8-2	Jewett City
21092[1]	Frisbie's Market Garden, 4-8-6	4-8-6	West Cheshire
21267[1]	Frisbie's Market Garden, 4-8-6	4-8-6	Norwich
21511	Frisbie's Special, 3-8-4	3-8-4	Jewett City
21099[1]	Frisbie's Special Vegetable and Potato Grower, 4-8-4	4-8-4	Guilford
21265[2]	Frisbie's Special Vegetable and Potato Grower, 4-8-4	4-8-4	West Cheshire
21353	Frisbie's Tobacco Grower, 5-4-5	5-4-5	Rockville
21352[1]	Frisbie's Tobacco Manure, 5-8-6	5-8-6	Rockville
21574[2]	Frisbie's Tobacco Manure, 5-8-6	5-8-6	Burnside
21349	Frisbie's Top Dresser, 7-5-4	7-5-4	Wethersfield
	International Agricultural Corp., Boston, Mass.		
21372	Buffalo Complete Tobacco	4-4-4	East Granby
21374	Buffalo Economy	2-8-2	Wallingford
21375	Buffalo High Grade Manure	4-6-10	Wallingford
21373	Buffalo New England Special	2-12-4	East Granby
21377	Buffalo Tobacco Producer	5.5-5-5.5	North Granby
21376[1]	Buffalo Top Dresser and Starter	7-6-5	Wallingford
	Lowell Fertilizer Co., Boston, Mass.		
20913	Lowell 2-8-3, Vegetables and Grain	2-8-3	Cheshire
21369	Lowell 4-6-10, Potatoes and Vegetables	4-6-10	Moosup
20912	Lowell 4-8-4 for Potatoes, Corn and Vegetables	4-8-4	Cheshire
21094	Lowell 5-8-7 for Potatoes and Vegetables	5-8-7	Southington
21098[1]	Lowell Animal Brand, 3-8-4	3-8-4	Suffield
21367	Lowell Bone Fertilizer, 2-8-2, for Corn, Grain, Grass and Vegetables	2-8-2	Southington
21371	Lowell Potato Phosphate, 4-8-7	4-8-7	Warehouse Point
21378	Lowell 5-4-5 for Tobacco, Fruits and Vines	5-4-5	Granby
21370	Lowell Tobacco Manure, 5-8-6	5-8-6	Warehouse Point
20914	Lowell 7-5-2 Top Dresser	7-5-2	Cheshire

[1] See Table XV, p. 55.
[2] See Note, p. 56.

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$49.00	1.60	0.88	0.57	0.95	4.00	**4.86**	0.90	9.70	**8.80**	6.99	**6.99**	21093
46.00	1.75	0.98	0.62	0.78	4.13	**5.02**	0.20	10.84	**10.64**	5.34	**5.34**	20904
34.00	0.91	0.03	0.34	0.36	1.64	**1.99**	0.65	8.65	**8.00**	2.01	**2.01**	21100
45.00	1.03	0.73	0.43	0.73	2.92	**3.55**	0.40	8.88	**8.48**	6.74	**6.74**	21092
44.00	1.04	0.74	0.52	0.64	2.94	**3.57**	0.48	8.88	**8.40**	6.37	**6.37**	21267
39.00	1.02	0.38	0.15	0.88	2.43	**2.95**	1.16	9.20	**8.04**	4.01	**4.01**	21511
38.75	1.20	0.52	0.56	0.74	3.02	**3.67**	1.33	9.53	**8.20**	3.81	**3.81**	21099
43.00	1.30	0.48	0.62	0.78	3.18	**3.87**	1.30	9.74	**8.44**	0.45	**3.94**	21265
61.00	1.23	0.27	0.55	1.90	3.95	**4.80**	1.05	5.63	**4.58**	0.58	**5.35**	21353
63.00	1.46	0.24	0.88	0.92	3.50	**4.26**	0.55	9.18	**8.63**	0.82	**6.67**	21352
.....	.....	.....	.....	.....	4.28	**5.20**	1.25	10.38	**9.13**	0.94	**6.56**	21574
.....	4.36	0.02	0.64	0.62	5.64	**6.86**	0.68	6.13	**5.45**	4.44	**4.44**	21349
.....	0.09	1.31	0.10	1.82	3.32	**4.04**	0.25	4.58	**4.33**	0.20	**4.07**	21372
36.50	0.34	0.26	0.38	0.82	1.80	**2.19**	2.20	10.58	**8.38**	2.39	**2.39**	21374
47.00	1.00	0.56	0.50	1.24	3.30	**4.01**	0.85	7.28	**6.43**	8.60	**8.60**	21375
.....	0.93	0.07	0.31	0.49	1.80	**2.19**	0.70	13.15	**12.45**	4.40	**4.40**	21373
60.60	0.22	2.42	0.03	1.83	4.50	**5.47**	0.23	6.05	**5.82**	0.58	**5.47**	21377
56.00	0.91	2.45	0.24	1.80	5.40	**6.57**	0.60	7.50	**6.90**	1.57	**4.78**	21376
30.00	0.84	0.08	0.21	0.53	1.66	**2.02**	0.43	9.85	**9.42**	3.08	**3.08**	20913
53.00	1.10	0.82	0.53	0.84	3.29	**4.00**	0.50	6.93	**6.43**	10.21	**10.21**	21369
37.00	1.03	0.82	0.39	1.00	3.24	**3.94**	0.53	8.83	**8.30**	4.05	**4.05**	20912
59.00	1.32	1.26	0.57	0.93	4.08	**4.96**	0.55	9.06	**8.51**	6.88	**6.88**	21094
40.00	0.79	0.46	0.31	0.68	2.24	**2.72**	0.53	8.81	**8.28**	4.04	**4.04**	21098
41.00	0.55	0.08	0.45	0.56	1.64	**1.99**	0.68	9.10	**8.42**	2.10	**2.10**	21367
39.75	1.02	0.90	0.24	1.08	3.24	**3.94**	0.73	9.18	**8.45**	6.81	**6.81**	21371
58.00	1.21	0.29	0.63	1.70	3.83	**4.66**	1.08	5.60	**4.52**	0.47	**5.35**	21378
57.75	1.56	0.36	0.77	1.24	3.93	**4.78**	0.75	9.00	**8.25**	1.02	**6.33**	21370
47.00	0.17	4.88	0.25	0.19	5.49	**6.67**	0.10	6.00	**5.90**	2.13	**2.13**	20914

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	Mapes Fertilizer and Peruvian Guano Co., New York.		
21096	The Mapes Connecticut Valley Special	6-4-7	Suffield
21097	The Mapes Corn Manure	3-8-3	Suffield
21387	The Mapes General Tobacco Manure	5-4-5	Glastonbury
21102	The Mapes General Truck Manure	5-6-5	Hartford
21385	The Mapes General Use Manure	3-6-4	Hartford
21390	The Mapes Grain Brand	2-8-2	Hartford
21384	The Mapes Onion Manure	4-6-4	Hartford
21095	The Mapes Potato Manure	4-7-5	Suffield
21380[2]	The Mapes Tobacco Ash Constituents	1-4-15	Suffield
21548[2]	The Mapes Tobacco Ash Constituents	1-4-15	West Suffield
20959	The Mapes Tobacco Manure Wrapper Brand	7.5-2-10.5	Warehouse Point
20960[2]	The Mapes Tobacco Starter Improved	5-6-1	Warehouse Point
21268[2]	The Mapes Tobacco Starter Improved	5-6-1	Hartford
21553[1]	The Mapes Top Dresser	10-4-2	Hartford
21103[2]	The Mapes Top Dresser	10-4-2	Hartford
	Meech & Stoddard, Inc., Middletown.		
21544	Bixota Brand Fertilizer, 2-8-2	2-8-2	Factory
21543	Bixota Brand Fertilizer, 3-8-3	3-8-3	Factory
21542	Bixota Brand Fertilizer, 4-8-4	4-8-4	Factory
21541	Bixota Brand Fertilizer, 5-8-7	5-8-7	Factory
	Nature's Plant Food Co., Boston, Mass.		
21403[1]	Nature's Plant Food	1.2-3-2	Groton
	New England Fertilizer Co., Boston, Mass.		
21386	New England 2-8-3 for Vegetables and Grain	2-8-3	Meriden
21391	New England 4-8-4 for Potatoes and Vegetables	4-8-4	Hamburg
21382	New England Corn Phosphate 2-8-2 for Grain and Vegetable	2-8-2	Rockville
21381	New England Potato Phosphate 4-8-7 for Potatoes and Vegetables	4-8-7	Rockville

[1] See Table XV, p. 55.
[2] See Note, p. 56.

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$68.00	2.07	0.54	0.92	1.72	5.25	**6.38**	0.48	5.53	**5.05**	1.62	**8.08**	21096
40.00	0.84	0.32	0.27	0.84	2.27	**2.76**	1.48	10.53	**9.05**	1.98	**3.02**	21097
.....	1.41	0.16	1.08	2.06	4.71	**5.73**	0.78	6.33	**5.55**	0.96	**5.57**	21387
46.00	2.02	0.48	0.61	1.06	4.17	**5.07**	0.85	8.58	**7.73**	2.58	**5.28**	21102
38.00	0.78	0.44	0.29	0.99	2.50	**3.04**	1.10	8.85	**7.75**	3.54	**4.15**	21385
34.00	0.05	0.28	0.40	1.23	1.96	**2.38**	2.05	10.18	**8.13**	2.00	**2.00**	21390
41.80	1.88	0.48	0.30	0.99	3.65	**4.44**	2.03	9.30	**7.27**	0.74	**4.56**	21384
45.00	1.77	0.41	0.46	1.02	3.66	**4.45**	1.15	9.78	**8.63**	2.59	**5.17**	21095
50.00	0.15	0.28	0.38	0.57	1.38	**1.68**	1.83	6.70	**4.87**	1.30	**10.85**	21380
.....	0.06	0.26	0.37	0.63	1.32	**1.61**	1.20	7.00	**5.80**	1.18	**12.86**	21548
73.00	3.53	0.55	1.21	1.58	6.87	**8.35**	1.38	5.05	**3.67**	1.40	**11.51**	20959
45.00	1.97	0.44	0.49	0.81	3.71	**4.51**	0.73	7.93	**7.20**	0.70	**0.97**	20960
42.75	2.24	0.56	0.57	0.94	4.31	**5.24**	2.30	8.19	**5.89**	0.86	**1.20**	21268
.....	5.21	0.40	1.09	0.72	7.42	**9.02**	0.65	6.08	**5.43**	2.62	**2.62**	21553
59.85	5.11	0.41	1.20	1.07	7.79	**9.47**	1.05	6.83	**5.78**	3.35	**3.35**	21103
39.00	0.87	0.03	0.70	0.44	2.04	**2.48**	2.52	10.49	**7.97**	2.46	**2.46**	21544
45.00	1.86	0.06	0.62	0.40	2.94	**3.57**	2.06	9.58	**7.52**	3.28	**3.28**	21543
48.00	2.38	0.08	0.64	0.38	3.48	**4.23**	1.78	9.88	**8.10**	3.91	**3.91**	21542
54.00	3.20	0.06	0.74	0.28	4.28	**5.20**	2.10	10.02	**7.92**	6.95	**6.95**	21541
.....	.....	.....	.....	.....	0.87	**1.06**	1.98	2.46	**0.48**	2.56	**2.56**	21403
37.00	1.01	0.12	0.33	0.72	2.18	**2.65**	0.60	9.50	**8.90**	3.59	**3.59**	21386
49.00	0.82	0.90	0.59	0.99	3.30	**4.01**	0.65	9.00	**8.35**	4.08	**4.08**	21391
44.00	0.72	0.10	0.29	0.61	1.72	**2.09**	0.63	9.45	**8.82**	2.41	**2.41**	21382
54.00	1.06	0.92	0.32	1.00	3.30	**4.01**	0.78	9.10	**8.32**	6.27	**6.27**	21381

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	New England Fertilizer Co., Boston, Mass.—*Continued.*		
21383	New England Superphosphate 3-8-4, for all crops	**3-8-4**	Rockville
21547	New England Tobacco Manure, 5-8-6	**5-8-6**	Glastonbury
21389	New England Tobacco, 5-4-5 for Tobacco, Fruits and Vines	**5-4-5**	West Suffield
	Nitrate Agencies Co., New York.		
21388	Naco Brand No. 12 Peruvian Guano Mixture	**5.25-10.5 -5.25**	Stamford
21716	Naco Brand Peruvian Guano	**12-10-2.5**	Suffield
	Olds & Whipple, Inc., Hartford.		
21393	Complete Corn, Potato and Onion Fertilizer	**4-8-4**	New Britain
21398	Complete Corn, Onion and Potato Fertilizer	**3-8-2**	Suffield
21395	Complete Tobacco Fertilizer	**5-3-5**	South Windsor
21399	Fish and Potash	**3-6-5**	South Windsor
21419	High Grade Potato Fertilizer	**5-8-7**	New Britain
21394	High Grade Starter and Potash Compound	**5-4-15**	Factory
	Parmenter & Polsey Fertilizer Co., Boston, Mass.		
21429	4-8-4 for Potatoes, Corn and Vegetables	**4-8-4**	New Britain
21424	Plymouth Rock Brand 3-8-4 for all Crops	**3-8-4**	Gaylordsville
	Frank S. Platt Co., New Haven		
21420[1]	Platco Special, 4-8-6	**4-8-6**	Factory

[1] See Table XV, p. 55.

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$48.00	0.76	0.82	0.21	0.66	2.45	**2.98**	0.40	8.78	**8.38**	3.88	**3.88**	21383
.....	1.85	0.18	0.73	1.34	4.10	**4.98**	0.60	9.01	**8.41**	1.34	**6.33**	21547
54.00	1.25	0.28	1.49	1.19	4.21	**5.12**	1.00	5.75	**4.75**	0.64	**5.30**	21389
.....	1.08	1.90	0.46	0.71	4.15	**5.05**	0.93	11.70	**10.77**	5.33	**5.66**	21388
80.00	1.14	4.38	0.49	5.00	11.01	**13.39**	1.71	12.00	**10.29**	2.42	**2.83**	21716
43.70	1.56	0.07	0.21	1.52	3.36	**4.09**	1.45	9.60	**8.15**	4.30	**4.30**	21393
39.42	1.54	0.02	0.08	1.12	2.76	**3.36**	1.20	9.65	**8.45**	1.17	**2.31**	21398
55.57	0.98	0.06	0.19	3.09	4.32	**5.25**	0.25	4.05	**3.80**	0.77	**5.95**	21395
42.75	1.01	0.14	none	1.54	2.69	**3.27**	0.60	7.88	**7.28**	5.39	**5.39**	21399
55.35	1.43	0.23	1.10	1.75	4.51	**5.48**	2.25	10.30	**8.05**	3.80	**7.61**	21419
61.75	1.46	0.06	0.51	2.10	4.13	**5.02**	0.25	4.50	**4.25**	1.93	**16.00**	21394
44.00	1.08	0.86	0.54	0.73	3.21	**3.90**	0.80	9.10	**8.30**	4.20	**4.20**	21429
39.75	0.93	0.11	0.54	0.90	2.48	**3.02**	0.68	9.40	**8.72**	3.74	**3.74**	21424
47.00	1.05	0.71	0.60	0.61	2.97	**3.61**	0.99	8.83	**7.84**	6.27	**6.27**	21420

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	The Rogers & Hubbard Co., Portland.		
21454	R. & H. All Soils-All Crops	4-8-4	Hartford
21421	Hubbard's "Bone Base" Fertilizer for Oats and Top Dressing	10-3-8	Glastonbury
21422	Hubbard's "Bone Base" Fertilizer for Seeding Down	3-5-6	Factory
21457[1]	Hubbard's "Bone Base" Soluble Corn and General Crops Manure	3-8-6	Norwich
21460	Hubbard's "Bone Base" Soluble Potato Manure	6-8-5	Norwich
21464	R. & H. Climax Tobacco Brand	5-4-4	Glastonbury
21459	R. & H. Corn and Grain Fertilizer	1-10-3	Norwich
21467	R. & H. Garden Fertilizer	2-8-4	Hartford
21462	R. & H. High Potash Fertilizer	3-8-10	Somers
21458	R. & H. Potato Fertilizer	2-8-4	Norwich
21456	R. & H. Tobacco Grower, Vegetable Formula	6-4-4	Windsor
21465	R. & H. Soluble Tobacco Manure	6-8-10	Somerville
	F. S. Royster Guano Co., Baltimore, Md.		
21471	Royster's Bully Guano	2-8-5	Glastonbury
21477	Royster's Fish, Flesh and Fowl	2-8-3	Danielson
21469[1]	Royster's Quality Trucker	4-8-7	Glastonbury
21476[1]	Royster's Top Dresser	7-6-5	Glastonbury
20905	Royster's Trucker's Delight	4-8-4	Milford
21468	Royster's Valley Tobacco Formula	5-4-5	Glastonbury
	Sanderson Fertilizer & Chemical Co., New Haven.		
21070	Atlantic Coast Bone, Fish and Potash	2-8-3	Warehouse Point
21069	Complete Tobacco Grower	5-4-5	Warehouse Point
21472	Corn Superphosphate	2-8-2	Seymour
21139	Formula A	4-8-4	Guilford
21475	Formula B	4-8-6	Cromwell
21486[1]	Kelsey's Bone, Fish and Potash	3-10-3	North Haven
21484	Potato Manure	3-8-4	West Cheshire
21489	Top Dressing for Grass and Grain	6-6-4	East Haven

[1] See Table XV, p. 55.

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$54.00	2.22	0.16	0.54	0.46	3.38	**4.11**	2.29	9.85	**7.56**	3.91	**3.91**	21454
.....	6.83	0.03	0.90	0.35	8.11	**9.86**	3.80	8.15	**4.35**	3.40	**7.10**	21421
49.25	1.08	0.13	0.38	1.15	2.74	**3.33**	5.30	12.30	**7.00**	5.49	**5.49**	21422
51.00	1.13	0.16	0.52	0.66	2.47	**3.00**	3.63	11.63	**8.00**	5·08	**5.08**	21457
64.00	3.17	0.15	0.92	0.76	5.00	**6.08**	2.94	9.99	**7.05**	1.14	**5.49**	21460
54.00	1.43	0.05	0.46	1.92	3.86	**4.69**	0.85	5.20	**4.35**	0.61	**4.48**	21464
38.00	none	0.13	0.24	0.56	0.93	**1.13**	2.03	12.60	**10.57**	2.57	**2.57**	21459
47.00	0.49	0.17	0.56	0.52	1.74	**2.11**	2.23	10.17	**7.94**	3.37	**3.37**	21467
46.00	1.33	0.09	0.63	0.48	2.53	**3.08**	2.87	10.76	**7.89**	9.73	**9.73**	21462
42.00	0.60	0.12	0.56	0.34	1.62	**1.97**	2.01	9.89	**7.88**	3.66	**3.66**	21458
.....	1.46	0.08	0.12	3.32	4.98	**6.05**	1.08	5.50	**4.42**	0.57	**4.10**	21456
61.00	3.47	0.15	1.23	0.67	5.52	**6.71**	2.19	9.70	**7.51**	1.48	**10.11**	21465
.....	0.11	1.22	none	0.41	1.74	**2.11**	0.75	9.13	**8.38**	4.97	**4.97**	21471
36.75	0.08	1.02	none	0.45	1.55	**1.88**	1.27	9.03	**7.76**	3.31	**3.31**	21477
.....	0.08	2.08	0.24	0.65	3.05	**3.71**	1.08	9.15	**8.07**	6.90	**6.90**	21469
.....	0.78	2.82	0.46	1.25	5.31	**6.46**	0.77	6.68	**5.91**	4.86	**4.86**	21476
43.00	0.10	2.22	0.23	0.64	3.19	**3.88**	0.90	8.87	**7.97**	3.91	**3.91**	20905
57.25	0.45	0.94	0.08	2.40	3.87	**4.71**	0.40	4.98	**4.58**	0.49	**4.95**	21468
35.00	0.04	0.58	0.42	0.64	1.68	**2.04**	1.15	9.48	**8.33**	3.02	**3.02**	21070
54.75	0.87	0.15	0.19	2.98	4.19	**5.09**	0.28	4.58	**4.30**	0.61	**4.95**	21069
38.00	0.12	0.50	0.34	0.66	1.62	**1.97**	0.90	9.10	**8.20**	2.15	**2.15**	21472
48.00	0.64	1.37	0.60	0.66	3.27	**3.98**	1.23	9.33	**8.10**	4.02	**4.02**	21139
45.00	0.76	1.00	0.32	1.42	3.50	**4.26**	1.69	9.77	**8.08**	2.68	**5.98**	21475
.....	0.36	0.74	0.43	0.73	2.26	**2.75**	0.88	10.87	**9.99**	3.05	**3.05**	21486
45.00	0.42	0.90	0.34	0.78	2.44	**2.97**	0.68	8.80	**8.12**	4.17	**4.17**	21484
49.00	2.85	1.18	0.33	0.64	5.00	**6.08**	0.98	7.00	**6.02**	3.82	**3.82**	21489

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	M. L. Shoemaker & Co., Philadelphia, Pa.		
21488	Swift-Sure Cotton Seed Mixture, 5-4-5	5-4-5	New Milford
21491	Swift-Sure Super Phosphate Crop Grower, 4-8-4	4-8-4	Hartford
21487	Swift-Sure Super Phosphate Potato No. 1, 4-8-5	4-8-5	New Milford
21136	Swift-Sure Super Phosphate Tobacco and General Use, 3-10-3	3-10-3	Thompsonville
	Springfield Rendering Co., Springfield, Mass.		
21492[1]	4-8-6	4-8-6	Suffield
21135	Animal Brand, 3-8-4	3-8-4	Windsor Locks
21142	Market Garden Grower and Top Dresser, 5-8-7	5-8-7	Stafford Springs
21485[1]	Special Potato, Onion and Vegetable, 4-8-4	4-8-4	Stafford Springs
21530	Tobacco Special, 5-4-5	5-4-5	Windsor Locks
	Virginia-Carolina Chemical Co., New York.		
21496	Aroostook Potato Grower	5-8-7	North Haven
21138	Champion Brand	4-8-4	Rockville
21140	Double Owl Brand	4-8-6	Guilford
21495	Eureka Brand	2-8-10	North Haven
21141[1]	Fish, Phosphate and Potash Brand	2-8-2	Danielson
21137	Indian Chief Brand	5-4-5	Hazardville
21131	Owl Brand	2-8-3	North Haven
21497	Perfection Brand	3-9-5	North Haven
21504	Plymouth Brand	2-12-4	New Hartford
	Whitman & Pratt Rendering Co., Boston, Mass.		
21120	Whitman & Pratt's 4-8-4 Brand	4-8-4	Norwich
	Wilcox Fertilizer Co., Mystic.		
21499	4-8-4, Fertilizer	4-8-4	New London
21319[1]	5-8-7	5-8-7	Factory
21115	Corn Special	3-10-4	Mystic
21116	Fish and Potash	3-8-3	Mystic
21501[1]	Grass and Truck Fertilizer	5-8-4	Factory
21500[1]	Potato and Vegetable Phosphate	4-8-6	Mystic
21123	Tobacco Special	5-4-5	Ellington

[1] See Table XV, p. 55.

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$60.00	0.72	0.11	0.14	3.39	4.36	**5.30**	2.03	8.40	**6.37**	1.63	**6.26**	**21488**
.....	1.17	0.11	0.28	1.50	3.06	**3.72**	0.95	12.13	**11.18**	2.68	**3.54**	**21491**
48.00	1.15	0.09	0.45	1.67	3.36	**4.09**	3.40	12.78	**9.38**	0.54	**5.39**	**21487**
52.00	1.16	0.04	0.34	1.38	2.92	**3.55**	2.60	13.38	**10.78**	0.51	**3.33**	**21136**
45.25	0.56	0.70	0.72	1.02	3.00	**3.65**	0.65	9.13	**8.48**	6.02	**6.02**	**21492**
45.00	1.14	none	0.60	0.75	2.49	**3.03**	0.38	8.88	**8.50**	4.13	**4.13**	**21135**
50.00	1.48	0.05	1.30	1.33	4.16	**5.06**	0.60	9.18	**8.58**	7.16	**7.16**	**21142**
44.00	1.43	0.05	0.79	0.78	3.05	**3.71**	0.55	9.03	**8.48**	4.04	**4.04**	**21485**
.....	1.48	0.06	0.58	1.80	3.92	**4.77**	0.28	5.38	**5.10**	0.80	**5.43**	**21530**
49.00	0.08	3.69	0.07	0.25	4.09	**4.97**	0.93	9.53	**8.60**	7.14	**7.14**	**21496**
50.00	0.11	2.57	0.29	0.30	3.27	**3.98**	1.30	9.35	**8.05**	4.04	**4.04**	**21138**
40.75	0.12	2.70	0.15	0.21	3.18	**3.87**	1.40	10.53	**9.13**	6.04	**6.04**	**21140**
40.00	none	1.21	0.14	0.23	1.58	**1.92**	1.10	9.23	**8.13**	9.97	**9.97**	**21495**
31.00	0.04	0.66	0.43	0.31	1.44	**1.75**	1.68	9.95	**8.27**	1.90	**1.90**	**21141**
54.25	0.43	0.46	none	3.29	4.18	**5.08**	0.55	5.25	**4.70**	0.53	**4.89**	**21137**
35.00	0.03	1.18	0.33	0.16	1.70	**2.07**	1.55	10.59	**9.04**	3.17	**3.17**	**21131**
41.00	0.02	2.10	0.26	0.22	2.60	**3.16**	1.45	10.78	**9.33**	4.92	**4.92**	**21497**
35.00	0.07	1.29	0.04	0.18	1.58	**1.92**	1.35	13.88	**12.53**	4.22	**4.22**	**21504**
40.00	1.30	0.18	0.11	1.69	3.28	**3.99**	5.43	14.63	**9.20**	4.06	**4.06**	**21120**
45.00	1.45	0.30	0.53	0.87	3.15	**3.83**	2.05	10.15	**8.10**	4.00	**4.00**	**21499**
.....	1.94	0.08	0.88	1.09	3.99	**4.85**	2.08	10.08	**8.00**	3.38	**6.80**	**21319**
39.00	1.23	0.09	0.48	0.74	2.54	**3.09**	1.50	11.28	**9.78**	4.26	**4.26**	**21115**
38.50	0.68	0.14	0.35	1.23	2.40	**2.92**	0.78	8.78	**8.00**	3.31	**3.31**	**21116**
.....	1.81	0.09	0.83	1.21	3.94	**4.79**	2.33	10.34	**8.01**	3.43	**4.03**	**21501**
44.90	1.66	0.01	0.60	0.82	3.09	**3.76**	1.63	10.05	**8.42**	2.14	**5.79**	**21500**
60.00	0.74	0.10	0.16	2.96	3.96	**4.81**	0.40	6.23	**5.83**	0.61	**6.40**	**21123**

TABLE XVI. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	S. D. Woodruff & Sons, Orange.		
21503[1]	Woodruff's Home Mixed	4-8-6	Factory
	Worcester Rendering Co., Auburn, Mass.		
21122	Prosperity Brand Corn and Grain	2-8-2	Putnam
21506[1]	Prosperity Brand Potato and Vegetable Fertilizer	4-8-4	Norwich
	Sampled by Purchaser:		
	American Chemical Specialties Co., Inc., New Jersey.		
20431	Springfield Carnation Food	2.4-3.25 -3.5	Jewett City
	Bowker Fertilizer Co., New York.		
20949	Bowker's Tobacco Fertilizer	5-4-5	Suffield
21587	Stockbridge Tobacco Fertilizer, 5-4-5	5-4-5	Suffield
	Eastern States Farmers' Exchange, Springfield, Mass.		
21347	7-8-3	7-8-3	Milford
21348	5-8-7	5-8-7	Milford
	The L. T. Frisbie Co., New Haven.		
21220	4-8-6 Fertilizer	4-8-6	Woodmont
21221	5-10-5 Fertilizer	5-10-5	Woodmont
	Mapes Fertilizer and Peruvian Guano Co., New York.		
20948	Potato Manure	4-7-5	Suffield
	Nitrate Agencies Co., New Jersey.		
20629	Genuine Peruvian Guano	12-10-2.5	Suffield

[1] See Table XV, p. 55.
[2] $4.80 per one hundred pounds.

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

Dealer's cash price per ton.	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.
	%	%	%	%	%	%	%	%	%	%	%	
$42.00	1.42	0.02	0.63	1.49	3.56	**4.33**	11.19	13.14	**1.95**	6.38	**6.38**	21503
34.50	1.02	0.06	0.30	0.46	1.84	**2.24**	0.17	8.33	**8.16**	2.32	**2.32**	21122
45.00	0.63	0.61	0.37	0.91	2.52	**3.06**	1.05	9.15	**8.10**	5.08	**5.08**	21506
.....	.....	.....	.....	.....	2.16	**2.63**	2.88	8.84	**5.96**	.....	**3.85**	20431
.....	.....	.....	.....	.....	4.29	**5.22**	.....	5.00	.....	.....	**5.50**	20949
60.25	.....	.....	.....	.....	4.19	**5.09**	0.31	4.63	**4.32**	.....	**5.02**	21587
[2]	.....	.....	.....	.....	5.32	**6.47**	0.70	9.15	**8.45**	.....	**2.99**	21347
[2]	.....	.....	.....	.....	3.99	**4.85**	0.68	9.30	**8.62**	.....	**6.53**	21348
41.00	.....	.....	.....	.....	3.16	**3.84**	1.03	9.33	**8.30**	6.70	**6.70**	21220
46.00	.....	.....	.....	.....	3.97	**4.83**	0.18	10.65	**10.47**	5.08	**5.08**	21221
.....	.....	.....	.....	.....	2.43	**2.95**	.....	9.45	.....	.....	**4.07**	20948
75.00	.....	4.35	.....	.....	15.00	**18.24**	0.15	9.54	**9.39**	.....	**2.01**	20629

SPECIAL MIXTURES AND HOME MIXTURES.

In Table XIX are given analyses of special mixtures prepared by manufacturers according to specifications furnished by the purchasers and also of home mixtures prepared by individuals or firms from raw materials purchased by them. Twenty-six samples of these types were analyzed. Ten of these were sampled by the Station agent and the remainder were submitted by the consumers.

In some cases formulas were submitted with the samples and they are given in Table XVII.

TABLE XVII. FORMULAS FOR SOME OF THE MIXTURES GIVEN IN TABLE XIX.

Station No.	Cottonseed meal.	Castor pomace.	Fish.	Tankage.	Nitrate of soda.	Sulphate of ammonia.	Bone.	H. G. Sulphate of potash.	Muriate of potash.	Acid phosphate.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
20169	700	300	300	...	200	...	300	200	...	...
20170	700	300	300	...	200	...	300	200	...	...
21327	500	500	300	...	200	...	300	200	...	...
21326	500	500	300	...	200	...	300	200	...	...
21379	500	500	500	...	...	...	200	300	...	...
20955	...	...	...	750	100	...	...	200	200	750
21330	...	...	1000	...	200	200	...	600	...	...

VII. MISCELLANEOUS FERTILIZERS, AMENDMENTS, WASTE PRODUCTS, ETC.

WOOD ASHES, ETC.

Sixteen samples have been examined.

The following were submitted by Hatheway & Steane, Hartford; purchased from John Joynt, Lucknow, Canada.:

20963, car No. 89524; **20964,** car No. 30111; **20965,** car No. 43297; **21233,** car No. 8098; **21234,** car No. 1542; **21522,** car No. 35078; **21744,** car No. 108196.

Other samples were:

21010. Sent by Amos D. Bridges' Sons, Inc., Hazardville. Bought of the Ross Brothers Company of Worcester, Mass.

21529. Station agent from F. T. Blish Hardware Co., South Manchester. Bought of John Joynt, Lucknow, Canada.

20892. Sent by A. N. Farnham, New Haven.

20497, 21800, 21801. Sent by A. N. Shepard & Son, Hartford. Bought of John Joynt, Lucknow, Canada.

21003. Sent by H. Whitaker, Hazardville. Bought of John Joynt, Lucknow, Canada.

19954. Canadian wood ashes, sent by Steane, Hartman & Co., Hartford.

19807. Sent by Stamford Dyewood Co., Stamford.

TABLE XVIII. ANALYSES OF WOOD ASHES, ETC.

Station No.	Phosphoric acid.	Water-soluble potash.	Insoluble material.	Cost per ton or per unit of potash.
	%	%	%	
20963	2.35	6.74	11.11	$5.00
20964	2.35	6.83	9.13	5.00
20965	2.25	6.38	12.73	5.00
21233	2.35	6.36	15.18	.....
21234	2.50	6.67	18.32	.....
21522	2.53	6.39	13.09	.....
21744	2.17	6.75	9.17	33.33
21010	1.38	2.73	16.84	23.00
21529	1.18	2.05	12.63	27.50
20892	3.07	7.19	8.45	.....
20497	1.85	5.31	12.50	.....
21800	1.68	7.34	8.10	.....
21801	1.68	6.13	16.13	.....
21003	2.10	6.53	12.20	.....
19954	2.28	4.12	7.15	.....
19807[1]	1.47	0.03	5.20	.....

Samples **21010** and **21529** were of inferior quality. Sample **19807** was submitted as "wood ashes". It was, however, a waste product, in the form of a slag or clinker, consisting chiefly of lime.

SHEEP MANURE, ETC.

Analyses of seven samples of sheep manure and one of poultry manure are given in Table XX. All were sampled by the Station agent.

21148. Sold by American Agricultural Chemical Co., N. Y. Sampled from stock of Bristol Grain & Supply Co., Bristol.

21283. Sold by Armour Fertilizer Works, N. Y. Sampled from stock of Rockville Grain & Coal Co., Rockville.

21174. Sold by Berkshire Fertilizer Co., Bridgeport. Sampled at the factory.

20911. Sold by Natural Guano Co., Aurora, Ill. Sampled from stock of Cheshire Reformatory, Cheshire.

21418. Sold by Pacific Manure & Fertilizer Co., Chicago, Ill. Sampled from stock of Lightbourn & Pond Co., New Haven.

20957. Sold by Pulverized Manure Co., Chicago, Ill. Sampled from stock of S. P. Strople, New Britain.

21482. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled at the factory.

21423. Sold by Premier Poultry Manure Co., Chicago, Ill. Sampled from the stock of Plumbing and Supply Co., South Manchester.

[1] Lime (CaO) 81.99 per cent.

TABLE XIX. ANALYSES OF SPECIAL MIXTURES

Station No.	Manufacturer.	Grade.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:			
20169	American Agricultural Chemical Co., New York	.....	Arthur Manning, So. Manchester	$66.00
20170	American Agricultural Chemical Co., New York	.....	Arthur Manning, So. Manchester	66.00
21327	American Agricultural Chemical Co., New York	.....	Arthur Manning, So. Manchester	.....
20955	Apothecaries Hall Co., Waterbury	.....	Conn. School for Boys, Meriden	.....
21110	Olds & Whipple, Inc., Hartford	.....	Allied Tobacco Co., Hartford	.....
21111	Olds & Whipple, Inc., Hartford	.....	Allied Tobacco Co., Hartford	.....
21546	Olds & Whipple, Inc., Hartford	.....	G. H. Carrier, Glastonbury	.....
21326	Olds & Whipple, Inc., Hartford	.....	Arthur Manning, So. Manchester	.....
21379	Olds & Whipple, Inc., Hartford	.....	C. M. Hickey, East Hartford	.....
21109	Olds & Whipple, Inc., Hartford	.....	L. W. Newberry, So. Windsor	.....
	Sampled by Purchaser:			
21330	L. T. Frisbie Co., New Haven	.....	F. L. Porter, So. Windsor	65.00
21000	National Fertilizer Co., Boston	7-3-7	H. Whitaker, Hazardville	.....
21001	Olds & Whipple, Inc., Hartford	6.8-3.2-6.4	H. Whitaker, Hazardville	.....
21248	Olds & Whipple, Inc., Hartford	6.2-6-5	Harold M. Newberry, East Windsor Hill	61.00
21249	Olds & Whipple, Inc., Hartford	6.2-6-5	Harold M. Newberry, East Windsor Hill	61.00
21333	Olds & Whipple, Inc., Hartford	6.2-6-5	Harold M. Newberry, East Windsor Hill	61.00
21331	Olds & Whipple, Inc., Hartford	7.6-6.5-7.8	Harold M. Newberry, East Windsor Hill	69.40
21332	Olds & Whipple, Inc., Hartford	7.6-6.1-7.8	Harold M. Newberry, East Windsor Hill	57.90
21002	The Rogers & Hubbard Co., Middletown	6-4-4	H. Whitaker, Hazardville	.....
20647		.....	American Sumatra Tobacco Co., Bloomfield	.....
20659		.....	American Sumatra Tobacco Co., Bloomfield	.....
20660		.....	American Sumatra Tobacco Co., Bloomfield	.....
20661		.....	American Sumatra Tobacco Co., Bloomfield	.....
20735		.....	American Sumatra Tobacco Co., Bloomfield	.....
20736		.....	American Sumatra Tobacco Co., Bloomfield	.....
21567		.....	Ernest N. Austin, Suffield	55.00

AND HOME MIXTURES.

Nitrogen.					Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
In nitrates.	In ammonia.	Organic, Water-soluble.	Organic, Water-insoluble.	Total.		Citrate-insoluble.	Total.	So-called "Available."	As muriate.	Total.	
%	%	%	%	%	%	%	%	%	%	%	
....	....	....	....	5.78	**7.03**	....	5.30	....	0.39	**6.17**	20169
....	....	....	....	5.86	**7.12**	....	4.99	....	1.67	**6.39**	20170
1.63	0.14	4.29		6.06	**7.37**	1.85	6.80	**4.95**	1.09	**6.29**	21327
0.95	....	....	....	4.00	**4.86**	....	7.45	....	8.67	**10.37**	20955
1.32	0.10	4.15		5.57	**6.77**	1.25	6.65	**5.40**	0.85	**6.18**	21110
1.28	0.08	4.15		5.51	**6.70**	1.15	6.63	**5.48**	1.16	**5.77**	21111
1.38	2.03	0.53	1.74	5.68	**6.91**	1.03	8.28	**7.25**	1.57	**8.04**	21546
1.54	0.08	4.55		6.17	**7.50**	1.18	5.95	**4.77**	0.66	**5.86**	21326
....	....	....	....	4.72	**5.74**	0.48	8.80	**8.32**	0.96	**8.41**	21379
1.75	0.07	3.78		5.60	**6.81**	0.35	6.65	**6.30**	1.40	**8.20**	21109
present	....	....	....	7.34	**8.92**	0.35	3.93	**3.58**	1.34	**13.74**	21330
0.95	0.13	5.06		6.14	**7.47**	0.28	4.00	**3.72**	0.90	**6.93**	21000
0.10	0.88	4.68		5.66	**6.88**	0.20	3.83	**3.63**	0.74	**6.67**	21001
0.08	1.14	3.92		5.14	**6.25**	0.20	6.23	**6.03**	0.76	**7.59**	21248
0.17	1.17	4.02		5.36	**6.52**	0.30	6.38	**6.08**	0.78	**6.44**	21249
....	....	....	....	5.00	**6.08**	0.23	6.68	**6.45**	2.23	**6.25**	21333
present	....	....	....	6.00	**7.29**	1.53	7.10	**5.57**	0.93	**7.85**	21331
present	....	....	....	4.63	**5.63**	0.30	7.05	**6.75**	0.97	**8.58**	21332
1.47	0.09	3.64		5.20	**6.32**	1.00	5.28	**4.28**	0.69	**4.08**	21002
....	....	....	....	5.54	**6.74**	....	5.40	....	0.32	**7.86**	20647
present	0.07	....	....	5.56	**6.76**	....	5.27	....	0.27	**5.22**	20659
present	0.07	....	....	5.52	**6.71**	....	6.01	....	0.28	**6.77**	20660
present	0.11	....	....	5.90	**7.17**	....	4.77	....	0.27	**5.56**	20661
....	....	....	....	5.73	**6.97**	....	6.50	....	0.25	**8.76**	20735
....	....	....	....	4.61	**5.60**	....	6.14	....	1.48	**8.85**	20736
....	....	....	....	7.24	**8.80**	0.53	4.10	**3.57**	1.97	**9.56**	21567

TABLE XX. ANALYSES OF SHEEP MANURE, ETC.

Station Number	21148	21283	21174	20911	21418	20957	21482	21423
	%	%	%	%	%	%	%	%
Nitrogen in nitrates	.....	0.07	.....	0.06	.....	.....	.....	0.18
" in ammonia	.....	0.12	.....	0.20	.....	.....	0.06	0.78
" organic	.....	1.31	.....	2.28	.....	.....	1.22	2.78
" total found	2.43	1.50	2.25	2.54	1.48	2.08	1.28	3.74
" guaranteed	2.06	1.23	1.80	2.25	1.50	2.00	1.23	4.10
Phosphoric acid, citrate-insoluble	.....	.....	0.15	0.15	.....	0.08	.....	0.30
" " total found	1.65	0.80	1.25	1.43	0.90	1.55	1.00	3.40
" " guaranteed	1.25	1.00	.....	1.25	0.75	.....	1.00	2.70
Potash, water-soluble, found	2.08	2.99	2.08	2.13	2.84	2.13	2.71	1.39
" " guaranteed	1.00	2.50	2.00	2.00	3.00	2.00	2.50	1.30
Cost per ton	$45.00	$50.00	$45.00	$40.00	$49.00	$50.00	.....	$53.00

POTASH-MARL.

21426. One sample of Potash-Marl manufactured by the Potash-Marl, Inc., New York, was taken by the station agent from the stock of Lightbourn & Pond Co., New Haven.

This is prepared from green sand marl and may contain six per cent or more of potash not, however, in water-soluble form. Only phosphoric acid, of which it contains an inconsiderable amount, is guaranteed by the manufacturer.

The analysis is as follows:

Station No.	21426
	%
Available phosphoric acid, found	0.47
guaranteed	0.24
Total phosphoric acid, found	1.30
guaranteed	0.88
Price per ton	$45.00

LIMESTONE, ETC.

Three samples of lime-bearing materials were submitted for analysis.

21126. Ground limestone, submitted by C. R. Treat, Orange.

20668. Unground rock, submitted by Edson Cogswell, New Preston.

20545. Hydrated lime, submitted by Dwight Coles, Salisbury.

Analyses are as follows:

Station No.	21126	20668	20545
	%	%	%
Lime (CaO)	32.76	24.73	62.25
Magnesia (MgO)	12.10	.....	0.85
Insoluble in acid	13.88	2.29	0.94

In case of sample **21126**, 98 per cent passed a 20 mesh sieve, 85 per cent passed 40 mesh and 80 per cent passed 50 mesh.

PEAT OR MUCK.

Four samples of this material were submitted.

20091. Natural humus, dried, submitted by Bertolf Bros., Sound Beach.

20611. "Radio-active Peat" submitted by A. A. Young, Jewett City. It is claimed that the radio-activity of the product is the stimulus for the increased growth of plants.

21596, Subsoil and **21597**, top soil, submitted by Elm City Nursery, New Haven.

Analyses are as follows:

Station No.	20091		20611		21596		21597	
	As rec'd %	Dry basis %	As rec'd %	Dry basis %	As rec'd %	Dry basis %	As rec'd %	Dry basis %
Water	22.40	.....	41.30	.....	78.00	.....	70.00	.....
Ash	48.98	63.08	33.70	57.40	2.68	12.17	1.62	5.39
Organic and volatile	28.62	36.92	25.00	42.60	19.32	87.83	28.38	94.61
Nitrogen	1.02	1.32	.....	.....	0.37	1.70	0.53	1.75

These materials particularly **21596** and **21597**, should be valuable as absorbents and for composting with manure; the economy of their use will depend, of course, upon the cost of handling.

We can give no opinion on the merits of **20611** from the standpoint of radio-activity.

SEWAGE SLUDGE.

Two samples of dried sewage sludge have been examined.

20612. Product of the sewage disposal plant in Stratford, submitted by R. H. Hunter.

21802. Product of the East Port Chester sewage disposal plant, submitted by Albert S. Mead, Greenwich.

Analyses are as follows:

Station No.	20612	21802
	%	%
Moisture	2.56	....
Ash	64.92	55.55
Nitrogen, in ammonia	0.06	0.02
organic, water-soluble	....	0.22
organic, water-insoluble	....	1.66[1]
total	1.74	1.90
Phosphoric acid, "available"	....	0.47
total	1.04	0.60
Potash, total	....	0.27

[1]About 60 per cent in so-called "active" form.

In general, the fertilizer ingredients, i.e., nitrogen, phosphoric acid and potash, in this kind of material are inconsiderable. Its chief usefulness is when applied to light, sandy soils which will be benefited by the humus which it contains.

MISCELLANEOUS MATERIALS.

Soils.

Nineteen samples have been submitted. Tests were made for acidity and lime requirement but no further examinations were undertaken. The diagnosis of soil troubles is a difficult and uncertain task not to be solved by the usual chemical analysis.

Check Cottonseed Meals.

Thirty samples, chiefly cottonseed meals, were examined and reported to the American Oil Chemists' Society in connection with their cooperative program in which this laboratory has participated. The schedule involves the analysis of weekly samples sent out by the Society to various control and industrial laboratories for the purpose of studying uniformity of methods and technique in the analysis of this class of products.

Check Fertilizers.

Eleven samples of mixed fertilizers have been analyzed and reported to the Royster Guano Co. The plan and purpose of this cooperative work is similar to that already explained for the Check Meal series.

Unclassified.

Seven samples of miscellaneous materials have been examined which require no particular comment.

BULLETIN 251 DECEMBER, 1923

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

The Raspberry Fruit Worm

By B. H. WALDEN.

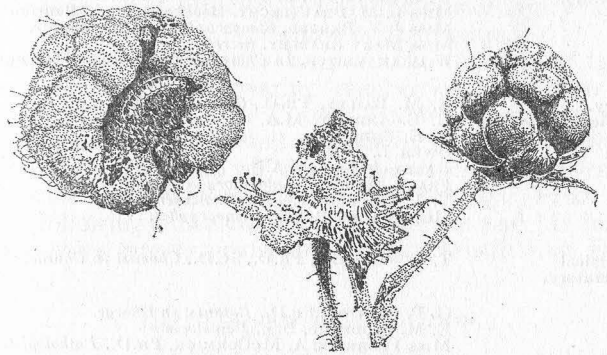


Figure 1. Infested Raspberry.

CONTENTS.

The Wilson H. Lee Co.

The Raspberry Fruit Worm.

Byturus unicolor Say

By B. H. Walden, B.Agr.

Though the Raspberry Fruit Worm or Raspberry Beetle has long been known as a pest of red raspberries in the United States, very little has been published by economic entomologists regarding its life history or habits.

The first published record of the occurrence of this species in Connecticut was by Lintner,[6] State Entomologist of New York, to whom specimens were submitted for identification from North Haven, May 25, 1891. The species has been represented in our collection since 1902, although few complaints of injury have been received until within the last three or four years.

The insect has apparently been on the increase in the State since the St. Regis everbearing raspberries came into general cultivation. In 1920, Mr. George Hunter, a grower of small fruits in East Haven, reported that his St. Regis raspberries were badly infested with small, whitish worms which upon investigation proved to be the larvae of *Byturus unicolor* Say. From 1921 to 1923 the following observations on the habits and life history of this insect were largely made upon his grounds in East Haven.

History and Distribution.

Byturus unicolor was described in 1823 by Thomas Say[1] from a single specimen collected in Arkansas. It was mentioned by Packard[2] as injuring raspberries at Salem, Massachusetts, in 1869. The most complete early account of the injury and habits of the species observed by the writer was published by Fitch[3] of New York in 1870–1872. Saunders[4] reported injury by this insect in 1873 without mentioning any specific locality, but his observations were undoubtedly made in Ontario. Fletcher[5] records the species definitely from Ontario in 1887. Goodwin[7] of Ohio published in 1909 additional information regarding the habits and life history, together with results of experiments in controlling the insect. Various writers have recorded the species from many parts of the United States. It undoubtedly occurs throughout the southern part of Canada and the United States with the exception of some of the more southern states. Leng[8] gives its range from the Atlantic Coast to Washington and Arizona.

Food Plants and Injury.

In Connecticut this insect has been found attacking the fruit of only the red species of raspberries and it shows a decided preference for certain horticultural varieties. The work of the adults, however, has been observed on the foliage of black cap raspberries and the Columbian or purple raspberry. There are also two records in the notes of the department where this insect has apparently infested the fruit of blackberry. Here again it seems to show preference for certain varieties as in East Haven, where there were two rows of blackberries (variety not known) adjoining the experimental plot of raspberries and no injury was observed either on the foliage or to the fruit. As indicated above, the early fruit of the St. Regis variety is especially subject to attack. A small block of the Victory raspberry in Montowese, the only planting of this recent variety observed, also showed considerable injury by this beetle. The fruit of the Cuthbert, an old standard variety which is considered one of the best commercial varieties of the state, however, has not been found seriously infested. The owner of the Victory raspberries in Montowese has grown the Cuthbert and St. Regis side by side; the latter was so badly infested that the variety was discarded. In North Branford where the two varieties were grown in the same field similar conditions regarding the infestations were observed. Goodwin, in Ohio, found the King variety severely injured while the fruit of the Cuthbert was scarcely attacked, and gives the following as a possible explanation: "The longer and more open bud clusters of the Cuthberts, affording less opportunity for the beetles to feed conveniently, seemed to be the only reasonable explanation for the comparative immunity, because the tender leaves of the latter seemed to be injured fully as much as the King."

Dr. Felt[9] of New York records serious injury to the Perfection variety in the Hudson Valley. The injury was much greater on an exceptionally early patch of this variety than on one where the fruit buds developed a week later, and he states that "the relative earliness of the field may be an important factor in determining the amount of injury."

There are three distinct types of injury caused by the insect.

1. The adults feed on the unfolding leaves, often skeletonizing them. Plate IV, a.

2. As the blossom buds appear the beetles attack these, eating out the inside and when numerous may destroy the whole bud cluster. Plate II, a.

3. The third type of injury is caused by the larvae infesting the fruit. In many cases the larvae develop in and destroy the fleshy receptacle on which the fruit is borne, causing the fruit to dry up before ripening, or they may feed on the carpels which dry up or become infected with a mould which causes the remainder of the berry to decay or become soft. At picking time many of the berries which do not show any exterior injury will each be found to contain a larva which has worked partly on the underside of the fruit and partly in the receptacle. The larvae frequently adhere to the picked fruit, and even with careful sorting it is hard to detect all of them. Plate I, c.

In the East Haven field in 1921, a count of the fruit buds in the most severely infested portion of the field showed that about 37 per cent. of the buds had been injured by the beetles and at the time the fruit was ripening 57.9 per cent. of the berries that developed were infested with the larvae. The owner did not harvest the early fruit of this variety either in 1921 or 1922.

The fall fruit is not attacked by this insect.

Life History and Habits.

The beetles appear in spring soon after the new growth of the plants is well started. In 1921 they were abundant on May 10, at the time of the first visit to the field. In 1922 observations were made from April 19, and the first adults were found on May 8 and were appearing in numbers from May 12 to May 16. The beetles seem to prefer the sunlight and are found on the tips of the plants on bright sunny days. In cold, cloudy weather the beetles are inactive and seek protection under the foliage.

They feed for a number of days before mating and laying eggs. The leaves before opening are folded in more or less of a fan-shaped manner and the beetles feed along the upper surface of the folds, so that when the leaves are fully open they are perforated with a series of elongated holes which parallel the veins. When the beetles are abundant nearly all of the tissue between the veins may be eaten as shown on Plate IV, a. After the blossom buds are formed the beetles attack these, eating out the inside as shown on Plate III, b.

When disturbed the beetles will fly for a short distance but apparently do not spread rapidly in the field. The insects were more abundant towards the south end of the block in 1921 and the same condition, to a somewhat less extent, was true in 1922. A new block of St. Regis raspberries was set about sixty feet from the old one in 1921, and no beetles were found on it that season. In 1922 only five or six adults were seen on the new plants and but a very few larvae were found in the fruit. These were in two rows towards the old field. Low growing crops were planted each year on the intervening space.

By June 5 the majority of the beetles had disappeared, although a few remained longer; the latest date that a beetle was observed in the field was on June 22.

The first eggs were found on May 22, fourteen days after the first adults were observed, although in 1921, three eggs were

found on May 10. The eggs are deposited singly and are quite difficult to find in the field. The position of the eggs on each of a number of tips examined at about the time the first blossom buds opened was as follows:

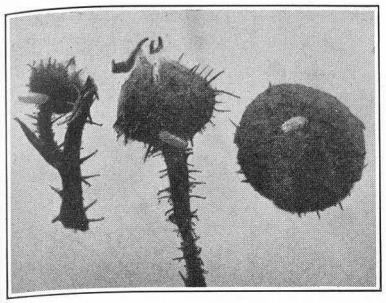
On base of blossom buds	10
In cavity eaten in buds	2
On bud petioles	4
Axil of bud petioles	5
Axil of bud and leaf petioles	2
Axil of leaflet petioles	4
Underside of leaves in fold	5
Total	32

After the blossom buds open, eggs are deposited within the blossom among the filaments of the stamens where they are quite difficult to find as they are about the size of the numerous anthers of the stamens and are concealed by them. It is quite probable that many more of the eggs are laid within the blossoms than observations indicate, as the number of larvae which developed greatly exceeded the number of eggs actually found.

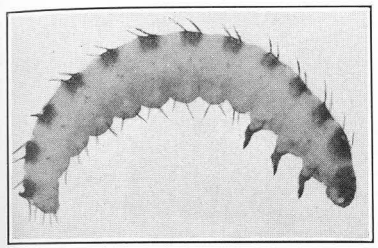
The average length of time between ovipositing and hatching of the egg has not been determined. Newly hatched larvae were found on material collected in the field May 27, or five days after the eggs were first observed. A large series of adults placed in breeding cages in the laboratory failed to deposit eggs. From ten adults caged out of doors, two eggs were obtained, one of which hatched in seven days while the other failed to develop.

Where the eggs are laid on the outside of buds and hatch before the buds open the young larvae eat small holes through the surface and enter the buds to feed (see Plate II, b). These holes have been observed where the eggs had not been laid on the bud, indicating that the larvae had traveled a greater distance than the length of the bud petiole. The young larvae have not been observed feeding on the outside of buds or on the leaves where eggs are occasionally laid; however, they are inconspicuous and the hairs and pubescence of the raspberry foliage offer such ideal conditions for concealment that it is impossible to state definitely without further investigation that the larvae do not feed outside of the buds. The latest date on which an egg was found in the field was on June 29. Full-grown larvae were found on June 16 and a few berries containing larvae were gathered as late as July 18.

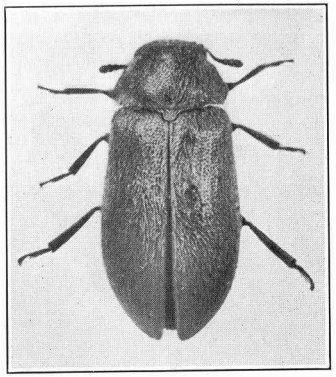
After leaving the berries the larvae drop to the ground and enter the soil forming small circular cavities or pupal cells about three millimeters in diameter. This fact has been noted by Fitch and Goodwin. Fitch also published a brief description of the pupa which appears to be the only one occurring in the literature of the species. Goodwin failed to obtain the pupa and writes as follows: "A few of the larvae formed pupal cells in the soil of



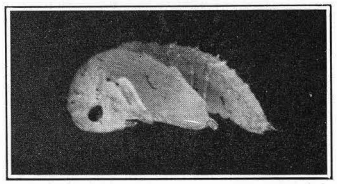
a. Eggs, enlarged four times.



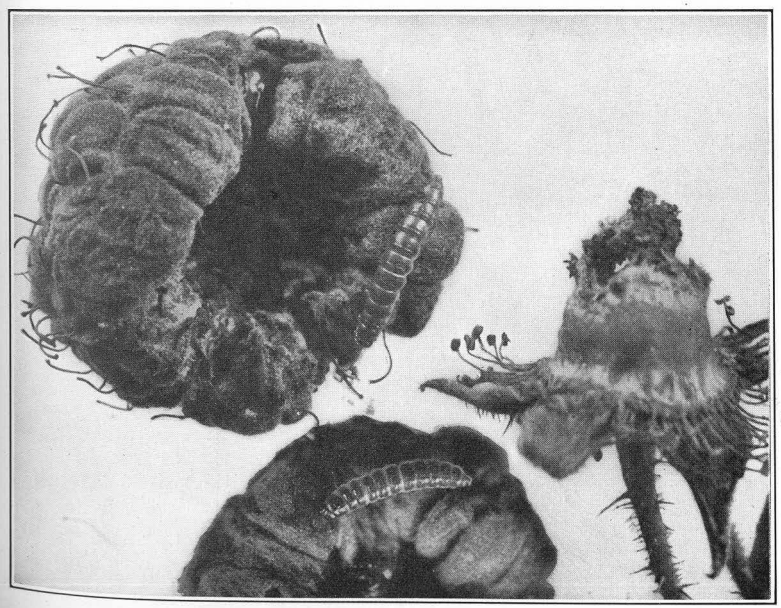
b. Larva (preserved specimen), enlarged eight times.



d. Adult, enlarged ten times.



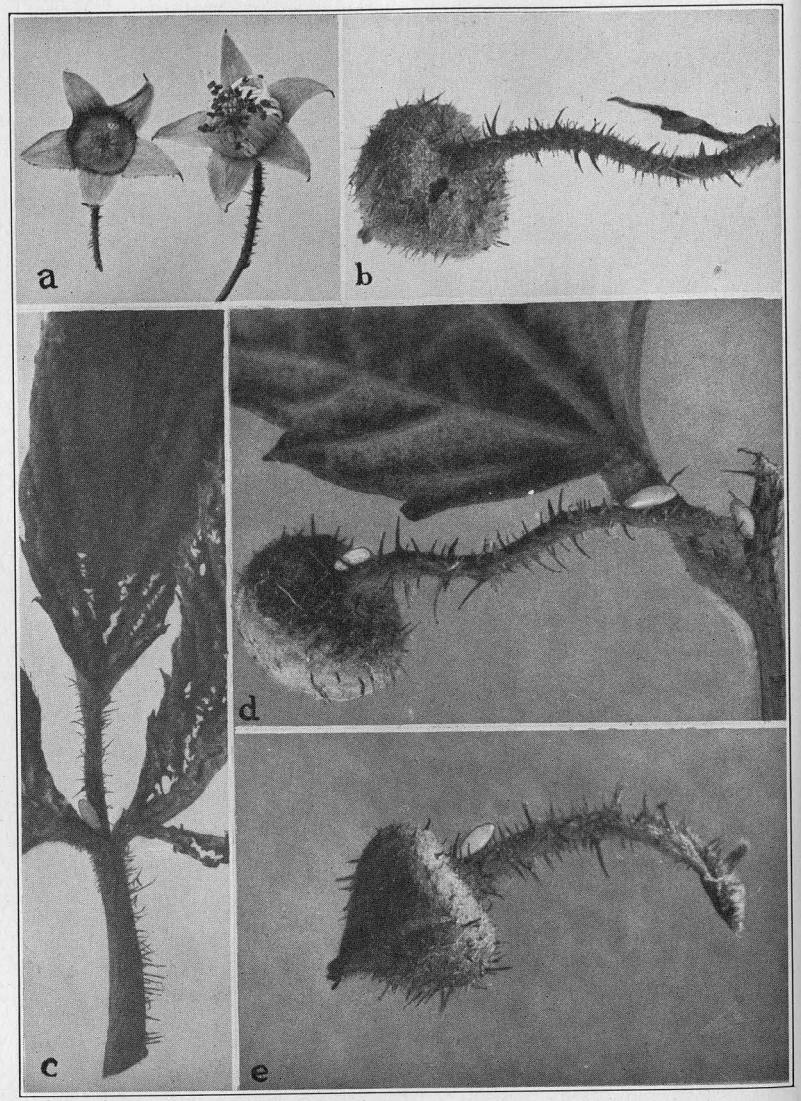
e. Pupa, enlarged eight times.



c. Larvae and injury to fruit, enlarged four times.

RASPBERRY FRUIT WORM.

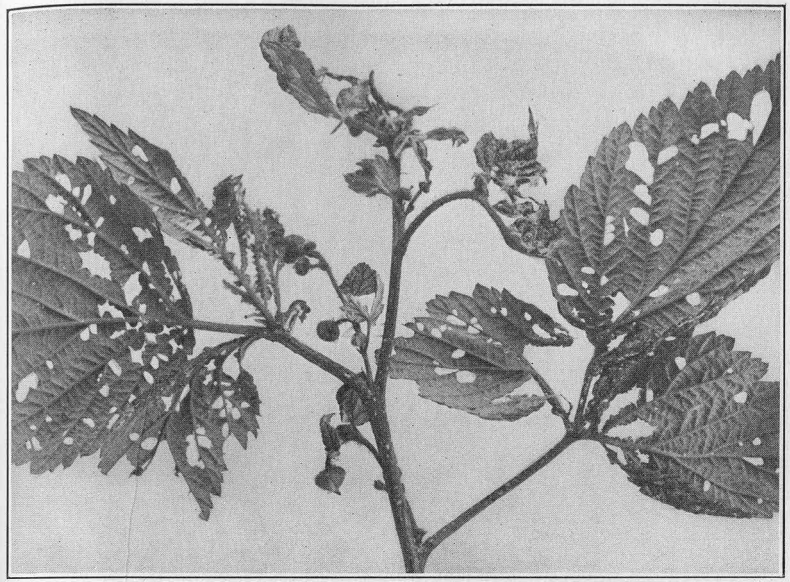
PLATE II.



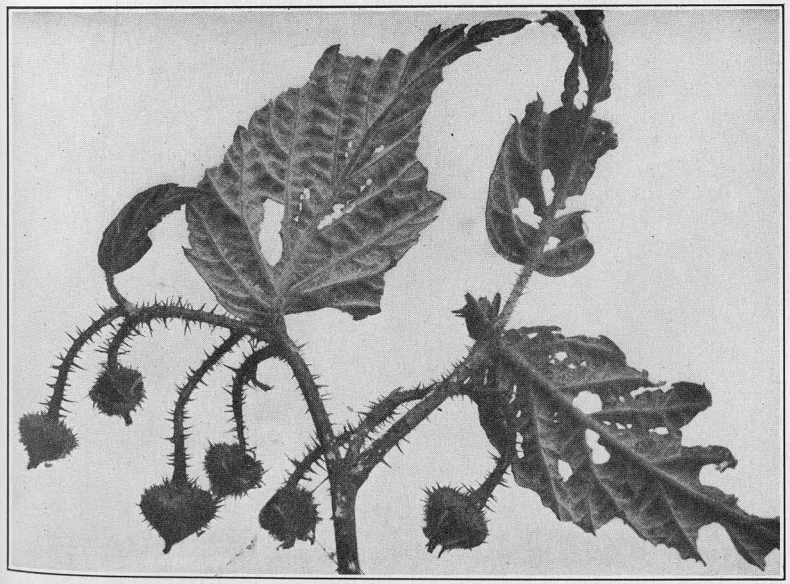
a. Blossom eaten by beetle at left, normal blossom at right, twice natural size.
b. Egg shell and hole in bud where larva entered, enlarged six times.
c. Egg on leaf petiole, enlarged four times.
d. Three eggs on bud and petiole, enlarged six times.
e. Egg on bud petiole, enlarged six times.

RASPBERRY FRUIT WORM.

PLATE III.



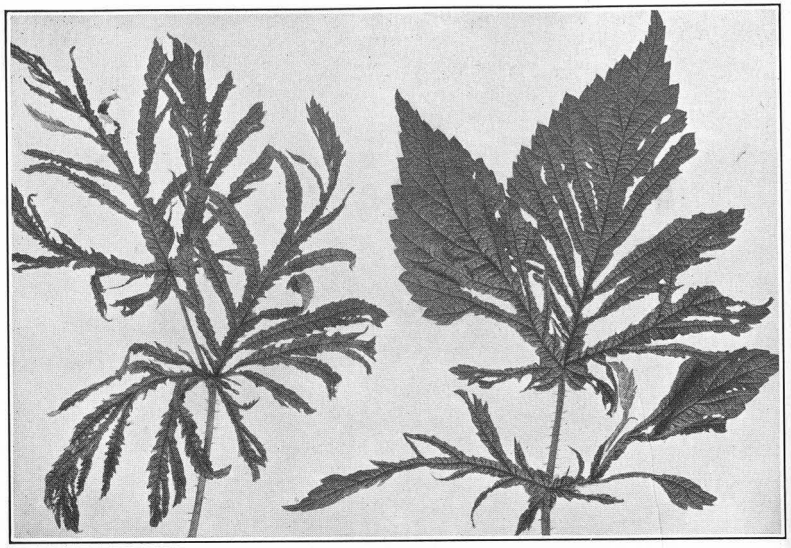
a. Tip showing injury by beetles, natural size.



b. Tips with blossom buds injured by beetles, natural size.

RASPBERRY FRUIT WORM.

PLATE IV.



a. Injury to foliage by beetles.

b. Above, raspberry shoot from sprayed plot; 67 fruits set: Below shoot from check plot; all but 17 buds destroyed.

RASPBERRY FRUIT WORM.

the breeding jars. These subsequently died through being disturbed and because of the lack of moisture.... My observations, however, substantiate the statement of Dr. Fitch that they pupate in the soil."

Three cages with soil in the bottom were prepared by the writer in 1922 and full-grown larvae were placed in each. Two of the cages were placed in the insectary and the soil kept moist but otherwise undisturbed. The third cage was examined frequently. The larvae in the latter cage entered the ground at once and within two days had formed cells but failed to pupate and finally died. On October 26 the soil in one of the other cages was examined and instead of the pupae being present as expected, adult beetles were found. The same condition was found in the third cage. In order to check field conditions with those of the breeding cages, a visit was made to East Haven on October 28. The soil around the raspberry plants was examined and adults were found. All of the beetles obtained were in the first one-half inch of the top soil. Some of the beetles were rather soft but others seemed to be fully developed. Most of the beetles were lighter in color than those collected in spring, but several were of normal color. No pupae were found but as the soil was moist and lumpy it would have been difficult to find any that may have been present, so that further observations would be necessary to determine if all of the adults emerge in the fall. These observations differ from those of Dr. Fitch, who stated:...."in this situation (pupa stage) it remains at rest through the winter, and till the middle of May or a little later, when it changes to its perfect form, and is then a small beetle...."

In 1923, fruit infested with nearly full-grown larvae was placed in breeding cages and on September 6, a number of the larvae had pupated. The last larva observed in the material pupated between September 23 and September 25.

The field was visited on October 9 and pupae and one larva found in the soil. No adults were observed. An adult emerged on October 13 from a pupa brought to the laboratory.

Description.

Byturus unicolor Say is placed in the family Dermestidae of the Coleoptera. The members of this family occurring in Connecticut, with the exception of this raspberry beetle, feed upon dry animal and vegetable matter and include some of the well-known household pests such as the "larder beetle," "carpet beetle" and "museum beetle." In Europe, *Byturus tomentosus* Fabr., is one of the most serious pests of raspberries. It is closely allied to *B. unicolor* and its habits are somewhat similar.

The genus *Byturus* is readily separated from the other genera of the family having "the tarsi with the second and third joints bilobed beneath; front coxal cavities closed behind; claws armed

with a large basal tooth" while in the other genera the "tarsi are simple; front coxal cavities open behind; tarsal claws simple."

The original description of the beetle is as follows:[1]

"*B. unicolor.* Reddish yellow, hairy thorax, each side depressed, tergum dusky, inhabits Arkansas, eyes black, thorax posterior angles broadly depressed and slightly reflected, the depression continued on the side but narrowed towards the anterior angles, wings dusky, length three-twentieths of an inch. This species is most closely allied to *B. tomentosus* of the authors. A single specimen brought from Arkansas by Mr. Nuttal."

The beetles are oblong-oval, convex above, dull yellow to pale brown in color, rather densely and coarsely punctured and covered with fine, light colored hairs. Head large with prominent dark, coarsely granulated eyes. Antennae 11-jointed, terminating in a three-jointed club. Thorax wider than long, slightly broader at base than at apex, sides curved and with thin, depressed edges. Elytra about three times as long as wide. Length 3.7–4.5 mm. Shown on Plate I, d.

Egg. Average length 1.16 mm., width .42 mm. Elongate-oval, slightly enlarged towards one end. Color, nearly white, sometimes with a yellowish green tinge. Surface apparently smooth, but somewhat roughened without definite sculpturing when highly magnified. Shown on Plate I, a, Plate II, c, d, e.

Larva. Length 5.75 to 6 mm., width. 53 mm., nearly cylindrical, tapering towards either end. Each segment with sparse, light colored, stiff hairs arranged in two transverse rows, those of the first row shorter than those in the second. The ninth abdominal segment with a pair of tubercles enlarged at the base, tapering to a point and curved towards the front. The tenth segment consists of a short, cylindrical blunt proleg. General color yellowish white, head amber color with the mouth parts darker. There are five ocelli appearing as dark brown spots arranged as follows: three in a vertical row just back of the base of the antenna and two smaller ones back of and parallel to the two upper ocelli in the first row. Thoracic shield amber. The dorsal surface of the segments with a transverse band of amber to light brown covering the anterior two-thirds and extending about one-third the way down the sides. Shown on Plate I, b and c.

Pupa. Length 3.75 mm., width 1.5 mm., through the thoracic region, narrowing towards the end of the abdomen. Sparsely clothed with light colored hairs about .5 mm. in length. Color, creamy white when formed, later becoming a yellowish or amber color. Eye spots dark brown, prominent. Wing pads turning a light slate color before the adult emerges. Shown on Plate I, e.

Control Methods.

The treatment that has been recommended against this insect is to spray the foliage with lead arsenate at the rate of four pounds (paste) to fifty gallons of water just before the beetles begin to feed in spring. Shallow cultivation in the fall to break up the pupal cells and expose the pupae has also been advised.

The only published account of spraying tests against this insect that the writer has seen is that of Goodwin in 1909. He reports that with one treatment, using the above formula, the injury was reduced from about thirty-five per cent. on the checks to eight or nine per cent. on the sprayed plot.

At East Haven, lead arsenate at the rate of two pounds (dry) to fifty gallons of water with three-fourths of a pound of calcium caseinate spreader was used in comparison with a dust mixture containing forty pounds of sulphur, ten pounds of dry lead arsenate and five pounds of hydrated lime. The block was divided lengthwise into two sections and the north ends of the rows of both sections were used as checks. The applications were made on May 12, when the adults were appearing in numbers but before there was any noticeable injury to the foliage. The field was examined on May 16 and it was found that the tips of the plants had made from an inch to an inch and one-half of growth since the treatment, and quite a number of beetles were observed on the new growth of the sprayed rows. There were noticeably fewer beetles on the dusted rows.

A second application was made on May 19 and examination made on May 22. While there were fewer beetles present on the treated plots than on the 16th, there were still more on the sprayed rows than on the dusted. No estimate was made of the blossom buds destroyed by the beetles but there was much less fruit set on the check than on the other plots. An examination of the fruit on June 29 showed the following results:

Treatment	Per Cent. Infested
Dust	10.
Spray	18.
Check	29.3

These results are not entirely satisfactory or conclusive from the standpoint of control but they indicate that the beetles can be poisoned with lead arsenate. The check plot, located by request of the owner at the north end, represented the minimum infestation of the field. As previously stated the insects in 1921 were more numerous towards the south end where nearly sixty per cent. of the fruit was infested, and it was expected that owing to this heavy infestation that the insects would be more evenly distributed throughout the field in 1922. The dust probably acted to a certain extent as a repellent. The owner informed the writer that an odor from the dust could be detected for several evenings after it had been applied.

One reason for the lack of control is undoubtedly due to the fact that the St. Regis is a rapid growing variety with the fruit

formed at the tips of the shoots. In order to keep the new growth coated it would be necessary to make several and frequent treatments during the time that the beetles are abundant.

In 1923, tests were continued in controlling this pest. The field was divided into three plots as in 1922. The same spray formula as applied in 1922 was used. The dust mixture consisted of eighty-five pounds of carrier (principally dolomite), fifteen pounds dry lead arsenate and two per cent. nicotine sulphate.

Four applications were made at intervals of about one week. The first was applied on May 14 as the adults were beginning to appear in numbers and the last application was made on June 7 as the first blossom buds were opening. Later applications would have undoubtedly poisoned the bees which were visiting the blossoms.

Owing to the comparatively dry season both the spray and the dust showed well on the foliage at the time of each subsequent treatment, but repeated applications were necessary to protect the new growth as it developed.

Tips were examined June 16 for injury to the fruit buds with the following results:

Treatment	No. of Buds Injured	No. of Buds not Injured	Per cent. of Injury
Spray	16	141	10.1
Dust	19	140	11.9
Check	86	47	64.6

Fruit from the different plots was picked and examined on June 30. On the check plot there was only about twenty per cent. as much fruit as on the treated plots. Plate IV, b, shows a shoot from the unsprayed plot and one from the check plot. Sixty-seven berries had set on the former and only seventeen on the latter. The percentage of wormy fruit was as follows:

Treatment	Per cent. of Fruit Infested
Spray	1
Dust	3
Check	40

The combined injury resulting from destroyed fruit buds and wormy fruit is given below:

Treatment	Per cent. of Fruit Destroyed
Spray	10.99
Dust	14.54
Check	78.76

Attention is called to the fact that the above treatments were not supplemented by any other methods of control which may be equally effective or even necessary to secure satisfactory results in a badly infested field.

General Recommendations.

Observations during the past two years have determined that *Byturus unicolor* is a difficult insect to control. In a badly infested field, it probably would be necessary to use every possible means to reduce the number of beetles, supplementing the spraying or dusting with the recommendations indicated below during the first season. The foliage should be kept well coated with lead arsenate from the time that the first beetles appear until the blossom buds open to such an extent that there is danger of poisoning bees.

If the fruit is infested with the worms to such an extent that it is unsalable, the second year's infestation can be greatly reduced by removing and burning the entire fruit clusters at about the time the earliest fruit begins to ripen. Observations during the past two seasons indicate that the eggs have practically all been laid at this time and that but few, if any, of the larvae have left the fruit to go into the ground.

Thorough, shallow cultivation as close as possible to the plants from late summer to early fall will tend to break up the pupal cases and expose the pupae to the elements. The pupae are fragile and in the laboratory cages were readily killed by stirring the soil, and quickly dried up when exposed on the surface. In the field the larvae and pupae have only been observed in the upper three-fourths of an inch of the soil.

During the present fall, poultry had had the run of the East Haven field and it was difficult to find larvae and pupae in the soil under the plants even in the check plot. Where raspberries are grown for home use only, the patch could often be located so that poultry could be turned into it during the time that the larvae and pupae are in the soil.

Literature.

[1] Say, Thomas (original description). Journal of the Academy of Natural Sciences of Philadelphia, Vol 3, page 197, 1823; Complete Writings, Vol 2, page 126, 1869.

[2] Packard, A. S. Guide to Study of Insects, page 448, 1869.

[3] Fitch, Asa. Transactions N. Y. State Agricultural Society, Vol. 30, pages 358–360, 1870–1872.

[4] Saunders, William. Report Entomological Society of Ontario for 1873, page 10, 1874.

[5] Fletcher, James. Central Experimental Farm (Canada), Report of Entomologist and Botanist for 1887, page 31.

[6] Lintner, J. A. Insects of New York, 8th Report, page 298, 1893.

[7] Goodwin, W. H. Ohio Agr. Expt. Station, Bulletin 209, 1909.

[8] Leng, C. W. Catalogue of the Coleoptera of America North of Mexico, page 189, 1920.

[9] Felt, E. P. 35th Report of the State Entomologist of New York for 1921, page 40, 1923.

BULLETIN 252 DECEMBER, 1923

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

The European Red Mite

PHILIP GARMAN

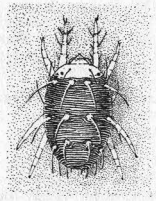


Figure 1. European Red Mite, greatly enlarged.

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The European Red Mite in Connecticut Apple Orchards.

Paratetranychus pilosus Can. & Fanz.

BY PHILIP GARMAN, PH.D.

Brown foliage, a result of the feeding of the European red mite, was first noticed on apples in Connecticut in 1920, when a block of Baldwins in a large commercial orchard near Branford became discolored. Since that time the trouble has increased rather than decreased in the State, and the mite now seems to be well established, threatening serious damage in some sections every year. What can be done to hold it in check has been asked from time to time, and we are now able to offer what seems to be a practical remedy, together with facts about habits and life history of the mite which should enable the orchardist to gain control.

HISTORY.

The European red mite was described in 1876 from Italy: it has been noticed in several countries of Europe having been given considerable attention as a pest in Sweden. In America it has been present for many years, but has been confused with other species, notably, the clover mite (*Bryobia pretiosa* Koch) and the common red spider (*Tetranychus bimaculatus* Harvey) from both of which it is distinct. On the Pacific coast it has passed under the name of citrus mite and apparently others, and has done serious damage in that locality. It was noted in Canada in 1915,[1] by Frost in Pennsylvania[9] in 1919, was found in Connecticut in 1920,[10] and since then has been reported from Maryland, New York and Ohio. The mite was recognized as present in California by Essig[4] in 1922, though it has probably been there much longer.

NATURE OF THE INJURY.

A heavy infestation of red mites turns leaves of apple trees brown early in June, and if continued gives them a dead appearance in July. This results in undersized and poorly colored fruit and affects the vitality and set of fruit for the following season. On plums and apples, a little later, there is considerable defoliation. A moderate infestation leaves the trees with sickly foliage and prevents growth of fruit the latter part of the summer, a condition

often unnoticed by the orchardist, but very conspicuous as compared with trees free of mites.

Distribution.

The red mite is present in Connecticut, Massachusetts, New Jersey, New York, Maryland,[12] Pennsylvania, West Virginia and Ohio. It has also been reported from Canada. In the west, Oregon and California consider it worthy of attention and it will probably be found in many other localities where perhaps it is not numerous enough at present to invite attention.

In Connecticut it is well distributed, having been seen in, or received from, Fairfield, Hartford, Middlesex, New Haven and New London Counties. The most serious damage seems to have been done in the southern part of the State and little complaint has been heard from the more northern counties.

Host Plants.

The species has been found by the author on rose, pear, peach, plum, cherry, apple and elm. It is reported to infest prune trees in Pennsylvania,[2] and is known to infest almond, prune and citrus fruits in California.[3] Most damage is done to apples and plums in Connecticut, though occasionally peach trees in the vicinity of infested apples have been injured.

Habits and Life History.

Examine an infested tree in winter after the leaves have fallen and you will note on branches the size of a lead pencil (sometimes on those as much as two inches in diameter) a coating of small red eggs, which if numerous enough will not require magnification to see them. They are dark red in color and are most abundant around bud scars and in crevices—resembling a coating of red brick dust. Wise orchardists know the signs and know that trouble may be in store—and act accordingly. These are the winter eggs, which carry the pest over from season to season. Watch carefully and you will find them hatching about the middle of April or first of May; or, in terms of the development of the apple tree, at the time when the blossom buds of most varieties begin to show pink; better still when the leaves are about an inch long. From the twigs the young mites make their way to the leaves and begin to feed, completing their development in two weeks, but sometimes requiring longer if a cold spring is at hand. By the first of June, conditions being favorable, they begin to multiply rapidly, passing the entire cycle in three weeks or shorter if the weather is warm. The life period is such that an overlapping of broods now begins for the following reasons. The egg develops in 6–13 days or an average of nine days, and the mites require

about as long to complete their development, or long enough to begin laying eggs (nine days more). If we now allow 15 days as the average life of the adult during which time the eggs are laid, not all at one time but a few each day, then at the end of 15 days under favorable conditions the first eggs of the particular female will have hatched and will be well along to maturity, giving two different generations on the leaf at one time. This apparently takes place shortly after the first of June in Connecticut, making it impossible to apply separate sprays for different broods during the summer. In all, considering the length of the cycle, some six generations might easily occur in a single summer, but it is not always safe to figure natural laws or processes by such simple mathematics. The number of generations in this case is of minor importance, but our experience indicates that most damage is done in June and early July when multiplication is most rapid, and before enemies become numerous.

The female is not a great egg layer, but is capable of laying as many as 34 eggs, at the rate of one or two per day. By the middle of August, many eggs are laid on the twigs and in the calyx and stem cavities of the fruit, and by September 15 the winter eggs are being laid rapidly. The adults die shortly after and show no tendency to hibernate in this climate.

The time required for development in each stage is shown in the following tables:

Table 1—Length of Incubation Period.

Eggs Laid	Eggs Hatched	Period, Days	Mean Temp., F.
May 16	May 29	13	63.2
May 18	May 29	11	64.2
May 21	May 29	8	....
May 21	June 1	10	67.2
June 24	June 30	6	....
June 24	June 30	6	....
July 11	July 17	6	73.1
Aug. 6	Aug. 14	8	....
Aug. 8	Aug. 16	8	....
Aug. 8	Aug. 17	9	....
Aug. 29	Sept. 6	8	....
Aug. 16	Aug. 30	14	65.5
Aug. 17	Aug. 30	13	66.4
Sept. 3	Sept. 9	6	72.0

Table 2—Period from Egg to Adult.

Egg Hatched	Adult Obtained	Period, Days	Mean Temp., F.
May 29	June 5	7	66.6
June 1	June 8	7	....
June 9	June 19	10	65.1
June 10	June 17	7	....
July 11	July 16	5	77.1
July 25	Aug. 1	7	72.9
July 25	Aug. 3	9	....
Aug. 30	Sept. 9	10	....
Aug. 14	Aug. 23	9	65.4

TABLE 3—PREOVIPOSITION PERIOD OF ADULT FEMALE.

Female Emerged	First Egg Laid	Period, Days	Mean Temp., F.
June 7	June 10	3	61.0
July 8	July 9	1	71.3
July 16	July 19	3	79.2
July 16	July 19	3	79.2
Aug. 6	Aug. 8	2	....
Aug. 10	Aug. 17	7	71.8
Sept. 9	Sept. 11	2	....

TABLE 4—LENGTH OF LIFE OF ADULTS.

Adult Emerged	Adult Died	Period, Days	Mean Temp., F.
June 7	June 21	14 (female)	....
June 9	June 30	21	....
July 8	July 22	14 (female)	79.0
July 16	July 22	6 (female)	82.2
Aug. 10	Aug. 29	19 (female)	68.1
Aug. 3	Aug. 17	14 (male)	74.8
Aug. 6	Aug. 19	13 (female)	....

TABLE 5—EGGS LAID BY ADULT FEMALES.

First Egg	Adult Died	Total Number
June 10	June 21	18
July 9	July 22	22
June 10	June 21	16
June 9	June 30	34

TABLE 5a—LIFE HISTORY OF EUROPEAN RED MITE.†

Eggs Laid	Eggs Hatched	Adult Obtained	Eggs from Adult	Total Period, Days
May 21	May 29	June 5 (male)	.....	15
May 21	.....	June 7	June 10	20
July 5	.....	July 16 (male)	.....	11
July 7	.....	July 16	July 19	12
July 21	.....	Aug. 3 (male)	.....	13
July 19	July 25	Aug. 1 (male)	.....	13
Aug. 6	Aug. 14	Aug. 23	.....	17

Early stages feed mostly on the underside of the leaf, but as the leaf becomes crowded, many adults move to the upper surface and feed there. Very little web is spun at any stage, the larvae and nymphs spinning more than the adults.

METHODS OF SPREAD.

Wind is the most important agent in local distribution of the red mite. Many spin down from the leaves on short threads and if a strong wind is blowing, are probably carried for a considerable distance. Distribution of infested nursery stock is probably responsible for spread of the mite since the eggs are small and easily overlooked. Probably many are carried on the fruit, especially winter apples, which sometimes contain eggs in calyx and stem cavities.

† Continuous records of single individuals.

THE DIFFERENT STAGES.

The European red mite passes through the following stages:—egg: active larva—quiescent larva: active first nymph—quiescent first nymph: active second nymph—quiescent second nymph: adult male or female. During quiescent periods the mites are inactive and no food is taken. The male usually emerges shortly before the female and awaits the emergence of the latter. Eggs are laid within a few days after emergence of the adult female. There is no difference in the number of immature stages of male and female.

DESCRIPTION.

Adult females are dark velvety red in color, the nymphal stages and the male dark brown or green. Winter eggs are dull red, summer eggs usually brown.

Egg—Slightly flattened above, radially grooved and with a short stalk arising from the center, the stalk being longer than the vertical diameter of the egg. Transverse diameter of egg .15 mm.

Larva—Nearly orange in color when recently hatched, later turning dark green or brown; mite with three pairs of legs; length .16–.18 mm.

Protonymph—Very dark green or brown in color; with four pairs of legs, the latter quite pale; length .19–.25 mm.

Deutonymph—Very dark green or brown; legs paler; length .25–.30 mm.

Adult, female—Color dark velvety red or brown with conspicuous white dots on dorsum at base of setae; 26 setose dorsal bristles in all; tarsi provided with a single claw widest at the mid point and with apparently five (there are probably six) appendiculate spurs projecting at right angles (Fig. 2, 4); four tenent hairs with hooked tips arise from the base of the claw and exceed it considerably in length; collar tracheae consisting of a single tube (Fig. 2, 3) dilated at tip to form a spherical chamber; maxillae consisting of four segments, the last tipped with a short spatulate body, probably representing an additional segment; next to the last segment with a strong hook, and the last with five setae (two apical, two basal on the dorsum, and one lateral) and a clavate hair between the two dorsal pairs; length of adult, .28-.31 mm.

Male—Much smaller than the female, the tip of the abdomen being much more pointed and the color usually brown, never red; genitalia as in Fig. 2, 5; length .26–.28 mm.

DIFFERENCE FROM OTHER ECONOMIC SPECIES.

There are abundant differences between the European red mite and the common red spider, *Tetranychus bimaculatus* Harvey. The dorsal setae are smaller in the latter species and the collar tracheae are much different, being hooked and segmented (see Fig.

2, 8). The eggs are spherical, usually pale, and without grooves or stalk.

Bryobia pretiosa Koch,† the clover mite, is distinguishable at sight, being considerably flatter and wrinkled above and with a number of flat scalloped plates around the margin of the body of the adult. There are two claws on each tarsus instead of one and the front pair of legs is much longer than any of the others. The eggs are red but are larger, usually measuring .19–.20 mm. in diameter, and lack the radial grooves and the dorsal stalk present in *P. pilosus*.

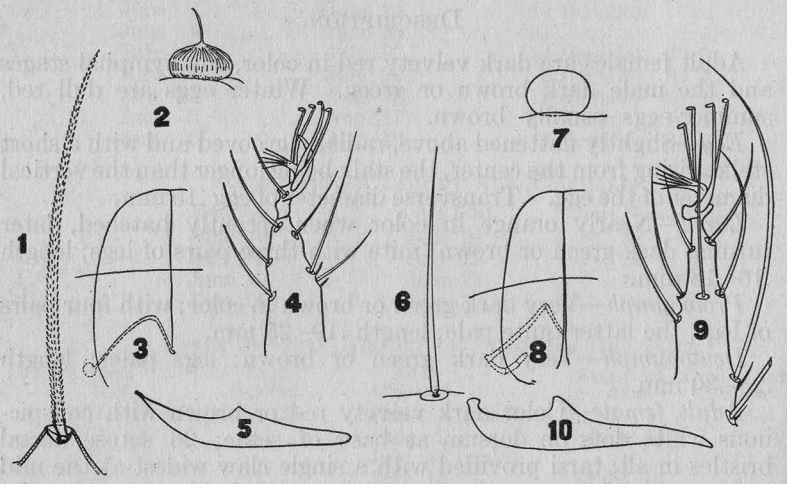


Figure 2. Structures of European red mite, *Paratetranychus pilosus* Can. and Fanz. and common red spider, *Tetranychus bimaculatus* Harvey.

1, *Paratetranychus pilosus*, seta of dorsum 846 times enlarged; 2, egg, 14 times enlarged; 3, collar tracheae and mandibular plate, 714 times enlarged; 4, tarsus of first pair of legs of female, 921 times enlarged; 5, penis, 1400 times enlarged.

6, *Tetranychus bimaculatus*, seta of dorsum, 846 times enlarged; 7, egg, 14 times enlarged; 8, collar tracheae and mandibular plate, 714 times enlarged; 9, tarsus of first pair of legs of female, 921 times enlarged; 10, penis, 1400 times enlarged.

Number of Mites Necessary to Produce Browning.

Some varieties of apples withstand much more of an infestation without showing the effects than others. Spy and Wealthy trees were browned in 1923 by 12 to 33 mites per leaf, estimated from the number of cast skins found after browning was noticed. Hurlbut trees with 55 to 133 per leaf suffered severe browning.

† *Bryobia pratensis* Garman.

Varietal Preferences.

Greening trees rarely have as many mites per leaf as other varieties, and no instances have been observed in Connecticut where severe injury has been done to this variety. Baldwin is perhaps the most commonly injured, but Hurlbut, York Imperial, McIntosh, Wealthy, Northern Spy and Fall Pippin have been injured, in some cases severely. Thin leaved varieties are most susceptible.

Natural Enemies.

Some of the most puzzling features of the appearance and disappearance of the red mite are connected with the occurrence of predaceous enemies. An orchard may, for instance, be heavily infested one season and show almost no mites the following year, although no spraying has been done in the meantime. This is often, though not always explained by the presence of enemies which in Connecticut seem able to conquer and almost eradicate the mite once every two or three years. Thus in 1922, a heavy infestation at North Branford was reduced almost to the zero point and no outbreak occurred the following year. In 1923, thrips, coccinellids, and small Hemiptera such as *Triphleps insidiosa* were numerous in orchards, and greatly checked the mite in several places.

Three species of thrips† were found, a small bug‡, a lady beetle§, a predaceous mite‖, and a small undetermined Neuropteron. All of these destroyed eggs of the red mite with relish, one thrips being observed to eat 19 eggs in twenty-four hours, while an adult *Stethorus* on being observed took six eggs and three mites within five minutes.

Enemies of the red mite are most numerous in July and August and when numerous enough keep the pest in check in spite of its rapid multiplication at this time of year. One or two thrips per leaf are apparently enough to keep in advance of an infestation because of their enormous appetite for mite eggs, and their habit of attacking mites themselves when eggs are scarce. They often leave the foliage and twigs with empty transparent egg shells, having sucked out their contents and departed.

Weather Conditions Affecting Abundance.

Adverse weather conditions are responsible for subsidence of outbreaks in some cases, but it is sometimes difficult to say whether this or the abundance of enemies is the cause. Conditions favorable to the mite may be favorable to development of the enemies or vice-versa. It has been reported that bad outbreaks have followed a very severe winter and the great numbers of mites in 1920 and

† *Leptothrips mali* Fitch, *Scolothrips 6-maculatus* Pergande and *Haplothrips* sp.; determined by Dr. A. C. Morgan.
‡ *Triphleps insidiosa* Say.
§ *Stethorus punctum* Leconte.
‖ *Seius pomi* Parrott.

1923 certainly followed abundan snows and cold weather. However, a serious outbreak occurred in 1922 after a ratl er mild winter, and the infestations in 1923 did not become serious until midsummer, whereas if cold weather had much effect this should have begun more promptly. Heavy rainfall or better a series of showers at frequent intervals in summer is successful in keeping an infestation from gaining headway, as witnessed in this State in 1922. This is due to the fact that many mites are washed from the leaves and are unable to regain the tree. It is quite possible that a rainy period in September would decidedly affect the abundance of the mite the following season, though no cases of this sort have been observed. In 1923, the prolonged dry period from the middle of June to September favored development and several orchards were damaged severely.

Control Measures.

Owing to the uncertainty that weather and enemies will produce a balance in favor of the orchardist, treatments for control must be considered and a regular schedule adopted. There are periods when the mite is especially vulnerable and a thorough spray is of much value; and it is a good policy to learn to know the mite in its different stages so that damage may be anticipated and prevented. As with many insects the best time to concentrate efforts is in early spring and sprays at this time should go far towards a control for the entire season, especially in this climate. It is well, therefore, to keep a sharp lookout for winter eggs when the annual pruning is done and not to wait until the leaves turn brown before considering treatment.

Sprays for the Winter Eggs.

The first attack should be on the overwintering eggs which may be reached with sprays and largely destroyed. Laboratory tests were conducted in 1920-21 with a view to finding the most effective treatments for this purpose. Some of the tables are given below together with tests of several other compounds reaching us since these were made.

In the tables, the names of a number of proprietary compounds appear, and the following explanation in regard to their general composition and source is necessary. Such compounds as lime-sulphur, and Scalecide are too well known to need comment.

"*Jarvis Compound.*"— A miscible oil containing phenol; manufacturer J. T. Robertson; obtained from Apothecaries Hall Co., Waterbury, Conn.

"*Kero-spray.*"—A commercial kerosene emulsion; manufacturer, Kero-Spray Co., 198 9th St., Jersey City, N. J.

"*Keresol.*"—An oil spray containing 70 per cent. kerosene; obtained from Mr. A. A. Claasen, Mascher and Turner Streets, Philadelphia, Pa.; effect of spray on trees unknown.

"*Sulco V. B.*"—A spray containing fish-oil and small per cent. phenol; manufactured by Cook & Swan Co., 148 Front St., New York; obtained from Apothecaries Hall Co., Waterbury; effect on apple trees unknown, probably safe.

"*Wormol.*"—A miscible oil recommended for use against peach borers by the General Chemical Company; obtained from General Chemical Company, 25 Broad St., New York, N. Y.; effect upon apple trees unknown.

"*B. T. S.*"—Barium tetrasulphide, a lime-sulphur substitute; a General Chemical Company product.

"*Sunoco Spraying Oil*".—A miscible mineral oil; apparently safe on apple trees; sold by Sun Oil Company, Philadelphia, Pa.

"*Target Brand Scale Destroyer.*"—A miscible oil containing phenol; sample submitted by the Interstate Chemical Company, Jersey City, N. J.

Tables Showing Results of Treating Eggs of European Red Mite With Different Insecticides.

Table 6.

Exp. No.	Treatment	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Treated	Date Examined
1.	Kerosene emulsion (10 per cent. kerosene)	660	402	60.9	Mar. 16	Apr. 29
2.	Kero-spray 1 part-25 parts water	298	166	56.0	"	"
3.	Sulco V. B. 1 part-25 parts water	502	255	50.7	"	"
4.	Keresol 1 part-18 parts water	442	265	59.9	"	"
5.	Jarvis Compound 1 part-15 parts water	104	6	5.7	"	"
6.	Scalecide 1 part-15 parts water	237	22	9.2	"	"
7.	Lime-sulphur 1 part-9 parts water	652	253	38.8	"	"
8.	Dry lime-sulphur 12 lbs.-50 gals. water	418	125	29.9	"	"
9.	B. T. S. 12 lbs.-50 gals. water	349	162	46.4	"	"
10.	Scalecide 1 part-25 parts water	341	115	33.7	"	"
11.	Check no treatment	265	151	56.9	—	"
12.	Scalecide 1 part-15 parts water	150	8	5.3	April. 7	Apr. 29
13.	Scalecide 1 part-15 parts water	669	9	1.3	"	"
14.	Scalecide 1 part-35 parts water	838	53	6.3	"	"
15.	Scalecide 1 part-25 parts water	744	68	9.1	"	"
16.	Scalecide 1 part-50 parts water	462	47	10.1	"	"
17.	Check no treatment	253	164	65.0	—	"
18.	Check no treatment	100	45	45.0	—	"

TABLE 7.

Exp. No.	Treatment	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Treated	Date Examined
	Lime-sulphur 1-9					
1.	Nic. Sulphate 1-500	649	189	29.1	Dec. 29	Feb. 23
2.	" " "	2,166	544	25.1	Feb. 8	Mar. 2
	Lime-sulphur					
3.	1 part-9 parts water	403	45	11.1	Apr. 5	Apr. 15
4.	" " "	378	18	4.7	Mar. 12	Mar. 28
5.	" " "	773	268	34.6	Dec. 29	Feb. 23
	Lime-sulphur 1-9					
6.	Nic. Sulphate 1-500	165	80	48.4	Apr. 13	Apr. 28
7.	" " "	221	54	24.4	Apr. 13	Apr. 29
	Lime-sulphur					
8.	1 part-9 parts water	526	351	66.7	Dec. 29	Apr. 28
9.	" " "	652	253	38.8	Mar. 16	Apr. 29
10.	" " "	449	132	29.4	Feb. 17	May 3
11.	" " "	299	83	27.7	Mar. 10	May 2

Notes.

Table 6. Eggs in tests 1-11 were taken from the same branch. Those in 12-18 were from another branch. All eggs dipped in the different solutions, not sprayed.

Table 7. Nos. 1-5 were kept indoors after treatment; 6-11 outdoors. Nos. 5 and 6 were sprayed, other dipped.

TABLE 8.

	Dry lime-sulphur					
1.	½ oz.-1 pint water	302	114	37.7	Apr. 5	Apr. 15
2.	" " "	274	6	2.1	Mar. 12	Mar. 28
3.	" " "	197	74	37.5	Mar. 4	Mar. 25
4.	" " "	418	125	29.9	Mar. 16	Apr. 29

TABLE 9.

	B. T. S.					
1.	½ oz.-1 pint water	1,047	368	35.2	Feb. 8	Mar. 2
2.	" " "	374	124	33.2	Apr. 5	Apr. 15
3.	" " "	438	35	7.9	Mar. 12	Mar. 28
4.	" " "	234	34	14.5	Mar. 4	Mar. 25
5.	½ oz.-1 pint water	349	162	46.4	Mar. 16	Apr. 29
	B. T. S. ½ oz.-1 pt. water					
6.	N.S. 1 part-500 part water	282	126	44.6	Apr. 5	Apr 29

TABLE 10.

1.	Scalecide 1-15†	773	27	3.5	Dec. 29	Feb. 23
2.	" 1-15	1,078	0	0.0	Feb. 8	Mar. 2
3.	" 1-15	412	0	0.0	Apr. 5	Apr. 15
4.	" 1-15	67	0	0.0	Mar. 12	Mar. 28
5.	" 1-25	173	0	0.0	Mar. 16	Apr. 4
6.	" 1-50	356	11	3.0	Mar. 16	Apr. 4
7.	" 1-15	119	0	0.0	Mar. 4	Mar. 25
8.	" 1-15	409	135	33.0	Dec. 29	Apr. 28
9.	" 1-15	104	6	5.7	Mar. 8	Apr. 29

† Proportions of Scalecide to water.

TABLE 10—*Continued.*

Exp. No.	Treatment	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Treated	Date Examined
10.	Scalecide 1-25	341	115	33.7	Mar. 9	Apr. 29
11.	" 1-50	150	8	5.3	Apr. 7	Apr. 29
12.	" 1-15	669	9	1.3	Apr. 7	Apr. 29
13.	" 1-25	744	68	9.1	Apr. 7	Apr. 29
14.	" 1-35	838	53	6.3	Apr. 7	Apr. 29
15.	" 1-50	462	47	10.1	Apr. 7	Apr. 29
16.	" 1-15	326	55	16.8	Feb. 17	May 3

Notes.

Table 8. Nos. 1-3 kept indoors, 4 outdoors.

Table 9. Nos. 1-4 kept indoors, 5 and 6 outdoors.

Table 10. Tests 1-7 were kept indoors after treatment; 8-16 were kept outdoors. Numbers 10-15 were sprayed, others were dipped in spray solutions.

TABLE 11.

Exp. No.	Treatment	Total No. of Eggs Used	No. Hatched	Per Cent. Hatched	Date Treated	Date Examined
1.	Sunoco spraying oil 1-15	233	4	1.7	Feb. 1	Mar. 8
2.	Sunoco spraying oil 1-15	262	1	.4	Mar. 15	Apr. 15
3.	Sunoco spraying oil 1-25	180	6	3.3	Mar. 15	Apr. 15
4.	Sunoco spraying oil 1-50	325	56	14.1	Feb. 3	Mar. 8
5.	Lime-sulphur, 1-6.....	297	68	22.8	Feb. 3	Mar. 8
6.	Lime-sulphur, 1-9.....	224	77	29.4	Feb. 3	Mar. 8
7.	Target brand scale destroyer, 1-15.....	357	3	.8	Feb. 3	Mar. 8
8.	Target brand scale destroyer, 1-50.....	265	37	13.9	Feb. 3	Mar. 8
9.	Red engine oil 1% emulsion with fish oil soap..	299	0	.0	Mar. 15	Apr. 15
10.	Red engine oil 2% emulsion with fish oil soap..	322	2	.6	Mar. 15	Apr. 15
11.	Scalecide 1-15.....	252	4	1.5	Mar. 15	Apr. 15
12.	Check, no treatment....	200	143	71.5	———	Mar. 8
13.	Check, no treatment....	175	136	77.7	———	Apr. 15
14.	Lime-sulphur 1-8.....	666	148	22.2	Apr. 11	May 15
15.	Scalecide 1-15.....	644	2	.3	Apr. 11	May 15
16.	Sunoco spraying oil 1-15	573	2	.3	Apr. 11	May 15
17.	Red engine oil 2% emulsion with fish oil soap..	646	31	4.8	Apr. 11	May 15
18.	Check, no treatment....	361	127	35.1	———	May 15

TABLE 12 (CHECKS).

Exp. No.	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Obtained	Date Examined
1.	1,956	345	17.6	Dec. 29	Feb. 23
2.	527	263	49.9	Feb. 9	Mar. 4
3.	60	45	75.0	Feb. 10	Mar. 4
4.	2,421	1,477	61.0	Feb. 8	Feb. 23
5.	334	326	97.6	Apr. 5	Apr. 15
6.	359	324	90.2	Apr. 8	Apr. 28
7.	208	185	88.9	Mar. 4	Mar. 25
8.	402	223	55.4	Mar. 10	Mar. 28
9.	403	333	82.6	Mar. 11	Mar. 28
10.	430	342	79.7	Mar. 12	Mar. 28
11.	255	209	81.9	———	Apr. 4

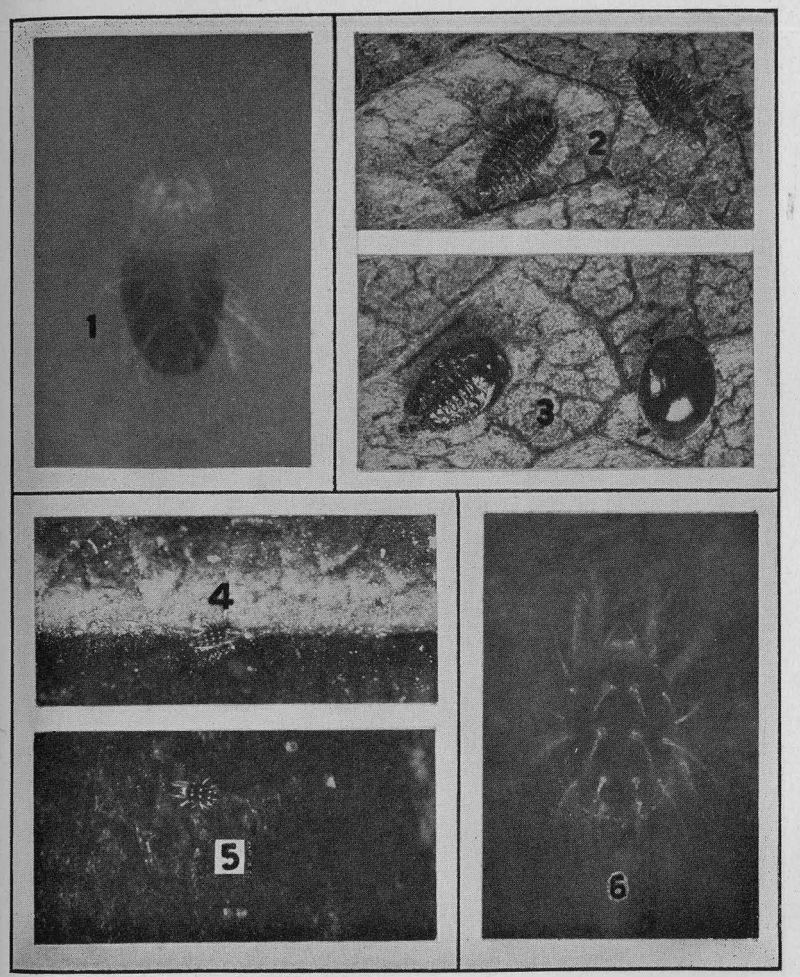
TABLE 12 (CHECKS)—*Continued.*

Exp. No.	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Obtained	Date Examined
12.	421	181	42.9	Dec. 29	Apr. 28
13.	265	151	56.9	Mar. 16	Apr. 29
14.	253	164	64.8	Apr. 7	Apr. 29
15.	100	45	45.0	Apr. 7	Apr. 29
16.	162	109	67.3	Apr. 13	Apr. 28
17.	120	20	16.6	Apr. 4	Apr. 28
18.	155	85	54.8	Apr. 5	Apr. 29
19.	531	337	63.4	Feb. 17	May 3
20.	188	114	60.6	Mar. 10	May 2

COMPARATIVE MORTALITY OF TREATED EGGS OF EUROPEAN RED MITE, KEPT OUTDOORS AND INDOORS AFTER TREATMENT.

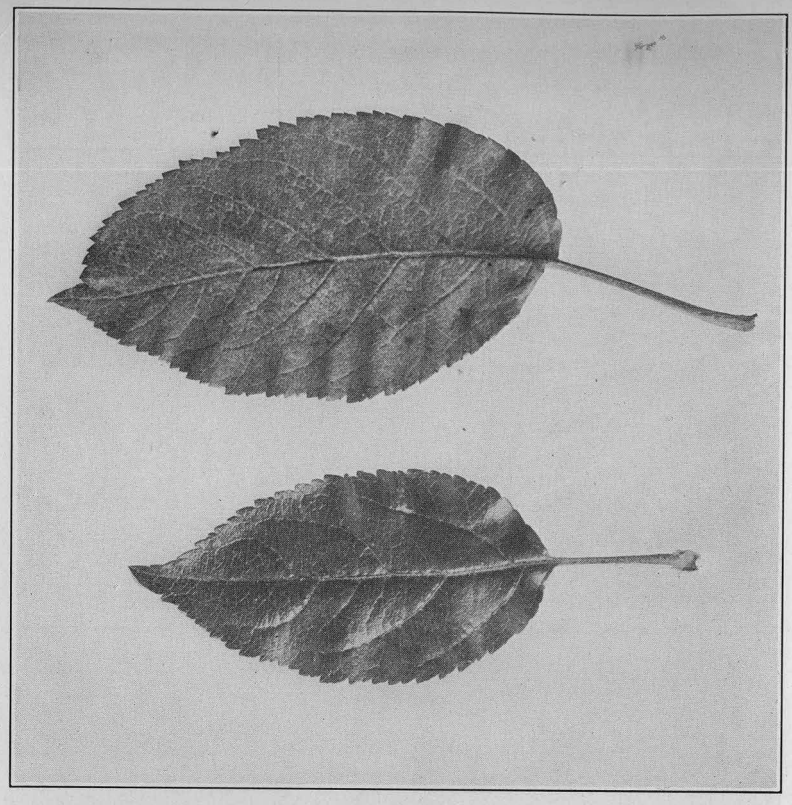
TABLE 13.

Treatment	Hatched Per Cent.	Possible Kill Per Cent.	Number of Eggs Used	
Check, no treatment	61.0	0	7,355	Indoors
	54.9	0	2,195	Outdoors
Kero-spray	86.5	0	445	Indoors
	55.7	0	298	Outdoors
Sulco V. B.	49.9	18.6	879	Indoors
	48.0	12.5	958	Outdoors
Keresol	34.2	44.0	385	Indoors
	59.9	0	442	Outdoors
Linseed oil emulsion	56.0	8.4	841	Indoors
	26.1	52.5	352	Outdoors
B. T. S.	26.7	56.3	2,093	Indoors
	45.6	16.8	631	Outdoors
Lime-sulphur; liquid 1-9	22.1	63.8	3,596	Indoors
	43.1	21.4	2,515	Outdoors
Lime-sulphur; dry	25.0	59.0	773	Indoors
	29.9	45.5	418	Outdoors
Kerosene emulsion	31.6	48.2	227	Indoors
	60.9	0	660	Outdoors
Wormol, 1 part in 15 parts water	5.4	91.1	419	Indoors
	14.7	73.2	292	Outdoors
Scalecide	1.2	98.1	2,978	Indoors
	9.9	81.8	4,043	Outdoors
Jarvis Compound	0	100	792	Indoors
	6	89.1	104	Outdoors

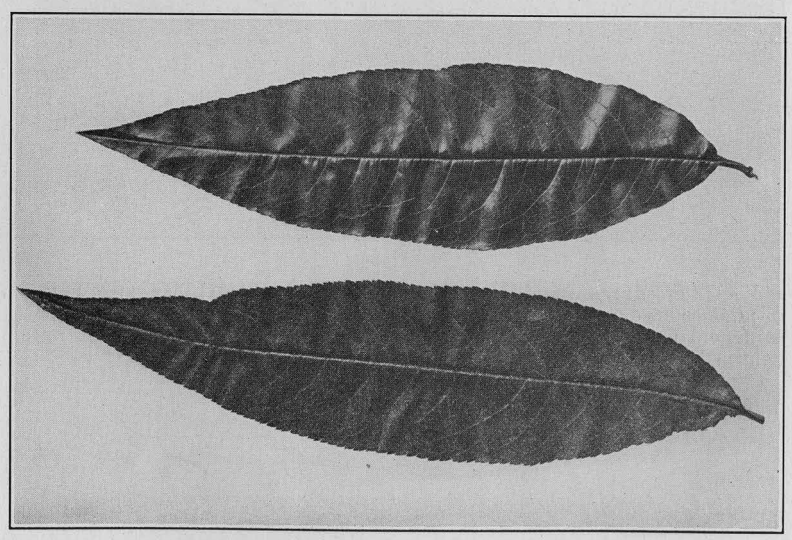


1. Quiescent nymph of European red mite, enlarged 80 times. 2. Larvae of predaceous enemy (*Stethorus punctum* LeConte). 3. Pupa and adult of same, enlarged 10 times. 4 and 5. Adult females of European red mite, enlarged 13 times. 6. Adult female, enlarged 80 times.

EUROPEAN RED MITE.



a. Apple leaves, showing leaf injured by European red mite (above), uninjured (below).



b. Peach leaves, showing leaf injured by European red mite (below), uninjured (above).

EUROPEAN RED MITE.

a. Infested apple tree which has lost much foliage from the attacks of the mite.

b. Eggs on calyx end of apple, and on twig, three times enlarged; insert, same from twig, enlarged about ten times.

EUROPEAN RED MITE.

PLATE VIII.

a. View in orchard of Smith T. Bradley, North Branford, showing untreated trees partially defoliated by mite.

b. View in same orchard showing trees which were sprayed with linseed oil emulsion.

EUROPEAN RED MITE.

Notes.

Table 12. Eggs listed here were not treated with any insecticide. Numbers 1-11 were kept indoors in moist jars; 12-20 outdoors.

Table 13. The percentages in the column headed "possible kill" were obtained by comparing each with the check hatch, obtaining the actual hatch, and subtracting this number from 100, thereby obtaining the per cent. killed. Where the per cent. hatched is higher than the check it is obvious that the insecticide has no killing power.

Summary of Various Treatments.

Table 14.

Exp. No.	Treatment	Hatched Per Cent.	Possible Kill Per Cent.	Number of Eggs Used
1.	Check, no treatment	55.2	0	9,550
2.	Kero-spray	74.1	0	743
3.	Sulco V. B	49.2	10.9	1,837
4.	Keresol	47.9	13.3	827
5.	Linseed oil emulsion	46.3	16.2	1,193
6.	B. T. S	31.1	43.7	2,724
7.	Lime-sulphur (liquid)	30.8	44.3	6,111
8.	Lime-sulphur (dry)	26.3	52.4	1,191
9.	Kerosene emulsion	12.9	76.7	887
10.	Wormol	9.2	83.4	711
11.	Scalecide	7.6	86.2	7,021
12.	2% Red engine oil emulsion	4.8	91.3	646
13.	Jarvis compound	.6	99.0	896
14.	Sunoco spraying oil	.3	99.5	573

Different authorities have claimed that dormant or delayed dormant sprays of lime-sulphur either killed the mites before hatching, prevented them from reaching the leaves, or killed them by continued action after reaching the leaves. Although lime-sulphur will kill some of the eggs as shown in the tables, it has been our experience (see Table 15) that it does not prevent them from reaching the leaves or kill them off in appreciable numbers after they begin to feed. It is in fact a much less efficient ovicide for the red mite than miscible oils. A fairly convincing example of this is found in the table below, which gives the results of a test conducted at the Experiment Station Farm in 1923.

Table 15—Effect of Field Treatments on the Winter Egg.

Treatment	Number of Fruit Spurs Examined	Number with Live Mites on Leaves	Per Cent. Infested
Scalecide 1-15	978	56	5.7
Lime-sulphur 1-9	975	972	99.6
Check, no treatment	1,000	1,000	100.0

Examination of the trees during the winter indicated a nearly equal infestation of all blocks. Sprays were applied at the latest possible date considering the development of the trees. Nearly a thousand fruit spurs in each block of about 20 trees were examined, every twig included having eggs on it or at its base. It

will be seen that lime-sulphur checked their development little or none, while the miscible oil used was considerably more effective.

This condition continued well into the summer and trees receiving lime-sulphur alone as a delayed dormant spray were in practically the same condition as those receiving no spray, that is, in the amount of infestation on the leaves. What virtue there is in lime-sulphur seems to rest mainly with early summer sprays and not so much with the delayed dormant. Early summer sprays at 1.5–50 or 1–50 have been successful in three different experimental orchards in keeping the mite in control—and this without any dormant or delayed dormant spray whatsoever. This, together with the information in Table 15, indicates that lime-sulphur dormant or delayed dormant sprays are of little value in red mite control.

It will be noted in Tables 7, 9 and 10 that there is a general reduction in percentage of hatch after treatments as the season advances from December to April or May. This is probably due to embryonic development, but the membranes do not split as in the case of aphids. The outer membrane, however, does loosen up and may be peeled off with a needle several days before the mite hatches. These facts were corroborated in practical experience at the Conyers Farm orchard at Greenwich, in charge of Mr. G. A. Drew. Fall spraying in this orchard with miscible oil killed a very small per cent., while spring applications were quite effective.

Scalecide is the only miscible oil which has been given a field test, and it is shown to be effective. There are other oil emulsions, however, which should do the work, and some, notably the home-made lubricating oil emulsions, apparently are causing no damage.[8] There is an element of danger in using them, and it is well to observe some precautions in applying.

1. Make sure that all of the oil emulsifies, leaving none floating on the surface of the water in the spray tank. This condition will often follow the use of old material which has been on hand for a year or more. In most cases it is best to have fresh stock.
2. Do not drench the trees; spray lightly, covering the outer twigs and smaller branches.
3. Do not spray in weather so cold that the spray freezes.
4. Apply before the buds break, as a late dormant spray. This usually falls several weeks before the *delayed dormant spray*.
5. Do not use at all unless red mite eggs are very numerous, or unless you expect a serious outbreak; an application of miscible oil once every three years should be sufficient when the mite is once in control.

Summer Sprays.

Different substances have been tested on the mites themselves for killing power, and the results are given below in Table 16. Such tests are not so satisfactory as similar tests for the eggs, be-

cause of the fact that the mite is susceptible to changes in temperature and also to condition of the food plant. At any rate, there is considerable more variation in the results obtained, though they indicate in a general way the effectiveness of soaps, lime-sulphur solutions, and oil emulsions.

Table 16—Results of Laboratory Tests to Control Mites.

Exp. No.	Insecticide Used	No. Dead	No. Alive	Per Cent. Dead	Temp. of Air F	Dates
1.	Ivory soap flakes 2 lbs. —50 gals	67	12	84.8		May 20–22
2.	Ivory soap 2 lbs.—50 gals. plus Melrosine 1 part to 100	71	14	83.5		May 20–22
3.	Ivory soap flakes 2 lbs. —50 gals	409	2	99.5	73	May 13–18
4.	Ivory soap flakes 2 lbs. —50 gals	406	4	99.0	80.5–82	May 13–18
5.	Lux 2 lbs.—50 gals	107	1	99.0	73	May 13–18
6.	Lux 2 lbs.—50 gals	164	3	98.1	80.5–82	May 13–18
7.	Potash fish oil soap 10 lbs.—50 gals	12	14	46.1		May 23–25
8.	Fish oil soap 5 lbs.— 50 gals	13	41	24.0		May 23–25
9.	Fish oil soap 10 lbs.— 50; sulphur 16 lbs. 50 gals	16	93	14.6	80.5–82	May 27–31
10.	Borax soap 4 lbs.—48 gals. water	128	26	83.1	60–79	Aug. 17–18
11.	Linseed oil emulsion 1 part—20 parts water	81	5	94.1	70–74	Aug. 17–18
12.	40% nicotine sulphate ¾ pt.—50 gals	114	5	95.7		July 28–30
13.	Borax soap 6 lbs.—50 gals	141	6	95.9		July 28–30
14.	Fels naphtha soap 4 lbs.—50 gals	15	0	100		July 28–29
15.	Star soap 4 lbs.—50 gals	23	2	92		July 29–30
16.	Dusted with sulphur	22	59	27.1	73	May 12–18
17.	Dusted with sulphur	101	2	98.0	80.5–82	May 12–18
18.	Lime-sulphur 1—40 nicotine sulphate 1 —500	36	2	95.0	60–79	Aug. 15–16
19.	Lime-sulphur 1—40; nicotine sulphate 1 —500	141	18	88.7	60–79	Aug. 17–18
20.	Ace-Hy 1—400†	108	254	29.8		June 31–July 1
21.	Ace-Hy 1—200†	40	2	95.2		Aug. 29
22.	Lime-sulphur 1—43¼ gals	79	28	73.8		July 28–30
23.	Check, no treatment	4	53	9.5	73	May 12–18
24.	Check, no treatment	22	31	41.7	80.5–82	May 12–18
25.	Check, no treatment	12	70	14.6		May 20–22
26.	Check, no treatment	2	84	2.3	60–79	Aug. 17–18

† An insecticide no longer on the market; containing cyanide (CN) as the active ingredient.

Sulphur dusts are variable, both in laboratory and in the field, but at least one factor influencing their effectiveness is found in the temperature of the atmosphere as shown in the two following charts, giving the killing power of sulphur dust and a dust containing 88 per cent. sulphur and 10 per cent. lead arsenate.

"Pomodust"† is now on the market and was apparently effective in controlling the red mite under the weather conditions experienced in 1923. The totally different action of sulphur dusts in

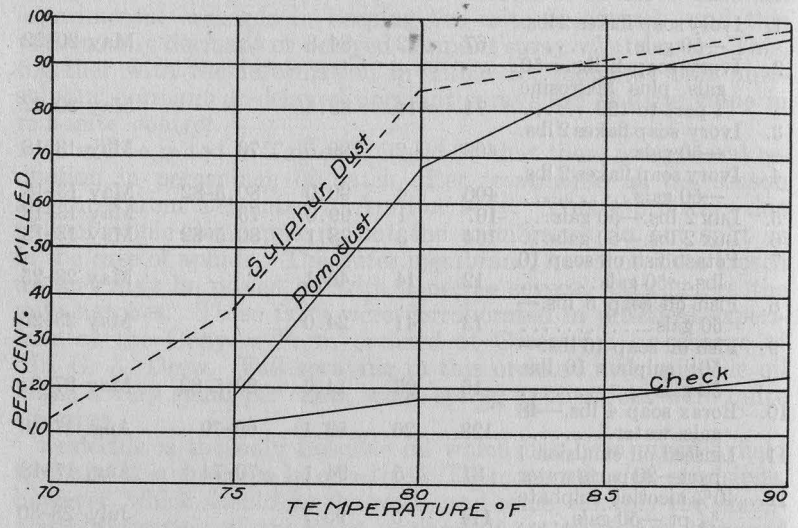


Chart 1. Showing kill obtained with sulphur dust and "Pomodust" at different temperatures; exposure in each case 24 hours.

1922 may be explained by the lack of excessive heat, and the dry weather which doubtless influenced the results in 1923.

Field tests have been conducted in five different orchards in Connecticut. The first were carried out at the Plant Brothers orchard in Branford in 1920. Soap, soap and nicotine sulphate, and sulphur-arsenate-nicotine dust were tried, but results were inconclusive due to the lateness of the applications. In 1921, no field tests were conducted but in 1922 serious outbreaks occurred and experiments were undertaken in three different orchards. Good control was secured with linseed oil emulsion, soaps, and a lime-sulphur-lead-arsenate-nicotine mixture. Tests at the Bradley orchard showed good control with linseed oil emulsion and with fish oil soap. Good control, however, was obtained with borax soap and lime-sulphur-lead-arsenate-nicotine combination in the

† Chemical analysis by the Connecticut Station, Department of Chemistry, showed that it contains sulphur 87.79 per cent., lead arsenate 9.80 per cent., and a trace of iron; water soluble arsenic .24 per cent.

Milford orchard of F. N. Platt. Counts were not made in the Milford orchard, but from a practical standpoint results were good, since the foliage continued green throughout the summer.

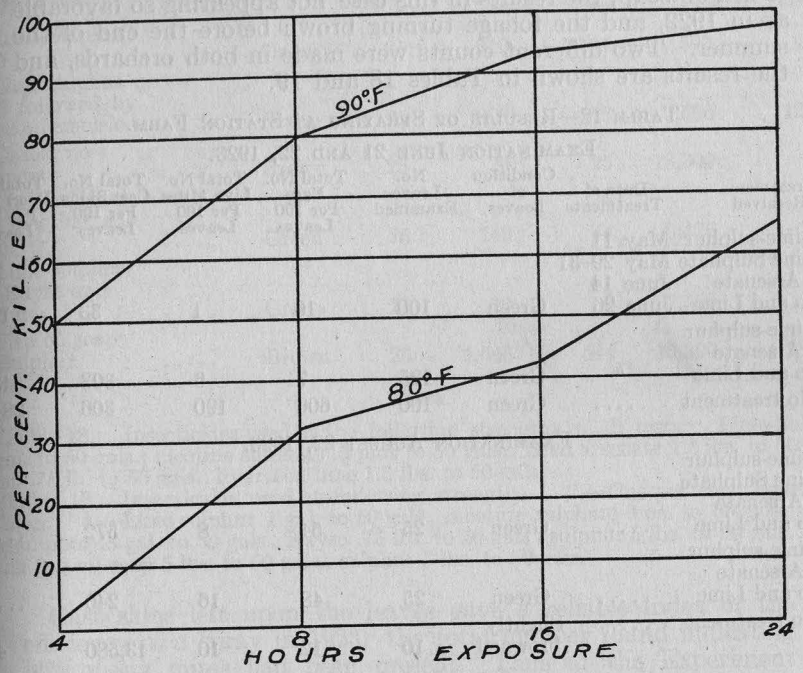


Chart 2. Showing kill obtained with "Pomodust" at different temperatures and different lengths of exposure.

TABLE 17—RESULTS OF FIELD TESTS WITH SOAPS, LINSEED OIL EMULSION AND SELF-BOILED LIME-SULPHUR IN BRADLEY ORCHARD.

Insecticide Used	No. Alive	No. Dead	Per Cent. Dead	No. of Leaves Examined	No. of Twigs Examined	Date of Treatment	Date of Examination 1922
Linseed Oil 1 gal.† Ivory soap 1½ lbs. Water 100 gals...	718	1,524	67.9	80	10	June 2	June 6
Ivory soap 6 lbs. Water 200 gals...	1,743	779	30.8	60	9	June 2	June 6
"Kerospray" 1 gal. —100 gals.....	916	381	29.5	50	6	June 2	June 6
Fish oil soap 14 lbs.—200 gals..	691	655	48.6	54	6	June 2	June 7
Self-boiled lime-sulphur (8-8-50) Kayso 2½ lbs.— 200 gals.....	951	356	27.2	64	8	June 2	June 8
None.....	1,592	278	14.	65	7	———	June 8

† Prepared according to directions in Mass. Agr. Exp. Sta. Bull. 179, pages 175-6, except that flakes were used instead of bars of soap.

Continued experimentation in 1923 in the orchard at the Experiment Station Farm and in the orchard at Conyers Farm, Greenwich, substantiated the results in 1922 except for the use of fish oil soap, the results in this case not appearing so favorable as in 1922, and the foliage turning brown before the end of the summer. Two different counts were made in both orchards, and the results are shown in Tables 18 and 19.

TABLE 18—RESULTS OF SPRAYING AT STATION FARM.

EXAMINATION JUNE 21 AND 22, 1923.

Treatment Received	Date of Treatments	Condition of Leaves	No. Leaves Examined	Total No. Eggs Per 100 Leaves	Total No. Live Mites Per 100 Leaves	Total No. Cast Skins Per 100 Leaves	Total No. Dead Mites Per 100 Leaves
1. Lime-sulphur Nicotine Sulphate Lead Arsenate.. Kayso and Lime	May 11 May 29–31 June 14 June 26	Green	100	16	1	33	14
2. Lime-sulphur Lead Arsenate Kayso and Lime	"	Green	125	7	6	303	43
3. No treatment	.....	Green	100	606	190	306	281

EXAMINATION AUGUST 22, 1923.

1. Lime-sulphur Nicotine Sulphate Lead Arsenate Kayso and Lime	.....	Green	25	54	8	572	...
2. Lime-sulphur Lead Arsenate Kayso and Lime	.....	Green	25	48	16	240	...
3. No treatment	.....	Slightly browned	10	12	10	13,580	4

TABLE 19—RESULTS OF SPRAYING AT CONYERS FARM.

EXAMINATION JUNE 12, 1923.

Treatment Received	Date of Treatments	Condition of Leaves	No. Leaves Examined	Total No. Eggs Per 100 Leaves	Total No. Live Mites Per 100 Leaves	Total No. Cast Skins Per 100 Leaves	Total No. Dead Mites Per 100 Leaves
1. Lime-sulphur 1—50	May 2 May 24 June 26	Green	225	3	2	130	3
2. Lime-sulphur followed by linseed oil emulsion	May 2 May 24 June 26	Green	100	39	61	71	88
3. Check, no treatment	.....	Turning brown	50	286	1,220	1,094	258
4. Lime-sulphur plus nicotine sulphate	May 2 May 24 June 26	Green	160	3	6	178	16
5. Lime-sulphur plus Kayso and Sulphur	"	Green	210	11	26	227	25
6. Fish Oil Soap and Sulphur	"	Green	200	25	29	196	38

TABLE 19. RESULTS OF SPRAYING AT CONYERS FARM—*Continued.*

EXAMINATION AUGUST 2, 1923.

Treatment Received	Date of Treatments	Condition of Leaves	No Leaves Examined	Total No. Eggs Per 100 Leaves	Total No. Live Mites Per 100 Leaves	Total No. Cast Skins Per 100 Leaves	Total No. Dead Mites Per 100 Leaves
1. Lime-Sulphur 1—50	.....	Green	25	212	44	592	40
2. Lime-sulphur 1—50 followed by linseed oil emulsion	.....	Green	25	328	168	5,590	120
3. Check, no treatment	.....	Brown	25	20	25	18,300	4
4. Lime-sulphur plus nicotine sulphate	.....	Green	25	140	44	3,476	16
5. Lime-sulphur plus Kayso and Sulphur	.....	Green	25	32	8	1,562	0
6. Fish oil soap and Sulphur	.....	Brown	25	1,648	544	10,300	280

Notes.

Table 18. Insecticides used at the following strengths in all tests. Lime-Sulphur 1.5 gal. to 50 gals.; nicotine sulphate .5 pint to 50 gals.; Lead arsenate 1.5 lbs. to 50 gals.; Kayso .75 lb. to 50 gals.; hydrated lime 1.5 lbs. to 50 gals.

Table 19. Insecticides used at following strengths. 2.—One per cent. linseed oil emulsion. 4.—Lime-sulphur 1 gal. to 50 gals., nicotine sulphate 6 oz. to 50 gals. 5.—Lime-sulphur .5 gal. to 50 gals., Kayso .75 lbs. to 50 gals., sulphur 5 lbs. to 50 gals. 6.—Potash fish oil soap 5 lbs. to 50 gals., sulphur 5 lbs. to 50 gals.

Cast skins left upon the leaves gave a reliable index of the efficiency of a spray in 1923, the total number found indicating how many mites had been present. Thus at the Experiment Station Farm, examination August 22, check trees showed twenty to fifty times as many cast skins per leaf as in the case of trees sprayed with lime-sulphur. At the Conyers orchard the check trees had from six to thirty times as many casts as could be found on trees sprayed with lime-sulphur. This seems to be more reliable than judging the foliage greenness, which may be affected by a number of causes. It will also be seen that no conspicuously greater control was obtained with lime-sulphur to which nicotine alone was added than with lime-sulphur combinations containing no nicotine. Lime-sulphur combinations thus far have not failed in a single instance under our observation to control the red mite successfully if applied according to spray calendar recommendations, especial attention being given to early summer sprays.

Mineral oil and linseed oil emulsions are very effective in killing mites—apparently more so than lime-sulphur if the count is made shortly after the spray is applied. They have given uniform results of this kind in every instance and there is no reason why linseed oil emulsion (or other safe spraying oil) cannot be used to advantage on trees unable to stand commercial lime-sulphur. For

apples their use seems to be needless in view of more efficient fungicidal effects of lime-sulphur. Soaps are likely to vary, and while their combination with sulphur may be effective at times, even this combination may fail to give good results. Probably their continued effect is dependent upon heat as with sulphur dusts already mentioned. A field test of three oil emulsions is shown in Table 20.

TABLE 20. EUROPEAN RED MITE CONTROL AT CONYERS ORCHARD.†

SPRAYED JUNE 25, 1923.

Exp. No.	Insecticide Used	Number Live Mites.	Number Dead.	Per Cent. Dead.	Possible Kill Per Cent.
1.	Sunoco spraying oil 1 part in 100 parts water.....	6	395	98.5	98.1
2.	Linseed oil emulsion 1 gallon linseed oil 1¼ lbs. Ivory soap 100 gallons water	30	177	85.5	82.5
3.	Schnarr's insecticide 1 part in 100 parts water.....	28	412	93.5	92.6
4.	None	241	61	20.1	0.0

Notes.

Trees in experiments 1 and 3 sprayed with hand pump and rod, 2 with gun and power outfit.

SPRAY BURN RESULTING FROM SPRAYS CONTAINING LIME-SULPHUR.

The main objection to the use of lime-sulphur solution has been due to burning of the foliage. Severe spray burn was noticed in different sections of Connecticut in 1923 and notes upon the probable cause are timely. As the spray formula consists of several compounds, the following possibilities arise:

1. The cause of the spray burn may be the lime-sulphur solution—due to composition or strength.
2. It may be due to lead arsenate alone—due to high water soluble arsenic content.
3. It may be due to nicotine sulphate—especially combination products with other insecticides.
4. It may be due to a combination of all of these materials resulting in other compounds or altered original compounds which cause burning.
5. Weather conditions noticeably affect the degree of spray burn.
6. The particular variety may be susceptible to spray injury.

† Leaves collected immediately after treatment and examined the following day.

Considering these causes in order, with precautions necessary to avoid injury, it seems advisable:

1. To reduce the strength of lime-sulphur on tender varieties such as Baldwin from 1½ to 50 gallons to 1 to 50 or even 1 to 75 in the later applications.
2. To obtain a guarantee that the lead arsenate used shall contain no more than .75% of water soluble arsenic. If large quantities are purchased have the material analyzed for water soluble arsenic at the Experiment Station or elsewhere.
3. Omit nicotine sulphate unless aphids are present in the orchard.
4. Combine your sprays in the following order:

    1. Lead arsenate
    2. Nicotine sulphate
    3. Casein lime
    4. Lime-sulphur.

Do not allow sludge to collect in the bottom of the spray tank; clean frequently.

5. Do not spray when the temperature or humidity is high. It is best to stop when the temperature reaches 90 degrees.
6. Be particularly careful with Baldwin and other thin leaved varieties. If the trees continue to be burned, use formula[3] containing lime-sulphur, casein lime and sulphur as follows:

Water	100 gallons
Lime-sulphur	1 gallon
Finely ground sulphur	5–10 lbs.
Casein lime	1 lb.

SUMMARY AND RECOMMENDATIONS.

1. The European red mite passes the winter in the egg stage upon smaller twigs and branches. Eggs hatch in April or May at the time fruit buds are turning pink.
2. The incubation period of the summer egg varies from six to thirteen days, and the adult develops in five to ten days. The preoviposition period lasts from one to seven days, but eggs are usually laid within a few days after emergence. Adults lived six to nineteen days and adult females laid a total of sixteen to thirty-four eggs during their lives. Winter eggs are sometimes laid in August; usually however during September and early October. Winter eggs are dark red, summer eggs, brown.
3. This mite is easily distinguished from other species in adult and egg stage.
4. An infestation of 50 to 100 mites per leaf is sufficient to cause leaves of apple trees to turn brown. Baldwin is the variety most commonly injured.

5. Enemies become numerous in July and August and are often responsible for the disappearance of the red mite.

6. Dry weather in summer favors their development and a wet period with frequent showers keeps them in check.

7. A definite spray schedule should be adopted in orchards where mites are numerous.

8. Lime-sulphur delayed dormant spray is not effective because of the late hatching of the egg.

9. Miscible oils are effective dormant sprays, and with care are reasonably safe in orchard work. Fall sprays of miscible oil are apparently ineffective.

10. Lime-sulphur, summer strength, sprays should be applied early beginning with the pink spray, which should be followed by at least two others containing lime-sulphur, the latest being applied the last of June or first of July.

11. Nicotine sulphate is unnecessary in the spray mixture so far as mite control is concerned.

12. Soaps, miscible oils and linseed oil emulsion are very effective summer sprays, but needless and apparently less efficient in control of fungous diseases than lime-sulphur.

13. Care should be exercised in applications of lime-sulphur and the precautions noted on page 123 carefully observed.

Acknowledgments.

In the course of the work outlined in the present paper, several persons have aided materially. Dr. W. E. Britton, and Messrs. M. P. Zappe, B. H. Walden, E. M. Stoddard and G. E. Graham have given invaluable service. The use of orchards belonging to the Plant Brothers at Branford, S. T. Bradley of North Branford, F. N. Platt of Milford, as well as the Conyers orchard at Greenwich, managed by Messrs. G. A. Drew and H. B. Reed, has increased the scope of the work immeasurably. Thanks are due to all persons in charge of orchards, without whose aid orchard field work would have been impossible; and to those who have given personal service and advice throughout the period of these investigations.

Literature.

1. Caesar, L.
1915. *In* Canadian Entomologist, 57-58.

2. DeLong, D. M.
1923. Results of Spraying and Dusting for the Control of the Red Spider (*Paratetranychus pilosus*).
In Journ. Econ. Ent. 16: 88-90.

3. de Ong, E. R.
1922. The Control of Red Spider in Deciduous Orchards.
Cal. Agr. Exp. Sta. Bull. 347.

4. Essig, E. O.
1922. The European Red Mite.
In Mo. Bul. Cal. State Dept. Agr. 11: 409-411.

5. Ewing, H. E.
1912. The Occurrence of the Citrus Red Spider *Tetranychus mytilaspidis* Riley on Stone and Citrus Fruit Trees in Oregon.
In Journ. Econ. Ent. 5: 414-415.

6. .....
1914. The Common Red Spider or Spider Mite.
Ore. Agr. Exp. Sta. Bul. 121.

7. Fernald, H. T. and Bourne, A. I.
1922. Injury to Foliage by Arsenical Sprays.
Mass. Agr. Exp. Sta. Bul. 207.

8. Flint, W. P.
1923. Shall we Change our Recommendations for San José Scale Control?
In Journ. Econ. Ent. 16: 209-212.

9. Frost, S. W.
1919. *In* Journ. Econ. Ent. 12: 407.

10. Garman, Philip.
1921. The European Red Mite, *Paratetranychus pilosus* Can. & Fanz., in Connecticut.
In Journ. Econ. Ent. 14: 355-359.

11. .....
1920. *In* Rept. Conn. State Entomologist, 184–189.
1921. " " " " 146–152.
1922. " " " " 333–338.

12. Hamilton, C. C.
1922. Univ. Md. Extension Service Information Card No. 6.

13. Houser, J. S.
1923. Proc. Fifty-sixth Ann. Meeting Ohio Sta. Hort. Soc., 56-59.

14. McGregor, E. A.
1919. The Red Spiders of America and a Few European Species Likely to be Introduced.
Proc. U. S. Nat. Mus. 56: 641-679.

15. Stratford, G.
1920. Control of Red Mite on Apple Trees.
In New Zealand Journal of Agriculture XX: 176-178.

16. Tragardh, Ivar.
1915. Bidrag Till Kannedomen Om Spinnkvalstren (Tetranychus Duf.).
Med. nir. 109, fr. Cent. f. fors, pa jordbr. Entom. avdel. n: r 20.

17. Quayle, H. J.
1912. Red Spiders and Mites of Citrus Trees.
Cal. Agr. Exp. Sta. Bul. 234.
1913. Some Natural Enemies of Spiders and Mites.
In Journ. Econ. Ent. 6: 86-88.

18. Vinal, Stuart C.
1917. The Greenhouse Red Spider Attacking Cucumbers and Methods for its Control.
Mass. Agr. Exp. Sta. Bul. 179.

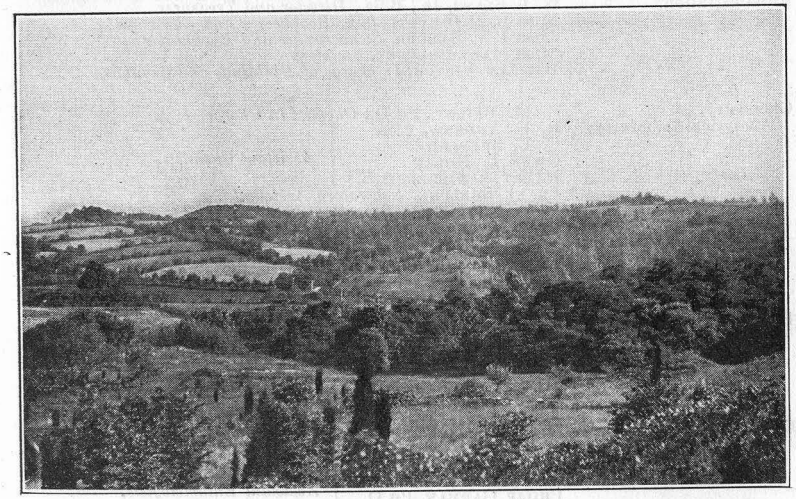
BULLETIN 253 JANUARY, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Better Forests for Connecticut

HENRY W. HICOCK



The Woodlot is a Farm Problem

Forestry Publication No. 14

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January, 1924

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PRACTICAL SUGGESTIONS TO THE WOODLOT OWNER.

Plant idle or waste land with fast growing coniferous or soft-wood trees.

Improve inferior stands of young hardwoods by planting 300 to 500 coniferous trees per acre.

Improve the better hardwood stands by thinnings, so that cord-wood and other low grade material may be by-products of the forest and the more valuable species may be left to grow to saw-log size.

Develop better methods for selling and utilizing woodlot products.

Change the present inequitable method of forest taxation which forces the forest crop to bear an annual tax thus lowering the net returns so that growing timber is often unprofitable.

Work for better protection from fire and other enemies of the forest.

Harvest the minor products of the forest, thus getting several crops from the same area.

THE FORESTRY SITUATION IN CONNECTICUT.

Use of Forest Products.

*Annual consumption of sawed lumber..	350,000,000 Bd. Ft.
*Annual production of sawed lumber....	65,000,000 Bd. Ft.
Ratio of consumption to production.....	5 to 1

The Forests of the State.

†Total land area of the state.....	3,085,000 acres.
Land in forest or suitable only for forest (estimated) at least.....	1,500,000 acres.
*Present annual production.....	65,000,000 Bd. Ft.
Annual per acre production on a basis of 1,500,000 acres.....	40 Bd. Ft.
Minimum yield per acre per year to be expected under reasonable management and protection.....	300 Bd. Ft.
Minimum annual yield to be expected on 1,500,000 acres.....	450,000,000 Bd. Ft.
Possible maximum yield per acre per year.....	1,000 Bd. Ft.
Possible maximum annual yield on 1,500,000 acres.....	1,500,000,000 Bd. Ft.

Annual Freight Bill

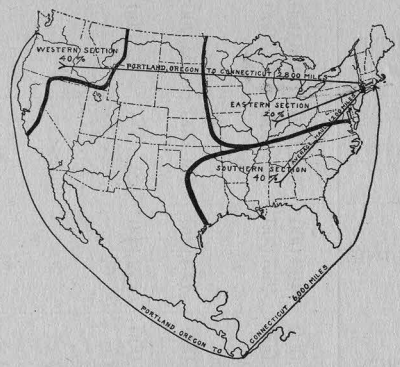
on lumber from other states.....	$3,000,000

*As reported by the U. S. Forest Service.

†As reported in the 1920 Census.

The Need for Forestry in Connecticut.

New England was one of the first forest regions in the United States to be exploited for lumber and at present is probably suffering more acutely from timber scarcity with resulting high prices than any other region. This condition has come about in a very natural manner. As timber becomes scarce in any section the bulk of the lumbermen move to some new region. When the supply in New England ran low the movement was to western New York, Pennsylvania and the Lake States. Later it was to the forests of the Southeastern States and more recently to the Pacific Coast.



Long Hauls Make Lumber Costly.

Each successive move has taken the major part of the industry farther from New England. *The result is that this region has been obliged not only to pay an increasingly higher freight rate due to a longer haul but also to compete for the products needed with regions which lie between it and the source of supply.*

The Pacific Coast timber which is the only large remaining virgin stand in the country will, at the present rate of cut, last about 50 years. *When it is gone this country will be dependent chiefly on the current growth from lands that have been cut over.* Logging methods in virgin stands have been very wasteful with practically no effort to provide in any way for a new crop to replace the one removed. In addition much of the area already logged has been burned over one or more times. The result is that there are in the United States some 80,000,000 acres of barren waste which is producing nothing and a much larger area on which the productivity is not over 20% of what the land is capable of growing.

CLASSIFICATION OF FARM LAND BY COUNTIES.*

	Connecticut	Counties							
		Fairfield	Hartford	Litchfield	Middlesex	New Haven	New London	Tolland	Windham
Total land area, acres	3,085,000	404,000	466,000	592,000	236,000	386,000	422,000	259,000	320,000
Area in farms, acres	1,898,000	225,000	295,000	377,000	122,000	188,000	288,000	183,000	220,000
Per cent. of total area in farms	62	56	63	64	52	49	68	71	69
Area improved land in farms, acres	701,000	108,000	143,000	136,000	35,000	76,000	80,000	53,000	70,000
Area unimproved land in farms, acres	1,197,000	117,000	152,000	241,000	87,000	112,000	208,000	130,000	150,000
Area average farm, acres	84	58	62	124	87	70	105	93	99
Area improved land on average farm, acres	31	28	30	45	25	28	29	27	32
Area unimproved land on average farm, acres	53	30	32	79	62	42	76	66	67
Per cent. of unimproved land on average farm	63	52	52	64	71	60	72	71	68
Number of farms	22,600	3,900	4,700	3,000	1,400	2,700	2,700	2,000	2,200

*From the 1920 census.

If the United States must ultimately depend for timber on current growth rather than on the accumulated growth of centuries (virgin timber) the aim should be to divide up the country into several units, each practically self supporting with regard to timber. The result of such a division would be to lower transportation costs and stabilize prices. New England should form such a unit. There is enough non-agricultural land within its borders to produce timber in sufficient amounts and of suitable kinds for its industries. Northern New England is a forest region.

Conifers Increase the Yield on Hardwood Land.

It can produce much more timber than is needed locally and will probably always have a surplus to export to other districts. Its products are chiefly soft wood. Southern New England is an industrial region and consequently a big market for forest products. *It has enough non-agricultural land to produce a quantity of lumber sufficient for its needs but it cannot grow all the kinds required.* It must therefore import lumber but to offset this it should have an equal quantity to export in order to preserve the balance.

Connecticut is a part of southern New England and the remainder of this report will be devoted to its forest problems, with suggestions for the improvement of the forests, particularly the farmers' woodlots.

THE FORESTS OF CONNECTICUT.

The annual consumption of sawed lumber in Connecticut is approximately 350 million board feet and of this amount only 65 million board feet or *about one-fifth is produced within the state.*

The total land area of the state is 3,085,000 acres and of this at least one half, or 1,500,000 acres, may be classed as non-agricultural or forest land. On the assumption that the forest land area is 1,500,000 acres, *the present annual production per acre is only 40 board feet.* This is very low. *With reasonable care and protection 300 board feet per acre per year is the minimum that ought to be expected and the possible maximum might run as high as 1,000 board feet per acre annually.* On the basis of 1,500,000 acres, the total annual yield should be between 450 million and 1,500 million board feet.

These figures indicate a two-fold problem.—

1. **A land problem.** By better treatment and protection to make the poorer non-agricultural lands produce a reasonable crop, thereby raising their status from that of a doubtful asset or even a liability to that of a profit producing asset.

2. **A timber problem.** To produce annually within the state at least 450 million board feet of sawed products. This would make the state practically self supporting. Some timber would, of course, be imported to supply the need for kinds that cannot be grown here but to offset this there would be some native timber for export.

It may be noted from the table (page 134) that there are 1,187,000 acres, or 38% of the land area of the state, not in farms. It is not possible to determine definitely the present status of the land not in farms but it may be reasonably assumed that not less than 25% of it, or 300,000 acres, is forest land. This added to the 1,200,000 acres on farms makes 1,500,000 acres which is a conservative figure and agrees closely with the figure of 1,483,000 acres abtained by the forest survey of Connecticut in 1914.* It is quite possible that this estimate could be increased by including with the forest land, all pastures reverting to forest. This may or may not be correct. Furthermore it involves the question of proper utilization of land which beyond the scope of this report.

This table shows that 63% of the farm land of the state is unimproved. This figure varies with the several counties but in no case is it under 50%. Improved land is given in the census as "land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards, and nurseries and land occupied by buildings." Unimproved land constitutes the remainder of the farm and is chiefly woodland, brush land, waste land and swamp. This unimproved land is usually too poor to till and of a doubtful value for pasture.

*A Forest Survey of Connecticut by Albert E. Moss.

In general it is fit only to grow trees because they are not exacting in their soil requirements.

Obviously the forest problem is largely a farmers' problem since farmers as a class own the most woodland. For most of them the situation is an acute one because their woodlots, averaging in area more than one-half the farm, are in a very low state of productivity due to fire, ravages of various diseases and insects, indiscriminate cutting and general misuse. In fact, it is a question whether or not many woodlots are paying expenses (i.e., interest and taxes) to say nothing of showing a profit. *An industrial*

Thinning in a Young Hardwood Stand.

organization either improves a poor paying line or abandons it. The farmer must do likewise for he cannot continue indefinitely to make his tilled land support itself and the woodlot also. If the woodlot cannot be made to pay it should be abandoned, but in most cases this will not be necessary because with reasonable handling it will improve to a point where it will pay.

In improving the forest there should be three main objectives:—

1. To handle the present deciduous or hardwood forest for better quantity and quality production. Quantity may be increased by favoring fast growing species and by reducing the competition which is always so keen in natural stands. Quality may be improved by favoring the most valuable species and the best individuals. Both objects can be attained through systematic thinning.

2. To gradually introduce conifers into the hardwood stands. Most conifers grow faster and yield more per acre than hardwoods. Moreover 80% of all lumber used is softwood from coniferous trees.

3. To treat the forest as a source of repeated crops of timber capable of improvement, rather than a non-renewable resource to be exploited to its fullest extent and then abandoned. Field crops require weeding, thinning, protection from enemies and suitable treatment to assure reproduction. Forest crops require similar care, though not as intensively applied, to secure comparable results.

Some Suggestions to the Woodlot Owner.

1. Thin the young woodlot systematically thereby getting rid of the poorer species and unhealthy individuals, allowing the best specimens to develop without excessive competition. The final yield will be as large and of better quality than in an unthinned stand and the material taken out will more than pay for the operation.

2. Plant at least 1,000 conifers each year for timber production. The cost will be not over $15.00 and the area covered from one to two acres depending on whether the planting is in the open or in brush. The attention required by a plantation is relatively small.

3. Grow Christmas trees on old pastures on a ten year rotation. This is a better use of land than allowing it to grow up to grey birches and is far more profitable. Up to three thousand trees per acre can be used for this purpose.

4. Avoid selling timber by the lot. In most cases the buyer reaps an excessive profit, a part of which rightfully belongs to the owner.

5. Make use of the present forest tax law. The law is not ideal but it favors the forest owner far more than the town assessors. Work for a better tax law.

6. Keep domestic animals out of woodland as a general rule. A limited amount of grazing may do no harm but over-grazing is detrimental to the woodlot. The better plan is to fence off the amount needed for grazing and use it only.

7. Grow saw timber. Cordwood should be obtained from thinnings and not by skinning immature stands. This latter process puts the lowest value on all species whereas such species as hickory, ash, whitewood, and red oak will bring high prices if grown to saw-log size.

8. Market more of the minor products of the forest, as ferns, mountain laurel and maple sugar.

9. Look upon the woodlot as one of the resources of the farm and not as something to pay taxes on. Figure out just how profitable the woodlot is. If it is not paying taxes and other overhead charges and allowing the owner a fair return for his investment in land, try to find out where the trouble is and remedy it.

10. Cooperate with the Connecticut Forestry Association, an organization which is working to advance forestry in the state.

11. Consult the Foresters of the Connecticut Agricultural Experiment Stations, New Haven, and the Connecticut Agricultural College, Storrs.

Thinned Pine Plantation, 28 years old.

Benefits to be expected from the improvement of the forest.

1. To the owner.
   a. Winter employment for farm labor and teams.
   b. Full utilization of land, no unprofitable acres.
   c. Income more evenly distributed throughout the year.
   d. Greater farm value if the owner wishes to sell.
   e. Larger loans from the Federal Land Bank.
2. To the community.
   a. Plentiful domestic lumber with low freight rates.
   b. More woodworking plants resulting from an assured supply of materials. This means closer utilization and better prices for woodlot products.
   c. Better protection of water supplies.
   d. Increased value of the forests for recreation.

CONCLUSION.

There have been *three major causes* for the present low productivity of the forests of Connecticut and of the United States as a whole. These must be corrected before any real progress can take place. They are:—

1. **Forest Fires.** It is a reasonably safe statement that fire has been the greatest single factor in lowering the yield of our forests. At least two-thirds of all forest fires are caused by negligence or carelessness. This condition can best be handled by building up a strong public sentiment against the persons responsible.

2. **Inequitable taxation.** A woodland owner must carry his forest for several decades before he gets any returns. During the growing period the town assessors may and usually do raise his valuation several times. *This often forces the owner to cut sooner than he otherwise would.* This method of taxing woodland may be likened to taxing a corn crop four or five times during a season and at a higher valuation each time.

3. **Poor cultural practice,** both *in caring for the current crop and in failing to provide for future crops* as well as unnecessary waste in logging and milling.

The forest owner cannot be blamed directly for the evils resulting from fire and taxes except that he has endured the losses therefrom without attempting to relieve the situation. Better legislation and stricter enforcement of existing statutes are needed. Forest owners can get these things only by going after them and pulling together.

The evils arising from not using practical forestry methods in growing and harvesting the timber crop can be charged directly to the owner and can be corrected only by him. It is true that the financial inducements to use better methods have not been great but the same may be said of many other things that we undertake with the conviction that they are worth while. If our grandfathers had adopted reasonable methods in handling their woodlots we would not now be obliged to pay a dollar for the material for a pantry shelf. If we are content to continue to use their methods it will probably cost the next generation two dollars. Is this fair?

BULLETIN 254 JANUARY, 1924

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

Report of the Director

For the

Year Ending October 31, 1923

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

January, 1924.

BOARD OF CONTROL.

His Excellency, Charles A. Templeton, *ex-officio, President.*

James H. Webb, *Vice-President*.....Hamden
George A. Hopson, *Secretary*.....Mount Carmel
Wm. L. Slate, Jr., *Director and Treasurer*.....New Haven
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STAFF.

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W. L. Slate, Jr., B.Sc., *Director and Treasurer.*
Miss L. M. Brautlecht, *Bookkeeper and Librarian.*
Miss J. V. Berger, *Stenographer and Bookkeeper.*
Miss Mary Bradley, *Secretary.*
William Veitch, *In Charge of Buildings and Grounds.*

Chemistry. Analytical Laboratory.
E. M. Bailey, Ph.D., *Chemist in Charge.*
R. E. Andrew, M.A.
C. E. Shepard
Owen L. Nolan
Harry J. Fisher, A.B.
Assistant Chemists.
Frank C. Sheldon, *Laboratory Assistant.*
V. L. Churchill, *Sampling Agent.*
Miss Mabel Bacon, *Stenographer.*

Biochemical Laboratory.
T. B. Osborne, Ph.D., Sc.D., *Chemist in Charge.*

Botany.
G. P. Clinton, Sc.D., *Botanist in Charge.*
E. M. Stoddard, B.S., *Pomologist.*
Miss Florence A. McCormick, Ph.D., *Pathologist.*
G. E. Graham, *General Assistant.*
Mrs. W. W. Kelsey, *Secretary.*

Entomology.
W. E. Britton, Ph.D., *Entomologist in Charge; State Entomologist.*
B. H. Walden, B.Agr.
M. P. Zappe, B.S.
Philip Garman, Ph.D.
Roger B. Friend, B.S.
Assistant Entomologists.
John T. Ashworth, *Deputy in Charge of Gipsy Moth Work.*
R. C. Botsford, *Deputy in Charge of Mosquito Elimination.*
Miss Gladys M. Finley, *Stenographer.*

Forestry.
Walter O. Filley, *Forester in Charge.*
A. E. Moss, M.F., *Assistant Forester.*
H. W. Hicock, M.F., *Assistant Forester.*
Miss Pauline A. Merchant, *Stenographer.*

Plant Breeding.
Donald F. Jones, S.D., *Geneticist in Charge.*
P. C. Mangelsdorf, M.S., *Assistant.*

Soil Research.
M. F. Morgan, M.S., *Investigator.*

Tobacco Sub-station at Windsor.
C. M. Slagg, M.S., *in Charge.*

The Wilson H. Lee Co.

Report of the Director

For the Year Ending October 31, 1923

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

For the first time it becomes my duty to prepare the annual report of the operations of the Station. By far the most important event of the year has been the resignation on July first of Dr. E. H. Jenkins, under whose guidance the Station has attained so enviable a reputation both at home and abroad. It seems fitting to include here an excerpt from the editorial pages of the Experiment Station Record for July of this year:

> "The entire active career of Dr. Jenkins is centered in a single institution. This is a remarkable fact when the number of changes in most of the stations during the early years is considered, and the extent to which the workers transferred from one institution to another. He went to the Connecticut State Station as assistant chemist in 1877, when it was transferred from Middletown to New Haven. This was after his graduation from Yale and return from a year's study at the University of Leipzig. He was one of the two chemists who with the director, Dr. S. W. Johnson, formed the entire staff of the station. He has been continuously in its service from that time to the close of June, a period of nearly forty-seven years. In 1883 he became vice-director, and on the retirement of Dr. Johnson in 1900 he succeeded him as director. Since the consolidation of the administrative control of the State and Storrs Stations in 1912, he has served as director of both, and has rendered a valuable service in coordinating their activities in such a way as to avoid needless duplication and make them better meet the needs of the State.
>
> Including his period as vice-director, Dr. Jenkins' executive duties have covered a span of forty years, while his entire period of service is not only the longest at a single institution of any worker now living but exceeds that of any surviving member of the station forces. To few men is the opportunity given for a comparable period in which to formulate and carry into execution plans for the consistent development and upbuilding of a research institution."

In assuming the duties laid down by Dr. Jenkins, I have a keen sense of the honor and responsibility which you have placed upon me and it is with great pleasure and gratitude that I record the constant readiness of Dr. Jenkins to advise and encourage and likewise the cordial and loyal support of the entire staff.

Since Dr. Jenkins' resignation did not take effect until July first, more than half of the year has been under his administration. This report, however, covers the entire station year ending October 31, 1923.

CHANGES IN STAFF

In addition to the changes in administration mentioned above, the following resignations and appointments have taken effect:

Resigned:

Mr. Samuel T. Sealy, Deputy in charge of Mosquito Elimination, April 1, 1923.

Mrs. Alta Moss Storrs, Secretary in the Analytical Laboratory, June 1, 1923.

Dr. George H. Chapman, In charge of Tobacco Sub-Station, August 1, 1923.

Appointed:

Mr. R. C. Botsford, Deputy in Charge of Mosquito Elimination, July 1, 1923.

Miss Mabel Bacon, Secretary in the Analytical Laboratory, June 1, 1923.

Prof. M. F. Morgan, M.S., Investigator in Soils, July 20, 1923.

Miss Mary E. Bradley, Secretary to the Director, August 1, 1923.

Mr. C. M. Slagg, M.S., In Charge of Tobacco Sub-Station, August 1, 1923.

PUBLICATIONS

The annual report of the Station for the year ending October 31, 1922 (507 pages), with the exception of 32 pages of reports by the treasurer and director and the index, consisted of the following **Bulletins**:

No. 240. Report on Food Products and Drugs (1922), Part I.
241. Fertilizer Report for 1922.
242. Report on Commercial Insecticides and Fungicides (1922).
243. Report of the Director for the Year Ending October 31, 1922.
244. Spray Calendar (1923).
245. Results of Dusting *versus* Spraying in Connecticut Apple and Peach Orchards in 1922.
246. The Apple and Thorn Skeletonizer.
247. Twenty-Second Report of the State Entomologist (1922).
248. Report on Food Products and Drugs (1922), Part II.
249. Report on Commercial Feeding Stuffs (1922).

The report also contains the First Report of the Tobacco Sub-Station at Windsor, Connecticut, and the following bulletins of the Sub-Station:

No. 1. Condensed Recommendations for the Control of Wildfire (January, 1922).

2. Wildfire of Tobacco in 1922 (January, 1923).
3. Experiments in the Curing and Fermentation of Connecticut Shade Tobacco (February, 1923).

Besides the above, the following **Circulars of Immediate Information** were published:

No. 19. Winter Pruning of Fruit Trees. (March 14, 1923.)
20. Dormant Sprays on Orchard Trees. (March 21, 1923.)
21. What are Good "Seed" Potatoes? (April 5, 1923.)
22. The Pink Spray for Apple Orchards. (May 1, 1923.)
23. Diseases Carried by Seed Potatoes. (May 1, 1923.)
24. The Calyx Spray for Apples, Pears and Quinces. (May 21, 1923.)
25. The European Corn Borer Quarantine. (May 28, 1923.)
26. The Apple and Thorn Skeletonizer. (August 15, 1923.)
27. Registration of Bees. (Sept. 15, 1923.)

Following is a list of **Journal papers** and other publications by staff members:

The Potency of Some Commercial Vitamine Preparations.
By E. M. Bailey. Read at a meeting of New England Food and Drug Control Officials, Portsmouth, N. H.

A Modified Test for Phthalates.
By R. E. Andrew. J. Ind. & Eng. Chem., **15**, 8, 838. (Aug. 1923).

Quantitative Aspects of the Role of Vitamine B in Nutrition.
By T. B. Osborne and L. B. Mendel. Jour. Biol. Chem. (1922) LIV, pp. 739–752.

Eggs as a Source of Vitamin B.
By T. B. Osborne and L. B. Mendel. Jour. Am. Med. Assn. (1923) LXXX, pp. 302-303.

Kidney Hypertrophy Produced by Diets Unusually Rich in Protein.
By T. B. Osborne, L. B. Mendel, E. A. Park and D. Darrow. Proc. Soc. Exp. Biol. and Med. (1923) XX, pp. 452-453.

A Product of Mild Acid Hydrolysis of Wheat Gliadin.
By H. B. Vickery. Jour. Biol. Chem. (1923) LVI, pp. 415-428.

Ocular Manifestations of the Rat which Result from Deficiency of Vitamin A in the Diet.
By A. M. Yudkin. Jour. Am. Med. Assn. (1922), LXXIX, pp. 2206-2208.

Pathogenesis of the Ocular Lesions Produced by a Deficiency of Vitamin A.
By A. M. Yudkin and R. A. Lambert. Jour. Exp. Med. (1923) XXXVIII pp. 17-24.

Changes in the Paraocular Glands Accompanying the Ocular Lesions which Result from a Deficiency of Vitamine A.
By R. A. Lambert and A. M. Yudkin. Jour. Exp. Med. (1923) XXXVIII pp. 25-32.

Connecticut Vegetable Diseases in 1922.
By G. P. Clinton. Rept. Conn. Veg. Growers' Assn. (1922) pp. 69-74.

Connecticut Fruit Troubles in 1922.
By G. P. Clinton. Proc. Conn. Pom. Soc. (1922) pp. 10-13.

The Aleyrodidae and Coccidae of Connecticut.
By W. E. Britton. Conn. Geol. & Nat. Hist. Survey (June, 1923) Bulletin No. 34, 48 pp.

The Apple and Thorn Skeletonizer.
By W. E. Britton. Proc. 32nd Ann. Meeting Conn. Pom. Soc. (1923) p. 21.

Rapid Spread of the Apple and Thorn Skeletonizer, *Hemerophila pariana* Clerck.
By W. E. Britton. Jour. Econ. Ent. (April, 1923) Vol. 16, p 207.

The Gipsy Moth. Proceedings of Conference at Albany, N. Y. Nov. 16, 1922.
By W. E. Britton. N. Y. State Dept. Agric. Bull. 148 (Dec., 1922) p. 44.

Swarms of Aphids.
By W. E. Britton. Jour. Econ. Ent. (Aug. 1923), Vol. 16, p. 395.

Report of Committee on Injurious Insects.
By W. E. Britton. Conn. Pom. Soc. Proceedings (1923) p. 5.

The Arbor-Vitae Leaf-Miner.
By W. E. Britton. Tree Talk, Vol. 5, No. 2 (1923) p. 24.

The Work of the State Entomologist.
By W. E. Britton. Hartford Daily Courant (Oct. 21, 1923).

Insects Attacking Vegetable Crops in 1922.
By W. E. Britton. Rept. Conn. Veg. Growers' Assn. (1922) p. 83.

The Hemiptera of Connecticut.
By W. E. Britton *et al.* Conn. Geol. & Nat. Hist. Survey Bull. 34 (June, 1923), 807 pages, 169 figs., 20 plates.

Comparative Results of Spraying and Dusting on Apples and Peaches.
By M. P. Zappe and E. M. Stoddard. Proc. Conn. Pom. Soc. (1923) p. 30.

Work with the Control of the European Red Mite in 1922.
By Philip Garman. Proc. Conn. Pom. Soc. (1923), p. 13.

Notes on the Life History of *Clastoptera obtusa* and *Lepyronia quadrangularis*.
By Philip Garman. Annals Ent. Soc. of America, Vol. XVI (June, 1923) p. 153.

A Report on Double-Crossed Burr-Leaming Corn Grown in 1922.
By D. F. Jones. A mimeographed circular. (April, 1923).

PHYSICAL EQUIPMENT

During the year a number of pieces of much needed apparatus were purchased for the laboratories, including three special microscopes and a potentiometer. Two insectaries were erected and repairs made to the Station property on Huntington Street. Two fireproof safes for records and other office equipment were also added.

About 900 volumes were added to the library, which now includes over 10,900 volumes and an unusual equipment of scientific journals.

The inventory of June 1, 1923, shows:

Value of buildings and lands	$295,275.00
Value of contents	103,746.55
Total	$399,021.55

CONTROL AND SERVICE WORK

Since the founding of the Station, control and service work has been one of its functions. From time to time, duties of this nature have been added by the General Assembly, most of them

under special acts, and the administration of these has been maintained separate from the main operations or research proper.

Thus the Station administers entirely or in part the fertilizer, feed, food and drug, and insecticide control; the certification of Babcock glassware; the gipsy moth control; orchard and nursery inspection; apiary inspection; mosquito elimination and the white-pine blister-rust eradication; and the examination and certification of tree surgeons.

The chemical laboratories are at the service of residents of the State for the examination of fertilizers, feeding stuffs and drug products, when such information may be considered of public value and interest when published in the Station reports. Plant disease specimens, insects, weeds and similar material may also be sent to the Station for identification and advice on control. Questions regarding livestock management should usually be addressed to the Storrs Station, but on other matters this Station stands ready to render help and advice. Requests for analysis of drinking water should be addressed to the State Department of Health.

REPORTS OF DEPARTMENTS.

ANALYTICAL CHEMISTRY.

Dr. E. M. Bailey in charge.

1. During the year, in accordance with the provisions of the Statutes, about 860 samples of fertilizers have been examined, the results reported to the purchasers or others interested, and the complete data finally classified and prepared for publication.

2. Three hundred and seventy-one samples of commercial feeding stuffs and other fodder materials have been examined. This number includes analyses of certain field crops connected with experimental projects at this Station and at Storrs.

3. Over 2,500 samples of food products and drugs have been analyzed. While this is largely for purposes of control, many examinations have been made for the information of physicians, dietitians and others interested in dietetics; thus a number of unusual vegetable foods have been analyzed for Dr. W. A. Orton of the Bureau of Plant Industry, U. S. D. A., who is interested in new foods which may be utilized for the purpose of adding variety to the rather limited diet of diabetic patients.

4. A bulletin on insecticides and fungicides has been published which includes scattering analyses made in previous years and results of a rather complete survey of the market made in 1922. The new work of the past year has been chiefly upon samples

submitted by the departments of Entomology and Botany of this Station. About fifty samples have been examined, which number includes miscellaneous materials related to the subject.

5. Nearly 4,300 pieces of Babcock glassware have been inspected for accuracy of calibration and for conformity to other standard specifications.

Aside from essentially routine work, some time has been given to studies of methods and their applications. These include the determination of ammonia in eggs, the determination of nicotine in tobacco and tobacco products, the determination of fat in ice cream and the determination of starch and sugar in presence of gums and mucilages. An improved method for the detection of phthalates in alcoholic solutions has been devised and the details of the method have been published as noted in the list of publications.

Collaboration with the Association of Official Agricultural Chemists has been continued; also the laboratory has engaged in the coöperative programs of the American Oil Chemists Society and the F. S. Royster Guano Company, which involves the analysis of check cottonseed meal and mixed fertilizers.

The chemist in charge has assisted Dr. E. P. Joslin in the revision of his text on Treatment of Diabetes Mellitus by preparing a revision of tables of composition of normal foods and of so-called diabetic and special foods. He has continued to serve as a consultant to the Council on Pharmacy and Chemistry of the American Medical Association on subjects pertaining to diabetic and special foods; also as a member of the Joint Committee on Definitions and Standards for food products and drugs. Mr. Andrew has acted as referee on methods for analysis of tea for the Association of Official Agricultural Chemists.

BIOCHEMISTRY (PROTEIN RESEARCH)

Dr. T. B. Osborne in Charge.

The work of the department is supported in part by a grant from the Carnegie Institution of Washington, D.C. In the study of problems of nutrition, we are favored by the collaboration of Dr. L. B. Mendel of Yale University. The active projects may be discussed as follows:

1. Study of the proteins of green plants has been continued and the scope of these investigations extended to attempts to learn the nature of the nonprotein substances with which they are associated.

Methods have been developed whereby it is possible to obtain large quantities of the fluid present in the vacuoles of the cells apart from the semisolid cytoplasm and subsequently to obtain

the latter, likewise in relatively large quantities, free from the cell walls and other supporting structures of the plant.

Studies of these two parts of the plant cell are being made in the hope that they may contribute to the scanty knowledge which scientists now have respecting the chemistry of the cell. Investigations in this field are essential for further progress in the study of many of the problems of the nutrition of animals and plants, as well as of those of plant physiology and plant pathology.

2. The relation of the chemical constitution of the diet to the development of rickets has been studies in coöperation with Dr. Park of the Medical School of Yale University. A combination of purified food constituents has been discovered which has indicated the part played by each in the development of this disease. Work in this field is still in progress, the purpose being to determine more precisely the effect of the various constitutents of food on the development of bones.

3. Studies of the relation of vitamines to nutrition are being continued.

4. The feeding experiments, referred to in the report for last year, respecting the part played by proteins, carbohydrates and fats, have been continued and the results embodied in a paper now in press.

5. Studies of the effect on the eye of a deficiency in the diet of the fat-soluble vitamine have been continued in coöperation with Dr. A. M. Yudkin, ophthalmologist of the School of Medicine of Yale University.

6. The studies of the effect of diet on fertility, which last year were undertaken in collaboration with Dr. Mason of Professor Harrison's department of Yale University, have been continued with striking and important results, some of which will soon appear in print.

7. Further work on the relation of the chemical structure of the proteins to their nutritive value has been begun.

8. A new edition of "The Vegetable Proteins" has been prepared and the subject brought down to date. This volume summarizes a large part of the work done in this department during past years and also includes that done by others in this field of study.

BOTANY.

Dr. G. P. Clinton in charge.

The work of the department may be summarized as follows:

1. **Experiments on Fertilization of Peaches.** This problem has been continued without change. Nitrate of soda seems to give most satisfactory results.

2. **Mosaic of Plants.** An intensive study of mosaic diseases of plants, with Dr. McCormick, has been made. This included infection experiments out of doors and in the greenhouse; a critical and prolonged microscopic study of the leaves of infected tobacco, etc.; and a chemical study, with help of Dr. Bailey's department, of healthy and mosaic tobacco leaves. We believe we now know as much about this disease as any one, but the cause still remains a mystery.

3. **North American Ustilaginales.** A beginning has been made on the publication, as an addendum to this volume, of such new species, hosts and distributions of the smuts as have come to light since the former publication. This work has taken considerable time, and much remains yet to be done before its completion.

4. **Rusts of Connecticut.** In connection with W. R. Hunt, a graduate student in botany at Yale, a monograph of the Rusts of Connecticut has been started. Mr. Hunt took the material collected by Dr. Clinton during his twenty years' connection with the Station and prepared it for his master's degree. During the summer he was employed by the Station for two months on similar work. A special effort was made to add to these collections during the year. The material has now all been determined, and includes between 125 and 150 species represented by over one thousand specimens.

5. **Plant Disease Survey.** The plant disease survey of the State for the Station and the U. S. Department of Agriculture has been continued. Card indexes of all observed diseases, their prevalence, distribution, etc., have been made, and preliminary reports made to the government at various times during the summer. The final report covering all diseases is now being completed.

6. **Comparison of Dusts and Sprays on Apples, Peaches, Potatoes and Celery.** Most of the work is carried on jointly with the Entomology Department and includes studies of the effectiveness of various dusts and sprays as controls for all of the common pests of these crops. In the main, it is conducted at the Station farm at Mount Carmel, but some outside orchards are resorted to when larger areas are needed. The results with dust on apples were more favorable this year than formerly, probably because of the dry weather.

7. **Selection of Sweet Corn for Disease Control** has been continued at the farm of Charles R. Treat in Orange. An unfavorable season produced a poor seed crop.

8. **A Continuation of the Study of Thielavia basicola.** Forty-two one-ascospore cultures were obtained through the process of treating the ascospores with pepsin, thereby causing them to germinate. These ascospore strains were crossed with the ordinary chlamydospore-endospore strains with the result that numerous perithecia were formed. Following a suggestion made by Prof. Thaxter of Harvard, an ascospore strain was crossed with several other fungi with the result that cross with Cladosporium produced perithecia as abundantly as with the chlamydospore-endospore strains of *Thielavia basicola*. This raises the question whether the production of perithecia with *Thielavia basicola* may not be due to the parasitism of the one fungus upon the other rather than the result of sexuality of the two strains. Crosses with other fungi will have to be made, particularly with *Thielaviopsis*.

During the year, 100 specimens of fungi and weeds sent in by various correspondents have been identified.

There have been added to the herbarium 656 specimens, mostly in exsiccati.

Several hundred specimens of fungi were collected in the State but not finally determined.

The testing of seed for residents of the State involved 463 germination and 30 purity tests.

ENTOMOLOGY.

Dr. W. E. Britton in charge.

Dr. Britton also holds the position of State Entomologist, which entails responsibility for considerable control and inspection work.

Control.

1. During the year there were inspected 114 nurseries, 179 cases of imported nursery stock, 31 orchards and 725 apiaries. The Insect Pest fund was increased by the last General Assembly to $15,000 per year.

2. The Gipsy Moth work has continued unabated. No extensive spread occurred, but the constant efforts of a crew of twenty-five men were required to hold it in check. The U. S. Department of Agriculture is coöperating in this fight. The annual appropriation was increased to $50,000.

3. Mosquito Elimination was handicapped by the change of the Statute, throwing the entire expense of maintenance on the State, but the funds were not increased. The State stands in a way to lose much of its present investment in drainage works if funds for necessary repairs are not soon provided.

Investigation.

1. A study of the plum curculio on apple has been undertaken during the year. This is a serious pest in this region and there is much to be learned of its habits and control.

2. Further tests of paradichlorobenzene to control peach borer are showing promising results.

3. The dusting and spraying experiments mentioned under BOTANY were continued, chiefly to try out the new dust preparations.

4. Studies on the European red mite have been continued and a bulletin prepared by Dr. Garman, summarizing the results of four years.

5. The control of foul brood of bees is being studied in a small way. It is hoped that this can be made more active.

6. A study of the raspberry fruit worm, covering three years, has been completed and a bulletin prepared by Mr. Walden.

7. Dr. Garman has completed a monograph on the Dragonflies of Connecticut, to be published by the Connecticut Geological and Natural History Survey.

Dr. Britton organized and edited, and in part prepared, The Hemiptera of Connecticut, published during the year as Bulletin 34 of the Connecticut Geological and Natural History Survey.

FORESTRY.

Mr. W. O. Filley in charge.

The work of the Forestry Department is very largely on long-time projects and it is seldom that one can be considered completed. During the past twelve months, progress has been made on certain projects, but none have been brought to completion.

1. **Experimental Forest Plantations at Rainbow.** No planting was done during the year. Much needed cleaning of the older plantations was practically completed last spring, and the entire tract is in better shape than for several years past.

The necessary studies were completed for a progress report and guide to the plantations, which will be published during the coming winter.

2. **Experiments in Thinning White Pine at Shaker Station.** Measurements were taken in the late fall, and not completed in time for this report, but will be included in that of next year.

3. **Experiments in Thinning Hardwoods at Quassipaug Lake.** No measurements until 1927.

4. **Studies of White-Pine Needle Blight.** On account of heavy snows and bad roads, no attempt was made to make further study of conditions at Enfield. Casual observations throughout the State indicated considerable of the so-called needle blight following several hot dry days in June.

5. **Distribution of Planting Stock.** As in previous years, an effort was made to assure a supply of planting stock for Connecticut land owners at reasonable prices by placing an advance order with a commercial nursery. There were no transplants available, but 475,000 two-year seedlings were distributed on 85 orders.

6. **Woodlot at Mount Carmel Farm.** Aside from necessary freeing of planted stock and removal of some of the overwood, nothing has been done in the woodlot.

7. **Willow Culture at Mount Carmel Farm.** The two holts were continued, but one will be pulled up next spring. About 10,000 cuttings will be available for distribution, and an effort will be made to place them where they can be observed from time to time.

8. **Control of White-Pine Blister-Rust.** From May to October, 1923, a total of over 13,000 acres in Litchfield County was freed from wild ribes, about 286,000 bushes being pulled up. This work was all on a coöperative basis. The town of Canaan appropriated $500; citizens of Salisbury have promised to raise $3,500 for two years' work; and citizens of Cornwall had raised $1,750 the previous year. Four crews were therefore employed in these towns. The American Brass Company assumed the cost of labor for eradication in its pine plantations in the vicinity of Torrington, and the State furnished a foreman for two months. One land owner in Litchfield also assumed the labor cost for eradication in his pine lands, the State supplying a foreman for about two weeks.

Another season's work will be necessary in both Salisbury and Canaan. Cornwall is practically completed, although a few weeks' work will be necessary next spring. The State appropriation of $15,000 for the two-year period appears to be adequate when supplemented by the funds contributed by towns or individuals.

Educational work throughout the State has been continued in coöperation with the Bureau of Plant Industry. Three educational agents were employed during the year, but one resigned on August first to take a position elsewhere, and his successor has not yet been appointed. The pine areas in the northern part of the State have been pretty well covered; pine owners have been personally interviewed, and their holdings scouted for the rust. New infections have been located on pine in three towns outside of Litchfield County: Simsbury, Farmington and Ellington. These infections will be carefully watched and the owners urged to coöperate with the State in eradicating the Ribes. During the coming winter, scouting and educational work will be continued in the southern half of the State.

On the whole, the situation is encouraging, especially as studies made this fall indicate very little spread of the disease in those areas from which Ribes were eradicated from 1916 to 1921. The

problem is still one of cleaning up Litchfield County, as the isolated infections in other parts of the State are much more easily taken care of.

9. **State Park and Forest Commission.** This is really a project for the establishment of State parks and State forests, in which the Agricultural Experiment Station coöperates by allowing its forester to serve as a member of the Commission. As treasurer of the Commission and as a member of all its standing committees he is at present fairly active in determining the policy of the State regarding both State parks and State forests.

10. **Studies of Forest Plantations.** These have been carried on throughout the year by the Blister Rust agents, who are in a position to locate and report on all such plantations, in connection with their other work. It is hoped to complete this study in time to include the results in a bulletin on "Forest Planting", to be published during the coming year.

11. **Soil and Land Survey.** During the summer and fall of 1923, the Forestry Department has coöperated in a soil and land survey which was undertaken experimentally in the towns of Lebanon and New Milford. The assistant foresters, Mr. Moss and Mr. Hicock, have both been employed in this work and have helped to develop methods and technique of mapping surface cultures which may be applied to other parts of the State if the survey is continued.

The department is frequently called on to inspect and give advice on the management of woodland, and illustrated lectures on forestry are in great demand. The people of Connecticut have not as yet fully realized the importance of forestry in a State including so much non-tillable land. Educational work is therefore still necessary until the regular extension forces take it up.

GENETICS (PLANT BREEDING)

Dr. D. F. Jones in charge.

The investigations in this field are listed as follows:

1. The inheritance of characters in corn.
2. The effect of inbreeding and crossing in corn.
3. The improvement of naturally cross-fertilized plants by selection in self-fertilized lines.
4. Methods of improving the naturally self-fertilized tobacco plant.

Double-crossed Burr-Leaming corn has continued to give increased yields of grain as compared with the highest yielding varieties grown at the Experiment Station farm at Mount Carmel. This new kind of corn is the result of combining by cross-fertilization four inbred strains derived from two varieties, Burr's White Dent and Leaming. The result is a hybrid type which gives a remarkably productive growth for the first year due largely to the fact that practically every plant makes a good ear. This yield is not maintained in the following years. Only crossed seed is recommended for planting. This seed is being produced in Connecticut and the amount of seed available is being increased as rapidly as possible.

Double-crossed Burr-Leaming requires from 120 to 140 days to ripen properly for husking. It is a large-growing variety which stands up well in the field and should not be planted too thickly. The yield of this corn in bushels of dry shelled grain per acre, compared with the five varieties which yielded the most in each of the five years tested, is as follows:

	1918	1919	1920	1921	1922
Double-crossed Burr-Leaming.	116	88	55	95	63
Average of five highest-yielding varieties.....	82	64	47	81	54

Better strains from the same source are now being substituted for some of the weaker ones formerly used, with the expectation that the yield of Burr-Leaming corn will be increased and the production of the seed will be made easier.

Other methods of combining the inbred strains are being tried out with the aim of simplifying the production of hybrid seed.

A number of the best inbred strains, selected for five years from four of the highest-yielding Connecticut varieties of dent and flint corn, were tested the past season for the purpose of making a high-yielding, high-quality and earlier-ripening corn than Burr-Leaming, suitable for husking in nearly all parts of this State and for silage in northern New England.

Inbred strains of Evergreen and Golden Bantam sweet corn have been selected for canning purposes, and crosses between these strains are now being tested. It is expected that the uniform production, even size of ears and simultaneous ripening of practically all plants will make crossed corn even more valuable for canning purposes than for field corn.

The method of corn improvement, outlined above and spoken of as "selection in self-fertilized lines" is also being applied in a preliminary way to alfalfa and clover and to some of the small fruits. In the former, particular attention will be given to the production of a long-lived, winter-hardy alfalfa and a clover resistant to mildew. The discovery of a few red clover plants entirely free from mildew in a field badly infected gives encouragement that a mildew-free clover variety is possible.

Technical studies, of interest only to investigators, are being confined to the inheritance of disease resistance and of abnormal-

ities, with particular regard to sterility; the obtainment of complete homozygosity in a naturally cross-fertilized species; and the linkage of hereditary factors.

Round Tip tobacco, originated by this department, is rapidly increasing in popularity. Breeding work is being continued at the Tobacco Sub-Station with some of the other types of tobacco.

SOILS.

Mr. M. F. Morgan in charge.

A moderate increase in the State funds for maintenance made possible the undertaking of certain soil studies in which Dr. Jenkins had long been interested. These include certain problems of tobacco soils which are to be undertaken next summer. However, since the funds were not available until July 1, 1923, the present season was devoted to that other most pressing problem:

A Study of the Soil Resources of Connecticut.

Two areas, Lebanon and New Milford, were intensively studied from every possible angle, the data thus assembled forming the basis of studies planned this winter on methods and future program. So far the work gives promise of great usefulness to the State and to soil science.

TOBACCO SUB-STATION AT WINDSOR

Mr. C. M. Slagg in charge

During the 1923 session of the General Assembly, a bill was passed increasing the annual appropriation for the Tobacco Sub-Station from $5,000 to $10,000, thus providing adequate support for the work. An experimental tobacco barn, 32 by 128 feet, has been erected. This barn is divided by three inside partitions into four compartments, each of which is fitted with a different type of ventilation.

At the present time there is also in course of erection a main building, designed to include sorting and packing rooms, tobacco curing rooms, an office and a laboratory, with a small greenhouse adjoining. This building is being constructed and equipped jointly by The Connecticut Agricultural Experiment Station and the Connecticut Valley Tobacco Improvement Association.

On August 1, 1923, Dr. George H. Chapman resigned his position of Research Director and Secretary of the Connecticut Valley Tobacco Improvement Association and Director of the Tobacco Sub-Station. Mr. C. M. Slagg, of the Office of Tobacco Investigations of the United States Department of Agriculture, was secured by the Association to serve as their Research Director and Secretary, and was later appointed "In charge of the Tobacco Station" on the Station staff.

Experiments under way at the Tobacco Station may be grouped under the following heads:

1. Fertilizer tests: Varying forms and amounts of nitrogen, phosphoric acid, potash, sulphur, magnesium and chlorine; a study of fractional applications of commercial fertilizer mixtures; and a comparison of cow and horse manure.

2. Varietal and strain test of Havana, Broadleaf, Shade Cuban and others.

3. Culture studies (Roundtip) 13 and 15 inch spacing in the row; the use of Thermogen paper; treatment of shade cloth in various ways to increase its utility.

4. Tobacco diseases, including the study of brown and black root-rots of tobacco, especially the effect of rotation.

On July 30, 1923, a field day was held. Approximately five hundred growers were in attendance to see the various field tests in progress.

The brown root-rot rotation plot tests, the magnesium, sulphur and chlorine plot test, and part of the variety and strain tests are coöperative with the Office of Tobacco Investigations, and the cloth preservative tests are in coöperation with the Bureau of Chemistry of the United States Department of Agriculture.

MOUNT CARMEL FIELD DAY

On August 7th a most successful field day was held at the Mount Carmel Farm. Among new and interesting features were a demonstration of garden tractors and a kindergarten for the care of children.

Respectfully submitted,

W. L. Slate, Jr.,
Director.

A List of Reports and Bulletins that are available to those who apply for them.

BULLETINS.

138. Commercial Feeding Stuffs in the Connecticut Market.
141. Commercial Feeding Stuffs in the Connecticut Market.
155. The Elm Leaf Beetle.
156. Cotton Seed Meal as a Fertilizer.
160. Clover Seed in the Connecticut Market.
169. The Leopard Moth. (Summary.)
170. The Trade in Cotton Seed Meal.
177. The Apple Tree Tent Caterpiller.
180. Studies on the Tobacco Crop of Connecticut.
182. The Brown-Tail Moth.
186. The Gypsy Moth.
191. Tests of Soy Beans, 1915.
192. Observations on Alfalfa.
193. Tests of Soy Beans, 1916.
194. Manure from the Sea.
195. Insects Injuring Stored Food Products in Connecticut.
198. Domestic Supplies of Potash.
200. Report on Food and Drug Products, for 1917.
201. Food Fats and Oils.
202. An Experience in Keeping Poultry in the City.
203. Report of the Entomologist, for 1917.
204. Report on Commercial Fertilizers, for 1917.
206. Report on Commercial Feeding Stuffs, for 1917.
209. Report on Commercial Fertilizers, for 1918.
210. Report on Food and Drug Products, for 1918.
211. Report of Entomologist, for 1918.
212. Report on Commercial Feeding Stuffs, for 1918.
213. Condensed Milk, Malted Milk, Milk Powder.
214. Report of Botanist, for 1917 and 1918.
215. The Food Value of Milk.
217. Report on Commercial Fertilizers, for 1919.
218. Report of Entomologist, for 1919.
219. Report on Food and Drug Products, for 1919.
220. Report on Diabetic Foods.
221. Report on Commercial Feeding Stuffs, for 1919.
222. New or Unusual Plant Injuries and Diseases Found in Connecticut, 1916-1919.
223. Report on Commercial Fertilizers, 1920.
225. A Study of the Bulb Mite.
226. Report of the Entomologist, for 1920.

227. Report on Food and Drug Products, for 1920.
228. Connecticut Round Tip Tobacco.
229. Report on Commercial Feeding Stuffs for 1920.
230. The Grass-Feeding Frog-Hopper or Spittle-Bug.
231. Report of the Tree Protection Examining Board.
232. Report of the Director for the Year ending October 31, 1921.
233. Report on Commercial Fertilizers, for 1921.
236. Report on Food and Drug Products, for 1921.
237. Control of White-Pine Blister Rust in Connecticut.
238. Report on Commercial Feeding Stuffs, for 1921.
239. Wildfire of Tobacco in Connecticut.
240. Commercial Vitamine Preparations.
241. Report on Commercial Fertilizers, for 1922.
242. Report on Commercial Insecticides and Fungicides, 1922.
243. Report of the Director for the year ending Oct. 31, 1922.
245. Results of Dusting *vs.* Spraying in Connecticut Apple and Peach Orchards in 1922.
246. The Apple and Thorn Skeletonizer.
247. Report of Entomologist, for 1922.
248. Report on Food and Drug Products, for 1922.
249. Report on Commercial Feeding Stuffs, for 1922.
250. Report on Commercial Fertilizers, for 1923.
251. The Raspberry Fruit Worm.
252. The European Red Mite.
253. Better Forests for Connecticut.
254. Report of the Director for the year ending Oct. 31, 1923.

REPORTS.

Beginning with the year 1877 and ending with 1916 the Station issued Annual Reports. Of these the following are out of print: 1877-1880 inclusive, 1882, 1883, 1885, 1886, 1887, 1889-1892 inclusive, 1895-1906* inclusive.

Commencing with the year 1917, the annual reports include all regular bulletins; they are issued in parts and each part bears a bulletin number.

*Of some other reports the Station has but a limited number, which are reserved to complete library sets.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

The Twenty-Eighth Report on Food Products and the Sixteenth Report on Drug Products

1923

E. M. BAILEY.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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February, 1924.

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P. C. Mangelsdorf, M.S., *Assistant.*

Soil Research
M. F. Morgan, M.S., *Investigator.*

Tobacco Sub-station at Windsor
C. M. Slagg, M.S., *in Charge.*

The Wilson H. Lee Co.

CONTENTS AND SUMMARY.

Materials	Page	Sampled by, or at request of: Station Agent	Dairy and Food Commissioner	Individuals	Total	Adulterated, below standard or otherwise illegal
FOODS.						
Alimentary Pastes	165	10	...	...	10	...
Bakery Products	169	13	...	...	13	...
Carbonated Beverages	170	...	101	...	101	17
Cocoa	171	...	...	1	1	...
Casein	171	...	...	1	1	...
Diabetic and Special Foods:						
Commercial, etc	172	70	...	...	70	...
Natural	180	33	...	...	33	...
Eggs	185	9	6	...	15	5
Fats and Oils:						
Butter	188	...	5	...	5	5
Cocoanut Fat	188	...	...	1	1	...
Cooking Fats	188	7	1	...	8	...
Olive Oil	188	1	6	...	7	...
Flour	189	18	...	...	18	...
Gelatin	189	...	...	1	1	...
Honey	190	...	...	1	1	...
Ice Cream	190	...	339	2	341	5
Milk and Milk Products:						
Market Milk	193	...	1228	131	1359	522*
Evaporated Milk	193	23	1	3	27	2
Evaporated Skimmed Milk	193	1	...	...	1	...
Sweetened Condensed Milk	197	...	...	1	1	...
Chocolate-Milk	197	2	...	...	2	...
Human Milk	199	...	...	16	16	...
Meat and Meat Products:						
Hamburg Steak	199	...	59	...	59	15
Preservative for	200	...	1	...	1	...
Pork Sausage	200	...	26	...	26	9
Frankfurts	200	...	49	...	49	23
Color for	202	...	1	...	1	...
Salt	203	23	...	...	23	2
Salad Dressing	204	28	...	...	28	...
Syrups, etc	208	3	...	...	3	...
Vinegar	208	...	6	7	13	3
Miscellaneous	208	...	...	18	18	...
Total	...	241	1829	183	2253	603

* Includes 333 samples "below standard" only.

The Twenty-eighth Report on Food Products and Sixteenth Report on Drug Products

1923

By E. M. Bailey.

This report summarizes the examinations which have been made of foods and drugs during the past year. Much of the work has been required by the Dairy and Food Commissioner for the immediate purpose of food and drug control, but some of it, notably the examinations of alimentary pastes, eggs, table salt, salad dressings and evaporated milk, has been upon samples collected by our Station agent. A considerable number of so-called diabetic and special foods and of vegetable foods of particular interest to diabetics, have been analyzed. Special attention has been given to some changes taking place in eggs during holding, particularly with reference to ammonia content; and to the lipoid phosphorous content of commercial flours and of certain egg-flour mixtures.

The writer has prepared a revision of tables of composition of diabetic and special foods and of normal foods for the third edition of Dr. Joslin's text on Treatment of Diabetes Mellitus; and has also collaborated with the Director of this Station and the Dairy and Food Commissioner in revising the Rules and Regulations pertaining to the Food and Drug Law.

Acknowledgment is made to Messrs. Andrew, Shepard, Nolan and Fisher for their efficient cooperation; to Mrs. Storrs for painstaking work in connection with the preparation of the tables of composition of foods for Dr. Joslin's text; and to Miss Bacon for assistance in preparing this and other reports for publication.

I. FOODS.

ALIMENTARY PASTES.

Egg Noodles, Etc.

METHODS.

The evaluation of egg noodles with reference to the proportion of eggs or egg material which they contain has generally been based upon the amount of fat and the amount of alcohol-soluble phosphoric acid (P_2O_5), in the product. Fat has been determined by

continuous extraction with dry ether and alcohol-soluble phosphoric acid (lecithin phosphoric acid), by the method as described by Juckenack.[1] By these methods flour of average composition yields about 0.66 per cent. of ether extract and 0.0225 per cent. of alcohol-soluble phosphoric acid. The addition of 1 egg to a pound of flour increases the ether extract to about twice the amount in the flour and considerably more than doubles the alcohol-soluble phosphoric acid (0.0513). These figures are based on the water-free material. Judging by these data noodles containing less than 0.04 or 0.05 per cent. of alcohol-soluble phosphoric acid do not contain appreciable quantities of whole egg material.

More recent methods of determining so-called lecithin phosphoric acid have been based upon adaptations of the Roese-Gottlieb method for the determination of fat and the estimation of phosphoric acid in the fatty residue so obtained. The methods of Jacobs and Rask, as stated by Lourie,[2] Rask and Phelps[3] and of Hertwig[4] are the chief methods of this type. The two first named make use of an alkaline extraction while in the last named procedure the extraction is effected in a neutral medium. All of these methods give higher figures for fat and for lecithin phosphoric acid both in flour and in noodles than is obtained by the Juckenack method. It should be understood, however, that the fatty residue as obtained by alcohol-ether extraction may contain many other substances than neutral fats, such as phosphatides, phytosterol, pigments, etc., and Rask and Phelps suggest the term lipoid phosphoric acid as more accurately descriptive of this alcohol-ether-soluble phosphoric acid than the term lecithin phosphoric acid.

Whatever the method used, the magnitude of the figures obtained for crude fat and for alcohol-soluble or alcohol-ether-soluble phosphoric acid are not of determining importance so long as the results by the different methods are referred each to its corresponding basis of comparison, i.e., the figures obtained by the particular method upon the basic materials. Hertwig has called attention to the fact that there may be a decrease in lipoid phosphoric acid as noodles age and probably also during the manufacturing process and suggests that results for this constituent be increased by .1 before calculating egg solids in the product examined.

Hertwig gives comparative figures for lipoids (crude fat), and for lipoid phosphoric acid by the neutral extraction and the alkaline extraction methods, and for lecithin phosphoric acid by the Juckenack method as applied to flour and noodles. The figures are of interest and are as follows:

[1] Ztschr. f. Unters. Nahr. und Genuss., **3**, 13. 1900.
[2] Jour. Assoc. Official Agr. Chemists, **6**, 11. 1922.
[3] Cited by Hertwig. Ibid. **7**, 92. 1923.
[4] Ibid. **7**, 92. 1923.

TABLE I. COMPARATIVE RESULTS FOR LIPOID PHOSPHORIC ACID AND LECITHIN PHOSPHORIC ACID.

(*Hertwig.*)

Substance	Alcohol-ether, Neutral extraction method		Alcohol-ether, Alkaline extraction method		Alcohol extraction, Juckenack method
	Lipoids	Lipoid–P_2O_5	Lipoids	Lipoid–P_2O_5	Lecithin–P_2O_5
	%	%	%	%	%
Flour (a).....	2.13	0.0531	1.84	0.0401	0.0293
Flour (b).....	2.07	0.0461	1.82	0.0473	.....
Noodles (c)....	4.13	0.0877	3.79	0.0765	0.0613

Hertwig recommends the neutral method of extraction in order to avoid possible decomposition of lipoids by acid or alkaline media.

PRELIMINARY TRIALS WITH EGG-FLOUR MIXTURES.

Without trying to simulate the process used in the manufacture of noodles the following trials were made with egg-flour mixtures using the method of Jacobs and Rask for determining alcohol-ether-soluble phosphoric acid as suggested by Lourie.

The flour used contained, on the moisture-free basis, protein (N x 6.25), 10.84 per cent.; alcohol-ether extract 1.71 per cent.; alcohol-ether-soluble phosphoric acid 0.041 per cent. Eggs in the proportion of one, two and three to a pound of egg-flour mixture were added and the mixtures dried at low temperature until they contained from 5 to 10 per cent. of moisture after which the preparations were ground and analyzed. The results obtained are as follows:

TABLE II. ANALYSES OF EGG-FLOUR MIXTURES, DRY BASIS.

Material	Ash	Protein, (N. x 6.25)	Lipoids, (Alcohol-ether extract)	Lipoid-P_2O_5
	%	%	%	%
Flour.....	....	10.84	1.71	0.041
One egg per lb. mixture.....	0.63	11.84	3.21	0.082
Two eggs per lb. mixture.....	0.73	13.30	4.70	0.117
Three eggs per lb. mixture.....	0.81	14.84	5.92	0.151

The egg solids in the eggs used in the above mixture averaged 13.8 grams per egg. Assuming 1.38 per cent. of lipoid

P_2O_5 in egg solids[1] the amount of lipoid–P_2O_5 we should expect to find in the mixture can be approximated as follows:

1 egg—13.8 gms. solids x 1.38 per cent. . . 0.190 gm. lipoid–P_2O_5
Flour—439.2 gms. (dry) x 0.041 per cent 0.180 gm. lipoid–P_2O_5
Mixture—453.0 gms. . . . . 0.370 gm. lipoid–P_2O_5
Per cent. lipoid–P_2O_5 calculated 0.082
Per cent. lipoid–P_2O_5 found 0.082

Similarly for two eggs per lb. of mixture we find 0.117 per cent. whereas the calculated amount is 0.122 per cent.; and for three eggs per lb. of mixture 0.151 per cent. instead of the calculated amount of 0.163 per cent. The percentage recovery is lower for greater amounts of eggs; in the case of three eggs per lb. of mixture (about 9 per cent. of egg solids), the recovery was about 92 per cent. Calculating the amount of egg solids in these mixtures according to the formula suggested by Lourie[2], thus,

$$\frac{(A - 0.041) \times 100}{1.38 - 0.041} = x$$

in which x = the per cent. of egg solids in the sample, A = the per cent. of lipoid–P_2O_5 in the sample and 0.041 = the per cent. of lipoid-P_2O_5 in the flour used in these trials, the following comparisons may be made:

	Egg solids used	Egg solids, estimated from lipoid–P_2O_5, found
	%	%
1 egg mixture	3.04	3.08
2 " "	6.08	5.70
3 " "	9.12	8.23

COMMERCIAL NOODLES, ETC.

Six samples of commercial noodles and one sample of macaroni were examined and the results are given in Table III.

TABLE III. ANALYSES OF ALIMENTARY PASTES.

No.	Material	Moisture	Ash	Protein, (Nx6.25),	Crude fat, (alcohol-ether extract)	Nitrogen-free extract and fiber	Lipoid-P_2O_5	Lipoid-P_2O_5, water-free basis
	Noodles	%	%	%	%	%	%	%
20201	Anger's. . . .	9.28	0.89	15.69	3.40	70.74	0.065	0.071
20211	A. & P. . . .	8.13	0.65	14.25	3.98	72.99	0.197	0.214
20205	Freihofer's . .	9.25	0.92	16.56	4.39	68.88	0.092	0.102
20194	Meuller's . . .	9.18	0.78	13.56	3.70	72.78	0.080	0.088
20206	Quaker	8.92	2.01	15.88	4.35	68.84	0.075	0.082
20213	Warner's . . .	9.30	1.17	16.75	4.29	68.49	0.076	0.084
	Macaroni.							
20214	Warner's . . .	10.45	0.95	13.88	1.90	72.82	0.047	0.052

[1] Jour. Assoc. Official Agr. Chemists, **6**, 11. 1922.
[2] Ibid., **6**, 11. 1922.

According to Lourie's formula noodles containing 5 per cent. of egg solids would show a lipoid–P_2O_5 content of about 0.121 per cent. Apparently, however, allowance should be made for the possible use of flour of less alcohol-ether-soluble phosphoric acid content than 0.0548 and also for the fact that the recovery of lipoid–P_2O_5 is not complete particularly, as noted by Hertwig, in products that are not of recent manufacture.

If allowance is made for flour containing as little as 0.041 per cent. of lipoid–P_2O_5 and for only 90 per cent. recovery of the lipoid–P_2O_5 present in the freshly made noodles, a product containing 0.097 per cent. lipoid–P_2O_5 would represent a formula calling for 5 per cent. of egg solids. Two of the samples examined exceeded this amount and four did not, although three of them approximated it more or less closely. Whether the egg solids represent whole egg or merely egg yolk cannot be deduced from the lipoid–P_2O_5 content alone. Hertwig has pointed out that the ratio of lipoid–P_2O_5 to alcohol precipitable nitrogen is a useful criterion for this purpose.

BAKERY PRODUCTS.

CAKES.

A number of bakery products, all yellow cakes, were examined for evidence of eggs and for artificial colors. Flour and eggs, or egg products, contribute all, or essentially all, of the phosphatid or lipoid phosphorus in this class of foods. Milk and shortening materials which consist of, or contain, milk constituents (butter and the margarines), may contribute some phosphorus of the phosphatid type in those products in which they are used but the amount will be relatively small.

In the samples of pastry examined lipoid phosphoric acid was determined in addition to the usual proximate constituents. "Fat" is the alcohol-ether extract upon which the lipoid phosphorus was determined and not "fat" in the generally accepted sense of "ether extract." For comparison in the case of sponge cake, two experimental cakes were made using the same recipe but with varying proportions of eggs. These are designated in the table of analyses as "home made."

TABLE IV. ANALYSES OF BAKERY PRODUCTS.

No.	Material	Moisture	Ash	Protein, (N x 6.25)	Crude fat, (alc-ether extract)	N-free extract and fiber	Lipoid-P_2O_5
	Sponge Cake	%	%	%	%	%	%
20649	Home made (2 eggs)	23.44	2.41[1]	6.68	3.78	63.69	0.069
20650	Home made (4 eggs)	26.31	1.49	7.89	6.32	57.99	0.133
20207	Bakery	23.85	0.80	10.69	11.25	53.41	0.226
20208	Bakery	19.91	1.86	6.59	8.20	63.44	0.107
20209	Bakery	27.55	1.42	8.18	5.51	57.34	0.131

[1] More baking powder used than in 20650.

TABLE IV. ANALYSES OF BAKERY PRODUCTS—*Concluded.*

No.	Material	Moisture	Ash	Protein, (N x 6.25)	Crude fat, (alc-ether extract)	N-free extract and fiber	Lipoid-P_2O_5
	Sponge Cake	%	%	%	%	%	%
20210	Bakery	18.85	2.11	7.97	5.71	65.36	0.139
20212	Bakery	18.75	1.39	8.35	10.60	60.91	0.116
20217	Bakery	42.45	0.54	5.03	3.57	48.41	0.060
	Cup Cakes						
20216	Bakery	20.66	1.42	6.00	14.38	57.54	0.034
20219	Bakery	18.98	1.64	5.65	23.44	50.29	0.053
	Plain Cake						
20218	Bakery	20.02	0.71	7.00	6.06	66.21	0.087
	"Cream" Puffs (Custard)						
20215	Bakery	57.03	0.61	5.63	14.02	22.71	0.067
20220	Bakery	58.34	0.98	6.27	88.77	25.64	0.079

No artificial color was found in any of the samples and the lipoid phosphorous content would indicate appreciable or substantial amounts of eggs or egg material. In general the cakes contained from 20 to 25 per cent. of moisture. Three approached or exceeded 50 per cent. of moisture and the lipoid phosphorous content is correspondingly low in these samples. Cup cakes showed the lowest percentage of this type of phosphorus.

CARBONATED BEVERAGES.

One hundred and one samples of carbonated beverages have been examined for the Dairy and Food Commissioner of which sixteen were found to contain saccharin and one contained preservative which was not declared on the label.

The inspection of this class of products is carried out largely under the provisions of a special act[1] which makes the use of saccharin illegal and which further provides that establishments bottling water and non-alcoholic beverages shall be licensed and that such license shall be issued only when conditions of cleanliness and general sanitation are satisfactory to the Dairy and Food Commissioner. Cleanliness in the preparation and distribution of food products is an item of the utmost importance and the results obtained from the operation of this law have been most gratifying.[2]

Adulterated or otherwise illegal samples are given in Table V.

[1] Public Acts of 1921, Chapt. 159.

[2] Twenty-fourth Report of the Dairy and Food Commissioner, Public Document No. 32.

TABLE V. CARBONATED BEVERAGES ADULTERATED OR OTHERWISE ILLEGAL.

D. C. No.	Sampled at		Manufacturer	Remarks
24366	*E. Portchester,*	Andrew Esposito	H. Dehmer Co. Inc.	Contains saccharin
24367		Louis P. Wellner	H. Dehmer Co. Inc.	Contains saccharin
24688		Andrew Esposito	H. Dehmer Co. Inc.	Contains saccharin
24689		Rocco Dattola	Silver Bot. Wks.	Contains saccharin
24690		Zachria Pessy	Atlantic Bot. Wks.	Contains saccharin
24372	*Greenwich,*	Hannah Hassan	H. Dehmer Co. Inc.	Contains saccharin
24373		Joseph Curtis	Atlantic Bot. Wks.	Contains saccharin
24374		George Matthews	H. Dehmer Co. Inc.	Contains saccharin
24375		George Matthews	H. Dehmer Co. Inc.	Contains saccharin
24376		Edward Dulmba	H. Dehmer Co. Inc.	Contains saccharin
24377		Edward Dulmba	H. Dehmer Co. Inc.	Contains saccharin
26026		P. Schinto	Silver Bot. Wks.	Contains saccharin
26000	*New Haven,*	B. Roklen & H. Abert	Own make	Contains saccharin
26744		Vincent Limauro	Own make	Contains saccharin
26745		Vincent Limauro	Own make	Contains saccharin
26746		Vincent Limauro	Own make	Contains saccharin
26048	*Willimantic,*	Thread City Bot. Wks.	Own make	Preservative not declared

COCOA.

One sample of cocoa was submitted by Miss E. F. Packer, secretary of the Hartford Tuberculosis Society.

It was examined as follows:

Moisture 3.87 per cent.; ash 4.84 per cent.; protein (N x 6.25), 24.63 per cent. (not corrected for the nitrogen of alkaloids); fiber 4.49 per cent.; carbohydrates, by difference, 42.29 per cent.; fat 19.88 per cent.

Formerly cocoa contained more fat than many brands now show. This is because of the increased demand for cocoa to be used in various beverages where the cacao flavor is chiefly desired as, for example, in soda fountain and other beverages. So-called "breakfast" cocoa should contain 22 per cent. or more of fat.

CASEIN.

Analyses of a number of casein preparations designed for clinical purposes were examined and reported in a previous bulletin.[1] One sample, **21431,** was examined during the past year. It was made by the Harris Laboratories, Tuckahoe, N. Y., and offered for clinical purposes and for use in feeding trials in nutritional investigations.

The analysis is as follows:[2]

Moisture 10.73 per cent.; ash 0.59 per cent.; calcium trace; nitrogen 13.66 per cent. (equivalent to 87.09 per cent. casein); fat 0.20 per cent.; moisture, fat and ash-free material 88.48; difference between casein and moisture, fat and ash-free material 1.39 per cent.; undetermined 1.39 per cent.; nitrogen on moisture-free basis 15.30 per cent.

[1] Conn. Exp. Sta., Bull. 236, p. 233, 1921.

[2] Methods as given in New and Non-official Remedies, Am. Med. Assoc. 1923.

DIABETIC AND SPECIAL FOODS.

Commercial and Manufactured Products.

A considerable number of brands of so-called diabetic and special foods have been examined during the past year. The foods of foreign manufacture were obtained chiefly through the courtesy of Mr. Benjamin Baruch of New York who secured them in England. The samples which he submitted were carefully labeled and original packages were furnished wherever possible.

COMMENTS UPON ANALYSES.

Flours and Meals. The official definition and standard for gluten flour is as follows:[1]

"Gluten flour is the clean, sound product made from wheat flour by the removal of a large part of the starch, and contains not more than ten per cent. (10%) of moisture, and, calculated on the water-free basis, not less than seven and one-tenth per cent. (7.1%) of nitrogen, not more than fifty-six per cent. (56%) of nitrogen-free extract (using the protein factor 5.7), and not more than forty-four per cent. (44%) of starch (as determined by the diastase method).

The gluten flours examined conform to these requirements but it should be emphasized that the use of such flours, or of any so-called diabetic food, should be governed entirely by the tolerance of the patient. Analyses are a guide to the physician in determining this factor in each case.

Ground gluten of standard quality should contain, on the moisture-free basis, twice as much nitrogen (14.2) per cent., and much less starch (not over 5.5 per cent.) than gluten flour. Compared with these specifications *Special Gluten,* **20829,** was about 0.6 per cent. low in nitrogen and exceeded the limit of starch.

The sample of *Cellulose Flour* from corncobs was submitted by Dr. Orton who explains that it is obtained after the cobs have been treated to remove starch and sugar for the manufacture of adhesives and furfural. It is used in the diabetic diet as a component of muffins, cookies, etc. *Cellu flour,* which we have discussed in a previous report,[2] is the same sort of material derived from other sources.

Sample **21559** was submitted for an opinion as to its suitability for diabetics. It is plain wheat flour of average composition.

Bakery Products. The analyses show that the products of Callard & Co. are generally high in protein and fat and low in carbohydrate, particularly the more available carbohydrate, i. e., starch and sugar. Many of the other products in this group show considerable or large amounts of starch. However, since the metabolism of protein may result in the production of considerable and varying amounts of sugar, a low starch, if accompanied by a very high protein, is not an unqualified advantage.

[1] Circ. 136, U. S. Dept. Agr., Office of Secretary.
[2] Conn. Exp. Sta. Bull. 227, p. 230.

Plasmon is the name adopted by the Plasmon Co., Ltd., London, for their preparation of milk protein (casein), which is a constituent of a number of their products. Jacob and Co. Ltd. of Dublin, Ireland, also make or distribute Plasmon products.

Cestus bread has about the average composition of ordinary wheat bread.

Protein Preparations. These are casein and gluten products. The sample of *Aleuronat* contained about 71 per cent. of protein which is much less than the product now manufactured contains according to the statement of the American agents, Messrs. Glogau and Company, Chicago. They explain that the product now has a protein content of 96 per cent.

Plasmon contained 11.90 per cent. of nitrogen which is equivalent to about 76 per cent. protein (casein). Previous analyses of this product summarized in Bulletin 220 of this Station, show about the same nitrogen content. By an oversight in compilation, however, the protein was there calculated by the factor 5.7. If the factor 6.38 had been used these analyses would have been in substantial agreement with the recent analysis as given in Table VI.

The specifications for dietetic casein accepted by the American Medical Association[1] require that it contain 15 per cent. of nitrogen on the moisture-free basis. On that basis *Cheltine Milk Protein,* **20074,** contains 14.5 per cent. of nitrogen and the sample of *Plasmon,* **20066,** contains 13.5 per cent.

Breakfast Foods. We have no information that *Kellogg's* bran or *Plasmon* oats are designed for diabetic diets. *Hoyt's Gluten Flakes* is relatively low in starch but contains about 15 per cent. of available carbohydrate.

Alimentary Pastes. These preparations are macaroni and vermicelli made with casein instead of flour or gluten flour.

Cocoa. Cocoa generally will contain from 2.8 to 3.8 per cent. of nitrogen, from 8.5 to 13.5 per cent. of starch and from 30 to 40 per cent. of total carbohydrate (nitrogen-free extract). The term "diabetic" as applied to foods should signify a "considerable lessening of the carbohydrates" as compared with normal foods of the same class. Circular 136[2] prescribes that the glycogenic carbohydrates shall not be more than one-half as much as in the corresponding normal foods.

The sample of *Biogene Cocoa* examined contains more nitrogen than ordinary cocoa but neither the starch (about 10 per cent.), nor the total carbohydrate (about 31 per cent.), is substantially less than is found in cocoa of average composition. The same may be said of *Loeb's* diabetic cocoa. *Cheltine* milk cocoa shows 22

[1] New and Non-official Remedies, 1923.
[2] U. S. Dept. Agr., Office of the Secretary.

TABLE VI. ANALYSES OF

No.	Manufacturer and Brand	Moisture	Ash	Nitrogen	Protein N x 6.25	Protein N x 5.7	Fiber	Nitrogen-free Extract: Starch	Nitrogen-free Extract: Sugar as Dextrose	Nitrogen-free Extract: Other N-free Extract	Fat, Ether Extract	No.
	Flours and Meals.											
	Cereal Meal Corporation, St. Louis, Mo.											
20137	Cereal Meal	6.39	4.60	3.07	19.19	....	5.13	27.09	7.68	23.35	6.57	20137
	Cheltine Food Co., Cheltenham, England.											
20056	Cheltine Diabetic Food	4.66	6.89	9.26	57.88	....	0.78	8.64	7.76	3.34	10.05	20056
	Farwell and Rhines.											
21222	Gluten Flour	8.81	0.65	7.10	.....	40.47	0.34	38.90	4.34	5.12	1.37	21222
	Federal Mill and Elevator Co., Lockport, N. Y.											
20113	Gluten Flour	9.20	0.90	6.76	.....	38.53	0.41	39.60	2.70	6.88	1.78	20113
	Loeb's Diabetic Food Bakery, N. Y.											
20828	Pure Gluten Flour	8.22	0.83	7.28	.....	41.50	0.15	36.68	3.04	7.39	2.19	20828
20829	Special Gluten	5.76	0.77	12.84	.....	73.19	0.19	8.66	0.76	8.70	1.97	20829
	Plasmon Ltd., London.											
20067	Plasmon Arrowroot	12.98	2.20	3.17	19.81	.....	0.11	61.59	0.65	2.53	0.13	20067
	Pure Gluten Food Co., N. Y.											
20666	Hoyt's Gluten Flour	7.40	0.99	9.32	.....	53.12	0.42	29.14	2.24	3.43	3.26	20666
	Miscellaneous.											
20086	Cellulose Flour from Corncobs	5.00	0.82	0.16	1.00	.....	63.80	0.34	none	28.50	0.54	20086
21559	Wheat Flour	11.02	1.02	2.06	.....	11.74	0.76	58.50	8.10	6.37	2.49	21559
	Bakery Products.											
	Callard & Co., London.											
20083	Almond Biscuits No. 15	4.08	5.30	5.46	34.13	.....	1.66	0.39	3.10	2.79	48.55	20083
20043	Bran and Almond Biscuits No. 13	3.34	4.03	3.90	24.38	.....	4.14	0.49	2.32	3.81	57.49	20043
20039	Casoid Biscuits No. 17 A	6.04	8.95	9.32	58.25	.....	0.13	0.32		1.71	24.60	20039
20040	Casoid Rusks No. 8	5.98	7.70	8.68	54.25	.....	0.09	0.49		4.91	26.58	20040
20085	Gluten and Almond Biscuits No. 11	5.42	2.58	10.46	65.38	.....	0.29	2.15	0.93	0.00	23.25	20085
20081	Gluten Biscuits No. 9	5.50	2.54	10.59	.....	60.36	0.40	2.42	0.98	3.90	23.90	20081
20080	Gluten Cracknells No. 7	6.18	2.12	12.06	.....	68.74	0.24	3.18	0.18	4.68	14.68	20080
20079	Gluten Dinner Rolls No. 6	6.89	1.52	12.94	.....	73.76	0.18	4.56	0.60	5.40	7.09	20079
20038	Kalari Batons No. 5	4.92	6.68	7.07	44.19	.....	0.38	trace	1.16	0.13	42.54	20038
20084	Parmesan Cheese Straws No. 17	3.43	5.79	5.00	31.25	....	0.50	3.48		6.61	48.94	20084
20037	Ponos Biscuits No. 14	7.55	8.44	9.69	60.56	.....	0.33	1.25		2.64	19.23	20037
20082	Prolacto Biscuits No. 12	5.76	8.82	9.56	59.75	.....	0.22	0.26		4.74	20.45	20082
20078	Soup Sippets	1.89	7.70	8.66	54.13	.....	0.03	0.52		6.99	28.74	20078
	Cheltine Food Co., Cheltenham, Eng.											
20073	Cheltine Assorted Biscuits	6.02	2.44	2.92	18.25	.....	0.55	46.18	5.28	5.28	16.00	20073
20075	Cheltine Brown Rusks	8.02	2.14	2.91	18.19	.....	0.22	45.42	5.55	10.75	9.71	20075
20076	Cheltine White Rusks	7.39	2.35	3.63	22.69	.....	0.20	40.44	7.53	4.61	14.79	20076
20062	Manhu Diabetic Biscuits	5.97	1.07	2.07	12.94	.....	0.80	52.59	9.12	5.55	11.96	20062
	Levine Bros., New Haven, Conn.											
20114	Gluten Bread	39.17	1.87	3.07	.....	17.52	0.29	23.83	1.89	11.68	3.75	20114

SO-CALLED DIABETIC AND SPECIAL FOODS.

TABLE VI. ANALYSES OF

No.	Manufacturer and Brand	Moisture	Ash	Nitrogen	Protein N x 6.25	Protein N x 5.7	Fiber	Nitrogen-free Extract Starch	Nitrogen-free Extract Sugar as Dextrose	Nitrogen-free Extract Other N-free Extract	Fat, Ether Extract	No.
	Bakery Products—Concluded.											
	Loeb's Diabetic Food Bakery, New York.											
20139	Aerated Bread	5.53	1.60	8.73	.....	49.76	0.34	20.76	2.83	7.00	12.18	20139
20145	Genuine Gluten Bread	30.21	1.83	5.71	.....	32.57	0.24	25.37	1.79	4.40	3.59	20145
	Jacob & Co. Ltd., Dublin, Ireland.											
20072	Plasmon Oat Biscuit	5.86	2.43	2.46	15.38	. ...	0.26	37.91	11.34	6.09	20.73	20072
20071	Plasmon Plain Biscuit	6.40	2.54	2.98	18.63	.....	0.19	45.99	6.54	3.89	15.82	20071
20069	Plasmon Sweet Biscuit	6.19	2.42	2.85	17.81	.....	0.18	43.88	9.70	4.64	15.18	20069
20070	Plasmon Wholemeal Biscuit	5.88	2.85	3.20	20.00	.....	0.71	39.21	7.98	6.57	16.80	20070
	R. M. Scott, Ipswich, England.											
20061	Gluten and Almond Biscuits	5.93	2.24	3.80	23.75	.....	0.50	40.73	3.76	3.18	19.91	20061
	Therapeutic Foods Company, Inc., New York.											
20133	Dr. Charrasse Gluten Bread	7.83	2.25	7.49	.....	42.69	0.16	32.26	3.73	5.25	5.83	20133
20136	Dr. Charasse Gluto-Kola Bread	8.51	2.17	7.34	45.88	.....	0.16	32.76	4.50	0.00	6.02	20136
20135	Dr. Charasse Gluto-Soja Bread	8.11	2.20	7.77	48.56	.....	0.26	30.04	3.26	0.69	6.88	20135
20134	Dr. Charasse Supreme Bread	8.21	2.45	7.30	45.63	.....	0.22	32.60	3.33	0.64	6.92	20134
	Therapeutic Foods Company, London.											
20055	Energen New Natural Gluten Bread	7.05	0.97	5.80	.....	33.06	0.59	35.44	8.60	4.23	10.06	20055
	Van Abbott & Sons, London.											
20060	Soya Biscuits	4.85	5.52	6.27	39.19	.....	2.20	2.50	8.94	11.82	24.98	20060
	Miscellaneous.											
20140	Cestus Bread, Gluten	34.26	1.15	1.97	.....	11.23	0.14	44.09	4.29	3.38	1.46	20140
21307	Gluten Bread	.....	.....	3.18	.....	18.13	.....	40.71		.....	.....	21307
	Protein Preparations.											
	Cheltine Food Co., Cheltenham, Eng.											
20074	Cheltine Milk Protein	9.05	3.08	13.24	84.47[1]	.....	none	none	0.19[2]	2.24	0.97	20074
20698	Cheltine Milk Protein	.....	.....	13.38	85.36[1]	.....	.....	.....	.....	.....	.....	20698
	Glogau & Company, Chicago, Ill. (Sole Agents).											
21558	Aleuronat	8.11	0.76	12.46	.....	71.02	0.26	7.14	3.54	3.59	5.58	21558
21874	Aleuronat	.....	.....	12.46	.....	71.02	.....	.....	.....	.....	.....	21874
	Plasmon, Ltd., London.											
20066	Plasmon Milk Proteid	12.13	7.92	11.90	75.92[1]	.....	none	none	1.44[2]	1.87	0.72	20066
	Breakfast Foods.											
	Kellogg's Toasted Corn Flake Co., Battle Creek, Mich.											
20193	Kellogg's Bran Cooked and Krumbled	5.05	6.30	2.31	14.41	.....	.....		68.53[3]		3.40	20193
	Plasmon, Ltd., London.											
20059	Plasmon Oats	9.02	1.80	2.77	17.31	.....	0.53	54.45	2.94	5.86	8.09	20059
	The Pure Gluten Food Co., N. Y.											
21861	Hoyt's Gluten Flakes	8.18	3.55	7.84	.....	44.69	3.89	4.50	11.98	18.86	4.35	21861

SO-CALLED DIABETIC AND SPECIAL FOODS—(*Continued*).

[1] Factor 6.38.
[2] Lactose.
[3] Includes fiber.

TABLE VI. ANALYSES OF

No.	Manufacturer and Brand	Moisture	Ash	Nitrogen	Protein N x 6.25	Protein N x 5.7	Fiber	Nitrogen-free Extract: Starch	Nitrogen-free Extract: Sugar as Dextrose	Nitrogen-free Extract: Other N-free Extract	Fat, Ether Extract	No.
	Alimentary Pastes.											
	Callard & Co., London.											
20041	Casoid Flakes (Macaroni Paste)	% 9.63	% 7.41	% 12.56	% 78.50	.....	% 0.22	% 1.16		% 0.01	% 3.07	20041
20042	Casoid Vermicelli	9.33	7.31	12.80	80.00	.....	0.13	0.50		0.00	2.73	20042
	Cocoa.											
	Callard & Co., London.											
20044	Biogene Cocoa	8.25	7.50	5.29	33.06	.....	2.41	10.15	0.90	19.82	17.91	20044
	Cheltine Foods Co., Cheltenham, Eng.											
20057	Cheltine Milk-Cocoa	7.75	5.14	7.53	47.06	.....	2.11	8.15	0.76	13.12	15.91	20057
	Loeb's Diabetic Food Bakery, N. Y.											
20830	Diabetic Cocoa	4.98	5.47	5.29	33.06	.....	3.62	11.08	1.56	22.34	17.89	20830
20138	Diabetic Cocoa	4.90	5.80	4.07	25.44	.....	3.83	11.59	4.44	23.09	20.91	20138
	Plasmon, Ltd., London.											
20065	Plasmon Cocoa	9.82	7.74	8.07	50.44	.....	1.33	4.53	1.48	13.07	11.59	20065
	Confections, etc.											
	Callard & Co., London.											
20049	Chocolate Biscuits	3.74	4.11	4.18	26.13	. ..	1.50	1.83	3.74	9.18	49.77	20049
20045	"Casoid" Chocolates	5.54	3.14	3.67	22.94	.....	1.54	1.83	3.18	23.02	38.81	20045
20047	"Casoid" Dessert Chocolate	3.83	3.95	3.98	24.88	.....	2.13	4.11	3.76	11.26	46.08	20047
20048	"Casoid" Nut Chocolate	3.66	3.88	3.82	23.88	.....	2.22	3.86	4.78	11.28	46.44	20048
20050	"Ponos" Cocoanut Ice[1]	7.85	1.29	1.38	.....	.....	1.19	3.12		....	36.18	20050
20046	Sugarless Chocolate	2.81	4.28	2.24	14.00	.....	3.16	5.85	8.14	17.33	44.34	20046
20077	Sugarless Jujubes (Peppermint)[2]	21.70	0.40	3.01	.....	.....	none	none	trace	.....	.....	20077
20052	Sugarless Glycerine Jujubes[2] (Pineapple)	19.76	0.35	2.89	.....	.....	none	none	trace	.....	.....	20052
20053	Sugarless Table Jelly[3]	8.68	0.42	4.50	.....	.....	none	none	trace	.....	.....	20053
	Lister Bros., New York.											
20058	Lister's Sugar Free Candy[4]	9.44	1.41	3.67	.....	....	none	none	trace	.....	.....	20058
	Plasmon, Ltd., London.											
20068	Plasmon Chocolate	1.76	1.74	2.20	13.75	.....	0.47	2.00	36.52	14.40	29.36	20068
	Miscellaneous.											
	Callard & Co., London.											
20054	Cibrola	11.31	10.86	11.94	76.18[5]	.....	none	none	0.19[6]	1.06	0.40	20054

[1] Saccharin present, glycerine indicated.
[2] Glycerine present, gelatin indicated.
[3] Saccharin present, gelatin indicated.
[4] Gums, saccharin, glycerine and gelatin present.

SO-CALLED DIABETIC AND SPECIAL FOODS—(*Concluded.*)

[5] Factor 6.38.
[6] Lactose.

per cent. of total carbohydrate which is considerably less than the average and approximately one-half of the maximum found in the normal product. *Plasmon* cocoa shows material reduction in both starch and total carbohydrate, approximately one-half the normal amount in each case. This is largely due to the increase in nitrogenous material. In the tables protein has been calculated from the total nitrogen without allowance for the nitrogen in the theobromine and caffeine present.

Confections, etc. A number of samples of confections have been examined. These are generally prepared without sugar and may be sweetened with saccharin or glycerine. Gelatin was present in some cases. Glycerine is convertable to sugar by chemical methods and bacteria effect upon it a similar change.[1] According to various authorities it is also transformed to sugar in the body. Gums may be present, as in *Lister's* sugar-free candy. To what extent these substances yield sugar in metabolism we cannot state; but they result in the formation of a considerable amount of copper-reducing material by the usual chemical methods of hydrolysis and in all cases when gums were present or suspected they were excluded by precipitation with alcohol before total sugars were determined.

Plasmon chocolate contained about 36 per cent. of soluble carbohydrate and was evidently a sweet chocolate.

Cibrola is a preparation of casein probably reinforced with glycerophosphates.

Natural Foods of Interest to Diabetics.

The restricted diet to which the diabetic patient must conform presents a real problem. Rigid menus become monotonous and increased attention is being given to variety by those interested in diabetic dietetics. Dr. Allen has emphasized the importance of this factor and much has been accomplished in this direction particularly by one of his student-patients, Dr. Orton. Commenting upon these efforts Dr. Joslin says:

"Diabetics everywhere throughout the world owe a debt of gratitude to Dr. W. A. Orton of the U. S. Department of Agriculture for his earnest endeavor to increase the number of agreeable vegetables. For this purpose he has brought to Washington specimens from all over the world. It is to be hoped that he will shortly publish a monograph giving the results of his work. Already there has appeared an article on the subject.[2] In England, also, the subject of gardening and vegetables for diabetics has been seriously considered by Spriggs.[3]"

This laboratory has collaborated with Dr. Orton by making analyses of a number of uncommon vegetables and other foods which have proved to be valuable adjuncts to the diabetic dietary.

[1] Browne, Sugar Analysis, p. 771.
[2] Orton, W. A.: Am. Jour. Med. Sci. 1921, 162, 498.
[3] Spriggs, E. I.: Duff House Papers, Henry Frowde, London, 1920, 1.

Data on these and other foods submitted by physicians and others interested are given in Table VII.

Description of the character and uses of some of the uncommon foodstuffs which we have analyzed are of interest. It is taken chiefly from data furnished by Dr. Orton who submitted most of the specimens. The information concerning nuts was furnished by Mr. C. A. Reed of the Office of Horticultural and Pomological Investigations.

VEGETABLES.

Artichokes. The carbohydrate of the artichoke is largely or entirely inulin, a polysaccharide which is present also in dahlia and some other plants. A brief discussion of this carbohydrate has already been given in a previous bulletin.[1] The name Jerusalem artichoke is considered by authorities as highly inappropriate and "Girasole" and "Sunroot" have been suggested as more suitable names. The latter term is used in the latest edition of Robinson's "Vegetable Garden." The comparison between the analysis of the cooked and uncooked tubers is not a strict one because they were not made upon the same sample. Cooking was effected by steaming. Boiling in water would probably have shown greater differences in composition, particularly a greater loss in mineral matter in the boiled tuber.

String Beans, canned. The samples represent the standard commercial grades. The analysis of Fancy No. 1 grade is of the beans only, but those of the other grades are of the beans with accompanying liquor.

Chayote. The chayote (pronounced chi-ó-tay), belongs to the cucumber family and is a native of Mexico and Central America but is now cultivated as a garden vegetable in the Southern States and in California. There are a number of varieties varying in color, size and character of surface. The surface may be smooth, corrugated, spiny or spineless. The fruit may be eaten when immature but the quality improves with maturity. Cultural directions and recipes for preparing the vegetable for the table are given in a pamplet issued by the Bureau of Plant Industry at Washington.

Chinese vegetables. In submitting these samples Dr. Orton wrote as follows:

"These are interesting Chinese specialties of which I believe no analysis has ever been made. Both are species of Brassica and are described by Prof. L. H. Bailey in his "Gentes Herbarum". The white-stalked vegetable, Bak Toy, is found on almost every oriental stand on the Pacific Coast cities. It makes an excellent salad and can be cooked in various ways. The green vegetable, Kai Tsoi, is perhaps, even more prized by the Chinese and we consider it an excellent mustard greens."

[1] Conn. Exp. Sta., Bull. 236, p. 245, 1921.

TABLE VII. ANALYSES OF

No.	Material	Moisture	Ash	Nitrogen	Protein, (N x 6.25)	Fiber	Carbohydrate (other than fiber)			Fat, ether extract	No.
							Starch	Sugar, as dextrose	Other carbohydrate		
	Vegetables.										
20510	Artichokes, Jerusalem: fresh, whole tuber	77.76	2.00	0.47	2.93	0.80	14.03[1]	0.20[2]	2.17	0.11	20510
20511	cooked, whole tuber	75.85	1.60	0.44	2.77	1.09	15.43[1]	0.29[2]	2.87	0.10	20511
	cooked, edible portion	78.86	1.37	0.38	2.36	0.82	14.04[1]	0.23[2]	2.25	0.07	.....
21560	Asparagus, fresh, edible portion	92.15	0.69	0.48	3.00	0.70	0.08	0.70	2.37	0.31	21560
	Beans, canned:										
20803	No. 1, Fancy green refugee, drained beans	93.65	1.14	0.22	1.39	0.76	0.10	0.89	1.98	0.09	20803
20804	No. 2 Fancy green refugee beans and liquor	94.43	1.07	0.16	0.98	0.53	0.06	1.21	1.62	0.10	20804
20805	No. 3 Fancy green refugee beans and liquor	95.12	1.22	0.13	0.79	0.49	0.06	0.98	1.29	0.05	20805
20806	No. 4 Cut green Refugee beans	94.08	0.97	0.16	0.99	0.55	0.12	1.45	1.78	0.06	20806
20807	Extra Standard No. 5 Cut green Refugee	94.77	1.13	0.14	0.85	0.51	0.23	1.00	1.46	0.05	20807
20460	Chayote, green, fresh	90.38	0.54	0.19	1.16	0.93	2.98	2.25	1.66	0.10	20460
20461	white, fresh	91.45	0.50	0.13	0.83	0.91	1.98	2.40	1.82	0.11	20461
20462	white, fresh	92.45	0.37	0.11	0.70	0.87	1.26	2.55	1.69	0.11	20462
20463	pale green Guatemalan, fresh	90.83	0.40	0.14	0.85	0.83	2.05	2.94	1.97	0.13	20463
20464	dark green, fresh	94.13	0.37	0.13	0.83	0.51	0.57	2.28	1.22	0.09	20464
20465	light green, fresh	93.61	0.36	0.12	0.77	0.54	0.85	2.31	1.46	0.10	20465
	Chinese Vegetables:										
21823	Kai Tsoi	94.56	1.08	0.27	1.71	0.70	0.03	0.42	1.31	0.19	21823
21824	Bak Toy	95.91	1.06	0.19	1.21	0.59	0.02	0.33	0.78	0.10	21824
	Palmetto cabbage:										
20979	fresh	87.22	1.74	0.53	3.33	0.93	1.01	1.00	4.13	0.64	20979
20980	cooked	88.97	1.22	0.46	2.89	0.85	0.83	0.88	3.89	0.47	20980
	Peppers, dried:										
20146	Neapolitan	9.60	5.55	1.86	11.63	7.57	1.55	35.15	25.35	3.60	20146
20147	Squash, pungent	10.29	5.98	2.28	14.25	8.41	1.46	30.00	25.59	4.02	20147
20149	Royal	9.64	5.55	1.94	12.13	7.59	1.24	35.35	25.47	3.03	20149
20150	Sunnybrook	10.59	7.32	2.16	13.50	6.57	1.13	32.00	24.39	4.50	20150
20151	Mexican, pungent	8.15	5.42	1.63	10.19	5.93	1.32	36.10	23.34	9.55	20151
21561	Rhubarb, fresh, edible portion	96.11	0.49	0.07	0.42	0.40	0.07	0.51	1.87	0.13	21561
	Salad Vegetables:										
21565	Aralia Cordata (Udo)	95.29	0.51	0.16	0.97	0.50	0.07	1.07	1.44	0.15	21565
21566	Celeriac	89.57	0.95	0.29	1.79	1.45	0.14	0.80	5.08	0.22	21566
20030	Tomatoes, green, edible portion	94.72	0.62	0.19	1.21	0.42	0.36	1.19	1.25	0.23	20030
	Vegetable Marrow:										
20686	edible portion, fresh	93.22	1.09	0.07	0.45	1.21	0.10	1.74	2.12	0.07	20686
20687	edible portion, cooked	93.03	1.04	0.07	0.41	1.36	0.08	1.89	2.13	0.06	20687
	Nuts.										
21562	Pignolia nuts, shelled	5.84	4.19	5.84	36.50	0.82	none	4.32	0.46	47.87	21562
21563	Pistache nuts, shelled	5.80	2.79	3.88	24.25	1.75	none	6.13	8.20	51.08	21563
21564	Cashew nuts, shelled	4.50	2.48	3.06	19.13	0.61	13.39	6.84	5.93	47.12	21564
21569	Brazil nuts, shelled	3.41	3.35	2.69	16.81	2.10	none	1.30	3.65	69.38	21569

[1] Water-soluble carbohydrate after hydrolysis calculated from levulose to inulin, factor 0.9.

[2] Direct reducing sugar calculated as levulose.

NATURAL FOODS OF INTEREST TO DIABETICS.

Palmetto cabbage. This sample was submitted by Dr. Orton from Sanford, Fla. He explains that it is the bud of the palmetto, the common palm of Florida. The fibrous outer portions of the bud are discarded and the tender inner tissues constitute the edible portion which is esteemed as a food. Taking the bud, however, sacrifices the life of a tree.

Peppers, dried. These were grown at Arlington Farm, Virginia and sent by Dr. Orton. Only the edible portion was included in the samples. The original green weights of the samples are not recorded but the water content of the fresh material is propably 90 to 95 per cent. so that the percentages of the constituents given, other than moisture should be divided at least by 9 to approximate the composition of the fresh vegetable.

Salad vegetables. Samples of Aralia Cordata (or Udo) and of Celeriac were submitted by Dr. Orton in June, 1923. The Udo was freshly gathered and the Celeriac had been kept in storage since the fall of 1922. Both are desirable salad vegetables, one of the merits of the last named being that it keeps so well in storage.

Vegetable Marrow, Moore's Cream. This sample was submitted in February 1923 by Dr. Minot of Boston and had been stored since the previous fall. Analyses are of the edible portion i. e. with rind, seeds and placentae removed.

NUTS.

Brazil Nut.[1] (*Bertholletia excelsa*). Also called Cream Nut' Nigger Toe, Para Nut, Castanha, Butter Nut, etc. The fruit of a lofty uncultivated tree in the Amazon Country of South America. It is gathered by the natives and brought to the coast for export, Para being the principal center. These nuts are received in the United States from February to April and held in cold storage until late summer or early fall, when they are placed upon the market as the new crop.

Pignolia (*Pinus panes*).[2] The edible seeds of the stone pines of southern Europe are imported into this country in large quantities. They are rarely seen this side of the Atlantic except in the shelled condition. These nuts are chiefly imported from Tuscany, the Castilian section of Spain and sometimes, but rarely, from Turkey.

Pistache (*Pistacea vera L.*) This species is said by "Nut Culture in the U. S." to have originated in Syria; however, it is now well established in the warmer countries of Europe, Asia, and Africa. It was introduced into this country nearly a half century ago and is now receiving considerable attention in California and other parts of the West and Southwest.

[1] Specimens contributed by Hills Bros. Co., New York.
[2] Specimens from lot purchased from Wood and Sclick, Inc., New York.

Cashew (*Anacardium occidentale L.*) This species is widely known throughout the tributaries of the greater part of the world. It is peculiarly interesting in two respects: First, the seed, shaped like a large bean not unlike a kidney, both in form and color, forms on the apical end of a fleshy, pear-shaped, yellowish or crimson fruit. Its method of attachment is decidedly unnatural in appearance. Second, the seed is incased within two thin but firm shells, between which there is enclosed a brownish colored fluid, extremely poisonous to the skin. This is readily dispelled by roasting, but in the process strong fumes are given off which are said to be highly irritating to the eyes. Painful cases of poisoning have been experienced by those handling this nut in the unroasted condition. This might be anticipated since the species is closely allied to our poisonous sumac and ivy in this country.

From the standpoint of composition these nuts are characterized by high contents of oil and relatively high protein. The carbohydrate is correspondingly low, particularly the part which may be regarded as available. Cashew nuts are conspicuous in the group in that they contain over 13 per cent. of starch.

EGGS.

Frequent requests are received from the Dairy and Food Commissioner to determine whether eggs sold under the designation of "fresh" are in fact fresh eggs. The examination made in such cases has been based chiefly upon the characteristics of the eggs as shown before the candle and on breaking out of the shell as noted in a previous report.[1] Lythgoe[2] and others, cite the determination of ammonia as useful additional evidence in deciding the question of freshness. The actual figures obtained for ammonia content, however, are always to be interpreted in connection with evidence obtained as to physical characteristics and also with inspection evidence.

We have made a limited number of trials in which eggs of known freshness[3] were held for a period of 40 days, the ammonia content being determined at intervals during that time. The eggs were held in a reasonably dry atmosphere protected from light, and the temperature varied from 36° to 73° F, the average mean temperature being 56° F. These conditions probably represent those under which eggs are often held in practice. There were 24 eggs in the lot and they were examined in eight groups of three eggs each. The results are not regarded as final criteria for classification but they are useful for reference and furnish some interesting comparisons. In general the air spaces were less than 1 inch in diameter (5/8 to 7/8), until the eggs were 21 days old. Until about this time also the yokes were not appreciably settled and the whites remained fairly firm. After 21 days the air spaces were one inch or more in diameter, the yolks were uniformly settled to one side of the shell and the whites were thin or watery.

Ammoniacal nitrogen determined at four intervals between 1 day and 15 days ranged from 1.3 to 2.1 milligrams and averaged 1.9 milligrams per 100 grams of egg. The average for the interval twenty-two to thirty-two days was 2.3 milligrams and from thirty-three to forty days it was 2.9 milligrams per 100 grams. Ammoniacal nitrogen was not found uniformly progressive in the later intervals but, in general, the results showed that up to two weeks the average content was slightly under 2 milligrams; from then up to one month the average was less than 2.5 milligrams and thereafter and up to about six weeks the average was 2.9 milligrams. At about three weeks the eggs, under the conditions of this experiment, began to show the characteristics of staleness, as judged by candling, at which time the ammoniacal nitrogen was found to be somewhat in excess of 2 mgs. per 100 grams of egg. At the end of the experiment the eggs were very stale but not rotten and the ammoniacal nitrogen found was about 3 mgms. per 100 grams.

Remington[4] has cited the probable limits of ammoniacal nitrogen in fresh eggs as from 1 to 1.5 mgms. per 100 grams. At about 2 mgms. the characteristics of staleness are noted and eggs containing 2.5 mgm. or more are very stale. Lythgoe[5] regards a strictly fresh egg as not exceeding 1 mgm. of ammonia while one containing 2 mgms. might be regarded as reasonably fresh. Lythgoe further suggests that large air spaces with low ammonia indicate eggs held at low (cold storage) temperature, while large air spaces with high ammonia indicate eggs held at higher temperatures.

A sample consisting of twelve eggs purchased in the market as *fresh* showed air spaces generally less than three-fourths of an inch in diameter, yolks and whites were normal and the ammonia content varied from 0.9 to 1.3 mgms., averaging 1.0 mgm. per 100 grams. The eggs clearly qualified as fresh.

Six other samples of six eggs each were purchased at prices ranging from thirty to forty-five cents per dozen, the quality of freshness being emphasized or implied in most cases. One of these samples might be passed as reasonably fresh, but the others, though edible, could not be called fresh eggs.

Determination of Ammoniacal Nitrogen in Eggs.

For the determination of ammoniacal nitrogen an adaptation of the Folin method was employed.

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[1] Conn. Exp. Sta. Bull. 248, p 394.
[2] Mass. State Board of Health, Report of 1911, p 431.
[3] The eggs were laid March 1st, 1923 and were less than 24 hours old when the experiment began.
[4] U. S. Dept. Agr., Bull. 51, July 1914.
[5] Loc. citu.

REAGENTS.

Nessler solution: Prepare as described in A. O. A. C. Methods of Analysis, p. 22.

Sodium carbonate: Saturated solution.

Potassium oxalate: Saturated solution.

White Mineral Oil.

Hydrochloric acid, N/10: Make approximately N/10 by diluting concentrated hydrochloric acid with ammonia-free water.

Ammonia-free water: Redistil distilled water from alkaline potassium permanganate and reject the first portion of the distillate. Acidify the remainder of the distillate with dilute sulphuric acid and distil again.

Standard ammonium sulphate: Aerate a concentrated solution of ammonium chloride, which has been made alkaline with sodium hydroxide, into dilute sulphuric acid until the acid is neutralized, using the regular Folin aeration apparatus. Precipitate the ammonium sulphate by means of alcohol, filter and wash with alcohol. Dissolve and reprecipitate the salt, filter and dry in a vacumm desiccator. Take 0.4717 gm. of the dry ammonium sulphate and make up to 500 cc. Five cc of this solution is equivalent to 1 mgm. of nitrogen.

DETERMINATION.

Break three eggs into a suitable dish and mix by beating thoroughly. Weigh 20 gms. into the cylinder of the Folin apparatus, add 5 cc of sodium carbonate, 2 cc of potassium oxalate and 5 cc of mineral oil. Place 2 cc of N/10 hydrochloric acid and 50 cc of ammonia-free water in a 100 cc graduated flask used as a receiving flask. Connect the apparatus with the blast pump and aerate the sample for two hours. Nesslerize the contents of the receiving flask as follows: Take 5 cc of Nessler solution, dilute with 25 cc of ammonia-free water, add it to the contents of the receiving flask in three portions, mixing after each addition, then make up to volume of 100 cc and thoroughly mix. Take 5 cc of standard ammonium sulphate solution, dilute with ammonia-free water, add 5 cc of Nessler solution diluted with 25 cc of ammonia-free water and make up to volume of 100 cc. Estimate the amount of nitrogen in the unknown solution by comparison with this standard solution (which contains 1 mgm. of nitrogen), using a Duboscq colorimeter.

Determine the efficiency of the apparatus from time to time by aerating known quantities of the standard solution. Introduce also the necessary correction for blanks run with the reagents alone at the time of each trial or series of trials.

FATS AND OILS.

Butter.

Five samples of butter were examined for the Dairy and Food Commissioner and all were passed as genuine.

Cocoanut Fat.

A sample of a fat was submitted by Prof. Fisher of Storrs for identification. Constants were determined as follows:

Polensky No. 11.7, Reichert-Meissel No. 7.2, Kirschner No. 2.3, Butyro-refractometer reading at 40° C, 36.

The constants indicated cocoanut fat which the sample proved to be.

Cooking Fats.

A sample of Nut-z-all, D. C. No. **24809** was examined as follows:

Moisture 10.73 per cent., fat 87.58 per cent., salt 1.37 per cent., casein (by difference), 0.26 per cent., undetermined mineral matter 0.06 per cent. Butyro-refractometer reading at 40°C. 36.5°. Reichert-Meissel No. 8.95. Halphen test negative.

The sample has substantially the same composition as that of other vegetable fat margarines which we have examined.[1]

Olive Oil, etc.

Seven samples were examined six of which were submitted by the Dairy and Food Commissioner. Five were sold for olive oil and no adulterants were found. Two samples contained cotton-seed oil. They were not, however, sold as olive oils but as table oils.

Phosphoric Acid Content of Some Cooking Fats.

A number of cooking fats were examined for phosphoric acid in connection with the determination of alcohol-ether-soluble phosphorous in baked products. Lard, Snowdrift, Crisco, Mazola, Oleomargarine, vegetable oil margarine and butter were included. The clear fats were ashed and treated as described in the methods of Jacobs and Rask[2]. In no case did the fats show more than traces of phosphoric acid (P_2O_5), by the method employed. In the case of butter and the margarines, when the whole products were used, appreciable quantities of total phosphoric acid were found due to the non-fat milk constituents present. Thus butter contained 0.038 per cent., oleomargarine 0.024 per cent., and vegetable oil margarine 0.019 per cent. of total phosphoric acid (P_2O_5).

[1] Conn. Exp. Sta., Bull. 210, p 203. 1918.
[2] Jour. Assoc. Official Agr. Chemists, **6**, 11. 1922.

FLOUR.

In connection with the analysis of egg-flour mixtures as described under alimentary pastes,[1] fifteen samples of commercial flour, analysis of which were published last year,[2] were further examined for lipoid phosphoric acid by the alkaline extraction method of Jacobs and Rask as used in the examinations of our egg-flour mixtures and of commercial noodles. In addition to these flours three authentic samples[3] of recognized grades of flour were also analyzed. A summary of the results obtained on the market flours and the analyses of the three authentic samples are given in Table VIII.

Table VIII. Analyses of Commercial Flour and of Three Authentic Samples of Flour.

Description.	Moisture, (5 hrs. at 105°C)	Ash	Protein, (N. x 5.7)	Fat, (Alc-ether extract)	Acidity, (as lactic acid)	Lipoid-P_2O_5, (moisture-free basis)
Commercial flours	%	%	%	%	%	%
Maximum	13.63	0.48	11.97	1.67	0.13	0.060
Minimum	11.18	0.36	7.03	1.03	0.06	0.035
Average	12.21	0.43	9.79	1.38	0.10	0.046
Authentic samples						
First patent	9.70	0.38	11.40	1.21	....	0.043 +
Straight	10.08	0.48	11.74	1.50	....	0.045 –
First Clear	9.77	0.64	13.11	1.66	....	0.045 +

The figures obtained for the alcohol-ether soluble phosphoric acid content of flour are, on the average, somewhat lower than have been reported by some other workers. In the method employed,[4] after evaporating the combined extracts to dryness there was found to be a considerable amount of material which was insoluble in the ether-petroleum ether mixture and this was removed by filtration. Filtration at this point is a departure from the method as described but it seemed evidently improper to include material insoluble in the reagents indicated. This may be a partial explanation of the discrepancy noted.

GELATIN

A sample of gelatin, **21225,** made by the Grayslake Gelatine Co., Grayslake, Ill., was examined as follows:

Moisture, determined 12.92 per cent.; by difference 12.47 per cent.; ash 0.26 per cent.; nitrogen 15.72 per cent., equivalent to gelatin 87.24 per cent.,

[1] See page 167.
[2] Conn. Exp. Sta. Bull. 248, p. 401.
[3] These were obtained through the courtesy of Mr. C. B. Morison, American Institute of Baking.
[4] Jour. Assoc. Official Agr. Chemists, **6**, 11. 1922.

(factor 5.55); fat 0.03 per cet.; keratin none found; arsenic none found; copper slight trace; zinc trace(?); in hot water solution, clear and no odor.

The analysis indicates a very pure product.

HONEY.

One sample of comb honey, **21603,** was submitted by a producer. Partial analysis was made as follows:

Ash 0.41 per cent.; moisture (in vacuum over sulphuric acid, room temp.) 10.67 per cent.; polarization—2.4° at 20° C.

The results obtained are substantially within the limits as given for honey by Leach.[1]

ICE CREAM.

Three hundred and thirty-nine samples of ice cream have been examined for the Dairy and Food Commissioner and two samples have been submitted from other sources. A summary of the results by towns or cities is given in Table X.

Only five samples were found to be substantially deficient in milk fat. One sample purchased from Rosario Cipolla, Hartford, was found to contain but 3 per cent. of fat. Two samples taken subsequently contained approximately the same amount but the dealer was protected by the display of a sign declaring the composition of his product.

The samples presumed to be of standard quality, but found to be deficient are as follows (Table IX):

TABLE IX. ICE CREAM BELOW STANDARD.

No.	Dealer	Manufacturer	Flavor	Fat
	Hartford			%
24937	Rosario Cipolla	Own make	Vanilla	**3.0**
	New Britain			
25647	Charlie Piccolei	Own make	Vanilla	**5.1**
	New Haven			
27236	Francisco De Felice	Own make	Vanilla	5.4
	Stamford			
26758	A. Esposito	Own make	Vanilla	7.1
	Unionville			
26018	Charles A. Hackney	Own make	Vanilla	6.7

[1] Food Inspection and Analysis, p. 666.

TABLE X. INSPECTION OF ICE CREAM.

City or Town	No. of Samples	Fat Content, Range		Average
		%	%	%
Ansonia	10	11.2	8.0	10.0
Bridgeport	33	21.0	7.8	12.0
Bristol	3	15.6	11.2	13.7
Collinsville	2	15.4	15.4	15.4
Crescent Beach	1	....	....	16.0
Danbury	11	17.2	9.2	11.7
Danielson	1	....	....	9.6
Derby	1	....	....	9.2
Forestville	3	15.0	11.4	12.8
Greenwich	5	15.4	11.2	13.5
Hartford	34	18.4	2.8[1]	13.5
Jewett City	2	18.0	14.0	16.0
Litchfield	1	....	...	13.8
Meriden	8	14.4	9.4	11.5
Middletown	9	17.6	12.8	14.8
Montville	1	....	....	8.0
Moosup	2	22.0	20.0	21.0
Mystic	3	24.0	12.0	18.3
Naugatuck	5	13.2	9.2	10.8
New Britain	12	14.0	5.1	11.1
New Haven	46	20.4	5.4	11.8
New Milford	5	18.4	7.8	11.6
New London	16	20.0	10.0	14.9
Norwalk	3	13.8	8.6	11.0
Norwich	12	24.0	10.0	15.4
Pawcatuck	4	19.6	10.8	15.2
Plainfield	1	....	....	13.0
Plainville	2	16.4	11.4	13.9
Pomfret	2	24.0	20.0	22.0
Portland	1	....	....	14.8
Putnam	7	22.0	12.4	16.1
Rockville	2	16.4	16.0	16.2
Somers	1	....	....	16.0
Somerville	1	....	....	11.6
Southington	1	....	....	14.8
South Manchester	4	16.0	11.2	13.3
South Norwalk	3	15.6	11.2	12.7
Stafford Springs	6	17.4	12.0	14.9
Stamford	12	17.4	7.1	11.5
Stonington	1	....	....	14.0
Stratford	1	....	....	11.4
Suffield	3	11.4	8.6	9.9
Terryville	1	....	....	10.0
Thomaston	3	14.8	11.2	12.6
Thompsonville	7	14.4	8.4	12.8
Torrington	7	14.4	7.4	11.0
Unionville	2	6.7	6.2	6.4
Wallingford	8	16.0	11.6	14.1
Waterbury	13	15.0	8.4	11.4
Waterford	1	....	....	10.4
West Wauregan	2	11.2	8.0	9.6
Willimantic	9	16.0	8.8	14.3
Winsted	5	18.4	9.8	13.4
Total	339			

[1] Sign displayed declaring per cent. of fat.

The manufacturers of ice cream may be divided, broadly, into two groups, *viz.*, those who exercise careful factory control and aim to keep their output reasonably close to the legal standard for fat; and those who intentionally make high-fat products for a special trade or who unintentionally, through lack of control, put more milk fat into their product than the law requires. In general, the large producers belong to the first-named group, and without data as to the comparative production of the two groups a study of the results for fat obtained on official samples will not give an adequate idea of the average fat content of ice cream sold in the State. However, with proper reservations it is of interest to consider, on the basis of fat content, the classification of official samples of ice cream examined in the five years since the ice cream law became effective.

CLASSIFICATION OF OFFICIAL SAMPLES OF ICE CREAM ON BASIS OF FAT CONTENT, 1919-1923 INCL.

	No. of Samples	Per cent.
8.0–9.9 per cent. fat	387	26.1
9.9–11.9 per cent. fat	344	23.2
12.00 per cent. and above	609	41.1
Below 8 per cent	142[1]	9.6
Total	1482	100.0

DETERMINATION OF FAT IN ICE CREAM.

The necessity for a rapid test for fat in ice cream has been felt by all analysts who are required to test ice cream in a routine way for purposes of control. For this purpose various modifications of the Babcock test have been suggested from time to time, but none have proved to be uniformly satisfactory or reliable. We have used the method as described by Lichtenberg[2] which, according to Troy[3], is substantially like a procedure previously described by Ross. A method suggested by Utt[4] employs the same reagents but after the addition of acetic-sulphuric acids the mixture is heated before centrifuging. A procedure[5] which is a combination of the two just mentioned, but which gives better satisfaction than the Lichtenberg method which we have heretofore used, is carried out as follows:

Transfer 9 grams of the well mixed sample to a 10 per cent. milk test bottle. Add 10 cc. of glacial acetic acid, mix thoroughly, and place in a water bath at a temperature of 75°–80° C for thirty minutes, shaking the bottle several times during the heating. Remove from the bath, add 5 cc. of water and 10 cc. of sulphuric acid of the strength used in the Babcock test. Mix thoroughly and

[1] Includes 32 fruit ice creams of legal standard, viz., 6 per cent.
[2] J. Ind. Eng. Chem., **5**, 786. 1913.
[3] Ibid., **5**, 960. 1913.
[4] Ibid., **7**, 773. 1915.
[5] Suggested by R. E. Andrew.

whirl in a centrifuge for 10 minutes. Add hot water up to the neck of the bottle and whirl for five minutes after which bring the fat column up into the graduation and whirl for three minutes longer. Multiply the fat reading by two for the percentage of fat in the sample.

The Roese-Gottlieb method is used in all cases where an amount of fat less than that required by the standard is found.

MILK AND MILK PRODUCTS.

MARKET MILK.

Twelve hundred and twenty-eight samples of milk have been examined for the Dairy and Food Commissioner and on the results of analyses are classified as follows:

Not found adulterated	706	57.5%
Adulterated by dilution with water	113	9.2
Adulterated by skimming	73	5.9
Adulterated by skimming and diluting with water	3	0.2
Adulterated by reason of being		
below standard in solids and solids not fat	136	11.1
below standard in solids and fat	29	2.4
below standard in solids, fat and solids-not-fat	168	13.7
Total	1228	100.0

Samples found to be adulterated by dilution with water, by skimming or by skimming and dilution are given in Table XI.

One hundred and thirty-one samples submitted by consumers or producers require no particular comment.

TESTER'S LICENSE.

Three samples of milk and nine samples of cream were tested for fat to check results obtained by candidates for license to test milk and cream as required by Sec. 1 of Chapter 180, Public Acts of 1923 amending Sec. 2464 of the General Statutes.

EVAPORATED MILK.

Twenty-three samples of evaporated milk and one of evaporated skimmed milk were collected by the Station agent. One sample was submitted by the Dairy and Food Commissioner and three were received from other sources.

The standard for *condensed milk*, *evaporated milk*, *concentrated milk*, requires, all tolerances allowed for, not less than 7.8 per cent. of milk fat and not less than 25.5 per cent. of total milk solids; provided, however, that the sum of the percentage of fat and of total solids be not less than 33.7[1].

Analyses of these samples are given in Table XII.

[1] F. I. D. 189.

TABLE XI. ADULTERATED MILK.

No.	Dealer	Solids	Fat
	Containing Added Water		
	Ansonia.	%	%
25856	Sam Ferlo	10.97	3.5
25857	Sam Ferlo	10.71	3.2
	Branford.		
26972	William Hall	11.01	3.4
25837	G. G. Nesbit	10.93	3.4
	Brewster, N. Y.		
25777	Weizenecker Bros	10.17	3.2
25778	Weizenecker Bros	10.34	3.2
25779	Weizenecker Bros	10.10	3.1
25780	Weizenecker Bros	10.05	2.9
25781	Weizenecker Bros	9.61	2.9
25782	Weizenecker Bros	10.2	2.7
25783	Weizenecker Bros	9.52	2.7
25784	Weizenecker Bros	10.03	2.9
	Bridgeport.		
24857	R. F. Barske	10.96	3.3
24858	R. F. Barske	11.33	3.6
24859	R. F. Barske	10.98	3.4
24794	Connecticut Lunch	10.53	2.9
24662	John Pappas	10.62	3.2
25916	Snow & Snow	10.52	3.2
24797	The Brothers Lunch	10.53	3.0
	Bridgewater.		
25787	Lee S. Dickenson	9.32	2.7
25788	Lee S. Dickenson	10.39	3.2
25789	Lee S. Dickenson	10.55	3.1
25790	Lee S. Dickenson	9.42	2.6
	Colchester.		
25711	A. Macker	10.47	3.1
25712	S. Schmil	8.87	2.6
25713	S. Schmil	7.90	2.0
	Cornwall Bridge.		
24616	H. Chapman	10.47	3.1
24617	H. Chapman	10.46	3.3
24618	H. Chapman	9.10	3.0
24619	H. Chapman	11.09	3.4
24620	H. Chapman	9.29	2.3
22247	W. Livenstone	10.92	3.2
22232	F. Lorch	11.42	3.7
22238	J. Lorch	10.25	3.0
24611	Mrs. P. Tamgo	10.72	3.1
	Containing Added Water—*Continued.*		
	Danbury.	%	%
25775	Morey Bros. Store	10.31	3.2
25771	Pure Milk & Cream Co.	10.22	3.1
25776	United States Stores Company	10.54	3.3
	Durham Center.		
25235	W. I. Parmelee	9.33	2.8
25236	W. I. Parmelee	8.52	2.7
25237	W. I. Parmelee	9.26	2.9
25238	W. I. Parmelee	9.40	3.1
25239	W. I. Parmelee	9.16	2.8
25240	W. I. Parmelee	11.33	3.6
25241	W. I. Parmelee	9.71	3.3
	East Haddam.		
25710	Max Ludnar	10.36	3.3
	East Hampton.		
25709	J. M. Peters	9.68	2.9
	East Haven.		
26955	Thomas Shirsky & Son	9.86	2.8
	Goshen.		
25993	H. E. Cass	11.93	4.4
	Leonard's Bridge.		
26305	Root Bros.	10.97	3.6
	Meriden.		
26365	C. H. Childs	11.13	3.6
27700	C. H. Childs	11.56	4.0
27703	C. H. Childs	11.44	3.9
26370	Wm. Hozlett	7.31	2.8
24523	E. J. Kaemner	11.66	3.6
26368	Wm. Pomeroy	10.66	3.2
24516	Presto Lunch	11.21	3.6
24526	Presto Lunch	11.42	3.4
24517	Quality Lunch	11.23	3.6
24527	Quality Lunch	11.40	3.6
24518	Smart's Lunch	10.87	3.1
24528	Smart's Lunch	11.06	3.3
	Monroe.		
26985	Sam. Goldstein	11.15	3.6
26983	Anton Shura	11.19	3.8
26984	Anton Shura	10.70	3.1

TABLE XI. ADULTERATED MILK—(*Continued*).

No.	Dealer	Solids	Fat
	Containing Added Water—*Continued.*		
	New Britain.	%	%
24874	James Portigo	11.24	3.5
24876	James Portigo	10.91	4.3
24877	James Portigo	9.74	3.2
25026	Tony Tomaszeski	10.23	2.9
	New Hartford.		
26520	Louis Malaten	10.40	3.1
26522	Louis Malaten	10.30	3.0
	New Haven.		
24729	T. F. Fitzsimmons	12.64	5.5
	New Preston.		
27469	John Chemski	10.62	3.2
27470	John Chemski	10.07	2.6
27472	John Chemski	10.31	2.9
	Newtown.		
26990	Chas. R. Beardsley	10.71	3.3
26991	Chas. R. Beardsley	10.80	3.5
	Northford.		
26389	D. Formissano	10.90	3.5
	North West Chester.		
25708	John Lensewsky	10.03	3.4
	Orange.		
27681	C. Winkle	10.25	3.6
27748	C. Winkle	10.62	4.2
27749	C. Winkle	12.05	4.7
27683	Philip Yarash	10.24	3.2
27750	Philip Yarash	10.04	3.3
27751	Philip Yarash	11.27	4.1
	Rockville.		
27319	Louis Pestretto	9.49	2.8
27320	Louis Pestretto	8.96	2.4
27321	Louis Pestretto	10.26	3.4
27322	Louis Pestretto	10.18	3.4
	Roxbury.		
25792	N. Oguan	9.65	2.6
	Containing Added Water—*Concluded.*		
	Shelton.	%	%
26361	Joe Ovesny	10.43	3.3
	So. Manchester.		
24543	Frank Beccio	10.43	3.3
24544	Frank Beccio	10.55	3.4
	Stamford.		
24805	Bliss Lunch	10.76	3.4
	Stepney.		
14518	I. Sippin	9.47	3.1
	Trumbull.		
24162	Jessie G. Lyon	9.60	3.1
24163	Jessie G. Lyon	10.80	3.0
24164	Jessie G. Lyon	9.17	2.7
	Wallingford.		
25582	Geo. Nesbit	10.95	3.5
25898	Mrs. A. E. Quigley	7.03	1.9
25899	Mrs. A. E. Quigley	9.71	3.4
26350	Mrs. A. E. Quigley	9.52	3.1
	Westport.		
25942	Silverbrook Farm	11.16	3.6
25945	Silverbrook Farm	10.50	3.1
25946	Silverbrook Farm	8.48	2.3
25947	Silverbrook Farm	8.32	2.2
	West Cheshire.		
27708	Howard E. Ives	10.06	3.2
	West Chester.		
25707	Solomon Sugannan	11.46	4.3
	West Hartford.		
24950	C. A. Carlson	10.17	2.6
	Yalesville.		
27752	Chas. Carttanota	9.75	3.1
27753	Chas. Carttanota	9.27	2.6
	Yantic.		
25724	Gregory Muckensturm	9.04	2.2
25714	Wm. Tibbitts	8.59	2.7
25715	Wm. Tibbitts	8.34	2.8
25716	Wm. Tibbitts	8.52	2.7

TABLE XI. ADULTERATED MILK—(*Continued*).

No.	Dealer	Solids	Fat
	Skimmed Milk		
	Amston.	%	%
26404	Morris Freeman	11.19	2.7
	Bridgeport.		
22984	Columbia Lunch	10.52	2.2
22988	Garden Restaurant	10.66	2.3
22986	Harvard Lunch	10.91	2.4
22979	477 Main Street	10.79	2.3
24650	Pappas Bros.	9.50	1.1
22990	Phoenix Lunch	11.09	2.7
	Danbury.		
23421	Joe Hurst	9.77	1.5
	Danielson.		
25180	Wm. S. Brown	9.50	1.1
	Hartford.		
24764	Armory Lunch	10.70	1.9
24761	Asia Restaurant	10.00	1.1
24313	Baldwin's Lunch	11.42	2.3
24314	Central Lunch	10.04	0.8
26543	Colt's Lunch	11.93	2.2
24319	Cranton's Coffee Lunch.	11.56	2.5
27207	Crystal Lunch	11.08	2.2
24317	Eagle Lunch	10.34	1.7
24340	Gem Lunch	9.99	1.3
24754	Grand Restaurant	11.24	2.7
27311	Hillside Lunch	10.91	1.9
24758	Jack's Lunch	12.45	3.2
27609	Kosher Restaurant	9.83	1.0
24320	Longley's Lunch	10.71	2.0
24798	McNamara Lunch	10.30	2.1
26549	New Way Lunch	10.94	2.3
24326	Victory Lunch	9.58	1.0
27204	Victory Lunch	10.30	1.6
24343	Virginia Lunch	9.90	1.1
26529	Waldorf Lunch	11.44	2.7
26539	Waldorf Lunch	10.72	1.7
27601	Waldorf Lunch	10.32	1.2
24753	Washington Lunch	9.72	1.2
27611	Washington Lunch	10.43	1.5
26546	Welcome Lunch	11.27	2.4
	Leonard's Bridge		
25892	Root Bros.	10.29	1.8
	Moosup.		
25191	A. T. Hill	11.58	2.7
	Skimmed Milk— *Continued.*		
	New Britain.	%	%
24771	Hudson Lunch	11.22	2.6
	New Haven.		
24841	B. & L. Lunch	11.08	2.4
24715	Barberito Lunch	10.98	1.7
25123	Chicago Lunch	10.86	2.3
24828	Citizen's Lunch	10.14	1.7
24816	Diamond Lunch	9.79	1.1
25118	Grand Restaurant	9.46	0.8
24840	Loft's Inc	11.00	2.5
25109	New Haven Oyster and Chop House	10.79	2.3
24833	Old Homestead Lunch	10.63	1.9
25111	James Otis Restaurant	10.48	2.0
25102	Oxford Lunch	9.54	1.2
24813	P. & G. Restaurant	10.46	1.9
24713	Quality Del. & Lunch	11.17	2.6
24817	Mrs. Root's Food Shop.	10.24	1.8
24700	Smith Lunch	11.30	2.6
24707	Waterbury's Luncheonette	11.38	2.6
	Newington.		
27251	M. Gacovitz	10.60	2.1
	Northford.		
25244	Fred Wellman	11.62	2.9
	Plainville.		
22977	Collins Restaurant	10.21	1.3
	South Norwalk.		
22993	Savoia Restaurant	11.37	2.8
	Stamford.		
24677	Carter's Lunch Room	9.64	1.6
24800	Hartford Lunch	10.25	2.0
24670	Joe Kerbel	9.27	1.5
24671	S. J. Ross	10.17	2.2
	Torrington.		
26162	Mrs. H. Hennessey	10.82	2.2
	Wallingford.		
27593	Louis Naisnerska	11.25	2.2
27594	Louis Naisnerska	11.00	2.2
27595	Louis Naisnerska	11.19	2.2

TABLE XI. ADULTERATED MILK—(*Concluded*).

No.	Dealer	Solids	Fat
	Skimmed Milk— *Continued.*		
	Waterbury.	%	%
22954	A. Blazevich	12.06	3.0
22960	Boston Lunch	11.41	2.5
22966	Hodson-Dean Lunch	11.01	2.4
22962	Plaza Lunch	10.96	2.3
22965	Star Lunch	10.60	2.1
	Willimantic.		
25368	Joe Putnyk	11.10	2.3
25367	R. Verry	10.84	2.3
	Skimmed Milk— *Concluded.*		
	Woodbridge.	%	%
24190	Pattsy Lonzo	9.80	2.0
	Skimmed and Watered		
	Bridgeport.		
24665	Efford & Murray	9.48	2.0
24792	Home Restaurant	10.10	2.5
22987	New York Lunch	9.17	2.2

It will be noted that the requirements of the standard are such that the sum of the percentages of solids and fat shall not be less than 33.7, that is to say, if an evaporated milk contains only the minimum of fat, viz., 7.8 per cent., then it cannot have also the minimum of 25.5 per cent. of solids, but must have at least 25.9 per cent. to make the required sum of 33.7; on the other hand a brand having the minimum of total solids (25.5 per cent.), must have at least 8.2 per cent. of fat.

The analyses show that the samples examined equalled or exceeded the standard in practically all cases. One sample of *Dairylea*, **21615**, was deficient, but two others fully met the requirements. *Sealect* brand, **20412**, was also deficient; a second sample could not be secured.

SWEETENED CONDENSED MILK.

One sample was submitted by Prof. Fisher of the Storrs Station to be examined for sucrose. It was found to contain 42.64 per cent. of that sugar.

CHOCOLATE-MILK MIXTURES.

Two samples of milk or skimmed milk mixed with cocoa or chocolate have been submitted for analysis. These were sold under the distinctive names of "*400*" and "*Angel Drink*" and were bottled by dairies. In substance they are analogous to the so-called chocolate-milk drinks long sold at soda fountains. In some States regulations have been passed fixing a minimum of milk fat which such products shall contain but no special regulations have been issued in this State.

Analyses of the products examined are as follows (p. 199).

TABLE XII. ANALYSES OF EVAPORATED MILK.

Sta. No.	Brand and Manufacturer or Dealer	Water	Solids	Ash	Protein (N x 6.38)	Fat	Solids + Fat	Milk Sugar, (by difference)
	Evaporated Milk	%	%	%	%	%	%	%
20409	*A. & P.*, The Great A. & P. Co.	73.21	26.79	1.60	6.64	8.03	34.82	10.52
21672	*Armour's Veribest*, Armour & Co., Chicago, Ill.,	73.93	26.07	1.57	6.76	7.95	34.02	9.79
21629	*Borden's.* The Borden Co., N. Y.	73.98	26.02	1.57	7.98	8.18	34.20	8.29
21621	*Carnation.* Carnation Milk Products Co., Chicago, Ill.	74.48	25.52	1.49	6.38	8.30	33.82	9.35
20516	*Connecticut Valley.* S. Vogel & Sons, Hartford, Conn.	73.74	26.26	1.60	6.64	7.50	33.76	10.52
20670	*Connecticut Valley.* S. Vogel & Sons, Hartford, Conn.	.....	.....	.....	.....	7.80	.....	.....
20423	*Dairylea.* Dairyman's League Cooperative Asso., Inc.	72.14	27.86	1.70	6.76	8.21	36.07	11.19
21838	*Dairylea.* Dairyman's League Cooperative Asso., Inc.	74.21	25.79	1.61	6.57	8.13	33.92	9.48
21615	*Dairylea.* Dairyman's League Cooperative Asso., Inc.	72.96	27.04	1.59	6.89	5.81	32.85	12.75
21651	*Daisy.* Defiance Dairy Products Co., Defiance, Ohio	74.24	25.76	1.58	6.64	7.89	33.70	9.65
20415	*Fonda.* Fond du lac, Wis[1]	73.78	26.22	1.58	6.70	7.83	34.05	10.11
21626	*Good Luck.* John F. Jelke Co., Huntley, Ill.	74.04	25.96	1.56	6.12	7.72	33.68	10.56
21705	*Lee.* H. D. Lee Mercantile Co., Waterbury, Conn.	74.13	25.87	1.66	6.76	7.91	33.78	9.54
21623	*Libby's.* Libby, McNeil & Libby, Chicago, Ill.	73.65	26.35	1.56	6.25	7.77	34.12	10.77
21633	*Mohican Special.* The Mohican Co., N. Y.	73.64	26.36	1.63	6.38	8.52	34.88	9.83
21616	*Nestle's Every Day.* Nestle's Food Co., N. Y.	73.71	26.29	1.54	6.00	7.91	34.20	10.84
21685	*Page.* Condensed Milk Co., N. Y.	74.30	25.70	1.57	6.70	7.85	33.55	9.58
21618	*Pet.* Helvetia Milk Condensing Co., St. Louis, Mo.	73.69	26.31	1.57	6.38	7.93	34.24	10.43
20421	*Pocono.* Jones Bros. Tea Co., N. Y.	73.63	26.37	1.55	6.06	7.56	33.93	11.20
21840	*Pocono.* Jones Bros. Tea Co., N. Y.	74.20	25.80	1.65	6.70	7.90	33.70	9.55
20412	*Sealect.* Sheffield Condensed Milk Co. Inc., N. Y.	73.91	26.09	1.56	5.93	7.25	33.34	11.35
21640	*Sunbeam.* Austin, Nichols & Co., N. Y.	73.88	26.12	1.63	6.95	8.02	34.14	9.52
20425	*Van Camp's.* The Van Camp Packing Co. Indianapolis, Ind.	71.28	28.72	1.73	7.72	7.56	36.28	11.71
21839	*Van Camp's.* The Van Camp Packing Co., Indianapolis, Ind.	73.23	26.77	1.73	6.64	7.95	34.72	10.45
21710	*Van Dyke's.* James Van Dyke Co., N. Y.	74.23	25.77	1.59	6.44	8.04	33.81	9.70
26951	[2]*Brand Unknown*	.....	.....	.....	.....	8.13	.....	.....
	Evaporated Skim Milk.							
21654	*Carolene.* Carolene Products Co., Detroit, Mich.	78.62	21.38	1.69	7.66	2.02	23.40	10.01

[1] Label damaged, manufacturer's name obscured.
[2] Dairy Commissioner's Series.

21810. *"400"*. Water 86.01 per cent.; solids 13.99 per cent.; ash 0.59 per cent.; fat (Roese-Gottlieb), 3.21 per cent.; total nitrogen 0.38 per cent.; protein (N. x 6.25), 2.38 per cent.; casein, determined,[1] 1.48 per cent.

21811. *"Angel Drink"*. Water 83.21 per cent.; solids 16.79 per cent.; ash 0.67 per cent.; fat (Roese-Gottlieb), 3.51 per cent; total nitrogen 0.44 per cent.; protein (N. x 6.25), 2.75 per cent.; casein, determined,[1] 1.81 per cent.

HUMAN MILK.

Sixteen samples of breast milk have been examined. The samples were submitted by Visiting Nurse Associations and by physicians. We impress upon those who submit samples that analyses may be very misleading unless the entire secretion of the gland is drawn and thoroughly mixed before sampling. The variations which may occur in different portions of human milk have been noted in a previous bulletin.[2]

Analyses of samples submitted during the year are given in Table XIII.

TABLE XIII. ANALYSES OF HUMAN MILK.

No.	Solids	Protein, (N.x 6.38)	Fat	Sugar	Ash
	%	%	%	%	%
19973	....	1.83	3.2	....	....
20628	13.45	1.45	4.4	7.60	....
20712	12.85	1.38	4.60	6.67	0.20
20747	15.08	0.94	6.80	7.17	0.17
20749	15.73	1.56	7.0	6.96	0.21
20890	9.97	1.44	1.4	6.88	0.25
21037	.....	1.43	5.5	....	....
21038	13.29	1.29	4.8	6.98	0.22
21362	10.88	1.17	2.4	7.08	0.23
21520	10.00	1.33	1.2	7.23	0.24
21573	.....	....	4.2	....	....
21590	10.17	1.12	1.7	7.10	0.25
21598	11.65	1.23	3.1	7.09	0.23
21723	12.74	1.44	5.0	5.99	0.31
21724	9.51	1.06	1.5	6.73	0.22
21945	....	1.38	3.6	....	....

MEAT PRODUCTS.

HAMBURG STEAK.

Hamburg steak rapidly deteriorates and develops a tainted or foul odor and an unattractive appearance. To deodorize the product and simulate the red color associated with fresh meat sodium sulphite or other salt of sulphurous acid is frequently employed. The use of sulphites for this purpose is in violation of the provisions of the food law, more particularly in that it conceals damage or inferiority.[3]

[1] Methods of Analysis, A. O. A. C., p. 267.
[2] Conn. Exp. Sta., Bull. 227, p. 255. 1920.
[3] Conn. Reg. 51.

Of fifty-nine samples examined for the Dairy and Food Commissioner, fifteen contained sulphites in amounts ranging from 326 milligrams to over 2,500 milligrams of sulphur dioxide per kilo of sample.

The samples in which this disinfectant was found are as follows:

TABLE XIV. HAMBURG STEAK CONTAINING SULPHITES.

D. C. No.	Sampled at		Sulphites (SO_2), mgms. per kilo.
25623	*Bridgeport,*	Chicago Market	1912.0
25620		Washington Market	865.0
25627	*Derby,*	F. Swist	426.0
25056	*Hartford,*	Hartford Cash Market Co.	834.0
25094	*New Britain,*	S. Welniskey & Sons	749.0
25080	*New Haven,*	A. M. Levine	784.0
25067		Congress Cash Market	1805.0
25618		Georges Market	1657.0
25611		E. Schoenberger & Sons	1281.0
25614		Capitol Market	1262.0
25617		William Miller Co.	326.0
25268	*Norwich,*	S. &. W. Self Service Co.	441.0
24848	*Union City,*	People's Market	1624.0
25626	*Waterbury,*	Waterbury Cash Market	2535.0
25602		Fulton Market	2470.0

A powder, **25630,** used for treating hamburg steak was submitted by the Dairy and Food Commissioner and found to contain sulphur dioxide equivalent to about 96 per cent. sodium sulphite (Na_2SO_3).

SAUSAGE.

The addition of cereal products or other starchy materials to sausage is not an uncommon practice. The purpose is to increase the water-absorbing power of the meat used and to prevent undue shrinkage of the sausage when cooked. Cuts of meat which are fresh and of good quality will contain enough moisture to secure a consistency of the ground sausage stock which will permit it to be readily packed in casings; but inferior sausage stock may be very dry. Because the use of absorbents in such products may readily lead to abuses the amount of starchy material which may be added to sausage is limited by official rulings and the presence thereof must be declared. According to regulations in this State[1], cereal products or other starchy materials added to sausage must be declared and the amount must not exceed 2 per cent. This ruling is in accord with that which is in force with the Federal meat inspection service.

Certain types of sausage, such for example as frankfurts, are frequently packed in artificially colored casings. This practice is permissible[2] if the proper declaration of color is made.

[1] Conn. Regulation 51.
[2] Ibid.

TABLE XV. SAUSAGE CONTAINING EXCESS OF STARCH OR ARTIFICIAL COLOR OR BOTH.

D.C. No.	Dealer	Manufacturer	Remarks.
	Pork Sausage.		
	Hartford.		
25050	Kashmann's Market	Scholefields, Meriden	Excess starch.
	Naugatuck.		
25250	Naugatuck Valley Market	Own make	Excess starch.
	New Britain.		
25071	M. Berkowitz	Thos. J. McNamara & Co., Bridgeport	Excess starch.
25073	Mohican Co	Thos. J. McNamara & Co., Bridgeport	Excess starch.
	New Haven.		
25063	H. Brown		Excess starch.
25069	Rice & Gorden		Excess starch.
25134	Van Dyke Co		Excess starch.
	Waterbury.		
25610	Swift & Co	Own make	Excess starch.
25606	Washington Market	Own make	Excess starch.
	Frankfurts.		
	Bridgeport.		
25086	The Bridgeport Public Market	George Kearns, New York, N. Y.	Color undeclared.
25081	Cudahy Packing Co	Own make	Excess starch; color undeclared.
25085	Elm City Provision Co.	Own make	Excess starch; color undeclared.
24989	Elm City Provision Co.		Color undeclared.
25083	Peter Hron	Own make	Color undeclared.
24987	T. J. McNamara	Own make	Color undeclared.
24988	T. J. McNamara	Own make	Color undeclared.
25091	T. J. McNamara	Own make	Excess starch; color undeclared.
25088	New England Market, Inc.	Own make	Excess starch; color undeclared.
	New Britain.		
25072	M. Berkowitz	T. J. McNamara & Co., Bridgeport	Excess starch
	New Haven.		
25075	The Alois Schwabe Co.	Own make	Color undeclared.
25078	Cedar Provision Co.	Own make	Color undeclared.
25082	Mrs. C. Hertler	Own make	Color undeclared.
25076	S. J. Hugo & Sons	Max Tunz	Color undeclared.

TABLE XV. SAUSAGE CONTAINING EXCESS OF STARCH OR ARTIFICAL COLOR OR BOTH—(*Concluded*).

D.C. No	Dealer	Manufacturer	Remarks
	Frankfurts—Concluded.		
	New Haven—Concluded.		
25092	Katz & Winn	Armour & Co., Hartford Branch	Excess starch; color undeclared.
25136	Henry Novicki	Elm City Prov. Co., New Haven	Excess starch.
25079	R. Perri	Elm City Prov. Co., Bridgeport	Excess starch; color undeclared.
25077	Carl Rossler	Own make	Color undeclared.
25074	Sperry & Barnes Co.	Own make	Color undeclared.
	Stamford.		
25275	Klein and Amahle	Own make	Excess starch.
	Waterbury.		
25604	John Hullstrunk	Own make	Excess starch.
25607	Sachsenhauser, Inc.	Own make	Excess starch.
25605	Washington Market	Own make	Excess starch.

Twenty-six samples of pork sausage and forty-nine of frankfurts were submitted by the Dairy and Food Commissioner.

Pork sausage was examined for starch, sulphites and borax. Sixteen samples were passed, nine contained starch in excess of 2 per cent. and one contained less than 2 per cent., but its presence was not declared. No sulphites or borax was found in any of the samples.

Frankfurts were examined for starch, color, sulphites and, in some cases, for borax. In sixteen samples no starchy absorbant was found. Twelve samples contained starch in excess of 2 per cent., fifteen contained 2 per cent. or less and in six the amount was not determined.

Eighteen samples were packed in casings which were artificially colored but in one case (**24696**, Bethel Provision Co.), color was declared. In eighteen no color was found; and in thirteen color was either not tested for or not proven.

Traces of starch possibly derived from spices were disregarded. In the samples examined the minimum amount of starch determined was about 1 per cent (0.94), and the maximum was 5.35 per cent.

A sample of color, D. C. No. **18137**, used by a manufacturer for coloring casings, was identified as Orange I, a permitted coal tar color. So far as colors in the samples examined were identified they were coal tar colors of the permitted group.

In Table XV are listed samples in which excesses of starch (over 2 per cent.), and artificial color were found. These amounts of starch are not permissible under Regulation 51 even if declared.

TABLE SALT.

The defination and standard for table salt is as follows:

> Table salt, dairy salt, is fine-grained crystalline salt containing, on a water-free basis, not more than 1.4 per cent. of calcium sulphate ($CaSo_4$), not more than 0.5 per cent. of calcium and magnesium chlorides ($CaCl_2$ and $MgCl_2$), nor more than 0.1 per cent. of matters insoluble in water.[1]

To prevent caking when exposed to atmospheric conditions and facilitate free delivery from a shaker, salt is sometimes mixed with starch, or the carbonates of calcium or magnesium.

Twenty-three samples of table salt were collected by the Station agent, including all the familiar brands, and analyses are given in Table XVI. In calculating the probable distribution of constituents, sulphuric acid (So_3) was calculated as calcium sulphate and any excess as magnesium sulphate. If calcium was in excess of sulphuric acid, the excess was calculated as calcium carbonate (if carbonates were indicated), or to calcium oxide (if the solution was alkaline), or to calcium chloride (if the solution was neutral). Excesses, if any, of magnesium over sulphuric acid were calculated as carbonate, oxide or chloride as in the case of calcium. Qualitative tests indicated that phosphates were either not present or present in not more than traces. Actual salt (sodium chloride) was calculated as the difference between 100 per cent. and the sum of the percentages of moisture, iron and aluminum oxides, sulphate, carbonate and chloride of calcium, and carbonate and chloride of magnesium. If the carbonates of calcium and magnesium were not present the per cent. of material insoluble in water was included with the impurities.

Eight samples were slightly under the weight claimed, but the deficiency was less than one ounce per pound, except in one case where it was 1.4 ounces. Fourteen samples contained more than the weight declared. One package was broken and there was some loss of contents.

The price per pound ranged from 1.8 cents to 6.9 cents and the average was 4 cents.

The samples contained from 96.6 per cent. to 99.5 per cent. of pure salt (sodium chloride), the average being 98.2 per cent. On a previous inspection[2] the average sodium chloride was 98.5 per cent.

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[1] Circ. 136, U. S. Dept. Agr., Office of Secretary.
[2] Conn. Exp. Sta. Report 1908, pp. 596-7.

TABLE XVI. ANALYSES OF

Sta. No.	Brand and Manufacturer	Cost per lb.	Carbon dioxide (CO_2)
		cents	
21697	*Benefit.* Direct Stores, Inc., Boston, Mass.	5.0	Present
20411	*Big 4.* Rock Glen Salt Co., Rock Glen, N. Y.	2.6	None
21649	*Columbia.* International Salt Co., N. Y.	2.4	None
21620	*Crystaline.* Crystaline Salt Co., Ithaca, N. Y.	4.8	Present
21628	*Diamond.* Diamond Crystal Salt Co., St. Clair, Mich.	6.4	Present
21689	*Diamond.* Diamond Crystal Salt Co., St. Clair, Mich.	6.9	Present
21699	*Diamond.* Diamond Crystal Salt Co., St. Clair, Mich.	5.6	None
20406	*Grandmother's.* The Great Atlantic and Pacific Tea Co.	1.8	None
21660	*Iona.* The Great Atlantic and Pacific Tea Co.	1.8	None
21643	*L. B. C.* The Logan Bros. Co., Bridgeport, Conn.	5.1	Present
21641	*Mardor.* E. C. Greening, Bridgeport, Conn.	5.8	Present
20407	*Nutmeg.* Miner, Read & Tullock, New Haven, Conn.	5.1	Present
21676	*Purity.* International Salt Co., Scranton, Pa.	4.8	Present
20414	*Red Cross.* Independent Salt Co., N. Y.	4.6	Present
21614	*Remington.* Remington Salt Co., Ithaca, N. Y.	3.4	Present
21619	*Remington.* Remington Salt Co., Ithaca, N. Y.	2.4	None
21708	*Remington.* Remington Salt Co., Ithaca, N. Y.	3.2	None
21631	*Sunbeam.* Austin, Nichols & Co., Inc., N. Y.	5.0	Present
20422	*U. S.* The Union Salt Co., Cleveland, Ohio	2.6	Present
20408	*Watkin's.* The Watkins Salt Co., Watkins, N. Y.	3.2	None
20420	*White Lily.* The Wadsworth Salt Co., Wadsworth, Ohio.	3.0	Present
21624	*Worcester.* Worcester Salt Co., N. Y.	3.4	None
20405	*Yorkshire.* International Salt Co., N. Y.	2.4	None

The moisture content was inconsiderable and did not exceed 0.5 per cent. in any case. Material insoluble in water was generally within the limits of the standard except where material had been added to prevent caking. In eleven samples such added material was declared on the labels of the packages. In two cases the insoluble matter was about 0.5 per cent. in each case due to carbonates of calcium and magnesium of which there was no declaration. The amount of calcium sulphate did not exceed the limit of the standard 1.4 per cent. and the sum of the percentages of calcium and magnesium chlorides was less than 0.5 per cent. in all cases. Sample **21697** appears to contain calcium carbonate instead of magnesium carbonate and in **21676** somewhat more than the 1 per cent. declared was found.

SALAD DRESSING.

There is no official definition or standard for salad dressing but, in general practice, the product contains an edible oil, eggs, vinegar and spices. Sugar and starchy materials may also be present. Eggs appear to be an essential constituent in the dressing known as mayonnaise according to most recipes.

TABLE SALT.

Moisture	Insoluble in water	Iron and Aluminum (Fe_2O_3. Al_2O_3)	Calcium Sulphate ($CaSO_4$)	Calcium Carbonate ($CaCO_3$)	Calcium Chloride ($CaCl_2$)	Magnesium Carbonate ($MgCO_3$)	Magnesium Chloride ($MgCl_2$)	Sodium Chloride (NaCl), by difference	Sta. No.
%	%	%	%	%	%	%	%	%	
0.26	1.74	0.02	0.83	1.71	....	0.15[1]	....	97.03	21697
0.18	0.15	0.01	0.70	....	....	....	....	98.84[2]	20411
0.46	0.01	0.00	0.73	....	0.11	....	0.05	98.64	21649
0.40	0.56	0.02	1.36	0.07	....	0.58[3]	....	97.57	21620
0.22	0.69	0.08	0.14	0.10	....	0.81[3]	....	98.65	21628
0.20	0.59	0.04	0.15	0.09	....	0.94[1]	....	98.58	21689
0.14	0.00	0.01	0.22	....	0.08	....	0.02	99.53	21699
0.23	0.04	0.01	1.09	....	0.14	....	0.01	98.48	20406
0.22	0.02	0.01	1.05	....	0.11	....	0.02	98.57	21660
0.39	0.91	0.06	0.82	0.15	....	0.90[3]	....	97.68	21643
0.38	0.95	0.03	0.82	0.18	....	0.92[3]	....	97.67	21641
0.43	0.92	0.01	0.97	0.16	....	0.98[3]	....	97.45	20407
0.41	1.52	0.02	1.16	0.16	....	1.65[1]	....	96.60	21676
0.30	0.64	0.01	0.71	0.12	....	0.79[3]	....	98.07	20414
0.32	0.60	0.01	1.02	0.15	....	0.60[3]	....	97.90	21614
0.32	0.01	0.01	1.00	....	0.15	....	0.02	98.49	21619
0.21	0.02	0.00	0.66	....	0.10	....	0.01	99.00	21708
0.43	0.73	0.14	0.85	0.18	....	0.49[3]	....	97.91	21631
0.15	0.53	0.01	0.53	0.54	....	0.15	....	98.62	20422
0.43	0.00	0.01	1.02	....	0.12	....	0.02	98.40	20408
0.32	0.47	0.01	1.19	0.11	....	0.47	....	97.90	20420
0.22	0.02	0.01	0.60	....	0.11	....	0.02	99.02	21624
0.36	0.02	0.01	0.61	....	0.21	....	0.05	98.74	20405

[1] One per cent. magnesium carbonate declared.
[2] Calcium and magnesium as oxides 0.12 per cent.
[3] Added magnesium carbonate declared.

Analyses of a number of commercial salad dressings have been given in a previous report[1] and during the past year further inspection has been made. Twenty-eight samples were collected by the Station agent and analyses are given in Table XVII.

The methods employed are substantially as suggested by Lepper[2] except that "fat" was determined by a modified Roese-Gottlieb method as employed in the work on alimentary pastes and alcohol-ether-soluble P_2O_5 was determined upon the fat thus extracted.

The analyses show that five samples contained relatively little oil (4.3 to 12.8 per cent.), and that in all of these starchy material was present. Starch was also present in two samples where the oil approached 50 per cent., but it was not found in any case where the oil content was over 50 per cent. Moisture varied widely.

The identity of the oils used was not established beyond the fact

[1] Conn. Exp. Sta., Report for 1911, p. 151.
[2] Jour. Assoc. Official Agr. Chemists, **5**, 248. 1921.

TABLE XVII. ANALYSES OF

Sta. No.	Brand, Manufacturer or Dealer	Constants of Fat	
		Refraction. Butyroref. at 25° C.	Halphen test
20396	*A. & P.* Atlantic & Pacific Tea Co.	67.0	Positive
15677	*Benefit.* Direct Importing Co., Boston	65.0	?
15671	*Blue Ribbon.* Richard Hellman, Inc., Long Island City, N. Y.	69.0	Positive
20393	*Booth's.* M. W. Booth Co., Meriden, Conn.	70.5	Negative
20395	*Canton-Maid.* Canton-Maid Products Co., Canton, Ohio	67.0	Positive
20394	*Challenge.* The Challenge Products Co., New Haven, Conn.	66.3	Positive
20224	*Country Club.* Svirdoff & Brochin, New Haven, Conn.	67.5	Positive
15675	*Crubro.* Cruikshank Bros. Co., Pittsburgh, Pa.	67.2	Negative
20400	*Easton's.* Gilbert J. Easton, Newark, N. J.	70.0	Negative
20389	*El-Food.* Elizabeth Food Products Co., Elizabeth, N. J.	67.0	Positive
20388	*Empire.* Empire Delicatessen Co., Hartford, Conn.	66.3	Positive
20398	*French's.* F. C. Bushnell & Co., New Haven, Conn.	68.0	Positive
20223	*Gelfand's.* Gelfand Co., Baltimore, Md.	70.1	Negative
20399	*J. Gilbert's.* John Gilbert & Son, New Haven, Conn.	67.0	Positive
20386	*Howard's.* J. G. Howard, Haverhill, Mass.	67.0	Positive
20390	*I-Car-De.*[1] Jas. A. Aicarde & Sons, Boston, Mass.	67.7	Positive
20392	*Libby's.* Libby, McNeill & Libby, Chicago, Ill.	68.0	Negative
15680	*My Wife's.*[1] Fred Fear, Bloomsburg, Pa.	71.2	Positive
15674	*Our Best.*[1] W. W. Walker Co., Hartford, Conn.	67.5	Positive
15679	*Picnic Lunch.* E. R. Durkee & Co., New York City	68.0	Positive
20402	*P. & T.* Park & Tilford, N. Y.	67.0	Positive
15672	*Premier.* Francis H. Leggett & Co., N. Y.	67.2	Positive
20401	*Puro.* F. G. Crombie, Bridgeport, Conn.	69.0	Positive
20403	*Riker's.* Liggett's Drug Stores, New York	70.1	Positive
20385	*Seidner.* Otto Seidner, Westerly, R. I.	67.5	Positive
15681	*Sunbeam.*[1] Austin, Nichols & Co., Inc., New York	67.0	Positive
20397	*Van Camp's.* Van Camp Packing Co., Indianapolis, Ind.	67.0	Positive
20225	*Wallacks'.* M. R. Wallack & Co., New Haven, Conn.	68.0	Positive

that cottonseed oil was present in three-fourths of the total number. Borax was not found.

Assuming 1.38 per cent. of lipoid-P_2O_5 in the dry matter of whole egg the analyses indicate the presence of egg approximately

[1] Labeled Mayonnaise.

SALAD DRESSING.

Moisture	Ash	Protein, (N x 6.25)	Carbohydrate (including fiber by diff.)	"Fat" (alcohol-ether extract)	Salt (NaCl)	Lipoid-P_2O_5	Nitrogen	Total acidity (as acetic acid)	Starch	Sta. No.
39.95	2.21	1.88	12.05	43.91	1.93	0.024	0.30	1.23	1.58	**20396**
74.37	2.25	3.94	15.17	4.27	1.49	0.034	0.63	1.32	3.87	**15677**
10.85	0.91	1.38	0.26	86.60	0.70	0.037	0.22	0.39	None	**15671**
13.29	1.70	1.69	5.25	78.07	1.41	0.023	0.27	0.39	None	**20393**
12.42	1.30	1.38	1.48	83.42	0.75	0.032	0.22	0.42	None	**20395**
20.49	1.67	1.19	4.67	71.98	1.43	0.016	0.19	0.48	None	**20394**
13.55	1.53	2.19	2.97	79.76	1.18	0.056	0.35	0.38	None	**20224**
68.53	3.16	1.38	14.09	12.84	2.73	0.005	0.22	1.92	2.01	**15675**
13.63	1.60	1.38	0.36	80.36	1.31	0.051	0.22	0.36	None	**20400**
37.57	3.32	3.13	1.41	54.57	2.77	0.080	0.50	1.14	None	**20389**
24.18	0.73	1.06	0.98	73.05	0.60	0.014	0.17	0.96	None	**20388**
31.51	2.46	3.75	0.48	61.80	1.98	0.109	0.60	0.84	None	**20398**
15.75	0.87	1.88	0.13	81.37	0.56	0.057	0.30	0.54	None	**20223**
10.70	0.91	1.19	0.00	87.20	0.43	0.051	0.19	0.39	None	**20399**
38.06	3.03	4.13	1.19	53.60	2.15	0.056	0.66	1.50	None	**20386**
21.03	1.37	3.94	6.85	66.81	0.81	0.162	0.63	0.54	None	**20390**
72.58	3.49	4.50	12.39	7.04	2.60	0.030	0.72	2.46	0.63	**20392**
72.83	3.72	2.06	11.71	9.68	3.27	0.004	0.33	0.71	2.41	**15680**
15.98	0.93	2.75	5.21	75.13	0.56	0.061	0.44	0.45	None	**15674**
40.85	6.62	4.69	15.24	32.60	5.72	0.031	0.75	1.68	0.82	**15679**
28.93	2.12	1.50	6.34	61.11	1.72	0.040	0.24	0.54	None	**20402**
40.16	3.00	3.75	0.09	53.00	2.37	0.140	0.60	1.38	None	**15672**
15.86	1.77	1.69	2.91	77.77	1.29	0.008	0.27	0.45	None	**20401**
72.87	3.53	2.56	12.41	8.63	2.22	0.041	0.41	0.60	3.29	**20403**
18.08	1.95	2.13	4.51	73.33	1.59	0.019	0.34	0.48	None	**20385**
38.33	2.02	2.75	None	56.92	1.49	0.098	0.44	0.48	None	**15681**
38.90	3.14	4.81	2.48	50.57	2.49	0.078	0.77	1.44	None	**20397**
16.45	1.83	1.44	3.76	76.52	1.49	0.003	0.23	0.54	None	**20225**

equivalent to from 1 to 10 per cent. of dry, whole egg material (.014 to .162 per cent. lipoid-P_2O_5), in the dressings as sold. This is disregarding three samples where the lipoid-P_2O_5 was less than 0.01 per cent. and assuming that the cereal or other starchy matter present does not appreciably increase the lipoid-P_2O_5. Comparison on the water-free basis of five samples labeled,

"Mayonnaise", viz., **15675, 20390, 15680, 15674** and **15681,** shows that the lipoid-P_2O_5 varies from 0.014 to 0.205 per cent. Many dressings not claimed to be of this type show amounts of lipoid phosphorus which equal or exceed these limits.

SYRUP, ETC.

A sample of brown sugar, **21584** and one of sugar syrup, **21585,** submitted by a consumer were examined for ash and total sugars.

21584. Ash 0.46 per cent.; sucrose (by polarization), 98.32 per cent.
21585. Ash 5.51 per cent.; invert sugar 25.60 per cent.; sucrose (increase in reduction after hydrolysis), 38.87 per cent.

The samples were of normal composition and quality.

A sample of *Green's Muscadine Punch,* **21206,** submitted by a consumer was examined as follows:

Total solids 62.24 per cent.; ash .014 per cent.; alcohol trace (2 per cent. by wt.); invert sugar 31.80 per cent.; sucrose (by increase in reduction after hydrolysis), 29.49 per cent.; preservative (other than sugar), none found; saccharin none found; color permitted coal tar, Guinea Green B and Amaranth identified.

This is a syrupy fruit flavor base to be diluted for beverage purposes.

VINEGAR.

The legal standard for cider vinegar in the State requires 4 per cent acidity (as active acid) and 1.6 per cent. of cider vinegar solids.[1]

Six samples were submitted by the Dairy and Food Commissioner one of which was unofficial. All met the requirements of the standard and other constituents so far as determined were normal.

Seven samples were examined for producers or other individuals; three were below requirement as to solids, but all substantially met the required degree of acidity.

MISCELLANEOUS MATERIALS EXAMINED CHIEFLY FOR POISONS.

Eighteen samples of miscellaneous materials were submitted by health officers, veterinarians and others to be examined for poisons. In thirteen cases no poisons were detected. The remaining five may be cited as follows:

20893. *Hens* which had died under suspicious circumstances. Submitted by the health officer, Town of Stratford. An appreciable amount of yellow phosphorus was found.

19769. *Material* thought to have caused death of several cows. Submitted by request of Dr. Thompson of Sharon. The material contained about 10 per cent. of arsenate of lead.

[1] Sec. 2459, General Statutes of Connecticut.

20515. *Poisoned bait.* Submitted by Mr. Titcomb, State Board of Fisheries and Game. Chromium was found.

20569. *Dog's stomach contents.* Submitted by B. W. Kenneson, State Police Barracks, Canaan. Strychnine was identified.

21303. *Wine made in galvanized tub.* The wine contained zinc (ZnO), in the amount of 370 parts per million which is considerably more than the amount allowed (100 parts), in foods where limits for metallic impurities are recognized. Recently attention has been called[1] to instances of poisoning apparently arising from eating foods cooked in galvanized iron utensils; and it was shown that certain acid beverages dissolved large amounts of zinc from galvanized containers in which the liquids had been allowed to stand.

II. DRUGS.

PREPARATIONS RECOGNIZED IN THE UNITED STATES PHARMACOPOEIA OR THE NATIONAL FORMULARY.

All samples of drugs were submitted by the Dairy and Food Commissioner unless otherwise stated.

Solution of Ammonium Acetate.

Solution of ammonium acetate is an aqueous solution containing not less than 7 per cent. of ammonium acetate, $NH_4C_2H_3O_2$.[2]

Sixteen samples were examined. Two of these, viz., **26561,** purchased of the Clark and Brainerd Co., New Britain and **25417,** purchased of Curran and Flynn, Willimantic, contained 5.55 and 5.28 per cent. of ammonium acetate respectively and were below standard. Thirteen samples satisfied the requirements of the Pharmacopoeia and one was not analyzed because of leakage in transit.

Glycerite of Bismuth.

This preparation should contain not less than 0.640 gram of bismuth oxide (Bi_2O_3), in each 5 cc. of solution.[3]

Two samples were examined, both of which were below the requirement. No. **26553,** the Dickenson Drug Co., New Britain, contained 0.468 gm. Bi_2O_3 and **25399,** W. E. LaBelle, Est., Danielson, contained 0.442 gm. in 5 cc.

Citrated Caffeine.

Citrated caffeine contains, when dried to constant weight at 80° C., not less than 48 per cent. of anhydrous caffeine.[4]

[1] Jour. Ind. Eng. Chem., **16,** 164. 1924.
[2] U.S.P. IX, p. 237.
[3] N. F. IV, p. 95.
[4] U.S.P. IX, p. 86.

Sixteen samples were submitted. Five contained 48 per cent. or over of anhydrous caffeine. Eleven did not fully meet the standard of 48 per cent., but they contained over 90 per cent. of the required amount. The assays ranged from 43.8 to 49.6 per cent. of anhydrous caffeine of the correct melting point, viz., 235°–236°.

Tincture of Ginger.

Under the prohibition regulations tincture of ginger made according to the formula given in the United States Pharmacopoeia is held to be intoxicating liquor. If made double strength, however, it is classed as unfit for beverage purposes.[1] Unfortunately the Pharmacopoeia does not give the minimum amount of extractives in the official preparation; it merely says that the residue on drying does not *exceed* 2 per cent. Data from various sources[2] indicate that the solids in the U. S. P. tincture may vary from about 1 to 2 per cent. A preparation of double strength tincture[3] contained 2.46 grams solids per 100 cc. or about 3 per cent.

The sample submitted, **25324**, contained 1.3 per cent. of solids which, judging by the data cited, is too low for double strength.

Hydrobromic Acid, Diluted.

Diluted hydrobromic acid is an aqueous solution containing not less than 9.5 per cent. nor more than 10.5 per cent. of hydrobromic acid (HBr)[4].

The three samples examined contained from 10.2 per cent. to 10.6 per cent. of hydrobromic acid and conformed substantially to the official requirement.

Hypophosphorous Acid, Diluted.

Diluted hypophosphorous acid is an aqueous solution containing not less than 9.5 per cent. and not more than 10.5 per cent. of hypophosphorous acid (HPH_2O_2).[5]

One sample submitted was of standard quality. It contained 10.24 per cent. of HPH_2O_2.

Tincture of Iodine.

Tincture of iodine is an alcoholic solution containing in 100 cc. not less than 6.5 gms. nor more than 7.5 gms. of iodine and not less than 4.5 gms. nor more than 5.5 gms. of potassium iodide.[6]

Of seventy-six samples submitted only six were substantially outside the limits of the standard.

[1] Treasury Decision 3092.
[2] Conn. Exp. Sta. Report, 1910, p. 499; Lythgoe & Nurenberg, Jour. Ind. Eng. Chem., Dec. 1911; Snyder, Am. Jour. Pharmacy, Apr. 1918.
[3] Randolph & Beringer, Jour. Am. Pharm. Asso., Jan. 1924.
[4] U.S.P. IX, p. 12.
[5] U.S.P. IX, p. 16.
[6] U.S.P. IX, p. 457.

Five were below in one or both particulars and one contained a large excess of iodine.

Four samples purchased by the Station agent in department stores were of satisfactory quality and were passed.

Table XVIII. Assays of Tincture of Iodine.

D. C. No.	Sampled at	Grams per 100 cc. Iodine	Grams per 100 cc. Potassium iodide
26564	*Bristol.* Rickman's Economy Drug Store	17.52	5.86
26624	*Hartford.* Turgeon Drug Co	5.95	3.61
26664	*Middletown.* Hartman Drug Co.[1]	6.13	3.80
26556	*New Britain.* Miller Hanson Drug Co	3.91	2.93
26586	*Rockville.* John J. Lee	5.90	3.57
26588	E. F. Wilson[2]	5.25	3.84

Citrate of Magnesia.

An unofficial sample of citrate of magnesia, **24387,** contained 0.79 gm. magnesium oxide (MgO), per 100 cc which is about one-half the amount required for the pharmacopoeial preparation.[3] The sample contained a large amount of sediment indicating impure ingredients or careless preparation or both.

Magnesia Magma.

(Milk of Magnesia).

Magnesia magma yields not less than 6.5 per cent. nor more than 7.5 per cent. of magnesium hydroxide $Mg(OH)_2$.[4]

Forty-three samples submitted by the Dairy and Food Commissioner and one purchased by the Station agent were examined of which twenty-eight satisfied the requirements of the standard or conformed substantially thereto. One sample was less than one-half strength and fifteen contained considerably more than the maximum of 7.5 per cent. The deficient sample and those containing excesses greater than 10 per cent. of the maximum limit are listed in Table XIX.

Table XIX. Assays of Magnesia Magma.

D. C. No.	Sampled at	Manufacturer	Magnesium Hydroxide $Mg(OH)_2$ %
25919	*Bridgeport.* Hindle Druggist	Sharp & Dohme	11.10
25922	F. S. Porter	Lilly	10.20
26565	*Bristol.* The Madden Drug Store	Phillips, N. Y.	8.41
26622	*Hartford.* G. Fox & Co	Lilly	9.50
26575	Louis K. Liggett Co	Liggett	8.99
26663	*Middletown.* United Chemists Co.	United Chemists	8.61
26660	The Woodard Drug Co	Phillips	8.64

[1] Manufactured by Felborn Pharmacal Co.
[2] Manufactured by Adelphi Mfg. Co., Brooklyn, N. Y.
[3] U. S. P. IX, p. 248.
[4] U. S. P. IX, p. 261.

TABLE XIX. ASSAYS OF MAGNESIA MAGMA—*Concluded.*

D. C. No.	Sampled at	Manufacturer	Magnesium Hydroxide $Mg(OH)_2$
26551	*New Britain.* The Dickinson Drug Co	Phillips	8.47
26555	The Miller Hanson Drug Co.	Phillips	8.56
25392	*Putnam.* E. H. Burt	.....	8.61
25390	Geo. A. Dresser	.....	8.53
26596	*So. Manchester.* Geo. E. McNamara Drug Co	Phillips	8.50
26590	J. H. Quinn & Co	Sharp & Dohme	2.80
26580	*Stafford Springs.* D. H. McCormick	Phillips	8.94
26727	*Torrington.* Park Pharmacy	Brewer & Co., Inc.	8.91
26615	*Windsor.* Robert H. Barnes	Norwich Pharmacal Co.	8.75

SPIRIT OF NITROUS ETHER.

(SWEET SPIRIT OF NITRE).

Spirit of nitrous ether is an alcoholic solution containing not less than 3.5 per cent. nor more than 4.5 per cent. of ethyl nitrite (C_2H_5-NO_2).[1]

This preparation deteriorates and it is directed to keep it in small, well-stoppered containers, in a cool place and protected from light.

Forty-eight samples were examined, thirty-five of which were passed as conforming entirely or substantially to the standard. Thirteen were deficient, containing from 1.4 to 3.1 per cent. of ethyl nitrite.

The preparations were frequently labeled 4 per cent. or 18 mins. ethyl nitrite per fluid ounce. Eighteen minims is about 3.6 cc per 100 cc of solution or (taking the specific gravity of ethyl nitrite as 0.9), 4 grams per 100 cc of solution. Assuming the specific gravity of the finished solution to be 0.823 (25°C), the percentage of ethyl nitrite is about 4.9.

Samples containing substantially less ethyl nitrite than the minimum required by the Pharmacopoeia are listed in Table XX.

TABLE XX. ASSAYS OF SPIRIT OF NITROUS ETHER.

D. C. No.	Sampled at	Manufacturer	Ethyl nitrite %
25397	*Danielson.* W. E. LaBelle, Est	.....	2.58
26634	*East Hartford.* The O'Connell Drug Co	Sisson Drug Co.	2.75
26649	*Meriden.* W. W. Mosher	Powers, Weightman & Co.	3.13
26650	Pink's Pharmacy	Preston Chemical Co.	1.90
26658	*Middletown.* Lincoln Drug Co	Mallinckrodt	1.96
26802	*Norwich.* James H. Dunn	.....	1.40
26593	*So. Manchester.* T. Weldon & Co.	Felborn Pharm. Assoc.	3.02
26578	*Stafford Springs.* D. H. McCormick	.....	2.90
25932	*Stamford.* C. S. Finch, Druggist	United Drug Co.	3.13
26730	*Thomaston.* George A. Lemmon	United Drug Co.	2.88
26737	*Waterbury.* R. E. Holmes	Conn. Chem. & Dis. Co.	3.01
26720	*Winsted.* Apothecaries Hall	Gibson-Howell, Inc.	2.80
26716	John A. Williams	Own Make	1.93

[1] U. S. P. IX, p. 403.

SOLUTION OF POTASSIUM HYDROXIDE.

This preparation is an aqueous solution containing not less than 4.5 per cent. of potassium hydroxide (KOH).[1]

The solution readily absorbs carbon dioxide from the air and should be securely stoppered.

Five samples were submitted, four of which exceeded the standard. One was slightly deficient containing 3.98 per cent. of potassium hydrate.

SOLUTION OF SODIUM HYDROXIDE.

This solution should contain not less than 4.5 per cent. of sodium hydroxide (NaOH).[2] Like potassium hydroxide solution it readily absorbs carbon dioxide and should be kept in bottles provided with rubber stoppers or with glass stoppers coated with paraffin.

Three samples were examined all of which were of satisfactory strength.

WITCH HAZEL WATER.

Forty-one samples of witch hazel water were examined for the Dairy and Food Commissioner and eleven were collected by the Station agent chiefly from department stores. Examination was made with reference to alcoholic strength, presence of wood alcohol and residue on evaporation.

Of the total number forty-eight were passed as conforming substantially to the requirements of the Pharmacopoeia.

Witch hazel water prepared according to the Pharmacopoeial formula and sold under the name recognized in that text should be made with pure alcohol. A number of samples have been found, however, which were evidently made with specially denatured alcohol. Such preparations should not be labeled in any way to confuse them with the official preparation of witch hazel. It should be made clear that they are not U. S. P. products and the fact that denatured alcohol has been used should be declared.

Four samples by reason of excessive residues[3] on evaporation were not official witch hazel water. Two contained alkaloids identified in one case as quinine. The sample in which quinine was identified was labeled "Double Distilled Hamamelis Virginica or Witch Hazel." While this is not the language of the title recognized in the Pharmacopoeia it suggests it closely enough to constitute a design or device which would mislead a purchaser to believe that the product is "witch hazel water" or "distilled extract

[1] U. S. P. IX, p. 252.
[2] U. S. P. IX, p. 255.
[3] U. S. P. IX, 58. Not more than 0.025 gm. residue per 100 cc allowed.

of witch hazel" which it is not in that it contains at least one substance (quinine) which is foreign to witch hazel water.

The samples not conforming to the Pharmacopoeial requirements are as follows:

TABLE XXI. ANALYSES OF WITCH HAZEL WATER.

No.	Sampled at	Manufacturer	Solids, gm. per 100 cc.
D. C. 26550	*Hartford.* G. Codrado.....	Amendola Bros., New Haven	0.072[1]
Sta. 21663	*New Haven.* Gamble-Desmond Co.	.....	0.232
D. C. 25436	*New London.* T. H. Stead.....	.....	0.052[2]
D. C. 25439	L. P. Desmarais...	.....	0.152

PROPRIETARY PREPARATIONS.

Two samples of medicated wine were examined.

19639. *Horke Vino,* bottled by T. F. Murray Co., Inc., Bridgeport, Conn., and **19640,** Trainer's American Elixir of Bitter Wine. (*Horke Vino*).

Analyses are as follows:

19639. Solids 3.62 gms. per 100 cc; ash 0.032 gms. per 100 cc; alcohol 19.14 per cent. by volume; emodin-like substances present; alkaloids none found.

19640. Solids 7.37 gms. per 100 cc; ash 0.38 gms. per 100 cc; alcohol 16.10 per cent. by volume; emodin-like substances present; alkaloids none found; phosphates, sulphates and magnesium present in ash.

Sample **19639** was slightly bitter to the taste and **19640** was more decidedly so.

It has been often suggested that the chief physiological effect of many so-called tonics is due to the stimulative action of the alcohol which they contain and in some cases astonishing quantities of such preparations may be consumed by a "patient"[3] who has developed the habit. Under the prohibition law the status of such remedies becomes of particular interest. The question hinges upon (a) whether the preparation in question contains medicament enough to preclude its use as a beverage;[4] (b) whether it contains more than enough alcohol to hold medicaments in solution or to act as a preservative.

In the absence of official ruling in particular cases[5] the question of beverage quality may be debatable unless the product has been rendered completely non-drinkable by bitter, astringent, nauseating or poisonous substances. Thus tincture of Jamaica ginger would seem to be clearly a non-beverage article but prohibition authorities have found it necessary to require that this

[1] Contains quinine.
[2] Alkaloids indicated.
[3] See Jour. Am. Med. Assoc., April 9, 1921, p. 1029.
[4] Webster's Dictionary defines "beverage" as "drink;" that which is drunk; especially a pleasant or refreshing drink, or an habitual one."
[5] The Internal Revenue Department holds certain U. S. P. and N. F. preparations fit for beverage purposes.

preparation shall only be made of double the ordinary strength and even then sold under rigid restrictions.

To determine whether the two wines under examination contained medicaments not immediately evident to the taste but which might produce subsequent effects which would tend to destroy their beverage character the following experiment was tried.

Two to four times the dose recommended to be taken at one time, *viz.*, two to four ounces, was freed from alcohol and fed to two human subjects. In the case of **13539** no effects were noted with the smaller amount and only mild cathartic action with the larger dose. With sample **13640** the cathartic effect of the smaller dose was more marked beginning in about three hours and extending over a period of eight hours. No other effects were experienced in either case by either subject.

As to whether the amount of alcohol present was in excess of the amount necessary to hold medicaments in solution the following trials were made to furnish at least the basis for an opinion.

Twenty-five cc of each sample were taken and the alcohol largely removed by successive dilutions and evaporations taking care not to reduce the volume below the original volume taken. These dealcoholized portions and equal volumes of the original samples were then transferred to Hortvet tubes centrifuged and the amounts of sedimentary material compared. With sample **13639** there was no appreciable difference between the original solution and the dealcoholized solution. With **13640** the amount of insoluble matter was considerably greater in the solution which had been freed from alcohol.

As to the necessity for alcohol, in the amounts found, for preservative purposes it was regarded as significant that dealcoholized residues from these samples when allowed to stand at summer temperature (80° to 90°F), exposed to the air for five days or longer developed no mould and showed no signs of decomposition. An aqueous solution can be adequately protected against decomposition in the sealed package by proper sterilization; and if these tonics are taken according to directions they will last only about six days. There appears to be no evident necessity for a preservative but if one is required, one-tenth per cent. of benzoate of soda would serve the purpose.

In case of **13639** it appears that the tonic might be used as a beverage, that the alcoholic content is in excess of the amount necessary to hold medicaments in solution and that alcohol is not necessary as a preservative. As for **13640,** in view of the results obtained, doubt might be raised as to the excess of alcohol and, possibly also, as to its beverage qualities.

21848. *Rheuma.* Anti-rheumatic, diuretic, demulcent and laxative. Made by the Rheuma Co., Buffalo, N. Y., and Walkerville, Ont. It is cautioned not to use large doses as a cathartic.

Examination was made as follows:

Brown liquid with considerable sediment; acid to litmus; odor of turpentine; taste bitter; solids 10.53 per cent.; ash 3.87 per cent.; salicylic acid

5.06 per cent.; iodine 0.69 per cent.; potassium oxide 0.90 per cent.; potassium iodide (calc. from iodine), 0.90 per cent.; digitalis glucosides indicated?; alkaloids none found; tannin, citrates, tartrates, none found.

The preparation consists of, or contains, salicylic acid, potassium iodide, probably turpentine and possibly also digitalis glucosides.

MISCELLANEOUS DRUGS, ETC.

Ammonia Water.

(Household Ammonia).

Twenty-four samples of ammonia water for laundry and household use were collected by the Station agent. The samples were purchased in grocery and department stores. There is no standard for this article and very few of the samples examined approach in ammonia (NH_3) content the minimum strength of ammonia water as prescribed in the United States Pharmacopoeia viz., 9.5 per cent. The lowest ammonia content found was 1.3 per cent. and the highest was 8.3 per cent. The average strength was 4.5 per cent.

Ammonia water, presumed to be of the strength demanded by the Pharmacopoeia and purchased from druggists, was examined last year[1] and of twenty-four samples ten were less than 90 per cent. of the required strength the deficient samples containing from 2.5 to 8.4 per cent. of ammonia (NH_3). On the average, household ammonia samples examined were about one-half as strong as pharmacopoeial ammonia water; on the other hand, judging from the results cited, five out of every twelve purchases of ammonia water in drug stores will be no stronger than the product for household use.

Partial analyses of the samples examined during the past year are given in Table XXII.

"Powdered Ammonia."

A sample of so-called powdered ammonia, **21679,** made by T. H. Britt Ammonia Co., Milwaukee, Wis., was examined as follows:

21679. Insoluble in acid trace; iron and aluminum none; phosphoric acid (P_2O_5), none; ammonia (NH_3), by distillation, 0.97 per cent.; calcium CaO, 0.45 per cent.; magnesium (MgO), 0.45 per cent.; sulphuric acid (SO_3), 3.75 per cent.; chlorine 20.75 per cent.; carbonate (CO_2), present.

The probable combinations were calculated to be as follows:

Ammonium chloride 3.05 per cent.; sodium chloride 30.88 per cent.; calcium sulphate 1.38 per cent.; magnesium sulphate 2.75 per cent.; sodium sulphate 8.93 per cent.; sodium carbonate 33.60 per cent.; sodium bicarbonate 13.69 per cent.; moisture and undetermined 5.72 per cent.

[1] Conn. Exp. Sta. Bull. 248, p. 437 1923.

Table XXII. Analyses of Household Ammonia.

Sta. No.	Brand, Manufacturer or Dealer	Sp. Gr. at 20° C	Total solids	Ash	Ammonia (NH_3.)
			%	%	%
21700	*Polo.* Austin, Nichols & Co., New Haven, Conn.	0.9870	0.130	0.040	3.13
21645	Bridgeport Public Market, Bridgeport, Conn.	0.9890	0.038	0.022	2.60
21639	*Parson's.* Columbia Chemical Works, New York	0.9640	0.134	0.066	8.83
21657	Economy Grocery Co., New Haven, Conn.	0.9695	0.014	0.010	7.42
21696	*Hartshorn.* Economy Grocery Co., Hartford, Conn	0.9755	0.013	0.007	5.66
21637	*Empire.* Empire Bottling Works, Newark, N. J.	0.9875	0.032	0.024	3.16
21677	*A & P.* The Great Atlantic & Pacific Tea Co., New London, Conn	0.9740	0.010	0.007	6.12
21647	Great Northern Pacific Grocery Co., Bridgeport, Conn	0.9724	0.119	0.037	6.65
21678	*Gold Seal.* Ideal Chemical Co., Boston, Mass.	0.9930	0.016	0.008	1.81
21684	*Red Cap.* C. M. Kimball Co., Winthrop, Mass.	0.9660	0.104	0.036	8.13
21635	*Hartshorn.* S. S. Kresge, New Haven, Conn.	0.9854	0.066	0.024	3.56
21833	C. S. Leete, New Haven, Conn.	0.9880	0.026	0.009	2.91
21658	Logan Bros. Co., New Haven, Conn	0.9712	0.035	0.022	6.75
21702	*Hartshorn.* N. Y. Butter Co., Waterbury, Conn.	0.9806	0.032	0.025	4.54
21681	*Fortified.* Salem Chemical & Supply Co., Salem, Mass	0.9838	0.076	0.063	4.02
21653	Shelton Ave. Delicatessen, New Haven, Conn.	0.9884	0.115	0.054	2.97
21667	*Polo.* Stoddard, Gilbert & Co., New Haven, Conn	0.9950	0.029	0.016	1.31
21638	*Sun.* Sun Chemical Co., Roslindale, Boston, Mass	0.9646	0.113	0.035	8.67
21713	*Leslie's.* The Arthur Leslie Co., New York.	0.9930	0.018	0.015	1.78
21695	*Capitol.* The Capitol Pickling Wks., Hartford, Conn	0.9924	0.012	0.008	1.78
21650	United Grocery Co., Bridgeport, Conn	0.9790	0.106	0.034	4.97
21636	*Hartshorn.* F. Woolworth, New Haven, Conn.	0.9910	0.026	0.024	2.32
21701	*Eagle.* F. Woolworth, Waterbury, Conn	0.9778	0.012	0.010	5.16
21707	*Hartshorn.* Yate Tea & Coffee Co., Waterbury, Conn	0.9850	0.063	0.030	3.42
	Minimum	0.9950	0.010	0.007	1.31
	Maximum	0.9640	0.134	0.066	8.83
	Average	0.9813	0.056	0.026	4.49

With less than one per cent. of ammonia (NH_3) in the product there is no justification for calling it "powdered ammonia." Soda ash (sodium carbonate), is a common constitutent of cleaning compounds.

Unclassified.

19938. *Ointment.* The sample was found to be essentially a mixture of petrolatum and saponifiable fat medicated with methyl salicylate and menthol.

21256. *Deeva Soap.* Lye-less Soap Corporation, N. Y. It is claimed that the soap liberates no free lye in contact with water. It was examined as follows:

Moisture (at 110° C), 20.16 per cent.; free fatty acids 15.59 per cent.; combined fatty acids 52.91 per cent.; free sodium carbonate 2.00 per cent.; alkali combined as soap (as Na_2O), 7.83 per cent.; sodium chloride 0.20 per cent.

Any alkali liberated in water would be neutralized by the free fatty acids present so that the claim with reference to free lye is probably justified.

18474. *Soap.* Submitted for examination as to irritating action upon the skin. Only a trace of free alkali was found but alkaline salts (carbonates, etc.), were present in amount greater than most standards allow for laundry soap[1] and in too large an amount for toilet soap.

21787. *Soap,* Rinso. Submitted for identification of the alkali used. Tests indicated the sample to be a soda soap.

20705. *White Tablets.* Medicament, if any, was unidentified.

BABCOCK GLASSWARE.

Section 4788 of the General Statutes provides that all test bottles and pipettes, used in testing milk and cream which are to be paid for on the basis of the Babcock test, shall be tested and, if found accurate, stamped by this Station.

The following classification shows the number and distribution of pieces of such glassware examined by the Station during the past year.

BABCOCK GLASSWARE EXAMINED.

	Total	Broken	Accurate	Inaccurate
Cream test bottles.	636	9	614	13
Milk test bottles.	3379	9	3317	53
Pipettes.	470	4	465	1
Acid measures.	10	0	10	0
Totals.	4495	22	4406	67

Attention of dairy officials, licensed testers and others concerned with the testing of milk and cream is directed to Bulletin No. 6, issued by the Dairy and Food Commissioner, in which the apparatus recognized as *standard* is described and specifications therefor given. These specifications are substantially the same as recognized and approved by the United States Bureau of Standards and also by the American Dairy Science Association and the Association of Official Agricultural Chemists. The types of test

[1] See Conn. Exp. Sta., Bull. 227, p. 267.

bottles regarded as *standard* are (1) *8 per cent. 18 gram milk test bottle*; (2) *50 per cent. 9 gram short neck cream test bottle*; (3) *50 per cent. 9 gram long neck cream test bottle*; and (4) *50 per cent. 18 gram long neck cream test bottle.* Frequently bottles of other descriptions are submitted for test of calibration. The Station does not feel justified under the Statute in refusing to certify such glassware, so long as it is for use in connection with the Babcock test, but it notifies the senders of non-standard types so that exchanges may be made if desired. These approved types adequately meet all ordinary requirements for the testing of milk and cream for milk fat and a multiplicity of styles and types serves no useful purpose.

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

TWENTY-THIRD REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

1923

W. E. BRITTON, Ph.D.
State Entomologist

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

February, 1924

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Joseph W. Alsop.....Avon
Charles R. Treat.....Orange
Elijah Rogers.....Southington
Edward C. Schneider.....Middletown

STAFF.

E. H. Jenkins, Ph.D., *Director Emeritus.*

Administration

W. L. Slate, Jr., B.Sc., *Director and Treasurer.*
Miss L. M. Brautlecht, *Bookkeeper and Librarian.*
Miss J. V. Berger, *Stenographer and Bookkeeper.*
Miss Mary Bradley, *Secretary.*
William Veitch, *In charge of Buildings and Grounds.*

Chemistry Analytical Laboratory

E. M. Bailey, Ph.D., *Chemist in Charge.*
R. E. Andrew, M.A.
C. E. Shepard
Owen L. Nolan
Harry J. Fisher, A.B.
Assistant Chemists.
Frank Sheldon, *Laboratory Assistant.*
V. L. Churchill, *Sampling Agent.*
Miss Mabel Bacon, *Stenographer.*

Biochemical Laboratory

T. B. Osborne, Ph.D., Sc.D., *Chemist in Charge.*

Botany

G. P. Clinton, Sc.D., *Botanist in Charge.*
E. M. Stoddard, B.S., *Pomologist.*
Miss Florence A. McCormick, Ph.D., *Pathologist.*
G. E. Graham, *General Assistant.*
Mrs. W. W. Kelsey, *Secretary.*

Entomology

W. E. Britton, Ph.D., *Entomologist in Charge; State Entomologist.*
B. H. Walden, B.Agr.
M. P. Zappe, B.S.
Philip Garman, Ph.D.
Roger B. Friend, B.Sc.
Assistant Entomologists.
John T. Ashworth, *Deputy in Charge of Gipsy Moth Work.*
R. C. Botsford, *Deputy in Charge of Mosquito Elimination.*
Miss Gladys M. Finley, *Stenographer.*

Forestry

Walter O. Filley, *Forester in Charge.*
A. E. Moss, M.F., *Assistant Forester.*
H. W. Hicock, M.F., *Assistant Forester.*
Miss Pauline A. Merchant, *Stenographer.*

Plant Breeding

Donald F. Jones, S.D., *Geneticist in Charge.*
P. C. Mangelsdorf, M.S., *Assistant.*

Soil Research

M. F. Morgan, M.S., *Investigator.*

Tobacco Sub-station at Windsor

C. M. Slagg, M.S., *in Charge.*

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CONTENTS.

BULLETIN 256

TWENTY-THIRD 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-third annual report as State Entomologist of Connecticut. Except for the financial statements which cover the fiscal year ending June 30, 1923, this report relates the activities of the department for the calendar year of 1923. It contains the usual somewhat detailed account of work prescribed by the Statutes, such as nursery and apiary inspection, mosquito elimination and gipsy moth suppression. The account of the gipsy moth work is given in condensed form. The results of studies of the raspberry fruit worm by Mr. B. H. Walden, have already been published as Bulletin 251, and of the European red mite, by Dr. Philip Garman, as Bulletin 252 of this Station. Special papers in this report deal with the results of experiments in dusting *versus* spraying apple orchards in 1923, the European corn borer, Oriental peach moth, the Asiatic beetle, the larch case-bearer, further experience with paradichlorobenzene as a remedy for peach borers, tests of sodium hypochlorite for the control of American foul brood of bees, swarms of aphids, and notes on miscellaneous insects.

Respectfully submitted,

W. E. BRITTON,

State and Station Entomologist.

INSECT PEST ACCOUNT.

REPORT OF RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST.

From July 1, 1922 to June 30, 1923.

RECEIPTS.

From E. H. Jenkins, Treasurer	$13,025.34	
Account of 1922, Balance	1,089.53	
State Comptroller, Gipsy Moth Account	218.80	
Interest on Bank Deposits	42.31	
Various Sources (automobile mileage)	49.02	
		$14,425.00

EXPENDITURES.

For Salaries and Wages	$8,111.28
Printing and Illustrations	363.13
Postage	17.77

Stationery	$ 211.51	
Furniture and Fixtures	127.95	
Library (Books and Periodicals)	1,011.93	
(Binding)	8.10	
Laboratory Supplies	692.38	
Spraying Supplies	105.00	
Machinery, Tools and Supplies	255.73	
Scientific Apparatus	593.16	
Express, Freight and Cartage	32.11	
Automobiles: Insurance	105.71	
Supplies and Equipment	175.88	
Repairs	218.72	
Gasoline	199.25	
Oil	64.05	
Traveling Expenses	267.07	
Miscellaneous	785.88	
Telephone and Telegraph	1.55	
Heat and Light	1.00	
Rental and Storage	42.85	
Balance, Cash on Hand	1,032.99	
		$14,425.00

Memorandum.—This account has been audited by the State Auditors of Public Accounts. The item of $218.80 received from the State Comptroller is in effect a transfer from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock, and covers the time and automobile mileage of members of the department staff while engaged in the work of inspecting imported nursery stock. The item of $785.88 under miscellaneous expenditures includes interest on bank balances, automobile mileage and other miscellaneous receipts paid over to the Station Treasurer and by him returned to the State Comptroller.

Summary of Inspection and Office Work.

224 samples of insects received for identification.
114 nurseries inspected.
108 regular certificates granted.
85 duplicate certificates furnished to be filed in other States.
60 parcels of nursery stock inspected and certified.
31 orchards and gardens examined.
35 shipments, containing 179 cases, 1,981,895 plants, imported nursery stock inspected.
15 shipments or 42.8 per cent. found infested with insects or fungi.
725 apiaries, containing 6,802 colonies inspected.
17 apiaries and 25 colonies found infested with European foul brood.
7 apiaries and 22 colonies found infested with American foul brood.
2,283 letters written on official work.
663 circular letters.
368 post cards.
53 reports to Federal Horticultural Board.
857 bulletins, etc., mailed on request or to answer inquiries.
86 packages sent by mail or express.
19 lectures and addresses at institutes, granges and other meetings.

Publications of the Entomological Department, 1923.

By W. E. Britton:

Twenty-second Report of the State Entomologist of Connecticut (Bulletin 247) 118 pages, 8 figures, 16 plates; 10,500 copies distributed in October, 1923.

The Aleyrodidae and Coccidae of Connecticut. Reprinted from Bulletin No. 34, Connecticut Geological and Natural History Survey, 48 pages, 3 figures, 4 plates, June, 1923.

The European Corn Borer Quarantine, Bulletin of Immediate Information No. 25, 5 pages; 3,000 copies, June, 1923.

The Apple and Thorn Skeletonizer, Bulletin of Immediate Information No. 26, August 15, 1923.

Registration of Bees, Bulletin of Immediate Information No. 27, 200 copies, September 15, 1923.

The Apple and Thorn Skeletonizer, Proceedings 32nd Annual Meeting Connecticut Pomological Society, page 21, 1923.

Rapid Spread of the Apple and Thorn Skeletonizer, *Hemerophila pariana* Clerck, Journal of Economic Entomology, Vol. 16, page 207, April, 1923.

The Gipsy Moth, Proceedings of Conference at Albany, N. Y. November 16, 1922, Bulletin 148, New York State Department of Agriculture, page 44, December, 1922.

Swarms of Aphids, Journal of Economic Entomology, Vol. 16, page 395, August, 1923.

Report of Committee on Injurious Insects, Proceedings 32nd Annual Meeting, Connecticut Pomological Society, page 5, 1923.

The Arbor-Vitae Leaf-Miner, Tree Talk, Vol. 5, No. 2, page 24, 1923.

The Work of the State Entomologist, Hartford Daily Courant, Sunday, October 21, 1923.

Insects Attacking Vegetable Crops in 1922 (Insect Part of Report of Committee on Diseases and Insects), Report of Connecticut Vegetable Growers Association for 1922, page 83.

Recent Developments in the Use of Insecticides, Part II, Bulletin 242, page 163.

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

Spray Calendar, (Bulletin 244) 44 pages with card, illustrated, 11,500 copies, May, 1923.

The Winter Pruning of Fruit Trees, Bulletin of Immediate Information, No. 19, March 14, 1923.

Dormant Sprays on Orchard Trees, Bulletin of Immediate Information No. 20, March 21, 1923.

The Pink Spray for Apple Orchards, Bulletin of Immediate Information No. 22, May 1, 1923.

The Calyx Spray for Apples and Quinces, Bulletin of Immediate Information No. 24, May 21, 1923.

By W. E. Britton et al: The Hemiptera of Connecticut, Bulletin No. 34, Connecticut Geological and Natural History Survey, Projected and Edited by W. E. Britton. Text by J. F. Abbott, A. C. Baker, H. G. Barber, W. E. Britton, W. T. Davis, D. M. DeLong, W. D. Funkhouser, H. H. Knight, A. C. Maxson, Herbert Osborn, H. M. Parshley, E. M. Patch, L. A. Stearns, J. R. de la Torre-Bueno, E. P. Van Duzee and H. F. Wilson; 807 pages, 169 figures, 20 plates, June, 1923.

By M. P. Zappe and E. M. Stoddard:

Results of Dusting *vs.* Spraying in Connecticut Apple and Peach Orchards in 1922 (Bulletin 245), 17 pages, June, 1922.

Comparative Results of Spraying and Dusting on Apples and Peaches, Proceedings 32nd Annual Meeting Connecticut Pomological Society, page 30, 1923.

By Philip Garman:

Work with the Control of the European Red Mite in 1922. Proceedings 32nd Annual Meeting, Connecticut Pomological Society, page 13, 1923.

Notes on the Life History of *Clastoptera obtusa* and *Lepyronia quadrangularis*, Annals Entomological Society of America, Vol. XVI, page 153; 10 pages, 1 figure, 1 plate, June 1923.

By B. A. Porter and Philip Garman:
The Apple and Thorn Skeletonizer, Bulletin 246, 20 pages, 3 figures, 4 plates, June, 1923.

By Samuel T. Sealy:
Recent Development of Mosquito Work in Connecticut, Proceedings of the Ninth Annual Meeting of the New Jersey Mosquito Extermination Association, page 94, 1922.
Accomplishments in the Past Year in Anti-Mosquito Work in Connecticut, Proceedings of the Tenth Annual Meeting of the New Jersey Mosquito Extermination Association, page 91, 1923.

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.*
} *Assistant Entomologists.*
John T. Ashworth, *Deputy in Charge of Gipsy Moth Work.*
James A. McEvoy, *Assistant in Gipsy Moth Work.*
Samuel T. Sealy,[1]
Robert C. Botsford,[2]
} *Deputy in Charge of Mosquito Work.*
Miss Gladys M. Finley, *Clerk and Stenographer.*

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

Mr. Samuel T. Sealy, who has served as Deputy in charge of mosquito work for three years, resigned to take effect April 1, 1923. Mr. Walden was placed in charge of this work temporarily. Mr. Robert C. Botsford was employed to work with Mr. Walden and on becoming familiar with the situation was appointed Deputy July 1.

Mr. J. Leslie Rogers was employed from July 1 to December 1 to aid in inspecting nurseries and after that work was finished, to search for the European corn borer. Mr. T. F. Cronin was employed from June to September as assistant in inspection of nurseries. Mr. M. J. Hubbell was employed during November in the construction of the addition to the insectary and in building some out-door breeding cages.

Besides giving his attention to the mosquito control for three months, Mr. Walden was able to complete his studies on the raspberry fruit worm, the results of which have been published as Bulletin No. 251.

Dr. Garman has continued with experiments to control the European red mite, *Paratetranychus pilosus* Can. & Fanz., and his results of four seasons' work in Connecticut against this pest have been published as Bulletin 252. Dr. Garman has given considerable attention to a study of the mites, has worked with Mr. Zappe on the investigations of the plum curculio on apple and *Anomala*

[1] Resigned April 1.
[2] From July 1.

orientalis, and has completed the manuscript of a monograph of the Odonata or Dragon Flies of Connecticut to be published in the near future by the State Geological and Natural History Survey.

Mr. Zappe has been in charge of the inspection of nursery stock, and of scouting for European corn borer. In co-operation with Mr. E. M. Stoddard of the Botanical Department, Mr. Zappe has continued the tests of various dusts in comparison with sprays in apple and peach orchards for the control of the various insects and fungous pests. The work this year was chiefly for the purpose of trying some of the new copper dusts, but in most cases insecticides were added and the results so far as they relate to insects may be found in the following pages of this report.

Dusts were also applied to potatoes at the Station Farm in comparison with the usual spray of Bordeaux mixture and lead arsenate. Mr. Zappe has further experimented with Paradichlorobenzene as an agent in controlling the peach borer.

The plum curculio, *Conotrachelus nenuphar* Hbst., has proven a serious pest of apples in Connecticut, often disfiguring a large proportion of the fruit and is seemingly difficult of control. In order to learn more of its habits and to devise some more effective control methods a five-year program has been adopted. Some progress has been made during the past season by Messrs. Zappe and Garman.

The gipsy moth control work has been continued as for the past few years, the field work being in charge of Deputy John T. Ashworth, aided by his Assistant, Mr. J. A. McEvoy. About twenty-five other men have been kept busy throughout the year in scouting for egg-masses and larvae, and in spraying during the latter half of May and June. This work is performed in co-operation with the Federal Bureau of Entomology.

The apiary inspection work has been done as in past years by Messrs. H. W. Coley and A. W. Yates on a *per diem* basis.

The Entomologist, besides directing the work of the Department and attending to the correspondence of the office, has continued to serve as Associate Editor of the Journal of Economic Entomology, and as Chairman of the Tree Protection Examining Board. He has also continued to aid the Federal Bureau of Entomology by gathering data and submitting reports for the Insect Pest Survey. Several years ago he organized and projected the work on the Hemiptera of Connecticut, which has just been published as Bulletin No. 34 of the State Geological and Natural History Survey; he is the author of that portion dealing with the white flies (*Aleyrodidae*) and scale insects (*Coccidae*) and has edited the entire volume of 807 pages. Some of the drawings for the text figures were done by Dr. Garman and the photographs were arranged and most of them made by Mr. Walden. The index and much of the proof reading was done in this office and altogether considerable attention has been given to it during the year.

New Equipment.

During the year the equipment of the Department has been substantially increased. A new insectary 10 x 20 feet with boarded roof and sides covered with cottage wire netting has been built at the Station Farm at Mount Carmel, and has already been used in connection with the plum curculio investigations on apple. The out-door insectary at the Station, which was 10 x 16 feet in size with shingled roof has been moved about one hundred feet northward, and an addition 12 x 14 feet built, with glass roof and sides covered with chicken wire netting. The original portion has the sides covered with fine mesh copper wire, and will be kept as a separate compartment. Both insectaries are shown on Plate IX.

Two new binocular microscopes (one of portable type) and a Bausch & Lomb photomicrographic stand with accessory lens and lighting equipment, and a Wales adding machine have been purchased for the laboratory. A new self-recording thermometer was also obtained to use in the insectary.

Several important additions have been made to the library, including the insect portion of the Biologia Centrali-Americana and a complete set of the Bulletin of Entomological Research of England.

ENTOMOLOGICAL FEATURES OF 1923.

The season has been abnormal and quite the opposite of 1922, in that little rain fell between July 1 and October 1. Many crops were below the usual yield on account of the drought. Particularly were apples under size. The first of the season was cool and moist and there were several hard frosts in April, but no early hard frosts in the fall.

Perhaps the most outstanding features of the season, so far as insects are concerned, were the general injury of apple trees in July by the apple and thorn skeletonizer, *Hemerophila pariana* Clerck, which caused nearly all unsprayed apple trees throughout the central part of the State to turn brown, the increase in the Oriental peach moth, *Laspeyresia molesta* Busck, and the discovery of the European corn borer, *Pyrausta nubilalis* Hubn., in Groton in October and in East Lyme in December.

There has been no important increase in the territory infested by the gipsy moth as was the case in 1921, caused by wind-spread, though a few additional towns were found by Federal scouts to be infested. For this reason the towns of Goshen, Litchfield, Cheshire, Meriden, Middlefield, Wallingford, Old Lyme and Old Saybrook have been placed under Federal quarantine.

The brown-tail moth has not again appeared in Connecticut, and not a single nest has been seen since 1919.

Fruit Insects.

The pear psylla, *Psylla pyricola* Forst., caused the usual amount of damage and was particularly prominent in a pear orchard in Southington in July.

The San José scale, *Aspidiotus perniciosus* Comst., is somewhat on the increase, though no such serious injury has been seen in Connecticut as has been reported from southern Illinois and Indiana.

The false apple red bug, *Lygidea mendax* Reut., was not prominent and generally caused less injury throughout the State than usual.

The pear leaf blister mite, *Eriophyes pyri* Pagst., was received from Hamden and Waterbury.

The European red mite, *Paratetranychus pilosus* Can. & Fanz., was responsible for rather wide-spread damage to Baldwin apple orchards during the season, probably more than in 1922. The results of Dr. Garman's experiments for the control of this pest may be found in Bulletin 252.

The rosy apple aphid, *Anuraphis roseus* Baker, caused less damage than usual though some injury was reported from Haddam and Deep River. Eggs were rather abundant on the fruit spurs in March about New Haven.

The green apple aphid, *Aphis pomi* DeGeer, was present on water-sprouts and terminal shoots, in usual abundance.

The rose leafhopper, *Empoa rosae* Linn., seemed to be more abundant than usual on apple trees, and on May 8, nymphs had just hatched from eggs at Milford.

The rose chafer, *Macrodactylus subspinosus* Fabr., was scarce in some localities and abundant in others and injured the developing fruit by eating holes in it.

The tarnished plant bug, *Lygus pratensis* Linn., caused some injury to the terminal twigs of apple and peach nursery stock and its work was observed in several nurseries in different parts of the State early in August.

The tent caterpillar, *Malacosoma americana* Fabr., is still increasing and may be expected to be very abundant throughout the State in 1924. Eggs are now present everywhere on the twigs of apple and wild cherry. During the year specimens of this insect were received from Clinton, Southport and Washington, with special reports from Danbury, Meriden and Mansfield, and from Fairfield, Litchfield and Windham Counties.

The apple maggot or railroad worm, *Rhagoletis pomonella* Walsh, was fully as abundant as usual though in our experiments, apples sprayed or dusted with lead arsenate after July 1 were almost free from injury. Specimens were received from New Haven, Cheshire and Berlin.

The plum curculio, *Conotrachelus nenuphar* Hbst., was more

abundant than in the average season and caused much injury to apples.

The Oriental peach moth, *Laspeyresia molesta* Busck, was more abundant than it has ever been before in Connecticut. The larvae tunneled in the twigs of peach trees, and were found in the fruit late in the season. This insect was first found in Connecticut at Stamford by Federal scouts in 1918, and it is not known to occur anywhere in the State except in Fairfield and New Haven Counties. In 1923 a few infested peaches were found at the Station Farm at Mount Carmel.

A cocoon of the bag worm, *Thyridopteryx ephemeraeformis* Haw., on quince was received from New Haven, May 1. The eggs hatched and the larvae were fed and reared to maturity and the adults obtained.

The grape vine tomato gall, *Lasioptera vitis* O. S., was abundant as usual, and specimens were received from West Hartford, June 14, and from New Britain, June 19.

The red-humped caterpillar, *Schizura concinna* S. & A., was present in usual numbers, and specimens were received from Bloomfield, July 16, and from East Hampton, August 14.

Vegetable Insects.

On account of the cool and damp weather in May and June the seed did not germinate promptly and there was considerable injury by the seed corn maggot, *Hylemyia cilicrura* Rond. One field of corn in Milford was seriously injured in June.

Wireworms (Elateridae) caused damage of varying extent in three fields of corn on one farm in Woodbridge, visited on July 6. In one small field 50 per cent. of the corn had been destroyed.

Cutworms caused the usual amount of injury throughout the State, but serious injury to tobacco plants was reported from Portland, June 22, where there was 15 per cent. damage. The owner used poisoned bran mash, but also poisoned the plants and practiced hand-picking.

There was, perhaps, more than the usual amount of injury from the stalk borer, *Papaipema nitela* Guen. Records of injury to corn came from Somers, Torrington, Waterbury, Hamden and Derby. In Windsor it attacked tobacco, and in Stratford, tomatoes and peppers. This insect occurs over the entire State, and may tunnel in any kind of herbaceous stem—even weeds. No remedy is known other than destroying the borers when found.

The corn ear worm, *Chloridea obsoleta* Fabr., was present in a number of fields late in the season, as it was in 1922, but was nowhere nearly so abundant as in 1921.

The turnip aphid, *Aphis pseudobrassicae* Davis, killed or seriously injured turnips and kale in many parts of the State in June, July and August. Specimens were received from Meriden, Danbury, Harwinton, Hamden and New Haven.

Colonies of the cabbage aphid, *Brevicoryne brassicae* Linn., started on cabbages in New Haven and did some damage, but later disappeared.

The pea aphid, *Illinoia pisi* Kalt., was also present on garden peas and caused perhaps the usual amount of damage. This damage was serious in some fields, one grower near New Haven reporting a total loss on three acres. In certain parts of Hartford County, a forty per cent. infestation was observed on June 22, and reported by County Agent Southwick.

The potato aphid, *Macrosiphum solanifolii* Ashm., also appeared in many fields and caused considerable injury. Samples were received from Wallingford on July 30, with the tips badly infested. At the Station Farm, Mount Carmel, a potato field was moderately infested, though the bulk of the aphids came later in the season than usual. They were abundant on August 7, but by August 24 had all disappeared.

The squash vine borer, *Mellitia satyriniformis* Hubn., the squash bug, *Anasa tristis* DeGeer, and the striped cucumber beetle, *Diabrotica vittata* Fabr., were all present in usual numbers, the last being reported as being very abundant at Storrs on June 22.

Considerable injury resulted from the attacks of the potato or cucumber flea beetle, *Epitrix cucumeris* Harr., and four per cent. damage in Woodstock on June 19, was reported by County Agent Davis.

In September, tobacco fields were severely injured by having the leaves partially eaten by the red-legged grasshopper or locust, *Melanoplus femur-rubrum* DeGeer. This damage was estimated as amounting to between forty and sixty per cent.

The brown colaspis, *Colaspis brunnea* Fabr., caused some injury in Hamden and Durham by feeding upon the leaves of beans. The observations were made by Mr. Zappe.

The European corn borer, *Pyrausta nubilalis* Hubn., was discovered at Groton by Federal scouts on October 25, 1923, and a few days later another small infestation was found farther eastward in the same town. All corn stalks, weeds, grass and rubbish on these small fields was burned. On December 14, another small infestation was found by Federal scouts in the village of Niantic, township of East Lyme. These infestations are described more in detail on page 278.

The Asiatic beetle, *Anomala orientalis* Waterhouse, which was discussed in last year's Report, pages 277 and 345, has caused considerable damage to lawns in the vicinity where the adult beetles were first discovered. The larvae eat the roots of the grass, killing it. A more complete account of this introduced pest will be found in the following pages of this Report.

White grubs devouring the grass roots of a lawn in Salisbury were sent by the owner to the Bureau of Entomology at Washington, and identified by Dr. Boving as *Anomala marginata* Fabr.

This is a species occurring in the southern Atlantic States and was not known to be present in Connecticut. Mr. Zappe visited the place and gathered material on September 25, and an attempt will be made to rear the adults.

Shade Tree and Forest Insects.

The woolly maple leaf scale, *Phenacoccus acericola* King, continues to infest sugar maple trees in villages and cities, but has not been observed in abundance on maple trees in the open country. Specimens were received from New Haven, Thompsonville and Norwalk.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., is without doubt the commonest scale insect in Connecticut, and infests not only shade and forest trees but also fruit trees and ornamental shrubs. It is the commonest insect found by inspectors in nurseries, and though perhaps not more abundant than usual, it seems to be fairly abundant year in and year out. As a rule, the growers pay little attention to it, except to destroy infested stock in nurseries when directed to do so.

The arbor-vitae leaf-miner, *Argyresthia thuiella* Pack., which caused considerable injury to arbor-vitae trees and hedges around New Haven in 1921 and much less in 1922, was not injurious in that region in 1923, though it was reported as causing serious damage to trees in New Canaan and Stamford.

The white pine weevil, *Pissodes strobi* Pk., still continues to injure small trees in the open with marked regularity. Specimens were received from Southington, Kensington and Windsor.

The imported pine sawfly, *Diprion simile* Hartig, is present here and there but not in great abundance. Specimens were received twice from New Haven during the season, and the insect was reported from Deep River.

The elm leaf beetle, *Galerucella luteola* Müll., caused more injury than last year throughout the State, but it was particularly severe in Fairfield County, and its work was observed in Glastonbury and Wethersfield.

The imported poplar and willow beetle, *Plagiodera versicolora* Laich., which first appeared in the State in Greenwich and Stamford has spread eastward and is now found in New Haven and Yalesville. Some of the infested trees in Greenwich were entirely defoliated.

The oak leaf-roller, *Tortrix quercifoliana* Fitch, was prevalent particularly around Hartford and Stamford on pin oaks. Certain trees in the vicinity of Stamford were nearly defoliated.

The larch leaf-miner, *Coleophora laricella* Hubn., was prevalent in some parts of the State and nearly defoliated the larch trees in June. Specimens were received from Canaan and New Canaan and the work of this insect was observed elsewhere.

The spruce leaf-miner, *Recurvaria piceaella* Kearfott, was received on May 7 from New Canaan, where it was causing some injury.

The larch leaf aphid, *Chermes strobilobius* Kalt., was present on larch leaves, especially of the European species. Specimens were received from New Canaan, June 7, and the writer observed this insect in New Haven.

The pine leaf scale, *Chionaspis pinifoliae* Fitch, continues to infest the leaves of several species of pines in sheltered situations. It was received from Manchester, August 22.

The beech leaf aphid, *Phyllaphis fagi* Linn., is nearly always present on the leaves of the European beech, especially the purple leaved form known as the copper beech. Specimens were received from Danbury, May 29.

Two periods of aphid swarming occurred in the cities of the State, one in June and the other in September. The June swarms consisted of *Euceraphis deducta* Baker, and the September swarms were *Aphis betulaecolens* Fitch. Both species infest birch trees and no doubt they came from the gray birches which grow abundantly in most parts of the State. They are certainly common near New Haven, Bridgeport and Waterbury where these swarms were particularly noticeable.

Late in the season willow trees throughout the State were infested with brown aphids, *Melanoxantherium* sp. Mr. Zappe observed them especially in New Canaan, Darien, Woodmont, Yalesville, Cromwell and Manchester, while inspecting nurseries, and the writer saw them on a large willow tree in New Haven on August 30. The twigs were covered with large brown wingless aphids, and thousands of such aphids were crawling about on the fence, porch posts and rails and on the painted woodwork of the house. Wherever an aphid was crushed there was a purple stain, and these aphids in such abundance were a perfect nuisance. Honey dew had dripped from the branches upon the grass and fence underneath and both the tree and the ground were fairly swarming with bees, wasps and flies, attracted by the honey dew. The owner was advised to spray his tree and house with nicotine solution and soap to kill the aphids.

A woolly aphid, *Prociphilus tessellata* Fitch, on maple, was received from Torrington, July 30.

The walnut caterpillar, *Datana integerrima* G. & R., was reported as being common at Chester in early fall.

The European pine shoot moth, *Evetria buoliana* Schiff, was received from Tarrytown, N. Y., on October 3, and from Ridgefield on November 24. This insect had attacked the Norway or red pine and its shoots were crooked and deformed as is characteristic of the injury caused by this insect.

The birch leaf skeletonizer, *Bucculatrix canadensisella* Chamb., was fully as abundant as in 1922 and defoliated birch trees here

and there throughout the State. Many thought it to be the same insect which skeletonized the apple trees.

The fall canker-worm, *Alsophila pometaria* Harr., was rather abundant in some localities and the larvae fed upon the leaves of shade, forest and fruit trees. Around Saybrook and New Haven, this injury was rather prominent, and apple, elm, poplar, birch and walnut (*Juglans*) leaves were eaten. During November and December the gray male moths were unusually common, fluttering about the base of trees, and we may expect considerable injury from this insect next season. The females have no wings and must crawl up the trunks of trees to lay their eggs. Only early spraying with some arsenical poison will prevent damage next season.

The fall web-worm, *Hyphantria cunea* Drury, which makes nests on the ends of branches the latter part of the season was also especially prominent in Hartford, Tolland, Windham and New London Counties. Specimens were sent in from East Granby, Meriden and Plantsville. Roadside, woodland and fruit trees were attacked and many were entirely defoliated.

Miscellaneous Insects.

The house centipede, *Scutigera forceps* Raf., was sent to the office October 2 from Southport, where it annoyed the inmates of a dwelling house.

The basement of an apartment house in New Haven became overrun by the European cricket, *Gryllus domesticus* Linn., and both owner and tenant applied to the writer in April for advice.

The black carpet beetle, *Attagenus piceus* Oliv., causes considerable damage each year by eating holes in clothing hanging in closets. During the season specimens were received from Meriden and Farmington. If small pieces of wool cloth are kept on the floor, the larvae will often feed upon them instead of attacking the clothing.

The chrysanthemum gall midge, *Diarthronomyia hypogaea* Loew., was sent to the Station, April 10 from some commercial greenhouses at Rowayton where the small potted plants had galls on the leaves.

A small leaf beetle, *Nodonota puncticollis* Say, was reported as eating the buds of roses in Bridgeport, June 19, and specimens were sent to the office.

The Euonymus scale, *Chionaspis euonymi* Comst., was received from New Haven on April 3 on *Pachysandra terminalis*, a low-growing evergreen plant used in shady situations by landscape gardeners. This is the first time that I have ever seen this plant infested.

The four-lined leaf bug, *Poecilocapsus lineatus* Fabr., was common in 1923 and attacked the growing tips of many different

kinds of plants. Specimens were received on currant from Hamden, June 23, on currant and chrysanthemum from West Haven June 26, and on peony and spearmint from Stratford, July 2.

The rhododendron borer, *Sesia rhododendri* Beut., described in the Report of this Station for 1922, page 347, is still causing injury in rhododendron plantations and the growers are interested in methods of controlling it. Specimens were received from Yalesville, June 16 and from Springfield, Mass., June 28.

Geranium plants were received from New Haven, August 3 which had been injured by white ants, *Reculitermes flavipes* Kollar. The ants had tunneled in the stems ruining some of the plants.

On November 23, specimens of box twigs were received from Waterford. The leaves were badly infested with larvae of the box leaf-miner, *Monarthropalpus buxi* Labou. If possible some experiments will be conducted for the control of this pest.

Larkspur plants on the grounds of Miss A. B. Jennings, Fairfield, were severely injured by the mite, *Tarsonemus pallidus* Banks. Dr. Garman visited the place on July 3 and found that many of the buds had been deformed and had turned black and some leaves were deformed.

The more important of these insects mentioned above, together with accounts of the experimental and control work of the Department are described in greater detail in the following pages of this Report.

Summer Field Meeting.

An important entomological event of the season was the summer field meeting of the entomologists of the northeastern United States, which was held in Connecticut July 26 and 27. The members gathered in New Haven on the afternoon and evening of July 25, the Hotel Taft being the headquarters. The trips to various points were made by automobile. On the morning of the 26th, they visited the Entomological Department of this Station and the Station Farm at Mount Carmel, then West Rock Park, Yale Bowl, Harkness Memorial Quadrangle, and the orchard of Frank N. Platt, Milford, where spraying and dusting experiments were being conducted. From this point the party proceeded along the coast to the State Park at Hammonasset Beach, Madison. Following the luncheon, there was a baseball game (Worthley, umpire); some of the entomologists went bathing while others collected insects along the beach. Late in the afternoon, the party went northward, passing Wesleyan University at Middletown, stopping at the large greenhouse and nursery establishment of the A. N. Pierson Co., Cromwell, viewed the gigantic elm tree in Wethersfield, and then to Hartford, where at the Hotel Bond a dinner and evening meeting had been arranged.

An interesting lecture on the Japanese beetle, illustrated by lantern slides, was given by Mr. Loren B. Smith of Riverton, N. J., in place of Mr. C. H. Hadley, who could not be present. Friday morning the party drove through Keney Park to the tobacco sub-station at Windsor, and visited the forest experimental plots at Rainbow, returning via Elizabeth Park, to Hartford, where luncheon was served in the State Capitol. After luncheon the visitors were shown about the Capitol and the State Library, then drove, via Rockville, to the Connecticut Agricultural College at Storrs. Here a demonstration of high-power spraying of woodland and orchard trees was given by the gipsy moth forces. After supper there was a baseball game between the Connecticut gipsy moth men and a team picked from the visitors (Burgess, umpire). In the evening motion pictures were shown in the armory, including those on the European corn borer, and the gipsy moth, prepared by the U. S. Department of Agriculture.

Besides members of the Station Staff, the following were present: H. A. Ames, Somerville, N. J.; E. A. Back, Washington, D. C.; D. N. Borodin, New York, N. Y.; H. L. Blaisdell, Melrose, Mass.; F. E. Brooks, Washington, D. C.; A. F. Burgess, Melrose Highlands, Mass.; C. W. Collins, Melrose Highlands, Mass.; C. R. Crosby, Ithaca, N. Y.; S. M. Dohanian, Somerville, Mass.; E. P. Felt, Albany, N. Y.; Hugh Glasgow, Geneva, N. Y.; F. W. Graves, Melrose Highlands, Mass.; Melvin Guptill, Sudbury, Mass.; T. L. Guyton, Harrisburg, Pa.; E. A. Hartley, Melrose Highlands, Mass.; G. W. Herrick, Ithaca, N. Y.; T. J. Headlee, New Brunswick, N. J.; H. E. Hodgkiss, State College, Pa.; C. E. Hood, Melrose Highlands, Mass.; J. L. Horsfall, Bustleton, Pa.; J. F. Jamieson, Riverton, N. J.; R. W. Kelley, New York, N. Y.; G. H. Lamson, Storrs, Conn.; F. H. Lathrop, Highland, N. Y.; M. D. Leonard, Albany, N. Y.; Q. S. Lowry, Boston, Mass.; J. A. Manter, Storrs, Conn.; C. W. Minott, Melrose Highlands, Mass.; F. H. Mosher, Melrose Highlands, Mass.; H. L. McIntyre, Albany, N. Y.; A. H. Parkins, Boston, Mass.; Alvah Peterson, New Brunswick, N. J.; D. M. Rogers, Boston, Mass.; J. V. Schaffner, Melrose Highlands, Mass.; A. F. Schulze, Storrs, Conn.; R. A. Sheals, Providence, R. I.; L. B. Smith, Riverton, N. J.; A. E. Stene, Kingston, R. I.; W. R. Walton, Washington, D. C.; H. I. Winchester, Melrose, Mass.; R. Woolridge, Melrose Highlands, Mass., and L. H. Worthley, Arlington, Mass.

INSPECTION OF NURSERIES IN 1923.

The General Statutes provide that "all nurseries or places where nursery stock is grown, sold, or offered for sale, shall be inspected at least once each year by the State Entomologist or one of his deputies, and if no serious pests are found, a certificate to that effect may be given." Consequently such inspection has been made each year of all growing nursery stock so far as the existence of such nursery stock is known to the State Entomologist. In 1923, two nurseries were inspected in the spring and again late in the summer. The annual inspection was commenced on July 26 and finished on September 26, except for one nursery learned about later and inspected on October 11. This work was in charge of Mr. M. P. Zappe, who was assisted by J. Leslie Rogers and T. F. Cronin. Mr. E. M. Stoddard of the Botanical Department and Doctors Garman and Britton helped one day each. For the most part these nurseries were given a rather more rigid inspection than usual, for, on account of the wide-spread infestations of the gipsy moth, it seemed almost necessary to make sure that none of the nursery stock was infested with that destructive pest. The weather was extremely favorable and as the whole period was one of protracted drought the work was not delayed on account of rain.

On the whole the nurseries were in good condition and fairly clean. Some owners are always more careful than others about such matters. Where the stock is kept clean it is not only easier to inspect, but the amount of stock to be treated or destroyed after inspection is reduced to a minimum.

At a hearing and conference before the Federal Horticultural Board at the State House, Boston, Mass., August 17, 1923, the point was made by the Board and confirmed by several of the nurserymen present that the nurseries must be kept comparatively free from serious insect and fungous pests. This idea should be reiterated and emphasized again and again. Clean stock only should be sent out from nurseries, and the customer has a right to expect it. Quarantine and inspection officers in other states are watching and may cause the destruction, treatment or return of stock found infested. Moreover, a large number of infested shipments from one state into another may lead to regulations prohibiting shipments altogether.

The understanding reached at the Boston conference is to the effect that a nurseryman must hold a state certificate before the Federal gipsy moth inspection will be granted. In the quarantined area this inspection and certification are necessary if one wishes to ship out of the infested area; but if the owner is not willing to clean up sufficiently to enable him to obtain a state certificate, the Federal inspection will be refused. Hence it behooves all nurserymen to co-operate cordially, promptly and thoroughly with the state inspectors, otherwise they may not be able to do

business because of these conditions. Several Massachusetts nurserymen stated that every tree and shrub in their nursery had been sprayed thoroughly with arsenate of lead.

However, there are pests other than the gipsy moth which must receive attention from the nurseryman. For instance the oyster-shell scale, *Lepidosaphes ulmi* Linn., is the commonest insect pest found in the nurseries, and the spruce gall aphid, *Chermes abietis* Linn., and the poplar canker, *Dothichiza populea*, are also close seconds. Both of these insects may be readily held in check by contact sprays made at the right time. The former has only one generation and the latter two generations each year in Connecticut. The spruce gall aphid attacks only spruce trees, but the oyster-shell scale infests a large number of different kinds of trees and shrubs.

Oyster-Shell Scale.

The oyster-shell scale lives through the winter in the form of white oval eggs which are formed under the shells during September. These eggs do not hatch until about the last week of the following May. The young then crawl out from underneath the old female shells and establish themselves on the bark. They soon begin to suck the sap and do not move afterwards. Each forms a shell, but these shells are very thin at first and gradually become larger and thicker. The proper time for the most effective treatment is soon after the eggs hatch and before the shells become heavy enough to protect the insects from the application. Thus a thorough spraying about the first week of June with kerosene soap emulsion, or with nicotine solution and soap will kill nearly all of the young scales. It is always advisable to cut and burn all branches or stems which can be spared and which are badly infested. The oyster-shell scale is particularly prevalent on willow, poplar, ash, birch, black walnut, butternut, lilac, maple and apple, and often occurs on many other trees and shrubs.

Spruce Gall Aphid.

The spruce gall aphid occurs only on spruce trees and two species may be found in Connecticut nurseries. The more common one, *Chermes abietis* Linn., attacks Norway, black, red and white spruces, and sometimes hemlock, making a cone-shaped swelling or gall at the base of the new growth. On the Colorado blue spruce, much larger galls occur which are caused by another species, *Chermes cooleyi* Gillette. The young females live on the twigs through the winter and in spring mature, lay their eggs and die. On hatching from the eggs in May, the young crawl to the tips of the twigs and settle at the base of the leaves where the

new growth is just beginning to form. The cone-shaped gall is here developed, the young being inside and sucking the sap. Becoming mature in August, the nymphs excape from the galls, which later turn brown and die, often killing the shoot beyond the gall. The insects molt after emerging and are then provided with wings. They crawl over the leaves where the females lay stalked eggs which hatch in about two weeks and this generation is the one which lives over winter on the twigs in a partially developed state.

On small trees in the nursery the galls may easily be clipped off in June and burned. This treatment has already been practiced in one Connecticut nursery where many conifers are grown, and resulted in few galls being found at the time of the annual inspection in August.

Spraying in April with a contact spray to kill the over-wintering females is one of the best control methods. In Massachusetts, whale oil soap, one pound in two gallons of water, proved so effective that no insects could be found afterward upon the trees. For several years in one large nursery the spruce trees have been sprayed in April with miscible oil, one part in twenty parts of water. The same treatment has also been applied late in the fall, and both spring and fall applications have been effective in controlling the spruce gall aphid. There has never been any injury to the trees from the treatment except once, and this was probably due to not mixing the contents of the original package thoroughly before diluting with water.

Poplar Canker.

From our records it appears that poplar canker was first found in Connecticut nurseries in 1918, when six nurseries were infested. Though each year infested trees have been destroyed, it has increased in abundance until in 1923 it occurred in 34 nurseries. This is an infectious disease caused by a fungus which grows in the bark in a manner similar to that of the chestnut blight, forming cankers and often girdling branches or the main trunk and killing all tissues above or beyond the point of attack. In nurseries, cutting and burning the diseased trees or branches is the remedy.

Pests Found in Nurseries.

In 32 nurseries no important pests were found. These were mostly newly established nurseries where the young stock has not become infested or small nurseries where special stock not commonly infested is grown. Following is a list of the principal pests found with the number of nurseries infested by each:

List of Pests Found in Nurseries in 1923.

INSECTS.

Aphids, apple, green	15	Mite, European red	4
woolly	4	on box elder	1
on chestnut	1	Sawfly, *Diprion simile*	2
pine	1	on arbor-vitae	1
spiraea	1	willow	1
spruce gall,		Scale, elm	10
Chermes abietis	28	Euonymus	2
cooleyi	9	*Lecanium corni*	1
Apple and thorn skeletonizer	18	oak gall scale (*Kermes*)	1
Arbor-vitae leaf-miner	1	oyster-shell	42
Birch Bucculatrix	6	pine leaf	8
Borer, lilac	1	rose	12
peach	1	San José	20
poplar	2	scurfy	5
Curculio, poplar	1	tulip tree	4
Lace bugs	2	West Indian peach	1
Laspeyresia molesta	2	white elm	1
Lina scripta	1	Tarnished plant bug	1
		White pine weevil	17

PLANT DISEASES.

Apple scab	3	Mildew on rose	4
Blister rust	6	Mosaic, raspberry	4
Cedar rust	8	Poplar canker	34
Crown gall	3		
Fire blight	3	Uninfested	32

From the preceding list it may be seen that the oyster-shell scale is found in a larger number of nurseries (42) than any other pest on the list, though the poplar canker comes next, being found in 34 nurseries.

In order to show how the figures of 1923 compare with those of preceding years, the following table shows the comparative abundance of the principal nursery pests for the past six years:

Six Year Record of Serious and Common Nursery Pests.

Pest	1918	1919	1920	1921	1922	1923
Oyster-shell scale	39	38	38	36	44	42
San José scale	18	19	11	28	19	20
Spruce gall aphid	15	19	21	31	21	28
White pine weevil	5	5	1	1	19	17
Apple and thorn skeletonizer	..	..	..	..	1	18
Poplar canker	6	5	13	21	31	34
Blister rust	1	..	..	2	9	6
No pests	32	32	46	36	36	32

One nursery has gone out of business since last year, three have changed ownership, and fourteen new names appear on the list. One nursery has been inspected twice. The list contains five more names than the list for 1922. Six other nurseries were

inspected but have not reported that the infestations have been removed. These have no certificates and will violate the law every time they make a sale.

In addition to the inspection of the nurseries, 60 separate packages of nursery stock have been inspected to accommodate individuals who wish to ship, and in some cases inspection of parcels has been made and certificates issued to nurseries which have not received the regular form of certificate covering their nursery stock.

The nurserymen's list for 1923 contains 106 names, as follows:

Nursery Firms in Connecticut Receiving Certificates in 1923.

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Barnes Bros. Nursery Co.	Yalesville	150	Sept. 25	1421
Barnes Nursery & Orchard Co.	Wallingford	45	Oct. 8	1437
Barton Nursery	Hamden	1	Sept. 21	1411
Beattie, Wm. H.	New Haven	1	Sept. 21	1412
Benbow, A.	Norfolk	1	Oct. 1	1430
Bertolf Brothers	Greenwich	25	Sept. 18	1402
Brainard Nursery & Seed Co.	Thompsonville	10	Sept. 27	1424
Braley & Co.	Burnside	1	Sept. 11	1390
Bretschneider, A.	Danielson	1	Sept. 18	1404
Bristol Nurseries, Inc	Bristol	16	Oct. 15	1439
Burr & Co., C. R.	Manchester, Ellington and Durham	500	Aug. 1	1363
Burroughs, Thos. E.	Deep River	3	Sept. 14	1396
Chapman, C. B.	Groton	1	Sept. 24	1419
Chapman, C. E.	North Stonington	2	Sept. 27	1427
Clinton Nurseries (Warren Richards, Mgr.)	Clinton	1	Oct. 31	1452
Conine Nursery Co.	Stratford	50	Sept. 8	1387
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Nov. 17	1460
Conn. Agr. Exp. Sta. (W. O. Filley, Forester)	New Haven	1	Sept. 18	1401
Crofut & Knapp Farm	Norwalk	20	Nov. 23	1462
Cross Highway Nurseries	Westport	6	Nov. 28	1464
Crouch, Alden	Mystic	1	Apr. 7	1361
Dallas, Inc., Alexander	Waterbury	1	Sept. 22	1414
Dawson's Nursery	Willimantic	2	Aug. 24	1369
Dowd, F. C.	Madison	1	Sept. 7	1386
Dunlap, Daniel S.	Cromwell	1	Aug. 30	1378
Edgewood Nursery, Vidal, Inc	Stamford	5	Sept. 14	1398
Eldredge, Charles F. (2)	Niantic	1	Sept. 24	1417
Elm City Nursery Co., Woodmont Nurseries, Inc	Woodmont and New Haven	155	Aug. 27	1373
Evergreen Nursery Co.	Wilton	5	Sept. 7	1384
Fairty, C. H.	New Canaan	1	Dec. 7	1466
Falcon's Flight Farms Nursery (B. Austin Cheney, Prop.)	Litchfield	1	Oct. 6	1436
Fraser, G. W.	Willimantic	1	Aug. 24	1370
Gardner's Nurseries	Rocky Hill	5	Nov. 13	1459
Geduldig's Greenhouses	Norwich	1	Sept. 14	1397

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Glenn Terrace Ornamental Nursery (James H. Everett, Prop.)	Mount Carmel	6	Nov. 30	1465
Heath & Co	Manchester	5	Aug. 1	1365
Hilliard, H. J.	Sound View	1	Sept. 24	1418
Hiti Nurseries (J. H. Bowditch, Prop)	Pomfret Center	9	Aug. 30	1374
Holcomb, Irving	Simsbury	1	Aug. 30	1379
Hoogendoorn, C.	Yalesville	1	Sept. 6	1383
Horan & Son, Jas.	Bridgeport	1	Oct. 15	1440
Houstons' Nurseries	Mansfield	4	Nov. 3	1455
Hoyt's Sons Co., Inc., The Stephen	New Canaan	300	Sept. 20	1406
Hunt & Co., W. W.	Hartford	10	Sept. 26	1423
Isselee, Charles	Darien	10	Nov. 24	1463
Jones, William	Norwalk	1	Aug. 30	1375
Kelly, James J.	New Canaan	1	Sept. 13	1394
Kellner, Herman H.	Danbury	1	Sept. 27	1425
Keso Nursery (J. J. Kelsey, Prop.)	Clinton	1	Sept. 10	1388
Ladd & Nichols	Greenwich	2	Sept. 24	1415
Laddin's Rock Nursery (Est. of W. L. Marks)	Stamford	5	Aug. 24	1372
Langenbach, F. J.	Norwich	1	Aug. 24	1368
Leghorn, John J.	Cromwell	1	Aug. 30	1376
Mallett Co., George A.	Bridgeport	1	Oct. 15	1441
Maplewood Nurseries (T. H. Peabody, Mgr.)	Norwich	1	Nov. 9	1457
Marigold Farm (H. Kelley, Prop.)	New Canaan	6	Nov. 21	1461
Meier, A. R.	West Hartford	1	Oct. 19	1446
Millane Tree Expert Co., The	Middletown	1	Nov. 12	1458
Myers, C. B.	Milford and Rowayton	6	Oct. 15	1443
New Haven Nurseries Co., The	New Haven	10	Sept. 15	1399
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Aug. 24	1371
New London Cemetery Association (Ernest E. Rogers, Pres.)	New London	1	Oct. 29	1447
New London County Nurseries (W. J. Schoonman, Prop.)	New London	5	Oct. 15	1442
North-Eastern Forestry Co.	Cheshire	20	Aug. 20	1367
Oakland Nurseries	Manchester	5	Aug. 1	1364
Outpost Nurseries (L. D. Conley, Prop.)	Ridgefield	25	Sept. 12	1393
Ouwerkerk & Van der Stam	Yalesville	7	Sept. 6	1380
Park Gardens	Bridgeport	1	Sept. 20	1407
Park Hill Flower Shop	Manchester	1	Sept. 12	1392
Pequod Nursery Co.	Yalesville	15	Sept. 11	1389
Phelps, J. Wesson	Bolton	1	Oct. 29	1448
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Oct. 29	1449
Pierson, A. N., Inc.	Cromwell	50	Aug. 30	1377
Polish Orphanage Farm (Rev. L. Bojnowski, Mgr.)	New Britain	1	Sept. 25	1420
Pomeroy, Edwin C.	Northville	1	Sept. 27	1426
Reck, Julius	Bridgeport	1	Oct. 31	1450
Rockfall Nursery Co. (P. Marotta, Prop.)	Rockfall	4	Aug. 1	1366
Ryther, O. E.	Norwich	6	Oct. 3	1434
Saxe & Floto	Waterbury	1	Sept. 18	1405
Scheepers, Inc., John	Sound Beach	6	Sept. 18	1403
Schleichert, J. L.	Bridgeport	1	Sept. 20	1408

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Scott, J. W.	Hartford	5	Nov. 6	1456
Seely, C. H.	Darien	1	Oct. 1	1431
Sierman, C. H.	Hartford	5	Oct. 10	1438
South Wilton Nurseries	South Wilton	5	Sept. 7	1385
Stamford Seed & Flower Co.	Stamford	1	Oct. 1	1432
Steck, Charles A.	Newtown	3	Oct. 2	1433
Steck, Jr., Charles A.	Bethel	1	Oct. 31	1454
Steck, Mrs. Chas.	Bethel	1	Oct. 31	1453
Stratfield Nursery Co.	Bridgeport	6	Dec. 17	1467
Stratford Nursery Co. (C. A. Cooper, Prop.)	Stratford	1	Sept. 20	1410
Stratford Rose Nurseries (John Barrow, Prop.)	Stratford	3	Sept. 20	1409
Tanner's Nursery Co.	Manchester	1	Oct. 16	1445
Upson, R. E.	Marion	1	Sept. 25	1422
Vanderbrook & Son, Chas. L.	Manchester	5	Sept. 11	1391
Van Wilgen & Co	Branford	15	Sept. 6	1381
Verkade's Nurseries	New London	8	Sept. 24	1416
Vidbourne & Co., J.	Hartford	7	Sept. 28	1429
Wallace Nursery	Wallingford	2	Sept. 6	1382
Watrous, Arthur J.	Meriden	1	Sept. 18	1400
Wild, Henry	Greenwich and Norwalk	16	Oct. 6	1435
Wilson & Co., C. E.	Manchester	50	Sept. 14	1395
Woodruff, C. V.	Orange	1	Sept. 21	1413
Yale University Forest School	New Haven	1	Sept. 28	1428
Young, Mrs. Nellie A.	Pine Orchard	1	Oct. 31	1451
Zack Co., H. J.	Deep River	2	Oct. 16	1444
Total acreage		1,731		

INSPECTION OF IMPORTED NURSERY STOCK.

The nursery stock entering Connecticut from foreign countries during 1923 consisted of 35 shipments, 179 cases, and 1,981,895 plants. This is a larger number of shipments and cases than last year, but a smaller number of plants. The following table shows the quantities of such nursery stock inspected at destination by State inspectors during the last four years:

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

This stock consists of Manetti rose stock and fruit seedlings to be used for propagation,—budding and grafting. More than one-half, mostly rose stock, was consigned to one firm. The inspections were nearly all made by Mr. Zappe.

The time required to inspect this stock amounts to 264 hours, or 1.35 months of 26 working days of seven and one-half hours

each. The total cost of this work including time of men and traveling expenses amounted to $289.11.

The sources of this imported nursery stock for the year were as follows:

SOURCES OF IMPORTED NURSERY STOCK, 1922-1923.

Country	No. of Shipments	No. of Cases	No. of Plants
France	14	74	1,009,700
Holland	14	79	720,195
England	5	21	212,000
Italy	1	2	13,000
Unknown	1	3	27,000
	35	179	1,981,895

The following table shows the quantities of stock as inspected by months:

Month	No. of Shipments	No. of Cases	No. of Plants
November	2	5	58,240
December	4	25	251,500
January	13	69	796,000
February	8	40	459,555
March	7	29	312,600
April	1	11	104,000
	35	179	1,981,895

In addition to the stock inspected and reported above, there were eight shipments containing 40 cases and 415,800 plants which were reshipped to other states and not inspected in Connecticut.

There were nine shipments consisting of 16 cases of seeds which entered Connecticut but were not inspected here. One shipment of one case containing 5,000 apple seedlings was received which had already been inspected in New York, and consequently it was not reinspected.

Of the 35 shipments inspected, 15 or 42.8 per cent. were found infested with insects or other animals or plant diseases, some of which are well-known pests. For instance, if *Aporia crataegi* Linn. should become established in the United States, it would add another to the already large list of pests which feed upon the foliage of fruit trees and rosaceous plants. Details of these infested shipments are given below.

PESTS FOUND ON IMPORTED NURSERY STOCK.

15 Shipments Infested.

INSECTS.

Aporia crataegi Linn. on fruit seedlings. (1 shipment) A. Choplin, Maze, France.

Emphytus cinctus Linn. (13 shipments) Fa. As. Ouwerkerk, Boskoop, Holland; W. Fromow & Sons, Windlesham, Surrey, England; M. Gielen, Oudenbosch, Holland; B. Rugo, Ltd., Dedemsvaart, Holland; W. C. Slocock, Woking, Surrey, England; P. L. Renault, Orleans, France; Hemeray-Aubert, Orleans, France; D. G. de Jonge, Sappemeer, Holland; Felix & Dykhuis, Boskoop, Holland; S. Bide & Sons, Ltd., Farnham, Surrey, England; N. Levasseur & Fils, Ussy, France.

Lepidopterous cocoons. (2 shipments) P. L. Renault, Orleans, France; N. Levasseur & Fils, Ussy, France.

Spider's eggs. (1 shipment) P. L. Renault, Orleans, France.

PLANT DISEASES.

Crown Gall on Manetti rose. (6 shipments) W. Fromow & Sons, Windlesham, Surrey, England; R. C. Noteult, Woodbridge, England; W. C. Slocock, Woking, Surrey, England; Hemeray-Aubert, Orleans, France; S. Bide & Sons, Ltd., Farnham, Surrey, England.

INSPECTION OF APIARIES.

As in preceding years, the work of inspecting apiaries has been done on a *per diem* basis by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford. Mr. Coley covers the southern half of the State, Fairfield, New Haven, Middlesex and New London Counties. Mr. Yates covers the northern half, Litchfield, Hartford, Tolland and Windham Counties.

This work required a total of 131 man days, and the entire cost for the season was $1,849.80.

Fewer apiaries were inspected in 1923 than in each of the three years preceding. This was due, in part at least, to the fear that bees would take to "robbing" if disturbed, on account of the extreme lack of moisture.

The following figures show the number of apiaries and colonies inspected, and the average number of colonies per apiary for the past three seasons:

Year	No. Apiaries	No. Colonies	Average No. Colonies per Apiary
1921	751	6,972	9.2
1922	797	8,007	10.04
1923	725	6,802	9.38

In 1923, inspections were made in 119 towns as against 125 towns in 1922. No apiaries have ever been inspected in the town of Union, Tolland County, because the inspector has never been able to learn of bees being kept in that town.

In 1923, inspections were made in the following 22 towns not visited in 1922: *Fairfield County*: Danbury, Stratford and Trumbull; *New Haven County:* Derby, Meriden and Orange; *Middlesex County:* Cromwell, East Haddam, East Hampton, Haddam, Middlefield and Middletown; *New London County:* None; *Litchfield County:* Bethlehem, Harwinton, New Hartford, Watertown and Woodbury; *Hartford County:* Farmington and Rocky Hill; *Tolland County:* None; *Windham County:* Chaplin, Eastford and Putnam.

On the other hand, in 1922 inspections were made in the following 29 towns not visited in 1923: *Fairfield County:* Bridgeport, Newtown and Weston; *New Haven County:* Bethany, East Haven, Middlebury, New Haven, Oxford and Woodbridge; *Middlesex County:* Westbrook; *New London County:* Colchester, Lyme and North Stonington; *Litchfield County:* Bridgewater, Canaan, Cornwall, Kent, New Milford, Norfolk, North Canaan, Salisbury and Sharon; *Hartford County:* Avon and Hartford; *Tolland County:* Tolland and Willington; *Windham County:* Ashford, Brooklyn and Scotland.

European Foul Brood.

Out of the 725 apiaries and 6,802 colonies inspected in 1923, 17 apiaries and 25 colonies were found infested with European foul brood. This gives a ratio of 2.34 per cent. of apiaries and .36 per cent. of colonies infested, as against 4.14 and .85 per cent. respectively in 1922.

European foul brood has gradually decreased in Connecticut since the inspection was begun in 1909. In 1923 this disease was not found at all in Fairfield, New Haven and Tolland Counties. European foul brood was found in the following towns in 1923: *Middlesex County:* Durham and East Hampton; *New London County:* Norwich, Old Lyme and Stonington; *Litchfield County:* Winchester; *Hartford County:* Glastonbury and Suffield; *Windham County:* Killingly, Plainfield, Pomfret, Putnam and Sterling.

Last year 33 apiaries and 68 colonies were found infested with European foul brood. Compared with these figures, the infestations in 17 apiaries and 25 colonies in 1923 are quite encouraging.

American Foul Brood.

Of the 725 apiaries and 6,802 colonies inspected in 1923, seven apiaries and 22 colonies were infested with American foul brood. This is a ratio of .965 per cent. of apiaries and .323 per cent. of colonies as against 1.38 and .27 per cent. respectively in 1922. American foul brood was not found in Connecticut until 1914. Since then there has never been much of this disease, but the percentage is spasmodic and erratic. It fluctuates irregularly and has shown no such gradual change as has been the case with the decrease in the European foul brood.

In 1923, this disease occurred in the following seven towns: *Fairfield County:* Greenwich and Trumbull; *New Haven County:* Derby, Seymour and Wallingford; *Middlesex County:* East Hampton; *Windham County:* Killingly.

The statistics of the apiaries inspected in each of the 119 towns visited, arranged by counties, are given on the following pages, and summarized on page 252.

Apiaries Inspected in 1923.

	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood
Fairfield County:							
Bethel	5	0	22	0	0	0	0
Danbury	1	0	15	0	0	0	0
Darien	1	0	16	0	0	0	0
Easton	6	0	120	0	0	0	0
Fairfield	9	1	83	2	0	0	2
Greenwich	7	4	27	7	6	0	1
Monroe	4	0	77	0	0	0	0
New Canaan	2	0	29	0	0	0	0
Norwalk	5	0	63	0	0	0	0
Redding	7	0	29	0	0	0	0
Shelton	2	0	34	0	0	0	0
Stamford	7	0	162	0	0	0	0
Stratford	6	0	37	0	0	0	0
Trumbull	8	1	100	2	2	0	0
Westport	6	0	56	0	0	0	0
Wilton	5	1	75	1	0	0	1
	81	7	945	12	8	0	4
New Haven County:							
Beacon Falls	2	0	38	0	0	0	0
Branford	2	0	10	0	0	0	0
Cheshire	3	0	47	0	0	0	0
Derby	4	1	33	6	6	0	0
Guilford	2	0	34	0	0	0	0
Hamden	5	0	57	0	0	0	0
Madison	2	0	24	0	0	0	0
Meriden	14	0	99	0	0	0	0
Milford	6	0	78	0	0	0	0
Naugatuck	7	0	52	0	0	0	0
North Haven	7	0	87	0	0	0	0
Orange	5	0	33	0	0	0	0
Prospect	5	0	79	0	0	0	0
Seymour	2	1	33	2	2	0	0
Wallingford	26	2	154	3	1	0	2
Waterbury	10	0	115	0	0	0	0
West Haven	1	0	7	0	0	0	0
	103	4	980	11	9	0	2
Middlesex County:							
Chester	7	0	44	0	0	0	0
Clinton	2	0	17	0	0	0	0
Cromwell	1	0	3	0	0	0	0
Durham	9	2	147	4	0	4	0
East Haddam	11	0	226	0	0	0	0
East Hampton	10	3	100	4	2	2	0
Essex	2	0	29	0	0	0	0
Haddam	8	0	74	0	0	0	0
Killingworth	2	0	11	0	0	0	0

APIARIES INSPECTED IN 1923—*Continued.*

	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood
Middlesex County—*Con.*							
Middlefield	5	0	56	0	0	0	0
Middletown	1	0	1	0	0	0	0
Old Saybrook	3	0	58	0	0	0	0
Saybrook	5	0	24	0	0	0	0
	66	5	790	8	2	6	0
New London County:							
Bozrah	2	0	17	0	0	0	0
East Lyme	3	0	47	0	0	0	0
Franklin	3	0	35	0	0	0	0
Groton	3	0	23	0	0	0	0
Lebanon	4	0	44	0	0	0	0
Montville	3	0	36	0	0	0	0
New London	2	0	24	0	0	0	0
Norwich	7	1	566	1	0	1	0
Old Lyme	2	1	45	2	0	2	0
Preston	9	0	66	0	0	0	0
Stonington	4	1	23	1	0	1	0
Waterford	3	0	20	0	0	0	0
	45	3	946	4	0	4	0
Litchfield County:							
Barkhamsted	1	0	18	0	0	0	0
Bethlehem	1	0	8	0	0	0	0
Colebrook	2	0	9	0	0	0	0
Goshen	4	0	16	0	0	0	0
Harwinton	1	0	3	0	0	0	0
Litchfield	20	1*	175	1*	0	0	0
Morris	7	0	45	0	0	0	0
New Hartford	1	0	5	0	0	0	0
Plymouth	6	0	17	0	0	0	0
Thomaston	10	0	76	0	0	0	0
Torrington	6	0	54	0	0	0	0
Washington	2	1*	76	1*	0	0	0
Watertown	18	0	92	0	0	0	0
Winchester	10	2*	61	6*	0	5	0
Woodbury	5	1*	50	1*	0	0	0
	94	5*	705	9†	0	5	0
Hartford County:							
Berlin	17	0	199	0	0	0	0
Bloomfield	5	0	54	0	0	0	0
Bristol	15	0	74	0	0	0	0
Burlington	2	0	13	0	0	0	0
Canton	9	0	68	0	0	0	0
East Granby	6	0	32	0	0	0	0

* 1 colony with Paralysis.
† 4 colonies with Paralysis.

APIARIES INSPECTED IN 1923—*Continued.*

	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Sacbrood
Hartford County—*Con.*							
East Hartford	3	0	18	0	0	0	0
East Windsor	8	0	81	0	0	0	0
Enfield	6	0	38	0	0	0	0
Farmington	18	0	68	0	0	0	0
Glastonbury	19	1	144	1	0	1	0
Granby	8	0	87	0	0	0	0
Manchester	11	0	71	0	0	0	0
New Britain	8	0	118	0	0	0	0
Newington	6	0	74	0	0	0	0
Plainville	3	0	7	0	0	0	0
Rocky Hill	4	0	25	0	0	0	0
Simsbury	4	0	45	0	0	0	0
Southington	8	0	40	0	0	0	0
South Windsor	7	0	32	0	0	0	0
Suffield	12	1*	93	3*	0	1	0
West Hartford	15	0	74	0	0	0	0
Wethersfield	2	0	10	0	0	0	0
Windsor	1	0	9	0	0	0	0
Windsor Locks	2	0	11	0	0	0	0
	199	2*	1,485	4*	0	2	0
Tolland County:							
Andover	6	0	36	0	0	0	0
Bolton	6	0	15	0	0	0	0
Columbia	3	0	7	0	0	0	0
Coventry	13	0	61	0	0	0	0
Ellington	4	0	14	0	0	0	0
Hebron	4	0	26	0	0	0	0
Mansfield	3	0	28	0	0	0	0
Somers	3	0	14	0	0	0	0
Vernon	1	0	13	0	0	0	0
	42	0	214	0	0	0	0
Windham County:							
Brooklyn	2	0	176	0	0	0	0
Canterbury	2	0	18	0	0	0	0
Chaplin	1	0	3	0	0	0	0
Eastford	6	0	18	0	0	0	0
Hampton	11	0	60	0	0	0	0
Killingly	13	2	46	4	3	1	0
Plainfield	20	1	111	1	0	1	0
Pomfret	12	1	88	2	0	2	0
Putnam	5	1	32	1	0	1	0
Sterling	2	2	8	3	0	3	0
Windham	7	0	67	0	0	0	0
Woodstock	14	0	110	0	0	0	0
	95	7	737	11	3	8	0

* 2 colonies with Paralysis.

SUMMARY.

County	No. of Towns	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased	American Foul Brood	European Foul Brood	Paralysis	Sacbrood
Fairfield	16	81	7	945	12	8	0	0	4
New Haven	17	103	4	980	11	9	0	0	2
Middlesex	13	66	5	790	8	2	6	0	0
New London	12	45	3	946	4	0	4	0	0
Litchfield	15	94	5	705	9	0	5	4	0
Hartford	25	199	2	1,485	4	0	2	2	0
Tolland	9	42	0	214	0	0	0	0	0
Windham	12	95	7	737	11	3	8	0	0
	119	725	33	6,802	59	22	25	6	6

	No. Apiaries	No. Colonies
Inspected	725	6,802
Infested with European foul brood	17	25
Per cent. infested	2.34	.36
Infested with American foul brood	7	22
Per cent. infested	.965	.323
Sacbrood	4	6
Bee paralysis	5	6
Average number of colonies per apiary		9.38
Cost of Inspection		$1,849.80
Average cost per apiary		$2.55
Average cost per colony		.27

REGISTRATION OF BEES.*

Many beekeepers are not complying with the law in regard to the annual registration of bees. They seem to think that if they register once, they need not do so again, but the law requires them to register each year before October 1st. This law is Chapter 174 of the Public Acts of 1919, and reads as follows:

"Section 1. Every person owning one or more hives of bees shall, annually, on or before the first day of October, make application to the town clerk of the town in which such bees are kept, for the registration of such bees, and such town clerk shall issue to such applicant a certificate of registration upon the payment of a recording fee of twenty-five cents, which certificate shall be in the form prescribed and upon blanks furnished by the commissioner of domestic animals and shall be recorded in the office of such town clerk.

Sec. 2. A record of such registration with the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be recorded in a separate book in the office of the town clerk, which records shall be accessible to the public.

Sec. 3. Any owner of bees who shall fail to register as required by the provisions of this act shall be fined not more than five dollars."

*Published as Bulletin of Immediate Information No. 27, September 15, 1923, and sent to the newspapers, all town clerks, and to all beekeepers where inspections have been made during the past four years.

An amendment to this law was passed at the last session of the General Assembly (see Chapter 129, Public Acts of 1923) as follows:

"Section two of chapter 174 of the public acts of 1919 is amended to read as follows: A record of such registration and of the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be kept in a separate book in the office of the town clerk, which record shall be accessible to the public. Each town clerk shall file with the state entomologist of the Connecticut Agricultural Experiment Station a complete list of such registrations and locations on or before the first day of February of the year succeeding such registrations. Any town clerk failing to perform such duty shall be fined not more than ten dollars."

Therefore in order to comply with the Statutes, each beekeeper should register his bees each year before October 1st, with his town clerk, and each town clerk must send to the State Entomologist before February 1st, a list of the beekeepers who have registered in that town.

REPORT OF GIPSY MOTH WORK.

Year ending June 30, 1923.

BY JOHN T. ASHWORTH AND W. E. BRITTON.

This work has been conducted in about the same manner as in former seasons and the methods were described in considerable detail in the Report of this Station for 1922, pages 290-326. The satisfactory co-operation between the State and Federal forces has continued, the Federal men for the most part working along the outside border of the infested area with a view of expending a major portion of the Federal appropriation in preventing the further spread of the pest. The present writers hereby express to Messrs. A. F. Burgess, in charge of moth work, and Harry E. Blaisdell, in charge of scouting and extermination work, their cordial appreciation of the aid received from Federal sources.

During most of the season 30 men have been employed by the State on gipsy moth work. Except for the wind-spread of a few years ago, which greatly increased the area infested and rendered the fixed appropriation inadequate to cover the territory, the pest has been kept well in check. There has never been any stripping of trees or noticeable injury in Connecticut caused by the gipsy moth.

Details of the season's work will be found in the following pages.

NEW EQUIPMENT.

Two new Ford light trucks have been purchased during the year and are used to transport scouting crews back and forth between the field and the boarding and lodging places. One Ford touring car was replaced by a new one in September, 1922.

Windham County.

This County, situated in the northeastern corner of the State and bordered as it is by Massachusetts on the north and by Rhode Island on the east, was the first part of the State to become generally infested, and is now as in former years the most heavily infested portion of the State, although no stripping has ever been found in Connecticut up to this time. The work of the past year in Windham County was all done by the State forces except in the towns of Thompson, Putnam and Pomfret; these towns were used as schools to teach and break in new men for the Federal Govern-

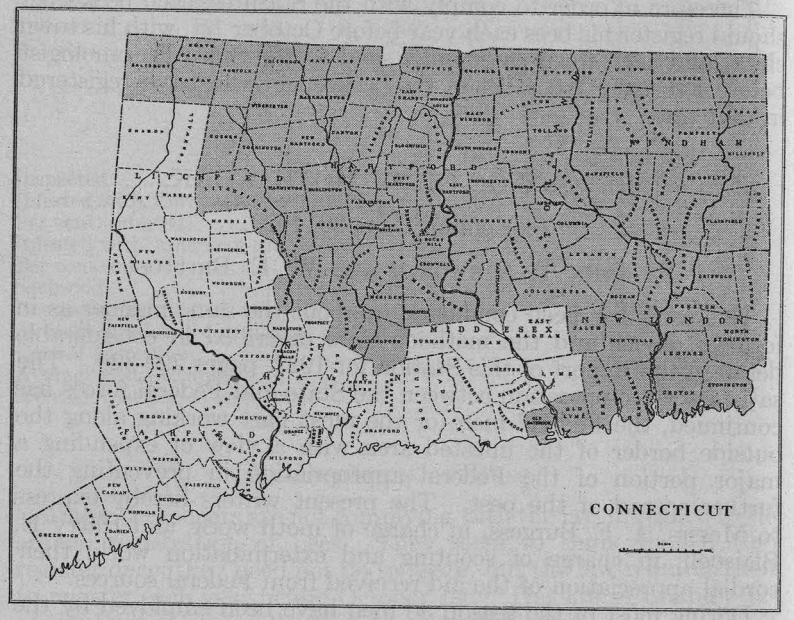

Figure 9. Map of Connecticut showing territory quarantined in 1923 on account of gipsy moth

ment, our own foreman being in charge but on the Federal pay roll. The table of statistics on page 262 shows the degree of infestation in each town.

In the towns of Canterbury, Chaplin, Hampton, Plainfield and Sterling, the infestations were all small and not worthy of particular mention.

In Ashford, one colony of 107 egg-clusters was found in woodland on the western side of Biglow brook on land owned by G. H. Myers of Union, Connecticut.

Brooklyn had one colony which was considered dangerous, 47 egg-clusters being found on an oak tree in an open pasture owned

by Patrick Moran near the junction of the State road and the Allen Hill road.

In Eastford two large colonies were found, both woodland infestations, one of 191 egg-clusters just south of Crystal Lake on land owned by Andrew Chilkott, and the other on land owned by Mr. Floating about two miles west of Eastford Post Office on the eastern edge of Nachaug River, containing 249 egg-clusters.

Killingly was not entirely scouted as the egg-masses were hatching before the work could be completed. One colony of 40 egg-clusters was found in a pasture orchard owned by C. W. Williams and situated along the Quinebaug River near what is known as the Ox-bow.

Pomfret as stated above was used as a school to train men, and the scouting was not completed; all colonies found were small.

In the town of Putnam the conditions were similar to those in Pomfret.

The worst colony in Scotland, though one easily handled, was found in an orchard owned by Mr. B. Ashley on the road leading off the State road just west of where Merrick brook crosses the State road; 26 egg-masses were found here.

Sterling was scouted the last of the season, and all infestations found were small and not considered dangerous.

Scouting in Thompson was not completed on account of lack of time, men, and money. Most of the work was confined to the western half of the town, and conditions were found to be about the same as last year. One colony of 135 egg-clusters was discovered in an old orchard owned by D. H. Cortiss just north of his home. The other infestations were small and easily handled.

Windham had two large colonies, both of which were found in orchards owned by Mr. W. A. Standish in North Windham, one of 31 egg-clusters in cherry trees and one of 84 egg-clusters in apple trees. Both of these colonies were very easy to spray and watch.

New London County.

With the exceptions of the towns of Lyme, Old Lyme and East Lyme, all work in New London County was done by State crews this year. The above named towns were scouted by Federal men.

In Bozrah one old egg-cluster was found near the Norwich town line on Wawecus Hill.

Colchester was scouted only in the eastern half, one colony of five egg-clusters being found on land owned by Barnet Rabenowitz, situated south of the Norwich-Colchester State road, near the Lebanon town line.

There were two groups of colonies found in East Lyme. One group contained two infestations situated in the northeastern part of the town near the Montville line: one of these had 10 egg-

clusters and was on land owned by Peter Trasco. The other group was in Niantic in the southern end of the town along the coast line; two colonies in this group were considered dangerous, one of 15 egg-clusters on land owned by F. E. Temple and one of 13 egg-clusters on land owned by H. B. Morton, both being found on apple trees in the Niantic section of the town. Forty trees were banded in the spring by Federal men.

In the town of Griswold two bad colonies were found, both in the vicinity of Hopeville and both on apple trees, one of 44 egg-clusters on land owned by William Lord, and one of 20 on land owned by Mr. York.

In scouting Groton this year, the town was found practically free from the gipsy moth, except in the villages of West Mystic and Groton where a number of infestations of one and two egg-clusters were found. One colony of 37 egg-masses was found on apple trees owned by E. D. Bengemor and C. R. Heath in the northern part of West Mystic.

One colony of 20 egg-clusters was found in Lebanon. This colony was in a large oak, on land owned by Mr. Sam Lubetsky in the western end of the town about one mile south of Brewster pond.

All of the colonies in Ledyard were small, an infestation of six egg-clusters being the largest.

Lisbon had one colony of eight egg-clusters on two white oaks in the southern end of the town between the railroad and Quinebaug River, on land owned by James McCanne.

None of the infestations found in New London were large or dangerous, one of five egg-clusters being the largest; this colony was found on three maples at Mrs. Gutri's home on the lower boulevard.

The infestations in Norwich were all in the southeastern part of the town, with the exception of one of five egg-clusters found on apple trees on property owned by Joe Lamoth in Taftville; the only colony that was of any size was in two apple trees in the yard of Philip Werster in the western part of the city section, 17 egg-clusters being found.

The usual roadside scouting was not done in North Stonington this season, but some woodland work was done early in the fall; one colony of 17 egg-clusters was found in woodland near the Westerly town line in the southeastern corner of the town.

Old Lyme had three colonies, two of them being large for this territory. One was found on the north side of the State road near Rogers Lake in some pasture oaks owned by Ernest Rogers, where 16 egg-clusters were found; the other was a colony of 12 egg-clusters in apple trees around a house owned by Walter H. Hanems, situated in the Black Hall district. Sixty-one trees were banded and spraying was done at all of the infestations by Federal men.

On account of the lateness of the season the scouting in Preston had to be done in a hurried manner and one colony of 35 egg-clusters was found in woodland owned by S. F. Pierce, situated in the eastern part of the town along the west branch of Broad Brook; the other infestations were all small.

Salem was scouted but no trace of the gipsy moth found.

In Sprague, all three of the infestations were in the northeastern part of the town near Hanover. One of 17 egg-clusters was found in a roadside orchard owned by William Westburg; another of five egg-clusters in a roadside white oak owned by Nicholas Kaletchi. Both of these colonies were sprayed. The other infestation was small, two old egg-clusters being found there.

Stonington was found to be generally but not heavily infested. Two of the largest colonies are herein mentioned: one of 71 egg-clusters found on a large oak in a pasture owned by Silas Wheeler in Old Mystic; the other was in an old orchard in the Wequetequock section where 27 egg-masses were found.

In Voluntown, the infestations were all small, the largest being one of 15 egg-clusters on two apple trees located near the Sterling line, owned by William Jarvis. One of 12 egg-clusters in an apple orchard near the center of the town might be mentioned, but the rest were all very small.

Three infestations were found in Waterford; all were small, three egg-clusters being the largest.

Lyme was scouted but nothing was found.

Tolland County.

All work in Tolland County this year was done by State crews. The towns along the northern edge of the county, on the Massachusetts border, were the most heavily infested; the rest of the county being comparatively free from this pest, some of the towns having only a single infestation.

Two colonies were found in the northern part of Andover, one of nine egg-clusters in white oaks owned by George Terstin and D. Keefe; the other of 12 egg-clusters was in apple trees owned by A. E. Samuels.

One colony and a single egg-mass were found in Bolton. Both were in apple trees. At the colony 16 egg-clusters were found in an orchard owned by B. Andsaldi near the Hebron town line.

Two small colonies and a single egg-cluster were found in Columbia; all were near together in the southwestern corner of the town near the Hebron town line. These colonies contained three and four egg-clusters respectively and were found in apple trees owned by Mr. C. L. Robinson and J. Kemvitz.

The scouting in Ellington had to be stopped on account of deep snow, but later in the season the work was taken up and the town finished; in fact all the crews in this district were moved at this

time to the southern part of the State around New London. Three of the largest colonies are herein mentioned. One of 79 egg-clusters was found in an orchard owned by Frank Gotcha about one mile south of Soapstone mountain; another of 46 egg-clusters was in apple and oak trees owned by Charles Thompson in the northwestern corner of the town. The third was one of 36 egg-clusters found in an oak owned by Clarence Clark near the Ellington railroad station.

Nothing was found in Hebron, but while scouting the town, some of the men got over the line into the northeastern corner of Marlborough and found three old egg-clusters in a white oak on land owned by Joseph Soglio; it was a question whether they were in Hebron or Marlborough, but the foreman charged them up to Hebron.

Somers was found to have infestations distributed over the entire town, none of which were very large. Two of 36 egg-clusters each were the largest. One of these colonies was in an orchard owned by Mr. Miller just west of Bald Hill; the other was found in two white oaks in a field in the village of North Somers. Another colony of 37 egg-clusters was found in a white oak owned by M. Keeney in the southwestern part of the town. These three and a number of smaller infestations were sprayed in the spring.

By looking at the table of statistics any one would think that Stafford (with its 142 infestations) was literally covered with gipsy moths, but such is not the case; the town is generally infested but not so badly as it seems. Single egg-clusters were called infestations in this town, and as there are a great many of them, it makes the degree of infestation look more serious than it really is. The largest colony contained 170 egg-clusters in apple trees and one maple tree owned by John Kellog located about one and one-half miles south of State Line pond. This was easily handled. Another large colony of 63 egg-clusters was found in a white oak in a woodland margin about one mile southwest of the West Stafford Post Office. Though the above mentioned colonies were the largest ones found, there were four other of 40 egg-clusters and several smaller ones which were all sprayed by State men in the spring.

Three small colonies were found in Tolland in addition to a number of single egg-cluster infestations. Fifteen egg-clusters were found in an orchard owned by Mike Barezczski, and another of 21 egg-clusters in five oaks owned by John E. Clough, both of which were situated a little north of Tolland village. The third colony was one of 21 egg-clusters in one apple tree and a stone wall on land owned by Charles Wockomocker, about one mile west of the South Willington railroad station.

In Union two large colonies were found in the extreme northwestern corner of the town, both in apple trees, one of 41 egg-clusters on land owned by Myron Heck, the other of 77 egg-clusters on the property of A. B. Wells. The largest colony found in the town was on the north shore of Mashapaug Lake on land owned by Dwight L. Crawford, 80 egg-clusters being found. The other 23 infestations in the town were small, containing from five to eight egg-clusters each.

Ninety-five of the 129 egg-clusters found in Vernon this season were on one apple tree owned by Peter Swanick in Rockville. The rest of the infestations were all small and in the Rockville section of the town.

The towns of Willington and Mansfield were not scouted this year on account of shortage of men and lack of time.

Hartford County.

Part of the work in Hartford County was done by Federal men and part by State men. Some of the towns which were scouted last year were not covered this year on account of a shortage of trained men and money, as the towns along the Massachusetts border further west had to be given attention.

Berlin was scouted by Federal men and three infestations found, all of them in the southern part of the town. One infestation of six egg-clusters was found on a walnut tree owned by James Derby; another of three egg-clusters in an oak and apple tree owned by the Connecticut Orchard Company, and the third of seven egg-clusters in apple trees owned by John T. Molumphy.

Federal men also did the work in Bloomfield, where five infestations were found, two of which were large colonies; one containing 40 egg-clusters was found on a large oak on land owned by J. S. Lagan, and the other of 15 egg-clusters was in an orchard owned by W. J. Cooley. All five of the infestations were in the southern end of the town along the Hartford and West Hartford borders. Twenty-three trees were banded and later 40 trees sprayed by Federal men.

All work in Bristol was done by Federal men and two small colonies found. One colony of 20 egg-clusters was found in the extreme northeastern corner of the town on apple trees owned by William Harding, and the other colony was one of eight egg-clusters in an orchard owned by M. Levinska, located about half way between Bridge pond and the Bristol reservoir. Ten trees were banded and 50 sprayed in the spring.

The work in Enfield was done by State men, nine infestations being found, of which two were large for this section of the State; one contained 29 and the other 15 egg-clusters. Both of these colonies were found in apple trees owned by George Hardiman and Eugene Quinn, and both were in the Thompsonville district; the other infestations were all small.

State men did the work in East Windsor, where most of the infestations were small. Two, however, were very bad. One of

109 egg-clusters was found in five apple trees in a dooryard on the Simon Miskill Estate at Broadbrook, and the other in a white oak at Warehouse Point owned by William Trombley, where 163 egg-clusters were found.

Newington was scouted by Federal men and two infestations found; one contained 29 egg-clusters in an apple tree owned by Mrs. McIncony on Robbins Avenue, the other eight egg-clusters in oak and walnut trees owned by Peter Albersom on Church Street. Spraying was done by Federal men at both places.

Two large colonies were found in New Britain by Federal men, one of 11 egg-clusters on Maple Street in mixed growth on the property of P. J. Curtiss, and the other was in the center of the town on land owned by Peter Kalashenok, containing 83 egg-clusters. Thirty-six trees were banded and later 12,000 trees sprayed by Federal men.

In Rocky Hill two colonies were found, one of four egg-clusters on willows on the Connecticut River bank in the southeastern corner of the town, and the other of two egg-clusters was on Parsnig Street on apple trees owned by W. F. Griswold. The work in this town was done by Federal men.

State men found two colonies in South Windsor which are worthy of mention. One of 18 egg-clusters occurred in maple trees in the center of the town, and the other, containing 12 egg-clusters, was in the northwestern corner of the town on poplar trees owned by Mrs. Louis Speny. The other four infestations were all small and not dangerous.

No roadside scouting was done in Simsbury this year, but early in the fall 1,247 acres of woodland were scouted and nothing found.

Other towns in Hartford County that were scouted and found free from the gipsy moth were Plainville, Southington and Suffield.

Litchfield County.

The work in Litchfield County was done by the Federal forces. Six towns were found to be infested with the gipsy moth, namely: Canaan, Goshen, Litchfield, Plymouth, Salisbury and Winchester; these towns were very slightly infested.

In Canaan three colonies were found, the largest being one of eight egg-clusters in apple and elm trees owned by Miss Ida L. Root, about one mile west of Wangum Lake; the other two were found in willow trees owned by N. C. Dean and W. E. Shepard, both in the Falls Village section of the town. At N. C. Dean's place the colony contained four egg-clusters, and that at W. E. Shepard's had seven egg-clusters.

One colony of eight egg-masses was found in Goshen on a willow tree owned by F. S. Johnson, just south of the Goshen Post Office.

Both colonies found in Litchfield were in the northeastern corner of the town on the State road between Litchfield and Torrington; one had 12 egg-clusters and the other only a single egg-cluster, all on apple trees in a pasture owned by F. W. Fuessenick and P. C. Burke.

In Plymouth one colony of 16 egg-clusters was found in some oak and maple trees owned by H. Mahoney, this colony being located in the southeastern corner of the town near Hancock Station.

Two large colonies were found in Salisbury on land owned by T. Burnetti about one mile north of Salisbury Post Office on the western side of Moore Brook; one in white oak growth contained 31 egg-masses and the other in apple trees had 21 egg-masses. Two other small infestations were also found in this town, one a single egg-mass on an apple tree owned by C. C. Lansing in Amesville, and another of three egg-clusters in a white oak owned by F. E. Howd about one mile north of Lakeville.

In Winchester one egg-cluster was found on an apple tree in Winchester Center, owned by E. W. Esenlohr, and a colony of eight egg-clusters on apple trees owned by W. W. Greene in Winsted.

In the spring and early summer 166 trees were banded and later 113 trees and five and three-fourths acres of woodland were sprayed at the above mentioned infestations.

The following towns in Litchfield County were scouted but no gipsy moths found in them: Kent, Morris, North Canaan, Sharon, Thomaston, Torrington, Warren, Watertown and Washington.

Middlesex County.

The entire County was scouted, except portions of the towns of East Haddam and Killingworth, which were not completed, although considerable work was done in them. Two towns were found infested with gipsy moths, Old Saybrook and Middletown.

In Old Saybrook two single egg-clusters were found, one on the Frank Negrelli Estate in the northern part of the town, and the other on property owned by Mrs. Bogue about one mile southwest of Saybrook Junction.

In Middletown two infestations of two egg-clusters each were found in the southeastern corner of the town on land owned by August Strom and the Green Meadow Club. Two infestations, one of two and another of one egg-cluster, were found on land owned by C. L. Johnson near Bear Hill. The last infestation was a single egg-mass on land owned by C. S. Wadsworth near Long Hill.

The towns of Chester, Clinton, Cromwell, Durham, East Hampton, Essex, Haddan, Portland, Saybrook and Westbrook were scouted but no trace of the pest found. The work in this County was all done by Federal men.

New Haven County.

Four towns were found infested with the gipsy moth in New Haven County this year, namely: Cheshire, Wallingford, Waterbury and Wolcott, one colony being found in each town.

The colony in Cheshire was one of 31 egg-clusters found in maple trees owned by A. H. Northrop, in the northeastern corner of the town near the Southington line.

The colony in Wolcott was a reinfestation from last year's colony, and was in oak trees owned by Peter Fontano about one mile north of Wolcott Post Office, containing seven egg-clusters; last year 19 were found and it is hoped that this colony has now been eradicated.

The Waterbury colony was one of eight egg-masses in maple trees owned by Mike Jenity of 792 Highland Avenue.

The gipsy moth has again made its appearance in Wallingford, but not in such abundance as in 1909, when more than 8,000 egg-clusters were creosoted. This year only three egg-clusters were found in an orchard owned by George Scards about a mile west of Pistapaug Pond.

At the above mentioned colonies, 33 trees were banded and 26 sprayed in the spring and early summer.

Other towns in this County which were scouted and not found infested were: Hamden, Meriden, Middlebury, Naugatuck, North Haven and Prospect. The work in this County was done by Federal men.

Spraying.

The foregoing summary has not covered the spraying done by the State department. The reason for this is that the Federal and State departments have a different method of reporting this branch of the work.

During this spraying season the weather was very favorable, practically no time being lost on account of rainy weather. This, together with the generosity of the Federal Bureau in lending the State a complete spraying truck and driver, are the two factors that enabled the State department to spray all of the infestations which needed spraying in the Counties of Windham, New London, Tolland and Hartford, east of the Connecticut River. The table of statistics shows the number of colonies sprayed in each town.

Statistics of Infestations.

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Windham County—15 Towns Infested.					
Ashford	19	400	7	169	240
Brooklyn	25	329	21	237	40
Canterbury	6	98	5	22	3
Chaplin	7	86	6	105	26

Statistics of Infestations—*Continued.*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae Killed
Windham County—*Concluded.*					
Eastford	44	1,211	15	278	961
Hampton	7	89	7	87	262
Killingly	13	193	9	85	189
Plainfield	4	68	11	82	100
Pomfret	18	145	7	37	843
Putnam	22	311	18	115	346
Scotland	10	57	2	10	3
Sterling	4	56	12	102	26
Thompson	78	1,361	19	390	543
Windham	18	233	9	65	63
Woodstock*	7	207	0	0	0
	282	4,844	148	1,784	3,645
New London County—17 Towns Infested.					
Bozrah	1	1	0	0	0
Colchester	1	5	1	4	5
East Lyme	9	52**	0	0	0
Griswold	17	144	6	47	41
Groton	33	137	10	60	21
Lebanon	3	27	3	40	2
Ledyard	9	27	2	15	15
Lisbon	3	10	0	0	375
New London	10	25	4	34	26
Norwich	7	36	3	9	1
No. Stonington	1	17	0	0	0
Old Lyme	3	32	0	0	0
Preston	3	40	1	12	410
Sprague	3	24	2	25	0
Stonington	25	367	15	184	71
Voluntown	12	53	2	7	817
Waterford	3	6	2	6	33
	143	1,003	51	443	1,817
Tolland County—10 Towns Infested.					
Andover	2	22	1	7	4
Bolton	2	17	1	6	0
Columbia	3	8	2	12	5
Ellington	21	284	9	75	156
Hebron	1	3	1	25	0
Somers	41	360	16	149	28
Stafford	142	1,281	25	233	2,038
Tolland	11	67	1	7	1
Union	26	467	14	154	146
Vernon	13	129	4	20	19
	262	2,638	74	688	2,397

* In Woodstock, only woodland scouting was done, in late summer.

** Plus one pupa.

STATISTICS OF INFESTATIONS—*Continued.*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Trees Sprayed	No. Larvae Destroyed	No. Bands Applied	No. Miles Roadway Scouted
Hartford County—10 Towns Infested.						
Berlin	3	16	32	0	14	67
Bloomfield	5	68	40	0	23	38
Bristol	2	28	50	0	10	104
East Windsor	10	298	66	359	0	79
Enfield	9	74	97	347	0	102
New Britain	2	94	1,200	0	36	40
Newington	2	37	1	0	1	37
Plainville	0	0	0	0	0	53
Rocky Hill	2	6	0	0	0	40
Southington	0	0	0	0	0	110
South Windsor	6	39	113	14	0	60
Suffield	0	0	0	0	0	3
Windsor Locks	1	4	0	0	0	10
	42	664	1,599*	720	84	*743
Litchfield County—6 Towns Infested.						
Canaan	3	19	83	0	63	52
Goshen	1	1	0	0	20	95
Kent	0	0	0	0	0	15
Litchfield	2	13	5	0	13	51
Morris	0	0	0	0	0	44
North Canaan	0	0	0	0	0	19
Plymouth	1	16	0	0	22	79
Salisbury	4	56	15	0	59	105
Sharon	0	0	0	0	0	5
Thomaston	0	0	0	0	0	55
Torrington	0	0	0	0	12	58
Warren	0	0	0	0	0	33
Washington	0	0	0	0	0	38
Watertown	0	0	0	0	0	93
Winchester	2	9	10	0	11	112
	13	114	113**	0	200	854
Middlesex County—2 Towns Infested.						
Chester	0	0	0	0	0	37
Clinton	0	0	0	0	0	52
Cromwell	0	0	0	0	0	42
Durham	0	0	0	0	0	64
East Haddam	0	0	0	0	0	14
East Hampton	0	0	0	0	0	18
Essex	0	0	0	0	0	37
Haddam	0	0	0	0	0	125
Killingworth	0	0	0	0	0	76
Middlefield	0	0	0	0	0	35
Middletown	5	8	37	0	23	167
Old Saybrook	2	3	0	0	0	36
Portland	0	0	0	0	0	69
Saybrook	0	0	0	0	0	33
Westbrook	0	0	0	0	0	36
	7	11	37	0	23	841

* Also 2.5 acres of woodland sprayed; and 175 acres of woodland scouted in Berlin and 1,247 acres in Simsbury.

** Also 5.75 acres of woodland sprayed.

STATISTICS OF INFESTATIONS—*Concluded.*

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Trees Sprayed	No. Larvae Destroyed	No. Bands Applied	No. Miles Roadway Scouted
New Haven County—4 Towns Infested.						
Cheshire	1	29	8	0	4	93
Hamden	0	0	0	0	0	48
Meriden	0	0	0	0	0	96
Middlebury	0	0	0	0	0	76
Naugatuck	0	0	0	0	0	86
North Haven	0	0	0	0	0	20
Prospect	0	0	0	0	0	35
Wallingford	1	3	0	0	17	116
Waterbury	1	8	8	0	6	142
Wolcott	1	7	10	0	6	53
	4	47	26	0	33	765

SUMMARY OF STATISTICS.

County	No. Towns Covered	No. Infestations	No. Egg-Clusters Destroyed	No. Infestations Sprayed	No. Trees Sprayed	No. Lbs. Arsenate Used	No. Trees Banded	No. Larvae Destroyed	No. Miles Roadway Scouted
Windham	15	282	4,844	148	0	1,784	0	3,645	0
New London	20	143	1,003*	51	0	443	0	1,817	0
Tolland	10	262	2,638	74	0	688	0	2,397	0
Hartford	15	42	664	0	1,599†	0	84	720	743‡
Litchfield	15	13	114	0	113†	0	200	0	854
Middlesex	15	7	11	0	37	0	23	0	841
New Haven	10	4	47	0	26	0	33	0	765
	100	753	9,321*	273	1,775	2,915	340	8,579	3,203

PARASITES LIBERATED IN 1923.

Full details regarding the parasites of the gipsy moth and their distribution in Connecticut may be found in the Report of this Station for 1922 (22nd Report of the State Entomologist), page 313. The Japanese egg parasite, *Schedius kuvanae* How., is mentioned on page 315. During 1923, large numbers of these tiny parasites were sent into Connecticut from the Government Parasite Laboratory at Melrose Highlands, Mass., and put out by Mr. McEvoy in the more thickly infested gipsy moth territory in the eastern part of the State, particularly Windham and New London Counties. The number of individual parasites liberated in each town are as follows:

WINDHAM COUNTY.

Ashford	64,000	Plainfield	20,000
Brooklyn	56,000	Pomfret	60,000
Canterbury	24,000	Scotland	32,000
Chaplin	24,000	Sterling	17,850
Eastford	96,000	Windham	32,000
Hampton	40,000		

* Also 1 pupa.

† Also 2.5 acres woodland in Hartford County and 5.75 acres in Litchfield County, sprayed.

‡ Also 1,422 acres of woodland scouted in Hartford County.

TOLLAND COUNTY.

Somers	20,000	Stafford	24,000

NEW LONDON COUNTY.

Colchester	4,000	North Stonington	4,000
East Lyme	17,900	Norwich	24,000
Griswold	40,000	Old Lyme	12,000
Groton	20,000	Preston	12,000
Lebanon	9,850	Sprague	12,050
Ledyard	12,000	Stonington	28,000
Lisbon	20,000	Voluntown	32,000
New London	28,000	Waterford	12,000

Windham County	465,850
Tolland County	44,000
New London County	287,800
Total liberated in 1923	797,650
" " " 1922	904,000
" " " 1921	1,598,775
Total liberated in Connecticut	3,300,425

APPROPRIATIONS.

The appropriation for the biennial period ending June 30, 1923, was $60,000.00. On account of the extensive increase because of wind-spread, it became apparent that more money would be needed and the legislature then in session was asked for an additional $10,000.00. This was granted in the form of a deficiency appropriation and became immediately available for the remainder of the fiscal period. The legislature also granted the full amount requested ($100,000.00) for the biennial period ending June 30, 1925.

GIPSY MOTH SUPPRESSION ACCOUNT.

Financial Statement.

RECEIPTS

Appropriation for biennial period ending June 30, 1923	$60,000.00
Expended, year ending June 30, 1922	30,301.77
Balance	$29,698.23
Deficiency appropriation, 1923	10,000.00
	$39,698.23

CLASSIFIED EXPENDITURES FOR THE YEAR ENDING JUNE 30, 1923.

Salaries and Wages	$31,163.59
Printing and Illustrations	32.65
Postage	.50
Stationery	41.73
Telegraph and Telephone	19.66
Insurance (supplies including horse sprayer)	51.40
Spraying Supplies	2,200.60

Machinery, Tools and Supplies		$ 280.11	
Express, Freight and Cartage		63.51	
Rental and Storage		441.00	
Automobiles: New	$1,240.44		
Insurance	172.86		
Supplies and Equipment	730.40		
Repairs	878.49		
Gasoline	1,429.39		
Oil	78.47		
		$4,830.05	
Traveling Expenses		229.94	
Inspection of Imported Nursery Stock		288.11	
Heat and Light		55.10	
			$39,697.95
Balance			.28
			$39,698.23

EXPERIMENTS IN DUSTING VERSUS SPRAYING IN CONNECTICUT APPLE ORCHARDS IN 1923.

BY M. P. ZAPPE and E. M. STODDARD.

The experiments with dusts in comparison with sprays for the control of various insect and fungous pests of apple and peach orchards begun in 1920 have been continued each year since. In 1923, only apple orchards were treated, and though the results so far as the control of insects are concerned do not differ greatly from the results of preceding years, it seems best to present them here as a matter of record.

The results of preceding experiments along this line may be found in the publications of this Station as follows: Report for 1920, page 168, results of 1920; Bulletin 235, results of 1921; Bulletin 245, results of 1922.

ACKNOWLEDGMENTS.

The writers are indebted to Mr. Frank N. Platt of Milford for the use of his orchard, power sprayer and for other assistance in conducting these experiments. Mr. George Graham helped in the application of the spray and dusts and in the work of harvesting and scoring the fruit. Messrs. B. H. Walden, J. L. Rogers, T. F. Cronin and S. R. Hamilton also helped in harvesting and scoring the fruit.

ORCHARDS UNDER EXPERIMENT.

Only two apple orchards were used for this work in 1923, and both have been used in the prior tests. The largest of these was the orchard of Frank N. Platt, Milford, containing 285 trees, 19 years old. The other was the old orchard at the Station Farm, Mount Carmel, containing 40 trees about 47 years old.

Apparatus Used.

The spray outfit was the same as used in preceding experiments, a Friend power sprayer with tank of 200 gallons capacity. Two lines of hose were used with two nozzles on each rod, carrying between 175 and 200 pounds pressure. The duster was a Niagara power outfit purchased new in 1923. It was mounted upon skids so that it could be readily transferred to an automobile truck. It is similar to the duster used in preceding experiments except that it is lighter, has an improved type of engine and blower and so probably gave somewhat better results.

Materials.

For the spray solutions the following materials were used:

Lead arsenate	3 pounds
Liquid lime-sulphur	3 gallons
Casein spreader	¾ pound
Water	100 gallons.

Only two kinds of dust were used in the tests in 1923. One was a sulphur-lead-arsenate dust containing fine sulphur, 90 parts, and lead arsenate, 10 parts. The other was a copper-arsenic dust containing 5.75 per cent. of metallic copper and 2.75 per cent. of metallic arsenic. The percentage of lime was not determined. When applied to moist foliage this dust immediately turns a bluish color, indicating the formation of a Bordeaux mixture on the foliage.

Number and Time of Applications.

Seven applications were made in the Milford orchard on the following dates:

1. Delayed dormant.....April 25–26.
2. Prepink, treatment.....May 4.
3. Pink, treatment.....May 10.
4. Calyx, first after blossoming.....May 24–28.
5. Second after blossoming.....June 12.
6. Third after blossoming.....July 6.
7. Fourth after blossoming.....August 1.

At the Station Farm, only dusts were used, three applications being made after blossoming, on May 29, June 13 and July 12-13.

Recording Data.

Trees which blossomed freely were selected as count trees. The fruit was kept separate and each apple scored for insect and fungous injury. All injuries on each fruit were recorded, even though slight, and often several kinds of injury were noted on a single apple; in such cases all types of injury were recorded separately. Later these figures were tabulated and percentages obtained. Altogether this work necessitated the separate handling and scoring of 144,895 individual apples, equivalent to about 362 barrels.

Milford Orchard.

The experiments in this orchard included four varieties: Gravenstein, McIntosh, Baldwin and Greening, but only the McIntosh

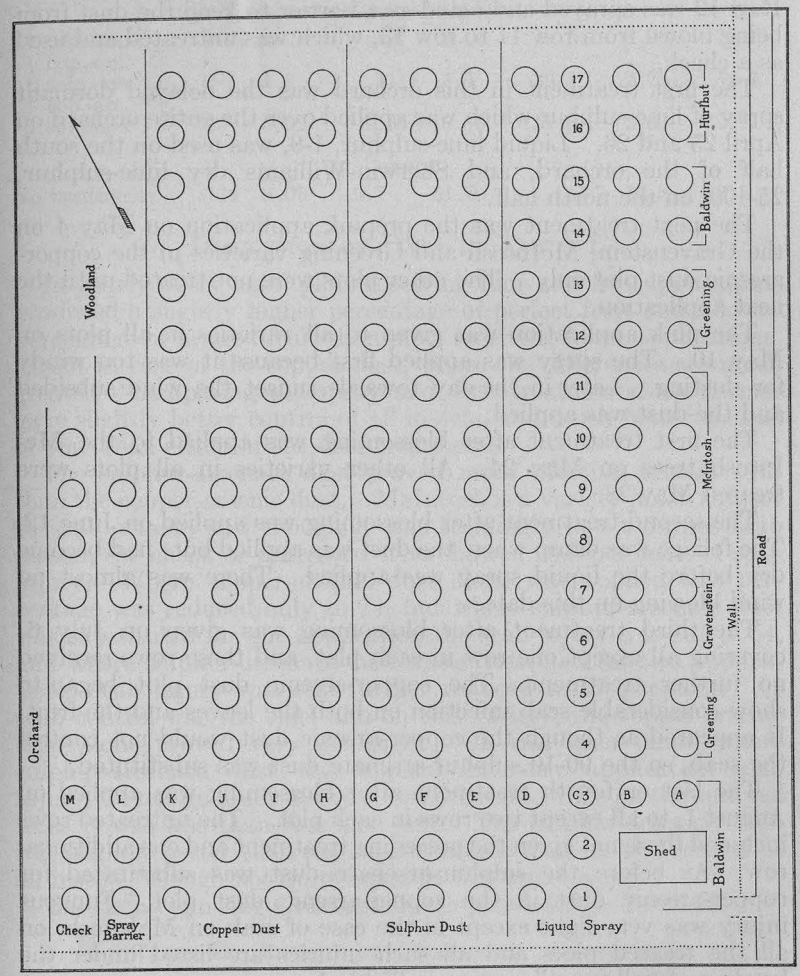

Figure 10. Plan showing arrangement of experimental plots in orchard of Frank N. Platt, Milford, where experiments in dusting and spraying were conducted in 1923.

produced a good crop of fruit. The other varieties bore a very light crop and in some plots there were not enough apples of one variety to give adequate data. The plots were so arranged that each plot contained trees of each variety.

The arrangement of the plots is shown in Figure 10, and was as follows: beginning on the east side, the first four rows were sprayed. Rows five to seven were dusted with sulphur-arsenate dust. Rows eight to 11 were dusted with copper-arsenic dust. Row 12 was sprayed and acted as a barrier to keep the dust from being blown from row 11 to row 13, which was untreated and used as a check.

The first treatment in this orchard was the delayed dormant spray of lime-sulphur which was applied over the entire orchard on April 25 and 26. Liquid lime-sulphur, 1-9, was used on the south half of the orchard, and Sherwin-Williams dry lime-sulphur, 25-100, on the north half.

The next treatment was the prepink application on May 4 on the Gravenstein, McIntosh and Greening varieties in the copper-arsenic dust plot only. The other plots were not treated until the next application.

The pink application was given to all varieties in all plots on May 10. The spray was applied first because it was too windy for dusting. Later in the day towards sunset the wind subsided and the dust was applied.

The first treatment after blossoming was applied to the McIntosh trees on May 24. All other varieties in all plots were treated May 28.

The second treatment after blossoming was applied on June 12. The foliage was damp when the dust was applied but had become dry before the liquid spray was applied. There was almost no wind blowing on this date.

The third treatment after blossoming was given on July 6, covering all except one row in each plot, and these rows received no further treatment. The copper-arsenic dust plot began to show considerable scab infection on both the leaves and the fruit. It appeared as though the copper-arsenic dust would not control the scab, so the 90-10 sulphur-arsenate dust was substituted.

The last or fourth treatment after blossoming was applied on August 1, to all except two rows in each plot. The untreated rows included those not given the preceding treatment and one additional row. As before, the sulphur-arsenate dust was substituted for copper-arsenic dust in the copper-arsenic dust plot. Fungous injury was very light except in the case of scab on McIntosh, on all the treated plots and all such injuries are listed under the heading of "all fungi", except in Table 1.

TABLE I. RESULTS OF TREATMENTS. MCINTOSH.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	Scab
			SPRAY.				
3	0	.29	.29	4.22	93.1	.94	1.55
4	0	.51	.09	2.79	91.5	1.3	3.8
5	0	.36	.02	1.78	96.7	.402	.825
			SULPHUR-ARSENATE DUST.				
3	0	1.26	.17	4.4	87.	1.37	5.27
4	0	1.21	.08	3.72	87.	1.21	7.09
5	0	3.14	.06	4.3	87.5	.68	4.29
			COPPER-ARSENIC DUST.				
4 cop.-ars.	.06	6.2	.19	9.08	19.5	3.26	73.7
4 cop.-ars. / 1 sulp.-ars.	0	4.7	.11	5.1	39.1	2.28	54.5
4 cop.-ars. / 2 sulp.-ars.	0	5.52	.165	8.13	51.5	2.63	27.1
			CHECK.				
No treatment	.134	8.05	9.7	51.0	.335	12.8	96.5

DISCUSSION OF DATA IN TABLE I.

In nearly every case, plots receiving four and five applications produced a slightly higher percentage of perfect fruit and a lower percentage of injured fruit than plots receiving fewer applications, except in case of the copper dust, where the differences are much greater. Comparing the spray and dust treatments, the former gave slightly better control of all insects, and much better control of scab than either of the dust treatments.

The sulphur-arsenate dust proved more effective against scab than the copper-arsenic dust. McIntosh is a variety much subject to scab attack, and though it was seemingly not a serious scab season, the check or untreated trees showed 96.5 per cent. of scab injury. Where copper-arsenic dust alone was applied this percentage was reduced only to 74, but where sulphur-arsenate dust was substituted for one application the scab injury was cut to 54, and where sulphur-arsenate dust was substituted for two applications, scab injury was still further reduced to 27 per cent. As scab control was the chief aim on this variety, the copper-arsenic dust alone proved very inefficient. On the other hand, where sulphur-arsenate dust was applied in every application scab injury did not go much above seven per cent., while on the sprayed trees it was less than four per cent. The sulphur-arsenate dust was slightly better than the copper-arsenic dust for the control of all insects, though not quite equal to the liquid spray.

The data regarding Gravenstein are presented in Table II.

TABLE II. RESULTS OF TREATMENTS. GRAVENSTEIN.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	All Fungi
			SPRAY.				
3	8.62	.5	.18	16.3	73.7	1.19	.25
4	3.9	.72	.07	20.8	74.4	.59	.13
5	2.26	.22	0	18.1	79.	.101	.11
			SULPHUR-ARSENATE DUST.				
3	3.64	.178	0	26.3	70.	1.07	0
4	12.8	0	0	26.4	60.8	2.48	.22

			COPPER-ARSENIC DUST.				
4 cop.-ars.	1.03	.079	.55	79.	17.3	7.35	.44
4 cop.-ars. 2 sulp.-ars.	11.5	.222	0	31.6	56.3	3.22	.21
			CHECK.				
No treatment	.65	1.9	5.64	84.	4.05	6.95	49.8

Discussion of Data in Table II.

As the Gravenstein trees bore a light crop of fruit, the data shown in Table II were obtained from comparatively few apples, but are given here for what they are worth. The plots receiving five applications of sulphur-arsenate dust and four applications of copper-arsenic dust bore no apples, so no data are available for these plots. In general the sprayed plots gave a slightly higher percentage of perfect fruit and lower percentages of insect injury than either of the dust plots, and the sulphur-arsenate dust gave rather better results than the copper-arsenic dust. Fungi were inconspicuous on the treated plots, but were conspicuous on the checks, especially Brooks fruit speck.

Similar data on Greening are shown in Table III.

Table III. Results of Treatments. Greening.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	All Fungi
			SPRAY				
3	4.32	2.54	1.78	14.2	72.6	2.52	.81
4	5.07	2.56	1.08	7.15	83.	.9	.16
5	1.	2.3	.35	12.1	80.6	1.95	1.4
			SULPHUR-ARSENATE DUST.				
4	.68	.82	1.37	12.1	79.	3.65	1.5
5	.25	.07	.96	6.9	81.9	1.71	1.5
			COPPER-ARSENIC DUST.				
4 cop.-ars.	0	0	3.	36.	52.2	17.2	.74*
4 cop.-ars. 1 sulp.-ars.	0	1.46	23.5	75.	8.8	3.68	6.87*
4 cop.-ars. 2 sulp.-ars.	0	.036	1.81	26.1	60.5	5.43	3.47
			CHECK.				
No treatment	0	8.37	36.	63.6	.24	30.5	43.9

Discussion of Data in Table III.

The Greening crop was also very light and no counts of fruit could be made in the sulphur-arsenate dust plot receiving three applications. There was little difference in the percentages of perfect fruit between the plots treated with liquid spray and with sulphur-arsenate dust; both were better than the copper-arsenic

*Very little fruit in this plot.

dust plot where the percentage of perfect fruit was very low, due largely to curculio injury which ran high. Injury by fungi was best controlled by the spray and sulphur-arsenate dust.

The data on Baldwin are given in Table IV.

Table IV. Results of Treatment. Baldwin.

No. of Applications	Aphis	Red Bug	Codling Moth	Curculio	Good	Other Insects	All Fungi
			SPRAY				
3	.81	.32	.16	12.7	85.	1.05	0
5	.16	.44	1.26	31.7	65.9	1.13	0
			SULPHUR-ARSENATE DUST.				
3	.71	.98	1.23	19.3	75.	2.8	.7
4	2.54	1.88	.94	31.9	56.4	4.23	0
5	.09	.86	.23	16.4	80.	2.1	.01
			COPPER-ARSENIC DUST.				
3 cop.-ars.	.59	4.27	1.57	33.5	51.7	7.7	4.02
3 cop.-ars. 2 sulp.-ars.	1.87	4.56	.04	22.7	72.3	2.2	.61
			CHECK.				
No treatment	.22	.44	8.95	42.7	19.	13.8	37.2

Discussion of Data in Table IV.

As was the case with Gravenstein and Greening, the Baldwin crop was light and in the plot receiving four spray applications and that receiving four applications of copper-arsenic dust plus one of sulphur-arsenate dust there were no trees which bore fruit; consequently no data could be gathered for these plots. There is little difference here between the liquid spray and sulphur-arsenate plots, and both gave better results than the copper-arsenic dust plots. The percentage of fungous diseases was negligible in the treated plots, but ran quite high in the check plot.

Station Orchard, Mount Carmel.

In this orchard both sulphur-arsenate dust and copper-arsenic dust were used but no liquid spray was applied. Only two varieties, Baldwin and Greening, were under experiment, and on account of the light crop of fruit, the data from both varieties are included in Table V. Each plot received only three treatments of dust, all after blossoming. The calyx treatment was made May 29, and the subsequent applications made June 13 and July 12 and 13. Such data as were obtained are given in Table V as follows:

Table V. Results of Treatment. Baldwin and Greening.

Treatment	Aphis	Codling Moth	Curculio	Good	Other Insects	All Fungi
Sulphur-arsenate dust.	7.36	5.95	40.1	43.1	5.74	1.32
Copper-arsenic dust...	2.42	4.48	36.6	54.4	4.1	2.07
Check.....	6.2	22.4	72.5	15.5	6.62	4.45

Discussion of Data in Table V.

In this orchard for some unexplained reason the copper-arsenic dust gave slightly better results in the control of curculio, codling moth and "other insects" than the sulphur-arsenate dust. This is at variance with the results obtained in the Milford orchard where the sulphur-arsenate dust treatment gave higher percentages of perfect fruit and lower percentages of insect injury than the copper-arsenic dust. Fungous troubles were not prominent, though reduced slightly by both treatments.

Conclusions.

In 1923, as in the preceding seasons of 1920, 1921 and 1922, when similar experiments were conducted by this Station, the liquid spray has given somewhat better results in the control of injurious insects and fungi on apple trees in Connecticut than any of the dust mixtures. The difference has not been so great in the control of insects as in the control of fungous diseases. The highest percentage of perfect fruit was obtained from the experimental plots treated with liquid spray.

The sulphur-arsenate dust gave fair control of insect pests and of fungous diseases, particularly apple scab.

The copper-arsenic dust in most cases gave nearly as good control of insect pests as the sulphur-arsenate dust, but was much less effective in controlling fungous diseases, though much better than no treatment.

The season of 1923 was characterized by little rainfall and consequently fungous diseases were not so prevalent as in a normal season or a very moist season. It seems to the writers quite probable that in a dry season like 1923, the dust mixtures would be far more satisfactory than in a wet season or even in a normal season when fungous diseases are more prevalent. It is also probable that in the presence of a greater amount of moisture the copper-arsenic dust would be changed into a sort of Bordeaux mixture on the leaves and might under such conditions compare more favorably with the sulphur-arsenate dust than was the case in this unusually dry season of 1923. It is also probable that in a dry season with rather high temperature like 1923, the sulphur-arsenate dust would be more effective as a fungicide than in a cool moist season.

Any orchardist wishing to grow choice fruit should not discard his spraying outfit in favor of a dusting equipment and should not skimp in the number of the applications and quantity of spray applied. On the other hand, if orchards are on elevated slopes with good air drainage and not seriously attacked by fungous diseases, a fair grade of commercial fruit can be grown by the dust treatment. Where the water supply is not convenient and help is difficult to obtain, the dust method might be followed advantageously.

TESTS OF SODIUM HYPOCHLORITE FOR CONTROL OF AMERICAN FOUL BROOD OF BEES.

By Philip Garman.

Two different substances have been advertised recently as cures for bee diseases. Sodium hypochlorite solution sold under the trade name of "Be-Helth" was recommended so highly for this purpose that it was given a trial.

Sodium hypochlorite (NaOCl) is an electrolized salt, the disinfectant property of which depends upon the ease with which it gives up its oxygen to oxidizable organic matter. After oxidation, sodium chloride (NaCl) is left, and this being ordinary salt is harmless to bees. Sodium hypochlorite is used in the dairy industry for sterilizing milk pails, etc., and it is also the principal constituent of Dakin solution used in treatment of wounds during the recent war. It is a product costing a few cents a gallon to manufacture according to various chemists. Its bleaching action is quite marked, being similar in this respect to calcium hypochlorite or bleaching powder. It is also the principal constituent of "Labarraque solution" used by scientists for many years in dissolving or softening chitin contained in the hard parts of insects. This dissolving and bleaching action make it theoretically ideal for use against bee diseases where it is necessary to dissolve dead scales and penetrate masses of diseased tissue.

Four frames of brood badly diseased with American foul brood were obtained from our inspectors, Messrs. Yates and Coley, during the summer of 1923. Three of these combs were removed from the frames and the frames sterilized by spraying with a concentrated solution of "Be-Helth". The fourth comb was not removed from its frame, but was sterilized by soaking for 24 hours in the concentrated solution. It required nearly three-fourths of a gallon for this purpose, but special care was taken to fill every cell with the material. For experimental purposes two three-frame nuclei were used and one disease-free ten-frame hive of Italian bees. In one of the nuclei, two of the sterilized frames with new foundation were placed together with a healthy frame of brood from another hive. The fourth frame with new foundation was placed direct in a ten-frame hive known to be free of disease. All this was done July 17, 1923.

Examination of the two nuclei and the ten-frame hive on August 9 showed one queen cell (in the nucleus containing treated brood comb) with typical American foul brood. No sign of the disease was seen elsewhere.

Examination August 29 showed American foul brood in every frame of the nucleus containing the supposedly sterile brood comb. None was, however, found in hive or nucleus containing brood frames only. The nucleus containing foul brood was destroyed

and close watch kept upon all other treated colonies, but no disease developed in any other place.

While no definite conclusions can be drawn from the results obtained, they indicate the risk involved in attempting control in comb actually containing American foul brood. The manufacturers no longer recommend its use for that purpose, in fact, but are advocating sterilization of super combs and hive equipment for which it may be successful as indicated by our experience with infected frames without comb. The greatest difficulty lies in the extreme thoroughness with which the work must be done to insure success. Thus even with the greatest care it is almost impossible to reach all parts of a comb with sufficient solution to kill the organism. It has been demonstrated by White[1] that the spores of *Bacillus larvae* causing American foul brood are very resistant to chemical disinfectants, and this together with the information above should make one cautious about placing too much confidence in the use of the material.

ANALYSIS of "BE-HELTH"[2]

	Grams per 100 cc.
Available chlorine	3.77
Total chlorine	3.81
Sodium hypochlorite	3.96
Sulphates	Trace.

Available chlorine was determined 33 days after the first analysis and was found to be 3.70 grams per 100 cc.

FURTHER EXPERIENCE WITH PARADICHLOROBENZENE AS A REMEDY FOR PEACH BORERS.

BY M. P. ZAPPE.

For several years this material has been recommended and used to destroy the larvae of the peach borer, *Synanthedon exitiosa* Say. When applied properly, good control is obtained, and it takes less time to make the application than it does to "worm" the trees.

Usually it is customary to clear the ground of weeds and rubbish near the base of the tree, then sprinkle about an ounce of the granular paradichlorobenzene in a circle around the base of the trunk and about an inch from the bark and not touching it. Soil free from rubbish is then banked around the tree covering the insecticide and packed closely against the bark.

The first test of this material was made at the Station Farm at Mount Carmel in September, 1921, and the results published in the

[1] White, G. F. American Foul Brood. U. S. D. A., Bureau of Entomology, Bulletin 809; 1920.

[2] Made by the Department of Chemistry, Connecticut Agricultural Experiment Station.

Report of the Station for 1922, page 331. In the fall of 1922, another application was made. These trees had then been set 11 years. There were five rows of peach trees with 30 trees in each row. Four rows were treated and one row was left untreated for a check. The material was applied October 4 and 5, and was allowed to remain until the following spring without being uncovered.

On June 14, all trees were carefully examined and records kept of all borers found. The results appear in the following table:

	No. of Trees	Total No. of Borers	Living Borers: Above Soil	Living Borers: Below Soil	Dead Borers: Above Soil	Dead Borers: Below Soil
Treated	107	71	23	0	7	41
Untreated	21	42	34	7	1	0

The results show that all borers below the surface of the soil were killed by the treatment, and that the only ones remaining alive were those above the surface of the soil where the fumes of the paradichlorobenzene could not affect them. A few dead borers were found above the surface of the soil, but probably their burrows opened below the soil surface so that they were penetrated by the fumes. In the untreated row only one dead borer was found and that was above the soil surface.

THE EUROPEAN CORN BORER IN CONNECTICUT.

Pyrausta nubilalis Hubn.

This destructive introduced pest, first discovered in this country in eastern Massachusetts in 1917, has continued to spread in that locality until the infestation involves fully half of Massachusetts, southwestern Maine, southern New Hampshire and a large portion of Rhode Island. The pest is also present in two large areas in New York State, one around Albany and Schenectady, which has spread into two towns in southwestern Vermont, and the other in western New York, this latter area extending along the southern shore of Lake Erie through the lake portions of Pennsylvania, Ohio, a few towns in Michigan and a large area in Ontario. According to the understanding of the writer these infestations around Lake Erie are all connected.

It has been expected that the margin of the Massachusetts infestation would soon extend far enough to reach the northeastern corner of Connecticut, but though Federal scouts have searched for it in Thompson and Putnam, during September, they did not find it. On the other hand, late in the fall of 1923, Federal scouts discovered three small separate infestations along the shore region of Connecticut, two in Groton and one in Niantic in the town of East Lyme.

Scouting by State Men.

Mr. M. P. Zappe was in charge of this work and was assisted by J. Leslie Rogers. The coast region of the towns of West Haven and Milford back two miles from Long Island Sound was scouted, and in addition corn stalks were examined throughout the seed corn growing areas of Milford, Orange and Woodbridge. Similar seed corn growing regions south of the village of Wethersfield and the Long Hill section of Middletown were also scouted. This scouting was done in October, November and December, and the time expended on this work was equivalent to 46 man days. In this scouting work no signs of the European corn borer were found.

Scouting by Federal Men.

According to data received from Mr. L. H. Worthley, expert in charge of European corn borer control, the Federal scouts began work in Connecticut on August 21, and continued through the remainder of the calendar year. They scouted the coast line two miles back from the shore from the Rhode Island State line westerly to West River and including New Haven, and from the Housatonic River to the New York State line. The section from New Haven to the Housatonic River was covered by State men as has already been explained. Mr. Arthur Viall, a Federal scout, worked for a few days with State scouts in Milford and Orange, as otherwise he would have been alone and without automobile transportation.

Federal scouts worked in Thompson from September 6 to 22, and in Putnam from September 19 to 25. Thus altogether the Federal men worked in Connecticut 319 man days, during which they traveled 4,430 miles, and scouted 4,876 corn fields having an area of 3,982 acres, and covered a territory estimated at 703 square miles. Three small and recent infestations were discovered along the shore in the eastern half of the State.

Infestations.

The first sign of infested material was found by Federal scouts in Groton on October 25, 1923. This was in a small patch of late sweet corn on land owned by Mr. C. A. Miller, Plant Avenue, opposite Golf Club House. Here 13 larvae were collected, though there were others in the corn stalks. It had every appearance of having become infested during the past season, and that these were the first brood larvae to appear in the vicinity. So far as could be ascertained all were in the corn plants as none could be found in weeds or other vegetables growing in the garden close by.

In company with Mr. Zappe and with Federal men, Messrs. Richardson and Leach, the writer visited this infestation on November 10 to become familiar with conditions. Mr. C. Doering, caretaker for Mr. Miller, who lived on the place, offered full co-operation with our men in an attempt to clean up this infestation.

On November 27 and 28, Messrs. Zappe and Rogers attempted to clean the field of corn stalks, stubble and weeds at this infestation, but the material was so wet that it burned with difficulty. Consequently it was left to dry out before finishing the job. On December 4, Messrs. Zappe, Rogers and the writer met Mr. Worthley and Messrs. Richardson and Kelly of the Federal force, and made further attempts to burn the remaining corn stalks and trash. As it was still difficult to burn this material Mr. Worthley suggested that he send down from Arlington, Massachusetts, a large automobile power outfit for burning, and that we pay for the oil. This work was done on Friday and Saturday, December 7 and 8.

On December 3, another small infestation was discovered in sweet corn in a garden patch near the residence of James Pringle, on Poquonnock Road in Groton, some two miles east of the first infestation. The burning machine was used to clean up both of these infestations, all plant material above ground and corn stubble being burned. Altogether, the time devoted to this clean-up work by State men was equivalent to 10 man days.

Plates XIV-XVI show conditions before and after burning at both of these infestations.

On December 12, a third infestation was found in a garden in the village of Niantic, town of East Lyme. On the Charles Cone Estate, occupied by Chester Beebe, a small patch of sweet corn was slightly infested, only a few larvae being found. These were sent to the Corn Borer Laboratory and identified as *Pyrausta nubilalis* Hubn. At this writing, clean-up measures have not been carried out, but this will be done later.

Source of Connecticut Infestations.

The question at once arises, how did these Connecticut points become infested? From the Federal men, we learn that the American broom corn crop was light in 1922, and that it was necessary to import raw material to keep the factories in operation. Consequently, broom corn was imported from Europe, and a shipment arriving at the port of New York was found to be infested and was ordered fumigated. The large fumigating plant at the Bush Terminal in Brooklyn had so much material awaiting treatment that this shipment was ordered reshipped to Boston for fumigation in the Cambridge plant. *En route* the boats put into the harbors at Bridgeport and New London, and waited several hours in each harbor on account of storms. Before the cargo reached Boston the moths were found to be emerging. It is believed that these infestations originated in this way. There is also an infestation on Fishers Island about four miles off shore from Groton which may also have come from this shipment.

Federal and State Quarantines.

On account of the danger of transportating this pest in shipments of vegetables other than corn, the State quarantine was revised, effective June 1, 1923, and the quarantine order with explanations was published as Bulletin of Immediate Information No. 25, and distributed under date of May 28, 1923. This publication is reproduced in the following pages.

European Corn Borer Quarantine.

The European Corn Borer, *Pyrausta nubilalis* Hubner, which was first discovered in Massachusetts in 1917, and which has since spread throughout the eastern portion of that State and into Maine, New Hampshire and Rhode Island, now menaces Connecticut and may at any time appear within its borders, especially as the margin of the present infested area is only a few miles distant from the northeastern corner of Connecticut. In addition to the infested territory mentioned above, there is a separate infestation in the vicinity of Albany, N. Y., and another in western New York extending along the shore of Lake Erie, through Pennsylvania, Ohio, and into Michigan, connecting with an infested region in southern Ontario.

The pest is believed to have first entered the United States and Canada in broom corn imported from Europe and distributed at at least three and perhaps more different points. As the pest is now known to attack a large number of different kinds of plants including common vegetables which are shipped long distances, there is great danger that this insect may be transported and new colonies formed in this manner. Though the natural spread of the insect is several miles each season, it may be carried hundreds or even thousands of miles in commercial shipments. Hence quarantines have been established to prevent these commercial jumps. Connecticut first established a quarantine against this insect on September 20, 1918, and revised it on June 1, 1920. As there is much new infested territory not covered in the former quarantine, a new quarantine order has just been issued, effective June 1, 1923. This order follows:

STATE OF CONNECTICUT

Office of
Agricultural Experiment Station
New Haven, Conn.

QUARANTINE ORDER No. 5.

Effective June 1, 1923.

Whereas a very destructive insect, known as the European Corn Borer, *Pyrausta nubilalis* Hubner, exists in certain portions of the States of Maine, New Hampshire, Massachusetts, Rhode Island, New York, Pennsylvania, Ohio and Michigan, and threatens the corn growing industry of the country; and whereas there is grave danger that this insect may be brought into this State by the transportation of infested plants or parts of plants from the infested area:

Therefore, pursuant to the provisions of Section 2106 of the General Statutes, it is hereby ordered that no corn on the ear, stover, or other parts of the corn plant, broom corn, including all the parts of the stalk, all sorghums, sudan grass, celery, green beans in the pod, beets with tops, spinach, rhubarb, oat and rye straw as such or when used in packing, cut flowers or entire plants of chrysanthemum, aster, cosmos, zinnia, hollyhock, and cut flowers or entire plants of gladiolus, and dahlia, except the bulbs thereof, without stems, shall enter Connecticut from the infested areas mentioned below, unless each shipment, car, box, bale, or package bear a valid certificate issued by an authorized Federal inspector, stating that the contents thereof have been examined and found free from infestation by the European Corn Borer. These restrictions do not apply to dry shelled kernels or cooked and preserved products, or products grown in non-infested territory passing through infested areas in transit.

Infested Areas.

Maine: Sebago in *Cumberland County;* Acton, Alfred, Berwick, Biddeford, Buxton, Cornish, Dayton, Eliot, Hollis, Kennebunk, Kennebunkport, Kittery, Lebanon, Limerick, Limington, Lyman, Newfield, North Berwick, Old Orchard, Parsonfield, Saco, Sanford, Shapleigh, South Berwick, Waterboro, Wells and York in *York County.*

New Hampshire: Alton, Barnstead, Belmont, Center Harbor, Gilford, Gilmanton, Laconia, Merideth, New Hampton, Sanbornton and Tilton in *Belknap County;* Brookfield, Effingham, Moultonboro, Ossipee, Tuftonboro, Wakefield and Wolfeboro in *Carroll County;* Alexandria, Ashland, Bridgewater, Bristol, Groton, Hebron, Holderness, Orange and Plymouth in *Grafton County;* Amherst, Antrim, Bedford, Bennington, Brookline, Deering, Francestown, Goffstown, Greenfield, Greenville, Hancock, Hillsborough, Hollis, Hudson, Litchfield, Lyndeboro, Manchester, Mason, Merrimack, Milford, Mount Vernon, Nashua, New Boston, New Ipswich, Pelham, Peterboro, Sharon, Temple, Weare, Wilton and Windsor in *Hillsborough County;* Allenstown, Andover, Boscawen, Bow, Bradford, Canterbury, Chichester, Concord, Danbury, Dunbarton, Epsom, Franklin, Henniker, Hill, Hooksett, Hopkinton, Loudon, Newbury, New London, Northfield, Pembroke, Pittsfield, Salisbury, Sutton, Warner, Webster and Wilmot in *Merrimack County;* Atkinson, Auburn, Brentwood, Candia,

Chester, Danville, Deerfield, Derry, East Kingston, Epping, Exeter, Fremont, Greenland, Hamstead, Hampton, Hampton Falls Kensington, Kingston, Londonderry, New Castle, Newington, Newton, New Market, Northampton, Northwood, Nottingham, Plaistow, Portsmouth, Raymond, Rye, Salem, Sandown, Seabrook, South Hampton, South Newmarket, Stratham and Windham in *Rockingham County;* Barrington, Dover, Durham, Farmington, Lee, Madbury, Middleton, Milton, New Durham, Rochester, Rollinsford, Somersworth and Strafford in *Strafford County.*

Massachusetts: Barnstable, Bourne, Brewster, Chatham, Dennis, Eastham, Falmouth, Harwich, Orleans, Provincetown, Sandwich, Truro, Wellfleet and Yarmouth in *Barnstable County;* Acushnet, Attleboro, Berkley, Dartmouth, Dighton, Easton, Fairhaven, Fall River, Freetown, Mansfield, New Bedford, North Attleboro, Norton, Raynham, Rehoboth, Seekonk, Somerset, Swansea, Taunton and Westport in *Bristol County;* Amesbury, Andover, Beverly, Boxford, Danvers, Essex, Georgetown, Gloucester, Groveland, Hamilton, Haverhill, Ipswich, Lawrence, Lynn, Lynnfield, Manchester, Marblehead, Merrimac, Methuen, Middleton, Nahant, Newbury, Newburyport, North Andover, Peabody, Rockport, Rowley, Salem, Salisbury, Saugus, Swampscott, Topsfield, Wenham and West Newbury in *Essex County;* Acton, Arlington, Ashby, Ashland, Ayer, Bedford Belmont, Billerica, Boxboro, Burlington, Cambridge, Carlisle, Chelmsford, Concord, Dracut, Dunstable, Everett, Framingham, Groton, Holliston, Hopkinton, Hudson, Lexington, Lincoln, Littleton, Lowell, Malden, Marlboro, Maynard, Medford, Melrose, Natick, Newton, North Reading, Pepperell, Reading, Sherborn, Shirley, Somerville, Stoneham, Stow, Sudbury, Tewksbury, Townsend, Tyngsboro, Wakefield, Waltham, Watertown, Wayland, Westford, Weston, Wilmington, Winchester and Woburn in *Middlesex County;* Avon, Bellingham, Braintree, Brookline, Canton, Cohasset, Dedham, Dover, Foxboro, Franklin, Holbrook, Hopedale, Medfield, Medway, Millis, Milton, Needham, Norfolk, Norwood, Plainville, Quincy, Randolph, Sharon, Stoughton, Walpole, Wellesley, Westwood, Weymouth and Wrentham in *Norfolk County;* Abington, Bridgewater, Brockton, Carver, Duxbury, East Bridgewater, Halifax, Hanover, Hanson, Hingham, Hull, Kingston, Lakeville, Marion, Marshfield, Mattapoisett, Middleboro, Norwell, Pembroke, Plymouth, Plympton, Rochester, Rockland, Scituate, Wareham, West Bridgewater and Whitman in *Plymouth County;* Boston, Chelsea, Revere, and Winthrop in *Suffolk County;* Ashburnham, Berlin, Blackstone, Bolton, Boylston, Clinton, Douglass, Fitchburg, Gardner, Grafton, Harvard, Holden, Hubbardston, Lancaster, Leominster, Lunenburg, Mendon, Milford, Millbury, Northboro, Northbridge, Princeton, Rutland, Shrewsbury, Southboro, Sterling, Sutton, Upton, Uxbridge, Westboro, West Boylston, Westminster and Worcester in *Worcester County.*

Rhode Island: Barrington, Bristol and Warren in *Bristol County;* Little Compton, Middletown, Newport, Portsmouth and Tiverton in *Newport County;* Cumberland, East Providence, Lincoln, North Providence, Pawtucket, Providence and Woonsocket in *Providence County.*

New York (Eastern): Albany, Berne, Bethlehem, Cohoes, Colonie, Coeymans, Guilderland, Knox, New Scotland, Rensselaerville and Westerloo in *Albany County;* Bleecker, Broadalbin, Caroga, Ephratah, Johnstown, Mayfield, Northampton and Perth in *Fulton County;* Coxsackie, Greenville and New Baltimore in *Greene County;* Benson, Hope, Lake Pleasant and Wells in *Hamilton County;* Amsterdam, Canajoharie, Charleston, Florida, Glen, Minden, Mohawk, Palatine, Root and St. Johnsville in *Montgomery County;* Cherry Valley in *Otsego County;* Brunswick, East Greenbush, Grafton, Hoosick, North Greenbush, Petersboro, Pittstown, Poestenkill, Sand Lake, Schaghticoke and Troy in *Rensselaer County;* Ballston, Charlton, Clifton Park, Corinth, Day, Edinburg, Galway, Greenfield, Hadley, Half Moon, Malta, Milton, Moreau, Northumberland, Providence, Saratoga, Saratoga Springs, Stillwater and Wilton in *Saratoga County;* Duanesburg, Glenville, Niskayuna, Princetown, Rotterdam and Schenectady in *Schenectady County;* Carlisle, Cobleskill, Esperance, Fulton, Middleburg, Schoharie and Wright in *Schoharie County;* Luzerne in *Warren County;* Cambridge, Easton, Fort Edward, Greenwich, Hebron, Jackson and White Creek in *Washington County.*

(Western): Ashford, Dayton, East Otto, Ellicottville, Franklinville, Freedom, Leon, Little Valley, Machais, Mansfield, Napoli, New Albion, Otto, Perrysburg, Persia, Salamanca and Yorkshire in *Cattaraugus County;* Arkwright, Charlotte, Chautauqua, Cherry Creek, Clymer, Dunkirk, Ellery, Ellicott, Ellington, French Creek, Gerry, Hanover, Harmony, Mina, Pomfret, Portland, Ripley, Sheridan, Sherman, Stockton, Villenova and Westfield in *Chautauqua County;* Alden, Amherst, Aurora, Boston, Brant, Buffalo, Cheektowaga, Clarence, Colden, Collins, Concord, East Hamburg, Eden, Elma, Evans, Grand Island, Hamburg, Holland, Lancaster, Marilla, Newstead, North Collins, Sardina, Tonawanda, Wales and West Seneca in *Erie County;* Alabama, Batavia, Darien, Pembroke and Stafford in *Genesee County;* Cambria, Hartland, Lewiston, Lockport, Newfane, Niagara, Pendleton, Porter, Royalton, Somerset, Wheatfield and Wilson in *Niagara County;* Arcade, Attica, Bennington, Eagle, Gainsville, Java, Middlebury, Orangeville, Perry, Sheldon, Warsaw and Wethersfield in *Wyoming County.*

Pennsylvania: Beaver in *Crawford County;* Amity, Conneaut, Corry, Elk Creek, Fairview, Franklin, Girard, Greene, Greenfield, Harbor Creek, Leboeuf, McKean, Mill Creek, North East, Presque

Island Peninisula, Springfield, Summit, Venango, Washington, Waterford and Wayne in *Erie County.*

Ohio: Ashtabula, Austinburg, Conneaut, Denmark, Geneva, Harpersfield, Jefferson, Kingsville, Monroe, Pierpont, Plymouth, Saybrook and Sheffield in *Ashtabula County;* Cleveland, Dover, Euclid, Independence, Mayfield, Middleburg, Newburg, Rockport, Warrensville and West Park in *Cuyahoga County;* Berlin, Huron, Kelleys Island, Margaretta, Perkins, Portland, and Vermillion in *Erie County;* Chardon, Chester and Thompson in *Geauga County;* Concord, Kirtland, Leroy, Madison, Mentor, Painesville, Perry, and Willoughby in *Lake County;* Amherst, Avon, Avon Lake, Black River, Brownhelm, Elyria and Sheffield in *Lorain County;* Jerusalem, Oregon, Toledo and Washington in *Lucas County;* Allen, Bay, Benton, Carroll, Catawba Island, Clay, Danbury, Erie, Middle Bass Island, North Bass Island, Portage and South Bass Island in *Ottawa County;* Townsend in *Sandusky County;* Lake and Ross in *Wood County.*

Michigan: Bedford, Berlin, Erie, Exeter, Frenchtown, Ida, La Salle, Monroe and Whiteford in *Monroe County;* Brownstown, Detroit, Ecorse, Gratiot, Greenfield, Grosse Pointe, Hamtramck, Huron, Monguagon and Springwells in *Wayne County.*

The regulations of this quarantine order are subject to modification to include additional territory, if such is found infested and in general will be interpreted as conforming to, rather than as being at variance with, the regulations of the Federal Horticultural Board.

Quarantine Orders No. 1 relating to this insect, and issued September 20, 1918, and No. 3, issued June 1, 1920, are hereby revoked.

This order shall take effect June 1, 1923.

E. H. JENKINS,
Director, Connecticut Agricultural Experiment Station.

Approved:
CHAS. A. TEMPLETON,
Governor.

PREVALENCE OF ORIENTAL PEACH MOTH.

Laspeyresia molesta Busck

The reappearance of the Oriental peach moth in Connecticut in 1922 and 1923 has already been mentioned on page 232 of this Report. The first information regarding the presence of this pest in Connecticut was received in 1917, when specimens were sent to the Bureau of Entomology by Mr. C. C. Lawrence of the F. A. Bartlett Tree Expert Company of Stamford, and identified as the Oriental peach moth. Mr. Lawrence also sent material to this

Station, but it was badly crushed and could not be properly identified. In the absence of the writer, Mr. Quincy S. Lowry, then Assistant Entomologist, answered the letter and suggested that more material be sent for examination. Meanwhile the reply from Washington specifically identified the insect, and a short report of the pest was included in the Report of this Station for 1917, page 315. Beginning April 1, 1918, Mr. Ernest D. Brown was employed by the Federal Bureau of Entomology to search for this pest in Connecticut in order to ascertain its exact distribution. Mr. Brown worked in Connecticut for six months and found the larvae of this insect only in Stamford where it was discovered in 1917, although he found twig injury in each of the four southern or shore counties of the State. He did not find this injury far inland or in the northern counties, nor was he certain that it was wholly caused by *Laspeyresia molesta,* because the peach twig borer, *Anarsia lineatella* Zell., causes similar injury and is also present in the shore region of the State. An account of the Oriental peach moth with a report on the scouting done by Mr. Brown was published in the Report of this Station for 1918, page 298, and following this article in the same Report (page 306) is an account of the peach twig borer, *Anarsia lineatella,* giving its distribution in Connecticut based upon the collecting done by Mr. Brown.

In 1919 and 1920, visits were made to the locality in Stamford where larvae occurred in 1918, but no signs of this insect could be found. Injury caused by it was not observed anywhere in the State in 1921, though entomologists from this office traveled about the State and were on the lookout for it.

During the autumn of 1922, considerable twig injury was noticed in the southwestern corner of the State, which was thought to have been caused by the Oriental peach moth. In the summer of 1923, twig injury was noticed in a number of orchards, and later during the annual inspection of nurseries in August and September, twig injury was found on peach stock in a few of the nurseries in Fairfield County, and on some orchard trees near the nursery stock. Perhaps the most serious attack observed was in the peach orchards at Conyers Farm, Greenwich, which the writer visited in company with Dr. Garman on June 25. Many of the new shoots were brown and had been tunneled by the larvae, though in most of them no larvae could be found. During December, Mr. A. T. Henry informed the writer that he observed considerable twig injury in his orchard at Wallingford, and on January 8, 1924, Mr. Arthur J. Watrous of Meriden, brought to the Station several peach twigs which had been tunneled by this insect during the growing season of 1923. Recently reports have been received from the orchard of Elijah Rogers and Son of Southington, indicating that this insect has injured some twigs there.

The latter part of the summer the larvae were found in fruit at Conyers Farm, Greenwich, where the manager estimates that fully

50 per cent. of the fruit was injured by the larvae, causing a money loss of at least $5,000.00 in damage to crop, not to mention injury to reputation on account of having wormy fruit. The late varieties such as Hale, Elberta and Belle of Georgia were damaged more than those varieties ripening earlier in the season. A number of infested peaches were observed at the Station Farm, Mount Carmel, and Mr. Watrous also reported that he found infested peaches in his orchard in Meriden.

According to fruit growers and entomologists, this pest caused serious damage in 1923 in Pennsylvania and in New Jersey, where in some cases 80 per cent. of the late peaches were infested.

Though the larvae attack apples and other fruits in the Middle Atlantic States, only peaches have been found infested by it in Connecticut.

Summary of Life History.

The eggs of the first brood are probably laid the latter part of May or early in June on the under surface of the leaves. They are laid singly and hatch in four to seven days; the larvae go to the new shoots and tunnel in them, causing them to turn brown at the tips as is shown on Plate XVIII. They often leave one shoot and enter another, and this explains why injured empty shoots are so abundant in a badly infested orchard. It is not known how many generations occur in Connecticut, but in Maryland, Dr. Garman[1] found four generations, only about 26 days being required for the entire life cycle. Wood and Selkregg[2] found a partial fifth generation near Washington, D. C., but Stearns[3] found only four broods in Virginia. In Maryland the first two broods were fairly distinct, but the third and fourth overlapped so that it was hard to separate them. In New Jersey according to Dr. Peterson, the last three broods overlap.

As the season advances and the new growth hardens and becomes woody twigs, the larvae attack the fruit. In late summer the newly hatched larvae apparently go directly into the fruit, and often several larvae are found in one peach. The larva has the habit of biting into the tissues and laying aside the first few mouthfuls, then eating its way into the twig or fruit. For this reason the larvae cannot be controlled satisfactorily by applications of arsenical poisons.

The larval period averages about eleven days and the pupa stage lasts about ten days. When mature the larva eats out cavities in the sides of twigs or whatever surface is near at hand and suitable for the purpose, and there makes an inconspicuous cocoon. Those maturing late in the season usually enter crevices of the bark

[1] Bulletin 223, Maryland Agricultural Experiment Station, page 113, 1917.
[2] Journal of Agricultural Research, vol. XIII, page 63, 1918.
[3] Technical Bulletin 21, Virginia Agricultural Experiment Station, 1921.

at the base of the trunk or in similar situations higher up on the tree and are very difficult to detect. The hibernating larvae pupate in these cases in the spring, and the moths soon emerge to lay eggs for the first brood of larvae.

Altogether some 15 different parasites of the Oriental peach moth have been reared in the United States. Of these 12 belong to the Hymenoptera and three to the Diptera. In Dr. Garman's studies in Maryland[1] two important parasites were obtained. One, a Braconid, *Macrocentrus* sp., was reared in small numbers from the larvae, and the other, a Chalcidid, *Trichogramma minutum* Riley, parasitized about 80 per cent. of the eggs. Wood and Selkregg[2] recorded six primary parasites belonging to the Hymenoptera and one belonging to the Diptera.

Professor E. N. Cory, State Entomologist of Maryland, estimates that about 60 per cent. of the larvae and about 50 per cent. of the pupae are parasitized in Maryland. Stearns[3] reports that on the average only 20 per cent. of the larvae of the three summer broods were parasitized in Virginia in 1920, and fully 85 per cent. of the hibernating larvae came through successfully.

Control Measures.

The Oriental peach moth is a difficult pest to control. Many tests have been made with various liquids and gases to kill the over-wintering larvae in their cases, but these cocoons or cases are almost impenetrable, so the larvae for the most part pass through the treatment uninjured.

After pruning the orchard, it is advisable to burn all twigs for this may destroy some of the hibernating larvae.

Stearns[1] finds that spraying with nicotine solution diluted at the rate of one part in 500 parts of water, will kill the eggs in Virginia[4]. A caseinate spreader at the rate of two pounds in 50 gallons of mixture increased the effectiveness of the treatment. Only 4.7 per cent. of the untreated eggs failed to hatch, whereas from 75 to 85 per cent. were killed by the treatment.

The approximate periods of heaviest egg-laying in Virginia were from May 8 to 16 for the first brood, from May 31 to June 7 for the second brood, and from June 27 to 29 for the third brood and from August 1 to 10 for the fourth brood. The spray treatments should be given with reference to these dates. Egg-laying dates have not been ascertained for Connecticut.

[1] Bulletin 209, Maryland Agricultural Experiment Station, 1917.
[2] Journal of Agricultural Research, Vol. XIII, page 70, 1918.
[3] Journal of Economic Entomology, Vol. 14, page 337, 1921.
[4] Journal of Economic Entomology, Vol. 14, page 340, 1921.

THE LARCH LEAF-MINER OR CASE BEARER.

Coleophora laricella Hubn.

On June 4, Mr. H. W. Hicock, Assistant Forester, brought to the laboratory from the town of Canaan, branches of larch which had been attacked by the larch leaf-miner or case bearer, *Coleophora laricella* Hubn. The newly formed leaves had been mined and injured to such an extent that the foliage of the entire branch had a gray appearance and later turned brown. According to Mr. Hicock, the specimens came from a large swamp a mile or so in extent, and the trees were distinctly brown on the day of his visit. This swamp is situated near the road connecting Canaan with South Canaan. Injured foliage is shown on Plate XIX, a.

On June 7, larch received from New Canaan also showed the attacks of this insect. The writer noticed slight injury to larch trees on private grounds and in public parks in New Haven and various other parts of the State. Never before in recent years has this insect been so abundant in Connecticut.

The larch case bearer is a European insect and on the continent it has caused damage to the larch trees of the forests, particularly in Germany. When the larch was introduced into the British Isles, this case bearer soon appeared in England and Scotland. Later it made its appearance in America and probably was brought across the Atlantic on nursery stock. It has been reported from Canada and the northeastern United States.

Injury to the Trees.

The young larva is a leaf-miner at first and tunnels the distal half of the needle. It cleans out this hollow needle and then cuts it off at the base of the excavated portion and uses the latter as a case, carrying it about when feeding, and resting in it much like the cigar case bearer, *Coleophora fletcherella* Fern., and other case bearers. The appearance of this case is shown on Plate XIX, b. As the partly grown larvae pass the winter in these cases on the twigs, they are ready to resume feeding on the first leaves that are put out in the spring. Consequently when the larvae are abundant the leaves are eaten about as fast as they can grow, with the result that the trees look sickly and brown by the first of June, instead of green and vigorous. Even though more leaves are put out, they are mined later in the season. Thus severe attacks weaken the trees, and Dr. Patch[10] writes as follows: "The injured needles often continue to grow but the clusters are ragged and many of the needles brown and dry. Small larches in the vicinity of Bangor and Orono which have been subjected to an attack of at least three seasons, died this summer from no other apparent cause than the presence of great numbers of the case bearers which kept the needles eaten off. Many large larches infested by this insect look yellowish and unhealthy."

Life History and Habits.

The eggs are laid upon the leaves during the first part of June and on hatching, each larva bores directly through the bottom of its shell and into the tissues of the leaf, where it continues to burrow, usually tunneling out the distal half. It has the habit of packing its excrement into the burrow in the mined leaf. By September the leaf has been completely mined, and the larva being small and only partly grown, cuts off the distal portion of the leaf; then it cleans out the excrement from the basal portion and uses this for its winter case. Sometimes it goes into a new leaf and sometimes makes its case of old leaves. The inside of each case is lined with a thin layer of silk. The larvae continue to feed for three or four weeks after making their winter cases, then fasten them with silk to the branches and twigs where they remain throughout the winter, as shown on Plate XIX, b. The outer end of the case is closed with silk and somewhat contracted. Usually this migration to the twigs occurs in October, and they remain there for about six months.

On the approach of warm weather, usually in April, the larvae dislodge their cases from the branches and migrate to the buds, where they are ready to partake of their first meal after their long winter fast. As soon as the new leaves are of sufficient size they fasten their cases to them or use them to enlarge their cases. This is fully described by Herrick[8] who states that this is the period when the insect does its greatest amount of damage, for each larva may feed upon more than one leaf, and being larger, destroys more leaves than before hibernation. The larvae continue to live in these enlarged cases and pupate in them in May, attaching themselves at the base of short side branches and in the center of leaf whorls.

The pupa stage lasts from 14 to 20 days and the adult moths emerge the last of May and following. The moths are active during the day and when at rest, the wings are folded closely over the body, and the antennae are extended forward.

Apparently there is only one generation each year, as is usual with most other case bearers.

Description.

Egg.—Eggs though small are visible without a magnifying glass. They are reddish-brown in color, nearly hemispherical in shape with 12 to 14 radiating ridges extending down the sides from the apex.

Larva.—Length, about five mm. when fully grown, dark reddish-brown, head, thoracic and anal shields, black.

Adult.—Wing expanse about nine mm., silvery grayish-brown or ash-gray in color, both front and rear wings narrow and bear

long fringe, characteristic of the family Elachistidae to which this species belongs.

Natural Enemies.

Herrick[8] bred three species of parasites in New York but only in small numbers; these were identified only provisionally on account of a lack of material. One belonged in the genus *Pachyneuron*, one to the Pteromalidae, and one to the Tetrastichidae. He reports that nine parasites have been recorded from Europe.

Control Measures.

There is no practical method of controlling this insect in forests or large plantations, but on shade and ornamental trees and in small plantations on private estates where cost is not an important matter, some attempt at control is feasible.

The most extensive experiments of which we have record are those conducted by Professor G. W. Herrick[8] in Ithaca, New York, in 1911. Trees sprayed with lead arsenate April 25, and even given an additional treatment May 5, were just as badly injured as the trees not treated.

Home-made concentrated lime-sulphur, testing 29° Beaumé, was diluted at the rate of one to seven and the tree thoroughly coated with the mixture on April 7, before the buds had begun to swell and before the larvae had left their winter positions. This tree was badly infested. An examination on April 27 showed that the buds had started and that on unsprayed trees the larvae had moved to the leaves, but not one had moved on the sprayed tree. On May 5, many larvae were examined. Only two were found to be alive; the others were dead and shriveled. Consequently, in view of these tests, it seems advisable to spray shade and ornamental trees with lime-sulphur, as for scale, late in the spring just before the buds open.

Literature.

[1] Felt, E. P., Memoirs N. Y. State Museum, 8, page 170, 1905. (Life history and habits.)

[2] Fernald, H. T., Can. Ent., Vol. li, page 264, 1919. (Injured trees in Northampton, Mass., same spot where Hagen reported it in 1886. Describes egg and habits of young larva.)

[3] Fletcher, J., Report of the Entomologist and Botanist, Central Experimental Farms, page 191, 1905. (Brief account).

[4] Fletcher, J., Thirty-sixth Annual Report, Ontario Ent. Soc., page 90, 1905. (Reports insect in moderate numbers at Experimental Farm, Ottawa, Can., and believes this the first record for Canada.)

[5] Gibson, A., Forty-first Annual Report, Ontario Ent. Soc., page 14, 1910. (Reports insect not abundant at Ottawa until 1910.)

[6] Hagen, H. A., Canadian Entomologist, Vol. xviii, page 125, 1886. (Abundant on European larches at Northampton, Mass.)

[7] Herrick, Glenn W., Annals Ent. Soc. Am., iv, page 68, 1911. (Describes habits and partial life history: original observations, Ithaca, N. Y., 1910-1911.)

[8] Herrick, Glenn W., Cornell Agr. Expt. Station, Bulletin 322, 1912. (Complete life history, habits, natural enemies, control, bibliography.)

[9] Herrick, Glenn W., Journal of Economic Entomology, Vol. 5, page 172, 1912. (Treatment with lime-sulphur.)

[10] Patch, Edith M., Maine Agr. Expt. Station, Bulletin 134, page 218, 1906. (Brief account of habits and life history. Mentions death of trees.)

[11] Patch, Edith M., and Johannsen, O. A., Maine Agr. Expt. Station, Bulletin 195, page 239, 1912. (Mention as being abundant on American Larch in 1911.)

[12] Swaine, J. M., Forty-third Annual Report, Ontario Ent. Soc., page 88, 1912. (Mentioned as being abundant on European and American larches in Ottawa in 1912.)

[13] Theobald, F. V., Report on Economic Zoology, page 111, 1905. (Brief illustrated account.)

[14] Weiss, H. B., Ent. News, Vol. xxvii, page 424, 1916. (Not extensively distributed in N. J. Probably introduced on nursery stock.)

THE ASIATIC BEETLE.

Anomala orientalis Waterhouse.

In the Report of this Station for 1922, page 345, is a brief account of this new pest which has apparently become established in Connecticut. Since this note was prepared for publication, further developments have occurred which warrant further mention here of the undesirability of this insect.

Late in the fall of 1922, one of my neighbors, Mr. H. M. Bowman, complained to me that white grubs were injuring his lawn at 228 Alden Avenue, and on November 2, I visited his place and collected a few specimens. These grubs had killed the grass in a patch perhaps eight by ten feet in the front lawn near the sidewalk. By digging in the soil, we found some of the grubs, though Mr. Bowman stated that they had recently descended and were much nearer the surface a short time before. Evidently they had gone down for protection during the winter. These grubs were quite active and though varying considerably in size, all were rather small. Otherwise they looked like ordinary white grubs, and at the time we took them to be the larvae of May or June beetles (*Phyllophaga* sp.) These grubs all died probably having injured each other with their mandibles, as we afterward learned they are apt to do when confined together with little soil. The grubs are shown on Plate XX, b.

The next spring other residents of the neighborhood complained of similar injury to lawns. Mr. Robert S. Scobie, corner of Central and Edgewood Avenues, particularly had been troubled by them and had reseeded his lawn, only to have the new grass also eaten by the grubs. Mr. William E. Woodmansee and Mr. Clarence M. Blair of Edgewood Avenue had also gone through similar experiences. An injured lawn is shown on Plate XX, c.

Mr. Scobie accommodated us on May 17 by collecting a considerable number of grubs with a good supply of dirt. These were promptly separated so that they could not injure each other, by putting only a few larvae in each of several cages and supplying them with plenty of food and soil. On July 24, adult beetles emerged and proved to be *Anomala orientalis*. Prior to the emergence of these beetles, specimens of the larvae were sent to Professor John J. Davis, Agricultural Experiment Station, La-Fayette, Indiana, who had formerly been in charge of the Japanese Beetle Laboratory at Riverton, New Jersey, and prior to that had made a study of white grubs and various larvae of the beetle family Scarabaeidae. Professor Davis replied that he had sent his collection of larvae to Washington and was therefore unable to identify our material. He therefore forwarded it to Washington and in due time a report was received stating that it had been examined by Dr. A. Boving and identified provisionally as *Anomala orientalis*. Of the reared material, some specimens are light brown with very faint markings and some are black, as is the case with the native *Anomala lucicola* Fabr. Between these two extremes there are all gradations. This variation is shown on Plate XX, a.

More material was collected in the field in 1923. The adults do not fly but are found in the grass and weeds near the ground or crawling up the stems. This habit retards the dissemination of the pest and simplifies materially the problem of control. Messrs. Zappe and Garman treated small areas of infested soil in the lawns of Mr. Woodmansee with calcium cyanide compound, carbon disulphide emulsion and some other materials. The first killed the larvae and also the grass and weeds. The other materials in the proportions used were not effective in destroying the larvae.

No very thorough survey has yet been made to ascertain the present distribution of the pest. The preliminary survey shows that the injured lawns are all within five or six city squares or blocks, but as a certain number of larvae may be present per square yard without injuring the grass above ground, the distribution is probably much greater than indicated. It would be necessary to dig through the turf in thousands of places to ascertain its real distribution. Moreover as this infestation apparently was caused by nursery stock being imported with balls of earth from Japan, before the prohibition of such shipments by the Federal Horticultural Board, there is also a strong probability that this insect has likewise been sent out from the nursery to other points, perhaps nearby or far distant. This nursery has now been moved to Woodmont some six miles distant, and possibly the insect has been carried there also. The ground where the nursery formerly stood has all been sold for building lots and residences have been built upon it. In excavating for cellars and in grading, the upper soil has nearly all been moved, and this must have had some effect on the larvae in the soil. The lawns most seriously injured are

those across the street (Edgewood Avenue) from that part of the nursery where the adult beetles were first collected in 1920.

The parasite, *Scolia manilae* Ashm., which was so successful in reducing the infestation of *Anomala orientalis* in Hawaii a few years ago, has been imported into New Jersey to be used in controlling the Japanese beetle, *Popillia japonica*, but does not survive the winters there. Consequently we cannot hope for much help from this insect in controlling the infestation of *Anomala orientalis* in Connecticut, but there is a possibility that some of our native species of *Scolia* or *Tiphia* may attack the grubs.

SWARMS OF APHIDS.

During the season there were two separate swarms of aphids, one in June and the other in September, both of which should be recorded here. A similar swarm has been mentioned in the Report of this Station for 1919, page 203.

The aphids were so abundant and noticeable in and about New Haven, Bridgeport and Waterbury in June, 1923, that the newspapers printed notes regarding the matter. The following account of the June flight was published in the Journal of Economic Entomology, Vol. 16, page 395, August, 1923:

SWARMS OF APHIDS: During the week ending June 9, newspapers and telephone inquiries reported that swarms of aphids were present in the cities of Meriden and Waterbury, Conn., and on June 8, specimens were received from Waterbury. On June 8, Mr. Zappe collected specimens at his home, Mount Carmel, where they were so abundant in the air that his little daughter said to him: "Daddy, it's snowing". During the week ending June 16, similar swarms of aphids appeared in the center of the city of New Haven, and the writer observed them on Elm Street on the afternoon of June 16. The tops of automobiles and clothes were literally covered with aphids and pedestrians were brushing them from their faces. Mr. Rogers of this Department states that in Bridgeport swarms of aphids have been present for three weeks, and one day in the city in catching a butterfly he also caught two or three hundred of these aphids in the net. Even at the date of this writing (July 3) aphids have not all disappeared in New Haven, and this morning Mr. Rogers ran into a swarm on Winchester Avenue. It is not certain that all of these aphids were of the same species, but those examined seemed to be identical and material submitted to Dr. A. C. Baker of the Bureau of Entomology has been identified as *Euceraphis deducta* Baker, a species described from Maine in 1917 (Journal of Economic Entomology, Vol. X, page 427). Birch is the host of this species and the swarms probably came from *Betula populifolia*, which is abundant around all of these Connecticut cities. In 1919, I recorded the presence of swarms of *Calaphis betulaecolens* Fitch

(see Journal of Economic Entomology, Vol. 12, page 351) in New Haven, Conn., and at first I supposed the swarms of the present season were of that species. A microscopic examination, however, showed them to be different. Dr. Baker writes that "it is very interesting that this recently described species should become so abundant".

This species, *Euceraphis deducta* Baker, had somewhat the aspect of a woolly aphid. That is, each individual bore some wax secretion in the nature of white filaments.

From September 19 to 25, aphids were again swarming in the streets of New Haven, and it was several days or perhaps weeks before they entirely disappeared. Specimens collected showed this to be *Calaphis betulaecolens* Fitch, a species devoid of the white wax filaments, and the same species observed in the city in 1919.

Both of these species live upon the leaves of birch trees, and it is not known whether they have alternate hosts, but perhaps like many other kinds of aphids, they were migrating to other host plants, which explains their presence in such number in the center of large cities. Birch trees are common on the uncultivated land around the outskirts of nearly all cities of Connecticut. The species of the September swarm, *Calaphis betulaecolens* Fitch, is also recorded from linden (*Tilia*) but evidently its full life history has not been determined.

MOSQUITOES AND HUMAN WELFARE.

Mosquitoes have been known and recognized as a pest since the earliest times. Writers have mentioned them; armies have been attacked by their hordes; large military and civic operations have been abandoned because of the great abundance of mosquitoes. Today mosquitoes occur throughout the world, from the tropics to the polar regions; all countries and all climates have been preempted by them and all races have been attacked by them. Not only do they attack persons, but also the larger animals, blood being necessary for the development of their eggs.

Certain kinds of mosquitoes through their bites transmit yellow fever, other kinds carry malaria and in no other way can these diseases be communicated from one person to another, except possibly by direct inoculation.

All kinds of mosquitoes annoy mankind, prevent property development, and therefore cause a tremendous economic loss to community, state and nation. Moreover, their abundance is wholly unnecessary.

Where Do Mosquitoes Breed?

Only in stagnant water. Until they reach the winged or adult stage, they can live only in fairly still water, where they are able to obtain air at the surface. The belief of many persons that mosquitoes breed in grass, shrubbery and vines, is wholly false, though the pests hide and rest in such places. Water is just as essential for the wrigglers (larvae and pupae) as it is for trout or codfish, and if there were no standing water, there would be no mosquito nuisance. Permanent and deep pools and streams are usually stocked with fish and do not breed mosquitoes, because the fish will eat the wrigglers, should any hatch there. Rain water pools, barrels, buckets, tin cans, bottles and clogged ditches and gutters are common breeding places for fresh water mosquitoes, and the shallow depressions on the salt marsh are typical breeding places for salt marsh mosquitoes.

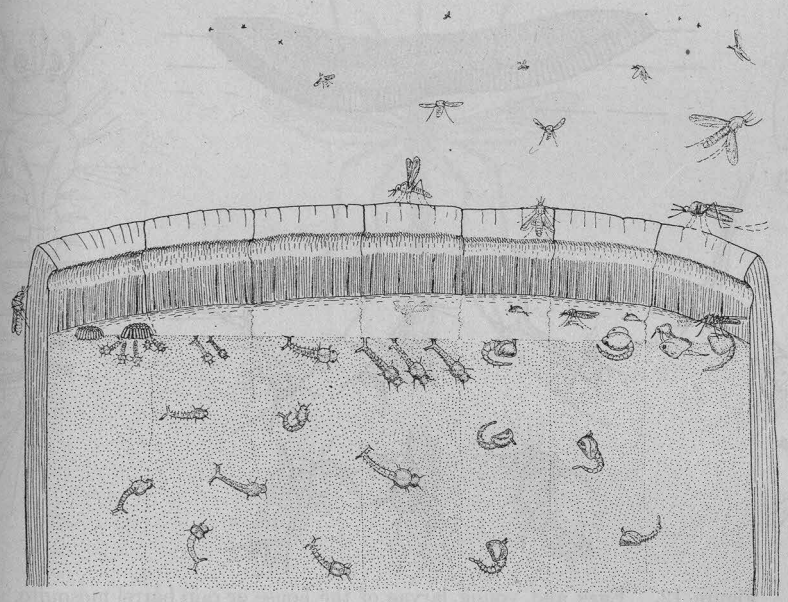

Figure 11. Section of rain barrel showing eggs, larvae and adults of the rain barrel mosquito.

Only the Females Bite and Sing.

Male mosquitoes are very puny creatures and are not able to puncture the human skin. They live only a short time, and make no singing or humming noise. The common sound known as the "song" of mosquitoes is made by the females which are also responsible for all the mosquito bites. They bite in order to obtain blood, without which they are unable to develop eggs.