Set No. 5

1875 - 1925

SEMI-CENTENNIAL

OF THE

Connecticut Agricultural Experiment Station

NEW HAVEN, CONNECTICUT

OCTOBER TWELVE

NINETEEN HUNDRED AND TWENTY-FIVE

1875 - 1925

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Connecticut Agricultural Experiment Station

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THE TUTTLE, MOREHOUSE & TAYLOR COMPANY,
NEW HAVEN, CONN.

PROGRAM

MONDAY AFTERNOON, TWO O'CLOCK

GREETING

Professor William L. Slate, Jr., Director, Connecticut Agricultural Experiment Station.

THE AGRICULTURAL EXPERIMENT STATION AND THE STATE

His Excellency, John H. Trumbull, Governor of Connecticut. President, Station Board of Control.

RELATIONS OF THE FEDERAL GOVERNMENT AND THE STATES IN AGRICULTURAL RESEARCH

Dr. E. W. Allen, Chief, Office of Experiment Stations, United States Department of Agriculture.

INFLUENCE OF EXPERIMENT STATIONS ON AMERICAN AGRICULTURE

Dr. R. W. Thatcher, Director, New York Agricultural Experiment Stations.

PRESENTATION OF PORTRAIT

Dr. Henry S. Graves, Provost of Yale University.

RESPONSE

Director Slate.

The Connecticut Agricultural Experiment Station

1875 - 1925

Professor Samuel W. Johnson may well be called the Father of the Agricultural Experiment Station movement in this country.

Beginning in 1835, his writings for the agricultural press on the progress and results of scientific agriculture in Europe, his reports on commercial fertilizers as chemist of the State Agricultural Society and later of the State Board of Agriculture, his frequent addresses at farmers' meetings in all parts of the state and his papers on Science as an aid to agricultural practice, prepared the way and urged on the movement to found an Agricultural Experiment Station in Connecticut. It was the first Station established in America and so proved its value as to encourage other states immediately to follow the example.

At a meeting of the Connecticut Board of Agriculture in 1874 a committee, with Prof. Johnson as chairman, was appointed to interest farmers and to bring the matter before the General Assembly. Mr. Orange Judd, a trustee of Wesleyan University, gave $1,000.00 and the University offered the free use of its laboratory. The Legislature deferred action for some time, but finally by an Act approved July 20, 1875, it accepted both offers and established such a Station at Wesleyan University at Middletown and appropriated for its use $2,800.00 yearly, for two years.

Professor W. O. Atwater, of Wesleyan, a former pupil and assistant of Prof. Johnson, who had greatly assisted in the preliminary work, was chosen Director. Wesleyan University became its foster mother, providing a laboratory and other facilities for its use without charge.

The thought uppermost with many farmers who urged the establishment of the Station was of its use in protecting from frauds in the sale of fertilizers. But Prof. Atwater's first statement shows a wise understanding of the true function of an Agricultural Station:

"It has been felt from the first that more abstract scientific investigation would afford not only the proper, but also the more widely and permanently useful work of the Agricultural Station.

"Such an institution will be worthy of the name in proportion as it carries on thorough investigation and experiment in agricultural science." This, from the first, has been its unchanging attitude and policy.

Those first two years under Prof. Atwater's wise direction so fully proved the value of the Station, that the General Assembly, in 1877, established it on a permanent basis. Prof. S. W. Johnson was appointed Director and it was placed at New Haven. Here, a laboratory, office and other equipment were furnished without charge by the Sheffield Scientific School of Yale, for five years. In 1882 the State provided the present site with laboratory and office.

In organization this Station differs from all others in the country. Besides having no organic connection with any other institution, it is an independent unit, having the general character of a corporation with power to sue and be sued in the state courts, to receive for itself gifts and to hold real and personal estate.

To trace its history and growth would be too long a story. With a fuller public understanding of its value both to farmers and to the general public the demands for its help have greatly enlarged, its resources have been increased and it has taken up one by one, as it was able, new lines of work. These, with the approximate dates of their establishment, are as follows: Chemistry, 1875. Botany, 1888. Biological Chemistry, 1890. Entomology, 1896. Forestry, 1901. Plant Breeding, 1905. Soil Research, 1923.

The State owns, for the Station use, six acres of land on Huntington Street, New Haven, on which are its offices, library and laboratories. The Station owns the Mt. Carmel Farm, an experimental field of thirty-five acres five miles north of the City; the Rainbow Experiment Forest of one hundred acres and the Tobacco Station Farm of thirteen acres, both in the town of Windsor.

It is supported by federal and state funds and also by the income of a trust fund left to the Station for its general uses by the will of Mr. William R. Lockwood of South Norwalk.

What it has done for the art of agriculture in the state is recorded in part in the forty-eight volumes of its reports, in two hundred and seventy bulletins, in the volumes of the reprints of papers published in the technical journals of the country, in some

special treatises written by members of its staff and, often unobserved, in a safer and more profitable agricultural practice.

Aside from the distinctively agricultural work of the Station, it has also served in many ways the whole community. Examples of this service are its work in promoting forest planting, in checking the trade within the state of inferior foods, drugs and "patent medicines," the analysis of diabetic foods, and its many contributions to our knowledge of nutrition.

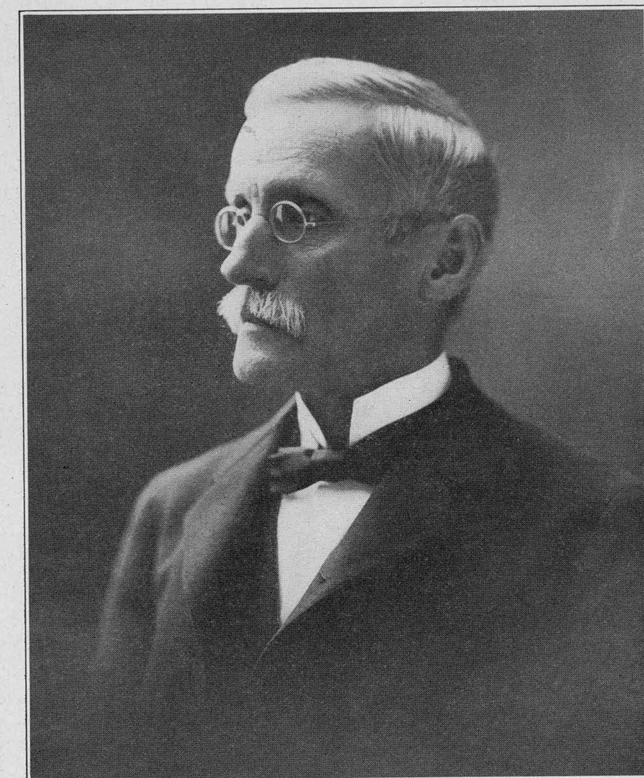
Within the bounds of its means its aims are fundamental research, the spread of agricultural knowledge and service to the people of the state.

Wilbur O. Atwater, Ph.D., LL.D.

First Director, Connecticut Agricultural Experiment Station, 1875-1877.

Graduated from Wesleyan University (A.B.), 1865; graduate student, Yale University (Ph.D.), 1869, Leipzig and Berlin, 1869-1871; Professor of Chemistry, Tennessee, 1871-1873; Maine State College, 1873; Wesleyan University, 1873-1907; First Director, Storrs Agricultural Experiment Station, 1888-1902; Founder and Director, Office of Experiment Stations, United States Department of Agriculture, 1888-1891; Established the series of United States Farmers' Bulletins, 1889; Special Agent, Nutrition Investigations, 1891, Chief in 1893, and until some three years before his death carried on the long series of dietary studies and investigations with the respiration calorimeter; Honorary LL.D., University of Vermont, 1904; Recipient of the Elliot Cresson gold medal of the Franklin Institute, and gold medal from the Paris Exposition in 1900, and other medals. Fellow, American Association for the Advancement of Science; member American Chemical Society, American Physiological Society, Washington Academy of Sciences, and of many foreign societies. Born, Johnsburg, N. Y., May 3, 1844. Died, Middletown, Conn., September 22, 1907.

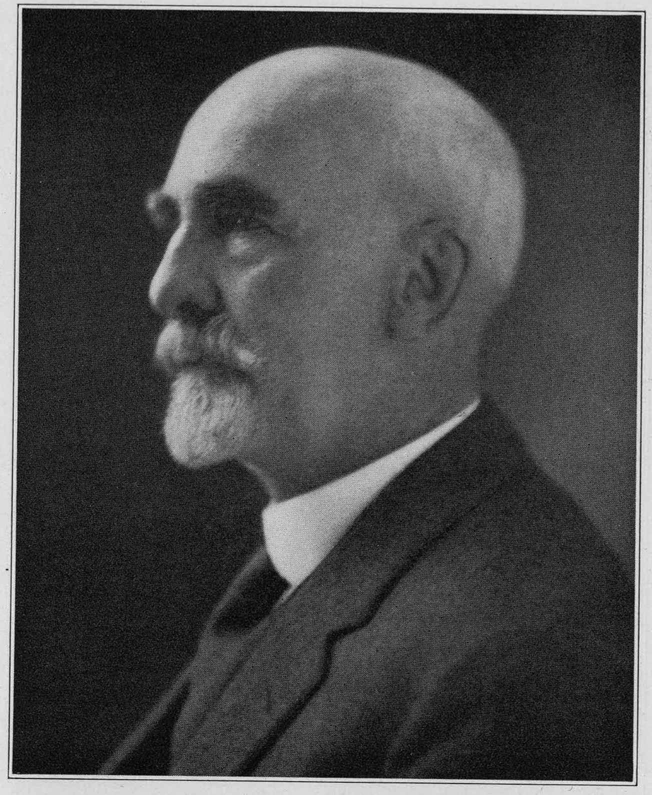
(Illustration by courtesy of the Wesleyan University Alumni Association.)



Samuel W. Johnson, M.A.

Director, Connecticut Agricultural Experiment Station, 1877-1899.

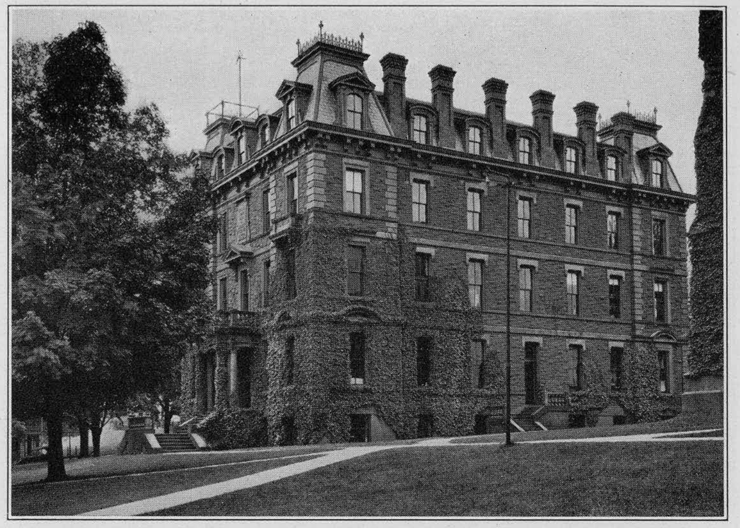
Student, Yale University, 1849-1850; Instructor in Chemistry, Physics and Human Physiology, State Normal School, Albany, N. Y., 1851-1852; Student, Leipzig, 1853-1854, Munich, 1854-1855; Honorary M.A., Yale University, 1857; Professor of Agricultural Chemistry, Yale University, 1856-1896; Emeritus, 1896; Associate Editor, *American Journal of Sciences,* 1869-1880; member National Academy of Sciences, American Academy of Arts and Sciences, Society for the Promotion of Agricultural Science, and American Chemical Society, of which he was president in 1878. Author of "How Crops Grow," 1868, translated into six other languages; "How Crops Feed," 1870, translated into four other languages. Born, Kingsboro, N. Y., July 3, 1830. Died, New Haven, Conn., July 21, 1909.



EDWARD H. JENKINS, PH.D.

Director, Connecticut Agricultural Experiment Station, 1900-1923; Emeritus, 1923.

Director, Storrs Agricultural Experiment Station, 1912-1923; graduated Yale University (A.B.), 1872; graduate student at Leipzig, 1875-1876, and then at Yale, receiving the Ph.D. in 1879. Chemist, Connecticut Agricultural Experiment Station, 1877-1900, Vice Director, 1884-1900, Treasurer, 1901-1923; Chairman, Connecticut State Sewerage Commission, 1897-1903; Charter member and President, Association of Official Agricultural Chemists and member of its first Committee on Food Standards; President, 1913, Association of American Agricultural Colleges and Experiment Stations; Fellow, American Association for the Advancement of Science; member, Society for the Promotion of Agricultural Science; Author of Agriculture in Osborn's History of Connecticut, 1925. Born, Falmouth, Mass., May 31, 1850, now lives at 108 East Rock Road, New Haven, Conn.

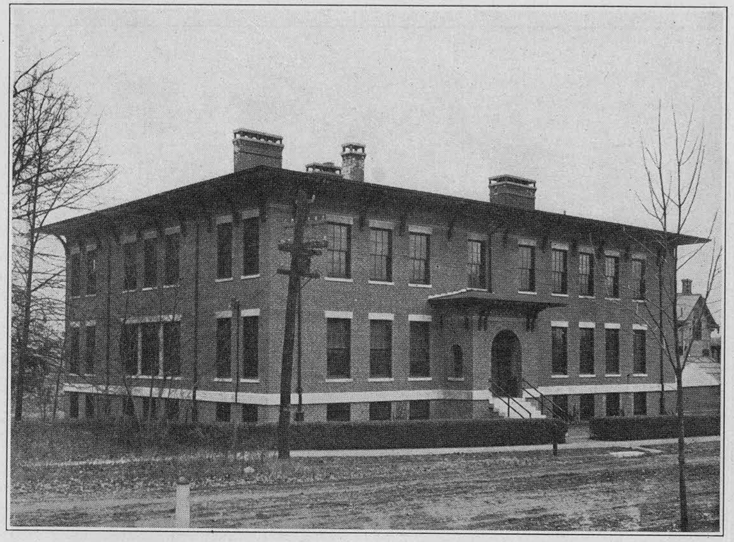


ORANGE JUDD HALL, WESLEYAN UNIVERSITY, MIDDLETOWN.

This building housed the Station during the first two years, 1875-1877. The Station quarters were on the ground floor in the southwest corner and are shown at the right of the picture.

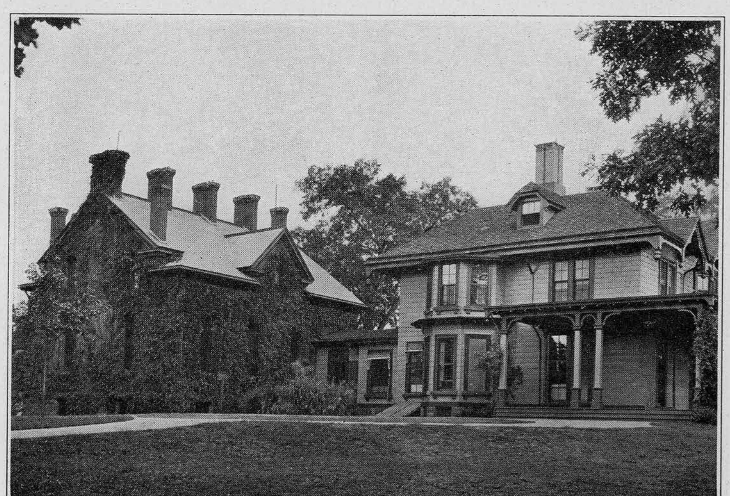
SHEFFIELD LABORATORY, YALE UNIVERSITY, NEW HAVEN.

Here the Station was quartered for five years, 1877-1882. The rooms used by the Station were on the ground floor of the wing and are shown at the right of the picture.



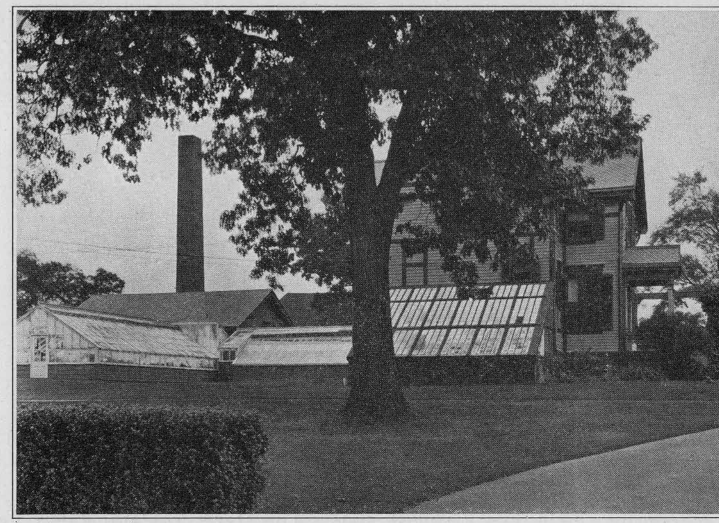
Johnson Laboratory.

The present building occupied by the Departments of Analytical Chemistry, Biochemistry, Botany, Entomology and Forestry. The easterly wing was erected in 1905, and the larger portion of the building completed in 1910.



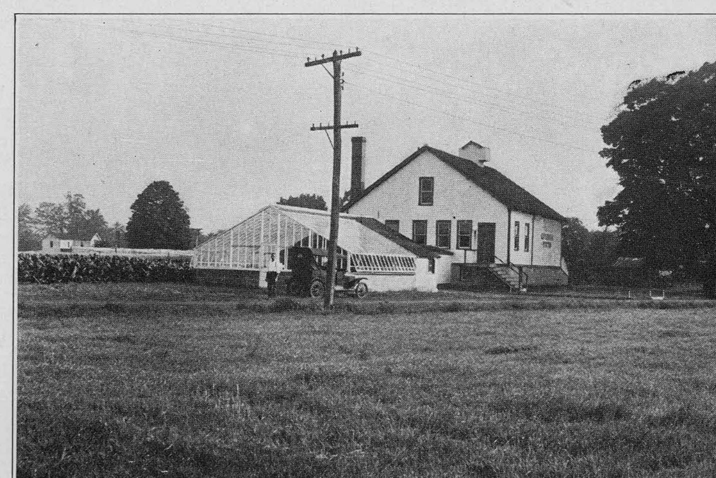
General Office and Library.

Director's residence and office at right, General Library at left. Property purchased in 1882. Brick building was erected in 1882, equipped as a chemical laboratory and used for that purpose until the completion of Johnson Laboratory in 1910. Then it was fitted with book shelves and has since been used as the General Library of the Station.



Laboratory, Greenhouse and Heating Plant.

The wood building at the right houses on the first floor the Department of Soil Research and on the second floor the Department of Plant Breeding. The building was erected in 1888 for the Botanical Department and later the Entomological Department used the second floor, both Departments moving into Johnson Laboratory on its completion in 1910. The greenhouse was erected in 1895, and the central heating plant marked by the tall chimney was constructed in 1917; this contains a small assembly room.



Tobacco Experiment Farm, Windsor.

Thirteen acres purchased in 1921. View showing laboratory and greenhouse erected in 1924.

STATION FARM, MOUNT CARMEL.

View during Field Day, August 1924. This farm contains thirty-five acres, of which twenty acres were purchased in 1911, and fifteen acres in 1915. On this farm are conducted many experiments in plant breeding, spraying and fertilizing of orchard, field and garden crops.

EXPERIMENTAL FOREST, LOCKWOOD FIELD, WINDSOR.

This field was purchased in 1900, with additions in 1905 and 1908 totaling about 100 acres. In background at left, red pine and at right Scotch pine, seventeen years after setting. In foreground, white pine, six years after setting.

State of Connecticut
PUBLIC DOCUMENT No. 24

Forty-ninth Report

OF THE

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

FOR THE YEAR

1925

PRINTED IN COMPLIANCE WITH STATUTE

NEW HAVEN
PUBLISHED BY THE STATE
1926

PUBLICATION
APPROVED BY
THE BOARD OF CONTROL

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY
New Haven, Conn.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

(As of October 31, 1925)

BOARD OF CONTROL.

His Excellency, Governor John H. Trumbull, *ex-officio, President.*

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George A. Hopson, *Secretary* ....Mount Carmel
Wm. L. Slate, Jr., *Director and Treasurer* ....New Haven
Joseph W. Alsop ....Avon
Elijah Rogers ....Southington
Edward C. Schneider ....Middletown
Francis F. Lincoln ....Cheshire

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

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Forestry.	WALTER O. FILLEY, *Forester in Charge.* 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, S.D., *Assistant Geneticist.*
Soil Research.	M. F. MORGAN, M.S., *Agronomist in Charge.* GEORGE D. SCARSETH, B.S., *Graduate Assistant.*
Tobacco Sub-station at Windsor.	PAUL J. ANDERSON, PH.D., *Pathologist in Charge.* N. T. NELSON, PH.D., *Assistant Physiologist.*

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

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

The Board of Control of the Connecticut Agricultural Experiment Station herewith submits its forty-ninth report for the year ending October 31, 1925.

The Report of the Director (Bulletin No. 274) to the Board of Control of this Station includes a review of the year, the changes in staff, and other pertinent matters. This was distributed to the mailing list in January, 1926, and is also included herewith, making further detailed report unnecessary.

As parts of this report there are submitted twelve regular bulletins and the report of the Tobacco Station at Windsor. By special effort the "Fertilizer Report" was distributed December first, thus increasing its usefulness. A new edition of the "Spray Bulletin" met with much favorable comment. The new Feeding Stuffs law placed upon the station added duties, but no difficulty has been experienced, the manufacturers and jobbers coöperating in fine spirit.

An account of the Semi-Centennial is published as Bulletin 280 and contains reproductions of the portraits of Professor Johnson and Dr. Jenkins, which were presented to the station at that time.

The new greenhouse has proved of great value in our plant breeding and soils work, increasing the productiveness in these lines.

Under the Purnell Act, the station has undertaken a detailed study of the soils of the State and the relation of forest composition and growth to these soils. It is yet too soon to expect results but the work is progressing very satisfactorily.

All of which is respectfully submitted,

GEORGE A. HOPSON,
Secretary.

Report of the Treasurer

July 1, 1924—June 30, 1925

W. L. Slate, Jr., in account with The Connecticut Agricultural Experiment Station for the fiscal year ended June 30, 1925.

Receipts.

Balance on hand, July 1, 1924:			
State General (Current Expense Appropriation)	$5,895.18		
Miscellaneous Receipts	274.81		
			$6,169.99
State Appropriation (General or Current Expense)		$50,000.00	
" " (General) (Additions)		951.52	
" " (Food)		7,500.00	
" " (Insect Pest)		15,000.00	
" " (Insect Pest) (Additions)		2,808.74	
United States Appropriation (Hatch)		7,500.00	
" " " (Adams)		7,500.00	
Fertilizer Analysis Fees		14,500.00	
Lockwood Trust Fund (including sales of tree seedlings and Mt. Carmel Farm produce)		9,000.00	
			$114,760.26
Miscellaneous Receipts:			
Sales of gasoline	$308.02		
Sales of automobile oil	21.43		
Mileage for use of automobiles	109.31		
Court fees	404.36		
Miscellaneous	16.71		
Interest on bank deposits	10.47		
		870.30	$115,630.56
			$121,800.55
Less Miscellaneous Receipts Deposited with State Treasurer			987.73
			$120,812.82

Disbursements.

Salaries	$62,635.27
Labor	11,796.31
Stationery and Office Supplies	775.16
Scientific Supplies (chemicals)	1,293.61
" " (other laboratory)	947.00
" " (photographic)	32.92
Feeding Stuffs	56.50
Insecticides, Fungicides, etc.	17.45
Lumber and Small Hardware	38.06
Miscellaneous Supplies	791.87
Automobile Oil	194.08
Food Samples	43.46
Fertilizers	657.57
Telegraph and Telephone	260.70
Postage	216.60
Travel (outlying investigations)	1,522.27
" (meetings, etc.)	1,237.07
" (gasoline)	963.16
Freight, Express and Parcels Post	162.59
Publications (bulletins, etc.)	114.71
" (miscellaneous)	151.70
Coal	3,247.69
Gas and Electricity	1,906.17
Water	250.75
Furniture and Fixtures (new)	296.31
" " " (repairs)	92.89
Library (books and periodicals)	758.34
" (binding)	386.70
Scientific Equipment (new)	2,054.21
" " (repairs)	31.19
Automobiles (new)	1,071.00
" (repairs)	664.83
Tools, Machinery and Appliances (new)	237.68
" " " " (repairs)	499.11
New Buildings and Structures	4.50
Buildings (repairs and alterations)	5,874.49
Insurance (fire, burglary and automobile)	1,084.51
Taxes	39.29
Miscellaneous Contingent Expenses	438.98
Total Disbursements (excluding Insect Pest)	$102,846.70
Insect Pest Fund Expenditures	17,615.92
	$120,462.62
Balance on hand, June 30, 1925:	
Insect Pest Appropriation (in hands of State Comptroller)	192.82
	$120,655.44
Miscellaneous Receipts (in hands of Station Treasurer)	157.38
	$120,812.82

REPORT OF

W. L. SLATE, Jr., Director

IN ACCOUNT WITH

Mosquito Elimination Appropriation

For the Fiscal Year Ending June 30, 1925

RECEIPTS.

Balance on hand, July 1, 1924 (Petty Cash Fund)	$ 500.00	
State Appropriation	6,000.00	
Additions to Appropriation (contributions and collections from towns)	4,188.12	
Total		$10,688.12

EXPENDITURES.

By the State Comptroller on vouchers submitted by W. L. Slate, Jr., Director:		
Salary	$2,366.66	
Labor	5,830.47	
Stationery and Office Supplies	8.80	
Chemical Supplies	2.01	
Photographic Supplies	.55	
Hardware Supplies	4.32	
Miscellaneous Supplies	53.82	
Oil for Mosquito Spraying	30.45	
Automobile Oil	4.25	
Telephone and Telegraph	4.65	
Travel	110.27	
Travel (gasoline)	97.79	
Express	2.00	
Furniture and Fixtures (new)	8.00	
Tools, Machinery and Appliances (new)	128.76	
" " " " (repairs)	16.45	
Automobile repairs and accessories	122.75	
Tide Gates and Culverts (new)	155.31	
" " " " (repairs)	1,201.39	
Insurance (automobile)	39.42	
	$10,188.12	
Balance on hand July 1, 1925 (Petty Cash Fund)	500.00	
		$10,688.12

REPORT OF

W. L. SLATE, Jr., Director

UNDER THE

Tobacco Research Act

(Public Acts, 1921. Chap. 184)

For the Fiscal Year Ending June 30, 1925

RECEIPTS.

State Appropriation	$10,000.00	
Additions to Appropriation (sales of tobacco)	5,369.92	
Total		$15,369.92

EXPENDITURES.

Salaries	$3,399.99	
Labor	5,747.26	
Stationery	190.58	
Chemicals and Laboratory Supplies	12.86	
Feeding Stuffs	81.59	
Lumber for repairs, and small hardware	101.61	
Insecticides	217.82	
Sundry Supplies	1,043.82	
Automobile Oil	16.60	
Fertilizer	615.37	
Telephone	92.98	
Postage	17.56	
Travel	607.90	
" (gasoline)	76.31	
Garage rent	55.00	
Freight, Cartage and Express	66.53	
Heat ($381.51), Light ($41.23) and Water ($10.53)	433.27	
Furniture and Fixtures (new)	299.10	
Library	3.00	
Tools, Machinery and Appliances (new)	314.54	
" " " (repairs)	7.35	
Automobile repairs	228.29	
Buildings and Land (new)	905.21	
" " " (repairs and alterations)	752.52	
Insurance	82.86	
		$15,369.92

BULLETIN 270 OCTOBER, 1925

Connecticut Agricultural Experiment Station

New Haven, Connecticut

Report on Inspection of Commercial Fertilizers for 1925

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

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

Report on Inspection of Commercial Fertilizers, 1925

E. M. Bailey,

Chemist in Charge, Analytical Laboratory.

THE FERTILIZER LAW.

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

Significance of the Term "Commercial Fertilizers"

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

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

Concerning Cottonseed Meal.

Cottonseed meal is a fertilizer within the meaning of the Statute but it is provided that when this product is sold for feeding purposes only, it shall be exempt from the tonnage tax.

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."

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

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

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

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

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

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

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

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

Requirements to be Complied with by Sellers of Commercial Fertilizers.

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

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

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

In the case of bone meal, tankage or other organic products, and in basic slag and mineral phosphates in which a large percentage of the phosphoric acid is not available by laboratory methods, the

phosphoric acid shall be claimed as total phosphoric acid unless it is desired to claim available phosphoric acid instead, in which case the guaranty shall take the form set forth above.

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

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

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

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

The seller must also, on the 1st of January and July, report the tonnage of fertilizer sold within the preceding six months and pay to the director of the Station a tonnage fee of 6 cents per ton.

On request, copies of the law and blanks for registration and for tonnage reports will be supplied by the Station.

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

Precautions to be Observed in Drawing Samples for Analysis.

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

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

Gratuitous Analyses.

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

REGISTRATIONS.

For 1925, 61 individuals and firms registered at this Station for sale in this State 437 brands of fertilizers. As required by Statute the brands so registered are listed as follows:

American Agricultural Chemical Co., 40 West St., New York, N. Y.

Castor Pomace
Complete Potato Mixture
Crescent Complete Manure
Double A Tobacco Fertilizer
Dry Ground Fish
Farm Favorite
Fine Ground Bone
Fish and Potash
Grass and Lawn Top Dressing
Ground Tankage
High Grade Acid Phosphate
Hi-Grade Tobacco Manure
Nitrate of Soda
7% Potash Fertilizer
Pulverized Sheep Manure
Sulphate of Potash
Universal Phosphate
Bowker's Lawn and Garden Dressing
Bradley's Complete Manure for Potatoes and Vegetables
Bradley's Complete Tobacco Manure

Bradley's Corn Phosphate
Bradley's New Method Fertilizer
Bradley's Northland Potato Grower
Bradley's Potato Fertilizer
Bradley's Potato Manure
Bradley's Superior Tobacco Compound
Bradley's XL Superphosphate of Lime
National Complete Tobacco Fertilizer
National Eureka Potato Fertilizer
National Market Garden Fertilizer
National Potato and Corn Phosphate
National Premier Truck Manure
National White Ash Tobacco Grower
National XXX Fish and Potash
Quinnipiac Corn Manure
Quinnipiac Fish and Potash Phosphate
Quinnipiac Market Garden Manure
Quinnipiac Potato Phosphate
Quinnipiac Prime Tobacco Manure
Quinnipiac Seed Leaf Tobacco Manure

American Cyanamid Co., 511 Fifth Ave., New York, N. Y.

Ammo-Phos

Apothecaries Hall Co., Waterbury, Conn.

Acid Phosphate
Animal Tankage
Bone
Bone and Meat Tankage
Bone Meal
Carbonate Potash
Castor Pomace
Cottonseed Meal 41%
Double Sulphate Potash and Magnesia
Dry Ground Fish
Nitrate Soda
Nitrate Soda and Potash
Potash Muriate
Potash Sulphate
Precipitated Bone
Sulphate Ammonia
Liberty Corn and All Crops 2-8-2
Liberty Corn and Vegetable 3-6-10
Liberty Corn, Fruit and All Crops 2-12-4
Liberty Fish, Bone and Potash 3-10-4
Liberty High Grade Market Gardeners 5-8-7
Liberty High Grade Tobacco Manure 7.5-4-7.5
Liberty Market Gardeners Special 4-8-4
Liberty Tobacco Special 5-4-5
Liberty Top Dresser for Grass and Grain 10-3.5-8

Armour Fertilizer Works, 50 Broad St., New York, N. Y.

Armour's Big Crop Acid Phosphate 16%
Armour's Big Crop Fertilizer 8-6-6
Armour's Big Crop Fertilizer 5-8-7
Armour's Big Crop Fertilizer 5-8-5
Armour's Big Crop Fertilizer 4-16-4

Armour's Big Crop Fertilizer 4-6-10
Armour's Big Crop Fertilizer 4-8-4
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
Bone Meal 3-48
Ground Tankage 9-15
Muriate of Potash 48%
Nitrate of Soda 18%
Sheep Manure 1.5-1-2

Ashcraft-Wilkinson Co., Trust Co. of Georgia Bldg., Atlanta, Ga.
Helmet Brand Prime Cottonseed Meal
Monarch Brand Prime Cottonseed Meal
Paramount Brand Good Cottonseed Meal

Atlantic Packing Co., New Haven, Conn.
Atlantic 5-8-7
Atlantic Corn and Grain Fertilizer 2-8-2
Atlantic Market Garden 4-8-6
Atlantic Special 3-8-4
Atlantic Special Tobacco Fertilizer 5-4-16
Atlantic Special Vegetable and Potato Grower 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

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

Berkshire Fertilizer Co., Bridgeport, Conn.
Berkshire Castor Pomace
Berkshire Complete Fertilizer
Berkshire Complete Tobacco
Berkshire Dry Ground Fish
Berkshire Economical Grass Fertilizer
Berkshire Fine Ground Bone
Berkshire Grass Special
Berkshire Long Island Special
Berkshire Market Garden
Berkshire Potato and Vegetable Phosphate
Berkshire Tobacco Special
Berkshire Sheep Manure
Acid Phosphate
Double Manure Salt
Ground Tankage
High Grade Sulphate Potash
Muriate of Potash
Nitrate of Soda
Precipitated Bone Phosphate

F. E. Boardman, 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 Fisherman's Brand Fish and Potash
Bowker's Hill and Drill Phosphate
Bowker's Market Garden Fertilizer
Bowker's Potato and Vegetable 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

Buckeye Cotton Oil Company, Cincinnati, Ohio.
"Buckeye" 36% Protein Cottonseed Meal
"Buckeye" 41% Protein Cottonseed Meal

A. H. Case & Co., Inc., Buffalo, N. Y.
Case's Brand of Pulverized Sheep Manure

Chittenden Co., E. D., Bridgeport, Conn.
Chittenden's Castor Pomace
Chittenden's Complete Grain
Chittenden's Dry Ground Fish
Chittenden's Fine Ground Bone
Chittenden's High Grade Acid Phosphate
Chittenden's High Grade Muriate Potash
Chittenden's High Grade Potato
Chittenden's High Grade Sulphate Potash
Chittenden's High Grade Tobacco
Chittenden's Nitrate of Soda
Chittenden's Potato Special 4-8-4
Chittenden's Potato Special 4-8-6
Chittenden's Tobacco Special
Chittenden's Top Dresser 5-8-4

Clark Seed Co., Everett B., Milford, Conn.
Clark's Special Mixture for General Use
Clark's Special Mixture with 6% Potash
Clark's Superphosphate
Clark's Tip Top Brand
Acid Phosphate
Bone
Muriate of Potash
Nitrate of Soda
Tankage

Connecticut Fat Rendering & Fertilizer Corporation, West Haven, Conn.
Tankage

Consolidated Rendering Co., 40 North Market St., Boston (9), Mass.
Acid Phosphate 16%
Castor Pomace
Dry Ground Fish
Ground Bone (2.5-25.18)
Ground Bone (2.46-3)
Muriate of Potash
Nitrate of Soda
Tankage 9-20
Tankage 6-30
Sulphate of Ammonia
Sulphate of Potash

Davey Tree Expert Co., Kent, Ohio.
Davey Tree Food

Davis, S. P., 207 Southern Trust Bldg., Little Rock, Ark.
Beauty Brand Cottonseed Meal
Goodluck Brand Cottonseed Meal and Cracked Screened Cottonseed Cake
Steerboy Brand Cottonseed Meal and Cracked Screened Cake

Eastern Cotton Oil Co., Norfolk, Va.
Superior Cottonseed Meal

Eastern States Farmers' Exchange, 33 Lyman St., Springfield, Mass.
Eastern States 8-6-6
Eastern States 5-10-5
Eastern States 5-8-7
Eastern States 4-8-10
Eastern States 4-8-4
Eastern States 3-12-3
Eastern States Acid Phosphate
Eastern States Fine Ground Bone
Eastern States Formula "A" Tobacco Fertilizer
Eastern States Formula "B" Tobacco Fertilizer
Eastern States Formula "C" Tobacco Fertilizer
Eastern States Ground Animal Tankage
Eastern States Kainit
Eastern States Muriate of Potash
Eastern States Nitrate of Soda
Eastern States Sulphate of Ammonia
Sulphate of Potash

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

Frisbie Co., L. T., New Haven, Conn.
Frisbie's 5-8-7
Frisbie's Corn and Grain Fertilizer 2-8-2
Frisbie's Fine Bone Meal
Frisbie's 3/50 Bone Meal
Frisbie's 12/10 Ground Tankage
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 Manure 5-8-6
Frisbie's Top Dresser 7-5-4
Precipitated Bone

Higgins, Inc., A. W., South Deerfield, Mass.
Old Deerfield Acid Phosphate
Old Deerfield Castor Pomace
Old Deerfield 5-8-7 Complete Fertilizer
Old Deerfield 4-8-4 Complete Fertilizer
Od Deerfield Manure Salts
Old Deerfield Muriate of Potash
Old Deerfield Tankage

Humphreys-Godwin Co., Inc., Memphis, Tenn.
Bull Brand Cottonseed Meal 43%
Danish Brand Cottonseed Meal 36%
Dixie Brand Cottonseed Meal 41.12%

International Agricultural Corporation, 126 State St., Boston, Mass.
International Acid Phosphate
International Connecticut Valley Special
International Crop Grower
International Economy
International General Favorite
International High Grade Manure
International Ideal
International Multiple-Strength
International New England Special
International Phosphate and Potash
International Tobacco Grower
International Tobacco Producer
International Tobacco Special
Bone Meal
Castor Pomace
Cotton Seed Meal
Muriate of Potash
Nitrate of Soda
Sulphate of Ammonia
Sulphate of Potash
Tankage

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

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

Lovitt & Co., L. B., Memphis, Tenn.
Lovit Brand Cottonseed Meal 36%
Lovit Brand Cottonseed Meal 41%
Lovit Brand Cottonseed Meal 43%

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

Mapes Formula & Peruvian Guano Co., 270 Madison Ave., New York, N. Y.
The Mapes Connecticut Valley Special
The Mapes Corn Manure
The Mapes General Tobacco Manure
The Mapes General Truck Manure
The Mapes General Use Manure
The Mapes 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
The Mapes Special Formula Tobacco Manure

Memphis Cottonseed Products Co., 1015 Falls Bldg., Memphis, Tenn.
Durham Brand 36% Cottonseed Meal
Durham Forty Three Cottonseed Meal

National Cottonseed Products Corp., Memphis, Tenn.
Sun Brand Cottonseed Meal

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

New England By-Products Corp., 20 West St., Lawrence, Mass.
Pure Bone Meal
Ground Steam Bone

New England Fertilizer Co., 40A North Market St., Boston, Mass.
New England 5-8-7 for Potatoes and Market Gardens
New England 4-8-4 for Potatoes, Vegetables and Grass
New England Corn Phosphate for Grain and Vegetables 2-8-2
New England Potato Phosphate 4-8-7 for Potatoes and Vegetables
New England Superphosphate, A High Grade Fertilizer for All Crops 3-8-4
New England Tobacco Manure 5-8-6
New England Tobacco 5-4-5

Nitrate Agencies Co., Baltimore, Md.
Naco Brand Acid Phosphate
Naco Brand Dry Ground Fish
Naco Brand Muriate of Potash
Naco Brand Nitrapo

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

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

Parmenter & Polsey Fertilizer Co., 41 North Market St., Boston, Mass.
Parmenter & Polsey 5-8-7 for Potatoes and Market Gardens
Parmenter & Polsey 4-8-4 for Potatoes, Corn and Vegetables
"P & P" 2-8-2 for Farm and Garden
"P & P" Plymouth Brand for All Crops 3-8-4

Piedmont Mt. Airy Guano Co., Baltimore, Md.
Piedmont Bone Meal
Harvest Brand 16% Acid Phosphate
Harvest Brand 8-6-6
Harvest Brand 6-8-6
Harvest Brand 5-8-7
Harvest Brand 5-8-5
Harvest Brand 4-8-4
Harvest Brand 4-6-10
Harvest Brand 3-8-4
Harvest Brand 2-8-2
9% Tankage
Muriate of Potash
Nitrate of Soda
Sulphate of Ammonia

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

Potash Marl, Inc., 13 East 40th St., New York, N. Y.
Potash-Marl

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

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

Rackliffe Bros. Co., Inc., New Britain, Conn.
4-8-4 Fertilizer
Nitrate of Soda
"M. F. E." Brand Nitrate of Soda

Rogers & Hubbard Co., The, Portland, Conn.
Rogers & Hubbard's All Soils-All Crops Fertilizer
Rogers & Hubbard's Climax Tobacco Brand
Rogers & Hubbard's Corn and Grain Fertilizer
Rogers & Hubbard's High Potash Fertilizer
Rogers & Hubbard's Potato Fertilizer
Rogers & Hubbard's Tobacco Grower, Vegetable Formula
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 "Bone Base" Soluble Tobacco Manure
Hubbard's Pure Raw Knuckle Bone Flour
Hubbard's Strictly Pure Fine Bone
5-8-7
4-8-4
Acid Phosphate
Castor Pomace
Cottonseed Meal
Garden Fertilizer
Ground Fish
Nitrate of Soda
Precipitated Bone
48% Sulphate of Potash

Royster Guano Co., F. S., 1606 Munsey Bldg., Baltimore, Md.
Royster's 16% Acid Phosphate
Royster's Bully Guano
Royster's Fine Ground Bone Meal
Royster's Quality Trucker
Royster's Top Dresser
Royster's Triumph Guano
Royster's Truckers Delight
Royster's Valley Tobacco Formula
Royster's Verbena Guano
Royster's Wrapper Brand
Muriate of Potash
Nitrate of Soda
Sulphate of Ammonia

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 Nitrate of Soda
Sanderson's Potato Manure
Sanderson's South American Sheep and Goat Manure
Sanderson's Top Dressing for Grass and Grain

Shoemaker & Co., Inc., M. L. Venango St. and Delaware Ave., Philadelphia, Pa.
"Swift-Sure" Bone Meal 5.5-45
"Swift-Sure" Crop Grower
"Swift-Sure" Special Tobacco Formula
"Swift Sure" Tobacco and General Use
"Swift Sure" Tobacco Starter
Acid Phosphate
Bone Meal 3-50

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

Thomas & Sons Co., I. P., Philadelphia, Pa.
I. P. Thomas 5-8-7
16% Acid Phosphate
Improved Trucker's Fertilizer 5-10-5
Muriate of Potash
Nitrate of Soda
Pure Ground Bone
Tankage
Truckers' High Grade Guano 4-8-4

Triton Oil & Fertilizer Co., 101 Beekman St., New York, N. Y.
Triton 5-8-7 Fertilizer
Triton 4-8-7 Fertilizer
Triton 4-8-4 Fertilizer
Triton 3-10-2 Fertilizer
Acid Phosphate

United States Guano Co., c/o Standard Wholesale Phosphate Acid Works, Baltimore, Md.
Standard United States 16% Acid Phosphate
Standard United States Bone Meal
Standard United States Evergreen Fish Guano
Standard United States Farmers Formula
Standard United States Fish, Bone and Potash
Standard United States Muriate of Potash
Standard United States Nitrate of Soda

Virginia-Carolina Chemical Co. (of Delaware), Equitable Bldg., 120 Broadway (Room 2249), New York, N. Y.
V-C Aroostook Potato Grower
V-C Champion Brand
V-C Double Owl Brand
V-C Good Luck Brand
V-C Indian Chief Brand
V-C National Brand
V-C Tip Top-Top Dresser

Vitogro Chemical Co., 38 Middle St., Lowell, Mass.
Vitogro for Flowers, Shrubs and Vegetables

Wilcox Fertilizer Works, 56 Main St., Mystic, Conn.
Wilcox 5-10-5 Fertilizer
Wilcox 5-8-7 Fertilizer
Wilcox 4-8-4 Fertilizer
Wilcox Corn Special
Wilcox Dry Ground Fish
Wilcox Fish and Potash
Wilcox Grass and Truck Fertilizer
Wilcox Potato and Vegetable Phosphate
Wilcox Top Dresser
Wilcox Tobacco Special
Acid Phosphate
Nitrate of Soda
Steamed Bone Meal

Woodruff & Sons, S. D., Orange, Conn.
Woodruff's Home Mixed Fertilizer

Worcester Rendering Co., Auburn, Mass.
Prosperity Brand Complete Dressing
Prosperity Brand Corn and Grain Fertilizer
Prosperity Brand Ground Tankage
Prosperity Brand Market Garden Fertilizer
Prosperity Brand Potato and Vegetable Fertilizer
Prosperity Brand Superior Top Dressing

INSPECTION OF 1925.

During the season our agent has visited 97 towns and drawn 601 official samples of mixed fertilizers and raw materials, which number includes all the registered brands which were found on sale. These together with samples submitted by purchasers and others may be classified as follows:

Classification of Fertilizers Examined.

	Number of Samples	Page
I. *Containing Nitrogen as the chief active ingredient:*		
Nitrate of Soda	23	18
Sulphate of Ammonia	5	20
Castor Pomace	30	20
Cottonseed Meal	53	24
II. *Containing Phosphoric Acid as the chief active ingredient:*		
Precipitated Bone Phosphate	10	27
Dissolved Rock Phosphate or Acid Phosphate	24	28
III. *Containing Potash as the chief ingredient:*		
Carbonate of Potash	7	31
Muriate of Potash	15	31
Sulphate of Potash	14	31
Double Sulphate of Potash and Magnesia	3	31
Kainit	1	31
IV. *Containing Nitrogen and Potash:*		
Nitrate of Potash and Soda	1	35
Nitrapo	1	35
V. *Containing Nitrogen and Phosphoric Acid:*		
Dry Ground Fish	26	35
Tankage	16	38
Ground Bone	26	40
VI. *Mixed Fertilizers:*		
Containing Nitrogen and Phosphoric Acid	4	43
Containing Nitrogen, Phosphoric Acid and Potash	269	43
Special and Home Mixtures	46	67
VII. *Miscellaneous fertilizers, amendments, waste products, etc.:*		
Wood Ashes	12	71
Sheep Manure, etc.	11	74
Lime, etc.	17	75
Miscellaneous	76	78
Total	690	

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA

This salt in a pure state contains 16.47 per cent of nitrogen. Commercial grades usually contain from 15 to 16 per cent of nitrogen which is equivalent to 18.2 to 19.5 per cent of ammonia or 91 to 97 per cent of nitrate of soda.

Twenty-three samples have been analyzed and the results are given in Table I. So far as nitrogen guaranties were given no deficiencies were found. The average nitrogen content was 15.43 per cent which is equivalent to 18.76 per cent of ammonia.

At prices quoted, $60.00 to $85.00, nitrogen has cost from 19.2 to 27.2 cents per pound. *Excluding the single high quotation, the range is 19.2 to about 25 cents.* The average last year was found to be 23.3 cents.

TABLE I. ANALYSIS OF NITRATE OF SODA.

Station No.	Manufacturer or Jobber.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
1561	American Agricultural Chemical Co., New York	Station agent. Stock of F. S. Bidwell Co., Windsor Locks	15.48	15.00
1558	Apothecaries Hall Co., Waterbury	Station agent. Stock of R. W. Hine, Cheshire	15.66	14.80
2052	Armour Fertilizer Works, New York	Station agent. Stock of F. A. Bartlett Tree Expert Co., Stamford	15.30	14.81
1517	Berkshire Fertilizer Co., Bridgeport	Station agent. Stock of T. W. Ryan, Stratford	15.46	15.00
1862	E. D. Chittenden Co., Bridgeport	Station agent. Stock of E. J. Bantle, Glastonbury	15.02	15.00
1685	Everett B. Clark Seed Co., Milford	Station agent. Stock of Jos. Adams, Southport	15.12	15.00
1583	Consolidated Rendering Co., Boston	Station agent. Stock of L. T. Frisbie Co., New Haven	15.32	15.22
1848	Consolidated Rendering Co., Boston	Station agent. Stock of A. E. Shedd, Norwich	15.50	15.00
1643	Eastern States Farmers' Exchange, Springfield	Station agent. Stock of Edgewood Farm, North Haven	14.96	14.80
2440	International Agricultural Corp., Woburn	Station agent. Stock of Geo. Adams, West Suffield	15.40	15.00
1681	Olds & Whipple, Inc., Hartford	Station agent at factory	15.58	15.00
1527	Piedmont Mt. Airy Guano Co., Baltimore	Station agent. Stock of Lightbourn & Pond Co., New Haven	15.38	15.02
2453	Rackliffe Bros., New Britain	Station agent. Stock of The Meriden Farmers' Exchange, Meriden	15.60	15.00
2460	Rackliffe Bros., New Britain	Station agent at factory	15.20	15.00
1551	The Rogers & Hubbard Co., Portland	Station agent at factory	15.52	14.80
1749	F. S. Royster Guano Co., Baltimore	Station agent. Stock of W. S. Brown, Trumbull	15.40	15.00
1741	Sanderson Fertilizer and Chemical Co., New Haven	Station agent at factory	15.90	15.00
1456	I. P. Thomas & Son, Philadelphia	Station agent. Stock of Highwood Vegt. Growers' Association, Highwood	15.52	15.00
1808	United States Guano Co., Baltimore	Station agent. Stock of Knowles-Lombard Co., Guilford	15.46	15.00
1814	Wilcox Fertilizer Works, Mystic	Station agent. Stock of Jordan Hardware Co., Willimantic	15.14	15.00
1029	W. R. Grace Co., New York.	American Sumatra Tobacco Co., Bloomfield	15.16	...
1368	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield	15.68	...
1247	....	T. J. Conine, Stratford	14.76	...

SULPHATE OF AMMONIA.

Pure sulphate of ammonia contains 21.2 per cent of nitrogen but the commercial grades contain about 20.5 per cent which is equivalent to about 25 per cent of ammonia or about 97 per cent of ammonium sulphate.

Five samples were examined and results are given in Table II. All substantially met or exceeded the guaranties for nitrogen. *Prices were not quoted but 17.5 cents per pound may be taken as a fair valuation for nitrogen from this source this year.*

TABLE II. SULPHATE OF AMMONIA.

Statioin No.	Manufacturer or Jobber.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guranteed.
2345	Apothecaries Hall Co., Waterbury	Station agent at factory	20.94	20.56
1521	The Barrett Co., New York	Station agent. Stock of T. W. Ryan, Stratford	20.96	20.75
1847	Consolidated Rendering Co., Boston	Station agent. Stock of A. E. Shedd, Norwich	20.46	20.50
1582	Consolidated Rendering Co., Boston	Station agent. Stock of L. T. Frisbie Co., New Haven	20.44	20.50
1905	Eastern States Farmers' Exchange, Springfield	Station agent. Stock of Henry Joy, Woodstock	20.80	20.55

CASTOR POMACE.

Castor pomace is the residue left after removing the oil from the castor bean. Because of its poisonous constituents it should be stored where farm animals cannot have access to it. While chiefly valuable for its nitrogen, it contains also about one per cent of potash and two per cent of phosphoric acid. It is used chiefly with cottonseed meal in tobacco mixtures.

Thirty samples were examined and are summarized in Table III. Thirteen were sampled by the station agent and the remainder were submitted by purchasers. Sample **1680** fell somewhat below its guaranty as did **1797**. In the latter case, however, while the purchaser stated 5.50 per cent of nitrogen as

the guaranty, the registration made by the dealer claimed only 5 per cent, according to which there was no deficiency.

The average guaranty was 4.61 per cent of nitrogen and the average found was 5.02 per cent. *Ton prices, where quoted, ranged from $23.00 to $36.00 and nitrogen therefore cost from 23.3 to 39.7 cents per pound. If allowance is made for potash and phosphoric acid at 4 cents per pound each the cost of nitrogen is 2 to 3 cents less.*

TABLE III. ANALYSES OF CASTOR POMACE.

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	The American Agricultural Chemical Co., New York City.			
1719	59085	R. H. Daly, Broad Brook	4.54	4.53
2023	....	Station agent, from stock of C. F. Allen, Warehouse Pt.	5.05	4.53
	Apothecaries Hall Co., Waterbury, Conn.			
1612	....	Station agent, from stock of J. P. Norton, Broad Brook	4.95	4.52
	Baker Castor Oil Co., New York, N. Y.			
1535	10602	American Sumatra Tobacco Co., Bloomfield	4.62	4.50
1536	4510	American Sumatra Tobacco Co., Bloomfield	5.00	4.50
1565	83732	American Sumatra Tobacco Co., Bloomfield	5.17	4.50
1566	156521	American Sumatra Tobacco Co., Bloomfield	5.39	4.50
1691	28228	American Sumatra Tobacco Co., Bloomfield	5.04	4.50
1692	13331	American Sumatra Tobacco Co., Bloomfield	5.10	4.50
1693	17135	American Sumatra Tobacco Co., Bloomfield	5.29	4.50
1839	....	Station agent, from stock of Albert Wetstone, Ellington	4.94	4.50
	Berkshire Fertilizer Co., Bridgeport, Conn.			
1575	....	Station agent at factory	4.73	4.52
2092	....	Station agent, from stock of E. N. Austin, Suffield	4.39	4.52
	E. D. Chittenden Co., Bridgeport, Conn.			
2373	....	Station agent, from stock of Frank Bantle, Glastonbury	5.10	4.52
	Consolidated Rendering Co., Boston, Mass.			
1585	....	Station agent, from stock of L. T. Frisbie Co., New Haven	4.74	4.52
	A. W. Higgins, South Deerfield, Mass.			
1835	N. Y. C. 243157	Spencer Bros., Suffield	4.79	4.52
2360	N. Y. 215118	Spencer Bros., Inc., Suffield	5.06	4.52
2637	....	Station agent, from stock of Spencer Bros., Inc., Suffield	5.17	4.52
	International Agricultural Corp., Woburn, Mass.			
1917	....	Station agent, from stock of John Adams, East Granby	5.00	4.53
	Olds & Whipple, Hartford, Conn.			
1680	....	Station agent at factory	4.70	5.00
1797	....	L. Wetstone & Sons, Inc., Hartford	5.06	5.50
1805	Thum. 50176	Huntting Bros., East Hartford	4.62	....
2033	Thum.	H. E. Wells, Warehouse Point	5.47	4.94
2034	Thum.	H. E. Wells, Warehouse Point	5.43	4.94
2059	....	E. Handel, Glastonbury	6.14	....
	The Rogers & Hubbard Co., Portland, Conn.			
1555	....	Station agent at factory	5.34	4.94
	Sanderson Fertilizer & Chemical Co., New Haven, Conn.			
2166	....	Station agent, from stock of Geo. M. Hatch, New Milford	4.69	4.53
	Spencer Kellogg & Sons, Inc., Buffalo, N. Y.			
1594	Kellogg Brand	John S. Leonard, Burnside	4.94	4.52
1897	....	Station agent, from stock of Frank Manner, Burnside	5.41	4.52
	Wilcox Fertilizer Works, Mystic, Conn.			
1547	....	Station agent, from stock of E. N. Austin, Suffield	4.92	4.52

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

COTTONSEED MEAL.

Fifty-three samples of cottonseed meal have been analyzed and are summarized in Table V. The grades represented are the 36, 41 and 43 per cent protein meals. Eleven samples were submitted with no statement of guaranty but analyses show them to be of the 41 or 43 per cent grade.

Of the fifty-three samples only three were deficient by more than 0.1 per cent of nitrogen; and in only two, **1109** *Dixie*, and **1831** *Bull*, would the deficiencies exceed $1.00 per ton reckoning nitrogen at 35 cents per pound. The average nitrogen found was 6.63 per cent and the average guaranty was 6.53 per cent. A similar computation last year showed an average of 0.15 per cent of nitrogen found over the average guaranteeed. Ninety-six per cent of samples substantially met or exceeded their guaranties.

The cost per pound of nitrogen in cottonseed meal has ranged from 38.1 cents in the 36 per cent protein grade to about 35.5 cents in the higher grades. The average for all samples is 35.9 cents as compared with 39.1 cents last year.

Table IV. Summary of Data on Cottonseed Meal.

Grade.	Number of Samples.	Average Nitrogen. %	Average Cost per Ton.	Average Cost of Nitrogen, Cents per Pound.
36 per cent (5.76 N)	7	5.87	44.00[1]	38.1
41 per cent (6.58 N)	24	6.65	47.24[2]	35.9
43 per cent (6.88 N)	11	6.87	45.53[3]	35.6
No guaranty	11	6.76	47.29[4]	35.2
Total and averages	53	6.63	47.78[5]	35.9

[1] Based on 4 quotations.
[2] " " 11 "
[3] " " 11 "
[4] " " 6 "
[5] " " 32 "

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.
	Apothecaries Hall Co., Waterbury, Conn.			
2645	....	Station agent at the factory	6.67	6.58
	Ashcraft-Wilkinson Co., Atlanta, Ga.			
1211	87085, 262241, 33852, 23612, 97292, 265348, 896992, 14638 and 31842	American Sumatra Tobacco Co., Bloomfield	6.68	....
2458	Helmet	Station agent, from stock of E. J. Bantle, Glastonbury	6.50	6.56
1829	Helmet, N. Y. C. 50088	Spencer Bros., Inc., Suffield	6.69	6.56
1830	Helmet, B & A 32917	Spencer Bros., Inc., Suffield	6.65	6.56
1834	Monarch, So. 134029	Spencer Bros., Inc., Suffield	7.07	6.88
2451	Monarch	Station agent, from stock of Spencer Bros, Inc., Suffield	6.99	6.88
2452	Paramount	Station agent, from stock of Geo. S. Phelps & Co., Thompsonville	6.00	5.76
	S. P. Davis, Littlerock, Ark.			
1832	Steerboy	Spencer Bros., Inc., Suffield	6.92	6.88
2456	Steerboy	Station agent, from stock of Geo. T. Soule, New Milford	7.00	6.88
2457	Good Luck	Station agent, from stock of Amos D. Bridges Sons, Hazardville ..	6.64	6.50
	Humphreys-Godwin Co., Memphis, Tenn.			
1107	Dixie, 47145	L. B. Haas & Co., Hartford	6.62	6.58
1108	Dixie, 80395	L. B. Haas & Co., Hartford	6.77	6.58
1109	Dixie, 27787	L. B. Haas & Co., Hartford	6.30	6.58
1199	Bull	E. N. & C. C. Austin, Suffield ...	6.76	6.88
1212	S. A. L. 85210	Steane, Hartman & Co., Hartford	6.58	6.58
1213	M. P. 20636	Steane, Hartman & Co., Hartford	6.71	6.58
1214	S. P. 87711	Steane, Hartman & Co., Hartford	6.60	6.58
1215	Miss. Pac. 22431	Steane, Hartman & Co., Hartford	6.55	6.58
1216	N. Y., N. H. & H. 91693	Steane, Hartman & Co., Hartford	6.93	6.58
1217	M. P. 28373	Steane, Hartman & Co., Hartford	6.78	6.58
1218	S. S. W. 13406	Steane, Hartman & Co., Hartford	6.94	6.58
1219	S. L. & S. F. 30325	Steane, Hartman & Co., Hartford	6.53	6.58
1220	A. C. L. 37142	Steane, Hartman & Co., Hartford	6.57	6.58
1445	Dixie, 13027, 10619	American Sumatra Tobacco Co., Bloomfield	6.91	6.58
1446	Dixie, 36850, 45278, 39714, 19054, 95856, 76941, S116417	American Sumatra Tobacco Co., Bloomfield	6.81	6.58
1447	Dixie, 82527, 84734, 37842, 15272, 271004, 156387, 29750, 152365, 79712, 49180	American Sumatra Tobacco Co., Bloomfield	6.82	6.58

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.
	Humphreys-Godwin Co., Memphis, Tenn.			
1472	28185, 12506, 32287, 97041, 49893, 29624, 31547, 128616, 43198	American Sumatra Tobacco Co., Bloomfield	6.86	....
1485	Dixie, 89628	Huntington Bros., Windsor	6.62	6.56
1546	Bull	Station agent, from stock of E. N. Austin, Suffield	6.87	6.88
1615	Dixie	Station agent, from stock of J. P. Norton, Broad Brook	6.78	6.58
1647	Dixie, R. & N. 12505	L. B. Haas Co., Hartford	6.56	6.58
1648	Dixie	L. B. Haas Co., Hartford	6.64	6.58
1690	Bull, 9493, Atchinson, Topeka and Santa Fe	H. C. Nelson, West Suffield	6.83	6.88
1788	Danish	C. Michel, West Suffield	6.01	5.75
1798	Dixie, 31978	L. Wetstone & Sons, Inc., Hartford	6.82	6.58
1799	Dixie, 40896	L. Wetstone & Sons, Inc., Hartford	6.81	6.58
1828	Bull, L. & N. 98374	Spencer Bros., Inc., Suffield	6.79	6.88
1831	Bull, S. S. & W. 30432	Spencer Bros., Inc., Suffield	6.60	6.88
1833	Bull, M. O. P. 36420	Spencer Bros., Inc., Suffield	7.08	6.88
1850	Dixie	Station agent, from stock of Glastonbury Farmers' Exchange, So. Glastonbury	6.58	6.58
2016	Dixie, W. & W. 67902	Geo. S. Phelps & Co., Thompsonville	5.71	5.76
2357	Bull, So. R. R. 164838	Spencer Bros., Inc., Suffield	6.83	6.88
2358	Dixie, S. S. W. 24342	Spencer Bros., Inc., Suffield	6.47	6.56
1486	Dixie, 79107	Huntington Bros., Windsor	6.78	6.56
2359	Bull, So. R. R. 134354	Spencer Bros., Inc., Suffield	6.65	6.88
2388	Danish, M. C. 99380	Spencer Bros., Inc., Suffield	5.75	5.76
2389	Danish, C. Ga. 50124	Spencer Bros., Inc., Suffield	5.80	5.76
2638	Danish, Cottonseed Feed	Station agent, from stock of A. E. Hall, Wallingford	5.75	5.75
	International Agricultural Corp., Woburn, Mass.			
2462	....	Station agent, from stock of Howard Barriesford, West Suffield..	6.81	6.58
	Olds & Whipple, Hartford, Conn.			
1800	514937	Huntting Bros., East Hartford ..	6.55	....
1801	195396	Huntting Bros., East Hartford ..	6.62	....
	The Rogers & Hubbard Co., Portland, Conn.			
2096	....	Station agent at factory	5.95	5.75

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

PRECIPITATED BONE PHOSPHATE.

Commercial bone phosphate, obtained as a by-product in the manufacture of gelatin, consists largely of dicalcium phosphate, and the phosphorus is practically all in so-called "available" form.

Ten samples were analyzed, five of which were sampled by the station agent. Samples **2128** and **2521** did not meet the guaranty of 38 per cent total phosphoric acid although they averaged 36 per cent of available phosphoric acid. *So far as prices were quoted available phosphoric acid cost about 7 cents per pound.*

TABLE VI. ANALYSES OF PRECIPITATED BONE PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer.	Place of Sampling.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. "Available." Found.	Phosphoric Acid. "Available." Guaranteed.
	Sampled by Station:		%	%	%	
1611	Apothecaries Hall Co., Waterbury	J. P. Norton, Broad Brook	1.15	38.70	37.55	36.00
1577	Berkshire Fertilizer Co., Bridgeport	At factory	1.45	41.70	40.25	38.00
2128	L. T. Frisbie Co., New Haven	At factory	1.15	36.48	35.33[1]	....
2521	L. T. Frisbie Co., New Haven	At factory	0.65	37.30	36.65[1]	....
1677	Olds & Whipple, Inc., Hartford	At factory	0.55	38.95	38.40	38.00
1553	The Rogers & Hubbard Co., Portland	At factory	0.70	37.20	36.50	36.00
	Sampled by Purchaser:					
1245	82715, 93520	American Sumatra Tobacco Co., Bloomfield	0.41	39.78	39.37	....
1448	91048	American Sumatra Tobacco Co., Bloomfield	1.20	43.36	42.16	....
1449	90373	American Sumatra Tobacco Co., Bloomfield	1.14	43.70	42.56	....
1803	Olds & Whipple, Inc., Hartford	Huntting Bros., East Hartford	1.05	38.50	37.45	....

[1] Guaranty, 38 per cent total.

DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

Acid phosphate is made by treating raw rock phosphate with sulphuric acid which converts the phosphorus into available forms, chiefly, of the type which is soluble in water.

Twenty-four samples were analyzed all but three of which substantially equalled or exceeded their guaranties. Sample **1588** was about 0.5 per cent low; but two other samples of the same brand were well over the guaranty of 16 per cent. Sample **1453** was considerably under 16 per cent and no other sample of the same brand could be found. Sample **2736** was low but **1813**, of the same manufacture, substantially met the guaranty.

On the basis of eleven price quotations, available phosphoric acid in this raw material has cost about 7 cents per pound.

Analyses are given in Table VII.

TABLE VII. ANALYSES OF ACID PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Citrate-insoluble.	Phosphoric Acid. Total	Phosphoric Acid. "Available." Found.	Phosphoric Acid. "Available." Guaranteed.	Station No.
	Sampled by Station.		%	%	%		
1588	American Agricultural Chemical Co., New York	Geo. S. Phelps & Co., Thompsonville	0.45	15.93	15.48	16.00	1588
1895	American Agricultural Chemical Co., New York	Geo. S. Phelps & Co., Thompsonville	0.33	16.57	16.24	16.00	1895
2499	American Agricultural Chemical Co., New York	Lawton Miner Co., Collinsville	0.45	18.20	17.75	16.00	2499
1559	Apothecaries Hall Co., Waterbury	J. R. Reinhard, Cheshire	0.80	17.73	16.93	16.00	1559
2050	Armour Fertilizer Works, New York	Brower & Malone Co., Norwalk	0.18	16.34	16.16	16.00	2050
1518	Berkshire Fertilizer Co., Bridgeport	T. W. Ryan, Stratford	0.15	16.28	16.13	16.00	1518
1607	E. D. Chittenden Co., Bridgeport	Gunther Bros., Rockville	1.18	17.55	16.37	16.00	1607
1688	Everett B. Clark Seed Co., Milford	W. H. Burr, Southport	0.75	18.03	17.28	16.00	1688
1580	Consolidated Rendering Co., Boston	L. T. Frisbie Co., New Haven	0.98	18.03	17.05	16.00	1580
1849	Consolidated Rendering Co., Boston	A. E. Shedd, Norwich	1.88	17.91	16.03	16.00	1849
1642	Eastern States Farmers' Exchange, Springfield, Mass.	Edgewood Farm, North Haven	0.80	16.98	16.18	16.00	1642
1904	Eastern States Farmers' Exchange, Springfield, Mass.	Henry Joy, Woodstock	0.78	16.86	16.08	16.00	1904
1899	International Agricultural Corp., Woburn, Mass.	E. D. Bartlett, Guilford	0.38	17.10	16.72	16.00	1899
2091	Nitrate Agencies Co., New York	E. N. Austin, Suffield	0.73	17.00	16.27	16.00	2091

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

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. "Available." Found.	Phosphoric Acid. "Available." Guaranteed.	Station No.
			%	%	%		
	Sampled by Station:						
1682	Olds & Whipple, Inc., Hartford	Sampled at Factory	0.95	17.63	16.68	16.00	1682
1735	Piedmont Mt. Airy Guano Co., Baltimore, Md.	Seymour Grain & Coal Co., Seymour	1.10	17.20	16.10	16.00	1735
1550	The Rogers & Hubbard Co., Portland	Sampled at Factory	0.20	17.50	17.30	16.00	1550
2106	F. S. Royster Guano Co., Baltimore, Md.	Hitchcock Hardware Co., Watertown	1.90	17.90	16.00	16.00	2106
1740	Sanderson Fertilizer & Chemical Co., New Haven	Sampled at Factory	0.28	17.85	17.57	16.00	1740
1453	I. P. Thomas & Son Co., Philadelphia, Pa.	Highwood Vegetable Growers' Association Highwood	1.75	16.63	14.88	16.00	1453
2163	Triton Oil & Fertilizer Co., New York	Paty Schwartz Co., New London	0.45	17.45	17.00	16.00	2163
1807	United States Guano Co., Baltimore, Md.	Knowles, Lombard Co., Guilford	0.83	17.45	16.62	16.00	1807
1813	Wilcox Fertilizer Works, Mystic	Jordan Hardware Co., Willimantic	0.13	17.00	16.87	17.00	1813
2736	Wilcox Fertilizer Works, Mystic	Manufacturer's sample	0.08	16.26	16.18	17.00	2736

III. RAW MATERIALS CONTAINING POTASH.

CARBONATE OF POTASH.

Pure carbonate of potash contains 68.2 per cent of actual potash (K_2O), but commercial grades will usually contain from 60 to 65 per cent.

All of the samples examined, six in number, were submitted by the purchaser and the only guaranty given was 96 per cent carbonate of potash which is equivalent to about 65.5 per cent of K_2O. The samples examined ranged from 58.5 to 67.6 per cent. Another sample, **1569**, was submitted by the American Sumatra Tobacco Co. as carbonate of potash, but there was apparently an error in sampling. The material contained only 24 per cent of potash with much phosphoric acid and was evidently a mixture of carbonate of potash and precipitated bone.

Analyses are given in Table VIII.

MURIATE OF POTASH.

The grade of this salt chiefly used for fertilizer is about 80 per cent pure and is generally guaranteed to contain from 48 to 50 per cent of actual potash (K_2O).

Fourteen samples were drawn by the station agent and one was submitted by a purchaser. Three samples, **1584**, **1687** and **1809** failed to equal their guaranties but second samples of two of these, **1846** and **2122**, were not found deficient. No second sample of **1687** was found.

On the basis of prices quoted potash from this source cost 5 cents per pound.

Analyses are given in Table VIII.

HIGH GRADE SULPHATE OF POTASH.

This material is about 90 per cent pure sulphate of potash which is equivalent to about 48 per cent of actual potash (K_2O).

Eight samples were drawn by the station agent and six were examined for purchasers. All substantially equalled or exceeded their guaranties.

Potash from this source cost, at the prices quoted, about 6 cents per pound.

Analyses are given in Table VIII.

DOUBLE SULPHATE OF POTASH AND MAGNESIA.

(Double Manure Salts.)

Only three samples were analyzed this season. All satisfied the requirement of 26 per cent of potash and contained from 10 to 14.5 per cent of magnesia.

Analyses are given in Table VIII.

KAINIT.

The one sample of kainit examined fully satisfied the guaranty. The analysis is given in Table VIII.

TABLE VIII. ANALYSES OF POTASH SALTS.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Carbonate of Potash. *Sampled by Purchaser:*		%	%	
1405	A. Klipstein, New York City	American Sumatra Tobacco Co., Bloomfield	64.92	65.40	1405
1406	" " " "	" " " " "	58.51	65.40	1406
1568	" " " "	" " " " "	64.51	65.40	1568
1570	" " " "	" " " " "	64.42	65.40	1570
1571	" " " "	" " " " "	67.64	65.40	1571
1572	" " " "	" " " " "	67.06	65.40	1572
	Muriate of Potash. *Sampled by Station:*				
1591	Apothecaries Hall Co., Waterbury	Sampled at Factory	51.72	50.00	1591
2053	Armour Fertilizer Works, New York	F. A. Bartlett Tree Expert Co., Stamford	48.38	48.00	2053
1519	Berkshire Fertilizer Co., Bridgeport	T. W. Ryan, Stratford	50.34	50.00	1519
1608	E. D. Chittenden Co., Bridgeport	Gunther Bros., Rockville	52.22	48.00	1608
1846	Consolidated Rendering Co., Boston	A. E. Shedd, Norwich	50.39	50.00	1846
1584	Consolidated Rendering Co., Boston	L. T. Frisbie Co., New Haven	49.20	50.00	1584
1687	Everett B. Clark Seed Co., Milford	W. H. Burr, Southport	47.99	50.00	1687
2407	Eastern States Farmers' Exchange, Springfield, Mass.	B. W. Bishop, Guilford	50.55	50.00	2407
1920	International Agricultural Corp., Woburn, Mass.	E. D. Bartlett, Guilford	51.67	48.00	1920

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

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Muriate of Potash—*Concluded.* *Sampled by Station:*		%	%	
2089	Nitrate Agencies Co., New York	E. N. Austin, Suffield	48.99	48.00	2089
2150	F. S. Royster Guano Co., Baltimore, Md.	Hitchcock Hardware Co., Watertown	49.61	48.00	2150
1454	I. P. Thomas & Son Co., Philadelphia, Pa.	Highwood Vegetable Growers' Association, Highwood	50.85	50.00	1454
1809	United States Guano Co., Baltimore, Md.	Knowles, Lombard Co., Guilford	45.00[1]	50.00	1809
2122	United States Guano Co., Baltimore, Md.	Knowles, Lombard Co., Guilford	50.27	50.00	2122
	Sampled by Purchaser:				
2060	Apothecaries Hall Co., Waterbury	Francis M. Coe, Litchfield	51.79	50.00	2060
	Sulphate of Potash. *Sampled by Station:*				
1587	American Agricultural Chemical Co., New York	Geo. S. Phelps & Co., Thompsonville	47.92	48.00	1587
1610	Apothecaries Hall Co., Waterbury	J. P. Norton, Broad Brook	48.53	48.00	1610
1578	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory	50.15	48.00	1578
1861	E. D. Chittenden Co., Bridgeport	E. J. Bantle, Glastonbury	48.77	48.00	1861
1581	Consolidated Rendering Co., Boston	L. T. Frisbie Co., New Haven	50.01	48.00	1581
2438	International Agricultural Corp., Woburn, Mass.	James T. Caffrey, Cromwell	50.01	50.00	2438
2433	Olds & Whipple, Inc., Hartford	Sampled at Factory	50.05	48.65	2433
1676	The Rogers & Hubbard Co., Portland	Sampled at Factory	50.39	48.00	1676

[1] Contains considerable sulphate.

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

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sulphate of Potash—*Concluded.* *Sampled by Purchaser:*		%	%	
2154	Berkshire Fertilizer Co., Bridgeport	Martin Noone, Suffield	49.12	48.00	2154
1450	Olds & Whipple, Inc., Hartford	American Sumatra Tobacco Co., Bloomfield	50.40	48.65	1450
1451	" " " "	" " " "	50.04	48.65	1451
1823	" " " "	" " " "	48.72	48.65	1823
1484	" " " "	Huntington Bros., Windsor	49.61	48.65	1484
1802	" " " "	Huntting Bros., East Hartford	49.53	48.00	1802
	Double Manure Salts. *Sampled by Station:*				
2320	Apothecaries Hall Co., Waterbury	Sampled at Factory	28.19[1]	26.00	2320
1579	Berkshire Fertilizer Works, Bridgeport	Sampled at Factory	28.46[2]	26.00	1579
1678	Olds & Whipple, Inc., Hartford	Sampled at Factory	26.38[3]	26.00	1678
	Kainit. *Sampled by Station:*				
1701	Eastern States Farmers' Exchange, Springfield, Mass.	Edgewood Farm, North Haven	13.82	12.40	1701

[1] Magnesia 9.97.
[2] Magnesia 12.25.
[3] Magnesia 14.50, chlorine 1.50.

IV. RAW MATERIALS CONTAINING NITROGEN AND POTASH.

Only two samples of this group of materials have been examined, both taken by the station agent.

1592. Nitrate of Soda and Potash. Apothecaries Hall Co., Waterbury. Sampled at the factory.

2088. Naco Brand, Nitrapo. Nitrate Agencies Co., New York. Sampled from stock of E. N. Austin, Suffield.

Sample **2088** was deficient in both essential ingredients.

TABLE IX. ANALYSES OF NITRATE OF SODA AND POTASH.

Station No.	1592	2088
Nitrogen:		
found	14.84	14.12
guaranteed	14.80	15.00
Equivalent to ammonia:		
found	18.04	17.17
guaranteed	18.00	18.25
Potash:		
found	13.48	14.77
guaranteed	12.00	15.00

V. RAW MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

DRY GROUND FISH.

Twenty-six samples of dry ground fish were analyzed, ten of which were official samples drawn by the station agent. All of the official samples equalled or exceeded their guaranties except **1554** which was 0.32 per cent low in nitrogen and **2090** which was deficient in phosphoric acid.

In the official samples the average nitrogen found was 8.80 per cent and the average phosphoric acid 7.59 per cent. *On the basis of the prices quoted to our agent, allowing 4 cents per pound for phosphoric acid, nitrogen in this material cost about 37.7 cents per pound. A similar calculation last year showed the cost per pound to be 37.9 cents.*

Analyses are given in Table X.

TABLE X. ANALYSES OF DRY GROUND FISH.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Total found.	Phosphoric Acid. Total guaranteed.	Station No.
	Sampled by Station:		%	%	%	%	%	
1896	American Agricultural Chemical Co., New York	Geo. S. Phelps & Co., Thompsonville	8.50	8.23	10.34	7.85	6.00	1896
1614	Apothecaries Hall Co., Waterbury	J. P. Norton, Broad Brook	8.61	8.20	10.47	6.30	5.00	1614
1522	Berkshire Fertilizer Co., Bridgeport	T. W. Ryan, Stratford	8.25	8.22	10.03	7.33	....	1522
2367	E. D. Chittenden Co., Bridgeport	E. J. Bantle, Glastonbury	8.82	8.00	10.72	7.05	6.00	2367
2408	Consolidated Rendering Co., Boston	W. A. Forbes, Silver Lane	8.32	8.22	10.12	10.15	6.40	2408
2090	Nitrate Agencies Co., New York	E. N. Austin, Suffield	9.73	9.05	11.83	5.73	7.00	2090
1679	Olds & Whipple, Inc., Hartford	Sampled at Factory	8.96	8.23	10.89	7.48	5.00	1679
1554	The Rogers & Hubbard Co., Portland	Sampled at Factory	9.13	9.45	11.10	8.63	....	1554
1916	Sanderson Fertilizer & Chemical Co., New Haven	Phelps Coal Co., Glastonbury	8.56	8.23	10.41	7.53	6.00	1916
2188	Wilcox Fertilizer Works, Mystic	Sampled at Factory	9.09	9.04	11.05	7.88	6.00	2188
	Sampled by Purchaser:							
943	Berkshire Fertilizer Co., Bridgeport	American Sumatra Tobacco Co., Bloomfield	8.52	....	10.36	8.41	....	943
944	" " " "	" "	7.81	....	9.50	8.62	....	944
957	" " " "	" "	8.31	....	10.10	7.94	....	957
958	" " " "	" "	8.15	....	9.91	8.10	....	958
959	" " " "	" "	8.20	....	9.97	8.33	....	959
1028	" " " "	" "	8.44	....	10.26	8.01	....	1028
1030	" " " "	" "	8.46	....	10.29	8.51	....	1030
1031	" " " "	" "	8.17	....	9.93	8.02	....	1031

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

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Total found.	Phosphoric Acid. Total guaranteed.	Station No.
	Sampled by Purchaser:		%	%	%	%	%	
1032	Berkshire Fertilizer Co., Bridgeport	American Sumatra Tobacco Co., Bloomfield	8.29	....	10.08	8.12	....	1032
1033	" " " "	" "	8.11	....	9.86	8.30	....	1033
1034	" " " "	" "	7.97	....	9.69	8.38	....	1034
1035	" " " "	" "	8.23	....	10.01	8.00	....	1035
1036	" " " "	" "	8.12	....	9.87	8.15	....	1036
2153	" " " "	E. N. Austin, Suffield	8.38	8.23	10.19	6.85	6.00	2153
1804	Olds & Whipple, Inc., Hartford	Huntting Bros., East Hartford	8.48	....	10.31	7.20	....	1804
1822	Olds & Whipple, Inc., Hartford	American Sumatra Tobacco Co., Bloomfield	8.51	....	10.35	6.68	....	1822

TANKAGE.

This material varies considerably in composition depending upon the relative amounts of bone and meat which it contains. In general products containing less than 5 per cent of nitrogen and over 15 per cent of phosphoric acid show a preponderance of bone, while those showing over 5 per cent of nitrogen and less than 15 per cent of phosphoric acid show substantial quantities of meat.

Sixteen samples were analyzed, thirteen of which were officially drawn. Of the official samples four, **1560**, **1604**, **2522**, and **1860** averaged 4.09 per cent of nitrogen and 21.85 per cent of phosphoric acid and are, therefore, bone and meat tankages. The remainder were meat tankages and averaged 7.55 per cent of nitrogen and 9.04 per cent of phosphoric acid.

Prices vary greatly for this raw material depending upon whether it is essentially nitrogenous or phosphatic in type. Thus the approximate valuations of the two samples containing the extremes of nitrogen, assuming values of 30 cents per pound for nitrogen and 4 cents for phosphoric acid, range from $39.00 to $68.00 per ton.

Analyses are given in Table XI.

TABLE XI. ANALYSES OF TANKAGE.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Ammonia equivalent to total nitrogen	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Station No.
			%	%	%	%	%	%	%	
	Sampled by Station:									
1560	Apothecaries Hall Co., Waterbury	J. R. Reinhard, West Cheshire	4.02	3.29	4.89	24.70	20.00	50.0	50.0	1560
1590	Apothecaries Hall Co., Waterbury	Sampled at Factory	7.76	7.40	9.43	3.68	3.00	64.0	36.0	1590
2325	Armour Fertilizer Works, New York	C. A. Templeton, Waterbury	6.96	7.40	8.46	10.99	6.87	50.0	50.0	2325
1520	Berkshire Fertilizer Co., Bridgeport	T. W. Ryan, Stratford	6.92	7.40	8.41	11.90	6.85	50.0	50.0	1520
2134	Everett B. Clark Seed Co., Milford	Geo. S. Jennings, Southport	7.35	7.40	8.94	4.25	13.73	41.0	59.0	2134
1686	Everett B. Clark Seed Co., Milford	W. H. Burr, Southport	5.23	4.93	6.36	13.60	13.73	44.0	56.0	1686
1604	Conn. Fat Rendering and Fertilizer Corp., New Haven	Sampled at Factory	3.82	3.29	4.64	21.85	25.00	50.0	50.0	1604
2522	Conn. Fat Rendering and Fertilizer Corp., New Haven	Sampled at Factory	3.52	3.29	4.28	22.76	25.00	50.0	50.0	2522
1860	Consolidated Rendering Co., Boston	Burr Nurseries, Manchester	4.98	4.92	5.96	18.10	14.00	39.0	61.0	1860
1616	L. T. Frisbie Co., New Haven	Sampled at Factory	10.41	9.87	12.66	6.30	4.57	24.0	76.0	1616
1900	International Agricultural Corp., Woburn, Mass.	E. D. Bartlett, Guilford	5.33	4.93	6.48	13.95	11.00	43.0	57.0	1900
1455	I. P. Thomas & Son Co., Philadelphia, Pa.	Highwood Vegetable Growers' Association, Highwood	10.33[1]	....	12.56	5.12	....	41.0	59.0	1455
1818	Worcester Rendering Co., Auburn, Mass.	A. E. Shedd, Norwich	7.64	5.74	9.29	11.60	10.00	37.0	63.0	1818
	Sampled by Purchaser:									
1118	Conn. Fat Rendering and Fertilizer Corp., New Haven	Sent from Factory	4.87	....	5.92	....	....	....	....	1118
1892	Consolidated Rendering Co., Boston	C. R. Burr & Co., Manchester	5.27	4.94	6.41	17.98	14.00	36.0	64.0	1892
2032	Consolidated Rendering Co., Boston	The Lyman Farm, Middlefield	4.88	..	5.93	14.93	....	33.0	67.0	2032

[1] Sold on unit of ammonia basis.

GROUND BONE.

Twenty-six samples have been examined, all but two of which were official samples.

Sample **1593** was deficient in nitrogen (0.2 per cent), and **2496** was considerably below guaranty in phosphoric acid. In the other samples guaranties were substantially met and in most cases there were liberal overages in both of the elements of plant food.

TABLE XII. ANALYSES OF GROUND BONE.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. Found.	Nitrogen. Guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Station No.
	Sampled by Station:		%	%	%	%	%	%	%	
1586	American Agricultural Chemical Co., New York	F. S. Bidwell Co., Windsor Locks	2.51	2.47	3.05	26.60	22.88	61.0	39.0	1586
1557	Apothecaries Hall Co., Waterbury	R. W. Hine, Cheshire	3.56	3.29	4.33	23.20	20.00	56.0	44.0	1557
2049	Armour Fertilizer Works, New York	Harrison & Gould, Milford	2.43	2.47	2.95	25.50	22.00	55.0	45.0	2049
1576	Berkshire Fertilizer Co., Bridgeport	Sampled at Factory	2.66	2.47	3.23	26.35	20.00	56.0	44.0	1576
2133	Everett B. Clark Seed Co., Milford	Geo. S. Jennings, Southport	3.18	2.47	3.87	22.60	22.88	48.0	52.0	2133
1863	E. D. Chittenden Co., Bridgeport	E. J. Bantle, Glastonbury	2.54	2.47	3.09	26.80	22.00	52.0	48.0	1863
1593	Consolidated Rendering Co., Boston	Rockville Milling Co., Rockville	1.85	2.05	2.25	27.30	25.18	39.0	61.0	1593
1894	Consolidated Rendering Co., Boston	Willimantic Grain Co., Willimantic	3.18	2.46	3.87	23.60	22.90	42.0	58.0	1894
2406	Eastern States Farmers' Exchange, Springfield, Mass.	Newtown Grain & Coal Co., Newtown	2.61	2.47	3.17	23.50	22.88	47.5	52.5	2406
1606	L. T. Frisbie Co., New Haven	Sampled at Factory	4.31	3.28	5.24	21.65	22.00	34.0	66.0	1606
1605	L. T. Frisbie Co., New Haven	Lightbourn & Pond Co., New Haven	3.24	2.46	3.94	24.75	22.90	45.0	55.0	1605
1898	International Agricultural Corp., Woburn, Mass.	Jacob Bantley, Glastonbury	2.82	2.50	3.43	26.30	22.00	63.0	37.0	1898
1915	New England By-Products Corp., Lawrence, Mass.	Peterson Hendee Co., Derby	3.86	3.75	4.69	26.45	25.00	61.0	39.0	1915
1683	Olds & Whipple, Inc., Hartford	F. T. Blish Hardware, So. Manchester	2.48	2.50	3.02	27.05	22.00	53.0	47.0	1683
1525	Piedmont-Mt. Airy Guano Co., Baltimore, Md.	Lightbourn & Pond Co., New Haven	4.03	2.47	4.90	15.00	22.90	45.0	55.0	1525

TABLE XII. ANALYSES OF GROUND BONE—*Concluded.*

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen. Found.	Nitrogen. Guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Station No.
			%	%	%	%	%	%	%	
	Sampled by Station:									
2102	The Rogers & Hubbard Co., Portland	Frank E. Beach, Branford	3.66	3.29	4.45	21.55	20.50	42.0	58.0	2102
1621	The Rogers & Hubbard Co., Portland	Cadwell & Jones, Hartford	3.71	3.82	4.51	25.00	24.70	52.0	48.0	1621
2520	The Rogers & Hubbard Co., Portland	Sampled at Factory	3.76	3.82	4.57	26.30	24.70	80.0	20.0	2520
1750	F. S. Royster Guano Co., Baltimore, Md.	W. S. Brown, Trumbull	3.16	2.47	3.84	26.85	22.90	66.0	34.0	1750
1745	Sanderson Fertilizer & Chemical Co., New Haven	G. W. Thorpe, West Cheshire	2.73	2.47	3.32	25.35	22.88	59.0	41.0	1745
1909	M. L. Shoemaker & Co., Philadelphia, Pa.	Olds & Whipple, Inc., Hartford	6.39	4.51	7.77	20.45	20.00	37.0	63.0	1909
1458	I. P. Thomas & Son, Philadelphia, Pa.	Highwood Vegetable Growers' Association, Highwood	2.78	2.45	3.38	24.86	23.00	50.0	50.0	1458
2496	U. S. Guano Co., Baltimore, Md.	Rackliffe Bros. Co., New Britain	3.13	2.46	3.81	21.77	23.00	52.0	48.0	2496
2184	Wilcox Fertilizer Works, Mystic	Jordan Hardware Co., Willimantic	2.54	2.46	3.09	26.60	22.00	60.0	40.0	2184
	Sampled by Purchaser:									
1407	....	American Sumatra Tobacco Co., Bloomfield	2.70	....	3.28	26.02	....	46.0	54.0	1407
1819	Sanderson Fertilizer & Chemical Co., New Haven	American Sumatra Tobacco Co., Bloomfield	2.85	....	3.46	25.70	....	57.0	43.0	1819

MIXED FERTILIZERS.

MIXTURES CONTAINING ONLY NITROGEN AND PHOSPHORIC ACID.

Only four samples of this group of fertilizers were examined.

1731. Top Dressing for Grass. Olds and Whipple, Inc., Hartford. Sampled by the station agent from stock of F. T. Blish Hardware Co., So. Manchester.

2439. High Grade Tobacco Starter. Olds and Whipple, Inc., Hartford. Sampled by station agent at the factory.

2644. Ammo-Phos. American Cyanamid Co., New York. Sampled by station agent from stock of Olds and Whipple, Inc., Hartford.

1746. Swift Sure Tobacco Starter. M. L. Shoemaker and Co., Philadelphia. Sampled by station agent from stock of F. S. Bidwell & Co., Windsor Locks.

Analyses are as follows:

Station No.	1731	2439	2644	1746
	%	%	%	%
Nitrogen, found	6.43	8.61	15.80	3.27
guaranteed	5.75	8.23	16.45	3.25
Ammonia equivalent to nitrogen	7.82	10.47	19.21	3.98
Phosphoric acid, total	4.95	5.45	21.55	13.70
available, found	4.35	4.55	20.82	11.55
guaranteed	4.00	3.00	20.00	10.00

In all these samples the quality of the insoluble organic nitrogen was satisfactory as judged by the usual methods.

MIXTURES CONTAINING AMMONIA, PHOSPHORIC ACID AND POTASH.

In Table XIII are given the analyses of two hundred and fifty-five samples of complete fertilizers, sampled by the station agent, and of fourteen sampled by purchasers, making two hundred and sixty-nine in all.

The figures in the column headed "grade" represent the guaranteed percentages of ammonia, available phosphoric acid and potash in the order named. Thus, for example, **4-8-4** means that the brand is guaranteed to contain at least 4 per cent of ammonia, 8 per cent of available phosphoric acid, and 4 per cent of potash. The figures in the analyses which correspond to these values are given in bold face type so that the comparison between the plant food guaranteed and that found on analysis can be readily made.

The essential facts concerning the inspection may be summarized as follows:

Total number of official samples		255
Samples considerably deficient:		
Deficient in one item	74	
" in two items	10	
" in three items	0	
Total		84
Total deficiencies		94
Total guaranties made, (total samples x 3)		765
Total number of samples showing deficiencies in money value of $1.00 per ton or more		13

This summary shows that about 1/3 (32.9 per cent), of the total number of samples examined have failed to satisfy their guaranties in all items of plant food. Seventy-four samples were deficient in one ingredient only; ten were deficient in two ingredients; and none were deficient in all ingredients. Amounts of plant food have substantially equalled or exceeded guaranties in 87.7 per cent of the total number of guaranties made; and, when overages are balanced against shortages, samples have shown commercial values[1] substantially conforming to those required by the guaranties in about 95 per cent of the total number of samples examined.

Concerning Guaranties.

A study of the distribution of deficiencies in plant food shows that those in ammonia, phosphoric acid, and potash are about equally distributed, there being 35, 28, and 31 in the order named. While in the majority of cases analyses show that guaranties are insured by liberal overruns, yet too often there is evidence of insufficient allowance for reasonable margins of safety.

Analyses as soon as made are reported to the manufacturer, to the dealer and to the purchaser. In case of considerable deficiencies, second samples are analyzed if such have been taken or can be obtained. Thus questions arising concerning analysis or sampling may be investigated and adjusted if possible.

The following comments may be offered with reference to the samples cited.

2312. A. A. C. Co's National Market Garden Fertilizer. This was guaranteed 4.00 per cent potash and 3.66 per cent was found. The manufacturer obtained 3.76 per cent on a duplicate portion of our sample.

2327. A. A. C. Co's Quinnipiac Market Garden Manure. Guaranteed 7 per cent potash. We reported 6.65 per cent whereas the manufacturer found 6.79 per cent in a duplicate portion of our sample.

1773. Armour's Big Crop Fertilizer **5-8-7**. Our report showed this sample to be low in ammonia and in available phosphoric acid. Checks by the manufacturer substantially agreed with our figures.

[1] Ammonia has been reckoned at 20.6¢ per pound; and available phosphoric acid and potash at 4¢ per pound each.

2099. Royster's Bully Guano. Guaranteed 5 per cent potash. Our report showed 4.66 potash and the manufacturer's check showed 4.88 per cent. Rechecks by us showed 4.53 and 4.51 per cent.

1857. Bowker's Stockbridge Truck Manure. Analysis showed this to be a **4-8-6** instead of a **4-8-7** brand as tagged. The manufacturer questioned the sampling but no error was found in the inspection report. A second sample of the same brand substantially comformed to guaranty in two ingredients but was deficient in potash.

Deficiencies in Money Value.

Thirteen samples show shortages in money value in excess of $1.00 per ton, such shortages being duly balanced against any overruns shown, and reckoning ammonia, available phosphoric acid and potash at the values previously cited (p. 44). In all these cases second samples were secured if possible and analyzed if obtained. A summary of deficient brands is given in Table XIV.

Table XIV. Brands Showing Commercial Deficiencies.

No.	Brand.	Approximate deficiency in money value per ton.
2495, 1773	Armour's Big Crop 5-8-7	$1.20[1]
1857	Bowker's Stockbridge Truck Manure	1.16[2]
2371, 2526	Chittenden's Potato Special 6% Potash	2.17[1]
2411	Chittenden's Top Dresser 4% Potash	3.03
2416	Davey Tree Food	1.09
1903	Eastern States 5-8-7	3.24[2]
2442	International Tobacco Producer	1.77[2]
2083	Lowell Top Dressing 7-5-2	1.10[2]
2511	Piedmont Mt. Airy Harvest Brand 8-6-6	3.30[3]
2149	Royster's Valley Tobacco Formula	1.59
2497	U. S. Guano Co. Standard U. S. Farmer's Formula	3.26

[1] Based on average of two samples
[2] Second sample not deficient. Average of two not deficient.
[3] Second sample not deficient.

Attention has already been directed to the fact that these samples showing considerable commercial deficiencies constitute but 5 per cent of the total number of samples examined. If these data are incorporated with similar data for the previous four years we shall gain some conception of what purchasers of mixed fertilizers have received for their money during the five year period. It appears from Table XV that in this interval 1276 official samples have been analyzed, and that 1155 (90.5 per cent) samples have substantially met or have exceeded the commercial valuations represented by their guaranties. A few manufacturers, of whose goods less than 10 samples have been examined in this stated period, are not included in the summary. The products of a given manufacturer are more adequately judged on the basis of a period of years; but in order to recognize improvement, if made, the comparative figures for the past year are given separately.

TABLE XV. COMMERCIAL DEFICIENCIES 1921-1925 INCLUSIVE.

Manufacturer.	Total number of samples.	Number equaling or exceeding guaranties in money value.	Per cent in 5-yr. period.	Per cent in 1925.
American Agricultural Chemical Co.	218	207	95	100
Apothecaries Hall Co.	39	39	100	100
Armour Fertilizer Works	55	39	71	75
Atlantic Packing Co.	37	33	89	100
Berkshire Fertilizer Co.	40	40	100	100
Boardman, F. E.	10	10	100	100
Bowker Fertilizer Co.	71	63	89	93
Bridges, A. D. & Sons	10	10	100	100
Chittenden, E. D. Co.	34	30	88	63
Clark, E. B. Seed Co.	23	21	91	100
Coe-Mortimer Co., The	30	27	90	...
Eastern States Farmers' Exchange	49	41	84	90
Essex Fertilizer Co.	35	34	97	100
Frisbie, L. T. Co.	57	47	83	100
International Agricultural Corp.	46	41	89	92
Lowell Fertilizer Co.	51	43	84	89
Mapes Fertilizer and Peruvian Guano Co.	65	64	99	100
New England Fertilizer	42	39	93	100
Nitrate Agencies Co.	14	11	79	...
Olds & Whipple, Inc.	29	29	100	100
Parmenter & Polsey Fertilizer Co.	19	18	95	100
Piedmont Mt. Airy Guano Co.	19	11	58	90
Rogers & Hubbard Co., The	67	65	97	100
Royster, F. S. Guano Co.	37	27	73	86
Sanderson Fertilizer and Chemical Co.	41	39	95	100
Shoemaker, M. L. & Co.	13	13	100	100
Springfield Rendering	22	20	91	100
Virginia-Carolina Chemical Co.	45	42	93	100
Wilcox Fertilizer Works	41	38	93	100
Worcester Rendering Co.	17	14	82	100
Total	1,276	1,155	91	95

THE "NEW ENGLAND STANDARD NINE."

Of the two hundred and fifty-five official samples of complete fertilizers, less than one-half (113) have fallen in the "Standard Nine" group; but if grades closely corresponding thereto are included the number is somewhat over one-half (133). Last year it was found that about 36 per cent of the samples examined fell exactly in these nine grades whereas this year the proportion is 44 per cent. As was the case last year, the largest number of samples have fallen in the grades **4-8-4**, **5-4-5**, and **5-8-7**.

In the following summary the "Standard Nine" grades are indicated in full face type.

Grade.	No. of Samples.
0-12-6	0
2-12-4	2
3-10-3	5
3-10-4	6
3-10-6	0
4-7-5	1
4-8-4	32
4-8-5	1
4-8-6	10
4-8-7	10
5-4-4	0
5-4-5	29
5-8-6	3
5-8-7	28
8-6-6	6
Total	133

QUALITY OF THE INSOLUBLE ORGANIC NITROGEN.

The accepted methods of evaluating the insoluble organic nitrogen in fertilizers determines the proportion which is "active." Thus activity values of under 50 per cent by the so-called alkaline method and 80 per cent by the so-called neutral method are taken as indicating inferior forms of nitrogenous materials. In several brands examined during the past season values somewhat less than these just given have been found; but in all these cases the percentages of water-soluble nitrogen plus the active insoluble nitrogen exceeded or closely approximated the nitrogen guaranties and the question of quality was not raised.

Table XIII. Analyses of Mixed Fertilizers Containing Nitrogen, Phosphoric Acid and Potash.

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	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.	
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	American Agricultural Chemical Co., New York.														
2020	Complete Potato Mixture	3-8-4	Glenbrook	1.14	0.35	0.62	0.46	2.57	3.12	0.83	9.06	8.23	3.93	3.93	2020
2029	Crescent Complete Manure	2-8-3	Bloomfield	0.13	0.71	0.55	0.58	1.97	2.40	0.88	9.15	8.27	3.01	3.01	2029
2028	Double A Tobacco Fertilizer	5-4-5	Bloomfield	0.38	0.71	0.17	2.95	4.21	5.12	0.28	4.40	4.12	0.44	5.08	2028
2024	Farm Favorite	2-10-2	Farmington	0.14	1.00	0.48	0.36	1.98	2.41	0.61	10.55	9.94	2.80	2.80	2024
2027	Fish and Potash	3-10-3	Granby	0.36	1.09	0.45	0.55	2.45	2.98	0.82	10.50	9.68	3.20	3.20	2027
2022	Grass and Lawn Top Dressing	6-6-4	Warehouse Point	1.68	2.56	0.23	0.57	5.04	6.13	0.33	6.70	6.37	3.99	3.99	2022
2025	7% Potash Fertilizer	4-8-7	New Britain	0.43	1.67	0.61	0.52	3.23	3.93	1.10	8.90	7.80	6.66	6.66	2025
2018	Universal Phosphate	1-8-2	North Haven	0.06	0.43	0.63	0.62	1.74	2.11	0.90	9.00	8.10	2.07	2.07	2018
2331	Bowker's Lawn and Garden Dressing	3-9-2	Hartford	0.42	0.26	0.33	1.57	2.58	3.14	1.54	11.30	9.76	2.06	2.06	2331
2306	Bradley's Complete Manure for Potatoes and Vegetables	4-8-7	Bethel	0.42	1.73	0.61	0.53	3.29	4.00	0.94	8.66	7.72	6.90	6.90	2306
2311	Bradley's Complete Tobacco Manure	5-4-5	Glastonbury	0.40	0.69	0.07	2.98	4.14	5.03	0.26	4.21	3.95	0.47	5.49	2311
2021	Bradley's Corn Phosphate	2-10-2	Bethel	0.05	0.84	0.57	0.34	1.80	2.19	0.63	10.58	9.95	2.33	2.33	2021
2019	Bradley's New Method Fertilizer	1-8-2	Meriden	0.16	0.36	0.39	0.39	1.30	1.58	0.80	8.92	8.12	2.25	2.25	2019
2315	Bradley's Northland Potato Grower	4-8-4	Colchester	0.41	1.26	0.50	1.00	3.17	3.85	0.61	8.46	7.85	4.05	4.05	2315
2026	Bradley's Potato Fertilizer	2-8-3	Canaan	0.07	0.69	0.48	0.60	1.84	2.24	0.78	8.65	7.87	3.06	3.06	2026
2304	Bradley's Potato Manure	3-8-4	Meriden	0.18	1.35	0.42	0.52	2.47	3.00	0.79	8.69	7.90	3.79	3.79	2304
1624	Bradley's XL Superphosphate of Lime	3-10-4	Thompsonville	0.15	1.48	0.49	0.44	2.56	3.11	0.72	10.55	9.83	3.85	3.85	1624
2500	Bradley's XL Superphosphate of Lime	3-10-4	Simsbury	0.12	1.43	0.55	0.43	2.53	3.08	0.70	10.80	10.10	3.63	3.63	2500
2314	National Complete Tobacco Fertilizer	5-4-5	South Windsor	0.44	0.70	0.18	2.82	4.14	5.03	0.26	4.53	4.27	0.41	5.44	2314
2307	National Eureka Potato Fertilizer	4-8-4	Danbury	0.54	1.67	0.47	0.55	3.23	3.93	0.66	8.57	7.91	4.24	4.24	2307
2312	National Market Garden Fertilizer	3-8-4	Wallingford	0.52	1.00	0.32	0.60	2.44	2.97	0.66	9.06	8.40	3.66	3.66	2312
2308	National Potato and Corn Phosphate	2-8-3	Danbury	0.15	0.66	0.54	0.58	1.93	2.35	0.68	8.46	7.78	3.05	3.05	2308
2310	National Premier Truck Manure	4-8-7	Warehouse Point	0.54	1.70	0.57	0.55	3.36	4.09	0.99	8.93	7.94	7.12	7.12	2310
2309	National White Ash Tobacco Grower	7-3-7	Warehouse Point	0.55	0.71	0.43	4.29	5.98	7.27	0.29	3.88	3.59	0.69	7.50	2309
2313	National XXX Fish and Potash	3-10-3	Wallingford	0.32	1.25	0.27	0.66	2.50	3.04	0.58	10.67	10.09	3.38	3.38	2313
2321	Quinnipiac Corn Manure	2-10-2	South Norwalk	0.04	0.76	0.51	0.35	1.66	2.02	0.63	10.62	9.99	2.04	2.04	2321
2327	Quinnipiac Market Garden Manure	4-8-7	New London	0.81	1.83	0.11	0.61	3.36	4.09	0.39	8.59	8.20	6.65	6.65	2327
2326	Quinnipiac Potato Phosphate	2-8-3	New London	0.14	0.57	0.45	0.56	1.72	2.09	0.49	8.41	7.92	2.78	2.78	2326
2329	Quinnipiac Prime Tobacco Manure	7-3-7	Manchester	0.58	0.64	0.23	4.47	5.92	7.20	0.31	4.08	3.77	0.69	7.61	2329
2330	Quinnipiac Seed Leaf Tobacco Manure	5-4-5	Gaylordsville	0.51	0.69	0.00	2.93	4.13	5.02	0.20	4.53	4.33	0.52	5.36	2330
	Apothecaries Hall Co., Waterbury.														
1619	Liberty Corn and All Crops 2-8-2	2-8-2	Middletown	1.11	0.27	0.22	0.52	2.12	2.58	1.56	10.11	8.55	3.31	3.31	1619
1618	Liberty Corn, Fruit and All Crops, 2-12-4.	2-12-4	Middletown	0.03	1.24	0.41	0.14	1.82	2.21	1.32	13.70	12.38	4.16	4.16	1618
2322	Liberty Corn and Vegetable, 3-6-10	3-6-10	Greenwich	0.83	1.55	0.14	0.32	2.84	3.45	0.64	7.22	6.58	10.82	10.82	2322
1609	Liberty Fish, Bone and Potash, 3-10-4	3-10-4	Broad Brook	0.04	1.56	0.79	0.21	2.60	3.16	0.90	11.15	10.25	4.02	4.02	1609
1622	Liberty Market Gardener's Special, 4-8-4	4-8-4	Cheshire	0.89	2.02	0.21	0.30	3.42	4.16	1.20	9.40	8.20	4.35	4.35	1622
1623	Liberty High Grade Market Gardener's, 5-8-7	5-8-7	West Cheshire	0.92	2.84	0.22	0.14	4.12	5.01	0.88	9.08	8.20	6.85	6.85	1623
2492	Liberty High Grade Market Gardener's, 5-8-7	5-8-7	Middletown	0.97	2.83	0.23	0.13	4.16	5.06	0.90	9.15	8.25	6.78	6.78	2492

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	Apothecaries Hall Co., Waterbury—*Con.*														
2323	Liberty High Grade Tobacco Manure ...	7.5-4-7.5	East Windsor	0.50	1.18	0.56	3.82	6.06	7.37	0.26	5.84	5.58	1.44	8.65	2323
1617	Liberty Tobacco Special, 5-4-5	5-4-5	Middletown	0.08	1.22	0.32	2.82	4.44	5.40	0.30	6.45	6.15	0.93	4.61	1617
2324	Liberty Top Dresser Grass and Grain, 10-3.5-8	10-3.5-8	East Windsor	7.19	0.00	0.25	1.08	8.52	10.36	3.07	7.95	4.88	8.88	8.88	2324
1613	Liberty Top Dresser	7-8-3	Broad Brook	1.89	3.71	0.01	0.15	5.76	7.00	0.63	8.90	8.27	3.50	3.50	1613
	Armour Fertilizer Works, New York.														
1625	Armour's Big Crop Fertilizer, 3-8-4	3-8-4	Thompsonville ...	0.04	1.69	0.38	0.53	2.64	3.21	0.78	9.13	8.35	3.86	3.86	1625
2055	Armour's Big Crop Fertilizer, 4-6-10	4-6-10	Ansonia	1.10	1.27	0.28	0.61	3.26	3.96	0.43	6.85	6.42	10.07	10.07	2055
2047	Armour's Big Crop, 4-8-4	4-8-4	Milford	0.72	1.34	0.33	0.86	3.25	3.95	0.28	8.40	8.12	4.48	4.48	2047
2048	Armour's Big Crop, 5-8-5	5-8-5	Milford	0.40	1.76	0.96	0.81	3.93	4.78	0.55	8.70	8.15	4.98	4.98	2048
2058	Armour's Big Crop Tobacco Special	5-4-5	Thompsonville ...	0.60	0.16	0.02	3.33	4.11	5.00	0.45	5.10	4.65	0.47	5.18	2058
2054	Armour's Corn Grower, 2-8-2	2-8-2	Danbury	0.04	1.13	0.33	0.62	2.12	2.58	0.61	8.60	7.99	3.06	3.06	2054
2495	Armour's Big Crop Fertilizer, 5-8-7	5-8-7	Ansonia	0.99	1.68	0.38	0.80	3.85	4.68	0.83	8.88	8.05	6.68	6.68	2495
1773	Armour's Big Crop Fertilizer, 5-8-7	5-8-7	Wallingford	0.92	1.72	0.62	0.60	3.86	4.69	0.48	8.25	7.77	7.29	7.29	1773
	Atlantic Packing Co., New Haven.														
2355	Atlantic, 5-4-16	5-4-16	Glastonbury	1.49	1.01	0.30	1.49	4.29	5.22	3.48	9.85	6.37	0.82	16.71	2355
2056	Atlantic Corn and Grain Fertilizer, 2-8-2..	2-8-2	Waterbury	0.02	0.89	0.20	0.56	1.67	2.03	0.65	8.65	8.00	2.19	2.19	2056
2328	Atlantic Market Garden, 4-8-6	4-8-6	Silver Lane	0.88	1.04	0.36	0.89	3.17	3.85	0.46	9.05	8.59	6.08	6.08	2328
2057	Atlantic Special Vegetable and Potato Grower, 4-8-4	4-8-4	Waterbury	0.69	1.36	0.43	0.80	3.28	3.99	0.70	8.95	8.25	4.27	4.27	2057
2356	Atlantic Tobacco Grower, 5-4-5	5-4-5	Glastonbury	1.05	0.75	0.62	1.75	4.17	5.07	0.33	5.45	5.12	0.37	5.52	2356
2352	Atlantic Tobacco Manure, 5-8-6	5-8-6	Silver Lane	1.27	1.39	0.50	0.81	3.97	4.83	0.83	9.33	8.50	0.66	6.17	2352
2639	Atlantic Special, 3-8-4	3-8-4	Waterbury	0.54	1.00	0.34	0.70	2.58	3.14	0.75	9.45	8.70	4.01	4.01	2639
	F. A. Bartlett Tree Expert Co., Stamford.														
1842	Bartlett's Green Tree Food	6-8-4	Sampled at Factory	0.22	4.50	0.22	0.72	5.66	6.88	3.07	9.65	6.58	4.67	4.67	1842
	Berkshire Fertilizer Co., Bridgeport.														
2351	Berkshire Complete Fertilizer	3-8-3	Waterbury	0.08	1.74	0.17	0.98	2.97	3.61	0.60	9.20	8.60	3.82	3.82	2351
1843	Berkshire Complete Tobacco	5-4-5	Suffield	0.00	0.75	0.59	3.56	4.90	5.96	0.38	4.68	4.30	0.66	5.43	1843
1844	Berkshire Economical Grass Fertilizer ..	10-3-8	Suffield	1.97	3.73	0.38	2.11	8.19	9.96	4.83	9.78	4.95	9.30	9.30	1844
2350	Berkshire Grass Special	7-2-4	Waterbury	4.49	0.56	0.00	1.11	6.16	7.49	1.78	6.00	4.22	4.25	4.25	2350
2348	Berkshire Long Island Special	5-8-7	Suffield	1.40	1.74	0.04	1.32	4.50	5.47	0.63	9.00	8.37	8.84	8.84	2348
1840	Berkshire Market Garden	4-8-4	Milford	1.01	1.31	0.19	0.95	3.46	4.21	1.03	9.08	8.05	4.89	4.89	1840
1841	Berkshire Potato and Vegetable Phosphate	2-8-4	Southport	0.07	0.87	0.21	0.61	1.76	2.14	1.15	9.40	8.25	4.57	4.57	1841
2347	Berkshire Tobacco Special	7-4-7	Suffield	0.27	2.03	0.20	3.94	6.44	7.83	0.15	4.90	4.75	1.01	6.75	2347
	F. E. Boardman, Middletown.														
2354	Boardman's Fertilizer for Potatoes and General Crops	4-7-4	Sampled at Factory	0.70	1.32	0.23	1.42	3.67	4.46	0.73	8.65	7.92	4.43	4.43	2354
2353	Boardman's Tobacco Fertilizer	4-7-4	Sampled at Factory	0.48	1.22	0.21	1.83	3.74	4.55	0.25	7.90	7.65	1.34	5.12	2353

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	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.	
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	Bowker Fertilizer Co., New York.														
2365	Bowker's All Round Fertilizer	3-8-4	New Canaan	0.23	1.21	0.44	0.58	2.46	2.99	0.85	9.00	8.15	4.27	4.27	2365
2375	Bowker's Hill and Drill Phosphate	3-10-4	Hazardville	0.58	1.03	0.22	0.77	2.60	3.16	0.85	10.93	10.08	3.06	4.15	2375
1645	Bowker's Fisherman's Brand Fish and Potash	3-10-3	Yalesville	0.55	0.83	0.42	0.56	2.36	2.87	0.70	10.46	9.76	2.99	2.99	1645
1644	Bowker's Market Garden Fertilizer	4-8-4	Yalesville	0.44	1.71	0.48	0.52	3.15	3.83	0.93	8.93	8.00	4.87	4.87	1644
2494	Bowker's Market Garden Fertilizer	4-8-4	New Canaan	0.39	1.72	0.57	0.51	3.19	3.88	0.78	8.98	8.20	3.98	3.98	2494
1858	Bowker's Potato and Vegetable Phosphate	2-8-3	Meriden	0.08	0.72	0.49	0.56	1.85	2.25	0.72	8.60	7.88	3.11	3.11	1858
2349	Bowker's Square Brand Farm and Garden Phosphate	2-10-2	Willimantic	0.31	0.72	0.11	0.52	1.66	2.02	0.53	11.18	10.65	2.54	2.54	2349
1867	Bowker's Sure Crop Phosphate	1-8-2	Willimantic	0.00	0.32	0.28	0.28	0.88	1.07	0.50	8.50	8.00	2.12	2.12	1867
2370	Stockbridge Potato and Vegetable Manure	4-6-10	Willimantic	0.62	1.55	0.41	0.52	3.10	3.77	0.50	6.70	6.20	10.25	10.25	2370
2376	Stockbridge Premier Tobacco Grower ...	7-3-7	West Suffield	0.17	0.83	0.61	4.33	5.94	7.22	0.35	4.10	3.75	0.72	7.24	2376
1626	Stockbridge Tobacco Manure	5-4-5	Thompsonville ...	0.49	0.69	0.00	2.90	4.08	.4.96	0.33	4.63	4.30	0.31	5.30	1626
2366	Stockbridge Top Dressing and Forcing Manure	6-6-4	Meriden	1.81	2.50	0.22	0.55	5.08	6.18	0.43	6.55	6.12	3.79	3.79	2366
1857	Stockbridge Truck Manure	4-8-7	Yalesville	0.47	1.64	0.56	0.51	3.18	3.87	0.93	9.10	8.17	6.04	6.04	1857
2493	Stockbridge Truck Manure	4-8-7	Milldale	0.48	1.68	0.67	0.53	3.36	4.09	1.14	8.96	7.82	6.75	6.75	2493
	Amos D. Bridge's Sons, Inc., Hazardville.														
1859	Corn, Onion, Potato and General Purpose Fertilizer	4-8-4	Sampled at Factory	1.23	1.14	0.17	0.96	3.50	4.26	1.28	10.10	8.82	0.90	4.54	1859
2640	Special Tobacco Fertilizer	5-4-5	Sampled at Factory	0.14	1.10	0.78	2.24	4.26	5.18	0.60	5.85	5.25	0.98	6.10	2640
	E. D. Chittenden Co., Bridgeport.														
1636	Chittenden's Complete Grain, 3% Potash	2-8-3	Rockville	0.10	0.74	0.35	0.40	1.59	1.93	0.78	8.76	7.98	3.18	3.18	1636
2369	Chittenden's High Grade Potato	5-8-7	Glastonbury	0.72	2.39	0.21	0.59	3.91	4.75	0.45	9.40	8.95	6.70	6.70	2369
2368	Chittenden's High Grade Tobacco	6-3-7.5	Glastonbury	0.14	2.73	0.44	2.07	5.38	6.54	0.15	4.25	4.10	0.44	8.36	2368
2372	Chittenden's Potato Special, 4% Potash ..	4-8-4	Bloomfield	0.84	1.54	0.03	0.72	3.13	3.81	0.73	8.73	8.00	4.51	4.51	2372
2371	Chittenden's Potato Special, 6% Potash ..	4-8-6	Bloomfield	0.69	1.45	0.13	0.57	2.84	3.45	0.65	9.08	8.43	5.38	5.38	2371
2526	Chittenden's Potato Special, 6% Potash ..	4-8-6	Abington	0.67	1.53	0.76	0.64	2.96	3.60	0.65	8.85	8.20	5.38	5.38	2526
2374	Chittenden's Tobacco Special, 5% Potash	5-4-5	Glastonbury	0.25	2.55	0.14	1.28	4.22	5.13	0.35	5.13	4.78	2.23	5.47	2374
2411	Chittenden's Top Dresser, 4% Potash ...	6-8-4	Glastonbury	0.57	2.85	0.13	0.59	4.14	5.03	0.50	9.00	8.50	4.71	4.71	2411
	Everett B. Clark Seed Co., Milford.														
1638	Clark's Special Mixture for General Use.	4-8-4	Branford	0.06	1.99	0.22	1.23	3.50	4.26	2.40	10.70	8.30	1.70	4.19	1638
1637	Clark's Special Mixture with 6% Potash..	4-8-6	Branford	0.06	1.92	0.37	1.05	3.40	4.13	1.35	9.85	8.50	6.42	6.74	1637
1865	Clark's Super Phosphate	5-8-7	Sampled at Factory	0.75	2.14	0.38	0.72	3.99	4.85	1.05	9.48	8.43	6.48	6.48	1865
1864	Clark's Tip Top Brand	5-10-5	Orange	0.82	2.22	0.37	0.86	4.27	5.19	1.22	10.63	9.41	2.54	4.81	1864
1868	Clark's Tip Top Brand	5-10-5	Allingtown	....	....	....	....	4.03	4.90	0.90	10.84	9.94	....	5.89	1868
	Davey Tree Expert Co., Kent, Ohio.														
2416	Davey Tree Food	7-8-3	Greenwich	0.03	2.37	0.81.	2.13	5.34	6.49	4.15	12.85	8.70	3.56	3.56	2416

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	Eastern States Farmers' Exchange, Springfield, Mass.														
1706	Eastern States 3-12-3	3-12-3	Newtown	0.37	1.48	0.41	0.28	2.54	3.09	0.70	12.78	12.08	3.62	3.62	1706
1775	Eastern States 3-12-3	3-12-3	South Windsor	0.55	1.41	0.36	0.56	2.88	3.50	0.23	12.83	12.60	3.37	3.37	1775
1705	Eastern States 4-8-10	4-8-10	Danbury	0.53	2.12	0.61	0.65	3.91	4.75	0.75	9.60	8.95	8.29	8.29	1705
1641	Eastern States 5-8-7	5-8-7	North Haven	0.81	2.09	0.29	0.66	3.85	4.68	0.40	8.70	8.30	7.12	7.12	1641
1903	Eastern States 5-8-7	5-8-7	Woodstock	....	....	....	....	3.49	4.24	0.53	8.83	8.30	6.56	6.56	1903
1902	Eastern States 5-10-5	5-10-5	Woodstock	0.06	2.87	0.75	0.43	4.11	5.00	0.88	11.05	10.17	5.30	5.30	1902
2405	Eastern States 8-6-6	8-6-6	Danbury	0.10	4.65	0.86	0.71	6.32	7.68	0.35	6.90	6.55	6.80	6.80	2405
2413	Eastern States Formula A Tobacco Fertilizer	6.5-4.2-5.5	Ellington	0.74	0.59	0.60	3.38	5.31	6.46	0.28	6.83	6.55	1.14	5.92	2413
2415	Eastern States Formula B	6-4-5.2	Warehouse Point	0.52	0.98	0.52	3.00	5.02	6.10	0.23	5.38	5.15	1.42	6.66	2415
2414	Eastern States Formula C Tobacco Fertilizer	6.5-4.2-5.5	Glastonbury	0.19	1.08	1.28	2.90	5.45	6.63	2.30	6.88	4.58	0.49	5.59	2414
	Essex Fertilizer Co., Boston.														
1700	Essex 2-8-2 Farm and Garden	2-8-2	Wallingford	0.08	0.84	0.26	0.54	1.72	2.09	0.77	8.84	8.07	2.18	2.18	1700
1639	Essex Fish Fertilizer for All Crops, 3-8-4	3-8-4	Wallingford	0.06	1.48	0.32	0.72	2.58	3.14	0.88	9.00	8.12	4.61	4.61	1639
1640	Essex Market Garden for Potatoes, Roots and Vegetables, 4-8-4	4-8-4	Wallingford	0.38	1.48	0.58	0.91	3.35	4.07	0.78	9.13	8.35	4.31	4.31	1640
2412	Essex Special Tobacco, 5-4-5	5-4-5	Rockville	1.48	0.16	0.22	1.88	3.74	4.55	0.65	5.70	5.05	1.65	5.55	2412
	L. T. Frisbie Co., New Haven.														
1703	Frisbie's 5-8-7	5-8-7	Danbury	0.64	1.91	0.67	0.80	4.02	4.89	0.70	9.63	8.93	6.93	6.93	1703
2124	Frisbie's 5-8-7	5-8-7	Wethersfield	0.69	1.97	0.56	0.80	4.02	4.89	0.78	9.43	8.65	6.88	6.88	2124
1704	Frisbie's Corn and Grain Fertilizer, 2-8-2	2-8-2	Danbury	0.04	0.83	0.27	0.54	1.68	2.04	0.63	8.65	8.02	1.99	1.99	1704
2130	Frisbie's Market Garden, 4-8-6	4-8-6	Winsted	1.05	0.95	0.53	0.77	3.30	4.01	0.65	9.23	8.58	6.02	6.02	2130
2126	Frisbie's Special, 3-8-4	3-8-4	New Britain	0.50	1.03	0.42	0.73	2.68	3.26	0.75	9.48	8.73	4.37	4.37	2126
2125	Frisbie's Special Vegetable and Potato Grower, 4-8-4	4-8-4	Wethersfield	0.19	1.91	0.53	0.63	3.26	3.96	0.60	9.13	8.53	4.24	4.24	2125
2132	Frisbie's Tobacco Grower, 5-4-5	5-4-5	Thompsonville	0.50	1.25	0.63	1.75	4.13	5.02	0.25	5.23	4.98	0.36	5.61	2132
2131	Frisbie's Tobacco Manure, 5-8-6	5-8-6	Windsor Locks	1.27	1.39	0.77	0.79	4.22	5.13	0.68	9.25	8.57	0.62	6.08	2131
2127	Frisbie's Top Dresser, 7-5-4	7-5-4	Sampled at Factory	1.67	2.73	0.52	0.72	5.64	6.86	0.40	6.00	5.60	4.48	4.48	2127
	A .W. Higgins, South Deerfield, Mass.														
2145	Old Deerfield 4-8-4 Complete Fertilizer	4-8-4	Madison	0.69	1.40	0.30	1.00	3.39	4.12	1.56	9.05	7.49	5.32	5.32	2145
2144	Old Deerfield 5-8-7 Complete Fertilizer	5-8-7	Madison	0.78	1.47	0.73	1.19	4.17	5.07	2.43	10.15	7.72	6.81	6.81	2144
	International Agricultural Corp., Woburn, Mass.														
2409	International Conn. Valley Special	7-6-5	Glastonbury	0.10	2.40	0.21	3.06	5.77	7.02	0.83	7.00	6.17	0.57	5.58	2409
1684	International Conn. Valley Special	7-6-5	Manchester	0.00	2.51	0.29	2.90	5.70	6.93	0.20	6.28	6.08	0.52	5.27	1684
2436	International Economy	2-8-2	Guilford	0.07	1.26	0.16	0.44	1.93	2.35	0.25	8.28	8.03	2.53	2.53	2436
2437	International General Favorite	3-8-6	Cromwell	0.08	1.42	0.53	0.42	2.45	2.98	0.30	8.58	8.28	6.24	6.24	2437

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	International Agricultural Corp., Woburn, Mass.—*Continued.*														
1659	International High Grade Manure	4-6-10	Manchester	0.00	1.76	0.88	0.50	3.14	3.82	0.43	7.15	6.72	9.10	9.10	1659
2503	International High Grade Manure	4-6-10	Warehouse Point .	0.06	1.86	0.48	0.67	3.07	3.73	0.40	7.53	7.13	9.52	9.52	2503
2410	International Multiple Strength, 10-8-10..	10-8-10	Glastonbury	0.20	5.19	0.09	2.78	8.26	10.04	0.40	8.35	7.95	1.18	10.34	2410
1658	International New England Special	2-12-4	Manchester	0.36	0.62	0.24	0.36	1.58	1.92	0.45	12.50	12.05	4.18	4.18	1658
1635	International Tobacco Grower	5-6-7	Manchester	0.06	1.98	0.19	2.20	4.43	5.39	0.20	5.69	5.49	0.74	7.08	1635
2502	International Tobacco Grower	5-6-7	Warehouse Point .	0.10	1.86	0.14	2.04	4.14	5.03	0.31	6.04	5.73	1.69	7.51	2502
2442	International Tobacco Producer	5-4-5	Hazardville	0.11	1.84	0.13	1.66	3.74	4.55	0.15	3.99	3.84	1.30	5.42	2442
2678	International Tobacco Producer	5-4-5	Broad Brook	....	....	....	....	4.10	4.98	0.23	4.25	4.02	....	5.05	2678
1634	International Tobacco Special	7-3-7	Manchester	0.10	2.48	0.29	2.91	5.78	7.03	0.28	3.78	3.50	0.56	6.86	1634
	Lowell Fertilizer Co., Boston, Mass.														
1657	Lowell Animal Brand, A High Grade Manure for All Crops, 3-8-4	3-8-4	Suffield	0.00	1.39	0.34	0.74	2.47	3.00	0.85	8.97	8.12	4.38	4.38	1657
1707	Lowell Bone Fertilizer for Corn, Grain, Grass and Vegetables, 2-8-2	2-8-2	Southbury	0.19	0.66	0.49	0.57	1.91	2.32	0.75	8.64	7.89	2.13	2.13	1707
1708	Lowell Potato Phosphate for Potatoes and Vegetables, 4-8-7	4-8-7	Southbury	0.84	1.14	0.77	0.81	3.56	4.33	1.24	9.00	7.76	7.78	7.78	1708
2087	Lowell 4-6-10, Potatoes and Vegetables ..	4-6-10	Moosup	0.13	2.02	0.61	0.66	3.42	4.16	0.78	7.23	6.45	10.81	10.81	2087
1710	Lowell 4-8-4 for Potatos, Corn and Vegetables	4-8-4	Warehouse Point .	0.73	1.02	0.62	0.87	3.24	3.94	1.00	9.18	8.18	4.40	4.40	1710
2082	Lowell 5-8-7 for Potatoes and Vegetables	5-8-7	Warehouse Point .	0.80	1.75	0.85	1.03	4.43	5.39	1.33	9.33	8.00	7.00	7.00	2082
2084	Lowell Tobacco 5-4-5 for Tobacco, Fruits and Vines	5-4-5	Manchester	1.55	0.10	0.35	2.11	4.11	5.00	0.70	5.73	5.03	1.14	5.59	2084
2083	Lowell Top Dressing, 7-5-2	7-5-2	Manchester	0.00	5.28	0.00	0.08	5.36	6.52	0.10	5.74	5.64	2.46	2.46	2083
2498	Lowell Top Dressing, 7-5-2	7-5-2	Warehouse Point .	0.00	5.81	0.00	0.11	5.92	7.20	0.53	5.21	4.68	2.07	2.07	2498
	Mapes Formula and Peruvian Guano Co., New York.														
1655	The Mapes Connecticut Valley Special ..	6-4-7	Hartford	2.14	0.33	0.72	1.76	4.95	6.02	0.63	5.15	4.52	0.78	9.30	1655
1653	The Mapes Corn Manure	3-8-3	Hartford	0.12	0.70	0.38	1.04	2.24	2.72	1.75	10.70	8.95	2.88	3.52	1653
1699	The Mapes General Tobacco Manure ...	5-4-5	Hartford	1.93	0.39	0.75	1.46	4.53	5.51	1.54	5.26	3.72	0.54	5.69	1699
1654	The Mapes General Truck Manure	5-8-5	Hartford	1.14	1.17	0.33	1.20	3.84	4.67	0.75	8.78	8.03	4.13	5.50	1654
1662	The Mapes General Use Manure	3-6-4	Meriden	0.77	0.90	0.23	0.92	2.82	3.43	0.73	8.68	7.95	0.35	4.90	1662
2435	The Mapes Onion Manure	4-6-4	Hartford	1.29	1.18	0.22	0.95	3.64	4.43	1.38	8.48	7.10	0.07	5.19	2435
1661	The Mapes Potato Manure	4-7-5	Meriden	1.13	1.10	0.23	0.96	3.42	4.16	1.00	9.33	8.33	4.65	5.36	1661
1918	The Mapes Tobacco, Ash Constituents ..	1-4-15	East Granby	0.09	0.18	0.25	0.50	1.02	1.24	1.23	6.00	4.77	0.88	15.15	1918
2441	The Mapes Special Formula Tobacco Manure	6-4-3	Hartford	1.80	0.37	0.86	1.61	4.64	5.64	1.68	5.75	4.07	0.62	5.85	2441
1702	The Mapes Tobacco Manure Wrapper Brand	7.5-2-10.5	Ellington	2.14	0.39	1.22	2.45	6.20	7.54	1.90	5.10	3.20	0.78	11.46	1702
1656	The Mapes Tobacco Starter, Improved ..	5-6-1	Windsor Locks ..	1.33	1.23	0.28	1.31	4.15	5.05	1.98	9.60	7.62	1.18	2.55	1656
2434	The Mapes Top Dresser	10-4-2	Hartford	4.90	1.84	0.48	1.03	8.25	10.03	0.93	6.20	5.27	0.35	3.13	2434

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	New England Fertilizer Co., Boston.														
1660	New England Corn Phosphate for Grain and Vegetables, 2-8-2	2-8-2	Rockville	0.13	1.09	0.32	0.44	1.98	2.41	0.70	7.98	7.28	2.10	2.10	1660
2081	New England Corn Phosphate for Grain and Vegetables, 2-8-2	2-8-2	Meriden	0.09	0.78	0.28	0.64	1.79	2.18	0.72	8.57	7.85	2.37	2.37	2081
1913	New England 5-8-7 for Potatoes and Market Garden	5-8-7	Meriden	0.77	1.85	0.26	0.96	3.84	4.67	0.80	8.95	8.15	7.34	7.34	1913
2509	New England 5-8-7 for Potatoes and Market Garden	5-8-7	Rockville	0.83	1.51	0.89	0.92	4.15	5.05	1.59	8.83	7.24	7.43	7.43	2509
1709	New England 4-8-4 for Potatoes, Vegetables and Grass	4-8-4	Meriden	0.31	1.48	0.61	0.92	3.32	4.04	0.93	9.23	8.30	4.23	4.23	1709
1912	New England Potato Phosphate 4-8-7 for Potatoes and Vegetables	4-8-7	Plainville	0.79	0.95	0.73	0.70	3.17	3.85	1.10	9.58	8.48	7.14	7.14	1912
1663	New England Superphosphate, A High Grade Fertilizer for All Crops, 3-8-4	3-8-4	Plainville	0.23	1.21	0.32	0.64	2.40	2.92	0.68	8.58	7.90	3.97	3.97	1663
2444	New England Tobacco, 5-4-5	5-4-5	Warehouse Point	1.66	0.10	0.34	2.18	4.28	5.20	0.63	5.50	4.87	1.62	5.37	2444
2443	New England Tobacco Manure, 5-8-6	5-8-6	Warehouse Point	1.58	0.14	0.55	2.10	4.37	5.31	1.43	9.83	8.40	1.82	6.18	2443
	Olds & Whipple, Inc., Hartford.														
1919	O & W Blue Label Brand Tobacco Fertilizer	6-3-6	Glastonbury	1.11	0.02	0.24	4.02	5.39	6.55	0.38	3.90	3.52	0.58	7.36	1909
1910	O & W Complete Corn, Potato and Onion Fertilizer	4-8-4	South Manchester	1.24	1.24	0.00	0.88	3.36	4.09	0.93	9.55	8.62	4.72	4.72	1910
1730	O & W Complete Tobacco Fertilizer	5-4-5	South Manchester	1.09	0.04	0.26	2.94	4.33	5.26	0.45	5.40	4.95	0.49	5.95	1730
1732	O & W High Grade Potato Fertilizer	5-8-7	Silver Lane	0.51	2.08	0.65	1.18	4.42	5.37	1.20	10.18	8.98	0.66	7.80	1732
1914	O & W High Grade Starter and Potash Compound	5-4-15	South Windsor	1.47	0.80	0.17	1.82	4.26	5.18	0.60	5.48	4.88	1.30	16.12	1914
1911	O & W Special Complete Corn, Onion and Potato Fertilizer	3-8-2	South Manchester	1.58	0.00	0.20	0.94	2.72	3.31	1.23	11.20	9.97	2.60	2.60	1911
	Parmenter & Polsey, Boston, Mass.														
2643	P & P Farm and Garden, 2-8-2	2-8-2	Stafford Springs	0.38	0.33	0.53	0.76	2.00	2.43	0.63	8.78	8.15	2.02	2.02	2643
2146	P & P Plymouth Rock Brand for All Crops, 3-8-4	3-8-4	Stafford Springs	0.22	1.19	0.26	0.70	2.37	2.88	0.75	8.89	8.14	4.32	4.32	2146
2642	P & P Potato and Market Garden, 5-8-7	5-8-7	Stafford Springs	0.84	1.68	0.81	0.94	4.27	5.19	1.35	9.08	7.73	7.50	7.50	2642
	Piedmont Mt. Airy Guano Co., Baltimore, Md.														
2097	Harvest Brand, 2-8-2	2-8-2	Guilford	0.05	0.97	0.59	0.39	2.00	2.43	0.70	8.85	8.15	3.93	3.93	2097
1528	Harvest Brand, 3-8-4	3-8-4	New Haven	0.14	2.12	0.50	0.42	3.18	3.87	0.50	9.00	8.50	4.00	4.00	1528
1736	Harvest Brand, 4-8-4	4-8-4	Seymour	0.00	2.34	0.64	0.36	3.34	4.06	0.82	8.18	7.36	3.90	3.90	1736
2510	Harvest Brand, 4-8-4	4-8-4	Guilford	0.07	2.25	0.52	0.46	3.30	4.01	1.02	8.25	7.23	3.94	3.94	2510
1771	Harvest Brand, 4-6-10	4-6-10	New Haven	0.08	2.06	0.67	0.36	3.17	3.85	0.50	7.00	6.50	9.77	9.77	1771
1526	Harvest Brand, 5-8-5	5-8-5	New Haven	0.12	2.38	0.75	0.83	4.08	4.96	0.98	9.70	8.72	5.19	5.19	1526

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	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.	
	Sampled by Station:			%	%	%	%	%	%	%	%	%	%	%	
	Piedmont Mt. Airy Guano Co., Baltimore, Md.														
2143	Harvest Brand, 5-8-7	5-8-7	Torrington	0.11	2.86	0.55	0.38	3.90	4.74	1.10	8.94	7.84	7.71	7.71	2143
2139	Harvest Brand, 8-6-6	8-6-6	Seymour	0.14	5.32	0.58	0.54	6.58	8.00	0.70	7.10	6.40	5.48	5.48	2139
2511	Harvest Brand, 8-6-6	8-6-6	Guilford	0.00	4.00	0.68	0.59	5.27	6.41	0.90	6.83	5.93	10.14	10.14	2511
2641	Harvest Brand, 6-8-6	6-8-6	Rockville	0.14	3.97	0.56	0.35	5.02	6.10	0.75	9.35	8.60	0.76	4.91	2641
	Frank S. Platt Co., New Haven.														
1733	Platco Special	4-8-6	Sampled at Factory	1.62	0.12	0.73	0.78	3.25	3.95	1.38	9.65	8.27	2.33	6.17	1733
	Rackliffe Bros. Co., New Britain.														
2459	Rackliffe 4-8-4 Fertilizer	4-8-4	Southington	1.71	0.11	0.48	1.11	3.41	4.14	1.53	9.70	8.17	4.51	4.51	2459
	The Rogers & Hubbard Co., Portland.														
1742	4-8-4	4-8-4	Hartford	0.18	1.90	0.59	0.62	3.29	4.00	2.64	10.85	8.21	4.33	4.33	1742
2142	5-8-7	5-8-7	Wethersfield	2.26	1.06	0.52	0.58	4.42	5.37	2.28	10.60	8.32	6.75	6.75	2142
1743	Garden Fertilizer	2-8-4	Hartford	0.10	0.90	0.43	0.46	1.89	2.30	2.65	11.20	8.55	4.54	4.54	1743
1627	Hubbard's "Bone Base" Fertilizer for Oats and Top Dressing	10-3-8	Talcottville	8.29	0.00	0.00	0.41	8.70	10.58	2.48	8.00	5.52	7.35	8.58	1627
1620	Hubbard's "Bone Base" Fertilizer for Seeding Down	3-5-6	Sampled at Factory	0.43	0.18	0.50	1.71	2.82	3.43	4.05	11.60	7.55	7.14	7.14	1620
2519	Hubbard's "Bone Base" Fertilizer for Seeding Down	3-5-6	Sampled at Factory	0.61	0.06	0.21	1.67	2.55	3.10	6.33	13.05	6.72	6.01	6.01	2519
2085	Hubbard's "Bone Base" Soluble Corn and General Crops Manure	3-8-6	Norwich	1.23	0.07	0.38	0.81	2.49	3.03	2.55	10.83	8.28	5.84	5.84	2085
2086	Hubbard's "Bone Base" Soluble Potato Manure	6-8-5	Cromwell	2.17	1.18	0.98	0.63	4.96	6.03	1.88	10.80	8.92	0.47	5.00	2086
2103	Rogers & Hubbard's All Soils, All Crops	4-10-4	Ellington	0.26	2.00	0.61	0.61	3.48	4.23	3.13	12.88	9.75	4.58	4.58	2103
2147	Rogers & Hubbard's Climax Tobacco Brand	5-4-5	Granby	1.20	0.14	0.27	2.55	4.16	5.06	0.60	6.00	5.40	0.86	5.65	2147
2104	Rogers & Hubbard's Corn and Grain Fertilizer	1-10-3	Willimantic	0.02	0.13	0.33	0.44	0.92	1.12	1.23	11.60	10.37	3.21	3.21	2104
2101	Rogers & Hubbard's High Potash Fertilizer	3-8-10	Branford	0.04	1.31	0.69	0.60	2.64	3.21	3.25	11.25	8.00	10.67	10.67	2101
2107	Rogers & Hubbard's Potato Fertilizer	2-10-4	New Britain	0.09	0.55	0.64	0.54	1.82	2.21	2.97	12.91	9.94	4.50	.4.50	2107
2095	Rogers & Hubbard's Tobacco Grower Vegetable Formula	6-4-4	Burnside	1.25	0.09	0.19	3.56	5.09	6.19	0.90	5.33	4.43	0.35	4.21	2095
	F. S. Royster Guano Co., Baltimore, Md.														
2099	Royster's Bully Guano	2-8-5	Trumbull	0.15	0.92	0.00	0.54	1.61	1.96	1.33	9.70	8.37	4.66	4.66	2099
2105	Royster's Quality Trucker	4-8-7	Waterbury	0.08	2.07	0.07	0.96	3.18	3.87	0.90	9.55	8.65	7.17	7.17	2105
2100	Royster's Triumph Guano	3-8-3	Thompsonville	0.11	1.47	0.11	0.79	2.48	3.02	1.40	9.60	8.20	3.17	3.17	2100
2098	Royster's Trucker's Delight	4-8-4	Plainville	0.11	2.04	0.16	0.70	3.01	3.66	1.05	9.40	8.35	3.99	3.99	2098
2513	Royster's Trucker's Delight	4-8-4	Granby	0.12	1.83	0.23	1.02	3.20	3.89	1.60	9.59	7.99	4.14	4.14	2513
2149	Royster's Valley Tobacco Formula	5-4-5	Granby	0.35	0.87	0.06	2.47	3.75	4.56	0.23	4.30	4.07	0.44	5.21	2149
2148	Royster's Wrapper Brand	7-3-7	Granby	0.38	1.47	0.70	3.56	6.11	7.43	0.30	3.80	3.50	0.56	7.92	2148

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	Sanderson Fertilizer and Chemical Co., New Haven.														
2155	Sanderson's Atlantic Coast Bone, Fish and Potash	3-10-3	Guilford	0.31	1.09	0.57	0.56	2.53	3.08	0.88	10.75	9.87	3.36	3.36	2155
1748	Sanderson's Complete Tobacco Grower	5-4-5	Manchester	0.43	0.68	0.24	2.85	4.20	5.11	0.30	4.63	4.33	0.51	5.27	1748
2141	Sanderson's Corn Superphosphate	2-8-3	Hamden	0.12	0.74	0.50	0.52	1.88	2.29	0.80	8.80	8.00	3.26	3.26	2141
1747	Sanderson's Formula A	4-8-4	Guilford	0.49	1.69	0.61	0.48	3.27	3.98	0.75	9.01	8.26	4.00	4.00	1747
2121	Sanderson's Formula B	4-8-6	Bloomfield	0.71	1.07	0.22	1.36	3.36	4.09	1.03	9.95	8.92	0.56	5.94	2121
2140	Sanderson's Potato Manure	3-8-4	Hamden	0.19	1.35	0.46	0.50	2.50	3.04	0.75	8.80	8.05	3.93	3.93	2140
2164	Sanderson's Top Dressing Grass and Grain	6-6-4	Unionville	1.49	2.50	0.25	0.57	4.81	5.85	0.43	6.80	6.37	3.84	3.84	2164
	M. L. Shoemaker & Co., Philadelphia.														
2158	Shoemaker's "Swift-Sure" Special Tobacco Formula	4-8-5	New Milford	1.12	0.08	0.43	1.89	3.52	4.28	2.58	11.10	8.52	1.26	5.57	2158
1751	Shoemaker's "Swift-Sure" Tobacco and General Use	3-10-3	New Milford	0.98	0.07	0.46	1.07	2.58	3.14	3.90	14.45	10.55	1.37	3.72	1751
	Springfield Rendering Co., Springfield, Mass.														
1767	Springfield Animal Brand, 3-8-4	3-8-4	Thompsonville	0.03	1.60	0.45	0.56	2.64	3.21	0.50	8.89	8.39	4.21	4.21	1767
1769	Springfield Market Garden Grower and Top Dresser, 5-8-7	5-8-7	Hazardville	0.81	1.89	0.53	0.81	4.04	4.91	0.55	9.23	8.68	7.39	7.39	1769
2461	Springfield Tobacco Special, 5-4-5	5-4-5	Thompsonville	1.24	0.09	0.41	2.24	3.98	4.84	1.08	6.90	5.82	0.61	5.52	2461
1768	Springfield Spec. Potato, Onion and Vegetable, 4-8-4	4-8-4	Hazardville	0.70	1.44	0.60	0.60	3.34	4.06	0.65	9.01	8.36	4.12	4.12	1768
	I. P. Thomas & Son, Philadelphia, Pa.														
1457	I. P. Thomas, 5-8-7	5-8-7	Highwood	1.24	2.02	0.18	0.61	4.05	4.92	1.23	10.94	9.71	6.77	6.77	1457
1459	Truckers' High Grade Guano, 4-8-4	4-8-4	Highwood	1.02	1.20	0.34	0.55	3.11	3.78	1.32	9.08	7.76	4.23	4.23	1459
1556	Improved Truckers' Fertilizer	5-10-5	Highwood	1.20	1.72	0.13	0.72	3.77	4.58	1.15	11.88	10.73	4.66	5.04	1556
2129	Improved Truckers' Fertilizer	5-10-5	Highwood	1.21	1.69	0.40	0.72	4.02	4.89	1.10	11.93	10.83	4.96	4.96	2129
	Triton Oil and Fertilizer Co., New York City.														
2162	Triton 3-10-2 Fertilizer	3-10-2	New London	0.42	1.50	0.00	0.80	2.72	3.31	0.10	10.80	10.70	2.41	2.41	2162
2159	Triton 4-8-4 Fertilizer	4-8-4	New London	0.54	1.26	0.48	1.24	3.52	4.28	0.88	8.62	7.74	4.17	4.17	2159
2160	Triton 4-8-7 Fertilizer	4-8-7	New London	0.48	1.32	0.82	0.80	3.42	4.16	0.88	9.03	8.15	6.47	6.47	2160
2161	Triton 5-8-7 Fertilizer	5-8-7	New London	0.81	2.06	0.24	0.87	3.98	4.84	1.28	9.78	8.50	7.00	7.00	2161
	U. S. Guano Co., Baltimore, Md.														
2183	Standard United States Evergreen Fish Guano	4-8-4	Plantsville	0.26	2.24	0.23	1.06	3.79	4.61	1.88	10.00	8.12	2.15	3.54	2183
2497	Standard United States Farmers' Formula	8-6-6	New Britain	0.10	5.02	0.13	0.25	5.50	6.69	1.18	9.30	8.12	6.54	6.54	2497
2455	Standard United States Fish, Bone and Potash	5-8-7	Plantsville	0.15	3.24	0.22	0.41	4.02	4.89	0.58	9.30	8.72	7.05	7.05	2455

TABLE XIII. ANALYSES OF MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Concluded.*

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	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.	
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	Virginia-Carolina Chemical Co., New York City.														
1766	V-C Aroostook Potato Grower	5-8-7	North Haven	0.14	2.92	0.52	0.26	3.84	4.67	1.35	9.70	8.35	7.32	7.32	1766
2157	V-C Champion Brand	4-8-4	North Haven	0.19	2.17	0.46	0.25	3.07	3.73	1.05	9.25	8.20	4.12	4.12	2157
2165	V-C Double Owl Brand	4-8-6	North Haven	0.10	2.66	0.53	0.19	3.48	4.23	1.23	8.85	7.62	6.22	6.22	2165
1765	V-C Good Luck Brand	3-10-5	North Haven	0.12	1.60	0.57	0.21	2.50	3.04	1.80	11.93	10.13	4.66	5.43	1765
1770	V-C Indian Chief Brand	5-4-5	Glastonbury	0.23	0.63	0.19	2.86	3.91	4.75	0.45	4.76	4.31	0.45	6.22	1770
2182	V-C National Brand	4-8-10	North Haven	0.00	2.78	0.43	0.22	3.43	4.17	1.46	9.00	7.54	10.92	10.92	2182
2156	V-C Tip Top Top Dresser	6-8-4	North Haven	0.13	4.19	0.45	0.29	5.06	6.15	1.38	9.05	7.67	4.11	4.11	2156
	Wilcox Fertilizer Co., Mystic.														
1810	Wilcox 4-8-4 Fertilizer	4-8-4	Willimantic	1.83	0.19	0.66	0.75	3.43	4.17	0.85	9.20	8.35	4.36	4.36	1810
1816	Wilcox 5-8-7 Fertilizer	5-8-7	Norwich	1.95	0.09	0.80	1.40	4.24	5.15	2.30	10.65	8.35	5.41	6.95	1816
2187	Wilcox 5-10-5 Fertilizer	5-10-5	Sampled at Factory	2.01	0.10	0.76	1.12	3.99	4.85	2.23	11.83	9.60	5.15	5.15	2187
2191	Wilcox Corn Special	3-10-4	Ellington	1.26	0.12	0.38	0.71	2.47	3.00	0.45	10.30	9.85	3.27	3.27	2191
2512	Wilcox Corn Special	3-10-4	Sampled at Factory	0.84	0.60	0.50	0.70	2.64	3.21	0.50	10.38	9.88	3.23	3.23	2512
1811	Wilcox Fish and Potash	3-8-3	Willimantic	1.46	0.18	0.60	0.84	3.08	3.74	0.58	9.02	8.44	3.69	3.69	1811
2186	Wilcox Grass and Truck Fertilizer	5-8-4	Sampled at Factory	1.18	2.02	0.10	0.87	4.17	5.07	0.10	9.00	8.90	4.42	4.42	2186
1812	Wilcox Potato and Vegetable Phosphate	4-8-6	Willimantic	1.65	0.09	0.67	0.76	3.17	3.85	1.35	9.45	8.10	2.43	6.16	1812
2190	Wilcox Tobacco Special	5-4-5	Ellington	1.05	0.22	0.49	4.48	6.24	7.59	0.13	6.05	5.92	0.76	6.90	2190
2189	Wilcox Top Dresser	8-6-6	Sampled at Factory	3.31	0.08	1.10	2.53	7.02	8.53	1.15	7.53	6.38	5.65	6.04	2189
	S. D. Woodruff & Sons, Orange.														
1772	Woodruff's Home Mixture	4-8-6	North Haven	1.16	0.02	0.03	1.86	3.07	3.73	1.55	9.48	7.93	6.18	6.18	1772
	Worcester Rendering Co., Auburn, Mass.														
2192	Prosperity Complete Dressing, 6-6-3	6-6-3	Putnam	2.36	0.12	1.09	1.37	4.94	6.01	0.83	7.03	6.20	3.27	3.27	2192
2193	Prosperity Corn and Grain Fertilizer	2-8-2	Putnam	0.54	0.88	0.36	0.52	2.30	2.80	0.68	8.70	8.02	2.30	2.30	2193
1817	Prosperity Market Garden Fertilizer	5-8-7	Norwich	1.06	1.50	0.77	0.88	4.21	5.12	0.65	8.63	7.98	6.49	6.49	1817
1815	Prosperity Potato and Vegetable	4-8-4	Norwich	0.86	1.38	0.51	0.84	3.59	4.36	0.75	9.60	8.85	4.54	4.54	1815
1845	Prosperity Potato and Vegetable, 4-8-4	4-8-4	Norwich	0.65	1.47	0.33	0.78	3.23	3.93	0.60	9.20	8.60	4.81	4.81	1845
2185	Prosperity Superior Top Dressing	8-6-6	North Stonington	2.09	0.17	2.46	1.74	6.46	7.85	1.13	7.90	6.77	4.84	4.84	2185

TABLE XIII. ANALYSES OF MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH—*Concluded.*

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available."	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Purchaser:														
	American Agricultural Chemical Co., New York City														
2043	Double A Tobacco Fertilizer, 173,839	5-4-5	Granby	....	....	....	....	4.24	5.15	0.35	4.90	4.55	....	4.62	2043
2044	Double A Tobacco Fertilizer, 75,100	5-4-5	Granby	....	....	....	....	4.36	5.30	0.43	5.68	5.25	....	4.65	2044
2045	Double A Tobacco Fertilizer, 7,301	5-4-5	Granby	....	....	....	....	4.13	5.02	0.45	4.63	4.18	....	4.99	2045
2046	Double A Tobacco Fertilizer, 571,689	5-4-5	Granby	....	....	....	....	4.23	5.14	0.40	4.43	4.03	....	5.03	2046
1718	Quinnipiac Seed Leaf Tobacco Manure ..	....	Broad Brook	....	....	....	....	4.14	5.03	0.27	4.23	3.96	0.40	4.84	1718
1649	Quinnipiac Prime Tobacco Manure, 63,858	7-3-7	Hartford	....	....	....	....	5.91	7.19	0.38	3.70	3.32	0.54	6.80	1649
	Apothecaries Hall Co., Waterbury.														
641	Fertilizer, 8-4-5 (Light)	8-4-5	Buckland	....	....	....	....	6.70	8.15	....	....	....	....	....	641
642	Fertilizer, 8-4-5 (Dark)	8-4-5	Buckland	....	....	....	....	6.32	7.68	....	....	....	....	....	642
	Eastern States Farmers' Exchange, Springfield, Mass.														
2557	5-10-5 Fertilizer	5-10-5	Saybrook	....	....	....	....	3.30	4.01	....	11.16	....	....	5.00	2557
2065	Eastern States, 5-8-7	5-8-7	Farmington	....	....	....	....	4.78	5.81	0.35	7.89	7.54	....	7.98	2065
	L. T. Frisbie Co., New Haven.														
2424	Frisbie's 5-8-7	5-8-7	Manchester	....	....	....	....	3.92	4.90	0.75	9.60	8.85	....	7.05	2424
	The Rogers & Hubbard Co., Portland.														
1595	Rogers & Hubbard Tobacco Grower Vegetable Formula	6-4-4	Burnside	....	....	....	....	5.11	6.21	0.92	5.30	4.38	....	4.32	1595
923	Seeding Down Fertilizer	....	Sent from Factory	....	....	....	....	....		5.68	12.60	6.92	....	....	923
1795	....	....	Hartford	....	....	....	....	5.05	6.14	0.45	6.25	5.80	....	6.83	1795

SPECIAL MIXTURES AND HOME MIXTURES.

Forty-six samples of home mixed goods and fertilizers mixed by manufacturers according to special formulas required by the purchasers have been analyzed and are reported in Table XVI. Only three of these were sampled by the station agent.

TABLE XVI. ANALYSES OF SPECIAL MIXTURES AND HOME MIXTURES.

Station No.	Manufacturer.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "available."	Potash. As muriate.	Potash. Total.	Station No.
	Sampled by Station:		%	%	%	%	%	%	%	
1774	Eastern States Farmers' Exchange, Springfield, Mass.	L. W. Newberry, So. Windsor	6.00	7.29	0.45	6.60	6.15	1.13	8.63	1774
1523	....	T. W. Ryan, Stratford	4.82	5.86	0.65	8.03	7.38	....	7.71	1523
1524	....	T. W. Ryan, Stratford	4.12	5.01	0.93	10.68	9.75	....	6.09	1524
	Sampled by Purchaser:									
1222	Formula A	American Sumatra Tobacco Co., Bloomfield	5.36	6.52	0.23	4.94	4.71	0.16	6.22	1222
1399	Formula A	" "	5.24	6.37	0.18	4.54	4.36	....	6.08	1399
1422	Formula A	" "	5.39	6.55	0.18	4.78	4.60	0.32	6.11	1422
1353	Formula AA	" "	6.92	8.41	0.46	3.91	3.45	0.29	1.09	1353
1401	Formula AA	" "	7.02	8.53	0.46	3.98	3.52	....	1.13	1401
1223	Formula B	" "	5.74	6.98	0.28	4.53	4.25	0.15	6.95	1223
1400	Formula B	" "	5.59	6.80	0.19	5.42	5.23	....	7.03	1400
1423	Formula B	" "	5.22	6.35	0.19	5.04	4.85	0.28	6.20	1423
1573	Formula C	" "	6.16	7.49	0.30	5.08	4.78	0.27	6.57	1573
1420	Formula D	" "	5.31	6.46	1.22	6.10	4.88	0.20	6.07	1420
1421	Formula F	" "	5.20	6.32	1.38	6.64	5.26	0.16	4.94	1421
1473	Formula G	" "	5.86	7.12	0.26	4.12	3.86	0.40	5.37	1473
1452	Formula H	" "	4.80	5.84	0.20	5.19	4.99	0.54	7.65	1452
1574	Formula H	" "	5.19	6.31	0.28	5.58	5.30	0.43	5.48	1574
1474	Formula I	" "	5.26	6.40	0.24	4.80	4.56	0.37	6.19	1474
1537	Formula J	" "	5.80	7.05	0.28	6.04	5.76	....	7.20	1537
1696	Formula K	" "	5.97	7.26	0.25	5.70	5.45	0.25	7.02	1696
1697	Formula N	" "	5.42	6.59	0.28	5.45	5.17	0.44	8.07	1697

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

Station No.	Manufacturer.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "available."	Potash. As muriate.	Potash. Total.	Station No.
	Sampled by Purchaser:		%	%	%	%	%	%	%	
1698	Formula O	American Sumatra Tobacco Co., Bloomfield	7.06	8.58	0.73	4.85	4.12	0.57	1.36	1698
1601	Old Formula	" "	5.88	7.15	0.20	5.90	5.70	....	4.07	1601
2116	....	George Bostick, Sr., Thompsonville	5.86	7.12	0.23	5.18	4.95	0.40	7.66	2116
2117	....	W. J. Burgess, Thompsonville	4.20	5.11	0.28	4.53	4.25	....	4.41	2117
2118	....	James T. Burgess, Thompsonville	5.93	7.21	0.15	5.55	5.40	....	6.93	2118
2014	....	O. W. Murphy, Collinsville ..	1.20	1.46	3.43	11.60	8.17	....	3.25	2014
2015	....	O. W. Murphy, Collinsville ..	4.92	5.98	0.88	5.65	4.77	....	3.72	2015
2197	Apothecaries Hall Co., Waterbury	Fred Hoffman, Ellington	6.25	7.60	0.78	4.54	3.76	1.66	7.79	2197
2198	Apothecaries Hall Co., Waterbury	Fred Hoffman, Ellington	3.37	4.10	0.70	8.60	7.90	....	4.44	2198
2361	Apothecaries Hall Co., Waterbury	Stamford Mason's Supply Co., Stamford	3.34	4.06	1.09	9.68	8.59	....	4.07	2361
2364	Apothecaries Hall Co., Waterbury	W. J. Burgess, Thompsonville	5.65	6.87	0.30	5.78	5.48	....	9.09	2364
2196	Berkshire Fertilizer Co., Bridgeport	Fred Hoffman, Ellington	6.02	7.32	0.18	4.20	4.02	0.66	7.89	2196
2318	Berkshire Fertilizer Co., Bridgeport	Louis Grouboush, Suffield ...	4.20	5.11	0.63	5.18	4.55	....	5.70	2318
2319	Berkshire Fertilizer Co., Bridgeport	Neland Loomis, Suffield	4.94	6.01	0.85	6.05	5.20	....	3.74	2319
1906	Everett B. Clark Seed Co., Milford	Angelo Cerrone, Northford ..	4.83	5.87	1.86	10.40	8.54	....	7.31	1906

TABLE XVI. ANALYSES OF SPECIAL MIXTURES AND HOME MIXTURES—*Concluded.*

Station No.	Manufacturer.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "available."	Potash. As muriate.	Potash. Total.	Station No.
			%	%	%	%	%	%	%	
	Sampled by Purchaser:									
1893	L. T. Frisbie Co., New Haven	C. R. Burr & Co., Manchester	3.85	4.68	0.68	9.13	8.45	....	6.83	1893
2035	Olds & Whipple, Inc., Hartford	H. E. Wells, Warehouse Point	5.50	6.69	1.10	6.00	4.90	....	12.00	2035
2036	Olds & Whipple, Inc., Hartford	H. E. Wells, Warehouse Point	5.38	6.54	1.15	5.95	4.80	....	11.79	2036
2037	Olds & Whipple, Inc., Hartford	H. E. Wells, Warehouse Point	4.60	5.59	1.20	9.93	8.73	....	8.14	2037
2385	The Rogers & Hubbard Co., Portland	A. N. Shepard & Son, Hartford	4.95	6.02	0.83	5.55	4.72	....	4.19	2385
2386	The Rogers & Hubbard Co., Portland	A. N. Shepard & Son, Hartford	4.91	5.97	0.88	5.63	4.75	....	4.33	2386
2387	The Rogers & Hubbard Co., Portland	A. N. Shepard & Son, Hartford	5.24	6.37	0.73	5.64	4.91	....	4.67	2387
1820	Sanderson Fertilizer & Chemical Co., New Haven	American Sumatra Tobacco Co., Bloomfield	3.34	4.06	1.08	9.80	8.72	....	5.19	1820
1821	Sanderson Fertilizer & Chemical Co., New Haven	American Sumatra Tobacco Co., Bloomfield	1.92	2.33	1.03	9.13	8.10	....	3.16	1821
2110	Wilcox Fertilizer Co., Mystic	E. C. Pendleton, Norwich	5.14	6.25	0.55	9.50	8.95	0.52	7.26	2110

VII. MISCELLANEOUS FERTILIZERS, AMENDMENTS AND WASTE PRODUCTS.

WOOD ASHES.

Twelve samples of wood ashes, chiefly Canadian products, have been analyzed. All were of good quality. Nine contained over 6 per cent of potash and eleven contained over 5 per cent. Besides potash, wood ashes contain from 1.5 to 2.5 per cent of phosphoric acid and probably 30 per cent or more of lime which contribute to their value as a fertilizer and a soil amendment, but as a source of potash at $5.00 per unit they are expensive.

Analyses are given in Table XVII.

TABLE XVII. ANALYSES OF WOOD ASHES.

Station No.	Manufacturer.	Purchaser.	Phosphoric acid.	Water-soluble potash.
			%	%
	Sampled by Station:			
1776	John Joynt, Lucknow, Canada	Gordon Scholes, Warehouse Point	1.68	6.25
1901	" "	Harry Zera, Suffield	2.10	6.22
	Sampled by Purchaser:			
1633	John Joynt, Lucknow, Canada	The Allied Tobacco Company, Hartford	1.73	6.41
1722	" "	" "	2.15	4.79
1907	" "	" "	1.75	6.16
1908	" "	" "	2.38	6.65
1675	" "	F. R. & R. M. Goodrich, Portland	2.15	5.60
1598	" "	Hatheway & Steane, Inc., Hartford	2.50	6.75
1599	" "	" "	2.25	6.50
1669	" "	" "	2.20	6.18
2317	" "	" "	2.13	5.26
1796	" "	L. Wetstone & Sons, Hartford	1.98	5.97

Table XVIII. Analyses of Sheep Manure, Etc.

Station No.	Manufacturer or Brand.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.		Phosphoric Acid.				Potash.		Station No.
						Available.		Total.				
				Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	
	Sampled by Station:		%	%	%	%	%	%	%	%	%	
2305	American Agricultural Chemical Co., New York City	Morrison & Dunham, Bethel	1.96	2.38	1.75	....	....	0.78	0.75	2.03	2.00	2305
2051	Armour Fertilizer Works, New York City	F. A. Bartlett Tree Expert Co., Stamford	1.39	1.69	1.50	....	....	0.98	1.00	3.19	2.00	2051
2123	Berkshire Fertilizer Co., Bridgeport	Factory	2.10	2.55	2.18	1.85	1.00	1.93	....	3.30	2.00	2123
1866	Case's Brand. A. H. Case & Co., Inc., Buffalo, N. Y.	W. L. Thorpe, North Haven	2.15	2.61	1.21	....	....	1.95	1.25	1.63	1.00	1866
1652	Sheep's Head. Natural Guano Co., Aurora, Illinois	Cadwell & Jones, Hartford	2.52	3.06	2.73	1.72	1.00	1.90	1.25	2.27	2.00	1652
1728	Groz-It. Pacific Manure & Fertilizer Co., San Francisco, Cal.	Meech & Stoddard. Inc., Middletown	1.68	2.04	1.82	0.71	0.75	0.88	1.25	2.79	3.00	1728
1725	Premier Poultry Manure. Premier Poultry Manure Co., Chicago, Illinois	Lightbourn & Pond, New Haven	5.21	6.33	6.00	2.75	2.50	2.93	2.75	1.42	1.30	1725
1726	Premier Sheep Manure. Premier Poultry Manure Co., Chicago, Illinois	Lightbourn & Pond, New Haven	2.62	3.19	3.00	1.25	1.00	1.45	1.50	1.91	2.00	1726
1729	Wizard Brand Manure. The Pulverized Manure Co., Chicago, Illinois	W. W. Hunt & Co., Hartford	1.94	2.36	2.10	0.78	1.00	0.95	....	1.78	1.00	1729
1734	Wizard Brand Sheep Manure. The Pulverized Manure Co., Chicago, Illinois	F. H. Liggett & Co., Stamford	2.38	2.89	2.43	1.35	1.25	1.53	....	2.56	2.00	1734
1744	So. American Sheep and Goat Manure. Sanderson Fertilizer & Chemical Co., New Haven..	G. W. Thorpe, West Cheshire	1.30	1.58	1.50	....	....	0.90	1.00	3.21	2.50	1744

SHEEP MANURE, ETC.

Analyses of eleven samples of sheep and other farm manures, all sampled by the station agent, are given in Table XVIII. All guaranties for nitrogen and potash were substantially met or exceeded; and there were no notable deficiencies in phosphoric acid.

The character of the nitrogen in sheep manure is shown by analyses of several brands sampled in 1924. Nitrogen distribution was determined as shown in the subjoined summary.

Sample No.	Total Nitrogen.	Insoluble Organic Nitrogen.	Active Insoluble Organic Nitrogen (Alkaline Method).	Per cent Active.
	%	%	%	%
22982	2.47	1.96	0.62	31.4
22983	2.07	1.85	0.66	35.8
22986	1.30	1.12	0.37	33.6
22991	1.33	1.12	0.45	40.2
23457	1.81	1.76	0.39	22.2

These figures show that organic nitrogen insoluble in water comprises the greater part of the total nitrogen; and that from 20 to 40 per cent of the insoluble nitrogen is "active" by one of the conventional methods for determining its activity. This parallels rather closely field experiments which have shown that only about one-third of the nitrogen in manure is recovered in the first year's crop and that its full quota of plant food is not utilized except over a period of years. It is recognized, however, that the value of farm manures is not confined to the commercial value of the nitrogen, phosphorus and potash which they contain. Their chief value perhaps lies in the fact that they serve as conditioners and as culture media for the growth of beneficial soil bacteria.

LIME, ETC.

Seventeen samples of liming materials, chiefly limestone, have been analyzed and are summarized in Table XIX. A discussion on the classification and uses of lime was given in our report last year.[1]

Sample **2362** was carbide residue about which information as to its utilization was asked. This material is the residue obtained in the manufacture of acetylene gas. It is useful as a source of lime for agricultural purposes if it is dry and otherwise in good mechanical condition. It should be exposed to the air to dispel traces of acetylene gas which would be injurious to seed. If applied to the soil 2 or 3 weeks before planting there should be no danger. The sample examined contained 47.3 per cent of lime (CaO), and had apparently been well exposed as the calcium was largely in the air-slaked condition.

[1] Conn. Exp. Sta., Bull. 261, p. 92 (1924).

Table XIX. Analyses of Limestone, Etc.

Station No.	Manufacturer or Brand.	Sampled by.	Chemical Analysis. Lime (CaO). Found.	Guaranteed.	Magnesia (MgO) Found.	Guaranteed.	Total Oxides.	Insoluble in acid.	Mechanical Analysis. 20 mesh.	40 mesh.	50 mesh.	80 mesh.	100 mesh.	Station No.
			%	%	%	%	%	%	%	%	%	%	%	
	Ground Limestone, Etc.													
	Manufacturer Unknown.													
1567	65016	American Sumatra Tobacco Co., Bloomfield ..	61.83	....	4.03	....	65.86	....	97.50	91.00	83.50	70.50	66.50	1567
	Coe Lime Works, Northford.													
960	Ground Limestone	Sidney Edwards, Middletown	53.15	....	0.67	....	53.82	2.90	....	....	....	....	....	960
1204	Ground Limestone	Sidney Edwards, Middletown	51.45	....	0.99	....	52.44	5.61	89.00	75.00	64.50	54.00	50.50	1204
1460	Ground Limestone	J. S. Owens, Ext. Agronomist, Storrs	....	....	....	....	....	....	73.00	54.00	45.00	37.50	35.50	1460
1532	Ground Limestone	J. S. Owens, Ext. Agronomist, Storrs	....	....	....	....	....	....	85.00	69.50	60.50	52.50	49.50	1532
2302	Ground Limestone	Sidney Edwards, Middletown	53.25	....	1.00	....	54.25	3.92	60.00	44.50	37.50	31.50	29.50	2302
2501	Ground Limestone	Station Agent from Factory, Northford	51.96	....	0.54	....	52.50	3.79	73.30	56.60	46.60	37.60	30.40	2501
	Farnam Cheshire Lime Co., Farnams, Mass.													
2346	Agricultural Lime	Station Agent from E. Delage & Sons, Plainville	60.25	60.00	0.15	0.00	60.40	1.79	94.00	72.00	55.00	39.00	33.00	2346
	Grangers Mfg. Co., West Stockbridge, Mass.													
620	Agricultural Limestone ...	J. W. Alsop, Avon	50.68	....	0.66	....	51.34	8.43	....	....	....	....	....	620
621	Agricultural Limestone ...	Conn. Sumatra Tobacco Co., Buckland	50.58	....	0.66	....	51.24	8.40	....	....	....	....	....	621
1404	Agricultural Limestone ...	Winchell Smith, Farmington	....	....	....	....	....	....	100.00	91.00	77.00	61.00	55.00	1404
1694	Agricultural Limestone ...	American Sumatra Tobacco Co., Bloomfield ..	39.66	....	8.31	....	47.97	11.98	100.00	100.00	98.00	93.00	90.00	1694
1695	Agricultural Limestone ...	American Sumatra Tobacco Co., Bloomfield ..	39.68	....	8.56	....	48.24	11.92	100.00	100.00	98.00	....	88.00	1695
2301	Ground Limestone	Sidney Edwards, Middletown	39.38	....	11.40	....	50.78	6.71	97.00	87.00	81.00	75.00	71.00	2301
2454	Agricultural Limestone ...	Station Agent from J. F. Raven Hardware Co., Meriden	38.67	....	7.96	....	46.63	12.00	97.50	86.00	74.70	61.20	55.10	2454
	Miscellaneous.													
2362	Carbide residue	N. Y., N. H. & H. R. R., New Haven	47.33	....	0.21	....	47.54	1.20	....	....	....	....	....	2362
2398	Waste Lime	J. B. Tinker, Canaan	31.10	....	11.27	....	42.37	....	....	....	....	....	....	2398

MISCELLANEOUS.

Seventy-six samples of miscellaneous material have been analyzed, most of which need no individual discussion.

This number includes thirteen samples submitted by the Tobacco Experiment Station which have been examined in some detail and are reported upon in Table XX.

There are included also, nine samples of check fertilizers in the coöperative program of the Royster Guano Co., and thirty samples of check cottonseed meals in a similar program of the American Oil Chemists' Society. The complete list is as follows:

Raw materials for Tobacco Station	13
Check fertilizers	9
Check cottonseed meals	30
Potash marl	1
Tobacco stems, dust, etc.	13
Soil	3
Other miscellaneous	7
Total	76

TABLE XX. ANALYSES OF MATERIAL SUBMITTED BY TOBACCO STATION.*

Materials.	Water and Undetermined.	Organic Matter.	Nitrogen.	Phosphorus Pentoxide (P_2O_5).	Potassium Oxide (K_2O).	Calcium Oxide (CaO).	Magnesium Oxide (MgO).	Iron and Aluminum Oxides (Fe_2O_3 & Al_2O_3).	Sulphur Trioxide (SO_3).	Sodium Oxide (NA_2O).	Chlorine (CL).	Silica (SiO_2).
	%	%	%	%	%	%	%	%	%	%	%	%
Cottonseed Meal	6.75	86.87[1]	6.72	2.64	1.98	0.27	1.07	0.06	...	...	0.00	0.13
Castor Pomace	7.50	86.85[1]	5.01	1.47	0.55	0.88	0.67	0.19	...	...	0.08	1.03
Sodium Nitrate	48.54[2]	...	15.46	...	...	...	...	...	...	35.66	0.34	...
Precipitated Bone	...	...	...	38.32[3]	...	...	...	...	...	...	...	...
Potassium Sulphate	2.87[4]	...	...	...	50.09	0.11	1.25	0.33	43.32	0.02[5]	1.75	0.65
Potassium Carbonate	36.43[6]	...	...	...	62.73	...	...	...	...	...	0.84	...
Tankage	8.45	78.20[1]	9.51	4.53	0.26	5.10	0.29	0.60	2.60	...	0.31	1.27
Ammonium Sulphate	19.85	...	20.78	...	...	...	...	...	59.37	...	...	...
Dry Ground Fish	7.57[4]	73.52[1]	9.16	7.33[7]	0.60	8.01	0.35	0.39	2.84	...	0.28	1.38
Double Manure Salts	9.74[4]	...	...	...	27.36	1.17	10.28	0.86	46.27	0.94[5]	1.68	2.08
Trona Potash	1.03[4]	...	...	...	60.94	0.00	0.04	0.11	0.27	2.49[5]	45.10[8]	0.20
Urea	...	...	46.20[9]	...	...	...	...	...	...	...	...	...
Green Sand Marl	7.43[4]	...	...	1.25[10]	6.59[11]	1.75	3.82	26.50	0.88	0.48	...	49.86

* Analyses by Mr. H. J. Fisher.
[1] The nitrogen given in next column is included here, it being principally in organic form.
[2] Of this, 44.14% is oxygen.
[3] 37.73% available.
[4] Loss on ignition.
[5] By difference.
[6] Mostly CO_2.
[7] 5.58% available.
[8] Oxygen equivalent to chlorine 10.18%.
[9] Urea 99.03%.
[10] 0.35% available.
[11] Water-soluble potash 0.10%.

1727. *Potash Marl.* Potash Marl, Inc., New York. Sampled by station agent, stock of Lightbourn and Pond, New Haven.

Analysis:

Available phosphoric acid 0.45 per cent; total phosphoric acid 1.33 per cent. The material was guaranteed 0.25 and 1 per cent of available and total phosphoric acid respectively.

Only phosphoric acid is guaranteed. The material contains, or may contain, 6 per cent or more of potash but it is largely or entirely insoluble in water. The product was quoted at $43.00 per ton but the plant food in it cannot be valued at over $5.00. We have no information that its worth as an amendment justifies the extra cost.

922. *Tobacco Stems,* unground, submitted by W. A. Henry & Sons, Wallingford.

933. *Tobacco Dust,* ground, submitted by Edw. Eggert, Hartford.

2555, 2556. *Tobacco Dust,* submitted by S. D. Woodruff Sons, Orange.

955. *Tobacco Stems,* ground, submitted by the Everett B. Clark Seed Co., Milford.

2558. *Tobacco Butts,* **2559** Tips, **2560** Tips, **2561** Middle leaf, **2562** Middle leaf, **2563** Tips, **2564** Butts, **2565** Middle leaf. Submitted by Dr. Anderson, Tobacco Station, Windsor, for determinations of moisture only.

Analyses of these tobaccos are given in the following tabulation.

ANALYSES OF TOBACCO.

Sta. No.	Moisture. %	Nitrogen. %	Phosphoric. %	Potash. %	Nicotine. %
922	30.50	1.41	0.38	5.82	....
933	....	2.71	0.43	2.83	1.03
2555	....	1.96	....	2.14	....
2556	....	1.84	....	1.61	....
955	....	1.48	....	6.01	....
2558	27.29	....	....	....	....
2559	24.91	....	....	....	....
2560	23.71	....	....	....	....
2561	26.99	....	....	....	....
2562	28.27	....	....	....	....
2563	20.01	....	....	....	....
2564	23.47	....	....	....	....
2565	21.24	....	....	....	....

BULLETIN 271 JANUARY, 1926

Connecticut Agricultural Experiment Station

New Haven, Connecticut

Spray Bulletin

BY

W. E. BRITTON, *Entomologist.*

AND

G. P. CLINTON, *Botanist.*

BULLETIN 271

JANUARY, 1926

Connecticut Agricultural Experiment Station

NEW HAVEN, CONNECTICUT

WILLIAM L. SLATE, JR., *Director*

SPRAY BULLETIN

W. E. BRITTON
Entomologist

G. P. CLINTON
Botanist

DIRECTIONS FOR PREPARING INSECTICIDES AND FUNGICIDES.

FORMULAS FOR INSECTICIDES.

LEAD ARSENATE.

3 lbs. (Paste) or 1½ lbs. (Dry) Lead Arsenate and 50 gals. Water.

Spray upon foliage to kill all chewing insects. May be used with Bordeaux or with lime-sulphur mixture.

PARIS GREEN.

1 lb. Paris Green. 3 lbs. Lime. 100 gals. Water.

Spray upon foliage to kill chewing insects. Commonly used with Bordeaux mixture on potatoes, largely superseded by lead arsenate.

CALCIUM ARSENATE.

1½ lbs. Dry Calcium Arsenate. 1½ lbs. Dry Air-Slaked Lime.
50 gals. Water.

Applied as dust or spray on potatoes. May be used in Bordeaux mixture. Not safe on fruit trees.

POISONED BRAN MASH.

5 lbs. Wheat Bran. 4 ozs. White Arsenic or Paris Green.
1 pint Cheap Molasses. 1 Lemon. 7 pints Water.

Mix to form a dry mash and scatter around field to kill cut-worms, army worms and grasshoppers.

FRESH HELLEBORE.

Dust on the plants, or mix with water, 1 oz. in 2 gals. and spray. For currant-worm and other sawfly larvae.

DRY LIME-SULPHUR.

Winter Spray.

12 lbs. dry Lime-Sulphur. 50 gals. Water.

Summer Spray.

3 lbs. Lime-Sulphur. 50 gals. Water.

LIQUID LIME-SULPHUR.

Winter Spray.

1 part Lime-Sulphur. 9 parts Water.

Summer Spray.

1¼ to 1½ parts Lime-Sulphur. 50 parts Water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

CORROSIVE SUBLIMATE.

1 ounce in 10 gals. water, poured around cabbage plants to prevent injury from cabbage root maggot.

DUST MIXTURES.

Sulphur 85%, lead arsenate 15% (or sulphur 90%, lead arsenate 10%), is used to dust apple orchards for fungous diseases and chewing insects. To kill sucking insects add 2% of nicotine. Copper sulphate 15% to 25%, hydrated lime 80%, and calcium arsenate 5% to 25%, is used successfully in some localities on vegetables but is likely to russet apples. Plain sulphur is used in peach orchards. These dusts can be purchased, mixed ready for use.

LINSEED OIL EMULSION.

1 gal. raw Linseed Oil. 1½ lbs. Soap Flakes. 1 gal. Water.

Dissolve flakes in water; stir in linseed oil and dilute to 100 gals.

NICOTINE SOLUTION.

½ pint of a 40% nicotine sulphate solution in 50 gals. water. Dissolve and add 2 lbs. Laundry Soap or 1 lb. Calcium Caseinate for a spreader. Excellent for killing aphids and other sucking insects.

KEROSENE EMULSION.

2 gals. Kerosene. 1 lb. Common Soap. 1 gal. Water.

Dissolve the soap in hot water, add the kerosene, and churn together with pump until a white creamy mass is formed, which thickens on cooling. Dilute *nine* times before using for most aphids, but may be used stronger or weaker.

MISCIBLE OILS.

Mix 1 part of "Scalecide," "Jarvis Compound," "Target Scale Destroyer" or other miscible oils with 15 parts of water, to kill San José scale, especially on old apple trees.

COMMON LAUNDRY SOAP.

Spray 1 lb. dissolved in 8 gals. water upon foliage to kill red spider, aphids, and other sucking insects. Soap flakes may be used in half this quantity.

CARBON DISULPHIDE.

To kill insects infesting stored grain, in tight bins, use 1 lb. for about 100 cubic feet of space. Expose for about 36 hours at 60° F. or higher.

CARBON DISULPHIDE EMULSION.

10 parts (volume) Carbon disulphide. 1 part (volume) Cold water soluble rosin fish oil soap. 3 parts (volume) Water.

Churn the soap and water to obtain an even mixture. Then add carbon disulphide and churn about two minutes until the mixture emulsifies as indicated by change in color and a creamy liquid is formed. Dilute 200 times when using and apply one quart per square foot. To kill insects in soil without injuring vegetation.

PARADICHLOROBENZENE.

A granular solid chemical which gives off fumes fatal to insect life. Has recently been used successfully to control the peach borer. Also called "Krystal gas," "Paradichloride," "P. C. Benzene," etc.

NAPHTHALENE.

Used in the form of moth balls and "flakes" to keep clothes moths out of clothing. "Flakes" scattered around the borders of floors and shelves will drive away ants.

CALCIUM CASEINATE SPREADERS.

1-2 lbs. in 100 gals. acts as a spreader and prevents chemical reactions, where different materials are mixed together.

FORMALIN FLY POISON.

1 tablespoonful Commercial Formalin. ½ cup Sweet Milk. ½ cup Water.

Mix and expose in a shallow plate with a slice of bread in it. Flies will drink the liquid, especially if no other moisture is accessible, and be killed.

ANT POISON.

Arsenate Soda 125 grains. Sugar 1 pound. Honey 1 tablespoonful. Water 1 quart.

Add arsenate soda and sugar to water. Boil until both are dissolved, then add honey. When cool, place in shallow dishes with a crust of bread or bits of sponge.

HYDROCYANIC ACID GAS.

1 oz. Sodium Cyanide. 2 ozs. Sulphuric Acid. 4 ozs. Water. For each 100 cu. ft. space.

For fumigating dormant nursery stock or buildings, place the acid and water in an earthen jar in the house, drop in the cyanide and close the house at once for half an hour. Ventilate for ten minutes before entering. In greenhouse use 1 oz. of cyanide for each 1000 cu. ft. of space; avoid sunlight; excessive moisture; driving winds. Fumigate, between 52° and 70° F. Calcium Cyanide in granular form may now be obtained for killing grubs, wireworms and ants in soil; and in form of dust for killing aphids and other sucking insects. Caution! Breathing the fumes will cause death.

FORMULAS FOR COMMON FUNGICIDES.

LIQUID LIME-SULPHUR.

Winter Spray.

1 part Lime-Sulphur. 9 parts Water.

Summer Spray.

1¼ to 1½ parts Lime-Sulphur. 50 parts Water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

DRY LIME-SULPHUR.

There are now on the market several forms of dry lime-sulphur or similar fungicides, that because of convenience in shipping and handling are replacing somewhat the more bulky liquid fungicides. Where experience has shown that spray injury does not result from their use, they may be substituted for the latter. Use according to directions given by the manufacturers.

SELF-BOILED LIME-SULPHUR.

8 lbs. Fresh Whitewash Lime. 8 lbs. Fine Sulphur. 50 gals. Water.

Start the lime slaking, sift and thoroughly stir in the sulphur, using just enough water to prevent burning and allow to boil from heat of lime for fifteen minutes. Then dilute and apply.

A very excellent substitute for this fungicide on peaches is the commercial article called "Atomic Sulphur," without lead arsenate, used at the rate of 5 lbs. to 50 gallons water.

DRY MIX.

8 lbs. Sulphur. 4 lbs. Hydrated Lime. 1 lb. Casein Spreader. 50 gals. Water.

Mix thoroughly together the first three ingredients and add to the water when needed. This fungicide is being used more and more in this state as a peach spray.

SULPHUR DUST.

Dusting with special grades of very fine sulphur, about 90 parts thoroughly mixed with 10 parts lead arsenate for apples and 80 parts sulphur and 20 parts air-slaked lime for peaches, or with special material prepared by manufacturers, has attained some prominence as a combined fungicidal and insecticidal treatment for fruit trees. Experience so far in this state seems to show that such treatment is much more effective in controlling insects than fungous troubles of the apple. Good results in controlling peach scab and fair results for brown rot have been obtained. Dusting is much quicker and so cheaper as regards labor, but the cost of the material used is considerably greater.

COPPER DUSTS.

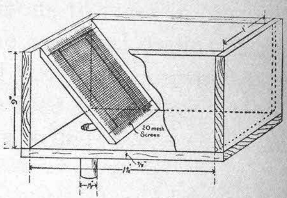
There are now on the market certain commercial dusts containing lime and copper sulphate that combine to form a Bordeaux mixture when in contact with moisture on the leaves. These are coming somewhat into use for certain diseases where dusts can be used to better advantage, so far as mechanical application is concerned, than can Bordeaux mixture. They have been used in this state with more or less success on apples, potatoes and especially on celery. On apples russeting, as with Bordeaux mixture, is likely to result.

BORDEAUX MIXTURE.

4-5 lbs. Copper Sulphate (Blue Vitriol). 5-6 lbs. Fresh Lime. 50 gals. Water.

For small acreage. Dissolve the copper sulphate in hot water. Slake the lime and strain through coarse cheese-cloth. Dilute each separately to 25 gallons. Pour together slowly through a strainer into the spray barrel.

For large acreage. Make stock solutions of copper sulphate and lime as follows: Dissolve 40-50 pounds of copper sulphate in 50 gallons of water, by suspending in a bran sack. One gallon of stock solution thus contains about one pound of copper sulphate. Slake 50-60 pounds of lime, strain into a barrel and make up to 50 gallons. A gallon of this solution contains at least one pound of lime. The excess takes care of waste in slaking. Put two 50-gallon dilution barrels on a platform so that the sprayer can be backed under them. For a 100-gallon sprayer put 10 gallons of stock lime mixture into the lime barrel and 10 gallons of stock copper sulphate solution into the copper sulphate barrel. Dilute each to 50 gallons. By using a molasses spigot for each barrel, the two streams may be run together through a trough into the sprayer. A large, fine wire strainer should be set in the sprayer opening. Lead arsenate, Paris green, or nicotine solution may be added if needed. Hydrated lime is handy to use, but Bordeaux made with it is said by some not to adhere so well and to be more likely to injure apple foliage.



TYPE OF STRAINER RECOMMENDED FOR SPRAY MATERIALS

Some growers get good results with the following method: Start filling the sprayer with water, washing in at same time 10 gallons of the stock lime mixture through the strainer. When half full, add the 10 gallons of stock copper sulphate solution with the remaining water, stirring meanwhile. When short handed, this method saves time. Half these amounts are used for a 50-gallon sprayer.

FORMALIN.

A. 1 pt. (1 lb.) formalin in 50 gals. water, for sprinkling grain to kill smut. See Smut under Oats. Wet sprinkle. Or better:

B. 1 pt. undiluted formalin is *sprayed* directly on 50 bushels of grain as it is shoveled over and then heaped in a pile and covered for four hours. Dry sprinkle.

C. 1 pt. formalin in 30 gals. water; soak uncut tubers 1 hour to prevent potato scab.

D. 1 pt. formalin in 12½ gals. water, for soil treatment. Use one-half to 1 gal. for each square foot of surface treated; cover for 24 hours after treatment; air afterwards and stir soil; allow 7-10 days before seeding and 10-14 days before transplanting in this soil.

CORROSIVE SUBLIMATE.

4 ozs. Corrosive Sublimate. 30 gallons Water.

Dissolve the corrosive sublimate in a small amount of *hot* water and then dilute. Soak uncut seed potatoes in this for ½ to 1 hour. After each treatment renew strength by adding 1 oz. of corrosive sublimate and water as needed to retain the 30 gallons. Use in wooden containers and mark *Poison.* Good for both scab and black scurf.

FORMULAS FOR LESS-USED FUNGICIDES.

OTHER BORDEAUX MIXTURES.

Dilute Bordeaux Mixture. Use 1 lb. copper sulphate, 4 of lime, and make as above directed. For second and third sprayings of apples to lessen russeting of the fruit.

Resin Bordeaux Mixture. Melt 5 lbs. resin with 1 pt. fish oil, cool slightly, add 1 lb. soda lye, stirring. Add 5 gals. water and boil till the mixture will dissolve in cold water. Mix 2 gals. with 48 of Bordeaux mixture. Used sometimes on such glaucous plants as asparagus, cabbage, onions, etc., to make a more adhesive spray.

SPREADERS.

Certain commercial forms of casein are now on the market and can be used in Bordeaux mixture as a spreader instead of the preceding.

COPPER SULPHATE.

2 to 3 lbs. Copper Sulphate. 45-50 gals. Water.

Used chiefly as a winter spray. 1 lb. to 250 gals. water is sometimes though rarely used on foliage.

POTASSIUM SULPHIDE.

3 ozs. Potassium Sulphide. 10 gals. Water.

Used chiefly in greenhouses, or for powdery mildews.

FORMALIN FUMES.

3 pts. Formalin. 23 ozs. Potassium Permanganate.
For each 1000 cu. ft. Space.

Place bulbs or tubers in 6 to 12 in. crates so fumes can get at them. To prevent injury to potatoes, fill space at rate of 167 bu. Place formalin in large pail in cleared central space and drop in the crystals of potassium permanganate. Close room air-tight for 24 to 48 hours.

INSECTS AND THEIR INJURIES TO PLANTS.

Insects are small animals belonging to the class Hexapoda (six-legged) and most of them have six legs in some stage of their existence. Spiders, mites, sow bugs, centipedes and millipedes are animals but not insects and all but certain mites have more than six legs. Insects may be divided roughly into two groups: (1) chewing or biting insects, and (2) sucking insects. The chewing insects (except termites or white ants, and grasshoppers and crickets) have four distinct stages in their life cycles, as follows: (1) egg, (2) caterpillar, grub or larva, (3) pupa, (4) adult insect. Such insects are said to have complete transformations. The exceptions noted above and the sucking insects do not pass through these four well-marked stages. There is usually, though not always, an egg stage, and an adult stage, but there is no pupa (except in case of the males in certain species of scale insects and white flies) and the larvae are called nymphs after hatching from the eggs, and undergo a gradual development, molting several times with only slight changes until the adult stage is reached.

Chewing or biting insects have strong jaws or mandibles with which they bite or tear off bits of food like the higher animals. Such insects swallow their food and here is where an arsenical poison can be employed with success. This class includes all caterpillars, beetles, sawflies, grasshoppers and crickets.

Sucking insects puncture the tissues with their beaks or probosces and suck out the sap for food. Such insects cannot be killed by applying arsenical poisons to plants but must be treated with dusts or contact sprays which will suffocate them and corrode their tissues. Aphids, scale insects, leafhoppers and all plant bugs belong to this class.

Never Spray Fruit Trees When in Bloom. The application of lead arsenate or other arsenical poisons to trees in blossom may do much harm (1) by injuring the essential organs of the flowers, so that fruit will not set, and (2) by killing many of the bees which carry pollen from one tree to another. If all honey bees and native wild bees were killed, there would be little or no set of fruit.

Spraying Versus Dusting. Six years' experiments in Connecticut show that in apple orchards, spraying gives a larger percentage of good fruit than dusting and is less expensive. Dusting gives fairly good control of insect pests but does not hold fungous diseases in check like spraying. Dusting has given as good results as spraying in controlling scab and brown rot on peaches. It is probable that dusts can be used to advantage on low growing vegetable crops, where spraying is impracticable.

Safe Combinations of Sprays. It is safe to mix lead arsenate with lime-sulphur, Bordeaux and nicotine, but none of these should be combined with miscible or other oils. It is also unsafe to use soap with lead arsenate.

FUNGI AND THEIR DISEASES OF PLANTS.

Nature. Fungi are the lowest forms of plant life. They differ from all other plants in lacking the green coloring matter, characteristic of leaves, known as chlorophyll. Lacking this they cannot manufacture from water, gases and the chemical constituents of the soil, their food. This they must obtain in an organized form from products of living or dead plants or animals. If from the living, they produce disease as a result and are called parasites; if from the dead, they merely produce decay and are called saprophytes.

Stages. Fungi consist of two stages: a **mycelium** or vegetative stage that has to do with gathering their food, and spores that perpetuate their existence the same as the seeds do the flowering plants. The vegetative stage is usually inconspicuous and often not visible to the naked eye, as it consists of microscopic branched threads that ramify through the substratum or host, on which it occurs, in search for food. There is comparatively little difference in the appearance of the mycelia of different fungi, hence the necessity of seeing the spores for identification.

The **spores** are formed on or near the surface of the host and are much more conspicuous and differentiated especially as seen under the compound microscope. Mushrooms and shelf fungi are the largest fruiting forms. Smuts and rusts form dusty or granular outbreaks; mildews produce a powdery or downy growth on the infected surfaces; other fungi may have more or less inconspicuous spore stages on the conspicuously injured tissues that show as spots, cankers, etc. Each fungus may have more than one kind of spores, but only one corresponds directly to the seed of the flowering plant in that it is the result of fertilization of the sexual elements, the other kinds being of an asexual nature such as buds, tubers, runners, etc., in plants. Some spores are temporary and are merely useful in quickly spreading the fungus over the host or to new ones. Other spores are more hardy and serve to carry the fungus over unfavorable periods, such as winter. With the rusts, not infrequently, certain spore stages occur as parasites on one host and others on an entirely different host species, thus greatly complicating the life history of the fungus.

Infection. In any case the spores give rise to new individuals by germinating into threads that by later growth form the mycelium. With parasitic forms this germ tube or thread must penetrate in some manner into the living tissues of its host in order to gain the food necessary for its growth. All preventive treatments of fungous diseases by spraying are based on killing the spores that are carried to the susceptible parts of the plants before they can gain entrance by their germ tubes into the tissues. Once inside, the mycelium is no more injured by the spray than the plant tissues on which it is placed. This makes it necessary to protect the tissues by repeated and thorough spraying as long as there is danger of the fungus gaining entrance. It also means that the fungicide must be able to kill the spores or their germ tubes but cause no injury to the plant tissues.

INSECT AND FUNGOUS PESTS OF CULTIVATED PLANTS.

Insects, etc.

ALFALFA.

Aphids—Green and pink aphids suck sap from leaves and stems occasionally ruining crop. Prompt cutting is one method of killing them.

Fungi.

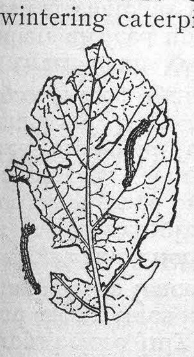
Downy Mildew—Forms a grayish growth on the young shoots and the under sides of the leaves, causing the tissues to turn brown or purplish and finally die. Develops in wet seasons where the plants make a rank growth. As yet rare in this state and so not serious.

Leaf Spot—Becomes common on the leaves, first showing as small brownish-purple spots; when abundant causes the leaves to turn yellow and drop off prematurely; in wet seasons often serious. No efficient remedy. Mow early rather than late. If possible secure seed from disease free fields and when fields become badly infected start new ones.

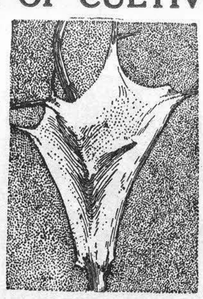
Insects, etc.

APPLE.

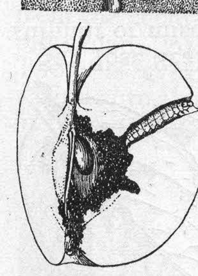
Bud-Moths: Case Bearers: Leaf Crumpler:—Small overwintering caterpillars feed upon the unfolding leaves. Spray with lead arsenate as soon as leaf buds begin to open. Repeat a few days later, if necessary. Rept. 1909, p. 353.



Canker-Worms—Small loopers devour the leaves in May and spin down on threads when disturbed. Spray with lead arsenate before blossoms open, and again soon after they fall. In unsprayed orchards place sticky bands around trunks of trees in October, keep sticky until January 1st, and again keep sticky during April and May. Rept. 1908, p. 777.

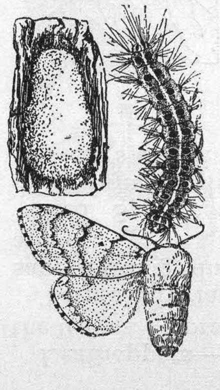


Tent-Caterpillar—During May the caterpillars form nests at the forks of the branches, and devour the leaves. Clip off and burn egg-masses on twigs in winter. Remove nests with caterpillar brush. Spray with lead arsenate once before blossoms open and again soon after they fall. Bull. 177, and Rept. 1913, p. 226.



Lesser Apple-Worm—Larva feeds on exterior of nearly mature fruit, and often causes injury in storage. Spray twice as for codling-moth. Keep foliage and fruit covered until fruit is nearly grown. Rept. 1910, p. 595.

Codling-Moth or **Apple-Worm**—Pink caterpillar tunnels inside the fruit, especially around the core. Spray with lead arsenate as soon as the blossoms fall. Repeat three and six weeks later. Rept. 1910, p. 594.



Brown-Tail Moth: Fall Web-Worm—See Pear.

Gipsy Moth—Brownish hairy caterpillars defoliate trees in May and June. Band trees with tanglefoot and spray foliage with lead arsenate. From August to May soak egg-masses with creosote. Bull. 186; Repts. 1905, p. 246; 1906, p. 235; 1907, p. 300.

Curculios—Grubs of both apple and plum curculios infest the fruit, making it gnarled and ill-shaped. Spray with lead arsenate as soon as blossoms fall, and again a week later.

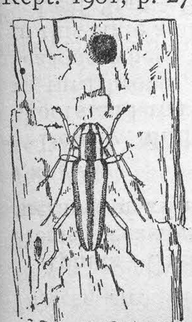
Repeat two weeks after blossoms fall. Destruction of early drops before July 1, from apple and neighboring peach, plum and cherry trees is important. Remove infested fruit in thinning. Keep fence rows clear of trash. Rept. 1904, p. 219.

Apple and Thorn Skeletonizer—Small spotted larvae feeding in web skeletonize upper surface of leaves. White pointed cocoons formed on leaves. Purplish moths fly about and rest on flowers. Three broods each season. Unsprayed apple trees brown in June and August. Spray with lead arsenate middle of May, first of July and middle of August. Rept. 1920, p. 190; 1921, p. 186; Bull. 246.

Green Fruit Worms: Palmer Worm: Leaf Roller—Caterpillars all feed upon foliage and immature fruit. Spray with lead arsenate, as for codling-moth.

Tussock Moths—Tufted caterpillars of several species feed upon the leaves in mid-summer. Spray with lead arsenate as for codling-moth. Rept. 1905, p. 230; 1907, p. 332; 1916, p. 105; 1917, p. 325.

Yellow-necked Caterpillar: Red-humped Caterpillar—Feed in clusters and often strip young trees in fall. Hand-picking is easy method of control. Spray leaves with lead arsenate. Rept. 1901, p. 274; 1917, pp. 328, 329.



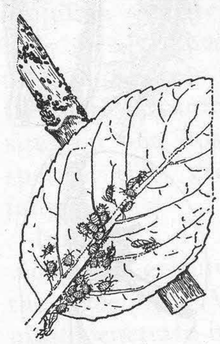
Maggot or **Railroad Worm**—Maggots tunnel through the pulp of the ripening fruit of sweet and sub-acid varieties, especially those ripening early in the season. Destroy all infested fruit. Spray as late as July 15 with lead arsenate to kill adult flies. Rept. 1910, p. 593.

Round-Headed Borer: Flat-Headed Borer—Grubs burrow in wood at base of trunks. Watch trees and dig out borers wherever sawdust appears. Paint trunk with lead arsenate and lime-sulphur. Rept. 1907, p. 333.

Leafhoppers—Whitish insects sucking sap from under side the leaves. Spray with nicotine solution, as for aphids.

Tarnished Plant Bug—Injures developing fruit by sucking sap, forming dimples. Spray or dust with nicotine as for aphids.

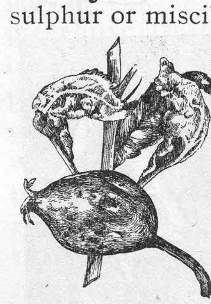
Red Spider: Clover Mite: European Red Mite—Cause much injury to leaves, especially in dry seasons. Overwintering eggs killed by spray of miscible oils about April 1st. Spray in May and June with lime-sulphur or strong soaps.



Leaf-Blister Mite—See Pear.

Green and **Rosy Aphids**—Green aphids suck sap from the leaves and terminal shoots, causing leaves to curl and checking growth. Rosy aphids infest fruit clusters, checking development. Use delayed dormant spray with nicotine solution (½ pint in 50 gallons water), either separately or with lead arsenate, lime-sulphur or Bordeaux mixture. Dust with nicotine. Repts. 1903, p. 259; 1909, p. 343.

San José Scale—See Peach. Spray dormant trees with lime-sulphur or miscible oil. Bull. 165; Rept. 1904, p. 221.



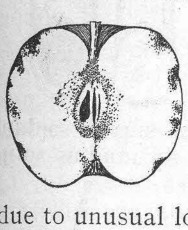
Red Bugs—Two species of red leaf bugs suck the sap, causing leaves and fruit to become distorted. Spray with nicotine solution, as for aphids, or dust with 2% nicotine. Rept. 1917, pls. II-III.

Woolly Apple Aphis—A bluish-white, cottony plant louse in colonies on bark, forming galls or swellings on twigs of small trees, and preventing wounds from healing; also on roots, forming galls, and destroying

small feeding roots. Plant only clean or fumigated stock. Soak soil with carbon disulphide, ½ ounce in 4 gals. water. Spray above ground with kerosene emulsion.

Oyster-Shell Scale: Scurfy Scale—Scale insects with elongated or pear-shaped shells, on bark, suck sap from the twigs; the former about the same color as the bark, the latter light gray or whitish. Spray with nicotine solution; soap and water; or kerosene emulsion, about the second week in June. Bull. 143; Rept. 1903, p. 225.

Fungi, etc.



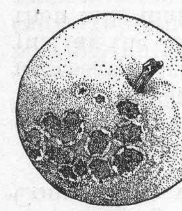
Baldwin Spot—Shows as small diseased masses of brownish tissue, usually a short distance beneath the skin; finally may appear at the surface as small, discolored, shrunken areas, then very similar in appearance to some of the fruit speck troubles. Not a fungous disease. Thought by some to be due to unusual local loss of water; similar troubles may start from punctures of rosy aphids or other puncturing insects. No definite remedy known; spray to keep down sucking insects.

Cankers—Occur on branches and are caused chiefly by European canker fungus which eventually forms a cavity surrounded by concentric elevated rings of wood extending to bark. Cut off infected branches, or cut out infected wood and bark; paint over cut surfaces. Keep orchard well sprayed and trimmed. Rept. 1903, p. 299.

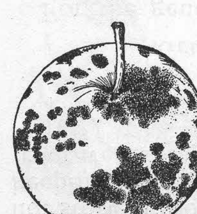
Black Rot—Causes mature fruit to turn brown, then black; forms small brown spots on leaves; does some damage through cankers on branches, which are eventually killed. Treat as for scab; prune and burn all dead limbs and twigs; cut out and paint over large cankers when found. Rept. 1909-10, p. 590.

Fruit Specks—Appear as more or less numerous, small, brown or black spots, starting at surface of fruit and slowly working inward; the Brooks fruit spot often has a pinkish border in light-skinned varieties. Usually controlled by the late sprayings in June and July. Rept. 1909-10, p. 590.

Rust—Shows as orange-colored blotches on leaves, eventually producing minute fringed clustered cups imbedded on the under side; less frequent on fruit. Rust spreads to the apple from the **cedar-apples,** which appear in the early spring on the red cedar. All cedars near the orchard should be destroyed. There is great difference in the susceptibility of different varieties to this disease. Spraying is only partially successful in this state. Repts. 1891, p. 161; 1909-10, p. 591.



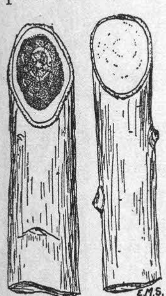
Scab—Produces "scabby spots" on fruit and leaves; rarely on twigs. Give the pre-pink and pink sprays before the blossoms open, another after the petals fall, and follow with one, two, or more, at intervals of three weeks. For first treatment, use strong Bordeaux, for others, weak Bordeaux or lime-sulphur or better still the latter for all treatments. Rept. 1909-10, p. 591.



Sooty Blotch—Forms on fruit an olive-black superficial growth in distinct round colonies, often merging together. Spray as for scab, with lime-sulphur, 1½ to 50. The sprayings after blossoming, as for the fruit specks, are the more important. Rept. 1909-10, p. 592; 1911, p. 367.

Blight—See Pear. Not so serious on apple in this state as on pear. Doubtful if control measures for apple are practical here in most cases.

Spray Injury—Takes the form usually of burn on leaves and russeting on fruit. Is most likely to occur after later sprayings. Worst in wet seasons with Bordeaux and in warm seasons with lime-sulphur. Drenching the trees with high pressure apparatus is apt to produce injury. Spraying in bright sunshine may cause some scorch on fruit on sunny side. Varies greatly with different sprays. Avoid those known to be injurious or injurious combinations (as soap and lead arsenate); use Bordeaux if at all only for **first** summer treatment or on varieties not especially subject to russeting. Liquid or dry lime-sulphur is now the fungicide most commonly used on apples in this state. Rept. 1911, p. 360.



INJURED HEALTHY

Winter Injury—Takes various forms from different conditions, such as: imperfect fertilization or russeting of fruit following late spring frosts; sun scorch of trunks due to mild winter weather followed by sudden cold; bud and twig killing, frost cracks in trunks, blackened wood, dead roots, etc., following unusually cold winters or unfavorable environment. Set out only hardy varieties; avoid planting in wet ground or on hillsides with extreme south or southwest slopes. Head trees low; avoid late fertilization and cultivation; keep earth tight around trunks; use cover crops. Repts. 1903, p. 303; 1906, p. 310; 1914, p. 6.

Storage Rots—Are troubles caused by a variety of fungi. Store fruit, in a dry condition, in a cool, well-aired place. Do not store in too deep piles or too tight receptacles. Use poorer keeping varieties first, and sort over if necessary. Apples from well sprayed trees keep best. Rept. 1915, p. 426.

General Treatment for Apple Orchards.

For the general control of fungi and insects on apples in Connecticut we make the following recommendations:

(1) Dormant (winter) treatment is necessary in the presence of red mite, San José scale and leaf blister mite. Use liquid lime-sulphur 1-9, or miscible oil 1-15; the latter is necessary for red mite control. The lime-sulphur is best used just as the leaves begin to show ("Delayed Dormant") as it then kills many aphids and may lessen scab infection. Miscible oil must not be applied later than when buds begin to swell or injury will result.

(2) Make at least three summer treatments with a fungicide and insecticide as follows:—

1. Pink spray, when blossom buds show pink.
2. Calyx spray when petals fall.
3. Young fruit spray three to four weeks later.

For scab control a pre-pink treatment is necessary to be applied between delayed dormant and pink. For control of sooty blotch, Brooks' fruit spot and often scab an additional treatment three to four weeks after No. 3 is required. This treatment is also necessary to control apple maggot, late codling moth and green fruit worms. The calyx spray is the most important to control codling moth.

(3) For a fungicide we recommend liquid lime-sulphur at the rate of 1¼ to 1½ gallons to 50 gallons of water, or dry lime-sulphur at the rate of 3 lbs. to 50 gallons of water, for all summer treatments. In case of severe scab infection Bordeaux mixture 1-4-50 may be used at the pre-pink and pink sprays without much danger of injury to the fruit but this practice is not in general use. In case one desires to dust, a sulphur dust is preferable to a copper dust.

(4) For the insecticide in the above, use lead arsenate, if in the paste form at the rate of three pounds per fifty gallons of the mixture, or if in the powder form one and one-half pounds per fifty gallons.

(5) If canker worms, tent-caterpillars, bud moths or browntail moths are causing damage, add lead arsenate to the first summer treatment; if not it may be omitted but should be included in each of the later treatments. Nicotine solution may be added to the pre-pink treatment for aphids and to any of the subsequent treatments to destroy aphids, red bugs, tarnished plant bugs, etc.

ARBOR-VITAE.

Insects.

Leaf-miner—The larva of a small moth mines the leaves causing them to turn brown. Spray heavily with nicotine sulphate solution the first week in June to kill adults and their eggs. Rept. 1921, p. 157.

Fungi, etc.

Browning—Shows especially through the older inner leaves turning brown and falling prematurely in late summer or fall. As there often remain only the leaves of the current year's growth the tree eventually presents a scanty healthy foliage; the brown leaves before they drop give the appearance of a serious fungous disease. Due to dry summers followed in some cases by winter injury. Not a progressive trouble and so finally not usually serious.

ASH.

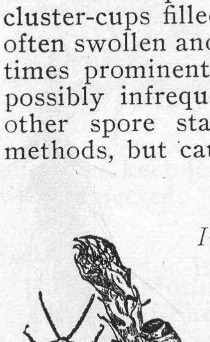
Fungi.

Anthracnose—Causes large brown areas to appear suddenly in late spring or early summer on the leaves which may soon wither up much as if sun scorched. Usually infrequent. If feared, spray as for anthracnose of sycamore.

Rust—Occurs commonly on blades and petioles of leaves, and less frequently on the green twigs and fruit, as small cluster-cups filled with orange spores. The plant tissues are often swollen and distorted. Variable in its occurrence, sometimes prominent and wide-spread and the next year or two possibly infrequent or absent. Said to spread to ash from other spore stage on marsh grass. No efficient control methods, but causes little permanent injury to the trees.

ASPARAGUS.

Insects.

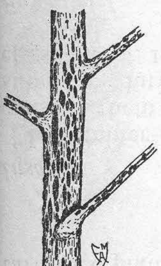


Asparagus Beetles, Common and **12-spotted**—Adults and larvae devour the foliage. Cut everything clean during the cutting season; afterward spray with lead arsenate and calcium caseinate. Rept. 1921, p. 171.

Asparagus Miner—Larvae tunnel under epidermis of stem near base, causing premature death of plant above ground. Burn infested stalks. Rept. 1906, p. 303.

Fungi, etc.

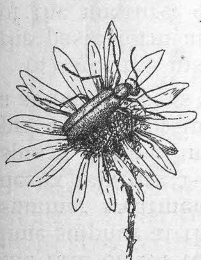
Frost Rot—Shows as rotting shoots here and there in the field, which have been previously injured by severe late frosts. Nothing need be done as the trouble is not progressive despite the presence of fungi causing the final decay.



Rust—Produces small reddish or black elongated pustules scattered over stems. In fall, carefully gather and burn all stems from affected beds and escaped plants in vicinity. In gathering for market cut below the ground, as protruding stems offer opportunity for development of first stage of the fungus. Spraying with resin Bordeaux partially controls the disease, but is seldom practiced now. Begin spraying the latter part of July and repeat about every 10 days until the middle of September. Thorough cultivation and fertilization, with plenty of humus in the soil, are advocated as beneficial. Grow varieties most resistant to the disease. This disease is not so serious as it was some years ago partly because more resistant varieties are now grown. Repts. 1896, p. 281; 1904, p. 313.

ASTER.

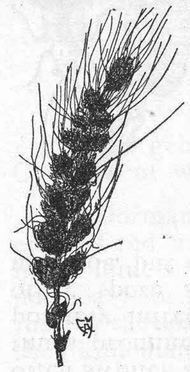
Insects.



Blister Beetles—Three or four species feed upon the flowers, the black one being commonest. Hand-pick and cover choice plants with mosquito netting. Bull. 208, p. 110.

Fungi, etc.

Yellows—Shows in the yellowed and often imperfectly developed foliage and one-sided blossoms. A physiological trouble; the cause is not definitely known. Buy best seed; transplant only healthy plants; have soil conditions good; keep down leafhoppers. Repts. 1903, p. 306; 1914, p. 413 (26).



BARLEY.

Insects.

Army Worm—See Grass.

Fungi.

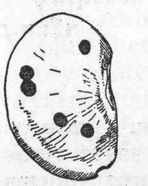
Rusts—See Oats and Wheat.

Smuts—Are of two kinds, covered and loose, both largely destroying the infected spikes and changing them into black, sooty structures, in the latter kind easily dissipated. Treatment, see Oats. Rept. 1903, p. 306.

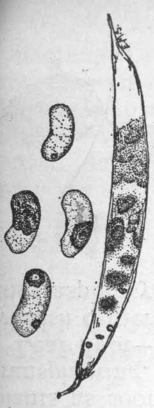
BEAN.

Insects.

Green Clover Worm—Occasionally green, wriggling caterpillars riddle the leaves in June and July. Dust string beans with air-slaked lime or other fine powder. Spray shell beans with lead arsenate. Repts. 1908, p. 828; 1919, p. 165.



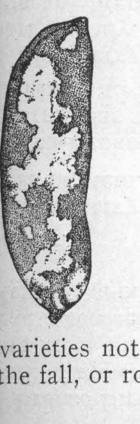
Weevils—Adults lay eggs in the pods in the field and continue to breed in the dried seed, finally rendering it unfit for food or for planting. Fumigate the seed with carbon disulphide as soon as harvested, store in air-slaked lime, or heat in oven for 1 hour between 120° and 150° F. Bull. 195, p. 6.



Fungi, etc.

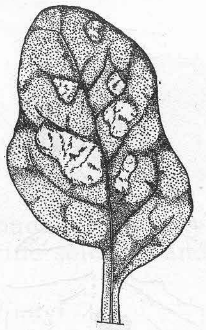
Anthracnose—Shows on leaves and pods as roundish discolored areas, often with a purplish border. Save seed from pods showing no spots, and plant these by themselves, selecting each year seed from unspotted pods for the seed crop and using remainder for general crop. Destroy all infected seedlings. Where very troublesome spray with Bordeaux, beginning when plants are only a few inches high and repeating about every 10 to 14 days until pods are formed. Rotation and destruction of old vines may prove helpful in keeping the trouble in check.

Blight—Appears much like anthracnose, but with discolored areas having more of a translucent or watery character. Treat same as for anthracnose. Repts. 1898, p. 262; 1903, p. 307.



Downy Mildew—Forms dense, white, woolly growths on pods and less luxuriantly on young stems and leaves of the Lima bean. Serious only in years unusually moist after the middle of July. Plant on well-drained soil. Spray with Bordeaux beginning about the middle of July, and repeat every 10 to 14 days until the middle of September. Rept. 1905, p. 278.

Rust—Produces small, round, reddish or black, dusty outbreaks, usually on the leaves. Plant varieties not likely to rust. Burn the old infected plants in the fall, or rotate. Rept. 1903, p. 308.



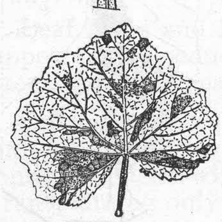
BEET-CHARD.

Insects.

Leaf-Miner—A small fly lays eggs in the leaves, and the larvae tunnel or mine between upper and lower surfaces. Practice clean cultivation. Destroy all infested leaves. Destroy all plants of the weed known as "lambs quarters" in which this insect breeds. Practice late fall plowing.

Fungi.

Leaf Blight—See Mangel. Rept. 1903, p. 309.



BEGONIA.

Eelworms.

Leaf-Blight Eelworm—Produces conspicuous dead areas on the leaves of Begonias (especially var. *Cincinnati*), ferns, etc. Spots vary in size and shape according to host and disposition of larger veins. Buy healthy stock only; keep infected plants by themselves and give them plenty of room; keep leaves as dry as possible and pick off and burn worst infected. Rept. 1915, p. 455.

BIRCH.

Insects.

Tussock Moths—See Apple, Hickory, and Horse Chestnut.

Birch Leaf-Skeletonizer or **Birch Bucculatrix**—Small greenish-yellow larvae feed upon both sides of the leaves in late summer, often entirely defoliating the trees. Spray with lead arsenate (about August 1). Rept. 1910, p. 701.

Birch Leaf-miner—Sawfly larvae mine the terminal leaves of gray birch causing them to turn brown. There are three annual generations and a partial fourth, in Connecticut. Control not investigated. Rept. 1924, p. 340.

Bronze Birch Borer—Grub makes spiral tunnel just beneath bark of upper main branches, ridges showing on outside. Cut and burn infested trees before May 1. Spray foliage with lead arsenate about June 1, and fertilize and water the trees. Rept. 1922, p. 359.

BLACKBERRY.

Insects.

Blackberry Crown Borer—Larva tunnels in roots and at base of stem. Dig out and destroy.

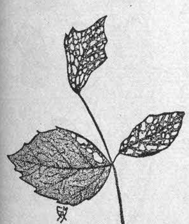
Red-Necked Cane Borer—Larva tunnels in canes causing an irregular swelling or gall, often three inches in length. Cut and burn all infested canes in winter or early spring.

Blackberry Sawfly—Larvae devour leaves in June and first part of July. Spray with lead arsenate when young larvae appear. Rept. 1912, p. 236.

Fungi, etc.

Crown Gall—Forms hard galls or irregular excrescences on roots and lower parts of stem. Dig out and burn affected plants as soon as discovered. Never use infected stock for transplanting. A bacterial trouble. Rept. 1903, p. 354.

Leaf Spot—Shows on leaves as small circular spots with whitish center and purplish border; also occurs on dewberry and raspberry. Not usually serious, but where necessary it can be controlled by Bordeaux applied to the leaves, beginning before they have reached their full size. Rept. 1903, p. 309.



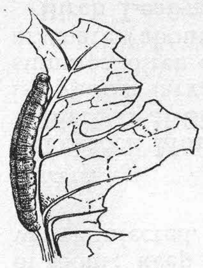
Orange Rust—Breaks out in spring or early summer as dusty masses of bright orange spores over the under side of the leaves. The fungus is perennial in the underground parts. Dig up and burn infected plants. Rept. 1903, p. 309.

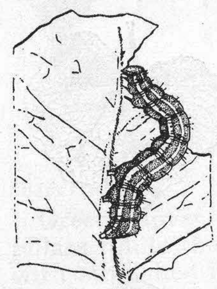
BOX.

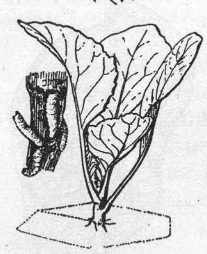
Insects.

Leaf-Miner—A small two-winged fly lays eggs in the leaf and the larvae tunnel between the upper and lower surfaces. Destroy infested leaves. Spray under side of leaves with molasses, 1 part in 3 parts water.

Oyster-Shell Scale—See Apple.







CABBAGE-CAULIFLOWER.

Insects.

Cabbage Worm—Green worms feed upon leaves all through season. Spray or dust unheaded plants with lead arsenate using calcium caseinate in the spray. Use insect powder or hellebore on headed plants. Bull. 190, p. 9; Rept. 1903, p. 271.

Cabbage Looper—Smooth looping caterpillars feed with cabbage worms late in summer, and require same treatment. Bull. 190, p. 12; Rept. 1910, p. 706.

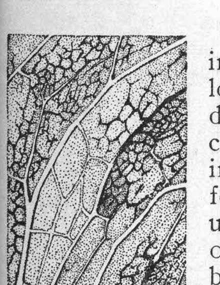
Cabbage Aphis—Sucks sap from the leaves. Make heavy applications of nicotine dust. Bull. 190, p. 14; Rept. 1924, p. 319.

Cabbage Maggot—Infests stems of early-set plants near surface of ground, checking growth and often killing them. Practice crop rotations. Place hexagonal tarred paper disks around stems at setting time. Treat with carbolic acid emulsion or with corrosive sublimate. Bull. 190, p. 3; Repts. 1908, p. 832; 1914, p. 142; 1915, p. 114.

Fungi, etc.

Bacterial Leaf Spot—Shows as small, blackish, angular spots or specks on the leaves especially of the cauliflower. When abundant causes yellowing and premature death of the infected leaves. Watch the seed beds for signs of infection. If prominent in the field, next year treat the seed (see Black Rot) and spray the seedlings with Bordeaux mixture.

Black Leg—Causes cankered and finally black areas especially at base of the stem of young plants which later in the field often rot off or fail to make heads. Select only apparently healthy seedlings for transplanting and if this fails treat as for Black Rot another year.



Black (Bacterial) Rot—Forms black lines in veins of leaves. In time leaves turn yellow and easily drop off, and interior of head develops a general soft rot. As the germs can be carried on the seed, avoid seed from infected fields. If in doubt, treat seed in formalin, 1 part to 240 of water for 15 minutes. Keep refuse from diseased plants out of manure; practice rotation; make seed bed in new soil if disease appears in old one. Rept. 1912, p. 345.

Club Root—Causes knob-like enlargements on the roots of cabbage and allied plants. The germ often becomes established in the soil; avoid such land and the use of refuse from old plants on the soil. Be especially careful that the seed bed is not infected. Infected land, if used, should be treated in the fall with lime broadcast at the rate of 80 bushels per acre and worked in. Rept. 1903, p. 310.

Soft Rot—See Salsify. Rept. 1903, p. 311.

CARNATION.

Insects.

Green Fly or **Aphis**—Sucks sap from young leaves and buds. Fumigate greenhouse with tobacco, or spray with nicotine solution and soap, or with soap and water.

Fungi.

Leaf Mold and **Leaf Spot**—Are two troubles much alike in appearance, producing grayish spots with colored borders on stem, leaves and calyx. Treat as for Rust.

Rust—Produces small dusty pustules, more or less confluent, on the leaves and stems. Select rust-resisting varieties. Spray in field with Bordeaux, adding spreader. Select for transplanting only hardy and rust-free specimens. Keep air of greenhouse dry. Give one or two sprayings with Bordeaux, after transplanting in greenhouse; for repeated sprayings use potassium sulphide or weak copper sulphate. Rept. 1903, p. 312.

Stem Rot and **Wilt**—Cause the lower leaves first to turn yellow and dry up; then the stem gradually rots off at its base. Select cuttings only from perfectly healthy plants, and start these in sterilized soil and replant out of doors in new land, avoiding excessive use of manure. If disease appears after setting out in the greenhouse, pull up infected plants upon appearance of first symptoms, make liberal application of lime, avoid over-watering, and see that roots are properly aerated. Repts. 1897, p. 175; 1903, p. 312.

CEDAR.

Insects.

Web-Worm—Small brown caterpillars feed upon the leaves which they web together. Spray with lead arsenate.

Fungi.

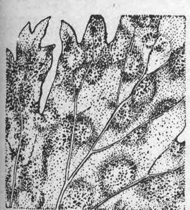
Cedar-Apple Rust—Appears in spring as conspicuous rounded galls with jelly-like horns bearing spores that carry the fungus to apple and related hosts. Cut off and burn all *cedar-apples* if undesirable to destroy the trees. See Apple Rust.

CELERY.

Insects.

Celery Caterpillar—Feeds upon the leaves of celery, parsley, fennel, carrot and parsnip. On the latter two plants lead arsenate may be used. On celery and parsley hand picking is perhaps the best remedy. Rept. 1920, p. 204.

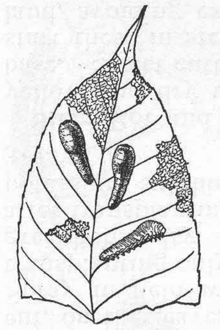
Fungi, etc.



Early and Late Blight—Two diseases showing "rusty" spots on leaves; the latter trouble distinguished by the very minute black dots in the discolored spots (fig.) and often progressing in stalks after storage. Spray the plants thoroughly in the seed bed with Bordeaux, as infected plants are a means of introducing the trouble in the field. Continue the spraying after transplanting at intervals of about two weeks up to the last of September. Some use copper dust instead of the spray. Before covering for bleaching, if leaf spot is abundant give final treatment. Rept. 1897, p. 167.

Soft (Heart) Rot—Shows as a soft rot of the tissues often confined to the heart. Do not plant in too wet soil; avoid land with green cover crops recently plowed in; in banking allow for proper aeration. See Salsify. Rept. 1914, p. 10.

CHERRY.



Insects.

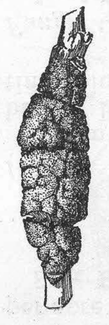
Cherry or **Pear Slug**—Larvae eat away the green tissue from upper side of leaf. Spray or dust with lead arsenate and sulphur. Rept. 1920, p. 199.

Canker-Worms—See Apple.

Cherry Maggots or **Fruit Flies**—Larvae of two species infest maturing fruit. Sprinkle foliage with sweetened lead arsenate in early June to kill the adult flies.

Plum Curculio—See Plum.

Cherry Aphid—A brown aphid which sucks sap from under side of leaves, causing them to curl. Spray with nicotine solution and soap, soap and water, or kerosene emulsion.



Fungi.

Black Knot—Forms knot-like growths on twigs and branches. Plant only trees free from this trouble; in the orchard, cut off and burn all infected branches in late fall or winter, painting over large cut surfaces. Cutting *out* knots is not advisable, as new outbreaks usually result. In cutting off, cut several inches below the knot, to insure removal of diseased tissues. Remove all knots each year until they fail to reappear. Spraying in spring and early summer with self-boiled lime-sulphur or Atomic Sulphur helps to keep new knots from fruiting, but is

entirely secondary in importance to the removal of the knots. Rept. 1911, p. 399.

Brown Rot—See Plum. Rept. 1911, p. 402.

Anthracnose—Shows as numerous, closely placed, purplish spots on leaves, which often have "shotholes." Spraying, if begun on young leaves early in May, is effective. Use self-boiled lime-sulphur or Atomic Sulphur. Give four or five sprayings at intervals of two weeks. Repts. 1895, p. 188; 1911, p. 401.

Powdery Mildew—Develops a cobweb-like growth over the leaves. Usually worst in young trees; controlled by spraying.

CHRYSANTHEMUM.

Insects.

Black Fly or **Aphis**—Sucks the juice from the young leaves and flower stems. Fumigate the house with tobacco; dip the plants in or spray them with soap and water or nicotine solution and soap.

Gall Midge—Larvae form cone-shaped galls on leaves and new shoots. Spray plants about three times each week with nicotine solution and soap. Rept. 1919, p. 161.

Leaf Mite—See Cyclamen.

Fungi.

Powdery Mildew—Develops as a white mealy or cobweb coating on leaves. Air and water carefully, and if necessary spray from time to time with potassium sulphide or paint heating pipes with sulphur.

Rust—Appears as dusty reddish-brown outbreaks, about the size of a pin head, chiefly on under sides of leaves. Avoid susceptible varieties. Start with cuttings free from rust. Destroy rusted leaves, especially on young plants. Early sprayings with dilute copper sulphate or potassium sulphide may help to prevent the trouble from getting a start. Rept. 1903, p. 315.

CINERARIA.

Insects.

Aphis or **Green Fly**—Sucks sap from the leaves and stems. Use nicotine solution and soap, or soap and water, as a spray or dip.

CLOVERS.

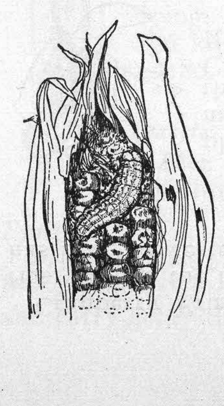
Insects.

Aphids—See Alfalfa.

Fungi.

Powdery Mildew—Appears as a white, somewhat powdery coating over the leaves, especially of red clover, in its summer spore stage only. Recently a wide-spread disease over eastern United States. While common in this state usually not serious as it appears most frequently on escaped plants or secondary growth. As yet no practical control measures.

CORN.



Insects.

Cut-Worms—See Tomato.

Army Worm—See Grass.

Stalk Borer—See Dahlia.

White Grubs—See Grass.

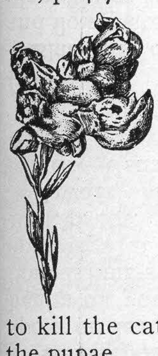
Corn Ear Worm—Eats the immature kernels at the end of the ear. Dust the silk with equal parts sulphur and powdered lead arsenate. Rept. 1921, p. 165.

European Corn Borer—Imported into eastern Massachusetts, New York and Canada and has been found at a few points along the Connecticut coast. Clean-up measures taken. Larvae tunnel in all parts of plant above ground. Destroy all infested plants. Send suspected material to Station. Repts. 1918, p. 316; 1923, p. 277.

Fungi.

Leaf Blight—Kills parts of the leaves in August and September much like an early frost. Most injurious in wet late seasons. Plant early maturing varieties and stimulate growth by good fertilization and cultivation. Rept. 1903, p. 317.

Root and Ear Rots—Injure roots and base of stalk with a reddish-brown rot. Stalks are easily broken off and often fail to produce ears. The ears show moldy, white or pinkish growths. Plant only vigorous disease-free seed, practice yearly rotation and do not let corn follow other grains. Bull. 222, p. 427.



Smut—Forms black dusty outbreaks on various parts of the plant. It is especially injurious to certain varieties of sweet corn. Seed treatment is ineffective.

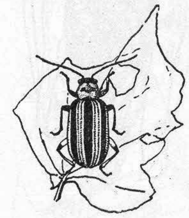
CRANBERRY.

Insects.

Fireworm or **Black-headed Cranberry Worm**—Small, pale green, black-headed caterpillars web the leaves and new shoots together and feed inside the nest. Spray with lead arsenate to kill the caterpillars. Flood the bog for three days to kill the pupae.

Yellow-headed Cranberry Worm—Small, green yellow-headed caterpillars injure plants in same manner as the preceding. Spray with lead arsenate. Keep bogs flooded until about May 20.

Cranberry Fruit Worm—Pale green larvae infest the berries. Flood the bog for about two weeks as soon as the fruit has been harvested. Destroy all infested berries.



CUCUMBERS.

Insects.

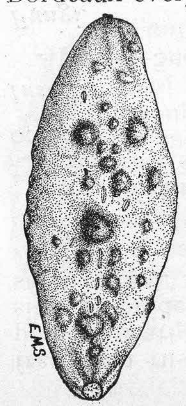
Striped Cucumber Beetle—Attacks young plants, eating the leaves. Larvae infest the main root or stem under ground, often killing the plant. Dust leaves with dry lead arsenate. Cover plants with screens. Bull. 216, p. 34; Rept. 1908, p. 807.

Melon Aphid—See Melon.

Fungi, etc.

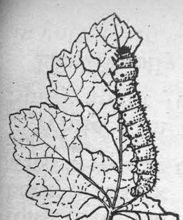
Anthracnose—Produces prominent discolored spots, more or less merged, on leaves; occurs as rot on fruit. More serious on watermelon. Treatment is the same as for mildew.

Downy Mildew—Forms discolored spots as in preceding, with fungous growth on lower side. Repeated sprayings with Bordeaux every 10 to 14 days during the season, beginning at least by middle of July, usually keeps this disease in check. Rept. 1904, p. 329.



Mosaic and **White Pickle**—Are two very similar, if not identical, physiological diseases, showing in the former on the leaves as mottling of lighter or yellow-green areas scattered among the normally green tissues, and in the latter causing the fruit to become irregularly shaped, knobbed, and often mottled or whitish in color. Keep down sucking insects that may spread the disease, as it is infectious; pull up and destroy vines first showing it. Rept. 1915, p. 430.

Wilt—See Squash.



CURRANT.

Insects.

Currant Fruit Fly—Small maggots infest the berries, which color prematurely and drop. Destroy infested fruit.

Currant-Worm—Devours foliage in May. Spray with hellebore or lead arsenate. Rept. 1902, p. 170.

Currant Borers—The larvae of two species of insects tunnel in the pith of the stems, causing the leaves to droop and wilt. Destroy infested canes during May.

Currant Stem Girdler—Adults cut or girdle tip of new shoots after laying eggs in them. Cut and burn these tips at any time of year. Rept. 1920, p. 201.

Currant Aphids—Yellowish-green aphids on under side of leaves, causing them to curl. Underspray with nicotine solution or kerosene emulsion, or apply nicotine dust.

Four-Lined Leaf-Bug—A yellow and black striped bug sucking sap from the leaves. Spray with nicotine solution and soap. Bull. 208, p. 118.

San José Scale—See Peach.

Scurfy Scale—A conspicuous pear-shaped light-gray scale on bark, the insect sucking sap from twigs. Spray about second week in June with kerosene emulsion or nicotine solution and soap. Bull. 143; Rept 1903, p. 227.

Fungi.

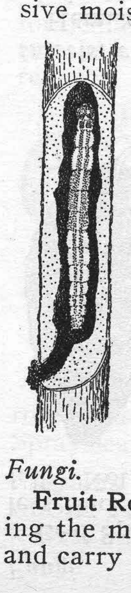
Anthracnose and **Leaf Spots**—Cause spots on the leaves and usually their premature shedding; the former also spots the fruit of certain varieties. Spray with Bordeaux as the leaves unfold, and repeat at intervals of 10 to 14 days until the fruit begins to ripen. If necessary continue spraying after harvest. Rake up and burn leaves in fall.

Blister Rust—Shows first as dusty orange-colored outbreaks about size of pinhead on lower surface of leaves, and later as short hair-like growths. Worst on black currants which should be destroyed, if infected, near white pines, the alternate host. Report presence to the Experiment Station. See Pine. Rept. 1911-12, p. 347.

CYCLAMEN.

Insects.

Leaf-Mite—Transparent microscopic mites cause leaves to curl, and plants do not blossom. Syringe under leaf surface strongly with water. Spray with, or dip plants in, nicotine solution and soap, 1 part in 400 parts of water. Avoid excessive moisture in house. Rept. 1914, p. 176.



DAHLIA.

Insects.

Tarnished Plant Bug—Sucks the sap from the stems and buds causing them to fall. Spray with nicotine solution and soap. Rept. 1904, p. 218.

Stalk Borer—Larva tunnels up and down inside the main stem, the top portion usually wilting and dying. Carefully make longitudinal slit in the stem and kill the borer. Bull. 208, p. 111; Rept. 1919, p. 180.

EGG-PLANT.

Insects.

Flea Beetle—See Potato.

Colorado Potato Beetle—See Potato.

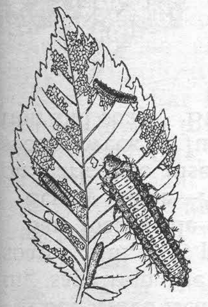
Fungi.

Fruit Rots—Caused by several fungi, the gray mold producing the most extensive rot. Spray with Bordeaux; pick off and carry away the rotting fruit.

ELM.

Insects.

Spiny Elm Caterpillar—Clusters of black spiny caterpillars often strip certain branches of elm, willow, and poplar. Remove and destroy entire cluster, or spray with lead arsenate. Rept. 1906, p. 260.



Elm Leaf Beetle—Adult beetles eat holes through the leaves in May, and in June and July the larvae or grubs eat away the green tissues from the under surface. Spray with lead arsenate early in May to kill egg-laying beetles, or spray under surface of leaves with same mixture about June 1, to kill the larvae. Yellow pupae at base of trees may be killed with kerosene emulsion or soap and water. Bull. 155; Rept. 1908, p. 815.

Canker-Worms—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Leopard Moth—Larvae tunnel in branches under the bark, cutting deep galleries, often girdling the branch, which later breaks off and falls to the ground. Small trees may be examined and borers killed by injecting carbon disulphide, or by inserting a wire. Bull. 169; Rept. 1911, p. 317.

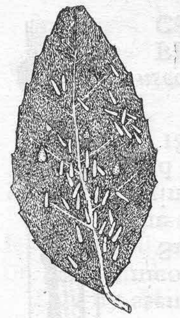
Elm Scale—A large brown soft scale, oval in shape with cottony marginal fringe, located especially in the cracks of the bark of trunk and lower branches, sucking the sap. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 235.

White Elm Scale—A whitish pear-shaped scale on twigs. Spray about June 10 with kerosene emulsion.

Elm Woolly Aphids—Several species curl the leaves, or form in cottony masses on the bark. Spray with kerosene emulsion

Fungi.

Leaf Spot—Shows as black slightly elevated specks more or less thickly imbedded in the leaves, causing their premature fall. Not usually so injurious as to warrant the expense of spraying with Bordeaux which should start on the young leaves. Rept. 1909-10, p. 717.



EUONYMUS.

Insects.

Euonymus Scale—The various species of Euonymus are attacked and often injured by this scale, which has narrow white (male) or pear-shaped gray or brown (female) shells. Cut and burn infested twigs. Cover and fumigate with hydrocyanic acid gas. Spray with nicotine solution or kerosene emulsion during June to kill young. Rept. 1921, p. 185.

FERN.

Insects, etc.

Hemispherical Scale—Brown, oval convex scales on fronds of plants under glass. Apply soap and water or nicotine solution as a dip or spray. Bull. 151, p. 9; Rept. 1905, p. 239.

Leaf-Blight Eelworm—See Begonia.

GERANIUM.

Insects.

Greenhouse Leaf-Tyer—Small green wriggling caterpillars feed upon the leaves of plants under glass. Spray with lead arsenate.

White Fly—See Tomato.

Leaf Mite—See Cyclamen.

Fungi, etc.

Bacterial Leaf Spot—Shows as light or finally dark brown, semi-pellucid when wet, spots on the leaves, causing their premature death when abundant. Watch the propagating stock and start with disease-free cuttings; destroy first infected leaves; if necessary spray with Bordeaux mixture.

Gray Mold—Produces dead areas on leaves and blasts blossoms. Worst in poorly lighted and leaky greenhouses. Keep drippage off plant; avoid watering in cloudy or muggy weather; ventilate. Attacks as a semi-parasite a variety of greenhouse plants. Rept. 1903, p. 322.

GOOSEBERRY.

Insects.

Currant-Worm—Devours foliage. Apply hellebore or lead arsenate early in season. Rept. 1902, p. 170.

Gooseberry Fruit-Worm—Feeds inside the berry. Destroy infested berries.

Currant Fruit Fly—See Currant.

Fungi.

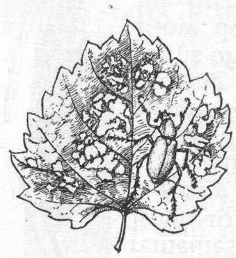
Mildew—Forms a felt-like growth on fruit and leaves of young shoots. Worst on European varieties; also attacks currants, especially young shoots. Spray with potassium sulphide or other sulphur spray as soon as buds break, and repeat about every ten days until the end of June.

Blister Rust—Not common as yet on cultivated varieties. See Currant. The cluster-cup rust is sometimes mistaken for this.

GRAPE.

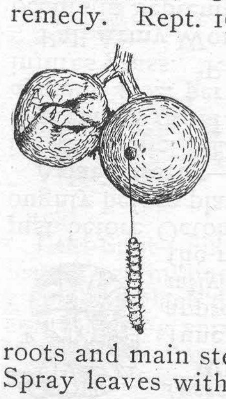
Insects.

Grape Vine Flea Beetle—Adults and larvae devour the leaves. Spray with lead arsenate the latter part of June.



Rose Chafer—Long-legged brown beetles appear about June 15 and feed upon leaves, flowers and newly set fruit, often doing great damage. Cover choice plants with netting. Spray heavily with self-boiled lime-sulphur just before blossoms open and again after fruit has set. Rept. 1916, p. 111.

Grape Plume Moth—Small green spiny caterpillars web together the newly formed leaves at the tips of new shoots. Damage more apparent than real. Crushing by pinching these leaves is the best remedy. Rept. 1914, p. 190.



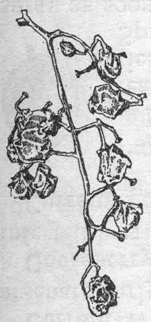
Grape Berry Moth—Larva feeds and develops inside the berries and is the cause of most wormy grapes. Spray with lead arsenate soon after the fruit sets, and repeat twice at intervals of about ten days. Bag the clusters soon after the fruit sets. Rept. 1920, p. 206.

Grape Root Worm—Adult beetles eat chain-like holes in leaves in July, and larvae or grubs devour the small feeding roots and eat channels in the bark of the larger roots and main stem underground, often causing great injury. Spray leaves with lead arsenate.

Sphinx and **Other Caterpillars**—Several species of horn worms as well as other kinds of caterpillars feed upon the leaves. Spray with lead arsenate or practice hand picking.

Grape Leafhopper—Small, yellow and red-marked leaf-hoppers sucking sap from under side of leaves. Spray under surface with nicotine solution and soap.

Grape Phylloxera—Sucks sap from roots and leaves, forming galls, and causing serious injury to European varieties. Graft on native species.



Fungi.

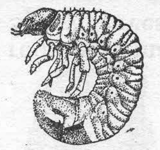
Black Rot—Causes reddish-brown spots on leaves; more rarely on stems; rots the berries, which finally become hard, shrunken and black. This is one of the worst diseases of the grape and often difficult to control by spraying. Begin spraying before blossoming time, about the last of May, with second application just after blossoming and subsequent sprayings at intervals of about 10 to 14 days. Usually 4 or 5 sprayings with Bordeaux are sufficient. Repts. 1889, p. 174; 1890, p. 100.

Downy Mildew—Develops, usually, dense white fruiting patches on under side of leaves and more or less discoloration on the upper; occurs somewhat on stems and fruit. With white varieties, like Niagara, may retard maturity, the occasionally infected berries of the bunch remaining hard, white specked, or shelling off prematurely. Treat as for black rot, omitting first treatment. Rept. 1893, p. 77.

Gray Mold—Causes rotting of ripening greenhouse grapes, covering them with a more or less conspicuous grayish mat of fruiting threads. Remove rotting grapes from the house. Use care in ventilating and watering. If necessary spray bunches several times with potassium sulphide.

Powdery Mildew—Produces a cobweb-like growth over upper surface of leaves; most conspicuous in the fall, when the minute, round, yellowish to black fruiting-bodies are found scattered over surface. Treat as for black rot. Potassium sulphide is also used effectively against this fungus. Rept. 1895, p. 185.

GRASS.

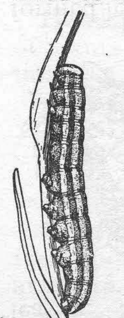


Insects.

White Grubs—White grubs are the larvae of June beetles, and when abundant in the soil and approaching maturity, cause much damage, especially in seasons following drought, by eating off the roots of grass, corn, strawberries, etc. Plow just before October 1 to expose insects. Harrow very thoroughly before planting. Repts. 1912, p. 288; 1915, p. 179.

Asiatic Beetle—Grubs of an introduced species injure lawns in Westville. Drench with carbon-disulphide emulsion in September or May when grubs are near surface. Calcium cyanide 4 oz. per sq. yard, watered in will kill grubs but also injures grass. Repts. 1923, p. 291; 1924, p. 294.

Fall Army Worm—Attack similar to that of army worm but occurs in September instead of July, and is more apt to be confined to lawns and millet. The worms do not migrate in such great numbers from one field to another. Same remedies apply. Also practice late fall plowing. Rept. 1912, p. 284.



Army Worm—In certain seasons grasses and grains are stripped of leaves and heads during July by brown striped caterpillars, which when abundant move like armies from one field to another, often causing great damage. Spray with lead arsenate, strips of grass or grain to protect fields not attacked. Plow deep furrows across line of march, turning the furrows towards the line. Sprinkle migrating worms with kerosene. Use poisoned bran mash. Rept. 1914, p. 157.

Fungi.

Brown Spot—Caused by a soil fungus that rots off the stems and roots near the surface, the parts above turning brown and dying. Usually starts in small circular spots in lawns in wet seasons. Do not confuse with similar injury due to severe winters and summer droughts. Spray infected spots and adjacent grass every week or two, according to weather, with Bordeaux mixture until spots fail to spread further.

HICKORY.

Insects.

Fall Web-Worm—See Pear.

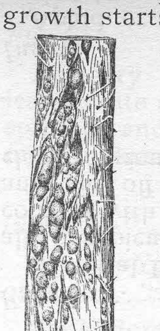
Walnut Caterpillar—See Walnut.

Hickory Tussock Moth—White and black hairy caterpillars feed upon the leaves in late summer. Spray with lead arsenate. Repts. 1907, p. 332; 1917, p. 325.

Hickory Bark-Beetle—Small black beetles breed under bark and the galleries soon girdle the tree. Adults emerge, leaving numerous round holes as if the bark had received a charge of bird shot. Beetles also feed at base of compound leaf stems, causing them to break and fall in midsummer. Has killed thousands of trees in Atlantic States. Badly infested trees should be removed before May 1, and burned, or at least the bark removed. Spray healthy and slightly infested trees about June 1, with strong lead arsenate and nicotine solution. Repts. 1901, p. 267; 1914, p. 198.

Hickory Borer—Larvae tunnel deep into solid wood of trunk. Hunt for sawdust, find the burrow, inject carbon disulphide, and plug the entrance.

Hickory Gall Aphid—Curious galls on the leaf stems often cause the leaves to fall in midsummer. Galls contain large number of aphids. Spray with nicotine solution just as new growth starts in spring. Rept. 1916, p. 145.

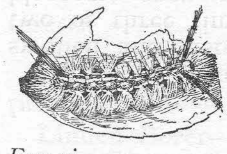


HOLLYHOCK.

Fungi.

Rust—Appears as small, compact, reddish-brown pustules on both leaves and stems. In late fall, cut off the plants close to the ground, and destroy them. Spraying with Bordeaux is helpful in checking the rust; begin as plants push through the ground. Rept. 1895, p. 188.

HORSE CHESTNUT.



Insects.

White-Marked Tussock Moth—Tufted caterpillars devour leaves in midsummer. Spray with lead arsenate. Repts. 1905, p. 230; 1916, p. 105.

Fungi.

Leaf-Spot—Shows as extended reddish-brown areas on the leaves, resembling sun scorch, but showing the fruiting stage as minute black dots in the dead tissues. This trouble can be controlled by spraying with Bordeaux. The first application is made on the unfolding leaves and is followed by two or three at intervals of about two weeks.

HORSE RADISH.

Insects.

Flea Beetle—Adults feed on the leaves, and larvae tunnel in the petioles. Spray with Bordeaux mixture and lead arsenate.

IRIS.

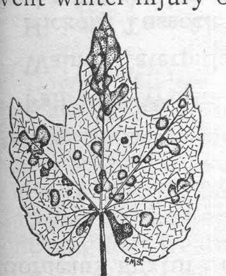
Insects.

Iris Root Borer—Larva tunnels in the rootstocks, injuring many plants. Destroy infested rootstocks. In bad infestations burn over the beds in winter to destroy the eggs. Repts. 1915, p. 189; 1918, p. 331.

Fungi, etc.

Leaf Blight—Occurs as elliptical spots with purplish border; if abundant causes leaves to turn yellow and die prematurely; is worst on German Iris. Keep foliage coated with Bordeaux or lime-sulphur, beginning early; gather and burn infected rubbish in late fall.

Soft Rot—Attacks rootstocks, destroying lower parts so that leaves turn yellow and die. Same bacterial disease is described under Salsify. Propagate only from healthy stock; plant in well-drained soil; use only well-rotted manure; prevent winter injury of roots. Rept. 1903, p. 327.



IVY, BOSTON.

Fungi.

Leaf Spot—Forms conspicuous brownish spots with purplish borders, which run together if abundant. It is the same as leaf stage of black rot of grape. Give several sprayings with commercial lime-sulphur, beginning on unfolding leaves. Burn leaves in fall.

KALE.

Insects.

Turnip Aphid—See Turnip.

Fungi.

Black Rot—Rept. 1915, p. 431. See Cabbage.

LARCH.

Insects.

Larch Sawfly—Larvae defoliate trees in midsummer. Spray with lead arsenate. Rept. 1915, p. 125.

Case Bearer or **Leaf Miner**—Small Lepidopterous larvae mine the leaves; pass the winter in cigar-shaped cases on the twigs. Dormant spray of lime-sulphur. Rept. 1923, p. 288.

Woolly Aphid—White cottony tufts on the bark and at the leaf whorls. Spray with kerosene emulsion or with nicotine sulphate solution and soap.

LARKSPUR.

Insects.

Mite—Curls leaves and buds of new growth which become swollen and distorted, often with a purplish color. Spray two or three times each week from first appearance until blossoms open, with nicotine sulphate, 1-400. Rept. 1914, p. 176.

Fungi, etc.

Bacterial Leaf Spot—Shows as purple-black, irregular, usually conspicuous spots on both surfaces of the leaves. Do not confuse with the mite injury described above. On first appearance pick off and destroy infected leaves. In fall cut off plants close to ground and carry away all rubbish.

LETTUCE.

Insects.

Aphid or **Green-Fly**—Sucks sap from leaves. Fumigate with tobacco or hydrocyanic acid gas. Spray with soap and water.

Fungi, etc.

Drop—Causes sudden wilting of plants by infecting and rotting off leaves at surface of soil; often shows a white moldy growth over the basal parts. This may develop into a serious trouble in the greenhouse, as the fungus often becomes established in the soil, when the best remedy is to change the soil entirely or sterilize it by steam or formalin (formula D). Treat some days before using. Rept. 1908, p. 863.

Head Rots—Are of two kinds in field lettuce—one a basal leaf rot, caused by the same soil fungus that injures lawns, invades the lower leaves in contact with the ground and rots these spreading upward; the other, a bacterial disease, begins at the margins of the leaves but often develops a serious rot more or less hidden within the apparently sound head. Very wet ground or weather is largely responsible for the appearance of either. Rapid growth favored by excess of humus in the soil promotes both. Avoid use of green manures. Keep top soil well dried out by shallow cultivation. Building-paper disks placed under individual plants might hinder infection from the first mentioned.

Leaf Mold and Mildew—The first produces a brownish and the second a white moldy growth in spots on the leaves. These diseases are usually held in check by sub-irrigation or care in watering and ventilating to keep plants and atmosphere as free from moisture as is consistent with good growth. Thoroughly spray young plants with Bordeaux, where feared.

LILAC.

Insects.

Lilac Borer—A white larva tunnels in the twigs. Cut and burn infested twigs. Rept. 1905, p. 260.

Oyster-Shell Scale—See Apple.

San José Scale—See Peach.

Fungi.

Powdery Mildew—Forms whitish cobwebby coating on leaves, with mature stage finally abundant as black dots. Conspicuous and common, but rarely demands preventive treatment by spraying.

LILY.

Insects.

Aphid—Yellow aphids with red markings, on under side of leaves. Spray with nicotine solution and soap.

Stalk Borer—See Dahlia.

LINDEN.

Insects.

Canker-Worm—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Linden Borer—A white larva tunnels in wood at base of trunk. Dig out borer, or inject carbon disulphide. Rept. 1915, p. 186.

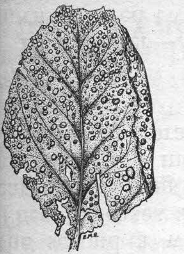
LOCUST.

Insects.

Locust Borer—Larvae tunnel in solid wood of trunk. When new leaves appear, spray bark of trunk and larger branches with mixture made by dissolving 1/4 lb. sodium arsenite in 5 gallons water to which 1 quart of miscible oil is added and the whole thoroughly agitated. Beetles will not lay eggs on shaded trunks, hence growing trees in thick stands or shading the trunks is effective.

MANGEL.

Insects.



Leaf Miner—See Beet.

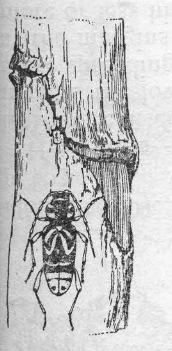
Fungi.

Leaf Blight—Shows as grayish circular spots with purplish borders; when abundant causes premature death of leaves. Rotate; keep refuse out of manure piles; spray with Bordeaux before disease gets started. Rept. 1915, p. 432.

Root Rot—Rots off roots below ground, turning foliage yellow and often killing it. Not common, but injurious occasionally in low wet fields. Avoid wet ground; keep rotted plants out of manure. Rept. 1915, p. 433.

MAPLE.

Insects.



Maple Borer—Larva tunnels in spiral course upward around trunk or larger branches of sugar maple, working in sapwood and cambium, often girdling the trees. Examine trees in September for sawdust. Find the burrow, inject carbon disulphide and plug the opening. Rept. 1922, p. 351.

White-marked Tussock Moth—See Horse Chestnut.

Other Tussock Moths—See Apple.

Canker-Worms—See Apple.

Cottony Maple Scale—Large, oval, brown soft scales on bark of branches of silver and red maples. Each scale in early summer develops a large cotton-like tuft of wax, nearly half an inch long, and soon afterwards the young appear. Spray with miscible oils. Rept. 1921, p. 179.

Woolly Maple Leaf Scale—Cottony or woolly masses of wax, containing the females, eggs and sometimes larvae, appear on the under side of the leaves of sugar maples in midsummer; leaves fall prematurely. Males and larvae enter crevices of bark of trunk and branches; latter pass the winter. Attacks only sugar maples. Spray dormant trees with nicotine solution and soap. Do not use miscible oils. Burn all infested leaves. Bull. 151; Repts. 1905, p. 226; 1911, p. 345.

Terrapin Scale—Small reddish-brown soft scales on small twigs of silver and red maples, sometimes killing the branches. Spray with kerosene emulsion. Rept. 1921, p. 183.

Oyster-Shell Scale—See Apple.

Maple Aphids—Green aphids are common on under surface of leaves of Norway and Sycamore maples in June. Spray with nicotine solution and soap, or with kerosene emulsion.

Gall Mites—Disfigure leaves by forming galls on upper surface. Destroy infested leaves.

Fungi, etc.

Anthracnose—Causes dead areas in the leaves, often hard to distinguish from the leaf scorch. Its appearance depends on character of season. For this reason spraying is of doubtful value in the long run, but when given should start on the unfolding leaves. Repts. 1903, p. 329; 1915, p. 436, unusual form.

Black (Tar) Spot—*Forms slightly thickened black spots on the leaves, resembling finger prints.* Cut-leaf maples are especially susceptible. Rake up and burn all leaves in the fall. Rept. 1908, p. 852.

Leaf Scorch—Shows as more or less extended and irregular dead areas, appearing suddenly, usually from the leaf margins inward. A physiological trouble due to sudden or excessive evaporation beyond the supply of water furnished by the roots, which is in turn due to abrupt changes in atmospheric conditions, drought, injury to roots, etc. Pruning, when necessary, watering or mulching, and stimulating root growth by nitrogenous fertilizers are best remedial measures. Rept. 1905, p. 267.

Stag-head—Shows in trees killed at the top or by central branches gradually dying. Due to various agents or unfavorable environment such as parasitic or semiparasitic toadstools and shelf-fungi, escaping gas in soil, winter injury, etc. Cut off dead and dying branches; clean out decaying wood, treat with a wood preservative and fill cavities. Stimulate new growth by nitrogenous fertilizers.

MARGUERITE.

Insects.

Marguerite Fly or **Leaf Miner**—A maggot tunnels between upper and lower leaf surfaces. Spray every ten or twelve days with nicotine solution. Rept. 1915, p. 188.

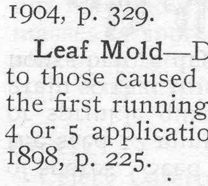
MELON (MUSK).

Insects.

Melon Aphid—Sucks the sap from the under side of the leaves, and when abundant causes much damage. Underspray the leaves with nicotine solution and soap. Dust with nicotine. Bull. 216, p. 47; Rept. 1908, p. 813.

Striped Cucumber Beetle—See Cucumber.

Fungi.



Anthracnose—Appears occasionally. See Cucumber.

Downy Mildew—Causes angular, eventually brown spots in the leaves, often killing vines; most prominent just before melons ripen, later ones not maturing or worthless. Begin spraying with Bordeaux mixtures soon after the vines start to run, and keep them covered to the end of the season. In very wet seasons spraying is not entirely effective. Rept. 1904, p. 329.

Leaf Mold—Develops dead spots on the leaves very similar to those caused by downy mildew. Spray with Bordeaux on the first running vines and repeat every 10 to 14 days, making 4 or 5 applications according to season. Repts. 1895, p. 186; 1898, p. 225.

Wilt—See Squash.

MILLET.

Insects.

Fall Army Worm—See Grass.

NASTURTIUM.

Insects.

Aphid—Brown aphids cluster on stems and leaves, sucking the sap. Spray with nicotine solution and soap.

OAK.

Insects.

Canker-Worms—See Apple.

Gipsy Moth—See Apple.

Brown-Tail Moth—See Pear.

Orange-striped Oak-Worm—Black and orange striped caterpillars feed upon the leaves late in summer. Spray with lead arsenate.

Fungi.

Anthracnose—Appears as light-brown spots on the young leaves, killing some before they unfold. Infection comes from spores produced in inconspicuous pustules on the young twigs. Treat as for anthracnose of sycamore.

Leaf Curl—Appears, not uncommonly on certain species of park and lawn oaks, as a dense violet-gray felt in cupped areas on under side of the leaves with the upper surface elevated and light colored. Without definite experience we recommend same treatment as for peach leaf curl, namely, a dormant spray with lime-sulphur, 1 to 9, just before buds begin to swell.

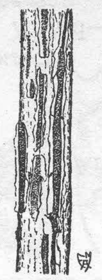
Heart Rots—Develop occasionally hoof-shaped or bracket fungi on trunks. Gain entrance through wounded and dead branches; cause rot of heart wood and sometimes slow death of sapwood and bark. Break off and burn fruiting bodies; cut out diseased bark and sapwood, and dig out infected heartwood; fill cavity if desired. Occur in other deciduous trees, especially maples. Bull. 222, p. 446.

OATS.

Insects.

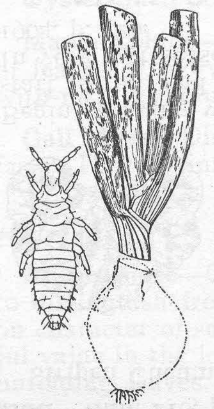
Army Worm—See Grass.

Fungi.



Black Stem Rust—Forms, chiefly on leaf sheaths and stems, first the II stage as reddish pustules and later the III stage as elongated black outbreaks. Also occurs on wheat, rye, and other grasses as different strains. The I stage appears in spring on barberry leaves as cluster-cups, but the fungus can skip this stage. Quite serious in regions where grain is grown extensively, and difficult to control. This and several related species are becoming more important here as more grain of various kinds is grown. Cut out barberries in vicinity of fields.

Smut—Destroys the grain, turning it into a black dusty mass of spores. Seed treatment will prevent this smut. Either soak the seed 12 minutes in water at 133° F., and dry thoroughly, or sprinkle quickly with formalin (formula A), stirring the grain so that it is thoroughly wet, and leave in piles for several hours before drying out. A less cumbersome treatment coming into general use is that given under formula B. Buy seed from smut-free fields.



ONION.

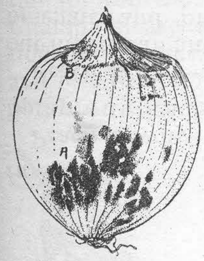
Insects.

Thrips or **"White Blast"**—Very small insects which feed upon the surface of the leaves, giving the field a whitish appearance. Burn all tops and refuse; burn over the grass land around the field to kill overwintering insects. Spray with nicotine solution and soap, or kerosene emulsion. Repts. 1903, p. 266; 1913, p. 233.

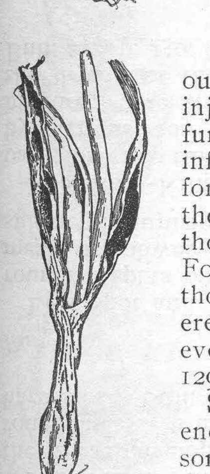
Maggot—Infests the bulb of the young plant. Practice rotation of crops. Spray

plants here and there over the field with sweetened lead arsenate to kill the adult flies. Rept. 1911, p. 286.

Fungi.



Anthracnose (Black Spot)—Shows as black circular spots on the bulbs, usually on white varieties after storing. Store onions as dry as possible and keep barn dry and cool. Avoid piling too deeply in bins. Air-slaked lime mixed with sulphur scattered over them at time of storing may prove beneficial. See Stem Rot for treatment with formalin fumes. Fig. (A). Rept. 1889, p. 163.



Smut—Forms black dusty outbreaks on various parts of plant raised from seed; especially injurious to the very young seedlings. This fungus becomes established in the soil, hence infected land should be avoided or used only for transplanted onions. If used, apply with the seed in drills per acre, 100 lbs. sulphur thoroughly mixed with 50 lbs. air-slaked lime. Formalin (1 lb. or 1 pt. to 12 gallons water) thoroughly sprinkled over the seed, before covered, by drip attachment to the seeder, is an even more desirable remedy. Repts. 1889, p. 129; 1895, p. 176.

Stem Rot—Starts rotting of bulbs at stem end, where they become soft and shrunken, sometimes showing beneath the layers a dense olive-brown growth. This fungus in a moist season occurs on various parts of the plant in the field (possibly responsible for "blast" of seed onions), but does not appear as a serious trouble with the bulbs until some time after they have been placed in the barn. Treat as for black spot. Late field spraying with Bordeaux shortly before pulling and again while lying in the field, combined with treatment by formalin fumes (See Fungicides) after storing, has given some indications of benefit. See Fig. (B) under anthracnose. Repts. 1903, p. 334; 1904, p. 321.

PALMS.

Insects.

Scales—Several kinds of white and brown scales infest the species of palms grown in greenhouses. Apply nicotine solution or soap and water as a spray or as a dip.

Fungi.

Anthracnose—Frequently causes leaves to die at tip. Fungus may show as small black imbedded specks oozing pinkish masses of spores. Avoid infected stock or isolate it; pick off and burn worst infected leaves; keep leaves dry and house well ventilated. Rept. 1913, p. 18.

PARSLEY-PARSNIP.

Insects.

Celery Caterpillar—On both hosts. See Celery.

Parsley Stalk Weevil—Larva tunnels in crown of plant. No remedy other than to destroy infested plants. Rept. 1913, p. 252.

Fungi.

Drop—On Parsley. See Lettuce.

Soft Rot—On Parsnip. See Salsify.

PEA.

Insects.

Green Pea Aphid—Attacks the plants early in June and sucks the sap from the leaves and stems, often causing great injury. Early peas may mature a crop before aphids injure them. Spray or dust vines with nicotine. Brush the vines just before cultivating. Repts. 1899, p. 240; 1913, p. 235; 1924, p. 319.

Pea Weevil—The adult lays eggs in the pods in the field and the larvae develop in the seed, the beetles emerging through round holes. Fumigate with carbon disulphide as soon as harvested. Bull. 195, p. 5.

Fungi.

Leaf Spot and **Powdery Mildew**—Shows in the former as roundish spots on both pods and leaves; in the latter, as a mealy or cobweb-like coating on same. Neither seems to be sufficiently injurious here to warrant the expense of spraying.

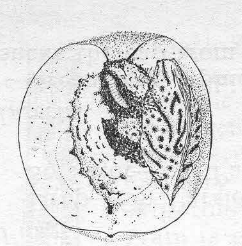
Root-Rot—Kills tops of roots and base of vines, causing parts above to turn yellow, wilt and die prematurely. Caused by various soil fungi. Practice rotation, use *well-rotted* manure; give frequent cultivation in wet years to hasten the drying of the top soil; plant most resistant varieties. Bull. 222, p. 450.

PEACH.

Insects.

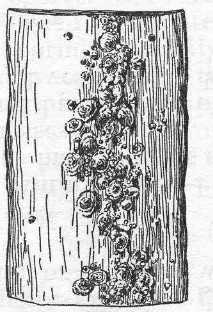
Peach Sawfly—Larvae feed upon leaves in June and July. Spray with lead arsenate. Rept. 1907, p. 285.

Peach Borer—Larva tunnels in the base of the trunk. Dig out in late fall and early spring. Paint base of trunk with lead arsenate and lime-sulphur. Remove top soil and sprinkle powdered paradichlorobenzene around the trunk, using about 1 ounce per tree, and cover with soil. Rept. 1909, p. 359.



Oriental Peach Moth—Larvae tunnel new shoots early in season, later broods leave shoots and enter fruit or go direct into fruit; larvae winter in cocoons on bark or on ground. No satisfactory controls yet known. Frequent sprays of nicotine sulphate and soap, cultivation of soil in fall or early spring in localities permitting it, and the use of paradichlorobenzene the same as for peach borer control, have been shown to be of some benefit. Rept. 1924, p. 299.

Fruit Bark-Beetle or **Shot-Hole Borer**—Makes minute tunnels under the bark of branches and trunk. Burn infested trees and keep others thrifty. Rept. 1896, p. 240.

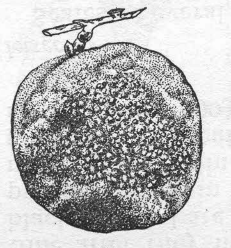


Plum Curculio—See Plum.

San José Scale—Minute scale insects, with circular shell, which suck the sap from twigs, fruit and leaves. On fruit a red spot surrounds each insect. Spray dormant trees with lime-sulphur or miscible oils. Bull. 165; Rept. 1901, p. 240.

Black and **Green Aphids**—Suck the sap from the leaves and shoots. Spray with nicotine solution.

Fungi, etc.



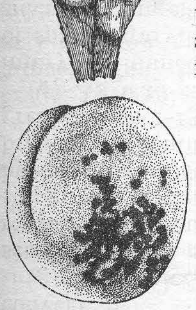
Brown Rot—Occurs on the young twigs, leaves and blossoms, but causes most serious injury to the fruit, rotting it about ripening time. The rotten areas become covered with numerous pustules of dusty brownish spores; eventually the diseased fruits form hard mummies. These carry

the fungus over the winter, and if half buried in the soil develop in early spring the mature stage, which causes infection of the blossoms, etc. Certain early varieties, like the Champion, are especially subject to rot. See general directions for treatment. This fungus occurs on plums and cherries and less commonly on pears and apples. Repts. 1909-10, pp. 607, 612; 1911, pp. 374, 391.

Crown Gall—See Plum.

Leaf Curl—Causes young leaves to become irregularly curled and swollen and finally to drop off; rarely on fruit. In April as soon as buds begin to swell, spray the trees thoroughly with commercial lime-sulphur, 1-9. Same treatment takes care of San José scale. Repts. 1909-10, pp. 608, 612; 1911, p. 374; 1914, p. 19.

Powdery Mildew—Forms a grayish felt on young twigs and leaves. Prune off infected twigs; give winter treatment as for leaf curl, and summer treatment as for scab and brown rot.



Scab — Produces roundish, olive-black spots on the fruit, discolored areas on the young twigs, and rarely "shot-holes" in the foliage. Two treatments with self-boiled lime-sulphur, dry mix or Atomic Sulphur upon the fruit after setting and when half grown (about the middle of May and June) will control this trouble. Repts. 1896, p. 269; 1909-10, pp. 608, 614; 1911, pp. 375, 391.

Spray Injury—Is more likely to occur than on apple. Avoid Bordeaux altogether. See (3) under general treatment following. Repts. 1900, p. 219; 1911, p. 372.

Winter Injury—Shows in various ways. In severe winters, especially when the ground is bare, the roots may be killed without injury to parts above the ground. In spring such trees put forth a scanty sickly foliage that soon drops. Often the injury occurs in the form of a "collar girdle" in the bark at the base of the tree. Sometimes it occurs above ground in the wood (shown by its blacker color), with or without injury to the bark. When the bark is not injured, severe pruning in spring will often save the trees. Nursery trees can sometimes be cut back to the snow line, below the injury, and an entirely new healthy trunk started. Avoid late applications of nitrogenous fertilizers and cultivation after middle of July. Mulch base of young trees in late fall with earth. Secure good drainage. Repts. 1903, p. 341; 1908, p. 872.

Yellows—Causes premature ripening and red spotting of fruit, develops yellowish curled leaves, and in time spindling sprout growth in bunches on the trunk. This is claimed to be a contagious disease, but it is apparently physiological in nature. Little peach in this state is scarcely to be distinguished from the yellows, showing chiefly in the small backward fruit. Root out all infected trees; prevent winter injury; be careful in selecting stock for planting. Nurserymen should use especial care in selecting their stock for budding. Repts. 1893, p. 92; 1908, p. 872.

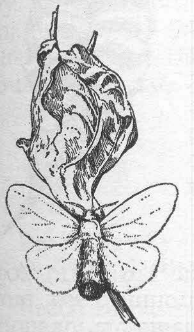
General Treatment for Peach Orchards.

(1) Spraying peaches while dormant is of value only in checking San José scale, mites and leaf curl. One application of commercial lime-sulphur, 1-9, either in late fall, or preferably early spring, will take care of all of these troubles. If the scale and the leaf curl are unusually prevalent both applications will prove of value in controlling them.

(2) For the prevention of scab and rot of peaches, give three sprayings, as follows: 1st, shortly after the blossoms have fallen; 2d, three or four weeks later; and 3d, one month later. Dusting with sulphur may replace spraying where more convenient.

(3) Self-boiled lime-sulphur, dry mix and Atomic Sulphur seem to be the safest and most reliable peach sprays. Fair results have been obtained with some of the commercial lime-sulphurs, and they are much more easily handled. There is, however, some danger of spray injury, especially with certain brands. If commercial lime-sulphur is used, a strength of not greater than 1-150, without poison, is advisable.

(4) As lead arsenate has done little to prevent curculio injury in Connecticut and as it seems to increase the danger of spray injury, we advise leaving it out unless there is considerable danger from the sawfly, when it can be added in the second spraying the same as for apples.



PEAR.

Insects, etc.

Pear or **Cherry Slug**—See Cherry.

Codling-Moth—See Apple.

Brown-Tail Moth—Occurs in the United States only in eastern New England. Brown hairy caterpillars feed on leaves, and make winter nests on twigs, maturing about the middle of June. Cut and burn winter nests. Spray foliage as soon as blossoms fall, and also in August, with lead arsenate. Rept. 1910, p. 683; Bull. 182.

Fall Web-Worm—Makes nests on ends of branches of many kinds of trees in late summer, the brown, hairy caterpillars feeding inside the nests. Clip off and burn nests when small. Spray with lead arsenate. Repts. 1901, p. 270; 1917, p. 319.

San José Scale—See Peach.

Pear Psylla—Small jumping plant lice suck sap from leaves and twigs, causing leaves to fall in midsummer. Spray with lime sulphur 1-9 in spring just before the blossom buds open. Spray again in July with nicotine sulphate and soap, or nicotine sulphate and lime using 20 lbs. of lime to each 50 gallons spray. If infestation is bad spray on warm days in spring or fall with nicotine and soap to destroy adults. Rept. 1903, p. 262.

Sinuate Pear Borer—Grubs tunnel in branches often killing them. Cut out the borers and spray foliage heavily in May with lead arsenate. Rept. 1920, p. 193.

Pear Thrips—A minute insect which feeds upon the unopened fruit buds, destroying them so that fruit does not set. Spray with nicotine solution and soap just as buds open, and again after blossoms fall.

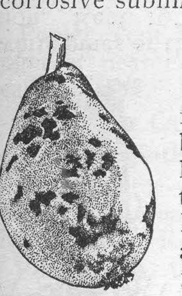
False Tarnished Plant Bug—Punctures developing fruit, causing it to be irregular and knotty. Spray with nicotine solution and soap.

Leaf Blister Mite—Attacks unfolding leaves of apple and pear; forms galls or blisters, which become red and later brown. Causes many leaves to fall in July. Spray dormant trees with lime-sulphur in late fall or in spring. Rept. 1910, p. 700.

Fungi, etc.

Blight—Kills young twigs, the leaves suddenly turning black; also produces sunken dead areas on trunks. This is a bacterial disease chiefly spread by bees during blossoming time, or by sucking insects. Winter-prune all diseased branches, cutting off several inches below diseased area. Cut out cankered areas and swab with disinfectant, paint exposed wood when dry. Several times after blossoming remove all young dead twigs. Use knife sterilized after each cut by

wiping with a cloth saturated with carbolic acid or with corrosive sublimate (1-1000). Rept. 1894, p. 113.



Leaf Blight—See Quince.

Scab—Forms olive-black scabby spots on fruit and leaves, often causing the former to become distorted and cracked. The fungus lives over winter on the twigs. Certain varieties are not much injured, others, like Flemish Beauty, are very susceptible. Spray as for apple scab. Repts. 1894, p. 135; 1904, p. 323; 1911, p. 396.

PEONY.

Insects.

Rose Chafer—Adult beetles feed upon blossoms of white varieties. See Grape.

Fungi.

Stem Rots—Appear in the spring as the new stems push up into the air. Sometimes the tip, the base or the whole stem may die from the rot. Two different fungi cause the same injury. Spray plants and soil as the stems push through the earth; keep soil dry by stirring; destroy infected stems.

PHLOX.

Insects.

Red Spider—Injures leaves, causing them to turn yellow. Clean culture. Spray clear water with force from hose, and in severe infestations, with linseed oil emulsion, kerosene emulsion, or with nicotine solution and soap.

Fungi.

Powdery Mildew—Covers more or less completely leaves and young stems with grayish coating within which are finally imbedded numerous, small, blackish fruiting-bodies. Give several sprayings with commercial lime-sulphur, starting before mildew appears.

PINE.

Insects.

Sawflies—Larvae of several native and imported species feed upon the leaves. Spray with lead arsenate. Rept. 1917, p. 273.

White Pine Weevil—Adult snout beetle lays eggs on leader in May and grubs feed and develop on it, causing it to wilt and die in midsummer. Leaders of ornamental trees may be protected by spraying them with lead arsenate or lime-sulphur. Jarring the adults into a net once a week during month of May serves greatly to reduce the damage. Infested leaders should be cut and destroyed. Repts. 1911, p. 307; 1919, p. 144.

Pine Leaf Scale—Whitish pear-shaped shells on leaves; small trees sometimes killed. Spray with nicotine solution or kerosene emulsion about the second week in June. Rept. 1921, p. 181.

Pine Bark Aphid—White cottony or woolly objects on bark and sometimes on leaves, sucking out the sap. Spray with kerosene emulsion. Repts. 1911, p. 343; 1919, p. 155.

Fungi, etc.

Blight (so-called)—Stunts the leaves and kills their tips, often suddenly, so that the tissues for a greater or less distance are reddish-brown. This is a physiological disease; it is not contagious; due to adverse weather conditions. Chief among these are severe winters, killing the leaves directly or indirectly through injury to roots; warm days, in late winter or early spring when ground is frozen, causing transpiration of water from the leaves that cannot be replaced; very late spring frosts, killing tips of new leaves; sudden changes, in summer from moist or muggy weather to bright sunshine, resulting in excessive transpiration and injury; very dry summers. No effective remedy. Rept. 1907, p. 353.

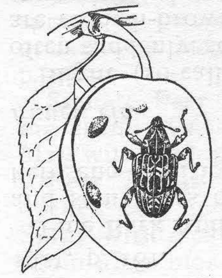
Dampening Off—Caused here chiefly by Rhizoctonia fungus rotting base of the stem, the seedling falling over. Sometimes it creeps up the stem, invading the base of the leaves which wither. Certain conifers are more subject to attack than others. Avoid unnecessary watering; provide good ventilation; infected soil often can be helped by treatment with formalin before seeding (see Fungicides, formalin D); spraying with Bordeaux is helpful in some cases. Some use sand as a coating over the beds. Repts. 1912, p. 348; 1915, p. 450.

Stem Rusts—Form on the swollen stems temporary, but conspicuous, white, blister-like spore cups filled with a dusty orange-colored spore mass. The white pine blister rust, an imported species, spreads to the gooseberries and currants, and forms other less conspicuous leaf stages on these. A very similar native species on two and three needle pines spreads to the leaves of the sweet fern. In either case infected pines should be destroyed, and also the alternate hosts, if they occur in the neighborhood. Spray seed-beds with Bordeaux if liable to infection. In white pine plantations pull out all currant and gooseberries within 500 feet. Send any suspicious white pines or their alternate hosts to this Station for examination. Rept. 1912, p. 347; Bulls. 214, p. 428, 237, p. 305.

PLUM.

Insects.

Plum Aphids—Suck sap from leaves. Spray with kerosene emulsion, nicotine solution and soap, or with soap and water.



San José Scale—See Peach.

Plum Curculio—Grub infests the growing fruit, causing it to fall. Jar the trees each morning for six weeks after blooming and catch the beetles on sheets and destroy them. Spraying with lead arsenate during the same period is also advised. Rept. 1910, p. 609; Bull. 235, p. 218.

Fruit Bark-Beetle or **Shot-Hole Borer**—See Peach.

Fungi.

Black Knot—See Cherry.

Brown Rot—Is the same as on peach. Thin fruit so it does not touch. Gather and destroy all mummies after harvest. Rather difficult to control by spraying, as spray does not readily adhere to the smooth fruit. First treatment with Atomic Sulphur, dry mix or self-boiled lime-sulphur, should be made on half grown fruit, others at intervals of two weeks, and the last one 7 to 10 days before picking. Use a spreader in the spray.

Crown Gall—Shows hard roundish knots one-half inch or more in diameter, near crown or on roots, less frequently on lower part of trunk. Do not plant infected trees. Remove knots when found and paint over cut surface. This is said to be very troublesome in some states, but here, as yet, little damage has resulted from it.

POPLAR.

Insects.

Poplar Tent-Maker—Larvae feed on leaves and fold them together near ends of branches, forming nests. Spray with lead arsenate. Rept. 1911, p. 310.

Spiny Elm Caterpillar—See Elm.

Tussock Moths—See Apple, Hickory and Horse Chestnut.

Poplar Borer—Larvae make large galleries in wood of trunk. Dig out, or inject carbon disulphide into the burrow and close the opening. Rept. 1907, p. 336.

Poplar and **Willow Curculio**—Larva tunnels in smaller trunk and branches. Destroy badly infested trees. Cut out borers; inject carbon disulphide. Rept. 1907, p. 335.

Oyster-Shell Scale—See Apple.

Fungi.

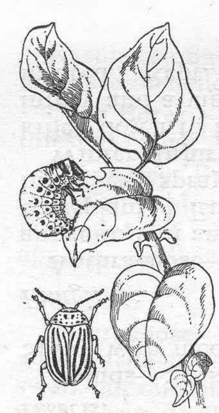
European Canker—Forms sunken dead areas of varying extent in the bark. Importation from Europe; showing here most commonly on Lombardy and white poplars. If trees are badly injured cut down and burn; otherwise cut out diseased areas going into the healthy bark, scraping and painting over exposed wood. Bull. 222, p. 461.

Rusts—Show on leaves as minute, powdery, yellow-orange pustules in II stage, and as slightly elevated reddish blisters in III stage. Have I stage, for different species, on larch and hemlock. Avoid planting near these hosts in nursery; rake up and burn infected leaves in the fall. Rept. 1915, p. 440.

POPPY.

Insects.

Aphids—Black aphids suck sap from stems and leaves. Spray with nicotine solution and soap.



POTATO.

Insects.

Flea Beetle—Small black jumping beetles eat holes through the leaves. Spray heavily both upper and under leaf surfaces with lead arsenate or calcium arsenate. Bull. 208, p. 103; Rept. 1906, p. 271.

Colorado Beetle—Adults and larvae devour the leaves. Spray with lead arsenate as soon as injury is apparent. May be used in Bordeaux mixture. Bull. 208, p. 106; Rept. 1911, p. 311.

Three Lined Potato Beetle—Larvae feed upon the leaves and carry their black excrement on their backs. Spray with lead arsenate. Bull. 208, p. 109.

Stalk Borer—Larva tunnels inside the stalk. Burn infested vines. See Dahlia. Bull. 208, p. 111.

Leafhopper—Sucks sap from veins, causing leaves to curl and "burn." Known as "hopper burn." Spray or dust with nicotine to kill leafhoppers.

Potato Aphid—Green and pink aphids appearing in large numbers suck the sap from shoots and stems, causing much damage in 1917. Spray or dust with nicotine. Bull. 208, p. 115.

Fungi, etc.

Black Leg—Ends as a black rot of stem below ground; makes plants usually stunted with yellowish curled foliage; occasionally rots tubers. Usually only scattered plants appear in the field, not spreading to the healthy. Soaking seed in formalin as for scab is helpful. Plant only certified seed. Rept. 1914, p. 21.

Blight or **Downy Mildew**—Causes a sudden blackening of the leaves, and death of vines, from July to September in moist seasons; usually shows a slight whitish growth of fungus on the under side of the leaves; rots tubers. Spray with Bordeaux before the trouble appears, about July 1, and keep vines *well covered* to the end of the season. Three to five sprayings by hand or five to seven by power sprayer are necessary. Use lead arsenate in the early sprayings for insects. After last cultivation thoroughly ridge up the rows to help keep the spores from washing down to the tubers. Early varieties usually escape blight by maturing before its appearance. Repts. 1904, p. 363; 1905, p. 304; 1909-10, p. 739; 1915, p. 470; 1916, p. 355; Bull. 214, p. 411.

Mosaic—Shows as a more or less conspicuous yellow-green mottling of the leaves. A physiological disease not well understood. Common here, but apparently not so injurious as in some other places. Do not save tubers for planting from fields showing this trouble. Keep down aphids. Use only certified seed. Bull. 222, p. 464.

Scab—Produces the common scabby appearance on surface of tubers. Soak uncut seed-tubers one hour in formalin (formula C). Formalin fumes (see Less-Used Fungicides) are often used when large quantities are treated. Care in filling space sufficiently, however, is necessary to avoid injury by "pitting" from absorption of fumes. Corrosive sublimate is recommended by some investigators, especially where the black scurf (Rhizoctonia) also occurs on the tubers, as this treatment seems more effective against the latter. Pre-sprinkling with water 48 hours before treatment and keeping moist meantime is said to increase their efficiency. Hot corrosive sublimate or formalin for short periods has also been recommended for potato tuber diseases. Avoid planting on infected land. The use of lime, wood ashes, and various barnyard manures will increase the amount of scab. The same trouble occurs on beets and turnips. Fig. (B). Repts. 1890, p. 81; 1891, p. 153; 1894, p. 118; 1895, p. 166; 1896, p. 246; 1909-10, p. 744.

Tip or **Hopper Burn**—Causes leaves to die at tip and margins and roll up; often mistaken for true blight. This is a physiological trouble due to drought or sudden change from moist to very hot bright weather or to leafhoppers. Cultivate thoroughly and often to conserve moisture. Spray with Bordeaux as for blight, as this often helps to increase yield by lengthening life of leaves. Rept. 1909-10, p. 742.

PRIVET.

Insects.

Aphids—Suck sap from the leaves causing them to curl. Spray with nicotine sulphate or apply nicotine dust.

Fungi, etc.

Anthracnose—Forms small cankers on stems, causing parts above to wilt and die. Usually found in nurseries on recently transplanted European privet. Prune off and burn infected branches; spray with Bordeaux. Rept. 1914, p. 22.

Winter Injury—Shows in spring by stems usually being killed down to base or snow line. Cut off dead stems below injury and a vigorous new growth will result if roots are not injured. Rept. 1904, p. 326.

QUINCE.

Insects.

Aphid—See Apple.

Oriental Peach Moth—See Peach.

Quince Curculio—Grubs infest growing fruit and adults feed upon it, causing it to be knotty. Jar the trees same as for plum curculio. Spray with lead arsenate about July 1, and repeat in 10 days.

Round-Headed Borer—See Apple.

Fungi, etc.

Black Rot—Affects the fruit, often beginning at the blossom end; also kills twigs and branches. In the fall or spring cut off and burn all dead branches. Give three sprayings, as for leaf blight, with Bordeaux mixture.

Blight—See Pear.

Leaf Blight—Appears as rounded, often confluent, reddish-brown spots with central black dots on leaves and as black sunken specks on fruit, the former often shedding prematurely and the latter cracking irregularly. Spray with Bordeaux just before blossoms open, again soon after they fall, and follow with one or two additional treatments at intervals of about two weeks, according to the weather. This fungus also occurs on pear. Repts. 1890, p. 99; 1891, p. 150.

Rust—Produces small clustered cups, with fringed borders, filled with orange spores, on fruit, young twigs and less frequently on leaves. Cut off and burn infected twigs and fruit. Look for infected cedars in neighborhood.

RADISH.

Insects.

Maggot—See Cabbage.

Aphid—See Turnip.

Fungi.

Club Root—See Cabbage.

RASPBERRY.

Insects.

Raspberry Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore. Rept. 1918, p. 329.

Cane Borer—Larva tunnels inside the canes. Cut and burn infested canes.

Raspberry Fruit-Worm—Brown beetles feed upon buds, leaves and blossoms, and white larvae adhere to berries at picking time. Spray with lead arsenate when beetles first appear. Bull. 251.

Fungi, etc.

Anthracnose—Shows as more or less confluent whitish spots, with purplish borders, on the stems. In spring, before buds swell, cut out and burn all badly infected canes and then spray with Resin-Bordeaux or Bordeaux with a casein spreader. If disease is very bad, spray again when young shoots are about six inches high, and repeat in 10 to 14 days. Aim chiefly to cover the young shoots with the spray. After fruit is gathered, again remove any badly infected canes. Cultivate ground thoroughly to promote vigorous growth of canes. Rept. 1899, p. 274.

Crown Gall—See Blackberry.

Rust—See Blackberry.

Wilt—Forms cankered areas on the canes, causing the parts above to wilt. In the old canes and near the pruned ends, the fungus often develops a brownish coating of spores around each small imbedded fruiting receptacle. Spraying has not proved very satisfactory. Old and diseased canes should be removed and burned after the fruiting season and again early in spring. Rept. 1906, p. 321.

Yellows—Is a more general term for Mosaic (mottled leaves), leaf curl and blue stem, three diseases causing serious trouble here. Plants gradually become worthless. Spraying, except for aphids, does not help these troubles. Dig out infected plants. Propagate only from perfectly healthy and most resistant varieties, or buy from inspected stock.

RHODODENDRON.

Insects.

Rhododendron Lace Bug—This bug sucks the sap from the under side of the leaves, which are usually colored brown by its excrement. Spray with nicotine solution or kerosene emulsion. Rept. 1921, p. 201.

Rhododendron Borer—Tunnels under bark of stems around crotches. Cut out borers and cover wounds with melted paraffin. Rept. 1922, p. 347.

Fungi, etc.

Leaf Scorch—Shows as dead marginal areas of varying width usually appearing suddenly. Plant in shade; keep ground mulched; water if necessary in dry weather by soaking ground beneath mulch. Rept. 1914, p. 23.

ROSE.

Insects.

Rose Slug—Eats away the green portion of the leaves. Spray with hellebore, lead arsenate or nicotine solution.

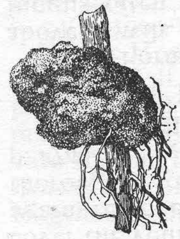
Rose Midge—Larvae distort young leaves and flower buds in greenhouses. Apply tobacco dust to the soil and fumigate nightly with tobacco stems or nicotine paper.

Rose Chafer—See Grape.

Leafhopper—Sucks the sap from the under side of the leaves. Spray with nicotine solution and soap.

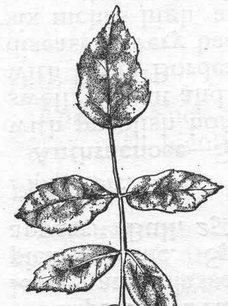
Rose Scale—Whitish circular shells on the stems contain insects which suck the sap. Cut and burn worst infested canes. Spray with nicotine solution and soap. Bull. 151, p. 11; Rept. 1905, p. 241.

Aphid or **Green Fly**—Sucks sap from the leaves and stems. Spray with nicotine solution.



Fungi, etc.

Crown Gall—Occurs very frequently on rose roots, especially those of Manetti stock. Use cleaned tools in grafting and avoid infected plants. See Plum. Rept. 1911-12, p. 355.



Leaf Blotch—Forms large purple-black blotches on leaflets which often turn yellow and fall off. For greenhouse treatment paint hot water pipes with mixture of sulphur and oil. Potassium sulphide or commercial lime and sulphur can be sprayed on the foliage. Spraying out of doors can be done with Bordeaux, if there is no objection to the sediment on leaves. Rept. 1903, p. 355.

Mildew—Develops a white powdery or cobweb-like growth on the young leaves, which become more or less distorted and fall off; occasionally blasts blossoms of certain varieties. Tea roses especially susceptible. Treat same as for leaf blotch; or dust flowers of sulphur over the leaves; be careful in airing greenhouses. Rept. 1903, p. 356. Bull. 222, p. 474.

RUTABAGA, See **TURNIP**.

RYE.

Insects.

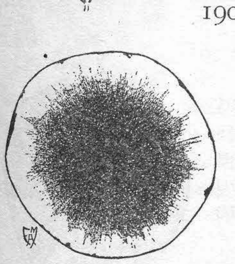
Army Worm—See Grass.

Wheat Midge—See Wheat.

Fungi.

Ergot—Forms conspicuous, elongated, purplish sclerotia, usually one in the spike, most common in volunteer rye, but occasionally in cultivated fields. Keep these sclerotia out of cattle feed, as they may cause abortion and other troubles.

Powdery Mildew—Shows as a thick grayish felt on the leaves with fruiting bodies as blackish embedded specks. Causes premature death of leaves; often associated with rust. No practical remedy. Rept. 1909-10, p. 735.



SALSIFY.

Fungi, etc.

Soft Rot—Caused by bacteria in the interior tissues of the roots, running down from the crown, and turning them a darker color. Usually occurs after storage. Avoid contaminated manure and too much rotting humus in the fields; store under dry cool conditions, allowing sufficient ventilation. Rept. 1914, p. 25.

SNAPDRAGON.

Insects, etc.

Leaf Mites—Cause leaves to curl and plants do not blossom. Spray with nicotine solution and soap, same as for Cyclamen. Rept. 1914, p. 176.

Root-Knot Eelworm—Causes irregular swellings on the roots where the eelworms are present, with resulting premature decay and sickly appearance of parts above ground. Worst in greenhouses and hotbeds, as this far north the nematodes are killed in unprotected ground over winter. Attacks roots of a great variety of cultivated plants. Purchase only healthy plants; change infected soil if possible, dry out thoroughly in summer, leave out doors over winter or sterilize with steam; avoid contamination of soil with infected refuse. Rept. 1915, p. 452.

Fungi.

Anthracnose—Shows as whitish spots with distinct purplish border on leaves and stems; spots often run together. Select seed and cuttings only from healthy stock; pick off and burn infected leaves. Spray with Bordeaux.

Rust—Forms reddish-brown, roundish pustules chiefly on under side of leaves, causing tissues above to become yellow spotted. Appears in greenhouses and causes more or less injury according to prevalence. Treat as for anthracnose. Rept. 1915, p. 443.

SNOWBALL.

Insects.

Aphids—Suck sap from the leaves, causing them to curl. Use nicotine solution and soap as a spray or dip.

Fungi, etc.

SOY BEAN.

Bacterial Leaf Spot—Appears as small, dark, reddish-brown angular spots frequently merging into larger areas. Certain

varieties are more susceptible than others, Ito San being one of the worst. Grow least susceptible varieties and if possible purchase seed from uninfected fields.

Crinkling Chlorosis—Shows as crinkling or yellowish-green mottling of leaves, or both together. Plants less vigorous than normal ones. Hollybrook variety apt to show trouble most. Treatment same as in preceding.

Insects.

SPINACH.

Spinach or **Beet Leaf-Miner**—See Beet.

Fungi.

Downy Mildew Blight—Forms conspicuous yellow spots on the leaves with a purplish-gray growth on the under surface. Unusually conspicuous recently. Little resistance shown by any variety. Disease worse in wet springs and in fields where spinach has been grown for some years. Practice rotation in isolated fields if feasible. Keep down the weed called Lambs Quarters as it is attacked by same fungus and is chiefly responsible for harboring the mature stage over winter.

Insects.

SPIRAEA.

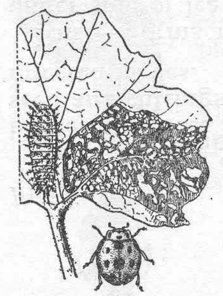
Aphids—Suck sap from the new shoots. Use nicotine solution and soap as a spray or dip.

SPRUCE.

Insects.

Spruce Gall Aphid—Forms galls at the base of the new growth on Norway and other spruces. Spray in the late fall or early spring with nicotine solution and soap or with kerosene emulsion. Repts. 1906, p. 302; 1922, p. 357.

Spruce Bud Moth—Larva feeds on leaves of terminal shoots of the branches, causing much damage. Spray with lead arsenate. Rept. 1922, p. 357.

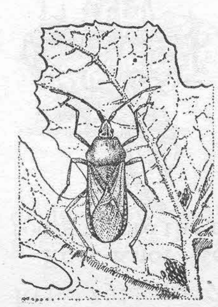


SQUASH-PUMPKIN.

Insects.

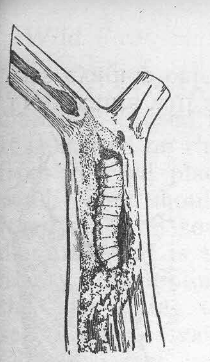
Squash Lady-Beetle—Both adults and larvae devour the leaves. Spray with lead arsenate. Bull. 181, p. 11; 216, p. 42; Rept. 1908, p. 810.

Striped Cucumber Beetle—See Cucumber.



Squash Bug or **"Stink Bug"**—A brown bug three-fourths of an inch in length sucks the sap from the under side of the leaves, which wilt and die. Spray with kerosene emulsion to kill the young. Bull. 216, p. 44; Rept. 1908, p. 811.

Squash-Vine Borer—Larva tunnels in the base of the stem, causing decay. Spray once a week during July around base of stems with nicotine sulphate (1-250). Cut slits lengthwise in the stem and kill borers.



Cover the joints of the vine with earth so that new shoots may be formed to support the plant. Grow a few early plants for traps, and destroy them. The main crop should be planted rather late. Bull. 216, p. 39; Rept. 1908, p. 806.

Fungi, etc.

Anthracnose—See Watermelon.

Storage Rots—Caused by various fungi that are best held in check by storage under conditions with minimum of heat and moisture.

Wilts—Cause leaves of the plants to wilt and then dry up, sometimes all of the vine thus suddenly dying. If a cross sec-

tion of the stem shows a slight milky and sticky exudation, it is caused by bacteria that clog up the water ducts. Fungi in the ducts or insects at the roots may cause similar injury. Heavy manuring often develops these troubles. Spraying is of little value except as it may keep off insects which inoculate the plants with the bacteria. Use enough seed to allow for loss by wilt and pull up and destroy all the wilted vines as they appear. Rept. 1903, p. 359.

Insects.

STRAWBERRY.

Strawberry Sawflies—Larvae devour leaves. Spray with lead arsenate or hellebore.

Strawberry Weevil—Small snout beetles; females cut off blossom buds of staminate varieties when ovipositing. Plant pistillate varieties in part. Dust heavily with lead arsenate and sulphur (1-5).

Strawberry Crown Borer—Grub tunnels and feeds in crown of plant. Practice crop rotation. Burn over infested field in fall.

Strawberry Flea Beetle—Adults eat holes through the leaves. Spray with lead arsenate.

Strawberry Leaf Roller—Larva rolls leaf and feeds inside. Spray with lead arsenate. Burn fields and plow abandoned fields as soon as crop is harvested.

Strawberry Root Aphid—Sucks sap from leaves and roots, killing plants. Set clean plants on land not infested. Spray with nicotine solution and soap.

Strawberry White Fly—Sucks sap from leaves. Under spray with nicotine solution and soap.

White Grubs—See Grass.

Fungi.

Leaf Spot and **Blotch**—Appear as conspicuous discolored spots, the former usually with whitish centers and purplish borders, and the latter with dark centers. Glen Mary sometimes severely injured by latter. Renew the beds frequently. In the late fall or early spring cut off leaves with mower, add a little straw where necessary, and burn over beds. Spray with Bordeaux two or three times before blossoming, beginning last of April and repeating weekly, and once after blossoming is over. Repts. 1903, p. 360; 1914, p. 5.

Powdery Mildew—Covers leaves (more frequently on under, but more conspicuously, when present, on upper surface) with cobweb-like growth, often causing them to become stiff and curled inward. This can be controlled with Bordeaux if sprayed before abundant. Rept. 1905, p. 276.

SWEET PEA.

Insects.

Aphids—See Pea.

White Fly—See Tomato.

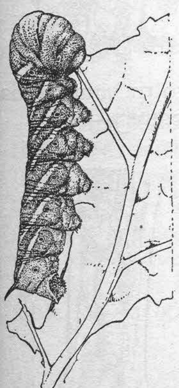
Fungi.

Dampening Off—Rots off stem just below ground, causing vines to turn yellow and finally die. Plant in well drained soil; place well-rotted manure deep in ground below the seed; avoid excessive watering; spray base of vines and ground with Bordeaux; change beds if appearing yearly. Rept. 1907, p. 359.

SYCAMORE.

Fungi.

Anthracnose—Kills young leaves in the spring; causes dead areas of irregular shape in tissues of older ones often following veins. If thought advisable to spray, use Bordeaux on the leaves as soon as showing and repeat when half and full grown.



TOBACCO.

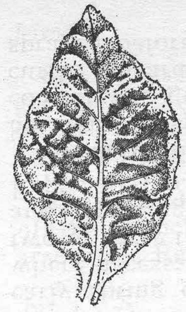
Insects.

Tobacco or **Tomato Horn-Worms**—Large green caterpillars with horn on the tail devour the leaves. Practice hand picking or spray or dust the plants with lead arsenate. Rept. 1906, p. 269.

Flea Beetle—Adults eat holes through the leaves. Spray upper and under surface heavily with lead arsenate. Bull. 208, p. 103; Rept. 1906, p. 271.

Cut-Worms—See Tomato.

Wire-Worms—Occasionally destroy newly set plants under cloth by tunneling in the stems below the surface of the ground. Trap plants will attract the wire worms, which may be killed with cyanide before setting the main crop.



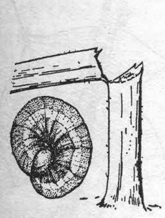
Fungi, etc.

Calico—Causes the leaves to become irregularly mottled with a lighter green color and makes a very inferior tobacco. Frequently infected leaves finally show numerous, irregular, often merging, brown spots known as "rust." While calico is a so-called physiological disease, it can be communicated to a healthy plant through contact with a very small amount of juice from a diseased plant. Care, therefore, is necessary after handling diseased plants in touching healthy ones. Never use tobacco water or tobacco stems on the seed beds. If calico shows in a seed bed, pull up all suspicious plants and those surrounding them. If troubled year after year, sterilize the seed beds or change them, and never make them on land used for tobacco the year before. When transplanting, wash the hands occasionally with soap and water. Repts. 1898, p. 242; 1899, p. 252; 1914, p. 357; Bull. 166, p. 10.

Dampening Off—Due to various fungi which rot off the seedlings or their roots. Keep air of beds as dry as consistent with good growth by care in watering and ventilating. If trouble starts in spots, take out all infected plants and refuse there.

Black Root Rot—Shows in seed beds by dwarfed "rosette" plants whose roots have been largely rotted off. Frequently it does damage in fields, especially where Havana has long been cultivated, but Round Tip is little injured; a short rotation is advisable in bad cases. Sterilize seed beds with steam or treat with formalin (formula D). Repts. 1906, p. 342; 1907, p. 363.

Wild Fire—*Shows first in lower leaves as small, roundish,* yellow spots. In time these grow larger, turn darker, and irregular dead areas appear more or less prominently. This disease is caused by bacteria and is favored by wet weather. It is carried on the seed and later may be readily transferred from infected places in the field by certain insects and the wind. Care should be used to select seed only from disease-free fields and sow this seed in sterilized seed bed. Where doubtful seed is used this should be soaked for 10 minutes in corrosive sublimate, rate of 1 to 1,000 parts water, stirring the seed during the treatment. Drain off the liquid, wash seed in pure water several times and dry before storing. Old cloth used previously on infected beds should be boiled in water before used again. Spray the beds, with Bordeaux mixture, shortly after the young plants have rooted, repeating every week until the setting season is over.



TOMATO.

Insects.

Cut-Worms—Eat off plant near ground or climb the plant and devour the leaves. Place around field poisoned bait or bran mash containing arsenic. Trap cut-worms with small piece of board. Rept. 1906, p. 264; Bulls. 190, p. 18; 208, p. 112; 216, p. 43.

Tomato or **Tobacco Horn-Worm**—See Tobacco.

Flea Beetle—See Potato or Tobacco.

Potato Aphid—See Potato.

Stalk Borer—See Dahlia.

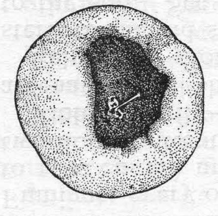
White Fly—Sucks the sap from under side of leaves. Spray under side of leaves with soap and water. Fumigate greenhouses with hydrocyanic acid gas (½ oz. to 1000 cubic ft.). Bulls. 140; 216, p. 50; Rept. 1902, p. 148.

Fungi, etc.

Bacterial Canker—Shows as small brownish streaks of dead and collapsed tissue running down the sides of the stems; at first may be concealed by the epidermis. The infected stems with their leaves soon wither and die. Badly infected fields are sometimes worthless. First seen here in a limited way in 1924, but was more frequent and serious the next year. Use seed from healthy plants only, or if uncertain treat seed. If necessary make new seed beds. Practice rotation, and especially avoid fields where disease has occurred.

Mosaic—Rept. 1908, p. 857. See Calico of Tobacco.

Leaf Spot—Produces on leaves and stems numerous, small, dark spots, often with white centers. Begin spraying with Bordeaux about the middle of July, making 3 or 4 applications at intervals of 10 to 14 days. This usually develops too late in the season here to cause serious damage.

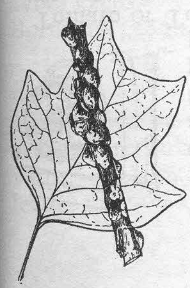


Point Rot—Causes the green fruit to rot at bloom end, showing a large, firm, dark-brown area. Claimed to be a physiological trouble. Frequently bad in very dry seasons. In greenhouses sub-irrigation is said to prevent it. Spraying is of little value. Considerable difference exists in varieties as to susceptibility.

Scab—Occurs most commonly in greenhouses, covering under surface of leaves more or less abundantly with an olive-brown growth which finally kills the tissue above. Spray with Bordeaux, picking ripe fruit before each of the later treatments.

Wilt—Occurs here chiefly in greenhouses; plants turn yellow and slowly wither up; fungus may finally show on dead stem and fruit as pinkish growth. Caused by fungus clogging ducts and cutting off water supply to leaves; in young stage presence shown by blackened bundles where stems are cut across. Change soil if appearing yearly; do not sow seeds from infected plants, as they can carry the disease. Spraying of no value. Rept. 1903, p. 366.

TULIP TREE.



Insects.

Tulip Tree Scale—Large brown hemispherical soft scales on bark, sucking the sap, especially on lower branches. Spray with lime-sulphur when trees are dormant. Oils may cause injury. Rept. 1921, p. 176.

TURNIP-RUTABAGA.

Insects.

Cut-Worms—See Tomato.

Cabbage Maggot—See Cabbage.

Turnip Aphid—Green aphids on under side of leaves sucking the sap. Dust with nicotine. Repts. 1916, p. 98; 1922, p. 346.

Fungi, etc.

Club Root—See Cabbage.

Soft Rot—Causes an interior soft decay of roots, etc., of a variety of vegetables, such as turnips, salsify, parsnips, carrots, celery. Very wet seasons and imperfect storage conditions are usually the starting point of these troubles. Store under best possible conditions for keeping down heat and moisture. Keep contaminated refuse out of manure pile. Rept. 1914, p. 25.

Phoma Rot—Appears usually after storage, causing conspicuous, dry, sunken, subcircular, black spots scattered over roots. Fruiting pustules show as black dots. Store roots in cool dry place and not too deeply in the piles. Practice yearly rotation and keep refuse from manure pile. If necessary, use only artificial fertilizers. Rept. 1912, p. 355.

VIOLET.

Insects, etc.

Violet Gall Midge—Larvae in curled edges of new leaves. Fumigate every other night with hydrocyanic acid gas (½ oz. to 1000 cu. ft.) until galls disappear. Exposure not less than two hours. Rept. 1921, p. 152.

Violet Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Eelworms—Form galls on the roots. Plant in new soil or sterilize the old soil by steam. Add plenty of air-slaked lime to the soil. See Snapdragon.

Fungi.

Spot Disease—Shows as whitish round spots on the leaves. Spray field plants early in fall with Bordeaux. Select only best stock for greenhouse; remove *all* affected leaves before transplanting. When plants have become established, spray again with Bordeaux. Be careful about watering plants, and, by proper ventilation and heat during September to November, keep atmosphere of house from ever becoming too moist.

WALNUT.

Insects.

Walnut Caterpillar—Clusters of black caterpillars covered with whitish hairs strip the branches and finally the trees in August. Spray with lead arsenate. Clip off twigs when caterpillars are small, and kill by crushing. Repts. 1914, p. 191; 1917, p. 326.

Walnut Weevil or **Curculio**—Adults feed at base of leaf stems. Larvae tunnel in new shoots and infest the fruit of Persian and Japanese walnuts. Spray with lead arsenate. Rept. 1912, p. 240.

Walnut Bud Moth—Larvae feed upon tender leaves and shoots, webbing them together. Spray with lead arsenate. Rept. 1912, p. 253.

WHEAT.

Insects.

Army Worm—See Grass.

Hessian Fly—Maggots burrow in sheath of a leaf at base of stem, causing the stalks to turn yellow and die. Plant late.

Wheat Midge—The fly lays eggs on the chaff and the maggots feed upon the developing kernels, so that the heads ripen early and produce no grain. Burn stubble before plowing. Plow infested fields deeply in the fall. Rept. 1917, p. 366.

Green Bug or **Aphid**—Green aphids suck the sap from leaves. Destroy in early fall all volunteer wheat and oats. Practice crop rotation.

Fungi.

Black Stem Rust—See Oats.

Leaf Rusts—Form small, dusty, orange-colored outbreaks on leaves, etc., and later darker and firmer mature stage. Several closely related species on barley, rye, and wheat but quite distinct from black stem rust. Some varieties are more resistant than others to these various grain rusts. No effective treatment.

Loose Smut—Destroys entire head, turning it into a dusty olive-black mass that is dissipated in time. Soak seed for 4 hours in cold water then treat, after standing in sacks 4 hours more, for 5 minutes in hot water at temperature of 133° F., or use formalin (B) dry sprinkle. Dry thoroughly if stored.

Stinking Smut—Fills the apparently scarcely changed seeds with a dusty mass of spores. Spores often found more or less abundantly in middlings and other feeds containing wheat, and their presence in amount indicates poor quality, and may have some connection with complaints of injury to stock fed on these. Use formalin treatment. Rept. 1909-10, p. 736.

WILLOW.

Insects.

Fall Web Worm—See Pear.

Spiny Elm Caterpillar—See Elm.

Poplar Tent-Maker—See Poplar.

Poplar and Willow Curculio—See Poplar.

Sawflies—Larvae devour leaves. Spray with lead arsenate.

Imported Willow Leaf Beetle—Larvae and adults feed upon the surface of the leaves of smooth-leafed species, soon skeletonizing them. Spray with lead arsenate. Rept. 1921, p. 195.

Aphids—Large reddish aphids congregate on twigs in fall, and suck the sap. Spray with kerosene emulsion or nicotine solution and soap.

Oyster-Shell Scale—See Apple.

Fungi.

Rusts—Occur on the leaves; similar in appearance and closely related to those on poplar. The alternate host for one species is the larch and apparently there is another the alternate host of which is not yet determined. Rept. 1915, p. 450.

MANUFACTURERS AND DEALERS IN SPRAY APPARATUS AND SUPPLIES.

Prospective purchasers should write to these firms for catalogues and prices.

MANUFACTURERS OF SPRAYING MACHINES.

Barnes Mfg. Co., The, Mansfield, Ohio. (Hand sprayers.)
Bateman Co., Fred. H., Grenloch, N. J. (Iron Age sprayers, traction and power.)
Bean Spray Pump Co., Lansing, Mich. (Hand and power sprayers and dusters.)
Brown Co., E. C., Rochester, N. Y. (Compressed air, hand and power outfits.)
Burch Plow Works Co., The, Crestline, Ohio. (Sprayers.)
Church, Stephen B., Seymour, Conn. (Power and hand sprayers.)
Church-Tyler Co., 210 Congress St., Boston, Mass. (Power and hand sprayers.)
Dayton Manufacturing Co., The, 2240 East Third St., Dayton, Ohio. (Hand sprayers.)
Deming Co., The, Salem, Ohio. (Hand and power pumps.)
Dobbins Bros. Mfg. Co., North St. Paul, Minn. (Hand dusters.)
Ellis Co., Wm. O., Concord Junction, Mass. (Spraying materials, Peerless Hand dusters.)
Field Force Pump Co., Elmira, N. Y. (Hand, traction and power spraying machines.)
Fitzhenry-Guptill Co., 135 First St., Cambridge, Mass. (Power sprayers.)
Friend Mfg. Co., Gasport, N. Y. (Spraying outfits, power and hand spray pumps and all sprayer accessories.)
Goulds Mfg. Co., 177 High St., Boston, Mass.; 16 Murray St., New York. (Hand and power sprayers.)
Hardie Mfg. Co., The, Hudson, Mich. Distributors: Brockport Sprayer and Pump Co., Brockport, N. Y.; H. V. Hart Co., Hagerstown, Md. (Hand and power sprayers.)
Hayes Pump and Planter Co., Galva, Ill. (Spray pumps.)
Humphryes Mfg. Co., The, Mansfield, Ohio. (Hand and power pumps.)
Leggett & Brother, Inc., 301 Pearl St., New York. (Hand and power dusters and liquid sprayers, insecticides and fungicides.)
Lunt Jillson Co., The, Manchester, Conn.; 1 Washington St., Boston, Mass. (Hand and power outfits.)
McKenzie Mfg. Co., La Crosse, Wis. (Power traction sprayers.)
Myers & Brother Co., The F. E., Ashland, Ohio. (Hand and power spray pumps. Complete power outfits.)
Niagara Sprayer Co., Middleport, N. Y. (Insecticides, dusts and dusters.)
Rumsey Pump Co., Ltd., 49 Federal St., Boston, Mass. (Hand and power pumps.)
Smith & Company, D. B., Utica, N. Y. (Sprayers and Dusting equipment for handling all insecticides.)
Spramotor Co., 107-109 Erie St., Buffalo, N. Y. (Hand and power outfits.)
Ward-Love Pump Corporation, Rockford, Ill. (Pumps for all purposes.)

MANUFACTURERS OF INSECTICIDES AND FUNGICIDES.

American Cyanamid Co., 511 Fifth Ave., New York City. (Insecticides and fungicides.)
Blanchard Co., The Jas. A., Hudson Terminal Bldg., 30 Church St., New York City. (Insecticides and fungicides.)
Bowker Chemical Co., 40 West St., New York City. (Insecticides and fungicides.)
Chipman Chemical Engineering Co., Inc., Bound Brook, N. J. (Insecticides and fungicides.)
Deloro Chemical Company Limited, Deloro, Ont., Can. (Arsenical insecticides, especially Calcium Arsenate.)
Ellis Company, Wm. O., Concord Junction, Mass. (Dusting and spraying materials. Peerless hand dusters.)
Frost Insecticide Co., Arlington, Mass. (Spray chemicals and apparatus.)
General Chemical Co., 40 Rector St., New York City. (Orchard Brand Spray and Dust Materials.)
Glidden Co., The, Cleveland, Ohio. (Insecticides and fungicides.)
Golden State Sales Corporation, 175 Franklin St., New York City. ("Kayso," Calcium caseinate spreader.)
Grasselli Chemical Co., The, 347 Madison Avenue, New York City. (Insecticides and fungicides.)

Heil Chemical Co., Henry, 210-214 So. Fourth St., St. Louis, Mo. (Spray *chemicals.*)
Hemingway & Co., Inc. (The Sherwin-Williams Co.), 292 Madison Ave., New York City. (Arsenical poisons.)
Interstate Chemical Co., 12-20 Bay View Ave., Jersey City, N. J. (Insecticides and fungicides.)
Lavanburg Company, Fred L., 160 William St., New York City. (Arsenical poisons.)
Mechling Bros., Chemical Co., Camden, N. J. (Insecticides and fungicides.)
Niagara Sprayer Co., Middleport, N. Y. (Dusting materials.)
Nicotine Production Corporation, Clarksville, Tenn. (Nicotine sulphate and free nicotine.)
Nitrate Agencies Company, Bayonne, N. J. (Manufacturers of agricultural insecticides and fungicides.)
Orchard and Garden Supply Co., The, Northampton, Mass. (Spray machinery and supplies.)
Pratt Company, B. G., 50 Church St., New York City. (Miscible oils.)
Riches, Piver & Co., 30 Church St., New York City. (Agricultural insecticides and fungicides.)
Roessler & Hasslacher Chemical Co., The, 709 Sixth Ave., New York City. (Cyanegg, Formaldehyde, Copper Carbonate.)
Sherwin-Williams Co., The, 601 Canal Road, Cleveland, Ohio. (Insecticides and fungicides.)
Standard Chemical Works, Inc., Reading, Pa. (Spray and dusting materials.)
Sun Oil Co., Philadelphia, Pa. (Miscible oils.)
Tanglefoot Co., The, Grand Rapids, Mich. (New England Agents, Abbott, Hall & Co., 12 So. Market St., Boston, Mass. Tanglefoot.)
Taylor Chemical Co., 8 W. 40th St., New York City. (Carbon di-sulphide.)
Tobacco By-Products & Chemical Corporation, Inc., Louisville, Ky. (Nicotine solution.)
Vreeland Chemical Mfg. Co., 16 East 40th St., New York City. (Insecticides and fungicides.)

CONNECTICUT DEALERS IN SPRAYING SUPPLIES.

American Hardware Stores, Inc., Bridgeport. (Spray pumps and insecticides.)
Apothecaries Hall Co., 24 Benedict St., Waterbury. (Wholesale Druggists. Insecticides, fungicides, spray materials.)
Bacon Bros., 345 Main St., Middletown. (Insecticides, fungicides and spray apparatus.)
Bedient, D. F., Ridgefield. (Spray materials.)
Benjamin, F. C., 132-6 White St., Danbury. (Spray apparatus, insecticides and fungicides.)
Bidwell Co., The F. S., Windsor Locks. (Insecticides, fungicides and spray apparatus.)
Blish Hardware Co., F. T., So. Manchester. (Insecticides, fungicides and spray apparatus.)
Cadwell & Jones, Seedsmen, 1084 Main St., Hartford. (Pumps, insecticides and fungicides.)
Chandler & Morse, Putnam. (Spray apparatus, insecticides and fungicides.)
Coles Company, The, Middletown. (Insecticides, fungicides, spray apparatus.)
Danbury Hardware Co., 249 Main St., Danbury. (Insecticides, fungicides and spray apparatus.)
Dickerman Hardware Co., Wallingford. (Insecticides and fungicides.)
Dreher-Smith Co., 234 Main St., Middletown. (Insecticides, fungicides and spray apparatus.)
Dudley, Frederick D., North Haven. (Spray and dust materials.)
Eaton Chase Co., The, 129 Main St., Norwich. (Spray apparatus and insecticides.)
Fairfield Hardware Store, Fairfield. (Spray materials.)
Gilman, Alexander & Co., Inc., Putnam. (Spray apparatus, insecticides and fungicides.)
Grasselli Chemical Co., 46 River St., New Haven. (Insecticides and fungicides.)
Greenwich Hardware Co., Greenwich. (Spray materials.)
Henry & Son, W. A., Blue Hills Farm, Wallingford. (Insecticides and fungicides.)
Hurd & Burr, Shelton. (Spray materials.)
Jackson-Marvin Hardware Co., 843-849 Whalley Ave., New Haven. (Insecticides and fungicides.)
Jordan Hardware Co., The, Willimantic. (Spray apparatus, insecticides and fungicides.)
Judson Company, The Dwight R., 237 State St., Hartford. (Insecticides and fungicides.)

Krenz, Ludwig, 544 Main St., Middletown. (Insecticides, fungicides, spray apparatus.)
Latham's, Stamford. (Spray apparatus, insecticides and fungicides.)
Lee & Osgood Co., The, 131-133 Main St., Norwich. (Insecticides and fungicides.)
Leete Co., The Chas. S., 299 State St., New Haven. (Wholesale Druggists. Insecticides, fungicides and spray materials.)
Lightbourn & Pond Co., 39 Broadway, New Haven. (Pumps, insecticides and fungicides.)
Lyman Farm, The, Middlefield. (Agts. for Friend spray machines and parts.)
Meeker, H. E., 86-90 White St., Danbury. (Insecticides, fungicides and spray apparatus.)
Morgan, A. D., 84 Washington St., So. Norwalk. (Spray materials.)
Norwalk Hardware Co., Norwalk. (Spray materials.)
Olds & Whipple, Inc., 164-168 State St., Hartford. (Insecticides and fungicides.)
O'Neil's Hardware Store, 165 Bank St., New London. (Spray materials.)
Platt Co., The Frank S., 450 State St., New Haven. (Pumps, insecticides and fungicides.)
Rackliffe Bros. Co., Inc., Park and Bigelow Sts., New Britain. (Spray materials.)
Redford, George E., 494 Main St., Middletown. (Insecticides, fungicides, spray apparatus.)
Sisson Drug Co., 729 Main St., Hartford. (Spraying machines and insecticides.)
Smith & Bishel Co., 246 Main St., Middletown. (Spray apparatus, insecticides and fungicides.)
Star Hardware Co., 36 Union St., Rockville. (Spray apparatus, insecticides and fungicides.)
Wheeler & Co., 207-213 Middle St., Bridgeport. (Spray apparatus, insecticides and fungicides.)
Whittlesey Co., The Chas W., 259-271 State St., New Haven. (Wholesale Druggists. Spray apparatus, insecticides and fungicides.)
Williams Co., The G. M., New London. (Spray apparatus, insecticides and fungicides.)

Connecticut Agricultural Experiment Station

New Haven, Connecticut

Report on Commercial Insecticides and Fungicides 1925

CONTENTS

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

Examination of Insecticides, Fungicides, Etc.

E. M. Bailey*

INTRODUCTION.

The Legislature of 1923 passed an act concerning the manufacture, sale and transportation of adulterated insecticides and fungicides. The text of the law and regulations, made as provided therein for its enforcement, are given in Bulletin 258 issued by the station in 1924. Both the law and such regulations as have been made are substantially the same as the federal law and regulations so that articles of this class which satisfy the requirements of interstate commerce will be accepted in this State.

The law requires this station to make analyses of samples which may be collected by the Dairy Commissioner or by our station agent. Evidence of adulteration or misbranding is required to be reported to the Dairy Commissioner who is responsible for enforcement of the law. Analyses and such other information regarding the character, composition and use of these materials as may be of interest are required to be published in bulletins of this station, either annually or at other intervals as may be advisable. The law carries no specific appropriation for the inspection work and a complete survey of the entire field of insecticides and fungicides each year is not thought to be advisable or necessary.

During the past year our agent has collected samples of lead arsenate and other arsenicals, and miscellaneous materials; examinations have been made also of products submitted from time to time by the Department of Entomology, and the Department of Botany of this station.

CLASSIFICATION OF MATERIALS.

The samples analyzed may be classified as follows:

Materials	No. of samples
Lead Arsenate	15
Bordeaux-Lead Mixtures	5
Sulphur Preparations	6
Nicotine Preparations	7
Emulsions	3
Miscellaneous (including A. O. A. C. collaborative samples)	13

* Analytical data are by Messrs. Andrew and Fisher. Inspection and sampling by Mr. Churchill.

METHODS OF ANALYSIS.

The methods of analysis employed are those authorized by the Association of Official Agricultural Chemists unless otherwise stated.

RESULTS OF INSPECTION AND ANALYSIS.

ARSENATE OF LEAD.

The specifications for arsenate of lead as defined in the law of this State are the same as those required by the Federal Insecticide Act.

Dry arsenate of lead must contain not less than twenty-five per cent of total arsenic oxide (As_2O_5), and arsenic in water-soluble forms not exceeding one and one-half per cent.

Arsenate of lead, not dry or powdered, may contain not more than fifty per cent of water; not more than seventy-five one-hundredths per cent of arsenic in water-soluble forms, expressed as arsenic oxide (As_2O_5); and not less than twelve and one-half per cent of total arsenic oxide (As_2O_5).

Analyses of the products examined are given in Table I.

TABLE I. *Analyses of Arsenate of Lead.*

Station No.	Brand, Manufacturer or Distributor.	Water. Found.	Water. Guaranteed not more than.	Arsenic Oxide, As_2O_5. Total. Found.	Arsenic Oxide, As_2O_5. Total. Guaranteed not less than.	Arsenic Oxide, As_2O_5. Water-Soluble. Found.	Arsenic Oxide, As_2O_5. Water-Soluble. Guaranteed not more than.	Lead-Oxide, PbO. Found.	Lead-Oxide, PbO. Guaranteed not less than.	Station No.
	Sampled by Station Agent.	%	%	%	%	%	%	%	%	
2479	Bowker's Insecticide Co., New York. *Bowker*	49.45	50.00	15.60	15.00	0.09	0.60	32.37	....	2479
2480	Chipman Chemical Eng. Co., New York. *Chipman*	....	....	31.10	30.00	0.23	1.07[1]	63.80	....	2480
2483	Chipman Chemical Eng. Co., New York. *Chipman*	....	....	30.89	30.00	0.18	1.07[1]	64.10	....	2483
2474	Grasselli Chem. Co., New York	....	....	31.32	31.00	0.18	1.15[1]	61.15	....	2474
2478	Grasselli Chem. Co., New York	....	....	30.67	31.00	0.14	1.15[1]	64.15	....	2478
2477	Interstate Chem. Co., Jersey City, N. J. *Key-Dry*	....	....	30.02	30.00	0.18	0.75	64.50	....	2477
2484	The Kil-tone Company, Vineland, N. J.	....	....	30.24	30.00	0.18	1.15[1]	63.55	....	2484
2464	Niagara Sprayer Co., Middleport, N. Y. *Niagara*	....	....	31.54	30.00	0.18	1.15[1]	64.35	....	2464
2470	Nitrate Agencies Co., New York. *Naco*	....	....	30.24	30.00	0.37	1.00	65.95	62.00	2470
2525	Pittsburgh Plate Glass Co., Newark, N. J. *Corona Dry*	....	....	31.86	....	0.14	...	65.65	....	2525
2471	Riches Piver & Co., New York	35.17	50.00	20.02	15.00	0.18	0.50	41.80	31.00	2471
2473	Sherwin-Williams Co., Cleveland, Ohio	....	....	31.86	30.00	0.18	1.00	65.00	....	2473
2472	D. B. Smith & Co., Utica, N. Y. *Lightening*	....	....	31.05	30.00	0.18	0.77[1]	63.30	....	2472
	Sampled by Purchaser or Manufacturer.									
2482	Vreeland Chemical Mfg. Co., Little Falls, N. Y. *Electro.* Mfr's sample	....	....	30.24	30.00	0.18	0.77[1]	64.40	....	2482
2390	G. A. Clyne, Waterbury. Purchaser's sample	....	....	....	....	0.11	...	....	....	2390

[1] Calculated from amount guaranteed as metallic arsenic.

Bordeaux-Lead Arsenate, etc.

2465. *Pyrox.* Bowker Chemical Co., New York.

2467. *Bordo-Lead.* Chipman Chemical and Engineering Co., New York.

2481. *Bordo-Arsenate.* Glidden Co., Cleveland, Ohio.

2468. *Hexpo.* H. J. Smith Co., Utica, N. Y.

2466. *Bordo-Lead Mixture.* Vreeland Chemical Mfg. Co., New York.

Analyses are given in Table II.

Table II. *Analyses of Bordeaux-Lead Arsenate, etc.*

No.	Condition.	Water.	Arsenic Oxide, As_2O_5. Total. Found.	Arsenic Oxide, As_2O_5. Total. Guaranteed, not less than.	Arsenic Oxide, As_2O_5. Water-Soluble. Found.	Arsenic Oxide, As_2O_5. Water-Soluble. Guaranteed, not more than.	Copper Oxide, CuO.	Lead Oxide, PbO.
		%	%	%	%	%	%	%
2465	Paste	65.95	5.57	5.00[1]	0.06	0.46[1]	8.39	1.28
2467	Dry	....	8.73	7.29[1]	0.18	0.38[1]	20.62	15.24
2481	Dry	....	14.77	5.90	0.18	0.50[1]	16.66	26.64
2468	Dry	....	8.37	6.90	0.28	0.50[1]	22.62	18.89
2466	Paste	44.23	8.91	5.58	0.11	0.78[1]	3.22	18.32

[1] Calculated from amount guaranteed as metallic arsenic.

Sulphur Preparations.

2506. *Sulfocide.* B. S. Pratt Co., New York. This product was labeled: Sodium polysulphide 39-40 per cent; sodium thiosulphate 1-2 per cent; inert ingredients 58-60 per cent.

Analysis showed the following composition:

Total sulphur	33.78	per cent
Sulphur as monosulphide	7.79	" "
Sulphur as thiosulphate	2.56	" "
Sulphur as sulphate	0.25	" "
Polysulphide sulphur (by difference)	23.18	" "
Equivalent to sodium polysulphide	38.48	" "

Sodium polysulphide is assumed to be the pentasulphide in the above calculation.

2518. *Niagara Pomodust.* Niagara Sprayer Co., Middleport, N. Y. The active ingredients claimed are sulphur not less than 87 per cent; arsenic (metallic), not less than 1.76 per cent; arsenic, water-soluble (metallic), not more than 0.50 per cent.

Analysis showed the following:

Total arsenic (metallic)	1.84	per cent
Water soluble arsenic (metallic)	0.12	" "
Total sulphur	89.73	" "

22695. *Sulphur-Arsenate Dust* 90-10; and **22696,** *Sulphur-Arsenate Dust* 83-15. John Bacon, Gasport, N. Y.

Analyses were made as follows:

	22695 Found.	22695 Guaranteed.	22696 Found.	22696 Guaranteed.
	%	%	%	%
Total arsenic as As_2O_5	2.85	....	3.74	....
as As	1.86	1.90	2.44	2.80
Water sol. arsenic as As_2O_5	0.17	....	0.22	....
as As	0.11	0.10	0.14	0.15
Total sulphur[1]	88.27	88.50	84.75	83.00

[1] Sulphur determined by the U. S. P. method IX, and sulphur in the undissolved residue by the A. O. A. C. method, Sec. 19, p. 20.

2551. *Sulphur Dust.* Sample submitted by Department of Entomology and examined for presence of lead arsenate. Qualitative tests showed presence of both arsenic and lead.

1855. *Lime-sulphur.* (Blanchard's). **1856.** Grasselli's. Samples were submitted by a purchaser and the following determinations were made.

	No. 1855	No. 1856
	%	%
Specific gravity at 22° C.	1.2333	1.3080
Baumé degrees	27.4	34.10
Total sulphur	19.62	26.35

Nicotine Preparations.

2476. *Black Leaf 40.* Tobacco By-Products and Chemical Corporation, Louisville, Ky. Active ingredient nicotine, 40 per cent. Nicotine found 40.93 per cent.

2517. *Niagara A 1 Dust.* Niagara Sprayer Co., Middleport, N. Y. Claimed to contain 2.7 per cent of nicotine. Nicotine found 2.78 per cent.

2469. *Hall's Nicotine Sulphate Solution,* 40 per cent nicotine. Hall Tobacco Chemical Co., St. Louis, Mo. Nicotine found 40.61 per cent.

2919. *Nico Fume* (Liquid). Tobacco By-Products and Chemical Corporation, Inc., Louisville, Ky. Claimed to contain 40 per cent free nicotine. The product contained 42.90 per cent.

2920. *Nico Fume* Tobacco Powder. Tobacco By-Products and Chemical Corporation, Inc., Louisville, Ky. This product was guaranteed to contain 12.5 per cent nicotine and the package was dated to indicate the time after which the above guaranty would not hold. The sample was purchased after the expiration of the period indicated, but attention was called to that fact by the dealer and the article was sold at a reduced price. The nicotine found was 12.71 per cent, indicating that the precaution on the label gave the manufacturer an ample margin of safety.

22371. *Tobacco Dust.* Submitted by E. M. Ives, Meriden.

Analysis:

Nicotine found	0.71%
Passed 200 mesh	96.00%

1300. Nicotine Dust. (Old Sample.) Submitted by Department of Entomology.

Analysis: Nicotine found 1.96%

Spray Emulsions.

1465. *Soluble Spray Oil* for dormant spraying. Clarkson & Ford, New York. Sample submitted by the Lyman Farm, Middlefield, Conn.

Partial analysis was made as follows:

	%
Specific gravity 25° C.	0.9333
Unsaponifiable	85.10
Rosin	present

The mixture is a light petroleum oil containing a sodium soap, probably sodium rosinate.

2507. *Pratt's Carboleine.* B. G. Pratt, 50 Church St., N. Y. Sample submitted by the Department of Entomology of this Station.

Analysis	Found. %	Guaranteed. %
Oil	88.74	86.00
Phenol	present	3.00
Ash	1.22	....
Water, determined by xylol, 11.17, by difference	10.04	....

The product was claimed to contain 83 per cent mineral oil and 3 per cent saponifiable oil. Potassium oxide was claimed to be 1 per cent.

2508. *Anthracine Oil Emulsion.* The Sherwin-Williams Co. Sample submitted by Department of Entomology. Claimed to contain anthracene oil 75 per cent, fish oil soap 3 per cent, water 22 per cent.

Analysis:

Total oil	72.63 per cent
Water (xylol method)	25.08 " "
Soap and undetermined	2.29 " "

Miscellaneous.

2475. *Kayso.* Golden State Sales Corp., New York.

Analysis:

Nitrogen	3.30%
Casein (N x 6.38)	21.05
Lime (CaO)	44.32

1600. *Lead arsenate* coated with lead stearate for experimental purposes (by Department of Entomology) was found not to have increased in water-soluble arsenic during the period of one year. At the two intervals the results for water-soluble arsenic (as As_2O_5) found were 0.09 in both cases.

2514. *Calcium Fluosilicate Compound.* Victor Chemical Works, New York. Submitted by Department of Entomology. Claimed to contain calcium fluosilicate not less than 15 per cent and inert ingredients not over 85 per cent.

Partial analysis was made as follows:

Phosphorus pentoxide (P_2O_5)	28.37%
Calcium oxide (CaO)	21.80
Iron and aluminum oxides ($Al_2O_3Fe_2O_3$)	20.60
Silica (SiO_2)	11.00
Flourine (F)	11.95

2505. *Atlas "A" Weed Killer.* Chipman Chemical Co., New York. Labelled as containing 45 per cent of sodium arsenite equivalent to 4 pounds arsenic trioxide per gallon.

Analysis:

Total arsenic found (as metallic)	23.67%
Calc. as sodium arsenite (Na_2HasO_3)	53.64

23420, 23421, 23422, 23423 and **23426.** Experimental mixtures examined for the Department of Entomology.

Water-soluble arsenic only was determined.

2591 and **2592,** *Fish Oil Soaps;* and **2593** and **2594,** Engine oil emulsion and Kerosene emulsion respectively. These were examined in collaboration with the A. O. A. C. referee's program for study of methods of analysis.

The results obtained are reported elsewhere[1] but they are summarized here for reference.

	2591 %	2592 %
Water, Xylol method	29.95	32.66
	29.96	32.49
Official method	30.00	32.06
	29.92	32.08

[1] Proceedings, A. O. A. C. 1925.

	2593	2594
	%	%
Ash	1.04	0.29
	1.08	0.28
Water (xylol method)	33.22	36.71
	33.28	36.93
Total Oil	65.26	63.40
	65.90	62.70
Potash (K_2O)	0.63	....
	0.65	....
Soda (Na_2O)	....	0.14
	....	0.15

Connecticut Agricultural Experiment Station
New Haven, Connecticut

CROSSED CORN

D. F. JONES
P. C. MANGELSDORF

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

CROSSED CORN

D. F. Jones and P. C. Mangelsdorf.

Vigorous, sturdy plants, a good sound ear on every stalk, no weak and spindling plants, few nubbins or moldy ears. These are some of the outstanding characteristics of crossed corn. It is all these desirable features combined that enable this new kind of corn to outyield the old standard varieties, year after year, and under all sorts of conditions.

Crossing two distinct types of animals or of plants almost always causes an increase in vigor. This has long been known and used in the production of mules, sterile hybrids of the horse and the ass. Swine breeders often utilize the beneficial effects of hybrid vigor by crossing different breeds of pigs, feeding for market the hybrid offspring but not breeding from them.

The same principle can be used in increasing the yield of corn and the Connecticut Agricultural Experiment Station has been working for many years to find the best methods of utilizing hybrid vigor and to produce strains of corn for crossing that give high yields adapted to the cultural and market requirements of this region.

Several promising types of crossed corn have now been produced, of which stock seed is available for seed growing. Other types are now being developed to meet different requirements and these will soon be available for distribution.

The uniform production from every plant, though the most important feature, is only one of the desirable characteristics of crossed corn. The ears are more even in size and shape, there are fewer nubbins, poorly developed ears and moldy corn. Many combinations show appreciably less smut and root rot infection. The stalks themselves are sturdy and strong and stand up when other plants are laid low by wind and rain. In time of tasseling and silking the crossed plants are far more even than ordinary varieties and in ripening there is the same remarkable uniformity.

In crossed sweet corn this uniformity in time of ripening is a very valuable feature for the market gardener or canner. It enables the grower to harvest his crop at one time and have practically all of the ears ready to be picked. This results in a better quality of canned or table corn, because fewer immature and over-ripe ears are included.

The uniform size of the ears is also particularly desirable in the case of sweet corn. It makes for a more attractive product and is a feature that appeals especially to the restaurant trade.

SEED SELECTION.

The uniformity of crossed corn, its evenness in ripening, its increased productiveness, the greater freedom from disease, cannot be obtained by any of the usual methods of seed selection in naturally-pollinated fields of corn.

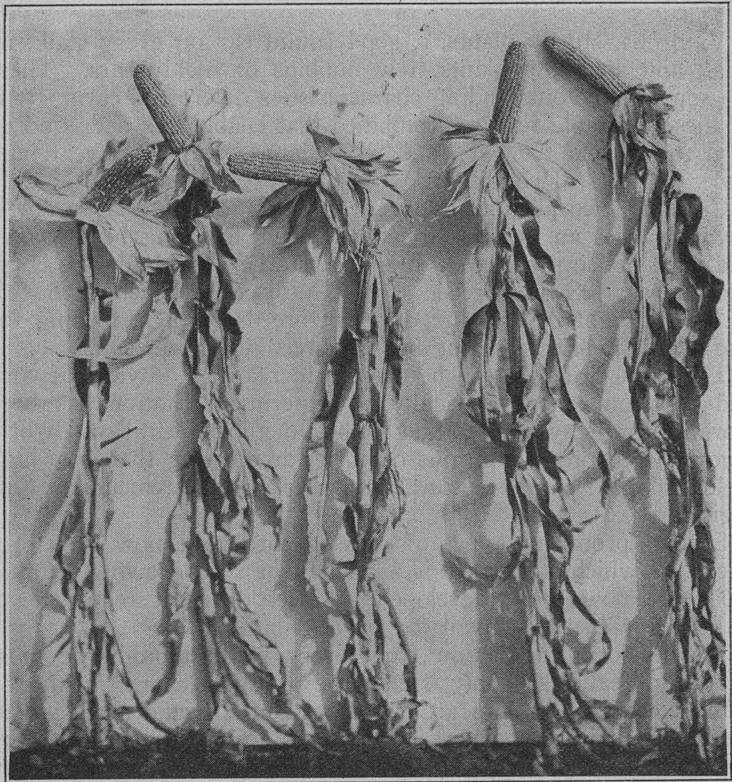


FIG. 1.—Vigorous, sturdy plants with a good ear on every stalk are characteristic of crossed corn.

One may go through a field or crib of corn, picking out the largest and finest ears, discarding all poorly filled and moldy ears and keeping only the one best ear out of every thousand, and yet these choice specimens do not reproduce their excellence; they do not "breed true." No matter how fine in appearance are the ears which are planted, they always give many weak plants and non-producers.

The failure of the finest ears to reproduce themselves has several causes. It is due, in part, to the fact that many of the best

ears are good, not because of their heredity but because of the especially favorable situation in which they grew. It is solely

FIG. 2.—In size and shape of ear and in time of ripening there is a remarkable uniformity.

their environment that has made them better than the average and the effects of environment, we now know, can not be passed on to later generations.

The main reason, however, that the selected ears do not breed true lies in the fact that the pollen which produced their seeds came from all sorts of plants. Every silk must receive pollen in order for a seed to develop. The pollen is shed by the tassels and good, poor and indifferent plants alike send their pollen into the air where it is mixed by the wind and carried to all parts of the corn field. The choicest ear in the entire field has received part of its pollen from some of the poorest neighbors.

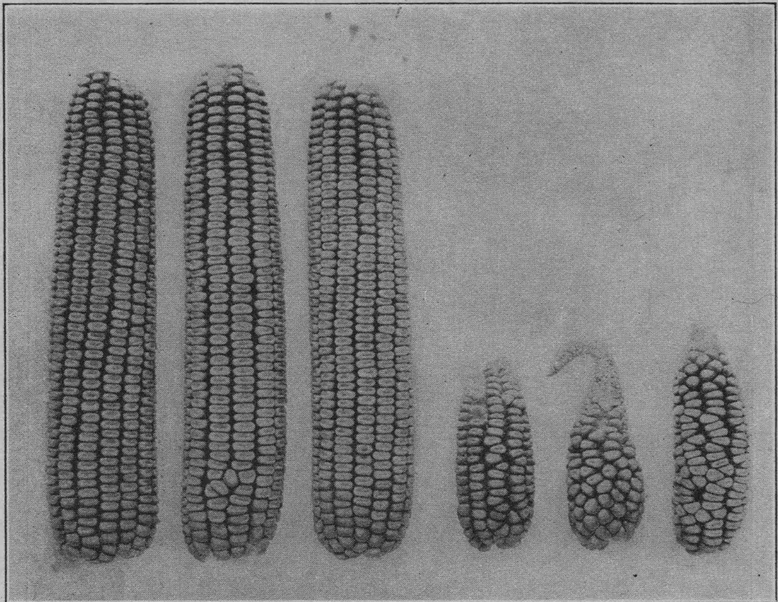


FIG. 3.—The plants grown from the small ears were just as large and the yield of shelled grain was the same as from the large seed ears.

This constant inter-crossing and hereditary mixing going on in every corn field has brought about a condition whereby every plant is a hybrid of greater or less degree of complexity and the offspring of hybrids are usually diverse and seldom like their parents. Moreover, corn has been naturally crossed in this way for countless years and is dependent upon hybrid vigor to produce its largest yield.

In spite of the natural crossing which is constantly going on, it is possible by ordinary field selection, patiently practiced, year after year, to bring about an improvement in certain respects. By saving for seed only the ears from the earliest ripening plants one may in time develop a variety that will mature somewhat

earlier. By choosing plants with many ears, the average number of ears per stalk can be gradually increased. Noticeable changes can be made in the number of rows of grain on the ear, the size and shape of the ear or the type of kernel.

Selection of this kind is usually made with some definite aim of adapting the variety more perfectly to the purpose for which it is grown. Such alterations are seldom accompanied by any increase of yield and often, particularly where extreme earliness is sought, productiveness is lowered.

Tests carried out at many places have shown that the prize winning ears at the corn shows often yield no more than unselected ears that are much less desirable in appearance. This fact is brought out in the accompanying illustration. Plants grown from the nubbins at the right were just as strong as those produced by the good ears shown on the left. The ears were fully as large and the yield of shelled corn was exactly the same.

In this case the difference in appearance of the two lots of seed ears was not due to heredity but merely to the conditions in the field in which they grew, the one in a good situation, the other in a poor one.

THE EAR-TO-ROW METHOD OF SELECTION.

When the seed from a number of ears of corn are planted separately, each in a row by itself, some lots grow better and yield considerably more than others. It was formerly thought that by selecting seed from the high producing rows or planting the remaining seed from the best yielding mother ears, and continuing this process from year to year, an increase in yield could be obtained. A marked increase in yield is sometimes obtained the first year or two but extensive tests have shown that the differences are not permanent and that in later generations the yield from the originally high producers is no more than that obtained from the unselected seed.

The failure of the high producing ears to maintain their increased yields is probably due to their hybrid composition. They split up and lose vigor in later generations. Selection towards a single type also brings about a certain amount of inbreeding which always weakens the plants.

HYBRID VIGOR.

Crossing somewhat different but related forms of plants or animals results in greater growth, the offspring often being better than either parent. Blue-gray cattle have long been used for beef in Scotland. They are the result of crossing a white Shorthorn bull and black Galloway or Angus cows. The large growth, early maturity and fine beef quality has given this breed cross an enviable reputation whereever beef cattle are raised.

The Carolina poplar is a thrifty, fast-growing tree that succeeds well in nearly all parts of the country. It is considered to be a

FIG. 4.—Two dwarf types of corn give an astonishing result when crossed.

natural hybrid between the Cottonwood of our western plains and the European Black poplar. A valuable feature of this tree is the ease with which it can be grown from cuttings. Its vigorous nature is thus easily maintained while at the same time the trees are multiplied in numbers.

Hybrid vigor is usually responsible for part of the value of most vegetatively propagated plants. As long as they are not

reproduced from seeds the stimulus to increased growth is maintained undiminished. In naturally cross-pollinated plants it is necessary to keep up a constant intercrossing in order to maintain full vigor.

The corn plant is so constructed with its tassel, the pollen-bearing structure, at the top of the stalk, that it can be easily detasseled before pollen is shed, thereby entirely preventing self-fertilization. Fifty years ago a method was outlined whereby two varieties of corn could be crossed by planting them in alternat-

FIG. 5.—The corn plant is so constructed that it can easily be crossed by planting in alternating rows and detasseling all of the plants of one kind before pollen is shed.

ing rows and pulling out all the tassels of one variety before pollen is shed. All of the seeds borne on such emasculated plants must result from cross-pollination of one variety with another.

Numerous tests have shown that an increased yield often results when certain varieties of different type, such as flint and dent, are crossed. Some varieties of corn from China when crossed with native varieties have given considerably larger yields than either parent. Crossing an early variety with a late variety sometimes gives a cross-bred progeny that yields as much as the later parent and is appreciably earlier. Varieties of similar type when combined have not given much better results than either parent.

The increased yields which are obtained come only the first year after crossing. To get the benefit of hybrid vigor in plants reproduced by seeds it is necessary to make the cross each year and plant only the crossed seed. Any improvement in yield or in other respects must be great enough to repay the extra cost of producing seed in this way. Variety crosses, while better than their parental stocks in some cases, have not, apparently, offered sufficient improvement to induce corn growers to make a practical application of this method.

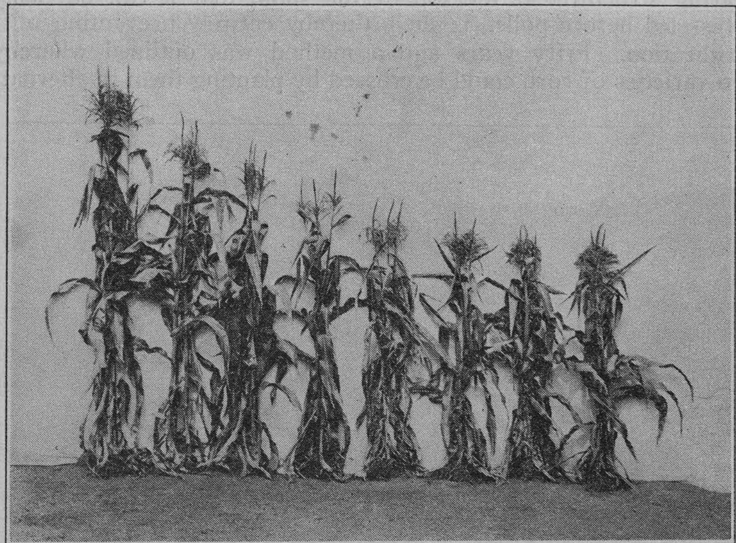


FIG. 6.—The result of seven generations of inbreeding.

INBREEDING BEFORE CROSSING.

A larger increase in yield together with a much greater uniformity and fixity of type is obtained by first inbreeding corn by artificial hand pollination for several years and then crossing two different inbred strains. This is shown in the accompanying illustration. A variety of Leaming which yielded 96 bushels per acre was inbred, that is, the silks were artificially pollinated with pollen from the same plants. After five years of inbreeding two strains, one of which had been reduced in yield to 32 bushels per acre, the other to 20 bushels, were crossed. The first generation cross of these two low yielding, inbred strains produced 115 bushels, an increase of twenty per cent over the original variety, under the same conditions. Not only did this hybrid exceed the original variety by twenty per cent in yield but the corn was of better quality. The ears were all closely alike in size and shape and all matured at practically the same time. Every stalk bore a good ear and there were fewer moldy ears, nubbins and less soft corn.

Here is a marked improvement secured by crossing. Unfortunately this particular cross and many other combinations made in the early years of these experiments were not well adapted to Connecticut conditions. The plants ripened too late to make a satisfactory corn for husking and the stalks were not large enough to make a good silage variety. Also the low yields and poor quality of the inbred strains made it practically impossible to produce crossed seed in quantity and at a price that would justify its use.

At the present time every effort is being made at this station and throughout the corn-growing states to produce inbred strains that

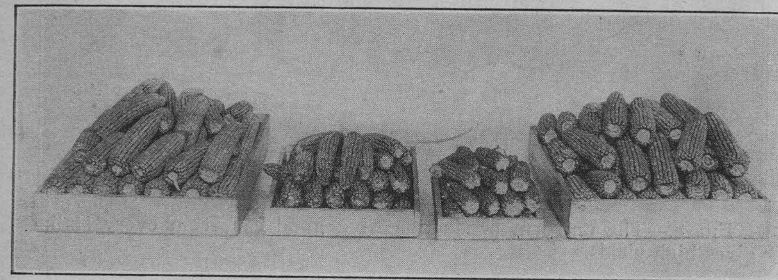


FIG. 7.—The two inbred strains were derived from the variety on the left and gave the result on the right when crossed—115 bushels per acre.

will give hybrid combinations well adapted to the local needs and which will be themselves sufficiently vigorous and productive to make the growing of crossed seed commercially profitable. Other methods of utilizing inbred strains of corn are being developed.

Crossed corn seed has now been grown in Connecticut five years and tested long enough to show its possibilities. Two crosses of inbred strains outyielded all varieties in the Iowa corn yield contest in 1924 in the south central section. One of the inbred strains used in one of these crosses was developed at this station.

A combination of four inbred strains known as Double Crossed Burr-Leaming has been tested for five years in comparison with the highest yielding varieties grown in this part of the country with the following results:

	Bushels of shelled corn per acre					
Highest Yielding Varieties	1918	1919	1920	1921	1922	Average
D. C. Burr-Leaming	116	88	55	95	63	83
Beardsley's Leaming	96	54	51	85	48	67
Luce's Favorite	..	79	38	81	50	62
Webber's Dent	81	62	57	73	49	64
Northern White Dent ..	84	75	32	87	..	69
Century Dent	68	51	55	77	67	64

FIG. 8.—The uniform production of a good ear from every stalk gives high yields.

FIG. 9.—Double Crossed Burr-Leaming grown at Durham, Connecticut.

Double Crossed Burr-Leaming has been grown in many other parts of the state and in various places in the corn-growing districts

south and west. In most cases it has out-yielded all other varieties, the stalks have stood erect in the fields until harvest and the leaves have remained green until the ears are well glazed.

A cross of two inbred strains of sweet corn grown for canning has yielded six tons of ears per acre in comparison with three and one-half tons from Evergreen corn.

FIG. 10.—Weak golden colored plants when crossed with dwarfs give all tall and vigorous progeny.

WHAT INBREEDING DOES.

Many abnormal or freak types of corn are known, such as dwarf plants, golden plants, which lack the normal green coloring matter necessary to manufacture food, liguleless plants, with upright instead of spreading leaves, and other characters which seriously weaken the plants and reduce their ability to produce grain. These abnormalities are inherited and pure breeding strains can be maintained from year to year.

When one of these unusual types is crossed with a normal plant only normal plants are produced in the first generation but the abnormality reappears in the second generation and may be recovered and made to breed true again, showing that these weakening characters are hereditary.

When, for example, a golden-leaved, liguleless plant is crossed with a dwarf form there result in the first following generation only vigorous, tall growing, dark green plants with spreading

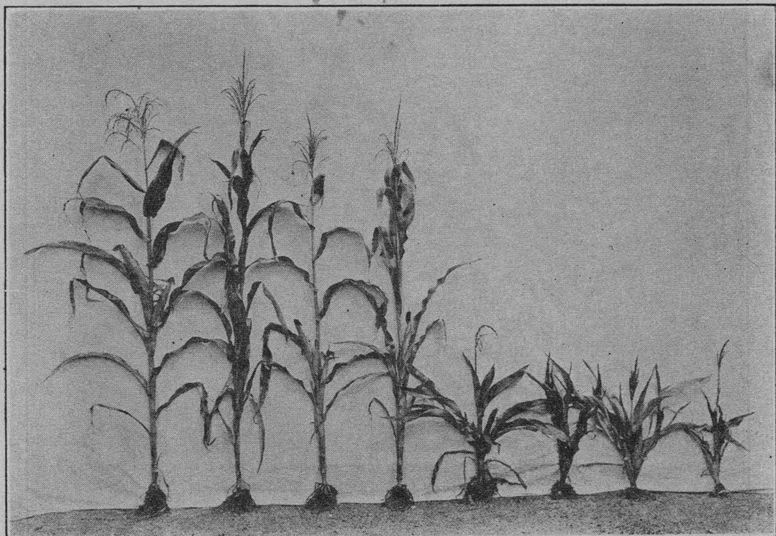


FIG. 11.—The second generation from the cross of golden, liguleless and dwarf. Eight different combinations of these characters are obtained.

leaves, all normal in every respect, uniformly vigorous and productive as shown in Figure 10.

Self-fertilizing these plants or allowing them to inter-pollinate gives an astonishing medley of plants in the next generation. There will be dwarf plants, golden plants and liguleless-leaved plants and some with two and even three of these abnormal characters combined in one individual. There will be some plants that are normal in all characters but very few will be as vigorous or productive as the first crossed plants.

The difference between the first and the second generation in respect to uniformity, size and productiveness is a very striking illustration of the bad effects of inbreeding. This is an extreme example but the same principle holds with naturally cross-fertilized

plants and with bisexual animals. In most cultivated plants such clear-cut abnormalities are not involved.

When any ordinary variety of corn is self-pollinated there is a noticeable reduction in size and yield and this usually continues for five or six generations. From this point on there is seldom

FIG. 12.—The descendants of a single plant after four generations of self-fertilization.

FIG. 13.—The plants within an inbred line are all closely alike but differ from every other line.

any further reduction. The plants in these generations, in any one strain, come to be all closely alike and remain fixed in their type from then on as long as they are not outcrossed to plants of different ancestry.

Every inbred strain descending from individual plants at the start is different to a greater or less extent from every other strain even though they all come from the same variety. Some are tall, others short. In color of leaves, silks and glumes, great diversity is found and in the size and shape of the ears, time of ripening, ability to stand erect and in number and size of tillers there is marked dissimilarity. Productiveness ranges all the way from little or nothing up to a fair yield for inbred plants but no

FIG. 14.—Crossing inbred strains immediately restores vigor and productiveness.

inbred strains have been obtained which are as productive as the original variety and usually the yields are reduced to less than half and the size of the seed and quality of the grain are proportionately lowered.

Since all of the plants within an inbred line come to be closely alike it makes no difference from that point on whether the plants are self-fertilized or are allowed to inter-cross among themselves. Their size and productiveness remain the same as long as pollen from all other kinds of corn is kept away from them.

When an inbred strain is crossed with another strain from the

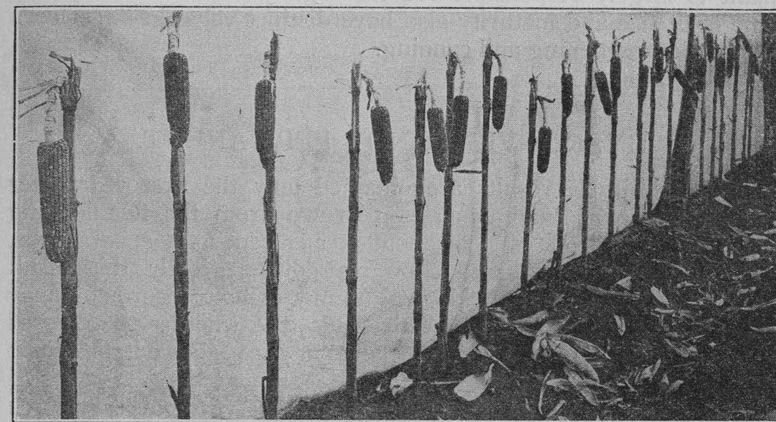


FIG. 15.—When rightly grown, crossed corn has no barren stalks or poor producers.

same or different variety there is a very great increase in size and yield in the next generation as we have already seen. In size the crossed plants are as large or larger than the original variety and in yield of grain they are often superior.

This is due apparently to the fact that the good qualities of both parents are expressed in the offspring while the weak qualities are covered over for the time being. Thus in the cross of golden, liguleless with dwarf the offspring are normal in every respect. The yellow foliage color, the upright posture of the leaves and the dwarfness of the stalk are all suppressed in this generation. What one parent lacks is supplied by the other, and conversely. Hybrid vigor seems to be a wise provision on the part of nature to enable the offspring to make the best of bad ancestry.

While most of the inbred strains do not have freak characters they are all lacking something which makes for full size and productiveness. Crossing any two strains usually brings back sufficient vigor to make the plants as productive as the original variety while certain combinations are very much superior.

The greater production of crosses of inbred strains is not due so much to the large size of the ears as to the fact that every plant, if given an equal opportunity to grow, produces a good ear. Some of the ears of the original variety may be larger and finer than any produced by the hybrid but for every plant of this kind there are many stalks that have only nubbins and even some that are entirely barren.

The uniform production of an average good ear from every plant is largely responsible for the high yield of crossed corn. The even size and maturity also have distinct value in sweet corn for market gardening and canning.

HYBRID VIGOR NOT PERMANENT.

These desirable results are obtained only the first year after crossing. The second generation grown from the fine looking hybrid ears fall off in yield about 20 per cent as a general rule. While the amount of reduction may differ greatly this result always follows when hybrid corn, no matter how vigorous it may be, is used again for seed. This holds true whether the crossed plants are self-fertilized artificially or are allowed to inter-pollinate naturally.

A cross of two inbred strains grown six years averaged 101 bushels per acre. The second generation of this cross from self-pollinated first generation plants grown the same years and compared under equal conditions gave an average of 69 bushels, a decrease of more than 30 per cent.

The Nebraska Station compared the first and second generations of eight hybrid combinations during two seasons and obtained an average of 52.2 and 27.8 bushels per acre respectively for the two successive generations. The original variety from which the inbred strains were derived gave 41.7 bushels in the same period. In this case the reduction in yield from the first to the second generation is nearly 50 per cent. The second generation was grown from seed produced by inter-pollinating the first generation plants.

Not only is there this decided decrease in yield but uniformity is also lost. In size and shape of ear, height of plant and in time of ripening the second generation is even more variable than ordinary varieties.

If the second generation is again inbred the whole story of the production of inbred strains is repeated. There is a continued decrease in size and yield, as in the first period of inbreeding, and the reduction continues for about the same number of generations,

five to seven on the average, until uniformity and constancy are again reached. The inbred plants are generally no more vigorous than those of the previous inbreeding although they differ from their parental strains and from each other in minor characteristics.

In other words hybrid vigor is a transitory effect and ordinarily can not be fixed and made permanent except in plants propagated vegetatively. Varieties of fruits, vegetables and flowers that are reproduced by tubers, roots, grafts or other asexual methods of propagation owe their value to a superior combination of hereditary factors which produce the qualities desired and which also give plants a large amount of hybrid vigor. This is shown by their seedlings which are almost invariably weaker and poorer in many respects.

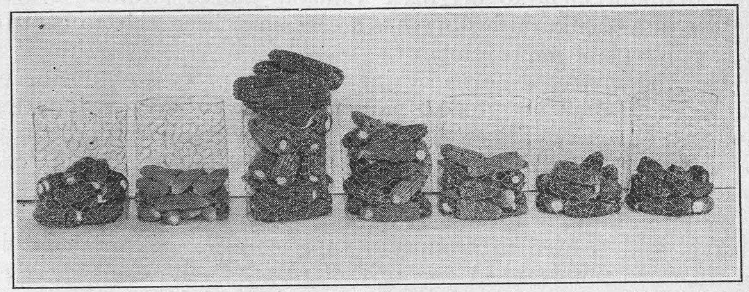


FIG. 16.—The first generation cross of two inbred strains will not continue to give as satisfactory results the next year. If inbred it will decline in vigor as in the first period of inbreeding.

Unfortunately from the standpoint of utilizing hybrid vigor, corn can not be reproduced in any way except by seeds. It can, however, be easily crossed. For that reason it is feasible to produce crossed seed for planting each year and grow only the first generation hybrid plants for production of sweet corn ears, grain or silage.

The additional cost of crossed seed is more easily justified for corn than for other crops because the cost of seed is a smaller item in the outlay for producing a crop of corn than for any other plant commonly grown.

SELECTION IN SELF-FERTILIZED LINES.

The character, productiveness and general value of any combination of inbred strains can not be accurately determined from the inbred strains themselves. Many strains which are weak and undesirable in their inbred condition give astonishing results when crossed. It is necessary therefore to test out many combinations to secure the ones that have outstanding value.

Not all crosses of inbred strains are superior to the original variety and like every other good product crossed corn requires extensive selection and much thorough testing in order to obtain something of real merit.

To have a reasonable chance of securing a good combination, many inbred strains must be obtained and then tested in many combinations. This work for the present can best be done by the State Experiment Stations and the Federal Department of Agriculture until the method is more generally used. The prospect of obtaining a particularly fine combination and being able to control the stock strains from which this cross is obtained holds out an inducement to originate valuable inbred strains. Never before in agricultural history has a seedsman been able to control a valuable plant improvement.

He who invents a new machine or a new process of manufacturing can patent his product and reap a reward for his industry and inventiveness. The originator of a new and improved plant or animal ordinarily loses control of his product as soon as he sells his first seeds or breeding stock.

With crossed corn the situation is entirely changed. The seed that is sold is used to produce a superior crop of corn but this in turn can not be used for further planting and the only way the same result can be secured is to obtain seed from the original producer each year. This is an advantage that will result beneficially to both the seedsman and the one who plants the seeds. This will stimulate the production of better kinds of corn as nothing else has ever done. Larger crops of better corn will be harvested on the same acreage and with the same labor. Therefore the cost of producing a bushel of corn will be reduced.

At this Station the method of obtaining good inbred strains is as follows. A variety is chosen which has been thoroughly tested and is known to be well adapted to the purposes to which it is to be put. A large number of the best ears of this variety are selected and seed from each ear is planted in a separate row in the field. About 20 to 30 plants are grown in each row. When the plants are ready to silk out five of the best plants are self-pollinated by hand.

This is a simple process with corn. A "three pound" paper sack is placed over the ear shoot as soon as it appears and before any silks are showing. The bag is slipped over the ear shoot without being opened and is held in place with a wire paper clip. At the same time, or a day or two later, an "eight pound" bag is put over the tassel and securely fastened around the stalk at the base of the tassel, also with a wire clip.

Two or three days later, depending upon the weather, when

the silks are out about three inches beyond the tip of the ear, the tassel is bent over and shaken into the tassel bag which has been unfastened. This collects the fine yellow powder, the pollen, which is dusted over the silks. The small bag is replaced quickly over the ear and the larger tassel bag is put over this, thus guarding against breaks in the bags which will let in pollen from outside. The bags are left on until the ears are gathered in order to mark them.

Pollination can only be done when the bags are dry. Wet

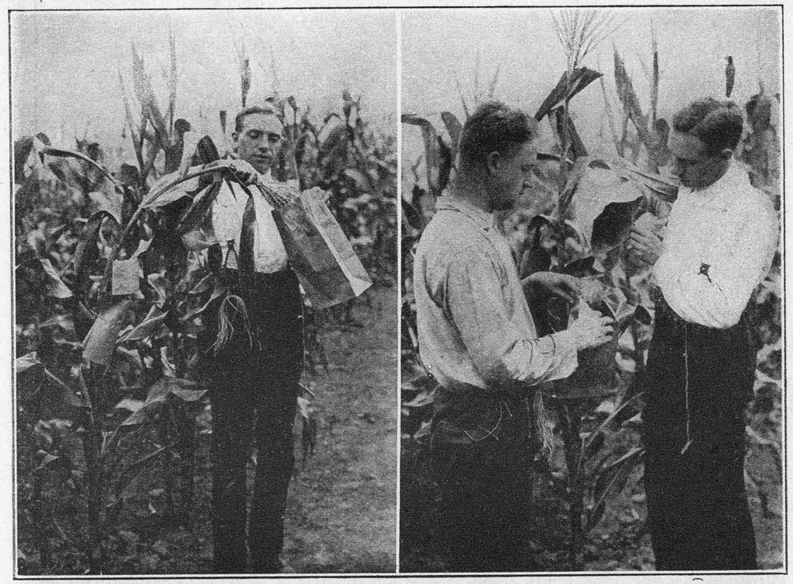


FIG. 17.—Self-fertilizing corn by hand pollination.

weather or heavy dew which causes the pollen to clump together renders it unfit for use. Only a very small quantity of good pollen is needed and this should be applied as soon as possible after the silks appear.

Care is taken to avoid touching the silks with the hands and also nearby plants are pushed away so that their pollen will not fall on the silks. Hand pollination in this way insures that the ears are fertilized with pollen from the same plant. This is the closest kind of inbreeding and will have very noticeable effects on the resulting progeny.

An inbred strain starting from an ear, borne on one plant, is called a self-fertilized line. From the five hand pollinated ears made the first year in each line, three of the most desirable are selected for planting the next year. These three progenies are grown in rows and two plants are self-pollinated by hand in each row.

FIG. 18.—Two self-fertilized lines from the same variety which differ remarkably in height.

FIG. 19.—Ability to stand erect has a basis in inheritance as these two strains were derived from the same variety and grown for fifteen years under the same conditions.

At harvest the best and second best of the three progenies are noted in each line. Two ears from the best and one from the next best are planted the following year and this system is followed for three or four generations. At that time many of the lines are fairly well fixed in their type and are uniform.

There are great differences between the several lines. Some are tall, others short and all degrees in between. Some have many tillers, others have few or none. Differences in ability to stand erect, in amount of smut damage, mold on the ears, and other characters of greater or less importance are noted.

Some lines are so unproductive that it is difficult to secure any seed from them. A number of promising strains are found that make a fairly good ear on every plant, all of the plants stand up during the season and have qualities that make them appear of value although few of them are more than half as productive as the variety started with. Nearly all of them are later in maturing than the variety at the start on account of their weakened condition. When crossed the plants grow and mature much faster and the value of the inbreeding process is at once apparent in the crossed progenies.

To obtain the best results it is necessary to test all of the best appearing inbred strains in combinations with each other. This is most easily done by hand-pollination, putting the pollen of one strain on the silks of the other and keeping a record of the strains combined.

METHODS OF PRODUCING CROSSED SEED.

When a good combination of two inbred strains, called a single cross, is once found it is a comparatively simple matter to produce crossed seed in quantity by planting the two inbred strains in alternate rows:

A B A B A B etc.

A = the pollen parent rows; the tassels are left on and seed from these plants is inbred and can be used for planting in a crossing plot another year.

B = the seed parent rows with all the tassels pulled out; seed from these plants gives crossed corn.

All of the plants of one kind are detasseled before any pollen is shed. This is done by pulling out or breaking off the tassel as soon as it appears above the leaves at the top of the stalks. Pollen is scattered by the wind as soon as the anthers, the tiny sacks suspended on short threads from the tassel branches, appear. These are put out first at the tip of the tassel and fresh ones come out every morning for several days. It is necessary to remove all

the tassels from all plants of one kind before the anthers can be seen. If pulled too soon the tassel sometimes breaks, leaving a portion in the plant which will later grow out and give off pollen.

If all of the tassels of one kind of plants are removed at the proper time all of the seeds produced on these plants must be cross-pollinated with the other strain. This is the seed to be used for field planting and will give vigorous and uniformly productive plants. Seed from the pollinator rows is all inter-pollinated and can be used for stock seed for planting in the crossing plot

FIG. 20.—A field in which crossed seed corn is produced. Two rows are detasseled while every third row, planted with a different lot of seed, furnishes the pollen.

next year. By maintaining two crossing plots in separate fields, detasseling one type in one field and the other type in the second field, it is possible to have inbred stock seed of both types produced each year.

Crossing can be made either way as far as the product from the crossed plants is concerned. Reciprocal crosses in corn give results that are closely, if not exactly alike. Usually, however, it is desirable for one reason or another to make the cross one way. Some strains make better seed than others while a strain that may be poorer as a seed parent may be better as a pollen parent. If this is the case a small plot of the seed parent can be grown in a field by itself to produce stock seed for planting in the crossing plot.

It is very important to maintain the stock seed of the two inbred types free from any outcrossing with any other corn. Pollen is blown by the wind for long distances. Fields that are 500 or more feet apart and not in the line of the prevailing winds will not show much mixing especially if they are separated by a barrier of trees or other windbreaks.

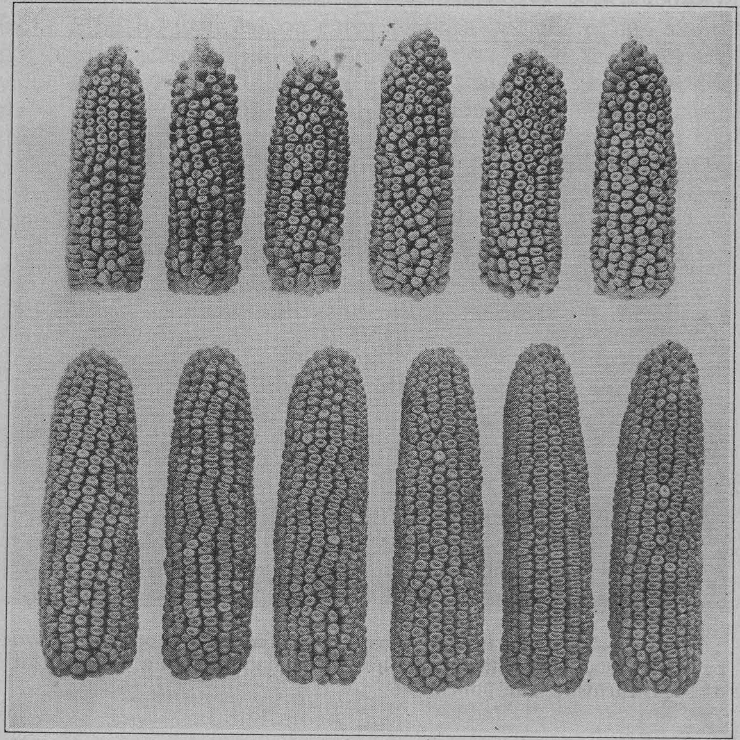


FIG. 21.—Two inbred strains showing uniformity of ear type.

Fortunately, when inbred plants are crossed with any unrelated kind of corn there is such a noticeable increase in the size of the crossed plants and change in type that is usually possible to detect such outcrosses and remove them before they produce pollen. In order to do this it is necessary to go through the crossing fields and rogue both the seed parent and pollen parent very carefully just before the tassels appear. It is best to remove or destroy the whole plant so that seed from them will not get mixed in with the stock strains.

Generally it will be found desirable to have the seed parent early in order to have the crossed seed for field planting well matured. The pollen parent can be later since pollen usually comes out well in advance of the silks. A small difference in this order will bring the two together at just the right time.

If there is much difference in time of silking and tasseling between the two parental stocks it is necessary to plant the two at different times. It is often difficult to know the right time to plant as the time of flowering varies with the season and changes unequally with different strains.

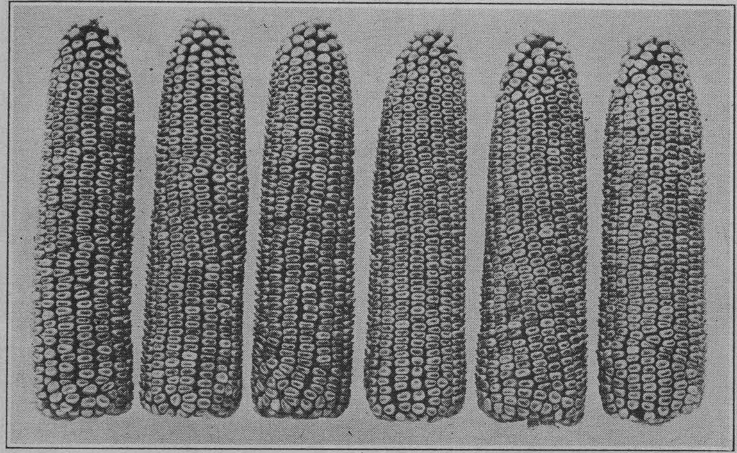


FIG. 22.—Crossing the two inbreds gives size and retains uniformity.

Two weeks difference in planting time will not make more than four or five days difference at pollinating time as the late planted corn tends to catch up with the early. However, if a dry spell or other unfavorable growing conditions intervene the later planting may not come on as fast as normally whereas the earlier planted corn may not be as much affected. For this reason it is advisable to plant the pollen parent at two different times, from ten days to two weeks apart. When the seed parent and pollen parent flower at about the same time a good plan is to plant all of the seed parent and half of the pollen parent at one time, leaving every other row of the pollinator to be planted ten days or two weeks later.

With vigorous corn it is not necessary to have the pollen-producing plants in every other row. One pollinating row to two, three or even four detasseled rows is sufficient depending on the amount of pollen produced and the duration of the flowering period. This must be determined by trial for each particular combination and the field in which it is grown.

SINGLE CROSSES.

Hybrids produced by combining two fixed inbred strains are called single crosses and have the greatest uniformity and trueness to type in the first generation of any type of crossed corn.

FIG. 23.—Crossed corn showing evenness in height and tassel formation.

Where uniformity in size, shape and other ear characters and evenness in ripening are particularly important, as in sweet corn for market gardening and canning, it will probably be well worthwhile to use this method in spite of certain serious handicaps.

The principal difficulty of producing single crosses is the low yields and poor quality of the seed obtained from the weakened inbred plants. No inbred strains have been produced that will yield much more than half as much as the original variety when dependent upon their own pollen or pollen from other inbred strains. They also make a much smaller amount of pollen, and unless the two strains are planted at just the right time so that

pollen will be given out as soon as the silks appear, and continue until all the silks are out, the amount of crossed seed produced will be very low.

FIG. 24.—All of the ears ripen at the same time.

Inbred strains are also slower in ripening, and the thorough curing, so necessary to insure strong germination, is difficult to obtain.

The success of single crossing will depend very largely on the production of inbred strains which are sufficiently vigorous and productive to make a fair yield of seed. Since corn is being inbred very extensively there is every prospect that such inbred strains will soon be forthcoming and that this method can be used satisfactorily with sweet corn for market gardeners and canners.

DOUBLE CROSSES.

A further development of the method of crossing has been made which overcomes the handicap of low production and poor quality of seed of the first method. This is to cross two first generation hybrids. In this way four different inbred strains are combined by three crossings as follows:

Inbred Strains	A B	C D
Single Crosses	A x B	C x D
Double Cross	(A x B) x (C x D)	

The two crosses of inbred strains are made as described above. The two different lots of crossed seeds are planted in alternating rows in the same way and all the plants of one lot are detasseled in the same way as before. The seed produced on the detasseled plants is used for field planting. The seed from the plants that produced the pollen is of no further value either for field planting or for stock seed and must be discarded.

The two single crosses being vigorous and productive, a good yield of high quality seed is obtained. The crosses produced in this way by one hybrid type pollinated by another are no less productive than either parent and production may even be appreciably increased.

It is important to test the combinations first but when a high yielding and desirable double cross is once produced it can always be reproduced by combining the same strains in the same way.

It is essential that the four inbred strains be of such constitution that they will give good results in all combinations when crossed singly, particularly the crosses AC, AD, BC and BD. The combinations AB and CD should also grow well to give a good yield of seed. The four strains may all come from the same variety or from different varieties. In the latter case the two strains which form the seed parent should come from one variety and the two to form the pollen parent from the other.

Double crosses are not as uniform as single crosses either in height of plant, size and shape of ear, or in time of maturity.

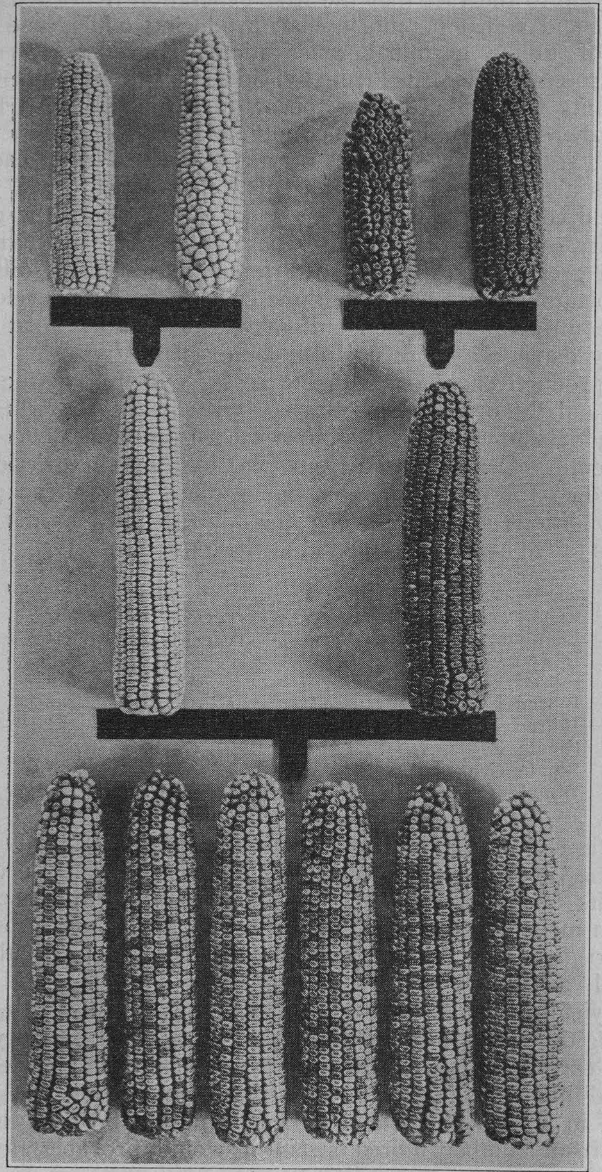


FIG. 25.—Illustrating by actual field results the bringing together of four inbred strains by three crossings to produce double crossed corn.

This is due to the fact that the first generation hybrids used for the seed and pollen parents are all producing ovules and pollen grains of unlike germinal constitution. However, all of the double crossed plants result from hybrid combinations. There is no opportunity for weaknesses to appear due to inbreeding. Hybrid vigor is therefore kept at the maximum and may even be increased. For that reason every plant is strong and sturdy and each one produces a good ear if given an equal chance to grow.

In field corn where uniformity is not so important the greater variability of double crosses may be an advantage in giving the plants a greater adaptiveness to different seasons and soils. All of the plants will not be at the same critical stage of development at some unfavorable period and may escape injury that would seriously damage a more uniform lot of plants.

The productiveness of a double cross compared to the single crosses and the original varieties is shown in the following combination of inbred strains self-fertilized four years, two strains from Century Dent and two from Leaming. Both varieties have been grown for many years in Connecticut, are well adapted to local conditions and are among the highest yielding of all the varieties tested at Mt. Carmel and at Storrs.

Variety or Cross	Yield in Bu. per Acre
Century Dent, 110	47.5
Leaming, 112	44.4
Inbred Century Strain, 110-2	15.3
Inbred Century Strain, 110-4	16.8
Inbred Leaming Strain, 112-1	42.7
Inbred Leaming Strain, 112-4	11.1
Single Cross, 110-2 x 110-4	51.2
Single Cross, 112-1 x 112-4	45.6
Double Cross (110-2 x 110-4) x (112-1 x 112-4)	69.8

The figures represent averages of from two to six plots of each lot. The yields have been corrected for soil differences according to results from the adjoining check plots and all are based on a uniform moisture content of 12 per cent. The double cross gave over 50 per cent more grain than the average of the two parental varieties.

The yield of one of the inbred strains is unusually high, nearly equalling the variety from which it was derived. The quality of the inbred corn was poorer than the variety and this yield was obtained in a field where there was an abundance of pollen. When planted in a separate field and dependent on its own pollen or pollen from another inbred strain it would probably not yield so high.

A combination of two inbred strains of Burr's White Dent and two of Leaming, both varieties originally from Illinois, has been found to give a large and vigorous stalk growth and generally

a higher yield of grain than any variety of corn grown in southern Connecticut. This particular combination is called Double Crossed Burr-Leaming and seed has been grown commercially since 1921. From 1918 to 1922 it was tested at Mt. Carmel in comparison with all of the varieties commonly grown in Connecticut and the yields are given in the first part of this bulletin.

This combination yielded more than all varieties in three out of the five years tested, while no one variety yielded more than

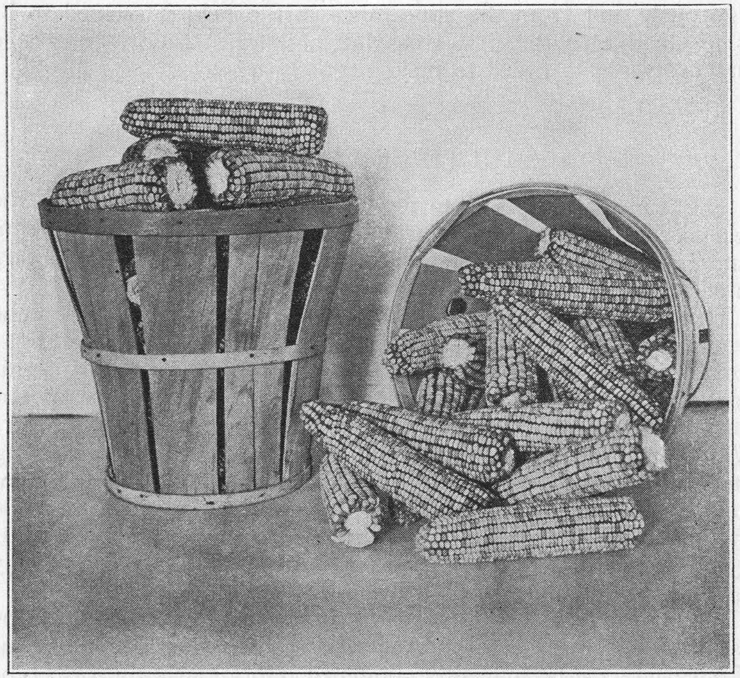


Fig. 26.—Double Crossed Burr-Leaming.

the others in more than one year. The greater return from Burr-Leaming is not only in the larger yield, but also in the freedom from mold, fewer nubbins and less soft corn. In addition the plants have a noticeable ability to stand erect when other varieties are blown down. and show a marked tendency to hold their foliage green until the seeds are ripe.

Although this new kind of corn will not out-yield all varieties, everywhere, in each season, it has been tested sufficiently under farm conditions to show that it can be planted profitably in many places.

Double crosses, like single crosses, will not maintain their high yields more than one year after the cross. From a field of Double Crossed Burr-Leaming that yielded well over one hundred bushels of shelled grain per acre, about one bushel of the largest and finest ears were selected. These were shelled together and this second generation seed was planted the following year in comparison with first generation seed. Two plots averaged 73.5 bushels in comparison with 95.1 bushels for the freshly crossed seed. This is a loss in grain of 23 per cent. The stalks grew vigorously and from the appearance in the field it seemed to be as productive as the first cross but at harvest time it was seen that many plants failed to make a good ear.

MULTIPLE CROSSES.

The principal objection to the method of double crossing is the necessity of maintaining four inbred strains of corn free from outcrossing with each other or other types of corn and making three separate crosses.

Theoretically, the same combinations of factors and in the same proportions can be secured by crossing the second generations from the two single crosses as by crossing the two first generation hybrids. A two years test shows that in the case of the Burr-Leaming combination the second generation of the Burr White single cross by the second generation of the Leaming single cross gives the same yield and quality of corn as the combination of the first generations of those two crosses. The yield and quality of the seed itself produced by second generation plants is not so good but the crop grown from that seed is in every way equal to the combination of the two first generation hybrids.

These results led to "multiple crosses," a further step in the evolution of crossed corn. A number of the best inbred strains of a variety are permanently combined into a fairly uniform type that can be propagated from year to year by natural inter-crossing, as are ordinary varieties. In other words, a "re-created" variety is produced in which all the best of the old variety has been combined and all the inherited abnormalities and weaknesses have been eliminated.

This recreated variety is now crossed with a similar combination of the best inbred strains from some other sort or perhaps a group of inbred strains of different type from the same variety.

Such a multiple cross would have the advantage of producing good yields of well developed seed and crossing each year would give maximum vigor and productiveness. This method has not yet been thoroughly tested but preliminary tests indicate that it will be feasible. The uniformity of the crossed plants produced

by this method may not be as great as in a double cross, but if the right combination of strains is made, yield should be maintained at a high level indefinitely.

MODIFIED SINGLE CROSSES.

Greater uniformity, where this is desirable, can be obtained by combining a number of strains from one line descending from a

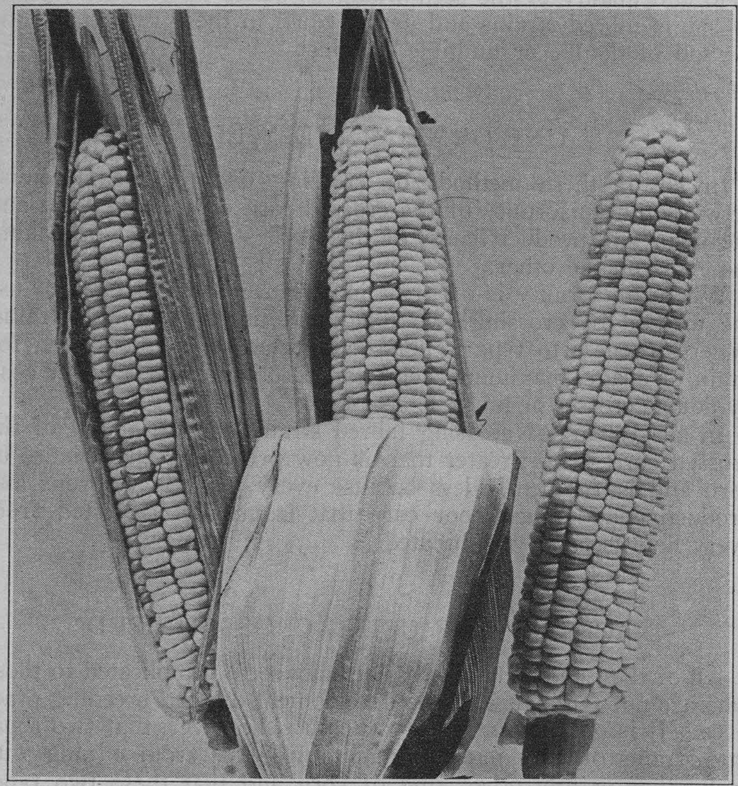


FIG. 27.—The uniform size and shape of ear and even ripening are important factors in sweet corn for market gardening and canning.

single plant but separated in the first or second generation and self-fertilized four or five years to rid them of recessive weaknesses and undesirable characters. Combining several of these substrains gives vigor and productiveness closely approaching the original variety and such a combination could be propagated from year to year by natural inter-pollination, at the same time maintaining a fair degree of fixity of type.

When crossed with a similar combination of sub-strains descending from a different plant of the same or a different variety yield and vigor would be as great as in any system of crossing and the uniformity of the hybrid in certain combinations would be nearly as pronounced as in straight single crosses of two fixed inbred strains.

Crossed seed for field planting would be made each year. The yield and quality of the seed would be better than that produced by single inbred strains and nearly equal in these respects to the method of double or multiple crossing.

UNIFORMITY AND YIELD.

In all of these methods of crossing one must compromise between the uniformity of the crossed corn on the one hand and the vigor and productiveness of the stock strains used in making the cross on the other.

Where uniformity is of great importance it will be best to use the method of crossing two fixed and uniform inbred strains. Where trueness to type is not so important, as in field corn for grain or silage, maximum yields can be obtained, at a lower cost, by double crosses or multiple crosses.

In all systems of crossing inbred strains the variability of the crossed corn is no greater than is now present in all varieties of corn and is frequently less because every plant is vigorous and productive and much poor corn that is usually harvested from every field is largely eliminated.

NECESSITY OF USING CROSSED SEED.

All of these methods of crossing may seem complicated to those who are not familiar with the development of corn breeding practices. It is only necessary to remember, however, that two separate strains of corn must be maintained free from mixing with each other or any other kind of corn and that these two types must be planted in alternating rows and all the plants of one of them detasseled before pollen is shed. The seed produced on these castrated plants is used for planting to produce crossed corn.

The experience of twenty years indicates clearly that the largest yields together with the greatest uniformity and fixity of type adapted to particular requirements can only be obtained by some system of crossing. Furthermore the evidence is conclusive that

these crosses will not maintain their high yields and other desirable qualities in later generations, so that to secure the benefits of hybrid vigor it is necessary to plant crossed seed every year.

COST OF SEED CORN.

It requires about ten bushels of potatoes to plant an acre, about two bushels of oats and a bushel and a half of wheat for a similar area.

Depending upon the size of the kernels and the rate of planting a bushel of corn will plant from four to seven acres. For dent corn five quarts of seed is usually ample for each acre.

While the value of seed corn is somewhat more in proportion to the market value of the grain for corn than other commonly cultivated crops, the cost per acre of the seed is the lowest of the list, and compared to the other expenses of growing a crop of corn, the preparation of the soil, application of fertilizers, frequent cultivation, husking out or cutting up for silage, the cost of the seed becomes almost a negligible item.

For this reason the outlay for seed may be considerably increased, even doubled or tripled, and still be repaid many times over if the high priced seed gives an appreciable increase in yield or improvement in quality.

Crossed corn can do this. It has been tested long enough to show that, when the right combination is obtained, one which is adapted to the locality in which it is to be grown, it will easily pay for the increased cost of the seed, and leave a margin of profit as well.

Connecticut Agricultural Experiment Station

New Haven, Connecticut

REPORT OF THE DIRECTOR

FOR THE

YEAR ENDING OCTOBER 31, 1925

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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as of
October, 1925

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Biochemical Laboratory.	T. B. Osborne, Ph.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.* Willis R. Hunt, Ph.D., *Assistant in Botany.* A. D. McDonnell, *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. — *Assistant Entomologists.* Robert B. Friend, B.S., *Graduate Assistant.* 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.* 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, S.D., *Assistant Geneticist.*
Soil Research.	M. F. Morgan, M.S., *Investigator.* George D. Scarseth, B.S., *Graduate Assistant.*
Tobacco Sub-station at Windsor.	Paul J. Anderson, Ph.D., *Pathologist in Charge.* N. T. Nelson, Ph.D., *Assistant Physiologist.*

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

REPORT OF THE DIRECTOR

For the Year Ending October 31, 1925

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

In accordance with the custom established some years ago, I have the honor to submit a review of the Station activities for the past year, and in addition a complete list of publications, the changes in staff and similar matters of general interest.

REVIEW OF THE YEAR

The Fiftieth Anniversary

The American agricultural station is now recognized by all as an essential agency of the state, but its establishment in Connecticut fifty years ago came only as the result of years of patient effort on the part of a few men. For twenty years, Professor Samuel W. Johnson urged the need of research in agriculture and in 1875 the General Assembly made the first appropriation. It was very fitting that the state and nation take note of the semi-centennial of this event.

On representation to the General Assembly, a small special appropriation was granted which made possible the arrangement of a suitable program. The celebration took place on the station grounds on Monday, October twelfth, and was attended by many prominent citizens of the state, directors of other experiment stations and representatives of the United States Department of Agriculture, the Association of Land Grant Colleges, Yale University, Connecticut Agricultural College and Wesleyan University. His Excellency, John H. Trumbull, Governor of Connecticut, presided and gave a brief address. Other addresses were given by Dr. E. W. Allen, Chief of the Office of Experiment Stations, United States Department of Agriculture, and Dr. R. W. Thatcher, Director of the New York Experiment Stations. As a part of the program a fine portrait of Dr. E. H. Jenkins was presented to the Station by Dean Henry S. Graves, Provost of Yale University, as a gift from Dr. Jenkins' many friends and admirers.

The wide recognition of the event and the esteem in which the station is held were also evidenced by the handsome parchment testimonials received from the Rothamsted Experimental Station, England, the Sheffield Scientific School of Yale University, and the Connecticut Agricultural College. In view of the general interest, there is now in preparation a bulletin which will include a complete account of the proceedings, together with a history of the station and its work.

"Defense" (Control) Work

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

In accordance with statutes assigning such duties to the Station, the Department of Chemistry has analyzed 830 samples of fertilizers, 352 of feeding stuffs, 1890 of foods and drugs, besides making many miscellaneous determinations. By making a special

Fig. 28.—A Group of Guests at the Semicentennial.

effort, the Report on Fertilizer Inspection was completed and published early in the winter, thus placing information in the hands of farmers before the buying season.

In addition to the above the Chemistry Department calibrated 6000 pieces of Babcock glassware, examined Insecticides and Fungicides offered for sale in the State, made special studies of Diabetic Foods and of prescriptions dispensed by physicians, all of which are statutory duties.

THE NEW FEEDING STUFFS LAW

The last General Assembly amended the statute regarding "Commercial Feeding Stuffs," making the application broader and requiring registration of all brands. This went into effect July 1, 1925, and will increase the volume of the Station's work.

INSPECTION OF ORCHARDS AND NURSERIES

The new law passed by the General Assembly of 1925 requires that all nurseries register with the State Entomologist (who is also the Station Entomologist). This adds to the details of inspection but makes the law much more effective. About 150 nurseries are listed. A total of 2,977,346 imported plants were inspected and reported to the Federal Horticultural Board. Many orchards and gardens have also been examined on request.

A new service to fruit growers, as a basis for their spraying plans, was a special survey of orchard pests maintained during the

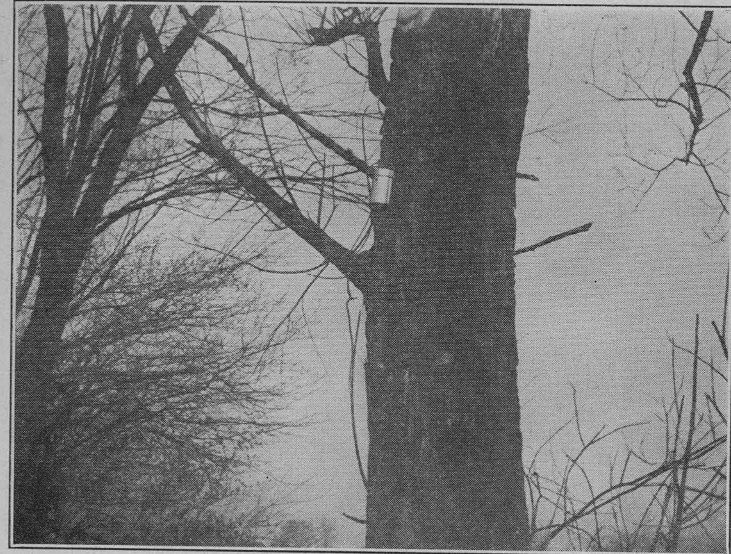

Fig. 29.—Fighting the Gipsy Moth. The can contains parasites that attack Gipsy Moth Eggs.

spring and early summer. This information was disseminated at timely periods through coöperation with the Extension Service of the Agricultural College and was made possible by the addition to the staff of another botanist, who has also assisted in the inspection of nurseries and orchards, thus covering the plant diseases more thoroughly than has been possible heretofore.

THE GIPSY MOTH

There has been no serious spread of this pest and all in touch with the situation are encouraged. Our entomologists, in coöperation with the Federal workers, have scouted 108 towns, creosoted

20,921 egg clusters, sprayed 276 colonies and scouted 8,399 miles of roadway. Parasites of several species have been released and the prospect for this method of control is good.

THE EUROPEAN CORN BORER

Through coöperation with the U. S. Department of Agriculture, part of the shore has been scouted. Five infestations were discovered and the burning of plants that harbor the larvae will be undertaken this winter. So far there is no cause for alarm but all citizens along the shore are urged to report suspected outbreaks.

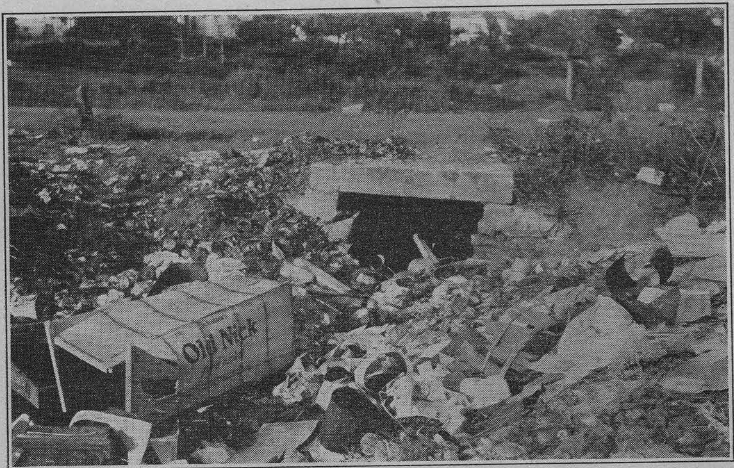

FIG. 30.—A "Mosquito" Problem. This ditch leads from a marsh and has been used as a public dump.

THE MOSQUITO NUISANCE

The summer of 1925 proved one of the worst in years. Owing to the lack of state funds, the ditches in some cases are in charge of the towns and cities. A series of dry years relaxes the local interest, new real estate developments affect the drainage, ditches are used for public dumps and when a wet season comes, the mosquitoes become a very real pest. In so far as the State appropriation allows, the areas in charge of the Station have been kept in good condition, but adjacent areas uncared for or undrained will furnish an ample supply of mosquitoes, for they will fly several miles. In West Haven the town authorities became very active about the middle of the season and 1926 should see much improvement. Fairfield, Greenwich and Stamford are also active.

State funds are insufficient for new work. The only new area drained was part of Westbrook where $1,100 was voted by the town and considerable ditching done. Clinton has voted $10,000 to be spent in 1926 and East Haven is about to undertake an elaborate program.

Under the new statute, contributions by the towns are voluntary, so that in spite of a small increase in the state appropriation, the funds available for maintenance are actually reduced. Unless towns, cities, boroughs and individuals take an active interest and raise funds, we may expect to find our shore communities and resorts very uncomfortable.

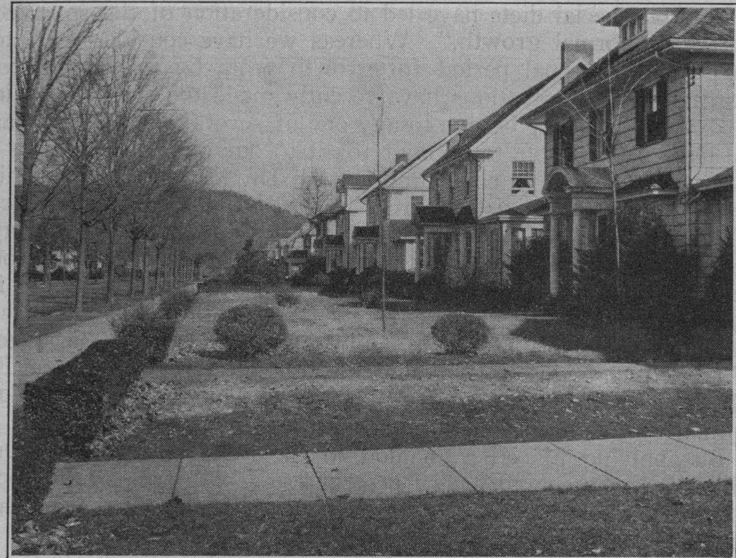

FIG. 31.—Lawn in Westville (New Haven) injured by the Asiatic Beetle.

THE ASIATIC BEETLE

This new pest of lawns has spread over a considerable area in Westville (New Haven). Local eradication is no longer effective. As a result of a careful survey, the entomologist has undertaken a campaign for complete eradication. This will require coöperation of the State, the U. S. Department of Agriculture, the City and some 700 householders. If funds ($25,000) are raised, work will begin this spring and it is hoped to stamp out the infestation by fall.

CONTROL OF WHITE PINE BLISTER RUST

The statute charges the Station with the work of control and eradication of this disease, the U. S. Department of Agriculture coöperating. During the past year a large crew operated in

Canaan, Salisbury and North Canaan, removing gooseberries and currants which spread the disease. For the entire state 15,691 acres were cleaned and scouting done in 15 towns.

Progress of Investigations

THE VEGETABLE PROTEINS

Recent observations of *unusually rapid growth* in several groups of rats on special diets have led to consideration of the so-called "curve of normal growth." Whereas we have considered 65 to 70 days the normal period for growth from 60 to 200 grams, animals on certain rations have recently made the same gains in 38 days. This may be due to any one of several causes. So far we have been unable to account for it to our own satisfaction.

Results of work in collaboration with Dr. Mason of Yale University indicate the existence of a *"fertility factor,"* in the absence of which degenerative changes procede in the testes, and fertility becomes impaired despite excellent somatic growth. Dr. Mason states in his report to the National Academy of Science (Apr. 1925)—"Addition of lettuce to the basic ration prevented the testicular degeneration which would otherwise occur. The effect of the lettuce is due to its richness in the anti-sterility vitamine E. The presence of this vitamine seems absolutely necessary for normal reproductive function and germ cell maturation."

By applying his ether method to the leaves of spinach, Dr. Chibnall has prepared a new protein *"spinacin"* from the cytopplasm. A protein of similar properties was also obtained from the leaves of maize.

Our experience with the problems presented by the *analysis of juice of the alfalfa plant* has shown the necessity for much further study before any adequate picture may be formed of the chemical reactions of the metabolism of the plant. Much attention is now being given to this problem.

BREEDING BETTER CORN AND VEGETABLES

"Crossed Corn" continues to give superior results wherever tested. On field corn special effort is now being directed to perfecting a simple method of producing crossed seed of such strains on a large scale, thus removing the objection raised by farmers.

Two new varieties of *sweet corn* have been produced by this new method of corn breeding which consists of crossing two uniform and fixed inbreds and utilizing only the first generation hybrid. *"Crossed Crosby"* is an early white corn of the Crosby type, having 12 to 16 rows and ripening about one week earlier than Golden Bantam. *"Red-Leaved White Evergreen,"* mentioned in the

report last year, is a pure white corn of the very best quality, medium in size, prolific and ripens in mid season. The leaves and husks are light reddish which makes the corn easily recognized on the market. Seed of these hybrids is now available in small quantities for testing and may be obtained by writing the Station.

The same method used heretofore is now being applied to *"Whipple's Early Yellow"* sweet corn, the aim being to improve the quality and give it the uniformity in size, shape and ripening that is characteristic of all "Crossed Corn."

Improvement of *vegetables* is now under way on an intensive plan. Cross fertilized crops like asparagus, beets, carrots, cab-

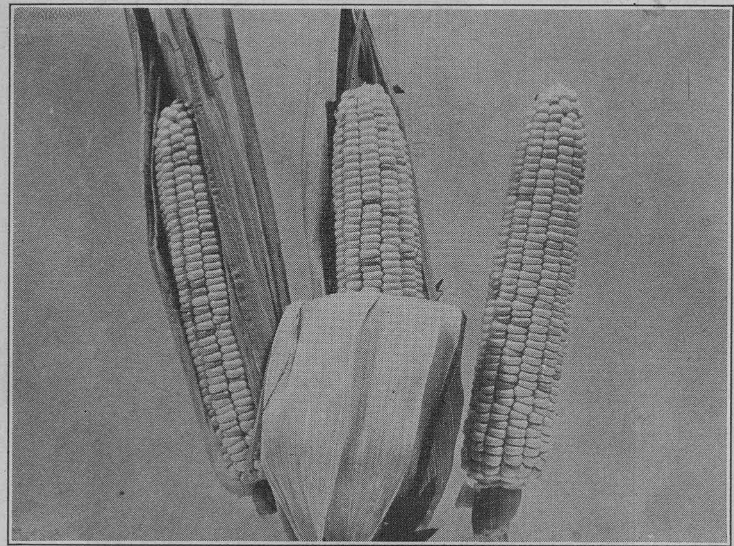

FIG. 32.—"Red leaved" Evergreen Sweet Corn.

bage, onions, rutabagas and squash, are being subjected to breeding and selection, following the same general method so successful with corn. For the self-fertilized vegetables selection methods are being applied, those receiving principal attention being beans, lettuce and tomatoes.

At the Station farm at Mt. Carmel where this work is carried on the plant breeder is also testing such new strains of vegetables as the Yellows-resistant Savoy Spinach originated by the Norfolk (Va.) Truck Station, a pod spot-resistant bean from the Cornell Station, the Vermont Hubbard Squash, Penn State Earliana Tomato and Penn State Ball Head Cabbage from the Pennsylvania Station, along with the varieties now standard in this region.

PLANT DISEASES

Celery blight causes heavy losses to market gardeners but few are equipped to spray. Dust is more easily applied but the results for this season are no more encouraging than last. Dust gives some control but Bordeaux spray is much more effective.

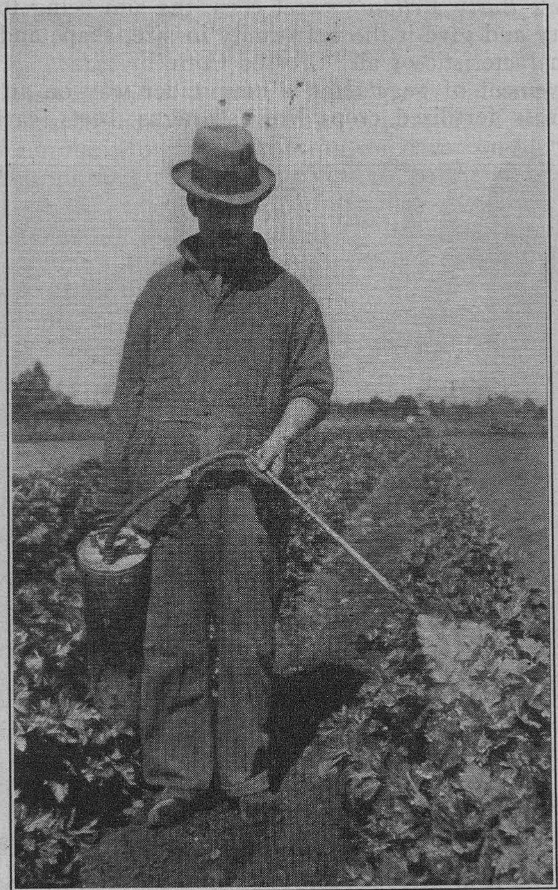

FIG. 33.—Spraying Celery on Experimental Plots.

As a result of several years careful work it has been shown that "Black Root Rot" of tobacco is caused by *Thielaviopsis basicola,* a fungus distinct from *Thielavia basicola,* which was formerly supposed to be the asco stage.

The study of *mosaic* has now been in progress twenty-two years. Perhaps no other plant disease has attracted so wide attention in

recent years, many botanists having taken up this perplexing problem. At this Station we are encouraged by recent discoveries which will throw further light on the nature of the disease. A bulletin is now in preparation.

Apple and Peach Diseases continue to occupy much attention. The trials of new dusts and sprays, combinations of both and methods of application, were continued in the Station orchards at Mt. Carmel farm and at the farms of Mr. Platt at Milford.

FIG. 34.—Young Pine Plantation in Brush Land.

THE INFLUENCE OF SOIL ON THE FOREST

This is practically a virgin field upon which the station foresters began work two years ago. Very little work has been done in this country or abroad, partly due to the lack of knowledge of the soils in forested regions. In Connecticut fully two-thirds of the land area is best suited to forestry, at least under present economic conditions. If the soil is a factor to be reckoned with in planting and managing forests and wood lots, then it is essential that we know the part it plays. To discover the facts a detailed study is now under way in close coöperation with the Soils Department. On each of our important soil types several timbered plots have been laid out. Careful measurements are made of the species, growth and stand as well as of the factors of soil water, reaction, and nutrients present. Out of this we hope to establish the effect, if any, of soil on our native and introduced trees and the adaptation of these latter to our conditions.

AN INVENTORY OF OUR FOREST PLANTATIONS

There is a dearth of collected information for our many citizens who wish to make forest plantings. For many years our advice on plantings has been based largely on European experience. There are now many plantations in the state over twenty years of age. To bring together this mass of individual experience a careful survey is now being made.

FIG. 35.—Injury to spinach caused by the Spinch leaf miner.

INSECT PROBLEMS

The *Plum Curculio* on Apple is receiving careful study. As a control there was introduced into the spray, lead arsenate coated with lead sterate and fish oil sticker. Marked decrease has been noted in the number of curculios this year, but this may be due to previous treatments or other conditions.

Foul Brood of Bees, on which work was begun in 1924, seems to yield to treatment with Hutzelman's alcohol-formalin solution. Other solutions of formalin were tried with encouraging results.

The Chemical Changes in Spray Mixtures present an important and interesting problem. It has been found that the amount of sulfur in solution directly affects the solubility of arsenic in lime-sulfur, lead arsenate, nicotine and casein mixtures.

The Oriental Peach Moth has apparently spread over all the state and more damage resulted in 1925 than 1924, being found also in quinces. Some orchards reported over 50 percent of the peaches wormy. So far no real control has been found although some reduction of injury was obtained by spraying in June with nicotine to kill the eggs and dusting later with lead arsenate-sulfur dust. Many other treatments are being tried. Bait pans containing molasses and yeast caught large numbers of moths and this may offer some relief.

An investigation was begun on the control of the *Spinach Leaf Miner* and this will be actively followed next year.

SPRAYING VS. DUSTING

Spraying vs. dusting experiments were continued in 1925 as before except to discontinue the use of copper dust and to add some promising combinations of spray and dust. The season of 1925 was unfavorable for the development of fungous diseases and as insects are usually well controlled by dusting, *all* the treatments gave quite good results. Spraying ranked first, a combination of spray for the first three treatments and dust for the last three was second, sulphur dust third, with other schedules ranking still further down the scale.

CONNECTICUT SOILS AND THEIR RESPONSE TO FERTILIZERS

Soils from twenty-four areas representing the most important soil types of the state are being studied exhaustively in the greenhouse and laboratory, with a view to determining how and why they differ in productive capacity and economic value. Chemical studies of nearly one hundred samples of soil show the following:

POUNDS PER ACRE IN SURFACE SOIL.

	Nitrogen	Phosphorus	Potassium*	Limestone requirement, Tons per A.	pH
Average	4,178	1,760	30,220	2.78	5.43
Highest	9,850	4,080	45,100	0	7.0
Lowest	826	502	17,800	7.57	4.1

* 12 soils only.

An example of what these results may mean is shown with soil No. I, preliminary pot studies upon which were begun in 1925.

The analyses showed 3,550 lbs. nitrogen, 1,238 lbs. phosphorus and 43,000 lbs. potassium per acre in the surface soil, with a limestone requirement of three tons per acre, and a high active acidity, 4.9 pH. The total phosphorus content was considerably below the average, and chemical tests showed this phosphorus to be in a very unavailable state. The illustration indicates the response of alfalfa when phosphorus and lime were applied to this soil.

Fig. 36.—The effect of several treatments on Soil No. 1 as shown by the growth of Alfalfa. K = Potash, P = Phosphoric Acid, L = Lime.

THE TOBACCO STATION AT WINDSOR

On March first, 1925, Dr. Paul J. Anderson took charge of the Tobacco Substation, since which time the program has gone forward in a very satisfactory manner.

Several special problems arose during the year, notably a severe outbreak of *wire worms.* The staff at Windsor with the entomologists at New Haven spent considerable time in testing various treatments and secured fair results from the use of calcium cyanide drilled in. If there is another outbreak in 1926, this will be tested further.

It has been known for a long time that *Black Root rot* injury might be increased by making the soil too alkaline, but there was no accurate data on just how acid a soil must be kept to be safe.

Studies carried on in the past season indicate that a soil may test as high as 5.9 pH without danger.

The soil conditions on the *Brown Root Rot* series not being satisfactory, a new series of plots was laid out last spring on the farm of Mr. Conner at Poquonock. No conclusions can be drawn for several years but the season of 1925 was very encouraging. Mr. Murwin of the U. S. Department of Agriculture had immediate charge of this project.

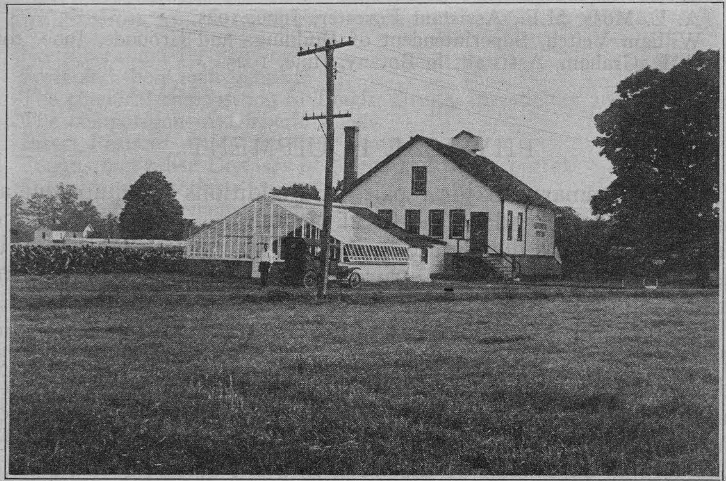

Fig. 37.—The Tobacco Station at Windsor—showing laboratory and greenhouse.

As usual, much time was spent in direct *service* to growers, who, in increasing numbers, bring their problems to the Tobacco Station or request visits. Dr. Anderson has also spoken at a number of meetings.

Four hundred growers attended the Tobacco Field Day, held at the farm on July 28. The visitors were conducted over the plots and the work explained. Following lunch a very interesting program was held.

MT. CARMEL FARM FIELD DAY

In view of the fact that an exhibit was to be sent to the Charter Oak Fair and the Semi-centennial celebrated in October, the Board voted to omit the usual field day at the Station Farm at Mt. Carmel. It is planned to arrange a special program next year in conjunction with the Farm Bureau.

CHANGES IN THE STATION STAFF

Appointments:

George D. Scarseth, B.S., Graduate Assistant in Soils, February, 1925.
Paul J. Anderson, Ph.D., In charge Tobacco Station at Windsor, March, 1925.
George E. Graham, Superintendent of Buildings and Grounds, June, 1925.
A. D. McDonnell, General Assistant in Botany, June, 1925.

Resignations:

A. E. Moss, M.F., Assistant Forester, June, 1925.
William Veitch, Superintendent of Buildings and Grounds, June, 1925.
G. E. Graham, Assistant in Botany, June, 1925.

PHYSICAL EQUIPMENT

As is customary, major repairs and additions to equipment are made toward the end of the fiscal biennium. This period ended June 30, 1925, and during the spring and summer the station buildings were painted, walks repaired and the entire plant put into good condition.

The General Assembly of 1925 provided $5,000 for the erection of a new section of the greenhouse on the station grounds. This takes the place of the house torn down in 1918 to make room for the proposed Board of Health laboratory. The new house is now under construction, is 22 by 85 feet and will make space for considerable expansion of the work in plant breeding and soils.

At the Tobacco Station at Windsor, a "Carrier Apparatus" for controlling temperature and humidity was installed in the curing chambers, thus making possible normal curing of small lots of tobacco, an impossibility in the sheds. This single piece of equipment cost $3,500 but much of our work was at a standstill without it. A small greenhouse was also erected at the Tobacco Station.

About 900 volumes were added to the library, which now includes 16,200 volumes and a very complete equipment of scientific journals. The station received from Dr. T. B. Osborne a very valuable gift of rare chemical journals totaling 3,500 volumes.

The inventory of June 20, 1925, shows:

Value of land and buildings	$304,550.00
Value of contents	120,884.80
	$425,434.80

WHAT THE STATION CAN DO

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

The Station can furnish information on:

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

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

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

The Station cannot furnish information on:

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

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

The Station cannot make analyses and examinations of:

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

PROJECTS ACTIVE DURING THE YEAR

Analytical Chemistry

Dr. E. M. Bailey in charge

1. Inspection of Fertilizers.
2. Inspection of Feeding Stuffs.
3. Inspection of Foods and Drugs.
4. Calibration of Babcock Glassware.
5. Inspection of Insecticides and Fungicides.
6. Studies on Methods.
7. Analysis of Diabetic Foods.
8. Analysis of Check Samples—Cottonseed Meal and Mixed Fertilizers.
9. A Study of the chemical changes in Standard Spray Mixtures. (See also Entomology No. 14.)

Biochemistry

Dr. T. B. Osborne in charge

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

1. A Study of the Relation of Diet to the Development of Bone.
2. The Effect of High Protein on the Kidney and Other Organs.
3. Experiments on the Influence of Diet on Fertility.
4. The Relation of Diet to the Rate of Growth.
5. Further Study of the Part Played by Individual Amino-Acids in Nutrition.
6. The Investigation of the Chemical Constituents of Green Leaves.

Botany

Dr. G. P. Clinton in charge

1. The Effect of Fertilizers, Especially Nitrate of Soda, on the Growth, Yield, Longevity and "Yellows" of Peaches.
2. The Nature and Cause of Mosaic Disease of Plants.
4. The Rusts of Connecticut.
5. Plant Disease Survey of Conn.
6. Thielavia Basicola; a Study of the Perfect Stage.
7. A Study of Pythiums.
8. Comparison of Spraying and Dusting on Apples and Peaches, Especially to Try New Dusts. (See Entomology No. 3.)
9. Control of Celery Blights with Sprays and Dusts.
13. Peach "Yellows."
15. Chestnut Blight—virulence studies.
16. White Pine Blister Rust. (Certain phases of the life History.)
21. Influence of Bud Inheritance on Yield of Peaches.
22. Influence of Root Grafts on Scions of Apples.

Entomology

Dr. W. E. Britton in charge

1. The Life History, Habits and Control of the Plum Curculio on Apple.
3. Comparisons of Spraying and Dusting on Apples and Peaches, Especially to Try New Dusts. (See also Botany No. 8.)

6. Control of Foul Brood of Bees.
7. A Study of the Life History and Methods of Control of the Asiatic Beetle, *Anomala orientalis.*
9. Insect Survey of Connecticut.
14. A Study of the Chemical Changes in Standard Spray Mixtures. (See also Chemistry No. 9.)
15. Bionomics of the Birch Leaf Skeletonizer, *Bucculatrix canadensisella.*
16. Experiments with Baits Attractive to the Cabbage Maggot Fly.
17. Life History and Methods of Controlling the Oriental Peach Moth, *Laspeyresia molesta.*
18. Life History of Imported Current Worm.
20. Life History, Habits and Control of the Imported Birch Leaf-Miner, *Fenusa pumila Klug.*
21. Life History and Control of the Spinach Leaf-Miner.
22. Insects Infesting Nursery Stock in Connecticut.

Control Projects

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

Forestry

Mr. W. O. Filley in charge

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

Control Project

7. Control of White Pine Blister Rust.

Genetics

Dr. D. F. Jones in charge

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

Soils

Mr. M. F. Morgan in charge

1. What Soil Type Characteristics are Factors in Determining Land Utilization.
2. Experiments in Lawn Fertilization.

Tobacco Sub-Station at Windsor

Dr. P. J. Anderson in charge

1. Fertilizer Tests.
   a. Sources of Nitrogen.
   b. Rates and Sources of Phosphoric Acid.
   c. Sources of Potash.
   d. Fractional Applications Compared with Broadcast at Different Rates.
   e. Miscellaneous Materials.
2. Strain Trials of Havana Seed and Broadleaf (Plant Breeding).
3. Improvement of Cuban Shade-grown—(Plant Breeding).
4. Effect of Various Cover Crops on Yield, Quality and Disease.
5. Tobacco Sick Soils (Brown Root Rot) with U. S. D. A.
6. Black Root Rot—Relation of Soil Reaction.
7. Trials with Cigarette and other Types of Tobacco.

PUBLICATIONS

Bulletins

No. 261. Fertilizer Report for 1924.
No. 262. The Rainbow Forest Plantations.
No. 263. Second Report of the Tree Protection Examining Board.
No. 264. Report of the Director for the Year Ending Oct. 31, 1924.
No. 265. Report of the State Entomologist, for 1924.
No. 266. The Improvement of Naturally Cross-Pollinated Plants by Selection in Self-Fertilized Lines. 1. The Production of Inbred Strains of Corn.
No. 267. Report on Food and Drug Products (1924).
No. 268. Report on Commercial Feeding Stuffs (1924).
No. 269. Perithecia of Thielavia Basicola Zopf in Culture and the Stimulation of their Production by Extracts from other Fungi.

Tobacco Series

No. 5. Fertilizer Experiments with Tobacco.

Circulars of Immediate Information

No. 48. Practical Lawn Suggestions.
No. 49. Regulations for Carrying Out the Provisions of the Law Concerning Concentrated Commercial Feeding Stuffs.
No. 50. Regulations Concerning the Shipment of Nursery Stock, and the New Law.

Journal Papers

Biochemistry

Ophthalmia as a Symptom of Dietary Deficiency.
Thomas B. Osborne and Lafayette B. Mendel. American Journal of Physiology, 1924, LXIX, 543-547.

A Note on Dakin's Method as Applied to Edestin.
Thomas B. Osborne, Charles S. Leavenworth and Laurence S. Nolan. Journal of Biological Chemistry, 1924, LXI, 309-313.

The Role of Vitamine B in Relation to the Size of Growing Rats.
Thomas B. Osborne and Lafayette B. Mendel. Journal of Biological Chemistry, 1925, LXIII, 233-238.

Variations in the Kidney Related to Dietary Factors.
Thomas B. Osborne, Lafayette B. Mendel, Edwards A. Park, and Milton C. Winternitz. American Journal of Physiology, 1925, LXXII, 222.

Recent Advances in Protein Chemistry.
Hubert Bradford Vickery. Industrial and Engineering Chemistry, 1924, XVI, 1029-1030.

Some Nitrogenous Constituents of the Juice of the Alfalfa Plant.
I. The Amide and Amino Acid Nitrogen.
Hubert Bradford Vickery. Journal of Biological Chemistry, 1924, LX, 647-655.

Some Nitrogenous Constituents of the Juice of the Alfalfa Plant.
II. The Basic Nitrogen.
Hubert Bradford Vickery. Journal of Biological Chemistry, 1924, LXI, 117-127.

Some Nitrogenous Constituents of the Juice of the Alfalfa Plant.
III. Adenine in Alfalfa.
Hubert Bradford Vickery and Charles S. Leavenworth. Journal of Biological Chemistry, 1925, LXIII, 579-583.

Note on the Basic Amino Acids Yielded by Casein.
Charles S. Leavenworth. Journal of Biological Chemistry, 1924, LXI, 315-316.

A Protein from the Leaves of the Alfalfa Plant.
Albert Charles Chibnall and Laurence S. Nolan. Journal of Biological Chemistry, 1924, LXII, 173-178.

A Protein from the Leaves of Zea mays.
Albert Charles Chibnall and Laurence S. Nolan. Journal of Biological Chemistry, 1924, LXII, 179-181.

Spinacin, a New Protein from Spinach Leaves.
Albert Charles Chibnall. Journal of Biological Chemistry, 1924, LXI, 303-308.

Milk as a Food.
Lafayette B. Mendel. Transactions World's Dairy Congress of 1923, Government Printing Office, Washington, 1924.

Le Lait, en tant qu'aliment.
Lafayette B. Mendel. Bulletin de la Societe scientifique d'Hygiene alimentaire, 1925, XIII, 147-157.
An Experimental Study of Ophthalmia in Rats on Rations Deficient in Vitamin A.
Arthur M. Yudkin. Archives of Ophthalmology, 1924, LIII, 416-425.

Botany

(a) Dusting versus Spraying of Celery, and (b) List of Fungous, Bacterial and Non-Parasitic Injuries of Connecticut Vegetables.
G. P. Clinton. Report Connecticut Vegetable Growers' Association, 1924: 54-8, 1925.
Recent Studies on Certain Apple Diseases and Their Control.
G. P. Clinton. Annual Report of Connecticut Pomological Soc. 1924: 65-73, 1925.

Entomology

Meeting of Connecticut Entomologists.
W. E. Britton. Journal of Economic Entomology, v. 17, p. 669-673, Dec. 1924.
Some Insect Information from a Connecticut Conference.
W. E. Britton. Florists' Exchange, v. LVIII, n. 22, Nov. 1924.
Better Care of Shade Trees.
W. E. Britton. Tree Talk, v. 6, n. 4, Feb. 1925, p. 4.
Fruit Pests—Important New Ones and Troublesome Old Ones.
W. E. Britton. 31st Annual Meeting of the Massachusetts Fruit Growers' Association, Inc., January, 1925, p. 118-131 (issued April, 1925).
Recent Developments in Insect Control.
W. E. Britton. Proceedings 34th Annual Meeting, Connecticut Pomological Society, Dec. 1924, p. 48 (issued 1925).
Report of Committee on Injurious Insects.
W. E. Britton. Proceedings 34th Annual Meeting, Connecticut Pomological Society, Dec., 1924, p. 46 (issued 1925).
Insects Attacking Vegetable Crops in Connecticut in 1924.
W. E. Britton. Report Connecticut Vegetable Growers' Association, p. 43 (issued 1925).
A New Genus and Species of Trombidiidae.
Philip Garman. Journal New York Entomological Society, v. XXXIII, p. 85, June, 1925.
Notes on Bee Diseases in Connecticut.
Philip Garman. Journal of Economic Entomology, v. 18, p. 445, June, 1925.
The Oriental Peach Moth Problem.
Philip Garman. Proceedings 34th Annual Meeting, Connecticut Pomological Society, Dec., 1924, p. 57 (issued 1925).
Experience with Baited Traps in Controlling Cabbage Maggots.
R. B. Friend. Report Connecticut Vegetable Growers' Association, p. 50, 1925.

Genetics

Origin of Flint and Dent Corn.
D. F. Jones. Jour. Heredity, 15: 417-419, 1924.
Genetics in Plant and Animal Improvement.
D. F. Jones. John Wiley & Sons, 1925.

Genetics and Morphology of some Endosperm Characters in Maize.
P. C. Mangelsdorf. Thesis in partial fulfillment of requirements for the degree of Doctor of Science, Bussey Institution, Harvard University, 1925.

All of which is respectfully submitted,

WILLIAM L. SLATE, JR.,
Director.

Connecticut Agricultural Experiment Station

New Haven, Connecticut

TWENTY-FIFTH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

1925

W. E. BRITTON, Ph.D.
State Entomologist

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

as of

February, 1926

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

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AUTHORSHIP

For bibliographical purposes, all material in this Report (Bulletin 275) should be credited to W. E. Britton, except where otherwise indicated.

ILLUSTRATIONS

The illustrations in this Bulletin are from the following sources: Figs. 38, 39 and 40 reproduced from printed blanks; Fig. 41, map drawn by Alex. Cahn and shaded by Stoddard Engraving Co.; Figs. 42, 43, 44, 47, 48 and 50 from drawings by Dr. Philip Garman. Fig. 49 drawn by Mr. R. B. Friend. Fig. 45 from photograph by Mr. B. H. Walden. Fig. 46 reproduced from city map. Plates are all from photographs: I, II, III, a, IV, b, V, a, and XII, b, by Dr. W. E. Britton; VI and XX, a, by Dr. Philip Garman; X by Mr. J. L. Rogers; XIV, XV and XVI by Mr. R. C. Botsford; all others by Mr. B. H. Walden.

BULLETIN 275

TWENTY-FIFTH 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-fifth annual report as State Entomologist of Connecticut. As in former years, this report fully covers the activities of the Department of Entomology, as regards the inspection and control work provided for by Statute, and also the various lines of research and observation dealing with economic entomology.

Respectfully submitted,

W. E. Britton,
State and Station Entomologist.

INSECT PEST ACCOUNT

Report of Receipts and Expenditures of the State Entomologist

From July 1, 1924 to June 30, 1925.

Receipts

Insect Pest Appropriation	$15,000.00	
Insect Pest Appropriation, Added by Board of Control	104.22	
Balance on hand July 1, 1924	2,704.52	
		$17,808.74

Expenditures

Salaries	$11,982.02
Labor	2,374.56
Stationery and Office Supplies	228.63
Scientific Supplies (Chemicals)	31.67
Scientific Supplies (Other laboratory supplies)	82.87
Scientific Supplies (Photographic)	81.25
Lumber and Small Hardware	.71

Miscellaneous Supplies*	$544.19
Automobile Oil	4.15
Telegraph and Telephone	6.00
Postage	40.60
Travel (Outlying Investigations)	294.87
Travel (Meetings, etc.)	185.97
Travel (Gasoline for automobiles)	240.14
Freight, Express and Parcels Post	14.09
Publications (Bulletins, etc.)	40.53
Furniture and Fixtures (New)	15.70
Furniture and Fixtures (Repairs)	14.00
Library (Books and periodicals)	55.38
Library (Binding)	7.50
Scientific Equipment (New)	116.75
Live Stock (Bees)	1.00
Tools, Machinery and Appliances (New)	102.60
Tools, Machinery and Appliances (Repairs)	8.45
Automobiles (New)	595.50
Automobiles (Repairs)	349.73
New Buildings and Structures	35.77
Insurance (Automobile)	121.29
Miscellaneous Contingent Expenses	40.00
Total Disbursements	$17,615.92
Balance in hands of State Comptroller, June 30, 1925	192.82
	$17,808.74

SUMMARY OF INSPECTION AND OFFICE WORK

210 samples of insects received for identification.
160 nurseries inspected.
151 regular certificates granted.
6 special raspberry certificates granted.
57 dealers' permits issued.
107 shippers' permits issued to nurserymen in other States.
143 duplicate certificates furnished to be filed in other States.
118 parcels of nursery stock inspected and certified.
47 bales of mountain laurel and willow (14 trips) inspected and certified for shipment into New York.
112 orchards and gardens examined.
27 shipments, containing 277 cases, 2,977,346 plants, imported nursery stock inspected.
18 shipments, or 66 per cent. found infested with insects or fungi.
766 apiaries, containing 8,257 colonies, inspected.
19 apiaries and 42 colonies found infested with European foul brood.
26 apiaries and 38 colonies found infested with American foul brood.
3,063 letters written on official work.
255 circular letters.
266 post cards.
46 reports to Federal Horticultural Board.
2,504 bulletins, etc., mailed on request or to answer inquiries.
45 packages sent by mail or express.
37 lectures and addresses at institutes, granges and other meetings.

* This includes fuel oil purchased for burning corn stalks and weeds around European corn borer infestations.

PUBLICATIONS OF THE ENTOMOLOGICAL DEPARTMENT, 1925

By W. E. Britton:

Twenty-fourth Report of the State Entomologist of Connecticut (Bulletin 265), 124 pages, 9 figures, 20 plates; 10,500 copies distributed in May.

Inspection of Nurseries in 1924, 8 pages, reprinted from the Report.

Better Care of Shade Trees, Tree Talk, Vol. 6, No. 4, page 4, February, 1925.

Fruit Insects—Important New Ones and Troublesome Old Ones, Report of 31st Annual Meeting, Massachusetts Fruit Growers' Association, Inc., January 7-8, 1925, pp. 118-131, distributed in April.

Report of Committee on Injurious Insects, Proceedings of 34th Annual Meeting, Connecticut Pomological Society, December 11-12, 1924, p. 46, published in 1925.

Recent Developments in Insect Control, Proceedings of 34th Annual Meeting, Connecticut Pomological Society, p. 48.

Insects Attacking Vegetable Crops in Connecticut in 1924, Report of Connecticut Vegetable Growers' Association, p. 43.

The New Law Providing for the Registration and Inspection of Nurseries, Special Bulletin, 500 copies, July 1925.

Regulations Concerning the Shipment of Nursery Stock and the New Law, Bulletin of Immediate Information No. 50, July, 1925.

European Corn Borer Here—Will You Co-operate? Leaflet used in clean-up work around infestations, 6,000 copies, October, 1925.

Regulations Concerning the Transportation of Nursery Stock in the United States and Canada, Bulletin of Immediate Information No. 51, 24 pages, 2,500 copies, October 1, 1925.

By W. E. Britton, G. P. Clinton and W. O. Filley:

Second Report of the Tree Protection Examining Board (Bulletin 263), 52 pages, 8 plates, March, 1925.

By Philip Garman:

Notes on Bee Diseases in Connecticut, Journal of Economic Entomology, Vol. 18, p. 445, June, 1925.

A New Genus and Species of Trombidiidae, Journal New York Entomological Society, Vol. xxxiii, p. 85, June, 1925.

The Oriental Peach Moth Problem, Proceedings of 34th Annual Meeting, Connecticut Pomological Society, p. 57.

By R. B. Friend:

Experience with Baited Traps in Controlling Cabbage Maggots, Report of Connecticut Vegetable Growers' Association for 1924, p. 50.

DEPARTMENT STAFF AND WORK

W. E. Britton, Ph.D., *State and Station Entomologist.*
B. H. Walden, B.Agr., *Photographic and General Work.* } *Assistant Entomologists.*
M. P. Zappe, B.S., *Inspection and General Work.*
Philip Garman, Ph.D., *Research Work.*
Roger B. Friend, B. Sc., *Graduate Research Assistant.*
John T. Ashworth, *Deputy in Charge of Gipsy Moth Work.*
James A. McEvoy, *Assistant in Gipsy Moth Work.*
Robert C. Botsford, *Deputy in Charge of Mosquito Work.*
Miss Gladys M. Finley, *Clerk and Stenographer.*
H. W. Coley, Westport, } *Apiary Inspectors.*
A. W. Yates, Hartford,

There has been no change in personnel of the regular staff since the last Report. Mr. Walden has continued to act as chief photographer of the Department, has taken charge of the office during the absence of the Entomologist, has assisted in scoring fruit in the experiments in spraying and dusting, and has continued his researches on the imported currant worm, *Pteronidea ribesi* Scop.

Mr. Zappe has continued to have charge of the inspection of nursery stock, and of scouting and clean-up work in co-operation with the Federal Bureau of Entomology, on account of the European corn borer. He has collaborated with Dr. Garman in the study of the plum curculio in apple orchards and on the life history and control of the Asiatic beetle, *Anomala orientalis;* with Mr. E. M. Stoddard of the Botany Department in making further tests of various dusts and sprays to control pests of apple orchards, and in making orchard surveys with a view to determining the proper time and materials for treatment.

Mr. J. Leslie Rogers was employed to assist in nursery inspection from July 1 and after the nurseries were completed, was continued on European corn borer clean-up work, during the remainder of the calendar year. Mr. Gerald T. Thompson likewise helped in inspecting nurseries until September 15, when he returned to College. Dr. W. R. Hunt of the Botany Department also assisted in nursery inspection, paying particular attention to plant diseases.

Dr. Garman has continued his investigations on the Oriental peach moth; treatment for the American foul brood of bees; and has made further observations on the European red mite. Jointly with Mr. Zappe, he has continued the investigations on the five-year program begun in 1922, of the plum curculio in apple orchards, and some attention has been given to the Asiatic beetle. Dr. Garman has constantly revised his manuscript on the Odonata or dragonflies of Connecticut, which for some time has been ready, and will later be published as a bulletin of the State Geological and Natural History Survey.

Mr. Friend, who is taking graduate work for the doctorate in Yale University, has continued his studies on the bionomics of the birch leaf skeletonizer, and jointly with the Entomologist has made observations on the imported birch leaf-miner, *Fenusa pumila* Klug., from Europe. Mr. Friend has also given considerable attention to several insects attacking vegetable crops.

The gipsy moth control work has been prosecuted vigorously as in past years by Deputy John T. Ashworth and his Assistant, James A. McEvoy, with headquarters at Danielson. This work is conducted in co-operation with the Federal Bureau of Entomology.

Mr. Botsford has continued to serve as Deputy to Director Slate in charge of mosquito elimination work.

Messrs. A. W. Yates, Hartford, and H. W. Coley, Westport, have continued to inspect apiaries, as in past seasons, on a *per diem* basis.

Miss Finley has continued to perform the necessary clerical and stenographic work of the Department.

The Entomologist has directed the work of the Department and attended to the correspondence of the office; jointly with Mr. Friend he has studied the imported birch leaf-miner; he has continued to serve as Associate Editor of the Journal of Economic Entomology, as Insect Pest Reporter in Connecticut for the Insect Pest Survey of the Bureau of Entomology, and as Chairman of the Tree Protection Examining Board. In October, he was also appointed Superintendent of the State Geological and Natural History Survey.

The more important activities of the Department are described in the various papers in the following pages of this Report.

ENTOMOLOGICAL FEATURES OF 1925

The early part of the season of 1925 was fairly cool and moist and not favorable for plants that thrive best at high temperatures. The first week in June was fair and very hot, and following this period leaf scorch was evident on some kinds of vegetation. After this hot week it was fairly cool for the remainder of the season, with only light rains until September.

One of the outstanding features of the season was the great increase in the Oriental peach moth. The gipsy moth has not spread and the towns of Cheshire and Wallingford have been removed from Federal quarantine. Not a single nest of the brown-tail moth has been seen in Connecticut since 1919.

In order to obtain accurate data regarding the seasonal development of fruit trees and their pests and especially the presence or absence of the latter, Messrs. Zappe and Stoddard made regular visits during May and June to a number of orchards in each county of the State. In all, 39 different orchards were visited; three or four visits were made to certain orchards and 62 visits were made altogether. The data gathered in these visits is used herein.

Fruit Insects

The Oriental peach moth, *Laspeyresia molesta* Busck., was very abundant in some of the orchards in New Haven County and much wormy fruit was the result. One orchard had nearly 50 per cent. of wormy fruit. The pest was not any more abundant in Greenwich than in 1924, but was much more destructive in some parts of New Haven County. The distribution of this insect in the State has not been fully investigated, but it seems not yet to be present around Storrs or in the eastern portion of the State. Where abundant, its control is a serious problem and is discussed on page 280 of this Report.

The European red mite, *Paratetranychus pilosus* C. & F., was unusually troublesome at Conyer's Farm, Greenwich, and did some damage at Branford, Wallingford and Middlefield. In Branford and Wallingford the mite injured McIntosh, and this is the first time we have ever seen brown leaves on this variety from the attacks of the mite. Some eggs were present on apple at Cheshire, April 2, Milford April 17, Southington April 21, Middlefield April 23, and on European plum at Hazardville, April 7. The best control measure consists in applying a late dormant spray of miscible oil (1-15) to kill the eggs, but failing to give this treatment, persistent spraying of the foliage in summer with dilute lime-sulphur will usually kill enough of the young mites to hold the pest in check.

Work of the pear leaf blister mite, *Eriophyes pyri* Nal., was observed at West Hartford, May 19, and a severe infestation on Bartlett and Seckel was seen at Bantam on May 22. A late dormant spray of lime-sulphur or miscible oil will usually control this pest.

The red-banded leaf-roller, *Eulia velutinana* Walker, was abundant in some orchards and caused considerable injury to fruit as described on page 298. Apparently this pest may be controlled by lead arsenate sprays or dusts as per regular schedule, with an extra application about August 1, in severe infestations.

The apple and thorn skeletonizer, *Hemerophila pariana* Clerck., attracted little attention during the season, though traces of it could be found in nearly every orchard, and the little moths were quite abundant at the Station.

The bud moth, *Tmetocera ocellana* Schiff., was not very troublesome in orchards in 1925, though a few specimens were noticed in Southington May 5. Early applications of lead arsenate will prevent injury.

The red-humped caterpillar, *Schizura concinna* S. & A., was received at the Station from Beacon Falls, August 1, Danbury August 4, Thomaston and Torrington August 19. These caterpillars feed in clusters and strip the leaves from young apple trees in orchard and nursery. Spraying with lead arsenate will prevent defoliation.

The tent-caterpillar, *Malacosoma americana* Fabr., was abundant all over the State, but was seemingly less abundant than elsewhere in Hartford County, particularly in the towns of Simsbury, Windsor, East Hartford, South Windsor and East Windsor. At Wilton, April 20, the young caterpillars had been killed soon after hatching, where a lime-sulphur spray had been applied.

The codling moth, *Carpocapsa pomonella* Linn., still continues to be one of the leading apple pests throughout the State. It is against this insect that arsenical poisons were first used on the apple, and it is the chief reason for their continued application.

The pear psylla, *Psylla pyricola* Foerster, continues to be troublesome wherever pears are grown. Eggs were abundant at Deep River, April 9, and at Southington, April 21-23. The nymphs were killed at Farmington by a spray of lime-sulphur (1-40). None were found in one Wallingford orchard where a delayed dormant miscible oil spray was applied.

Seckel pears in the writer's garden were injured for the first time by curculio larvae. Though the adult has not yet been reared, the injury has been ascribed to the quince curculio, *Conotrachelus crataegi* Walsh, and is described more fully on page 324 of this Report.

Fall cankerworms, *Alsophila pometaria* Harr., were present in abundance and caused injury in many localities. We had occasion to observe them in New Haven, and eggs were seen in East Haven February 19, and in Groton and North Stonington April 9. The caterpillars attack not only fruit trees but also shade and forest trees. The trees on the Station grounds were banded in the fall of 1924, and as these bands were kept in a sticky condition during the emergence of the adults, and at the time when the eggs hatched, the foliage was scarcely mutilated and was not injured. Spraying with lead arsenate early in May will prevent defoliation.

An unusual form of injury was reported from Danbury, May 16, where small flea-beetles were defoliating young peach trees. The species responsible for the injury has green wing-covers, reddish-brown thorax, and has been identified as *Crepidodera rufipes* Linn. Of course trees may be protected by a spray of lead arsenate.

The grapevine flea-beetle, *Altica chalybea* Illiger, injured grapevines at Highwood in April by eating holes into the buds. (Plate IX, b.)

The bumble flower beetle, *Euphoria inda* Linn., was received from Danbury on May 20 and June 5, where it was said to be injuring trees and in one instance it was thought to be the gipsy moth. As a rule the beetles feed upon decaying fruit later in summer and we have no records of their injuring the tissues of trees.

The plum curculio, *Conotrachelus nenuphar* Hbst., was responsible for much injury to apples on unsprayed trees at North Stonington June 11, and at Woodstock June 12. Also in Groton, Montville and Lebanon June 11, all fruit on trees near fences and next to woodland was injured and infested by many larvae. Apples injured by this insect were noticed at Wallingford June 4, Pomfret June 12, Waterbury July 22, East Granby August 18; also on apples and peaches at Rockville June 5, and on cherries at New Britain June 15. The characteristic scars on the fruit were noticed in the experiments in spraying and dusting in Milford and at the Station orchard at Mount Carmel. The control of this pest is treated more fully on page 286 of this Report, but apparently lead arsenate sprays applied at the time of the pink, calyx, 7-day and 14-day treatments will in most cases produce 90 per cent. of clean fruit in apple orchards, though where possible all rubbish where the beetles hibernate should be removed.

In May, Mr. Walden investigated a case in South Glastonbury where there was a 10 to 15 per cent. injury to strawberry plants by the raspberry fruit worm or raspberry beetle, *Byturus unicolor* Say, described on page 302 of this Report.

Strawberry plants in Coventry, Bolton and Simsbury were injured in May by cutworms eating the leaves. Mr. Walden visited Simsbury and has described the injury elsewhere in this Report.

The apple maggot, *Rhagoletis pomonella* Walsh, continues to be troublesome in many orchards, and infested fruit was received from Waterbury July 22, and from Danbury October 6. It may be controlled by late applications of lead arsenate, about July 4 and July 20.

The rosy apple aphid, *Anuraphis roseus* Baker, was not very abundant in most apple orchards, but was observed in Cheshire May 27, and there were a few in Pomfret and Woodstock on June 12, and in East Granby August 18. It was very bad on one tree in an orchard at Hazardville June 5.

The green apple aphid, *Aphis pomi* DeGeer, was observed in many orchards in spring and early summer. There were very few at Litchfield, Bantam and Cornwall, April 22, at Wallingford, Middletown and East Hampton, April 23, at Cheshire May 27, at Greenwich May 14, at South Glastonbury May 5, at Wallingford June 4, and at Woodstock June 12. They were abundant at Southington April 2, 31 being counted on one bud; at Rockville April 7, Milford April 17, Wilton April 20, Deep River April 9, and on unsprayed tree, Durham, and Southington, May 5, and very abundant at North Stonington June 11. The species was observed also in Cheshire, Southington and Newington April 21, New Haven April 22, Middlefield April 23, Greenwich March 31, North Stonington April 9, and at Farmington May 6, where a spray of nicotine sulphate had knocked off many of the aphids which were still alive and crawling on the ground. At Southington May 5, aphids were abundant where lime-sulphur was applied as a dormant spray, but there were few where miscible oil had been used. Also at Yalesville, aphids were present on McIntosh trees which had been sprayed with lime-sulphur (1-8), nicotine sulphate, and Kayso, but were few where a dormant spray of miscible oil had been applied.

The green peach aphid, *Myzus persicae* Sulzer, was present on peach trees in some localities and caused the leaves to curl. There were few in Cheshire May 27, and though abundant in Rockville, by June 5 all had been cleaned up by natural enemies. In one orchard in Highwood on May 22, the leaves on inside fruit clusters had been badly curled and those on terminal branches were uninjured. Syrphid larvae and lady beetles were abundant, and though we suggested a nicotine dust application for the aphids, could hardly recommend it.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., is one of the commonest pests found in nurseries and is present in many apple orchards. It is usually about the same color as the bark on which it rests, and in shape is elongate, broader at one end than the other, and often curved. Though it occurs on apple, it also infests many shade and woodland trees and seems to prefer poplar, willow, birch, ash, butternut and lilac in Connecticut. There is only one generation each year and it passes the winter in the form of oval white eggs under the old shells on the bark. A spray of nicotine sulphate early in June soon after the eggs hatch is a good remedy.

The San José scale, *Aspidiotus perniciosus* Comst., is more prominent than five or 10 years ago, particularly on untreated trees and shrubs in protected places. It was observed at East Haven February 19, on cherry at Milford August 5, and in West Haven October 14. Orchard trees in Connecticut which are sprayed regularly or occasionally with lime-sulphur or with miscible oil do not become seriously infested.

Young pear and apple trees are occasionally injured by a whitish pear-shaped scale known as the scurfy scale, *Chionaspis furfura* Fitch. This scale was noticed at East Haven February 19, by Mr. Zappe. There is one generation each year, and the species passes the winter as oval, purple eggs under the shells. These eggs hatch the last days of May and a spray of nicotine sulphate early in June is the proper remedy.

Vegetable Insects

In reviewing the vegetable insects of the season, we have the advantage of the observations of Mr. A. E. Wilkinson, Vegetable Specialist of the Connecticut Agricultural College at Storrs, who traveled all over the State and visited all the principal vegetable growing sections, and observed the pests and other conditions. Free use is here made of Mr. Wilkinson's reports.

Damage by cutworms was more prominent than usual in most localities, and was severe throughout the State on all kinds of vegetable crops. Reports of injury to vegetables were received from Middletown May 18, from Southington, Waterbury, Thomaston, Morris and Windsor, May 21; from South Norwalk, Easton, Weston, Danbury, Bethel, Brookfield and New Fairfield, on June 5. In general, a poisoned bait of bran mash distributed about the field will prevent damage from cutworms.

The stalk borer *Papaipema nitela* Guen., was observed in many gardens. It was found in potato stalks at Woodbury, July 31, and was received in corn from Stratford, July 1, Thomaston July 7, Taconic July 21, and Yantic August 4. There is little to do except to remove and destroy the infested stalks.

The corn ear worm, *Chloridea obsoleta* Fabr., though not as abundant as usual, was reported from Mansfield in midsummer and received from East Hartford October 3, and on popcorn from Bridgeport November 3.

The European corn borer, *Pyrausta nubilalis* Hubner, which was discovered at seven points along the Connecticut shore in 1924, and cleaned up around each infestation, is still present in the State. The Federal scouts did not find it in all localities where it occurred last year, but found slight infestations at Bridgeport, Saybrook, New London and at several places in Groton and Stonington. Clean-up work was carried on, but on account of weather conditions could not be completed in Groton and Stonington until spring. This work is described more fully on page 303 of this Report.

The imported green cabbage worm, *Pontia rapae* Linn., was present as usual, though possibly less abundant. It was reported from Windsor May 21, and from Southport, Westport, Easton and Bridgeport on June 2.

The squash borer, *Melittia satyriniformis* Hubner, caused the usual amount of injury to squash and pumpkin vines.

The Colorado potato beetle, *Leptinotarsa decemlineata* Fabr., was not observed to be unusually abundant except on the Station Farm at Mount Carmel, where attention was not given at the proper time. Mr. Wilkinson reported only a few to be seen on June 4, when he visited plantations in South Norwalk, Easton, Weston, Danbury, Bethel, New Fairfield and Brookfield, but that both larvae and adults were plentiful at Southington, Buckland and Wapping on July 24. Of course spraying and dusting with lead arsenate is the remedy.

The cucumber or potato flea-beetle, *Epitrix cucumeris* Harr., was very abundant on potatoes and was also observed on tomatoes and egg-plants at South Norwalk, Easton, Weston, Danbury, Bethel, New Fairfield and Brookfield, June 4, and at Southport, Westport and Bridgeport on June 2. It was present on cucumbers at Windsor Locks, Plainville and Southington, May 21, and on potatoes at Southington, Buckland and Wapping July 24. Thorough spraying with Bordeaux mixture and lead arsenate is probably the best remedy in the field, but a few tomatoes or egg-plants in the garden may be protected by spraying with nicotine sulphate.

The common asparagus beetle, *Crioceris asparagi* Linn., and the twelve-spotted asparagus beetle, *C. duodecimpunctata* Linn., were present in nearly all large asparagus plantations in the State. They were abundant at Riverton and Southington on May 21, and at South Norwalk, Easton, Weston, Danbury, Bethel, Brookfield and New Fairfield on June 5. The larvae or grubs of the former and the adults of both species feed upon the stems and foliage, but the larvae of the twelve-spotted species feed in the seed pods and do not seriously injure the plants. In severe infestations, the larvae and adults may be killed on the tall or mature plants, by spraying with lead arsenate forced with strong pressure through a nozzle with fine aperture. Nicotine sulphate may be sprayed upon the shoots if the beetles threaten to injure them.

The striped cucumber beetle, *Diabrotica vittata* Fabr., was present in about the usual numbers in most plantations and was controlled only with the usual difficulty. It was reported from Southport, Westport, Easton and Bridgeport, on cucumbers, squashes and melons on June 2. At the Station Farm it was abundant and several treatments were necessary to control the pest. In experiments conducted in various sections of the country, particularly on Long Island and in Canada, calcium arsenate and hydrated lime have given fairly good control, though occasional injury to plants resulted on Long Island. Sodium fluosilicate (1 part) and hydrated lime (9 parts), as well as calcium arsenate and gypsum (1-20), gave good results in Canada. Dr. H. C. Huckett on Long Island found that by mixing No. 2 wheat flour with hydrated lime or gypsum, equal parts, it reduced injury and increased adhesiveness. He also planted squash plants for traps near the cucumbers, then dusted the cucumber plants, thus driving the beetles upon the squash plants, which were then covered and exposed for three minutes to a treatment of four per cent. nicotine dust. This proved effective in destroying the beetles.

The cabbage maggot, *Hylemyia brassicae* Bouché, caused the usual amount of damage and in some localities early cabbages gave only about 50 per cent. of a crop on account of cabbage maggot and cutworms. Cabbage maggot was reported as abundant at Southington and Windsor, May 21; Bridgeport, Southport, Westport and Easton, June 2; Devon, Stratford, Shelton, Cannondale and New Canaan, June 3; South Norwalk, Easton, Weston, Danbury, Bethel, New Fairfield and Brookfield, June 5; Hampton, Canterbury, Brooklyn, Danielson, Pomfret, Woodstock, Norwich, Niantic, Lyme, Waterford, Ellington, Rockville, Vernon, Bolton, Coventry, Tolland, Somers, Stafford and Mansfield, June 12. The flies were noticed about radishes at Plainville, May 21. Mr. Friend observed this insect as severely infesting radishes at Cheshire, and in cabbages at Westport. Probably mercuric chloride or corrosive sublimate (1 ounce in 10 gallons water) is as good a remedy as any, but is known to retard the growth of the plants and consequently more fertilizer should be applied where this treatment is used. It is inadvisable to dip the young plants into this mixture before setting. In the home garden where only a few plants are grown, tarred paper disks placed flat on the surface of the ground around each plant at the time of setting, will protect them from serious injury.

The spinach maggot or leaf-miner, *Pegomyia hyoscyami* Panzer, which also infests beet and "lamb's quarters," was present in about the usual abundance, though Mr. Friend did not find an infested field suitable for conducting control experiments. This pest was noticed by Mr. Wilkinson at Middletown, May 18, and on beets and spinach at Bridgeport, Southport, Westport and Easton, June 2.

The potato aphid, *Macrosiphum solanifolii* Ashm., was abundant in some sections of the State, and had seriously injured more than 100 acres of potatoes around Middletown by July 21. It was also observed at Stratford, Bridgeport, Westport and Trumbull, on July 19, where some of the vines had turned brown. On July 20, aphids were observed in Windham, Tolland and New London Counties, and on July 24, they were present in abundance at Southington, Buckland and Wapping. After the rain on July 31, few aphids could be found. Heavy applications of nicotine dust is perhaps the best artificial treatment.

The pea aphid, *Illinoia pisi* Kalt., was present in many fields, but on the whole it did not cause serious injury to peas in Connecticut in 1925. It was reported as being present at Green's Farms June 3, and at South Norwalk, Easton, Weston, Danbury, Bethel, Brookfield and New Fairfield, June 5. Around New Haven, several slight infestations were observed in pea plantations, but there was no serious injury brought to my attention. The same aphid caused considerable injury to fields of alfalfa as described on page 295 of this Report. In the home garden, dusting with nicotine is perhaps the best remedy.

The cabbage aphid, *Brevicoryne brassicae* Linn., was present at Middletown May 18, and at East Morris May 21, in both instances on plants from the south. A few were noticed by the writer on home grown plants around New Haven, but they afterward disappeared without doing much damage. Even a moderate infestation will prevent the plants from heading, and liberal applications of nicotine dust will control the aphids.

The turnip aphid, *Aphis pseudobrassicae* Davis, was absent from several turnip patches around New Haven, and no reports were received of injury caused by it.

The tarnished plant bug, *Lygus pratensis* Linn., was reported by Mr. Wilkinson as being very abundant on potatoes at Storrs on July 27. The remedy is to dust or spray with nicotine.

The onion thrips, *Thrips tabaci* Linde., was abundant at Westport, July 19.

The squash bug, *Anasa tristis* DeGeer, was found everywhere as usual. The over-wintering bugs are hard to kill except by crushing, but the newly-hatched nymphs may be killed by a spray of nicotine sulphate.

Insects Attacking Field Crops

The army worm, *Cirphis unipuncta* Haworth, was present in some localities and caused considerable injury to timothy grass in Wallingford July 2, and in Milford July 20. Prompt cutting of the grass for hay was recommended as the best treatment in both cases.

White grubs which are the larvae of May or June beetles, *Phyllophaga* sp., were reported as injuring grasslands in a few localities. One report on September 23 of grubs injuring a lawn in Meriden was investigated, thinking it might prove to be the Asiatic beetle, but it was only common white grubs.

The Asiatic beetle, *Anomala orientalis* Waterhouse, which has recently become established in the Westville section of New Haven, caused more injury in the latter half of the summer than has ever been seen before. The grubs eat the roots of grass and thus far the injury has only appeared on lawns around private residences. A more detailed account of this pest may be found on page 309 of this Report.

There was severe injury from attacks of wireworms to newly-set tobacco plants under cloth in Windsor during the last of May. Similar damage was reported by about a dozen tobacco growers. A more detailed account of this outbreak will be found on page 312 of this Report. Mr. Wilkinson reported injury to cabbage plants by wireworms at Middletown, May 18, and at Windsor, May 21.

Alfalfa fields were attacked in Seymour, North Branford, Simsbury, East Windsor, Middletown and Woodbridge by the pea aphid, *Illinoia pisi* Kalt., and a more detailed account is given on page 295 of this Report.

Shade and Forest Tree Insects

The larch leaf-miner or case bearer, *Coleophora laricella* Hubn., was observed in a few places, and specimens were received from Rainbow, May 13. Probably it was less destructive than in 1923 and 1924.

The cottony maple scale, *Pulvinaria vitis* Linn., was received from Hartford on maple, June 29 and July 16.

The tulip tree scale, *Toumeyella liriodendri* Gmel., was received from North Stonington August 28. Two small tulip trees on the Station grounds became infested and were sprayed with commercial liquid lime-sulphur (1-9) in October 1923. This cleaned off most of the infestation but a few scales were present one year later and the trees were sprayed with one of the miscible oils, and are now clean.

The pit-making oak scale, *Asterolecanium variolosum* Ratz., was received from New Haven December 4, on oak. This scale usually occurs on golden or English oak, *Quercus robur,* and a pit or depression is found in the bark under and around each scale.

The woolly maple leaf scale, *Phenacoccus acericola* King, occasionally causes injury to sugar maple trees, and specimens were received from New Haven on September 30. The large woolly or cotton-like wax masses are found on the under sides of the leaves in midsummer, and contain the mature females and eggs or newly-hatched young. The immature females and the male cocoons are much smaller and occur in the cracks and crevices of the bark of the trunk and lower branches throughout the winter. Spraying in March with lime-sulphur and nicotine has proved to be a satisfactory treatment.

The pine leaf scale, *Chionaspis pinifoliae* Fitch, was received from Southington March 5, Greenwich March 26, Meriden September 24, and Wethersfield October 3. There are two generations each year and two or three applications of nicotine sulphate between June 1 and August 15 should keep this pest in check.

The hickory leaf-stem gall aphid, *Phylloxera caryaecaulis* Fitch, causes certain trees to become very unsightly by forming galls on the petioles of the compound leaves, which often turn brown and drop in midsummer. Specimens were received from Ridgefield June 11, and from Danbury August 21. Though we have conducted no tests for the control of this aphid, probably a spray of miscible oil or lime-sulphur before the buds open would kill the overwintering females or eggs.

A wooly aphid on maple, *Neoprociphilus aceris* (Monell), was received from New Haven, June 22.

The spruce gall aphids, *Chermes abbietis* Linn., on Norway spruce, and *Chermes cooleyi* Gillette, on Colorado blue spruce, seem to be more abundant than was the case a few years ago. The former was received from Marion June 10, Vernon June 16, and from Meriden September 24; the latter from Greenwich March 24, Pine Orchard July 24, and from Norfolk August 8. These pests are found in many of the nurseries and are mentioned on page 237 of this Report. Spraying the trees in April with nicotine sulphate or with a miscible oil will kill the overwintering females before the eggs are laid.

The fall web-worm, *Hyphantria cunea* Drury, was about as abundant as usual in late summer and made its nests on the ends of branches of all kinds of fruit, shade and woodland trees. Apparently it was more abundant than usual in New London County. The only specimens received were from New Haven, August 20. The remedies are to clip off and burn the nests or crush the caterpillars, or spray with lead arsenate.

A small Scolytid beetle, thought to be *Ips pini* Say, was received from Hazardville May 26, tunneling in pine bark.

Sawfly cocoons are often found on pine twigs, and those of the imported pine sawfly, *Neodiprion simile* Hartig, were received from Greenwich March 26, and larvae and pupae of *Neodiprion pinetum* Norton, on red pine were received from Danbury, October 30.

Work of the poplar and willow curculio, *Cryptorhynchus lapathi* Linn., was received from Thompsonville, September 8.

The spruce mite, *Paratetranychus ununguis* Jacobi, was injurious to spruce trees about New Haven and specimens were received from Milford May 23, Stamford July 20, and Meriden September 24. One of the best remedies is a spray of linseed oil emulsion.

The maple bladder gall caused by a mite, *Eriophyes quadripes* Shimer, is seen each year on the leaves of silver maple, and during 1925 specimens were received from Collinsville, June 10, Hartford, June 29, Westport, July 21, and Somers, August 13.

The imported birch leaf-miner, *Fenusa pumila* Klug, now occurs all over Connecticut on gray birch, particularly on young sprouts. Specimens were received from Yalesville, July 15, Leete's Island, July 30, and Norfolk, August 8.

The imported willow leaf-beetle, *Plagiodera versicolora* Laich., which first appeared in the State in Greenwich, has now spread nearly all over Connecticut. Specimens were received from West Haven August 20, and while inspecting nurseries Mr. Zappe observed the presence of this insect in Greenwich, August 11 and 14, Stamford, August 29, New Canaan, August 3, Ridgefield, September 9, and Bristol, September 8.

The elm leaf beetle, *Galerucella xanthomelaena* Schrank, was present and there were many localities where the unsprayed trees were brown in late July and August. Specimens were received from Middlebury, July 16. In many villages the elm trees were sprayed and the foliage kept green throughout the season.

The birch leaf skeletonizer, *Bucculatrix canadensisella* Chamb., though perhaps not so abundant as in 1923 and 1924, was present and caused many areas of gray birch to become brown in late summer.

Household Insects

Nearly every season a certain number of specimens of insects infesting stored food products in or about the household are sent to the Station, and some of those received in 1925 are mentioned here.

The Oriental cockroach, *Blatta orientalis* Linn., was received from Danbury, February 2, and the German cockroach or croton bug, *Blatella germanica* Linn., from Cheshire, April 1. Both species are found in homes, especially around the kitchen and pantry and along the water pipes. Commercial roach powders are now sold everywhere.

The black carpet beetle, *Attagenus piceus* Oliv., is a common pest in houses where the larvae live in floor cracks and feed upon the lint, and the adult beetles eat holes in clothing in closets. Filling or frequent cleaning of the cracks is advisable. Small pieces of woolen cloth placed on the floors in closets will often be eaten instead of the clothing. Specimens of this insect were received from New London, June 10, and from Milford, October 23.

The common carpet beetle or "buffalo bug," *Anthrenus scrophulariae* Linn., was received from Waterbury, October 24. This also injures clothing and particularly carpets on floors. Carbon tetrachloride may be used on infested carpets, or heat generated by applying moisture and going over the carpet with hot flatirons.

The common clothes moth, *Tineola bisselliella* Hummel, was received from New Haven, May 23. Clothes which are worn or moved frequently are usually not injured, and if hung out in the sun about once a month, there is little danger of injury. If this cannot be done, they should be stored at a low temperature, put in moth-proof bags, or packed in naphthalene or camphor.

The granary weevil, *Calendra granaria* Linn., in poultry feed was received from New Haven, September 17; the Mediterranean flour moth, *Ephestia kuehniella* Zeller, in wheat flour from Waterbury, July 17, and the drug store beetle, *Sitodrepa panicea* Linn., in stored grain from New Haven, June 25. These insects are common pests of stored food products, and may be controlled by fumigating or heating the infested products.

The common white ant, *Reticulitermes flavipes* Koll., was received from New Haven, April 17, where it infested the structural wood around the base of a veranda; also the clover mite, *Bryobia praetiosa* Koch, was reported as crawling about on a house in New Haven, May 8.

Miscellaneous Insects

The box leaf-miner, *Monarthropalpus buxi* Labou., was received from Green's Farms, March 16. This is a serious pest of box and has also been recorded from Waterford.*

The juniper web-worm, *Dichomeris marginellus* Fabr., was received from Manchester and West Haven, on June 5, where the caterpillars had injured junipers by webbing the leaves together and feeding upon them inside the web.

Convention of Entomological Workers

The second convention of Entomologists working in Connecticut was held at the Station on October 30, 1925. The program was varied from that of last year by securing addresses from a few men working outside the State on problems which are or threaten soon to become Connecticut problems. Thus we had Mr. L. B. Smith and Dr. Alvah Peterson from New Jersey and Dr. H. C. Huckett from Long Island. Though the attendance was somewhat smaller than last year, there was great interest shown and all present seemed to feel that it had been a successful and interesting meeting. The following program was fully carried out:

* Report for 1923, page 312.

Program

A. M.

Greetings.
W. L. Slate, Jr., Director, New Haven, Conn.

10:15 Notes on the Birch Leaf Skeletonizer.
R. B. Friend, Assistant Entomologist, New Haven, Conn.

10:45 The Asiatic Beetle in Connecticut in 1925.
M. P. Zappe, Assistant Entomologist, New Haven, Conn.

11:15 The Corn Borer Survey of 1925.
L. H. Worthley, In Charge of Control Work, Arlington, Mass.

P. M.

12:30 Luncheon.

1:30 The Japanese Beetle Survey of 1925.
Loren B. Smith, Entomologist in Charge, Riverton, N. J.

2:15 Gipsy Moth Survey of 1925.
A. F. Burgess, In Charge, Melrose Highlands, Mass.

3:00 Progress in Controlling Curculio on Apple in 1925.
Dr. Philip Garman, Assistant Entomologist, New Haven, Conn.

3:30 Cucumber Beetles.
Dr. H. C. Huckett, Research Associate, N. Y. Experiment Station, Long Island Branch, Riverhead, N. Y.

4:00 Oriental Peach Moth Survey.
Dr. Alvah Peterson, Bureau of Entomology, Riverton, N. J.

4:30 Anti-Mosquito Work of the Season in Connecticut.
R. C. Botsford, Deputy In Charge, New Haven, Conn.

4:45 The Birch Leaf-Miner in the Northeastern States.
Dr. W. E. Britton, State Entomologist, New Haven, Conn.

The following were present: A. F. Burgess, S. S. Crossman, H. L. Blaisdell, T. H. Jones, Melrose Highlands, Mass.; H. A. Ames, Bound Brook, N. J.; S. E. May, Canaan, Conn.; F. C. Rich, Ansonia, Conn.; L. H. Worthley, T. M. Cannon, Arlington, Mass.; Loren B. Smith, J. Peter Johnson, Riverton, N. J.; H. C. Huckett, Riverhead, N. Y.; J. A. Manter, E. W. Nelson, R. S. Filmer, P. E. Bitgood, L. A. Gilbert, J. G. Conklin, Storrs, Conn.; O. W. Spicer, Stamford, Conn.; G. M. Codding, Mount Vernon, N. Y.; P. H. Meagher, Wallingford, Conn.; C. L. Marshall, Meriden, Conn.; D. W. Thomas, 2d, Highwood, Conn.; G. A. Clyne, Waterbury, Conn.; Allen Latham, Norwichtown, Conn.; J. T. Ashworth, Danielson, Conn.; P. L. Buttrick, W. O. Filley, W. L. Slate, Jr., W. E. Britton, Philip Garman, B. H. Walden, M. P. Zappe, R. B. Friend, R. C. Botsford, Leslie Rogers, New Haven, Conn.; Alvah Peterson, Riverton, N. J.

INSPECTION OF NURSERIES IN 1925

The General Assembly of 1925 enacted a new law defining nurseries and nursery stock and providing that all nurserymen register and apply for an inspection each year before July 1; that all dealers register prior to March 1 each year and receive a permit; that all nurseries outside the State wishing to ship nursery stock into Connecticut file copies of their valid inspection certificate and receive permits allowing them to ship stock into Connecticut. The new law is as follows:

The New Law Providing for the Registration and Inspection of Nurseries

Chapter 265, Public Acts of 1925

Section 1. Inspection and Shipment of Nursery Stock: The state entomologist or his deputies or assistants shall, upon application, inspect at least once each year all nurseries at which woody field-grown trees and plants shall be grown for sale or shipment; may inspect any nursery stock when dug, before shipment or at destination; may inspect nurseries at any time for the purpose of controlling plant pests or to ascertain whether such pests exist in nurseries; may employ such deputies or assistants as he may deem necessary; may prescribe forms for registration, certificates and permits and may make rules and regulations regarding time and methods of inspection; may destroy or treat or order the destruction or treatment of, and prohibit the movement of, plants infested with dangerous pests; may co-operate with agents of the United States Department of Agriculture in the inspection of nurseries and control of plant pests; may, at reasonable times, enter any public or private grounds in performance of his duties under the provisions of this act. In case orders shall be issued for the destruction or treatment of infested plants, the owner, manager or agent of the nursery shall, within a reasonable time from the date of such order, destroy such plants as shall be ordered destroyed and make such treatment within the time specified in the order, or be subject to the penalty provided in section five of this act.

Sec. 2. All nurserymen shall register with the state entomologist each year, on or before July first, and make application for inspection, and furnish such data on such blanks as the state entomologist shall prescribe and furnish. In case a nurseryman shall fail to make such application on or before July first, he shall pay to the state entomologist the cost of such inspection. All firms, stores and individuals who shall sell but shall not grow nursery stock, shall be classed as dealers, and shall, each year, on or before March first, register with the state entomologist, giving the chief sources of their nursery stock and such data as he may require, on such forms as he may prescribe and furnish, and the state entomologist may issue a permit allowing such dealer to sell such nursery stock. Each nursery outside the state, before shipping nursery stock into the state, shall file with the state entomologist a copy of a valid inspection certificate and the state entomologist may issue a permit allowing such nursery to ship stock into the state. The state entomologist shall keep a record of all money received as costs for inspection, and such money shall be deposited with the state treasurer.

Sec. 3. The state entomologist shall issue to regular nurseries certificates, valid until the first day of August following the date of issue and covering

the stock inspected and such other stock as shall have been received under valid certificates of inspection; may issue temporary permits covering certain portions thereof, and permits to dealers. All such certificates and permits may be revoked for cause. Nursery stock which shall not have been inspected or stock from a nursery not holding a valid certificate of inspection shall not be sold or transported, and transportation companies shall refuse to accept any shipment not bearing such certificate or some form of permit issued by the state entomologist, and all nurserymen shall furnish a certificate, and all dealers a permit, to accompany each package of stock sold or transported, but no provision of this act shall prevent or render liable any individual or firm who shall transport stock from his field or property to another field or property belonging to or operated by him, when such stock is not to be immediately sold or offered for sale and when such transportation shall not violate any established federal or state embargo or quarantine regulations.

Sec. 4. For the purposes of this act, any place at which hardy trees, shrubs and vines shall be propagated or grown out of doors for commercial purposes, shall be considered a nursery, and such stock shall be regarded as nursery stock; hardy herbaceous perennial plants, including strawberry plants, may be subject to the same provisions regarding inspection and pest control, if, in the opinion of said state entomologist, it shall seem desirable to control the movement of such plants. Florists' ordinary plants, unless woody and field-grown, shall not be included.

Sec. 5. Any person who shall interfere with the state entomologist or his deputy or assistant in the performance of his duties under the provisions of this act, or any person, firm or corporation who shall violate any of the provisions hereof, shall be fined not more than fifty dollars. Any person aggrieved by any order issued under the provisions of this act may appeal to the superior court, or to any judge thereof if said court shall not be in session, and said court or such judge may grant such relief or issue such order or judgment in the premises as to equity may appertain.

Sec. 6. Section 2119 of the general statutes is repealed.

(Approved June 24, 1925.)

As this act gives the State Entomologist authority to make rules and regulations and to prescribe forms for certificates and permits, the following regulations have been adopted and were printed together with the law as Bulletin of Immediate Information No. 50, under date of July 15, 1925, and a copy sent out with each certificate and permit issued. The forms for certificate and permits are included here for reference. The regulations are as follows:

Nursery Certificates

The original certificate issued by the State Entomologist under Chapter 265, Public Acts of 1925, is to be kept in the nurseryman's possession, and is not to be attached to any package of nursery stock. It applies to the whole nursery which has been inspected and to such purchased stock as has been received from other nurseries under the certificate of a state or government officer. If any stock is received from outside the state unaccompanied by such a certificate, the State Entomologist should be notified at once so that it may be inspected.

An exact transcript of the certificate including number and date may be printed on labels or tags for shipping and must be attached to each package sent out of the nursery. An additional statement, made by the owner, that the stock has been fumigated, will be required in many states. The law now requires that the inspection certificate be attached to every package shipped to points both within the State of Connecticut and outside. Please see that a copy always accompanies each sale whether shipped by freight, express, mail, automobile or whether carried away by the purchaser.

After the date of expiration, which is a part of each certificate, the document becomes invalid and should not be attached to any box, bale or package. The nurseryman has no right to change the date or any other portion of the certificate.


OFFICE OF STATE ENTOMOLOGIST
STATE OF CONNECTICUT
NEW HAVEN CONN.

No. ______ Date ______ 192

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

NURSERY INSPECTION AND REGISTRATION

CERTIFICATE

This is to Certify that ______

of ______ Conn., has registered as a Nurseryman, that the nursery stock has been duly examined in compliance with the provisions of Chapter 265, of the Public Acts of 1925, and that it is apparently free from dangerously injurious insects and plant diseases.

This certificate expires August 1, 192__.

______
State Entomologist

FIG. 38.—Facsimile of nursery inspection and registration certificate, less than two-thirds size.

The improper use or abuse of a certificate will not be tolerated, and the certificate may be revoked for cause.

Duplicate copies of certificates for filing in other states will be furnished on request of the nurseryman.

Dealer's Permits

The original permit issued by the State Entomologist under Chapter 265, Public Acts of 1925, should be kept in the dealer's

possession and is not to be attached to any package or shipment of nursery stock, though copies may be made for this purpose. These may be typewritten or printed and a copy must go with each separate sale from stores, and with each shipment or package of nursery stock transported. This copy must be an exact transcript, and must include number, date of issue and of expiration. After the expiration date, the permit becomes invalid and should not be used. The dealer has no right to alter the date or any other portion of the permit. This permit may be revoked for improper use or abuse, and for not complying with the law.

Shipper's Permits

The shipper's permit is issued to nurserymen in other states who file applications and duplicate signed copies of their state inspection certificates. The original permit should be kept, and a copy (typed or printed) together with a copy of the inspection certificate of the state in which the nursery is situated should accompany each shipment into Connecticut.

Package Certificates

Occasionally individuals and firms not in the nursery business wish to ship a few trees or shrubs but cannot do so without inspection certificates. If such materials can be inspected by our men on their usual trips without extra travel and expense, this will be done on request, as an accommodation. Other inspections may be arranged by special appointment, or plants can be sent to the Station with address and postage for forwarding, and here they will be examined and sent along.

The U. S. Postal Laws and Regulations, Section 467, paragraph 2, governs the mailing of plants and plant products, and reads as follows:

"Nursery stock, including all field-grown florists' stock, trees, shrubs, vines, cuttings, grafts, scions, buds, fruit pits and other seeds of fruit and ornamental trees or shrubs, and other plants and plant products for propagation, except field, vegetable and flower seeds, bedding plants and other herbaceous plants, bulbs and roots, may be admitted to the mails only when accompanied with a certificate from a State or Government inspector to the effect that the nursery or premises from which such nursery stock is shipped has been inspected within a year and found free from injurious insects, and plant diseases, and the parcel containing such nursery stock is plainly marked to show the nature of the contents and the name and address of the sender."

Such materials may be mailed without certificate to any Agricultural Experiment Station or to the United States Department of Agriculture. Florists' plants (not woody, field-grown) and vegetable or other annual herbaceous plants do not require certificates but must be plainly marked as to contents, origin and destination. Package certificates apply only to the contents of the packages on which they are placed, and the contents of which have been examined.

Quarantines

Both state and Federal quarantines prohibit the movement of nursery stock and forest products from the area quarantined on account of gipsy and brown-tail moths to any point outside of that area, without inspection and certificate. Federal Inspectors will be stationed at convenient points to cover the quarantined area of the state. Applications for such inspections may be made to the nearest Federal Inspector or to the following:

Mr. D. M. Rogers, 408 Atlantic Avenue, Boston, Mass.
In charge of Federal gipsy moth quarantine inspection service.

Dr. W. E. Britton, State Entomologist, Agr. Exp. Sta., New Haven, Conn.
In charge of state gipsy moth quarantine inspection service.

Circular letters were issued to nurserymen and dealers, and notices published in Connecticut newspapers calling attention to the new law and its provisions. The law provides that all nursery certificates shall expire on August 1 of each year. All dealer's permits have been made to expire on December 31, and all shipper's permits are valid during the period covered by the certificates issued to the nurseries by their respective States.

Inspection Work

The annual inspection of growing nursery stock was begun July 7, and most of it was completed by October 15, though a few applied afterward and these inspections were made later. This work was in charge of Mr. M. P. Zappe, who was assisted by Messrs. J. L. Rogers, and G. T. Thompson, and Dr. W. R. Hunt of the Botany Department. Mr. B. H. Walden inspected two nurseries and W. E. Britton, one; Messrs. R. B. Friend and R. C. Botsford, each helped one or two days, and Mr. E. M. Stoddard of the Botany Department helped inspect two nurseries. In one large forest plantation from which trees were sold, Messrs. W. O. Filley, H. W. Hicock, J. E. Riley, Jr., R. Gregory Belcher and Thomas H. Vance of the Forestry Department, assisted.

In addition to the inspections made by the nursery inspectors, the gipsy moth scouts were instructed to make careful examinations for gipsy moth eggs in and around all nurseries in the quarantined area, and to report promptly to the office in case any were found. No gipsy moth infestations were discovered in or near any Connecticut nursery in 1925.

In 34 nurseries no important pests were found. A list of insect pests and plant diseases found in nurseries during the annual inspection of 1925, together with the number of nurseries infested by each, is given below:

List of Pests Found in Nurseries in 1925

Nurseries uninfested 34

INSECTS

Aphids, apple, green	10	Mite, European red	3
woolly	11	pear blister	9
cherry	1	on silver maple	1
on larch	1	spruce	6
spruce gall,		Red-humped caterpillar	2
Chermes abietis	27	Sawfly, *Diprion simile*	1
" *cooleyi*	19	pine	1
on willows	1	Scale, elm	8
Apple and thorn skeletonizer	8	oak gall scale (*Kermes*)	2
Birch bucculatrix	1	pitmaking	1
Borer, bronze birch	1	oyster-shell	38
lilac	4	pine-leaf	4
poplar	1	rose	3
willow	2	San José	32
Cherry and pear slug	1	scurfy	1
Curculio, poplar and willow	1	tulip tree	6
Elm leaf beetle	5	white elm	1
European pine shoot moth	1	Tarnished plant bug	2
Fall webworm	6	Tent caterpillar	1
Lace bugs on Crataegus	1	White grubs	1
rhododendron	6	White pine weevil	5
Laspeyresia molesta	11	Willow leaf beetle, Imported	
Leafhoppers on apple	18	*Plagiodera versicolora*	6
lilac	1	*Lina scripta*	1
Mite, box	1	Yellow-necked caterpillar	1

PLANT DISEASES

Apple scab	30	Mildew on horsechestnut	2
Black knot	1	lilac	7
Brown rot	1	rose	33
Canker, poplar	34	spiraea	1
Crown gall	3	Peach yellows	1
Fire blight	3	Raspberry anthracnose	1
Leaf spot on catalpa	3	mosaic	6
pear	1	Rust on hawthorn	1
quince	2	white pine blister on *Ribes*	7
rose	6	cedar (on apple)	35
Mildew on apple	7	(on cedar)	1
catalpa	15	sweet fern (on pine)	1
cherry	1	on willows	1
grapes	16		

From an examination of the preceding list it will be seen that the oyster-shell scale still continues to be the commonest pest found in Connecticut nurseries, occurring in 38 of them. The next most common pests in order of their abundance are as follows: cedar rust on apple, 35 nurseries; poplar canker, 34 nurseries; mildew on rose, 33 nurseries; San José scale, 32 nurseries; apple scab, 30 nurseries; spruce gall aphid, *Chermes abietis*, 27 nurseries, and *Chermes cooleyi*, 19 nurseries.

In order to show how the figures of 1925 correspond with those of preceding years, the following table gives the data for the past eight years, as reported by the inspectors:

EIGHT YEAR RECORD OF SERIOUS AND COMMON NURSERY PESTS

Pest	1918	1919	1920	1921	1922	1923	1924	1925
Oyster-shell scale	39	38	38	36	44	42	44	38
San José scale	18	19	11	28	19	20	32	32
Spruce gall aphids	15	19	21	31	21	28	40	27
White pine weevil	5	5	1	1	19	17	5	5
Apple and thorn skeletonizer	..	..	..	..	1	18	2	8
Poplar canker	6	5	13	21	31	34	25	34
Pine blister rust (on *Ribes*)	1	..	..	2	9	6	8	7
Nurseries uninfested	32	32	46	36	36	32	33	34

It may be seen from the table that in 1925, the two species of spruce gall aphids together form the commonest pest in Connecticut nurseries, and must be given some treatment to hold them in check. The oyster-shell scale, however, is and has been for the past eight years the commonest single species pest, though the past season the pine blister rust (on *Ribes*), the poplar canker and the San José scale are not far behind. It is hoped that we can soon issue a bulletin on insect pests of the nursery, giving directions for control, so that the Connecticut nurserymen will know just what treatments will hold these pests in check.

NUMBER OF NURSERIES

The operation of the new law requiring nurserymen to register has brought to light many new nurseries, that heretofore were unknown to the State Entomologist. During the season of 1925, 160 nurseries have been inspected. Of this number 153 have received regular certificates; two of these were inspected twice, once in the spring and again in the fall; three have informed this office since the inspection that they have discontinued the business. Three have been instructed regarding slight infestations, but have not notified this office that the directions have been carried out.

In addition to these inspections and certificates, 118 separate parcels of nursery stock have been inspected and package certificates furnished; also 143 duplicate certificates have been furnished the regular nurserymen for filing in other States.

The total area of Connecticut nurseries in 1925 is about 2,731 acres, and the list contains 151 names, as follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1925

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Amelunxen & De Wyn	Yalesville	2	Aug. 5	12
Baby Blue Spruce Gardens	New Milford	1	Sept. 5	66
Barnes Bros. Nursery Co.	Yalesville and Durham	150	Aug. 17	22

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Barnes Nursery & Orchard Co.	Wallingford	50	Oct. 20	129
Barton Nursery	Hamden	1	Sept. 4	60
Benbow, A.	Norfolk	1	Sept. 14	85
Berkshire Nurseries (C. B. Myers, Mgr.)	Milford	10	Dec. 12	150
Bernson, Gosta M.	Cromwell	1	Aug. 5	16
Bertolf Brothers	Greenwich	45	Aug. 21	31
Booy, H. W.	Yalesville	2	Aug. 6	17
Brainard Nursery & Seed Co.	Thompsonville	10	Aug. 26	40
Braley & Co.	Burnside	2	Aug. 24	37
Branford Nurseries (2)	Branford	4	Sept. 5	64
Bretschneider, A.	Danielson	1	Sept. 16	88
Bridgeport Hydraulic Co.	Bridgeport	650	Sept. 28	105
Bristol Nurseries, Inc.	Bristol	20	Sept. 16	87
Brooklawn Conservatories	Bridgeport	1	Sept. 2	55
Brouwer's Nurseries	New London	2	Aug. 20	29
Brown, E. M.	Hartford	2	Oct. 13	122
Burr & Co., C. R.	Manchester	500	July 23	1
Burroughs, Thos. E.	Deep River	4	Sept. 1	46
Cant, Alexander	Springdale	1	Nov. 7	141
Cardarelli, E. J.	Cromwell	2	Aug. 3	10
Chapman, C. B.	Groton	1	Oct. 10	118
Chapman, C. E.	No. Stonington	2	Sept. 2	52
Clinton Nurseries (Warren Richards, Mgr.)	Clinton	2	Sept. 17	91
Conine Nursery Co.	Stratford	50	Aug. 19	26
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Aug. 21	32
Conn. Agr. Expt. Station (W. O. Filley, Forester)	New Haven	1	Sept. 30	107
Corrigan, James J.	West Haven	1	Sept. 22	101
Courtland Avenue Nurseries (A. Pedersen, Prop.)	Stamford	1	Sept. 10	76
Cross Highway Nurseries	Westport	6	Dec. 10	147
Curtis, E. D.	Bantam	3	Dec. 18	151
Dallas, Inc., Alexander	Waterbury	5	Sept. 21	97
Dawson's Nursery	Willimantic	1	Sept. 14	84
Dowd, Inc., F. C.	Madison	2	Nov. 10	143
Dunlap, Daniel S.	Cromwell	3	Aug. 3	8
Eager, Edward M.	Bridgeport	1	Dec. 5	145
East Rock Nursery (S. Palmieri, Prop.)	New Haven	1	Sept. 12	80
Edgewood Nursery	New Haven	1	Oct. 23	135
Edgewood Nursery, Vidal, Mackintosh, Inc.	Stamford	1	Oct. 10	120
Eells & Sons	Manchester	1	Aug. 13	19
Eldredge, C. F.	Niantic	1	Nov. 18	144
Elm City Nursery Co., Woodmont Nurseries, Inc.	New Haven and Woodmont	100	Aug. 31	42
Elm Grove Cemetery Association	Mystic	1	Oct. 23	132
Engelhardt, Paul	Wallingford	1	Sept. 22	100
Ensign-Bickford Co.	Simsbury	10	Dec. 10	148
Evergreen Nursery Co.	Wilton	12	Aug. 21	30
Fraser's Nurseries	Willimantic	2	Sept. 1	48
Galligan, C. W.	North Haven (Address West Haven)	1	Oct. 14	124

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Gardner's Nurseries	Rocky Hill	22	July 28	4
Geduldig's Greenhouses	Norwich and Ledyard	2	Sept. 10	74
Geremia, Frank	Yalesville	1	Oct. 23	133
Geremia, Joseph	Yalesville	1	Aug. 5	11
Glen Terrace Nursery (J. H. Everett, Prop.)	Mount Carmel	14	Nov. 10	142
Golden Hill Nursery (A. Johnson, Prop.)	Shelton	1	Oct. 2	111
Hanford, R. G.	Norwalk	1	Oct. 2	112
Hansen, Peter	Fairfield	2	Sept. 3	57
Heath & Co.	Manchester	5	July 23	2
Hilliard, H. J.	Sound View	1	July 28	5
Hiti Nurseries (J. H. Bowditch, Prop.)	Pomfret Center	8	Aug. 22	36
Holcomb, Irving	Simsbury	1	Aug. 7	18
Holdridge, S. E.	Ledyard (Address Norwich)	2	Sept. 2	53
Hoogendoorn, C.	Yalesville	1	Aug. 5	14
Horan & Son, Jas.	Bridgeport	2	Sept. 19	95
Houston's Nurseries	Mansfield	10	Oct. 20	130
Hoyt's Sons Co., Inc., The Stephen	New Canaan	400	Aug. 31	43
Hubbard, C. S.	Cromwell	1	Aug. 31	41
Hull, Curtis M.	Wallingford	1	Oct. 23	134
Hunt & Co., W. W.	Hartford	10	Aug. 31	44
Intravaia, Joseph	Middletown	1	Sept. 21	98
Jennings, G. S.	Southport	1	Nov. 3	138
Jones, William	Norwalk	1	Oct. 15	126
Kelley, James J.	New Canaan and Darien	9	Sept. 12	83
Kerner, Eugene	Woodbury	7	Sept. 22	103
Keso Nursery (J. J. Kelsey, Prop.)	Clinton	1	Sept. 4	63
Keystone Nurseries (H. H. Kellner, Prop.)	Danbury	1	Sept. 10	75
Leghorn, John J.	Cromwell	2	Aug. 3	9
Long Hill Nursery (John Eckner, Prop.)	Burnside	1	Oct. 7	115
Malavasi & Son, Sam	New Haven	1	Oct. 19	128
Mallett Co., Geo. A.	Bridgeport	1	Sept. 17	90
Maplewood Nurseries (T. H. Peabody, Prop.)	Norwich	1	Oct. 15	125
Marigold Farm (H. Kelley, Prop.)	New Canaan	5	Oct. 2	108
Marshall, Robert	Wethersfield	1	Oct. 2	110
Meier, A. R.	West Hartford	1	Aug. 22	34
Merwin Lane Nursery	Fairfield	2	Sept. 10	77
Middeleer, Charles	Darien	10	Sept. 19	96
Millane Tree Expert Co.	Middletown	1	Sept. 9	73
Morgan, Wm. F.	No. Stonington (Address Westerly, R. I.)	3	Oct. 13	123
New Haven Nurseries (L. A. Soldan, Prop.)	New Haven	1	Oct. 7	114
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	16	Sept. 9	71
Newington Gardens	Newington	2	Aug. 22	35

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
New London Cemetery Assn. (E. E. Rogers, Pres.)	New London	1	Aug. 20	27
New London County Nurseries (W. J. Schoonman, Prop.)	New London	4	Sept. 5	69
New London Greenhouses and Nursery, Inc. (Geo. A. Gorton, Receiver)	New London	1	Oct. 21	131
Nicolson & Thurston	Litchfield	1	Sept. 6	67
North-Eastern Forestry Co.	Cheshire	40	July 31	7
Norwich Nursery (O. E. Ryther, Prop.)	Norwich	6	Oct. 29	137
Norwood Nursery	Hamden	1	Oct. 3	113
Nott Plant Co.	Meriden	1	Oct. 8	116
Oakland Nurseries	Manchester	5	July 23	3
Outpost Nurseries (L. D. Conley, Prop.)	Ridgefield	50	Sept. 18	93
Ouwerkerk & Van der Stam	Yalesville	15	Aug. 5	13
Park Gardens	Bridgeport	1	Nov. 5	140
Pequod Nursery Co.	Yalesville	15	July 31	6
Perry, Wilfred S.	Waterbury	1	Oct. 2	109
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Sept. 30	106
Pierson, Inc., A. N.	Cromwell	60	Aug. 17	23
Plumley, D. L.	Clintonville	1	Sept. 4	61
Polish Orphanage Farm	New Britain	1	Sept. 11	78
Pomeroy, Edwin C.	Northville	1	Sept. 5	65
Reumann, Theodore	Stamford	1	Oct. 10	119
Ridgefield Florist & Nursery Co. (W. Pinchbeck, Prop.) (2)	Ridgefield	2	Sept. 16	89
Rockfall Nursery Co. (P. Marotta, Prop.)	Rockfall	50	Aug. 13	21
Rowayton Greenhouses, Inc.	Rowayton	1	Sept. 5	70
Rushworth, Edwin	Yalesville	1	Aug. 5	15
Russell, C. B.	Newington	1	Oct. 9	117
Saxe & Floto	Waterbury	1	Oct. 23	136
Schaeffer Bros. Nursery	Ledyard	3	Aug. 17	24
Scheepers, Inc., John	Stamford	14	Sept. 2	56
Scott's Nurseries	Hartford	5	Dec. 8	146
Sierman, C. H.	Hartford	8	Aug. 26	38
Southport Nursery (L. Coari, Prop.)	Southport	10	Aug. 21	33
South Wilton Nurseries	South Wilton	3	Sept. 1	47
State Forest Nursery (A. F. Hawes, State Forester)	Weatogue	2	Sept. 12	82
State Street Nursery	New Haven	2	Sept. 1	50
Steck, Chas. A.	Newtown	6	Oct. 13	121
Steck, Harold W.	Farmington	1	Sept. 22	99
Steck, Mrs. Sarah B.	Bethel	1	Sept. 28	104
Stratfield Nurseries	Bridgeport	15	Nov. 3	139
Stratford Florist Co. (C. A. Cooper, Prop.)	Stratford	1	Sept. 12	81
Stratford Rose Nurseries (John Barrow, Prop.)	Stratford	1	Sept. 3	58
Sunny Ridge Nursery (C. A. Steck, Jr., Prop.)	Bethel	6	Sept. 22	102

Name of Firm	Address	Acreage	Certificate Issued	No. of Certificate
Szirbik & Co., Geo.	New Haven	1	Oct. 16	127
Tanner's Nursery Co.	Manchester	4	Aug. 26	39
Thomas, D. W.	Highwood	1	Sept. 14	86
Tow Path Gardens (S. W. Eddy, Prop.)	Avon	1	Dec. 10	149
Upson, R. E.	Marion	2	Sept. 17	92
Vanderbrook & Son, Chas. L.	Manchester	11	Aug. 13	20
Van Wilgen Nurseries	Branford	7	Sept. 2	54
Vasileff, Nicholas	Greenwich	1	Sept. 4	62
Verkade's Nurseries	New London, Lyme and Chesterfield	20	Aug. 20	28
Wallace Nursery	Wallingford	5	Sept. 4	59
Wayside Farm Gardens	Thomaston	1	Sept. 5	68
Wheeler, Chas. B.	No. Stonington	2	Sept. 2	51
Wilcox, Harry D.	Avon	1	Sept. 11	79
Wild, Henry	Greenwich and Norwalk	20	Sept. 1	45
Wilson & Co., C. E.	Manchester	75	Aug. 19	25
Woodruff, C. V.	Orange	1	Sept. 18	94
Yale University, School of Forestry	New Haven	2	Sept. 1	49
Zack Co., H. J.	Deep River	5	Sept. 9	72
Total, 151 nurseries		2,731 acres		

Inspection of Raspberry Plantations

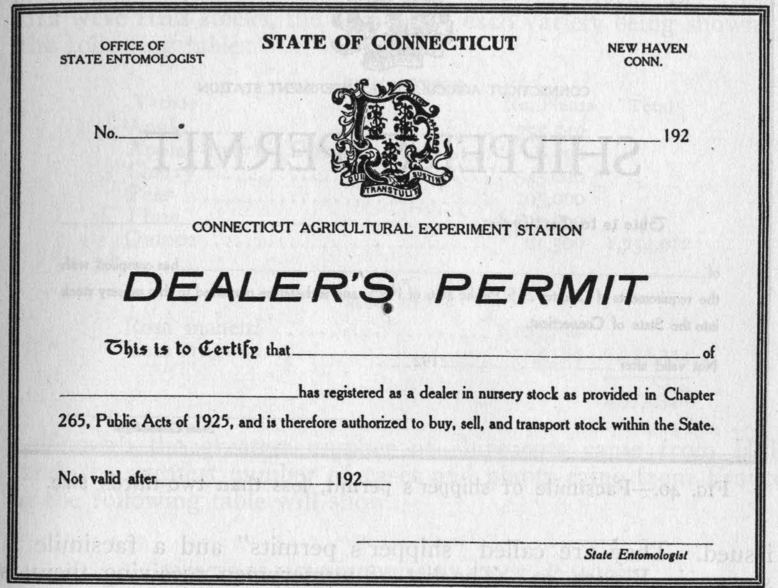
A number of raspberry growers and nurserymen applied for inspections in order to obtain certificates for plants free from mosaic. Consequently two inspections of each were made by Entomologists and Botanists of 11 plantations, mostly in nurseries. Some of these plantations contained too much mosaic to grant certificates, but six special certificates were granted, as follows:

Special Certificates on Raspberry Plants

Name of Firm	Address	Variety	Certificate Issued	No. of Certificate
Barnes Nursery & Orchard Co.	Wallingford	Herbert St. Regis	Sept. 28	7
Burr & Co., C. R.	Manchester	Marlboro St. Regis	Sept. 30	11
Conine Nursery Co., F. E.	Stratford	Cuthbert Kansas St. Regis	Sept. 28	8
Long Hill Nursery (John Eckner, Prop.)	Burnside	St. Regis	Sept. 28	10
Rockfall Nursery Co.	Rockfall	Columbian Cuthbert Kansas Plum Farmer St. Regis	Sept. 28	6
Scheepers, Inc., John	Stamford	LaFrance	Sept. 28	9

Nursery Dealers

As provided by the new law, dealers in nursery stock must also register, and notices and application blanks were sent out to all addresses of dealers that could be obtained, and notices were published in the newspapers, calling attention to the provisions of the new law. As a result, 57 dealers' permits were issued for the six months from July 1, when the new law went into effect, until



OFFICE OF STATE ENTOMOLOGIST — STATE OF CONNECTICUT — NEW HAVEN CONN.

No.________ ________192

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

DEALER'S PERMIT

This is to Certify that ________________ of ____________ has registered as a dealer in nursery stock as provided in Chapter 265, Public Acts of 1925, and is therefore authorized to buy, sell, and transport stock within the State.

Not valid after ________192

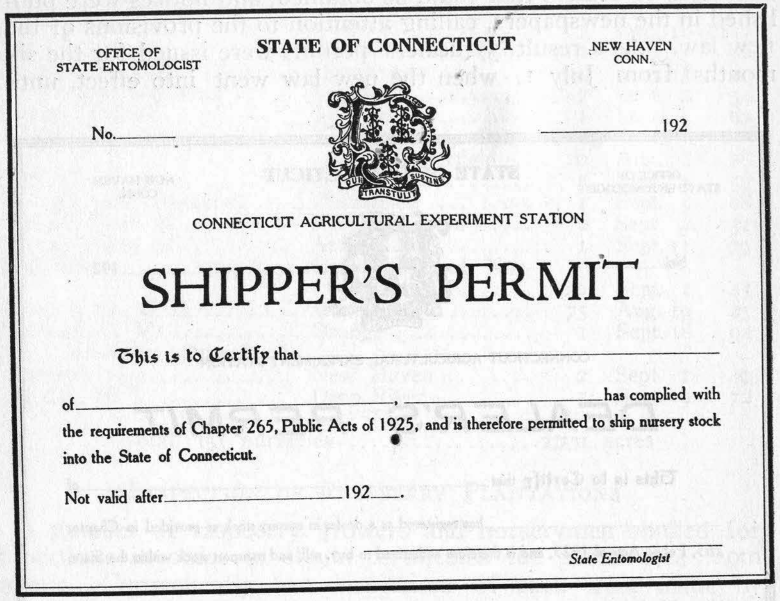
____
State Entomologist

FIG. 39.—Facsimile of dealer's permit, less than two-thirds size.

December 31. These permits were issued only for the remainder of the current year. The list of dealers is not included in this Report, though a facsimile of the permit is shown in Figure 39.

Out-of-State Shippers

Following the provisions of the new law, nurserymen in other states wishing to ship nursery stock into Connecticut are required to file copies of their inspection certificates with the State Entomologist, and receive permits allowing them to ship stock into the State. Application blanks were sent to all nurserymen who filed certificates and to others whom we thought might wish to fill Connecticut orders. The requirements of the new law have also been published in the nursery journals. The permit issued to each firm covered the same period as the inspection certificate filed by that firm. For the six months from July 1, when the new law became operative, until December 31, 107 such permits have been


OFFICE OF STATE ENTOMOLOGIST — STATE OF CONNECTICUT — NEW HAVEN CONN.

No.________ ________192

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

SHIPPER'S PERMIT

This is to Certify that________________

of________________has complied with the requirements of Chapter 265, Public Acts of 1925, and is therefore permitted to ship nursery stock into the State of Connecticut.

Not valid after________192___.

State Entomologist

FIG. 40.—Facsimile of shipper's permit, less than two-thirds size.

issued. They are called "shipper's permits" and a facsimile is shown in Figure 40. The list of nurserymen receiving them is not published in this Report.

INSPECTION OF IMPORTED NURSERY STOCK

The nursery stock entering Connecticut from foreign countries during 1925 has been fruit and rose seedlings for propagation. This stock has been inspected as in preceding years mostly by Mr. Zappe, though assisted at certain times by Messrs. Walden and Rogers. The number of shipments, cases and plants was less than in 1924, as shown in the table below which gives the statistics for the past six 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
1924	33	313	3,480,170
1925	27	277	2,977,346

These 27 shipments were imported by eight different Connecticut firms, 18 of them being consigned to two firms. Of the total number, 16 shipments contained rose stocks and 10 shipments contained fruit stocks. One shipment contained both fruit and rose stocks.

The time required to inspect this stock is equivalent to one man working 40 days and this time, together with the cost of travel and other necessary expenses, amounts to about $500.00.

Of this material, 1,233,334 plants were rose stocks and 1,754,012 were fruit stocks, the number of each variety being shown in the following table:

FRUIT STOCK

Variety	No. Plants	Total
Apple	755,512	
Apple, dwarf (Doucin)	6,000	
Cherry	545,000	
Pear	195,000	
Plum	191,000	
Quince	61,500	1,754,012

ROSE STOCK

Rosa manetti	1,109,750	
Rosa rugosa	113,584	1,223,334
		2,977,346

Though the greatest number of shipments came from Holland, the greatest number of cases and plants came from France as the following table will show:

SOURCES OF IMPORTED NURSERY STOCK, 1924-1925

Country	No. Shipments	No. Cases	No. Plants
France	10	167	1,904,000
Holland	14	105	999,584
England	2	4	73,750
Canada	1	1	12
	27	277	2,977,346

The following table shows the quantities of stock as inspected by months:

Month	No. Shipments	No. Cases	No. Plants
November	1	2	15,000
December	2	21	217,500
January	8	32	307,734
February	3	34	365,600
March	2	18	180,000
April	8	152	1,701,500
May	3	18	190,012
	27	277	2,977,346

In addition to the material tabulated above, there were 19 shipments containing 25 packages of seeds, mostly of trees and palms, which were not inspected in Connecticut.

Of the 27 shipments inspected, 18 shipments or 66 per cent, were found infested with insects or plant diseases. One of them, *Aporia crataegi* Linn., on apple and pear stock from France, is considered a dangerous insect pest, which should be kept out of the United States if possible. Details regarding the pests discovered in these shipments are given below:

PESTS FOUND ON IMPORTED NURSERY STOCK

18 Shipments Infested.

Insects

Acronycta rumicis Linn., on cherry stock. (1 shipment.) Andre Choplin, Angers, France.

Aporia crataegi Linn., on apple stock. (3 shipments.) Franco-American Seedling Co., Angers, France; Andre Choplin, Maze, France (on pear and apple stock).

Calophasia lunula Hubner, on pear stock. (1 shipment.) Andre Choplin, Maze, France.

Emphytus cinctus Linn., on rose stock. (13 shipments.) Fa. As. Ouwerkerk, Boskoop, Holland; Walter C. Slocock, Woking, England; M. Gielen, Oudenbosch, Holland; Oudyk Bros., Boskoop, Holland; H. H. Woldering, Veendam, Holland; B. Ruys, Ltd., Dedensvaart, Holland; Andre Choplin, Angers, France.

Gelechiidae sp. on cherry. Andre Choplin, Angers, France.

Lepidopterous cocoon, on apple. Andre Choplin, Maze, France.

Leptocryptus lacustris Sch., on quince. Andre Choplin, Angers, France.

Notolophus antiqua Linn., egg mass on apple leaf. (1 shipment.) Franco-American Seedling Co., Angers, France.

Plant Diseases

Crown Gall on rose stocks. (2 shipments.) M. Gielen, Oudenbosch, Holland; Andre Choplin, Angers, France.

INSPECTION OF APIARIES IN 1925

In 1925, as for several years past, the apiary inspection work has been done by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford, on a *per diem* basis. Mr. Coley covers the southern half of the State (Fairfield, New Haven, Middlesex and New London Counties), and Mr. Yates the northern half (Litchfield, Hartford, Tolland and Windham Counties).

This work required a total of 130 man days and the entire cost for the season was $1,881.45.

Fewer apiaries were inspected in 1925 than in 1924, though the apiaries averaged slightly larger than last year. The following table shows the number of apiaries and colonies inspected and the average number of colonies per apiary for each year in Connecticut, since the inspection work was commenced in 1910.

SIXTEEN YEAR RECORD OF APIARY INSPECTION IN CONNECTICUT

Year	No. of Apiaries	No. of Colonies	Average No. Colonies Per Apiary	Average Cost of Inspection Per Apiary	Per Colony
1910	208	1,595	7.6	$2.40	.28
1911	162	1,571	9.7	1.99	.21
1912	153	1,431	9.3	1.96	.21
1913	189	1,500	7.9	1.63	.21
1914	463	3,882	8.38	1.62	.19
1915	494	4,241	8.58	1.51	.175
1916	467	3,898	8.34	1.61	.19
1917	473	4,506	9.52	1.58	.166
1918	395	3,047	7.8	1.97	.25
1919	723	6,070	11.2	2.45	.29
1920	762	4,797	6.5	2.565	.41
1921	751	6,972	9.2	2.638	.24
1922	797	8.007	10.04	2.60	.257
1923	725	6,802	9.38	2.55	.27
1924	953	8,929	9.4	2.42	.25
1925	766	8,257	10.7	2.45	.22

In 1925, apiaries were inspected in 118 towns against 142 in 1924 and 119 towns in 1923.

Inspections were made in the following 16 towns in 1925 which were not visited in 1924: Fairfield County: Bethel; Middlesex County: Saybrook; New London County: Lyme; Litchfield County: Harwinton and New Hartford; Hartford County: Bloomfield, East Granby, East Windsor, Granby, Hartford, Marlborough, Suffield, Windsor and Windsor Locks; Tolland County: Hebron; Windham County: Scotland.

On the other hand, the following 41 towns where inspections were made in 1924, were not visited by the inspectors in 1925: Fairfield County: Brookfield, Fairfield, Monroe, Newtown, Stratford, Trumbull, and Weston; New Haven County: Branford, East Haven, Hamden, Milford, New Haven, North Branford, Orange, West Haven, Wolcott and Woodbridge; Middlesex County: Middlefield; New London County: Ledyard, New London, and North Stonington; Litchfield County: Bridgewater, New Milford, Roxbury, Washington, Woodbury; Hartford County: Enfield, New Britain, Plainville, and Southington; Tolland County: Andover, Ellington, Somers, Stafford, Tolland, Union, Vernon, and Willington; Windham County: Ashford, Eastford, and Pomfret.

European Foul Brood

European foul brood is a bacterial disease of the young larvae caused by *Bacillus pluton*. It is more destructive in spring and early summer than at other periods of the year. The cell contents are usually not gelatinous or ropy, and though the odor of fermentation is generally present, it is not very offensive. The remedy is to requeen the diseased colonies with Italian queens, and to build up strong colonies by uniting two or more weak colonies if deemed necessary.

Of the 766 apiaries and 8,257 colonies inspected in 1925, 19 apiaries and 42 colonies were found infested with European foul brood. This is 2.48 per cent. of the apiaries and .507 per cent. of the whole number of colonies inspected during the season. This is a somewhat larger percentage of the apiaries and slightly smaller percentage of the colonies than were found infested by this disease in 1924. The following table shows the figures regarding European foul brood since the inspection began in 1910.

RECORD OF EUROPEAN FOUL BROOD

Year	Percentage of Infestation Apiaries	Percentage of Infestation Colonies	Year	Percentage of Infestation Apiaries	Percentage of Infestation Colonies
1910	75.9	49.7	1918	9.8	3.3
1911	51.8	27.4	1919	6.6	1.2
1912	47.7	23.5	1920	4.3	1.5
1913	44.4	24.5	1921	3.91	1.26
1914	32.6	13.9	1922	4.14	.85
1915	26.1	10.3	1923	2.34	.36
1916	18.8	7.05	1924	1.78	.526
1917	16.7	4.86	1925	2.48	.507

During 1925, European foul brood was found only in Naugatuck, New Haven County; Lebanon, New London County; Cornwall, Watertown, and Winchester, Litchfield County; Canton, Granby, Marlborough, and Suffield, Hartford County; Hebron, Tolland County; Plainfield, Putnam, and Sterling, Windham County. None was found in Fairfield and Middlesex Counties.

American Foul Brood

American foul brood is also a bacterial disease of the larvae, caused by *Bacillus larvae,* but it attacks at a later stage of the brood development than does the European foul brood. It usually shows when the larvae are mature and pupating after the cells are sealed. The diseased cells become sunken, and if broken open, the contents have a peculiar ropy or stringy consistency and a very offensive odor. The remedy has been to shake into clean hives, destroy the infected combs, and disinfect the old hives. Now it is feasible to sterilize the combs by soaking them in an alcohol-formalin solution containing 20 per cent. formalin, after which they can safely be used.

Of the 766 apiaries and 8,257 colonies inspected in 1925, 26 apiaries and 38 colonies were found diseased with American foul brood. This is 3.26 per cent. of the apiaries and .446 per cent. of the whole number of colonies inspected in 1925. This is a somewhat larger percentage of infestation than has been found for several years, as the following table will show:

RECORD OF AMERICAN FOUL BROOD

Year	Percentage of Infestation Apiaries	Percentage of Infestation Colonies	Year	Percentage of Infestation Apiaries	Percentage of Infestation Colonies
1910	0	0	1918	1.01	.32
1911	0	0	1919	3.	1.1
1912	0	0	1920	1.18	.25
1913	0	0	1921	2.5	.56
1914	1.07	.7	1922	1.38	.27
1915	.8	.18	1923	.965	.323
1916	1.07	.15	1924	1.04	.22
1917	.42	.17	1925	3.26	.424

During 1925, American foul brood was found in Ridgefield, Stamford and Wilton, Fairfield County: Meriden, Wallingford, and Waterbury, New Haven County; Cromwell and East Haddam, Middlesex County; Norwich, New London County; Litchfield, Plymouth, and Torrington, Litchfield County; Andover, Tolland County; and Bristol and Manchester, Hartford County. None was found in Windham County.

Sacbrood

Sacbrood or pickled brood is a disease caused by a filterable virus, and is often mistaken for European or American foul brood. The larvae die about the time the cells are capped and lie on their backs with heads turned upward. The color, though variable, is often light yellow or brown with head nearly black. The body is swollen and the contents are watery, but there is no ropiness. The entire cell contents can readily be removed intact as if enclosed in a sac.

Treatment for sacbrood consists in keeping bees from contact with infected honey, frames and hives, and in uniting weak colonies to make strong ones.

In 1925, sacbrood was found in 26 apiaries and 69 colonies. This is 3.39 per cent. of the apiaries, and .83 per cent. of the colonies examined.

RECORD OF SACBROOD

Year	Percentage of Infestation Apiaries	Percentage of Infestation Colonies	Year	Percentage of Infestation Apiaries	Percentage of Infestation Colonies
1910	0	0	1918	.253	.032
1911	..	.51	1919	1.24	.19
1912	..	Several	1920	1.18	.229
1913	..	2.8	1921	1.06	.157
1914	2.59	.721	1922	1.37	.187
1915	2.02	.47	1923	.53	.086
1916	.428	.051	1924	1.78	.52
1917	1.48	.199	1925	3.39	.836

Paralysis

Adult bees are sometimes sickly, and are said to have paralysis. The cause may be poisoning or several other conditions, and it is usually impossible to give advice regarding treatment, particularly until more is known about symptoms and conditions concerning the apiary.

Statistics of Inspection

The statistics of apiary inspection by towns and counties may be found on the following pages, with summary on page 253.

Town	Apiaries		Colonies		Foul Brood			
	Inspected	Diseased	Inspected	Diseased	American	European	Sacbrood	Paralysis
Fairfield County:								
Bethel	4	0	32	0	0	0	0	0
Danbury	2	1	44	8	0	0	8	0
Darien	7	1	46	1	0	0	0	1
Easton	4	0	91	0	0	0	0	0
Greenwich	28	3	206	7	0	0	7	0
New Canaan	12	1	103	6	0	0	6	0
Norwalk	6	0	53	0	0	0	0	0
Redding	2	0	8	0	0	0	0	0
Ridgefield	4	1	16	1	1	0	0	0
Shelton	1	0	28	0	0	0	0	0
Stamford	35	4	333	8	5	0	3	0
Westport	2	0	7	0	0	0	0	0
Wilton	6	1	123	1	1	0	0	0
	112	12	1,090	32	7	0	24	1
New Haven County:								
Beacon Falls	2	0	27	0	0	0	0	0
Cheshire	2	0	81	0	0	0	0	0
Derby	3	1	22	1	0	0	1	0
Guilford	2	0	28	0	0	0	0	0
Madison	2	1	26	1	1	0	0	0
Meriden	24	0	195	0	0	0	0	0
Naugatuck	2	2	31	6	0	3	3	0
North Haven	5	0	45	0	0	0	0	0
Prospect	2	0	16	0	0	0	0	0
Seymour	2	1	36	1	0	0	1	0
Wallingford	26	6	174	14	4	0	10	0
Waterbury	2	1	89	3	3	0	0	0
	79	12	770	26	8	3	15	0
Middlesex County:								
Chester	8	1	80	2	0	0	2	0
Clinton	5	4	62	19	3	0	16	0
Cromwell	2	0	66	0	0	0	0	0
Durham	8	2	98	3	2	0	0	1
East Haddam	7	0	120	0	0	0	0	0
East Hampton	14	0	166	0	0	0	0	0
Essex	4	1	72	2	0	0	2	0
Haddam	4	0	68	0	0	0	0	0
Killingworth	2	1	9	3	0	0	3	0

Town	Apiaries		Colonies		Foul Brood			
	Inspected	Diseased	Inspected	Diseased	American	European	Sacbrood	Paralysis
Middlesex County—*cont.*:								
Middletown	5	1	27	1	0	0	0	1
Old Saybrook	8	1	72	2	0	0	2	0
Portland	5	0	38	0	0	0	0	0
Saybrook	2	0	9	0	0	0	0	0
Westbrook	1	1	4	1	0	0	1	0
	71	12	891	33	5	0	26	2
New London County:								
Bozrah	4	0	142	0	0	0	0	0
Colchester	11	0	78	0	0	0	0	0
East Lyme	3	0	59	0	0	0	0	0
Franklin	2	0	104	0	0	0	0	0
Griswold	5	0	130	0	0	0	0	0
Groton	6	1	61	1	0	0	1	0
Lebanon	7	1	140	1	0	3	0	0
Lisbon	2	0	32	0	0	0	0	0
Lyme	2	0	96	0	0	0	0	0
Montville	5	0	53	0	0	0	0	0
Norwich	9	2	440	5	4	0	1	0
Old Lyme	2	0	52	0	0	0	0	0
Preston	3	0	38	0	0	0	0	0
Salem	2	0	44	0	0	0	0	0
Sprague	1	0	16	0	0	0	0	0
Stonington	7	0	83	0	0	0	0	0
Voluntown	2	0	25	0	0	0	0	0
Waterford	2	1	45	1	0	0	1	0
	75	5	1,638	8	4	3	3	0
Litchfield County:								
Barkhamsted	6	1	37	2	0	2	0	0
Bethlehem	6	1	22	3	0	3	0	0
Canaan	1	0	7	0	0	0	0	0
Colebrook	5	0	34	0	0	0	0	0
Cornwall	9	1	70	1	0	1	0	0
Goshen	7	0	81	0	0	0	0	0
Harwinton	7	0	40	0	0	0	0	0
Litchfield	12	1	214	2	2	0	0	0
Morris	4	0	39	0	0	0	0	0
New Hartford	13	0	76	0	0	0	0	0
Norfolk	4	0	25	0	0	0	0	0
North Canaan	4	0	80	0	0	0	0	0
Plymouth	3	1	21	1	1	0	0	0
Salisbury	6	0	43	0	0	0	0	0
Sharon	3	0	102	0	0	0	0	0
Thomaston	7	0	35	0	0	0	0	0
Torrington	16	1	95	1	1	0	0	0
Watertown	13	1	78	2	0	2	0	0
Winchester	15	1	96	2	0	2	0	0
	141	8	1,195	14	4	10	0	0

Town	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood	Paralysis
Hartford County:								
Avon	4	0	32	0	0	0	0	0
Berlin	12	0	183	0	0	0	0	0
Bloomfield	6	0	143	0	0	0	0	0
Bristol	14	1	74	5	4	0	1	0
Burlington	7	0	47	0	0	0	0	0
Canton	16	1	99	5	0	5	0	0
East Granby	6	0	33	0	0	0	0	0
East Hartford	5	0	25	0	0	0	0	0
East Windsor	1	0	19	0	0	0	0	0
Farmington	4	0	18	0	0	0	0	0
Glastonbury	13	0	166	0	0	0	0	0
Granby	3	1	39	2	0	2	0	0
Hartford	3	0	22	0	0	0	0	0
Hartland	1	0	125	0	0	0	0	0
Manchester	14	1	110	3	3	0	0	0
Marlborough	2	1	41	3	0	3	0	0
Newington	1	0	9	0	0	0	0	0
Rocky Hill	4	0	32	0	0	0	0	0
Simsbury	7	0	55	0	0	0	0	0
South Windsor	3	0	33	0	0	0	0	0
Suffield	14	2	102	3	0	3	0	0
West Hartford	20	0	165	0	0	0	0	0
Wethersfield	11	0	62	0	0	0	0	0
Windsor	17	0	80	0	0	0	0	0
Windsor Locks	7	0	27	0	0	0	0	0
	195	7	1,741	21	7	13	1	0
Tolland County:								
Andover	1	1	6	3	3	0	0	0
Columbia	5	0	34	0	0	0	0	0
Coventry	6	0	81	0	0	0	0	0
Hebron	4	1	24	2	0	2	0	0
Mansfield	1	0	8	0	0	0	0	0
	17	2	153	5	3	2	0	0
Windham County:								
Brooklyn	4	0	190	0	0	0	0	0
Canterbury	3	0	33	0	0	0	0	0
Chaplin	3	0	21	0	0	0	0	0
Hampton	9	0	87	0	0	0	0	0
Killingly	7	0	32	0	0	0	0	0
Plainfield	20	3	108	9	0	9	0	0
Putnam	5	1	49	1	0	1	0	0
Scotland	7	0	24	0	0	0	0	0
Sterling	2	1	6	1	0	1	0	0
Thompson	6	0	70	0	0	0	0	0
Windham	7	0	86	0	0	0	0	0
Woodstock	3	0	73	0	0	0	0	0
	76	5	779	11	0	11	0	0

SUMMARY

County	No. Towns	Apiaries Inspected	Apiaries Diseased	Colonies Inspected	Colonies Diseased	Foul Brood American	Foul Brood European	Sacbrood	Paralysis
Fairfield	13	112	12	1,090	32	7	0	24	1
New Haven	12	79	12	770	26	8	3	15	0
Middlesex	14	71	12	891	33	5	0	26	2
New London	18	75	5	1,638	8	4	3	3	0
Litchfield	19	141	8	1,195	14	4	10	0	0
Hartford	25	195	7	1,741	21	7	13	1	0
Tolland	5	17	2	153	5	3	2	0	0
Windham	12	76	5	779	11	0	11	0	0
	118	766	63	8,257	150	38	42	69	3

	No. Apiaries	No. Colonies
Inspected	766	8,257
Infested with European foul brood	19	42
Per cent. infested	2.48	.507
Infested with American foul brood	26	38
Per cent. infested	3.26	.446
Infested with sacbrood	26	69
Infested with bee paralysis	3	3
Average number of colonies per apiary		10.7
Cost of inspection		$1,881.45
Average cost per apiary		2.45
Average cost per colony		.22

REPORT OF THE GIPSY MOTH WORK

Year Ending June 30, 1925.

By John T. Ashworth and W. E. Britton.

This work has been carried on as in preceding years by State and Federal agencies working in close and friendly co-operation. The Federal agencies have scouted the towns near and outside the margin of the infested area in order to prevent further spread, and the State appropriation for the most part has been expended within the area known to be infested. This close co-operation has rendered the work far more effective than could possibly result if both agencies worked independently. We hereby express our appreciation and thanks to Mr. A. F. Burgess and his assistant, Mr. H. L. Blaisdell, of the Bureau of Entomology.

In the following pages will be found a brief account of the work done by both State and Federal forces in each town, arranged by counties. Under towns is mentioned only the number of infestations sprayed, but the amount of spraying done in each town may be learned from the table of statistics, pages 267-269, where the quantities of poison used are given (25 pounds of lead arsenate make 400 gallons of spray mixture).

A report on larvae and pupae is also given in the tables; scouting for larvae is done both before and after spraying, around the colonies discovered during the winter. Most of the larvae here reported were found before spraying, and all such larvae and pupae were killed by hand.

New Equipment

During the year ending June 30, 1925, considerable new equipment was bought and some of the old renewed: 1,500 feet of new spray hose was purchased from the Acme Rubber Company, and a saving of ten cents per foot effected by using couplings from old or leaky hose. The old Corona typewriter was turned in as part payment for a guaranteed second-hand Remington machine. The old Ford touring car was exchanged toward a new Dodge touring car. The two oldest Ford trucks were also turned in and replaced with new ones; three new Ford trucks were added to the fleet, which now numbers nine Ford delivery trucks and one Dodge and one Buick, both touring cars. A Ford Dealer's cabinet with repair parts, one electric drill, one portable auto jack, and several small tools, such as wrenches, drills, screw drivers and hammers, have been added to the storehouse equipment.

Details of the Work by Towns

The following pages give a detailed account of the conditions in each town where work was done.

WINDHAM COUNTY

Brooklyn—27 Infestations—903 Egg-clusters.

Brooklyn was scouted during September and October by State men. The town was found to be generally, although not heavily, infested. Egg-clusters were found in 57 different places (counting single egg-clusters and colonies). At three of the colonies, 407 or almost half of the total number of egg-clusters were found. Two of these infestations were found on land owned by Mr. Benham, in the southern or Wauregan corner of the town; one colony was found in woodland and a stonewall, the other in an orchard; 268 egg-clusters were found at these two places. One other large colony was found in an orchard owned by Mr. Salmon on Allen Hill. These three and 13 other colonies were sprayed in June by State men.

Killingly—43 Infestations—1,676 Egg-clusters

Killingly was used this year as a school in which to train men in this work for the Federal Bureau, as well as for the State. Most of the infestations found in the town were small for this

territory; there were only three colonies of over 100 egg-clusters each. One of these was found in a stonewall on land owned by Lewis Pringle, situated on the west shore of Old Killingly pond, and contained 290 egg-clusters. Another colony of 120 egg-clusters was found in an apple tree owned by Hiram Franklin, just south of Danielson, on what is known as the Green Hollow road. The last colony to be mentioned was one of 101 egg-clusters, found on a white oak and in a stonewall in Dayville on land owned by Stanley King. Twenty-one colonies were sprayed in May by a State crew.

Plainfield—21 Infestations—428 Egg-clusters

In Plainfield as in Killingly, the scouting was done by men who were being trained, both State and Federal men doing the work. Only two important colonies were found in the town. The largest was a colony of 101 egg-clusters in white oak growth near the north end of Moosup pond, owner unknown. The other was in shade trees and a stonewall on land owned by S. H. Dolly, about one mile east of Plainfield village, where 89 egg-clusters were found, most of them in the stonewall and all but one being old egg-clusters. Twelve of the colonies were sprayed by State men in June.

Pomfret—71 Infestations—2,109 Egg-clusters

Pomfret was scouted early in the year by State crews. As in the last two years, infestations occurred in all parts of the town. About one-fourth of the total number of egg-clusters found were old ones (or hatched). Several infestations were found in stonewalls, but most of them were in woodland; the percentage of orchard infestations was very small in Pomfret this year. There were only three colonies where more than 100 egg-clusters were found; the largest was one of 436 egg-clusters, 191 trees in woodland owned by Mr. Wetherbee in the extreme southwestern corner of the town being infested. The next largest colony was in two white oaks owned by Mr. McGinnes, about one mile east of Pomfret station, where 280 egg-clusters were found. Another colony of 114 egg-clusters was found in woodland and a stonewall on land owned by Howard White, near Pomfret Landing. Twenty-four infestations were sprayed in June by State men.

Putnam —68 Infestations—1,956 Egg-clusters

Scouting in Putnam was completed October 31, and the results showed the town to be infested in about the same degree as last year. There were four colonies of more than 100 egg-clusters each, and four colonies of between 50 and 100 egg-clusters; the other colonies were mostly small ones. One of the largest colonies was in three oak trees and a stonewall on land owned by Jerome Shippee, near the Putnam Town Farm, containing 189 egg-clusters. Another of 195 egg-clusters was found in an orchard owned by Miss Bertha White, on the State road to Providence, just east of the Windham County Home. One of 127 egg-clusters was found on one white oak in a pasture owned by H. D. Dimond, in the East Putnam district. The fourth colony of 105 egg-clusters was found in a pasture owned by Frank E. C. Pearce; the egg-clusters were in one oak, one hickory and in a stonewall. Forty-two of the infestations were sprayed by State men during May and June.

Scotland

Scotland was scouted by a State crew the last of the season when the foliage was about half grown. This made the work slow and difficult, but the entire town was scouted and no infestations found.

Sterling—2 Infestations—82 Egg-clusters

Federal men who were being trained scouted Sterling this year, and only two colonies of more than five egg-clusters each were found; both were in orchards near the Rhode Island line, just north of the railroad. One orchard was owned by A. Gibson, the other by H. M. Cook, and contained 11 and 16 egg-clusters respectively. Single egg-cluster infestations were scattered through the town, the greater portion being in the northern part. Both colonies were sprayed June 2 by State men.

Thompson—103 Infestations—5,256 Egg-clusters

In Thompson as in several towns in Windham County, the scouting was done by Federal men who were learning to do the work. The town was found infested throughout, and only three of the largest colonies are mentioned. One of 200 egg-clusters was found on roadside oaks near North Grosvenordale; another of 175 egg-clusters was found in one apple tree in a pasture owned by A. J. Barvia, near the railroad just north of West Thompson station. A colony of 153 egg-clusters was found in an orchard and oak woodland owned by John Andrews in North Grosvenordale. By the time the spraying crews reached Thompson, the larvae were nearly full-grown, so only 22 of the infestations were sprayed before the work stopped. Spraying and scouting for larvae was done by State men.

Woodstock—41 Infestations—3,902 Egg-clusters

About two-thirds of Woodstock was scouted by Federal men late in the year; in fact egg-clusters were hatching when the work was stopped. None of the colonies found were considered large for this territory. At the largest colony, 58 egg-clusters were found on one elm tree and in a stonewall, in the southeastern corner of the town. Another of 54 egg-clusters was found in an orchard owned by E. J. Cortiss, in the village of East Woodstock. The next largest colony was one of 26 egg-clusters in an orchard owned by Margaret Potter, on the road leading north from North Woodstock near the Massachusetts line. All the other colonies had less than 25 egg-clusters each, and 15 colonies were sprayed by State men.

New London County

Colchester—5 Infestations—394 Egg-clusters

Colchester was scouted by State men and completed on April 28. Five infestations were found, all of them in the eastern half of the town. Two were large colonies for this territory; the largest contained 325 egg-clusters in woodland owned by Edward Brown, about two miles south of Colchester village. The other colony was about one mile eastward in oak and hickory trees on land owned by Nicholas Clement, where 52 egg-clusters were found. These and two other small infestations of eight egg-clusters each were sprayed by a State crew, about the middle of June.

Franklin—5 Infestations—18 Egg-clusters

Five infestations were found in Franklin by State men, all of them being very small ones. The largest was a colony of nine egg-clusters found in one white oak on land owned by B. Bogacink, about one mile west of Franklin, on the road leading to North Franklin. At each of the other infestations, three egg-clusters or less were found. Two places were sprayed in June by a State crew.

Griswold—3 Infestations—54 Egg-clusters

About two-thirds of Griswold was scouted, the time being insufficient to complete the town. About 37 miles of roadside were covered and three infestations found; one of 51 egg-clusters was in an old apple tree on roadside, in the Pachaug district; another of two egg-clusters was found in two trees (one maple and one elm) on land owned by Ora Askholm, in the extreme northwestern corner of the town; the third of one egg-cluster in an apple tree owned by F. Peterstrom, about one mile south of

Glasko village. Two places were sprayed by State men on June 15.

Groton—2 Infestations —27 Egg-clusters

A training school for the Federal Bureau was started in Groton, continued for several days, and a part of the town scouted and only two infestations found. This region proved to be too sparsely infested for training recruits, and the school was discontinued. One colony of 17 egg-clusters was found in an orchard in Mystic village owned by Charles Benjamin; the other had 10 old egg-clusters in apple and plum trees owned by H. Shaughness near Eastern Point. One colony was sprayed on June 17 by State men.

Lisbon

No scouting was done in Lisbon this year except for larvae. This work was taken up in July after the spraying stopped. As no infestations were found, the men were sent to look over last year's colonies. At one of these, larvae and pupae were found, so every tree around this colony was climbed and thoroughly examined; 285 larvae and pupae were found and destroyed by State men.

Salem

Salem was scouted the last of the season by a State crew and no infestations found.

Stonington—1 Infestation—19 Egg-clusters

The work done in Stonington this year was of the same character as that done in Groton; only one colony and five single egg-cluster infestations were found; then the men were transferred to Thompson. The colony was in white oaks in a pasture owned by Mr. Cash Miller, about one mile south of Stillmanville, and contained 14 egg-clusters. Five single egg-cluster infestations were found scattered in and around the village of Stonington. The colony was sprayed on June 16 by a State crew.

TOLLAND COUNTY

Andover—1 Infestation—30 Egg-clusters

A State crew completed the scouting in Andover on April 20. One colony of 30 egg-clusters was found in one apple tree on land owned by D. Fox, on the south side of the railroad near the Columbia line. This colony was sprayed on June 27 by State men.

Bolton—1 Infestation—26 Egg-clusters

This town was scouted by State men during February and March and one colony of 26 egg-clusters found. This was in woodland owned by Sam Alavoid, about one mile east of Bolton village. Two acres of woodland were sprayed by State men on June 27.

Columbia—2 Infestations—175 Egg-clusters

Two colonies were found in Columbia this year by State men, both in the southwestern part of the town near the Hebron town line on land owned by False Keosenity. One was found in apple trees scattered along the roadside and contained 46 egg-clusters; the other was in woodland where 129 egg-clusters were found. Eighty-eight apple trees and 29 shade trees were sprayed at one colony and one and one-half acres of woodland at the other by State men on June 26.

Ellington—11 Infestations—97 Egg-clusters

Seven of the 11 infestations found in Ellington this year were on or near the State road from Vernon to Somers; none of them were large and only four are mentioned here. The largest infestation contained 28 egg-clusters. This colony was found in apple trees owned by H. Schuldenfrei on the east side of the State road near the Somers town line. Another of 21 egg-clusters was found on a white oak in the margin of woodland owned by Frank Goodiza, about one and one-half miles directly east of the colony just mentioned. One of 17 egg-clusters was found on a white oak owned by Clem Clark, near Ellington depot and another of 14 egg-clusters in a white oak in the northwestern part of the town. Seven of the places were sprayed by State men the latter part of June.

Hebron—1 Infestation—12 Egg-clusters

One colony of 12 egg-clusters was found by State men in Hebron this year, in maple and hickory trees and also a stone-wall along the roadside in the village of Gilead on property owned by H. D. Hodge. This colony was sprayed by State men on June 25.

Somers—16 Infestations—81 Egg-clusters

Somers was scouted by State men, and the work completed on November 15. Sixteen infestations were found scattered in the four corners of the town, with nothing in the center. All the colonies were small and were mostly in apple trees. The largest colony was one of 17 egg-clusters in apple trees owned by Jos.

Pelcozasski, near the Massachusetts line. Another of 15 egg-clusters was found on two oaks owned by M. Keeney, in the village of Somerville. These two colonies were the largest, and most of the others were single egg-cluster infestations. Six of the places were sprayed in June by State men.

Stafford—55 Infestations—1,290 Egg-clusters

Several large colonies were discovered in Stafford this year by State men. The largest contained 225 egg-clusters on a white oak and an apple tree in a field owned by Fred Ramyoni, about one and one-half miles north of Orcuttville. Another of 117 egg-clusters was found in an orchard owned by Charles Stebbens, in the northwestern corner of the town. A colony of 93 egg-clusters was found in apple and oak trees and a stonewall owned by Mr. Sartonia, just east of Staffordville post office. There were 10 other colonies of between 30 and 40 egg-clusters each. Thirty-four places were sprayed late in June by State men.

Vernon—2 Infestations—47 Egg-clusters

Vernon was scouted by State men, the work being completed on February 7. Two infestations were found; one, a single egg-cluster, on a white oak, on town property in the village of Rockville. The other contained 46 egg-clusters found in four white oak trees on land owned by Otto Broll, near the center of the town. This colony was sprayed by State men on June 29.

HARTFORD COUNTY

Avon

The work in Avon was confined to the territory around last year's infestation. Three miles of roadside and several acres of woodland were scouted and no egg-clusters found.

Berlin

Berlin was scouted by State men and the work finished on May 14. No infestations were found.

Bloomfield—3 Infestations—25 Egg-clusters

State men finished scouting in Bloomfield on January 5. Three small infestations were found; one was a colony of 11 egg-clusters on oak and ash trees in a pasture owned by J. G. Hawley, just east of the railroad on State road leading from Bloomfield to Blue Hills Avenue, Hartford. Another colony of 11 egg-clusters was found one mile further south on the east side of the railroad in apple trees owned by A. Corte & Son. The third was a colony of three egg-clusters found on oaks owned by Mr. Fuller, near the Simsbury line on the south side of the State road leading from Bloomfield to Simsbury. Two places were sprayed on June 17 and 18 by State men.

East Granby—2 Infestations—8 Egg-clusters

The two infestations found this year in East Granby were both reinfestations. At Mr. Vitten's place just north of the post office, eight egg-clusters were found on willow trees. Larvae were found at Mr. E. W. Kellogg's place later in the spring, so spraying was done at both places on June 19 by State men.

East Hartford—1 Infestation—16 Egg-clusters

One colony of 16 egg-clusters was found in East Hartford this year in the southern end of the town in the margin of a swamp on land owned by H. C. Keeney. This colony was sprayed on June 15. All work in the town was done by State men.

East Windsor—4 Infestations—107 Egg-clusters

All four infestations found in East Windsor this year were in one group located near the center of the town. The largest was in white oak trees at Mr. C. S. Clapp's place, where 69 egg-clusters were found. Another of 22 egg-clusters was found in oaks and ironwood trees at Mr. R. H. Bartlett's. The next largest was a colony of 13 egg-clusters in a pasture white oak owned by Oliver Fenton. The fourth infestation was a colony of three egg-clusters in a white oak owned by F. N. Barber. The two largest colonies were sprayed on June 17 by State men.

Enfield—1 Infestation—2 Egg-clusters

Only one infestation was found in Enfield this year by the State crew that scouted the town. One old and one new egg-cluster were discovered on one oak and a maple tree owned by F. M. Davis, in Hazardville. No spraying was thought necessary.

Farmington—1 Infestation—9 Egg-clusters

The infestation in Farmington this year was a reinfestation of last year's colony in the northeastern corner of the town in woodland owned by Mr. Charles Beach. Three old and six new egg-clusters were found on oak, pine and spruce trees, and on June 12, a State crew sprayed about two and one-half acres of woodland in and around this colony.

Granby—8 Infestations—312 Egg-clusters

Eight infestations were found this year by State men in Granby, with a total of 312 egg-clusters. Of this total, 288 egg-clusters were found in three of the colonies. At the largest colony, 195 egg-clusters were found in woodland owned by Max Shinder, in the southwestern corner of the town. Another colony of 73 egg-clusters was found in one apple tree in the margin of a woodland owned by Edwin Dewey, one-half mile north of West Granby post office. The third was a colony of 20 egg-clusters in an apple tree owned by Francis Spring, near the Suffield town line in the northeastern corner of the town. Four places were sprayed by State men on June 20.

Hartford—9 Infestations—149 Egg-clusters

Although one more infestation was found in Hartford this year than in 1923, the total number of egg-clusters was greatly decreased; in fact 894 less egg-clusters were found this year than in 1923. The colony on the river flats just east of the Fuller Brush plant was again the largest infestation found in Hartford. Ninety-nine egg-clusters were found this year, where last year there were 936. Considering the difficulties met in handling this infestation, the results of last year's work are considered very satisfactory. Another colony of 22 egg-clusters was found on maple and poplar trees at No. 46 Vernon Street. The next largest was a colony of 10 egg-clusters found on elm and willow trees, on Flatbush Avenue. The six other infestations were all small, three of them being single egg-cluster infestations. Eight of the places were sprayed by State men about the middle of June.

Manchester

The scouting in Manchester this year was not completed, and only 12 miles of roadside covered, when the men had to be taken to fill vacancies in other crews, and before the work could be taken up again, the spraying season started. No gipsy moth infestation was found in the town as far as it was scouted.

New Britain—3 Infestations—15 Egg-clusters

Three small infestations were found in New Britain, the largest being at last year's colony on Bassett Street, opposite the High School. Nine egg-clusters were found on oak and pear trees here, where 110 were found last year. The other two infestations were on Washington Street, about one mile north of the colony just mentioned. One contained five egg-clusters on maple shade trees on city property, and the other was a single egg-cluster in an apple tree owned by John Cill. Two colonies were sprayed by State men on June 11.

South Windsor—3 Infestations—40 Egg-clusters

Three colonies were discovered this year in South Windsor by a State crew. One colony of 24 egg-clusters was on poplar, apple, locust and plum trees in the northwestern corner of the town. Another of 13 egg-clusters was found on a roadside apple tree owned by T. E. Sheppard, in the northern part of the town near the East Windsor line. The third contained three egg-clusters on three apple trees owned by Charles Parker, in the southeastern end of the town near the Manchester town line. All three places were sprayed on June 16 by State men.

Suffield—10 Infestations—784 Egg-clusters

Four of the 10 infestations found this year in Suffield were large ones although easily handled, as they were all on trees in open country. The largest was a colony of 371 egg-clusters in willow trees along the brook running parallel with the railroad just north of West Suffield village. Another colony of 143 egg-clusters was found a little further up the same brook on willow, white oak and walnut trees owned by Henry Barr. Another colony of 132 egg-clusters was found in one white oak on land owned by O. R. Austin, about three miles north of West Suffield village. The fourth largest colony was on oak trees in a pasture owned by Henry Sheldon, near the East Granby town line on the State road leading from West Suffield to East Granby, where 114 egg-clusters were found. Three infestations were sprayed in June by State men.

Simsbury—3 Infestations—72 Egg-clusters

Two of the infestations were found in the northwestern corner of the town, one of 32 egg-clusters and one of 11 egg-clusters, both in woodland owned by G. P. McLean and Mr. Furlong. The third colony was in apple trees owned by John Kilikoelski, in the extreme southern margin of the town, where 29 egg-clusters were found. Two of the colonies were sprayed in June by State men.

Wethersfield—2 Infestations—3 Egg-clusters

Both infestations were close together in the east end of the village near the Connecticut River, in the same locality where last year's big infestation of 622 egg-clusters occurred. Two egg-clusters were found at one place and one at the other. Both places were scouted for larvae on June 10, and as none were found, no spraying was thought necessary.

Windsor—2 Infestations—54 Egg-clusters

A State crew completed the scouting in Windsor on October 18. One colony of 46 egg-clusters in one white oak owned by Howard Throth, and another of eight egg-clusters on two roadside apple trees, were found. Both of the colonies were situated in about the center of the town, and were sprayed on June 18 by State men.

Four other towns in Hartford County were scouted by State crews, namely: Plainville, Rocky Hill, Southington and Windsor Locks, and no trace of the gipsy moth found in them.

MIDDLESEX COUNTY

Scouting was completed in the following six towns in Middlesex County this year by State crews: Clinton, Cromwell, Killingworth, Middlefield, Portland and Westbrook; nothing was found in any of them.

In Middletown, on account of the lateness of the season, scouting had to be confined to the sections around last year's infestations. Two egg-clusters were found at Mr. Johnson's place near Bear Hill; later larvae were found at this place, so spraying was done by State men on June 9.

NEW HAVEN COUNTY

Twenty towns were scouted this year in New Haven County by Federal and State crews: two towns were found infested, namely: Meriden and New Haven.

Meriden—1 Infestation—11 Egg-clusters

One colony of 11 egg-clusters was found in Meriden on poplar and maple trees on East Main Street, and on the property of St. Paul's Church, Curtis Memorial Library and Municipal building. The egg-clusters were scattered over the entire block and the infestation was sprayed on June 6 and 8 by State men.

New Haven—1 Infestation—120 Egg-clusters

A large colony of 120 egg-clusters was found in New Haven by Federal men in oak, elm and poplar trees owned by Mrs. R. Wood, at 603 Winchester Avenue. Spraying was done in a large area around the outside of this infestation in the early part of June by Federal men.

The following towns in New Haven County were scouted by State crews and nothing found: Cheshire, Wallingford, and Waterbury. Federal men scouted the towns of Ansonia, Beacon Falls, Bethany, Derby, East Haven, Hamden, Middlebury, Milford, Naugatuck, Orange, Oxford, Prospect, Seymour, Southbury and Woodbridge, and found them free from gipsy moth infestation.

LITCHFIELD COUNTY

Barkhamsted—4 Infestations—131 Egg-clusters

Barkhamsted was scouted by State men and two large colonies were found in the southeastern end of the town; one of 70 egg-clusters was in woodland owned by Mrs. P. Perry; the other of 50 egg-clusters was in an orchard owned by John Lowander. Another smaller colony of nine egg-clusters was found in woodland owned by the Hartford Water Company, just east of Pleasant Valley. The fourth infestation was one of two egg-clusters found on two maples in a field owned by J. Legett, in the northeastern end of the town. All four of the infestations were sprayed in June by State men.

Canaan

Canaan was scouted by Federal men in the late spring. No egg-clusters were found, but at one 1923 infestation, larvae were found feeding, so 35 shade and 10 apple trees were sprayed in June.

Colebrook—4 Infestations—23 Egg-clusters

All four of the infestations found this year in Colebrook were small. They were in two groups of two infestations each. One group was in the extreme northeastern corner of the town, and both infestations were in woodland. The largest was a colony of five egg-clusters on land owned by Joe Tiller, and the other, one of four egg-clusters, was on land owned by Mr. Howell. The other group was in the western margin of the town; one colony of 12 egg-clusters was found on a maple tree and in a stonewall at Mr. McKenzie's place; the other was a colony of two egg-clusters in woodland owned by L. J. Phelps. Three places were sprayed June 24 by State men.

Cornwall—2 Infestations—23 Egg-clusters

Cornwall was scouted by Federal men, and two infestations were found. One of 19 egg-clusters was in woodland owned by J. Grusanski, in the southern end of the town about two miles east of Swift Bridge; the other was a colony of four egg-clusters on land owned by Constant Beauty, about one mile east of Cornwall Center. The larger colony was sprayed by Federal men.

New Milford—1 Infestation—3 Egg-clusters

Federal men in scouting New Milford this year, discovered three egg-clusters at last year's colony on Mr. F. L. Wanger's place, where 35 egg-clusters were found last year. It was sprayed in June by Federal men and it is hoped that the colony has been eradicated.

Norfolk—15 Infestations—286 Egg-clusters

All but one of the infestations found in Norfolk were situated in the northern half of the town. One small colony of five egg-clusters was found in woodland owned by Mrs. Spofford and the Norfolk Water Company in the southeastern corner of the town. Four of the colonies were large for this part of the State, but a large amount of spraying was done this year and it is hoped that most of the infestations have been cleaned up. The largest colony found was one of 83 egg-clusters in mixed woodland growth owned by E. H. Peasley, in the northeastern part of the town. The next largest contained 48 egg-clusters, in woodland and an orchard near the Massachusetts line in the northwestern corner of the town. A colony of 31 egg-clusters was found in willow and apple trees owned by Carl Stoeckel and Mr. Carlson, about one mile north of Norfolk post office. Another colony of 30 egg-clusters was discovered just north of the village of Norfolk in woodland owned by E. M. Shepard. These four colonies and 10 other smaller infestations were sprayed by Federal men.

North Canaan—2 Infestations—146 Egg-clusters

The work in North Canaan was all done by Federal men this year. Two infestations were found close together in the eastern end of the town near the Norfolk line, both in woodland. Four egg-clusters were found at Mr. Pescidar's place and 142 on the property of C. Rosier, and both places were sprayed.

The following towns in Litchfield County were scouted and nothing found: (by State men), Plymouth and Thomaston: (by Federal men), Bethlehem, Bridgewater, Kent, Morris, Roxbury, Salisbury, Sharon, Warren, Watertown, Washington and Woodbury.

FAIRFIELD COUNTY

Sixteen towns in Fairfield County were scouted by Federal crews this year, namely; Bethel, Brookfield, Bridgeport, Danbury, Easton, Fairfield, Monroe, Newtown, New Fairfield, Reddling, Shelton, Sherman, Stratford, Trumbull, Weston and Westport. No gipsy moth infestations were found in the county.

The statistics of infestations, and work done in the towns covered, are given in the following tables:

Statistics of Infestations, 1924-25

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Windham County:						
Brooklyn ...	27	903	16	781	16	47
Killingly* ...	43	1,676	21	277	462	116
Plainfield* ..	21	428	12	250	206	99
Pomfret	71	2,109	24	575	183	110
Putnam	68	1,956	42	629	980	84
Scotland	0	0	0	0	0	42
Sterling	2	82	2	25	3	56
Thompson* ..	103	5,256	22	964	1,094	131
Woodstock* .	41	3,902	13	450	11,741	94
	376	16,312	152	3,951	14,685	779
New London County:						
Colchester ..	5	394	4	925	64	134
Franklin	5	18	2	150	0	48
Griswold	3	54	2	16	18	37
Groton*	2	27	1	12	47	12
Lisbon†	0	0	0	0	0	285
Salem	0	0	0	0	0	54
Stonington* ..	1	19	1	50	171	19
	16	512	10	1,153	300	489
Tolland County:						
Andover	1	30	1	12	0	41
Bolton	1	26	1	100	0	53
Columbia ...	2	175	2	150	48	54
Ellington ...	11	97	7	125	0	95
Hebron	1	12	1	25	0	68
Somers	16	81	6	118	0	82
Stafford	55	1,290	34	597	486	165
Vernon	2	47	1	81	0	81
	89	1,758	53	1,208	534	639
Hartford County:						
Avon	0	0	0	0	0	3
Berlin	0	0	0	0	0	88
Bloomfield ..	3	25	2	100	0	72
East Granby .	2	8	2	87	26	50
East Hartford	1	16	1	62	0	59
East Windsor	4	107	2	50	1	74
Enfield	1	2	0	0	0	87
Farmington ..	1	9	1	200	39	89
Granby	8	312	4	100	98	90

* Work done by Federal scouts.
† Patrolled 1923 infestation.

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Hartford County—*cont.*:						
Hartford ...	9	149	8	1,037	8	128
Manchester ..	0	0	0	0	0	12
New Britain.	3	15	2	425	221	58
Plainville ...	0	0	0	0	0	30
Rocky Hill ..	0	0	0	0	0	44
Simsbury ...	3	72	2	87	2	94
Southington .	0	0	0	0	0	73
South Windsor	3	40	3	75	8	79
Suffield	10	784	3	131	3,450	88
Wethersfield .	2	3	0	0	0	53
Windsor Locks	0	0	0	0	0	26
Windsor	2	54	2	37	0	70
	52	1,596	32	2,391	3,853	1,367
Middlesex County:						
Clinton	0	0	0	0	0	37
Cromwell ...	0	0	0	0	0	52
Killingworth .	0	0	0	0	0	62
Middlefield ..	0	0	0	0	0	33
Middletown*.	0	0	1	62	1	..
Portland	0	0	0	0	0	78
Westbrook ..	0	0	0	0	0	29
	0	0	1	62	1	291
New Haven County:						
Ansonia* ...	0	0	0	0	0	52
Beacon Falls*	0	0	0	0	0	21
Bethany*	0	0	0	0	0	62
Cheshire	0	0	0	0	0	43
Derby*	0	0	0	0	0	35
East Haven*.	0	0	0	0	0	40
Hamden* ...	0	0	0	0	0	115
Meriden	1	11	1	290	225	147
Middlebury*.	0	0	0	0	0	60
Milford*	0	0	0	0	0	85
Naugatuck* .	0	0	0	0	0	73
New Haven*.	1	120	1	125	0	90
Orange*	0	0	0	0	0	111
Oxford*	0	0	0	0	0	80
Prospect* ...	0	0	0	0	0	43
Seymour* ...	0	0	0	0	0	50
Southbury* .	0	0	0	0	0	120
Wallingford .	0	0	0	0	0	134
Waterbury ..	0	0	0	0	0	147
Woodbridge*	0	0	0	0	0	55
	2	131	2	415	225	1,563

* Scouted only around old infestation.

Towns	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Litchfield County:						
Barkhamsted.	4	131	4	268	22	97
Bethlehem* .	0	0	0	0	0	53
Bridgewater*.	0	0	0	0	0	50
Canaan*	0	0	1	150	0	60
Colebrook ..	4	23	3	150	2	77
Cornwall* ..	2	23	1	150	0	104
Kent*	0	0	0	0	0	90
Morris*	0	0	0	0	0	50
New Milford*	1	3	1	187	0	177
Norfolk* ...	15	286	14	5,244	0	93
North Canaan*	2	146	2	412	0	56
Plymouth ...	0	0	0	0	0	98
Roxbury* ...	0	0	0	0	0	74
Salisbury* ..	0	0	0	0	0	112
Sharon*	0	0	0	0	0	144
Thomaston ..	0	0	0	0	0	56
Warren*	0	0	0	0	0	64
Washington*.	0	0	0	0	0	111
Watertown* .	0	0	0	0	0	90
Woodbury* ..	0	0	0	0	0	100
	28	612	26	6,561	24	1,756
Fairfield County:						
Bethel*	0	0	0	0	0	49
Bridgeport*..	0	0	0	0	0	117
Brookfield* ..	0	0	0	0	0	68
Danbury* ...	0	0	0	0	0	164
Easton*	0	0	0	0	0	81
Fairfield*	0	0	0	0	0	128
Monroe*	0	0	0	0	0	75
New Fairfield*	0	0	0	0	0	52
Newtown* ...	0	0	0	0	0	180
Redding*	0	0	0	0	0	96
Shelton*	0	0	0	0	0	89
Sherman* ...	0	0	0	0	0	49
Stratford* ...	0	0	0	0	0	58
Trumbull* ..	0	0	0	0	0	66
Weston*	0	0	0	0	0	53
Westport* ..	0	0	0	0	0	90
	0	0	0	0	0	1,415

SUMMARY OF STATISTICS

County	No. Towns Covered	No. Infestations Found	No. Egg-Clusters Creosoted	No. Colonies Sprayed	No. Lbs. Poison Used	No. Larvae and Pupae Killed	No. Miles Roadway Scouted
Windham	9	376	16,312	152	3,951	14,685	779
New London	7	16	512	10	1,153	300	589
Tolland	8	89	1,758	53	1,208	534	639
Hartford	21	52	1,596	32	2,391	3,853	1,367
Middlesex	7	0	0	1	62	1	291
New Haven	20	2	131	2	415	225	1,563
Litchfield	20	28	612	26	6,561	24	1,756
Fairfield	16	0	0	0	0	0	1.415
	108	563	20,921	276	15,741	19,622	8,399

Quarantine

The Federal forces again scouted the towns of Cheshire and Wallingford, and as no gipsy moth infestations were found, these towns have been released from the Federal quarantine.

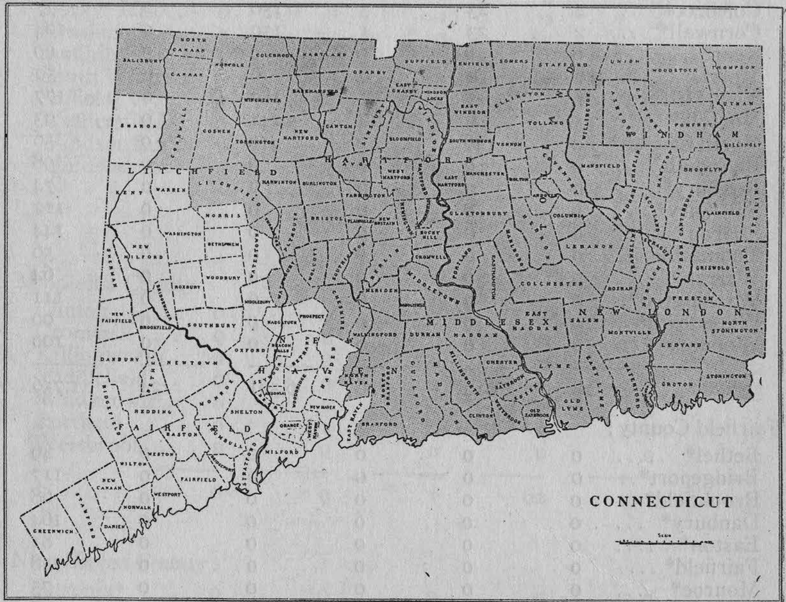


Fig. 41.—Map of Connecticut. The shaded portion represents the area quarantined on account of the gipsy moth. Late in the season the towns of Cheshire and Wallingford were released from quarantine, but are not so designated on this map.

Parasites

Each year for several years, parasites reared at the Federal Parasite Laboratory, Melrose Highlands, Mass., have been liberated in Connecticut. The names of the species and the names of the towns where liberated, together with the number of individuals liberated in each town, have been published in preceding reports. In 1925, only one species, an egg parasite, *Anastatus bifasciatus* Fonsc., was liberated in Connecticut, and colonies were planted in 40 towns in six counties by Mr. McEvoy. The following list gives the names of the towns where these parasites were liberated in 1925, and the number liberated in each town:

Gipsy Moth Parasites Liberated in Connecticut
Year Ending June 30, 1925

County	Town	Anastatus bifasciatus	
New London	Bozrah	3,000	
	Colchester	13,000	
	East Lyme	10,000	
	Franklin	11,000	
	Groton	14,000	
	Lisbon	5,000	
	Montville	6,000	
	Old Lyme	5,000	
	Preston	58,000	
	Salem	1,000	
	Sprague	2,000	
	Waterford	2,000	130,000
Hartford	Berlin	15,000	
	Bloomfield	3,000	
	East Granby	5,000	
	East Hartford	8,000	
	East Windsor	5,000	
	Enfield	1,000	
	Farmington	3,000	
	Glastonbury	8,000	
	Granby	17,000	
	Hartford	17,000	
	Hartland	7,000	
	Manchester	6,000	
	New Britain	7,000	
	Newington	7,000	
	Simsbury	8,000	
	South Windsor	1,000	
	Suffield	8,000	
	West Hartford	3,000	
	Wethersfield	1,000	
	Windsor	4,000	134,000
Tolland	Andover	3,000	
	Bolton	6,000	
	Hebron	3,000	
	Vernon	2,000	14,000
Litchfield	Barkhamsted	7,000	
	Colebrook	6,000	13,000
New Haven	Meriden	2,000	2,000
Middlesex	Middletown	8,000	8,000
			301,000

Gipsy Moth Suppression Account

FINANCIAL STATEMENT

Receipts

Appropriation for biennial period ending June 30, 1925	$100,000.00
Expended, year ending June 30, 1924	41,798.01
Balance	$58,201.99

Classified Expenditures for the Year Ending June 30, 1925

Salaries and Wages		$42,934.99	
Printing and Illustrations		73.88	
Postage		.65	
Stationery		53.28	
Telegraph and Telephone		34.87	
Insurance		170.90	
Spraying Supplies		1,300.00	
Machinery, Tools and Supplies		1,467.81	
Express, Freight and Cartage		6.74	
Rental and Storage		818.68	
Automobiles: New	$3,715.00		
Insurance	482.49		
Repairs	1,636.87		
Supplies and Equipment	1,619.96		
Gasoline	2,139.56		
Oil	712.51		
		10,306.39	
Traveling Expenses		467.18	
Inspection of Imported Nursery Stock		169.39	
Heat and Light		173.64	
Miscellaneous		.85	
			$57,979.25
Balance			222.74
			$58,201.99

FURTHER EXPERIMENTS IN DUSTING AND SPRAYING APPLE ORCHARDS

Season of 1925

By M. P. Zappe and E. M. Stoddard

The experimental work with dusts and liquid sprays begun in 1920 was continued in 1925, the chief object being to make further tests of combined dust and spray treatments. Consequently the plots receiving only dust and others receiving only spray were continued for purposes of comparison, and in addition several combinations of spray and dust were tested.

The results of former tests made at this Station have been published in the Station bulletins and reports as follows: Report for 1920, page 168, results of 1920; Bulletin 235, results of 1921; Bulletin 245, results of 1922; Report for 1923, page 267, results for 1923; Report for 1924, page 286, results of 1924.

Orchard Under Experiment

The orchard of Mr. Frank N. Platt, Milford, which has been employed in preceding tests, was also used in 1925. It contains about 285 trees, 21 years old. The varieties selected for the test in 1925 were Baldwin, Greening and McIntosh.

Acknowledgments

The writers are indebted to Mr. Frank N. Platt for the use of his orchard, power sprayer, and assistance in conducting the tests, and to Messrs. B. H. Walden, Philip Garman and J. L. Rogers, who assisted in scoring the fruit at harvest time.

Method of Recording Data

Trees which blossomed freely were selected as count trees. The ripe fruit was harvested and left in baskets under the tree from which it was picked 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 136,486 individual apples, equivalent to about 341 barrels.

In scoring fruit, we use a sorting table at which four men can work conveniently. Each apple is examined and the injury recorded on a score board; if the apple is perfect this fact is recorded. The score board consists of a series of tallying registers which are mounted on a board for convenience, as shown on Plate V, b. In front of each register is the name of the injury to be recorded on that particular register. The men doing the scoring of the fruit call off the injury to another man who does nothing but record the data as it is given, or the board may be placed on the sorting table and each man who scores can record his own data. On check trees where injuries are numerous and of various kinds, they are recorded singly for each fruit. Where injuries are mainly of one or two kinds, they are often recorded in lots of five. In this case a scorer holds the type of injury, or good apples as the case may be, in one hand until he has five, and then records it by pressing the lever of the register once, it being understood that each figure on that register represents five apples or five injuries.

Often several kinds of injury are found on one apple; in this case each type of injury is recorded and the register marked "Duplicate" must be punched once for each injury except the first one. When the results are tabulated, the number on the

"Duplicate" register subtracted from the total number of injuries will give the total number of apples scored. This figure must be known when the percentages are worked out.

After all the fruit from a certain tree has been scored, the figures on the tallying registers are recorded on score sheets which are carried in a shallow drawer under the score board, and are fastened to the top of the board by thumb tacks when in use, (see Plate V, b).

The number of registers needed on the score board depend upon the kind of fruit to be scored. When scoring apples, from eight to ten registers are needed, and for peaches, five or six are sufficient. Oftentimes some of the registers may be used to indicate the degree of injury: whether light, medium or heavy. In scoring apples for curculio injury, the number of scars can be easily recorded by the use of these registers.

Materials and Apparatus Used

The 90-10 sulphur dust which former tests have shown to be the best adapted for Connecticut conditions was the only dust used in 1925. This contains 90 parts of sulphur and 10 parts of lead arsenate, by weight.

Materials used in the liquid spray were as follows:

Dry lime-sulphur	6 pounds
Lead Arsenate	3 pounds
Casein spreader*	1 pound
Water	100 gallons

The spray outfit was the same as used in the preceding experiments, a 200 gallon Friend power sprayer carrying two lines of hose with rods and nozzles. The duster was a 1923 model Niagara power outfit, mounted on an automobile truck.

Arrangement of Plots in the Platt Orchard

This orchard was divided into six plots of two rows each, with the varieties running across the rows, so that all varieties were represented in each plot. Rows A and B were sprayed throughout the season; rows C and D were dusted with 90-10 dust the entire season; rows E and F were sprayed at the prepink, pink and calyx treatments, and were dusted three times afterwards; rows F and H were sprayed at prepink and third treatment after calyx, and dusted at pink, calyx, first and second treatments afterwards; rows I and J were dusted at the prepink, calyx and second treatment after calyx, and sprayed at the pink and first and third treatments after calyx; row M was a check row and received no treatment.

* Used only on a portion of one plot.

Application	Date	Rows A & B	Rows C & D	Rows E & F	Rows G & H	Rows I & J	Row M	Varieties Treated
No. 1 Prepink	Apr. 27	Spray	Dust	Spray	Spray	Dust	Check	McIntosh only
No. 2 Pink	May 1	Spray	Dust	Spray	Dust	Spray	Check	All varieties
No. 3 Calyx	May 15	Spray	Dust	Spray	Dust	Dust	Check	All varieties
No. 4, 1st after calyx	June 3	Spray	Dust	Dust	Dust	Spray	Check	All varieties
No. 5, 2d after calyx	July 1	Spray	Dust	Dust	Dust	Dust	Check	All varieties
No. 6, 3d after calyx	July 27	Spray	Dust	Dust	Spray	Spray	Check	All varieties

The sprayed plot was divided into two sections, one with and the other without casein spreader.

The numbers designating the applications may be explained as follows; 1, prepink; 2, pink; 3, calyx; 4, first treatment after calyx; 5, second treatment after calyx; 6, third treatment after calyx.

Results of Treatment on McIntosh

	Spray No Casein	Spray Casein	Dust	Spray 1, 2, 3 Dust 4, 5, 6	Spray 1 and 6 Dust 2, 3, 4, 5	Spray 2, 4, 6 Dust 1, 3, 5	Check
Good	86.5	90.5	88.8	89.5	80.9	79.	.86
Scab	6.4	2.7	2.08	1.2	6.35	7.7	51.7
Aphis	1.76	3.5	3.21	3.20	4.38	5.56	4.79
Red bug	.86	.8	.34	.81	.63	.35	2.25
Codling moth	.01	.04	.27	.16	.15	.01	4.29
Curculio	3.42	2.1	4.57	3.92	5.18	6.12	29.6
Other chewing insects	1.45	.5	1.37	1.33	2.52	1.2	6.48

Discussion of Results

There are no striking results from any one treatment shown in this table, there being only small differences in the percentages of good fruit from the various treatments. The difference between the highest and lowest percentage of good fruit is only about 11 per cent. In the sprayed plot, there was a very slight advantage in the section which had casein spreader in the mixture. The percentage of scab in the treated plots was not high in any case, but in the check plot over one-half of the fruit showed traces of the disease. The plot receiving only dust treatments had less scab than the dust plots of former years. In the combined spray and dust plots, the one having the early sprays and dust later in the season gave a somewhat higher percentage of good fruit, and a little lower percentage of scabby fruit, than the others.

Results of Treatment on Baldwin

	Spray No Casein	Dust	Spray 1, 2 Dust 3, 4, 5	Spray 5 Dust 1, 2, 3, 4	Spray 1, 3, 5 Dust 2, 4	Check
Good	91.27	83.6	87.97	85.25	86.9	1.79
Aphis	.94	1.13	3.93	1.75	3.89	.78
Red bug	1.76	.90	1.44	2.35	.99	2.66
Codling moth	.52	1.67	.74	.36	.23	2.01
Curculio	5.90	9.50	4.27	8.63	5.39	39.3
Other chewing insects	1.66	3.85	2.53	2.13	2.8	19.9
Sooty blotch	0	0	0	0	0	36.2
Fruit speck	0	0	0	0	0	68.6

Discussion of Results

This variety bore no fruit in the casein spray plot; therefore no figures can be shown. In general the sprayed plot gave a little the highest percentage of good fruit, though the differences are slight. The dusted plot yielded a somewhat lower percentage of perfect fruit and slightly higher percentage of codling moth, curculio and other chewing insect injury, but not enough higher to make any great difference. The combined spray and dust plots were nearly as good as the sprayed plot; in fact there were no very great differences between any of the plots. There was no scab and hardly a trace of sooty blotch and fruit speck on the fruit from any of the treated plots.

Results of Treatments on Greening

	Spray No Casein	Spray Casein	Dust	Spray 1, 2 Dust 3, 4, 5	Spray 5 Dust 1, 2, 3, 4	Spray 1, 3, 5 Dust 2, 4, 6	Check
Good	86.15	92.05	91.1	92.7	91.05	89.5	1.2
Aphis	1.91	2.86	1.50	.68	1.74	2.06	1.29
Red bug	1.13	1.08	.68	.51	.47	.65	4.75
Codling moth	.41	.35	.23	.23	.50	.64	7.74
Curculio	7.89	3.06	4.21	3.91	4.48	5.65	78.0
Other chewing insects	1.99	.84	2.52	1.96	2.01	1.39	21.6
Scab	.96	.04	.05	.25	.21	.23	21.2
Sooty blotch	0	0	0	0	0	0	70.5
Fruit speck	0	0	0	0	0	0	25.0

Discussion of Results

The results on Greening were similar to those obtained on Baldwin, there being no particular plot which was very much better or worse than any of the others. The combination plot receiving early sprays and late dusts gave a slightly higher percentage of good fruit than any others. The spray plot with casein was a little better than that which had no casein in the mixture. The amount of scab on all plots was negligible except in the check, where it ran up to 21 per cent. The check plot also showed 70 per cent. of sooty blotch and 25 per cent. of fruit speck, while the treated plots had none.

Summary and Conclusions

In an attempt to find some way to determine the relative value of different spray treatments, we have devised a method of scoring which seems to give accurately and briefly the desired result. This method consists of listing the treatments and injuries as shown in the table below and checking for each treatment the troubles it controlled the best in comparison with other treatments in the same experiment, and checking for highest percentages of good apples. For example, in the accompanying table, we find from our data that treatment No. 1 best controlled codling moth on McIntosh, and we indicate this under No. 1, opposite codling moth, by a letter M. If two treatments are equally good, each one is checked. The sum of the scores under each treatment give the relative value of each.

	1 Spray No Spreader	2 Spray with Spreader	3 Dust	4 Spray 1, 2, 3 Dust 4, 5, 6	5 Spray 1, 6 Dust 2, 3, 4, 5	6 Spray 2, 4, 6 Dust 1, 3, 5
Good	B	M		G		
Aphis	BM			G		
Red bug			BM		G	
Codling moth	M		G	G		MB
Curculio		GM		B		
Other chewing insects	B	GM				
Scab	B	GB	B	MB	B	B
Sooty Blotch	BGM	BGM	BGM	BGM	BGM	BGM
Fruit Speck	BGM	BGM	BGM	BGM	BGM	BGM
Total score	12	13	10	12	8	9

B = Baldwin G = Greening M = McIntosh

From this table we find that spray with spreader was the most efficient and spray without spreader and combination No. 4 tied for second place, followed by dust and combinations No. 6 and No. 5, in the order named.

Our results are well summarized in the above table as regards effectiveness of treatments, and a few other features not shown in the table will be mentioned briefly in conclusion. Scab was less prevalent than usual in 1925, due to weather conditions unfavorable for infection in the spring, all control measures gave good results and such infection as did occur was light to medium even on untreated trees. Rains and high humidity in early May undoubtedly would have caused a wider difference in favor of spraying. The same is also true of sooty blotch and fruit speck, as a subnormal rainfall in July and August made conditions unfavorable for infection, especially of fruit speck. No nicotine solution was used in the summer applications, but evidently there was some control value in all the treatments especially spraying at the prepink, pink and calyx.

As our work was conducted to collect data on combinations of spray and dust, we would call attention to the combination with the first three applications of spray and the last three of dust which gave results comparable with spray in all six applications. If this gives effective control in a normal scab year and coupled with entire freedom from the chance to burn the foliage in midsummer, this combination ought to prove satisfactory.

EFFICIENCY OF DELAYED DORMANT APPLICATIONS FOR THE CONTROL OF APPLE APHIDS

By M. P. Zappe and E. M. Stoddard

It is a fact well known among fruit growers that at the time that the delayed dormant sprays are applied, most of the apple aphids have hatched.

It should be understood that the following three species of aphids infest the apple, and their eggs hatch in the order given: (1) spring grain aphid, *Toxoptera graminum* Rondani; (2) green apple aphid, *Aphis pomi* DeGeer; (3) rosy apple aphid, *Anuraphis roseus* Baker. All species are sometimes present on the buds, but the green apple aphid is the commonest species and the spring grain aphid, which is not injurious to the apple, was not abundant in Connecticut apple orchards in 1925. As the rosy aphid, the most injurious species, does not hatch until rather late, usually when the tips of the leaves are perhaps half an inch long, it is important that the treatment be delayed until late enough to kill the young rosy aphids after the eggs have hatched. These aphids may be found clustered on the tops of the swelling buds and occasionally some may be seen crawling along the twigs from one bud to another. At this time they are unprotected by any foliage and an application of the proper spray, thoroughly applied, will give more satisfactory control than later sprays, especially after the aphids have begun to curl the leaves around themselves.

In order to compare some of the ordinary dormant sprays for aphid control, we sprayed the orchard of Mr. Frank N. Platt at Milford. Four varieties of apples were used in the tests: McIntosh, Baldwin, Greening and Gravenstein. The orchard was divided into four plots which were treated as follows:

Plot I	Dry lime-sulphur, 12 lbs. to 100 gals. water
Plot II	Dry lime-sulphur, 12 lbs. to 100 gals. water, and 1 pint nicotine
Plot III	Sunoco spray oil, 1 part to 20 parts water
Plot IV	Check (no treatment)

The spray applications were made on April 14 and 15, using a Friend 200-gallon power sprayer. Two lines of hose with rods and two nozzles at each rod were used. At this time the buds were just beginning to show the green tips of the young unfolding leaves, and aphids that had hatched were clustered on the tops of the buds.

A little later in the season, on May 8, after the aphids had begun to reproduce, several trees in each plot were selected at random and 100 twigs per tree were scored for aphids. The terminal leaves on the selected twigs were examined and were classified as having no aphids, light, medium or heavy infestation. The following tables show the number of terminal twigs examined and the results:

Dry Lime-sulphur and Nicotine

Variety	Light	Medium	Heavy	None	Total Infestation Per Cent
Greening	44	10	6	40	60
Baldwin	40	10	0	50	50
Gravenstein	44	12	8	36	64
McIntosh	44	14	10	32	68
Average for all varieties	43	11.5	6	39.5	60.5

Dry Lime-sulphur, No Nicotine

Variety*	Light	Medium	Heavy	None	Total Infestation Per Cent
Greening	60	14	6	20	80
Baldwin	62	16	8	14	86
McIntosh	72	8	6	14	86
Average for all varieties	64.6	12.6	6.6	15.3	84

* No Gravenstein trees in this plot.

Sunoco Spray Oil

Variety	Light	Medium	Heavy	None	Total Infestation Per Cent
Greening	26	4	0	70	30
Baldwin	48	0	2	50	50
Gravenstein	66	12	4	18	82
McIntosh	42	4	2	52	48
Average for all varieties	45.5	5	2	47.5	52.5

Check

Variety	Light	Medium	Heavy	None	Total Infestation Per Cent
Greening	62	28	4	6	94
Baldwin	60	20	10	10	90
Gravenstein	40	36	16	8	92
McIntosh	56	12	8	24	70
Average for all varieties	54.5	24	9.5	12	88

Summary

It may be seen from the foregoing tables that Sunoco spray oil at the strength of one part oil to 20 parts water was the most efficient of the sprays used for the control of aphids at the delayed dormant period. Lime-sulphur and nicotine was second best. Lime-sulphur without the nicotine was only a little better than the check trees.

The Gravenstein variety seems to be very susceptible to aphid attacks, while the McIntosh seems to be more immune. This is not only true of aphid infestations of leaves, but in former experiments has often been found to hold true of aphid injured fruit, the Gravenstein apples showing great distortion by this insect, while the McIntosh fruit shows very little.

It therefore seems very important that greater efforts be made to control aphids on Gravenstein than on McIntosh.

If the fruit grower contemplates using nicotine in his sprays, we feel that it is best to use it in the delayed dormant, prepink and pink sprays, or even in the calyx spray, if aphids are plentiful enough at this time to warrant the expense. In later sprays than these, it is of doubtful value; in fact it is almost useless to try to control aphids after the trees are in full leaf.

THE ORIENTAL PEACH MOTH IN 1925

Philip Garman

The Oriental peach moth continued to do damage in Connecticut in 1925 and increased considerably in severity in the Wallingford section. In the course of experimental work, wormy fruit was found amounting to 46 per cent. in one orchard. Though not nearly as severe in other orchards, yet the damage was enough to be noticed and commented upon. In some orchards no increase was noticed over last year.

Spraying operations were conducted in two different orchards and life history work was carried on at the Station, supplemented by many field observations. The first adult emerged from hibernation May 5, and adults continued to emerge until June 11. Eggs of the first generation were deposited beginning May 15, continuing until June 17. The first brood (from egg to adult) extended in 1925 from May 15 until July 19. Second brood eggs were laid, beginning June 27 continuing until July 22, the brood extending from June 27 until August 20. The third brood eggs were laid, beginning July 28 and continuing until August 27. Many of the larvae of this generation hibernated but some emerged, producing a fourth or partial fourth generation. According to our records this partial fourth generation began September 6, the first egg being obtained on that day. Whether many of this brood actually reach maturity and hibernate has not been determined for Connecticut. The last adult emerged September 20, and adults were trapped in the orchards September 21. All data obtained is illustrated graphically in Figure 42, the stippled areas indicating the probable extent of the stage in cases where insectary data is apparently incomplete. About 1,500 eggs in all were obtained from moths in captivity and over 500 individual cages were handled in obtaining the records.

Several parasites have been reared from the insect, as follows:

Eubadizon sp. A parasite overwintering in the cocoon of the host and emerging in spring about the time the moths appear. Adults were obtained May 7 and 8, and August 14. The host material was collected in Wallingford and Greenwich, Connecticut.

Macrocentrus ancylivora Rohwer. A fairly abundant parasite in August emerging July 28 and August 28 from our specimens. This parasite is apparently identical with important parasites found in New Jersey, Maryland and Virginia. It was obtained from host material collected in Wallingford.

Glypta rufiscutellaris (Walsh). Two specimens obtained in Wallingford emerged from the host July 28, 1925.

The control experiments were conducted in the orchard of the Barnes Nursery and Orchard Company at Wallingford through the courtesy of the Messrs. Barnes; and at the Conyers farm orchard at Greenwich through the courtesy of Mr. G. A. Drew. Treatments in both cases were supplementary to the regular treatments given, which in both cases comprised treatments for control of scab and curculio, and in the Conyers farm orchard, a fall

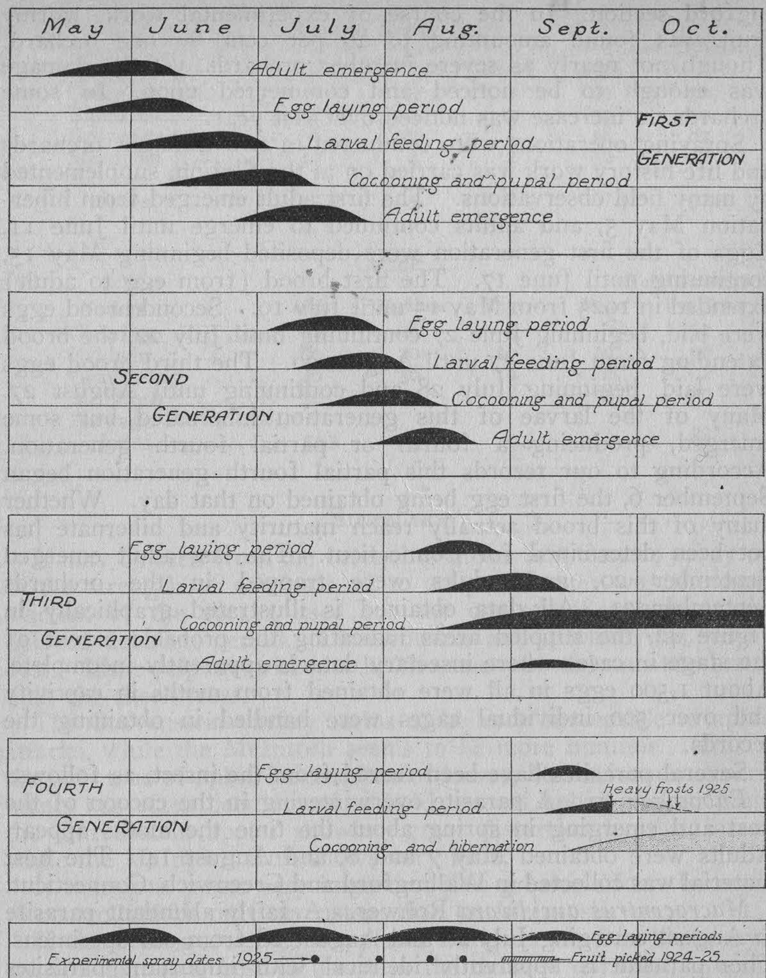


FIG. 42.—Oriental Peach Moth. Preliminary life history chart based on data obtained in 1925. This chart is not intended to give complete results since there are many points which need further study. However, it shows the trend of development in 1925 as correlated with out spray program. The stippled areas are uncertain periods which are indicated by field observation. There is also a possibility that some of the second generation larvae pass the winter, but of this we have not yet secured any evidence for Connecticut. The adult emergence as shown under the head of "first generation" is in reality a part of the third and fourth generations of the previous season. It is shown in this position on the chart for the sake of convenience.

application of lime-sulphur. It will be seen that none of the treatments, or those of last year as shown in Table I, reduced the amount of infested fruit below 10 per cent., and we have been forced to conclude that other measures must be found and that all known means of control must be employed in a severe infestation in order to bring through a larger amount of sound fruit. Consequently tests were made of a number of different insecticides with a view to determining what substances if any would kill the larva before entering or would provide a suitable coating upon which the larva would feed without digging into the peach or twig. Results of these tests are not yet complete. Small bait pans were also employed in the field to determine the possibility of capturing moths by this means, thus reducing the total population of the insect in the orchard. In six small tin buckets hung in a bearing orchard, 283 moths were captured between August 11 and September 1. Honey, water and yeast was first employed, but was later replaced by molasses and water according to the recommendations of Peterson.[1] Adults fly into the mixture, their wings become wet and they are unable to escape. This means of control shows some promise and several investigators are busy working out details of application. It is hoped that it will provide the necessary means of increasing sound fruit and will prove sufficiently economical. The whole problem of control is very difficult owing to the habits of the insect, which seems to have developed almost a perfect defense, and about the best that can be done at the present time is the recommendation of nicotine sprays; cultivation before May 5, so as to bury the larvae to a depth of three inches; treatment with paradichlorobenzene to destroy the larvae hibernating on the trunk near the ground and destruction or removal of drop fruits. Our experiments to date indicate that four sprays containing nicotine sulphate as applied in 1925 gave as good control as five sprays applied in 1924, though at somewhat different intervals. In 1925 these sprays were applied July 13, August 10 and August 20, the fruit being picked the first of September. In 1924, the fruit was picked nearly two weeks later and the final treatments were given August 15. Life history data obtained in Connecticut thus far show that the insect was very abundant in August during 1924 and 1925, and this probably accounts for the favorable results obtained from the treatments in 1925. Considerable foliage injury was noted in the blocks sprayed with nicotine and fish oil soap (potash) which was attributed to an increase of soap in one application (four pounds to 50 gallons of water), since subsequent sprays containing two pounds of soap per 50 gallons did no damage. Sulphur arsenate dusts (acid lead arsenate 10 per cent., sulphur 90 per cent.) caused some of the leaves to turn yellow and drop, although applied

[1] Peterson, A. Journal of Economic Entomology, Vol. 18. 181-190, 1925.

carefully when most of the foliage was dry. This dust in itself is not effective enough and too dangerous to be considered for treatments to control the Oriental peach moth. Nicotine dust caused no noticeable damage, but it is evident that is cannot be used as late as the nicotine soap spray since it has a tendency to cling in the fur of the peach if applied less than three weeks before picking time. This would undoubtedly affect the sale of the fruit. On the other hand, nicotine soap sprays may be applied as late as needed without leaving any undesirable residue on the peaches at harvest time. The nicotine sulphate can probably be added to a fungicide such as self-boiled lime-sulphur or dry mix sulphur lime without decreasing its effectiveness. Very late applications should contain only nicotine sulphate or nicotine sulphate and soap.

TREATMENTS FOR ORIENTAL PEACH MOTH CONTROL, 1924-1925

TABLE I.

Treatment	Farm and Date	No. of Peaches Considered	Total per cent. injured
1. Self-boiled lime-sulphur, June 9 and July 14	Conyers Farm 1924	2,186	23.
2. Nicotine sulphate, self-boiled lime-sulphur, casein lime; July 9 and July 14; nicotine sulphate plus soap, June 30, July 28 and August 15	Conyers Farm 1924	2,167	14.
3. Sulphur arsenate dust followed by nicotine dust, June 9 and July 14; nicotine dust, June 30, July 15 and August 2	Conyers Farm 1924	1,692	11.
4. Nicotine dust, July 13, July 29 and August 10	Conyers Farm 1925	1,964	23.
5. 90-10 sulphur arsenate dust, July 13 and August 10	Conyers Farm 1925	1,932	15.5
6. Nicotine-soap spray, July 13, July 29, August 10 and August 20	Conyers Farm 1925	1,883	10.5
7. Check	Conyers Farm 1925	1,924	21.5
8. 90-10 dust, July 15 and August 14	Barnes Orchard 1925	824	38.
9. Nicotine dust, July 15, July 30 and August 14	Barnes Orchard 1925	755	28.
10. Check	Barnes Orchard 1925	439	46.

CONTROL OF ORIENTAL PEACH MOTH

TABLE II. BARNES ORCHARD—1925

Treatment Received	Total No. Peaches	No. Good	% Good	New Injury: Side	New Injury: Stem	New Injury: % Side	New Injury: % Stem	% New Injury	Old Injury: Side	Old Injury: Stem	Old Injury: % Side	Old Injury: % Stem	% Old Injury	Total Injuries	Total % Injured
90-10 Dust, July 15, August 14	824	511	62.01	22	213	2.66	25.84	28.51	40	46	4.85	5.58	10.43	313	37.98
Nicotine dust, July 15, July 30, August 14	755	544	72.05	15	158	1.98	20.92	22.91	20	18	2.64	2.39	5.03	211	27.94
Check	439	234	53.30	19	129	4.32	29.38	33.71	23	34	5.23	7.74	12.98	205	46.69

TABLE III. CONYERS FARM ORCHARD—1925

Treatment Received	Block No.	Total No. Peaches	No. Good	% Good	New Injury: Side	New Injury: Stem	New Injury: % Side	New Injury: % Stem	% New Injury	Old Injury: Side	Old Injury: Stem	Old Injury: % Side	Old Injury: % Stem	% Old Injury	Total Injuries	Total % Injured
Nicotine dust (2.7%), July 13, July 29, August 10	1	1,964	1,514	77.08	1,191	220	6.05	11.206	17.26	66	31	3.36	1.57	4.93	450	22.91
90-10 Sulphur-arsenate dust, July 13, August 10	2	1,932	1,631	84.42	41	215	2.12	11.12	13.25	37	9	1.91	.46	2.38	301	15.57
Check	3	1,924	1,509	78.43	79	266	4.10	13.82	17.93	39	21	2.02	1.09	3.11	415	21.56
Nicotine spray (1 qt.-200 gals.) plus fish oil soap, July 13, July 29, August 10 and August 20	4	1,883	1,685	89.48	37	117	1.96	6.21	8.11	32	7	1.69	.37	2.07	198	10.51

Explanation of Tables II and III

All fruit from these blocks was taken from trees in the center of the block. At Conyers Farm, two baskets were taken from each of 10 selected trees, of approximately equal bearing capacity—the peaches being picked from all parts of the tree and subsequently cut open to determine whether infested or not. There were approximately 60 trees in each block, the trees being of considerable size, as shown in Plate VI. Prevailing winds blew across the blocks from end to end and not from one block to another. The nicotine dust block, however, was alongside of an apple orchard which may in part account for the poor showing made by this method of treatment. Owing to the possibility of allowing dusts to remain on the fruit at picking, it was found necessary to reduce the number of applications as compared with sprays containing nicotine. Only three applications of dust were made as against four sprays. The variety was Belle of Georgia.

The work at Barnes orchard, Table II, was carried out in a similar manner, but the amount of fruit scored was much smaller and the results obtained are not considered to be of as much value as those obtained at Conyers Farm. Prevailing winds in this orchard blew across the three different blocks from the sulphur-arsenate dust plot to the nicotine dust to the check which was at the far side of the orchard. The variety was Elberta.

In both tables, the heading "new injury" is intended to show that made by late entering larvae probably the third brood, and in most cases the larva itself was found. The heading "old injury" refers to old scars usually accompanied by considerable gum indicating that it was caused by the feeding of the first or second brood larvae. In this case the larva was never found within the peach.

THE CURCULIO PROBLEM IN CONNECTICUT

Philip Garman

The plum curculio in Connecticut offers a serious hindrance to the production of perfect apples in many orchards. It is not so much a problem in peach orchards, although it occurs there abundantly, but apparently there is no second brood of larvae and peaches rarely become extensively infested. Certain varieties of plums are naturally attacked, this fruit being a favorite food, but since plums are not grown extensively in Connecticut, the problem of control is not pressing. It is also known to feed upon cherries, apricots and nectarines. On the other hand, a large proportion (often 80 or 90 per cent.) of the apples in a commercial orchard may be deformed or destroyed and a considerable percentage of marred fruit may and often does remain after

thorough spraying. Such conditions to be remedied need the most careful study of the curculio's habits as well as thorough and painstaking application of control methods.

The curculio is one of the oldest pests of apples and other fruits in Connecticut. Mention of it is found in almost all literature dealing with fruit culture dating back as far as colonial times—and strange to say, some of the oldest methods of fighting the insect are often practiced to-day. Arsenical sprays have been mainly developed during the past 60 years and there will no doubt continue to be improvements along these lines, since we are only within recent years becoming acquainted with the feeding habits of the insects in relation to the toxic substances placed on the trees, comparative kill obtained with different products, freedom from spray burn, and many other points essential to the effective and economical use of available poisons. The arsenate of leads which have replaced all other stomach poisons for killing orchard insects, have been developed to a high state of perfection as regards mechanical condition and adhesion; and much more cannot apparently be expected in the poisons themselves. There still remains, however, the possibility by additions of making them attractive for the particular insect, increasing their stay on the trees long enough to cover the period of activity of the pest, or of increasing the thickness of the coating or palatability in some way in order to obtain more satisfactory results.

All poison work as well as other controls, however, must be definitely founded on biological data obtained in the vicinity. It is, for instance, important to know that beetles begin to emerge from hibernation in Connecticut about the first of May or when most apple trees are in the pink bud stage; that they become most abundant on the trees about the 15th or 20th of May (about the time when the blossoms have fallen) and that their period of greatest activity apparently lasts till the middle or last of June, the egg-laying period extending to the second week of July. It is also important to know that larvae develop abundantly in early apple drops and that they begin to leave this fruit the latter part of June, the majority entering the soil by the middle of July and few or none remaining by the first of August; furthermore that beetles again begin to emerge from the soil by the first of August or a little before, but that their maximum emergence appears to lie between the 15th of August and first of September, the beetles hibernating shortly after with a relatively small amount of fall feeding.

Of the control measures commonly practiced, the following may be mentioned: (1) cultural practices, or care of drop fruits—one of the oldest means of control and a very important adjunct to spraying practices especially where curculios are abundant—and one very commonly neglected. To be successful, cultivation should be completed by the first of August, or if drop fruits only are handled, the operation should probably be complete by the first of July. (2) Spring and early summer applications of arsenicals. To be successful these must be considered from the standpoint of the growing tree and fruit (the tree must be kept thoroughly covered with poison at this time), and from the standpoint of the relative abundance of beetles on the trees. A schedule comprising pink, calyx, 7-day after calyx, and two weeks after calyx, all with arsenate of lead, meets these requirements and will apparently be successful in producing a satisfactory majority (90 per cent.) of clean fruit where the infestation is light or medium. If, however, the infestation is very heavy, even the complete schedule may fail to give the desired freedom and it becomes necessary to apply additional measures to secure relief. Moreover, in some orchards it may be difficult to get over the orchard once a week at the critical time, in which case there are several possibilities. The owner may apply cultural practices as outlined or take care of drop fruit (which if collected should be buried to a depth of two feet so the beetles will not emerge); in small orchards it would be possible to jar the beetles from the trees, collecting and destroying them—a method seldom practiced to-day; or it is possible to spray or dust again in the fall after the beetles have emerged as recommended by Snapp; the latter method offers one serious objection in the case of apples, in that sprays at this time might remain on the fruit at picking time. In the case of peaches or plums, however, this difficulty is not apparent and many beetles can doubtless be killed with a late spray since they feed on the leaves after the fruit is off. (3) There is still another possibility, namely: the treatment of wild apple trees which usually produce annually large numbers of curculios, or the treatment of abandoned or uncared-for orchards which are a decided menace when near a commercial orchard. We have examined many such trees in the neighborhood of well-kept orchards and there can be little doubt that curculios develop there and fly into the commercial orchard, adding much to the troubles of the grower. Hibernating quarters such as fence rows should be cleaned up and stone walls removed if possible.

Two years' experimentation with sprays together with data accumulated by this Department in connection with other work indicate that continued applications year after year give increasing percentages of clean fruit. However during six years' experimental spraying[1] in one of our orchards at Mount Carmel, the desired freedom was secured only after removal of a neighboring peach orchard, (which normally received no arsenical sprays), use of programs planned especially to control curculio, and systematic collection of early drop fruits from the apples. Data on spraying operations are slowly accumulating under a five-year program and it may be that something will develop that will work effectively in the case of severe infestations without the need of supplementary operations. The difficulties, however, become apparent when we realize that the tree is growing most rapidly at the time of the greatest abundance of the pest, that the average sprays show some repellent action and even if most of the beetles in an orchard are killed, many may come in from outside sources—unless those danger points are considered and treatment provided.

[1] Experimental curculio spraying begun in 1924.

The following bibliography of Experiment Station and other publications dealing with the curculio problem is given as it shows the opinions of State and Federal workers on the subject. It is from these sources that many of the recommendations found in literature to-day are taken.

1905. Crandall, C. S. Illinois Agricultural Experiment Station, Bulletin No. 98. Extensive account of apple and plum curculios with detailed field experiments for control. Spraying operations considered unsuccessful—cultivation recommended.

1906. Crandall, C. S. *Ibid.*, Bulletin 106, pp. 219-231.

1921. Fernald, H. T. In Applied Entomology, pp. 137-139. *Control* (p. 138). "No one method nor even all the methods of control taken together will give entire freedom from this pest. A combination of the treatments however, will accomplish considerable in this line." Recommends removal of rubbish and hibernating quarters; (2) pruning trees to allow sunlight to enter; (3) allowing fowls and hogs to run under trees or through shallow cultivation from time larvae begin to leave fruit till six weeks later; (4) spraying with arsenate of lead "for apples—treatment commonly given for codling moth though similar later applications may also be necessary if the insects are abundant"; (5) jarring the trees and collecting the beetles when only a few trees are involved.

1906. Forbes, S. A. Illinois Agricultural Experiment Station, Bulletin 108. Used arsenicals in field tests against the curculio on apples with an average increase of 63 per cent. sound fruit over untreated trees.

1914. Headlee, T. J. Report of the Department of Entomology, New Jersey Agricultural Experiment Station for 1913, p. 654. States that where curculio is present foliage must be kept covered with arsenical from time the "creature begins to feed until it disappears." Overwintering beetles remain in plum orchards about six weeks, in apple orchards for about a month.

1918. Headlee, T. J. *Ibid.*, Report for 1917, pp. 437-438. "Attack seems to have come between the blossom-fall and the ten-days-after-blossom-fall spraying." "In orchards standing near woodlands or plantings interspersed with old stumps or carpeted with grass, the damage was particularly severe." Recommends clean culture during forepart of season followed by cover crop not producing a dense sod, removal of stumps and cleaning of fence rows. Recommends spraying to preserve the coating intact for the first month after blossoms fall.

1919. Headlee, T. J. *Ibid.*, Report for 1918, pp. 212-213. Recommends 7-day spray after calyx. Records two successful cases of control in orchards where curculios were abundant and where crop unsprayed was "ruined by the curculio." Recommends as a schedule for curculio control

(1) before buds swell; (2) as blossom buds first show color; (3) directly after petals fall; (4) seven days later; (5) 17 days after blossoms fall; (6) June 20 to 30 for all fall and winter varieties. Better results obtained with lime-sulphur and arsenate of lead than with arsenate of lead alone; both have repellent action.

1921. Headlee, T. J. *Ibid.*, Report for 1920, p. 449. Table showing comparison of dust and spray on apples unsatisfactory control of curculios indicated with dust. Seven to nine per cent. injured by curculio.

1923. Headlee, T. J. *Ibid.*, Report for 1922, p. 373. Table showing comparison of dust and spray on apples including curculio records. Dusts do not control curculio as well as sprays.

1924. Headlee, T. J. Ibid., Report for 1923, pp. 276-278, Tables 6, 7 and 8. Results of curculio spraying.

1925. Herrick, Glenn W. In Manual of Injurious Insects, pp. 156-157. "*Control measures.*—All fence rows, hedge rows, and stone walls should be removed from about an orchard. Sunlight on the fallen fruit is fatal to the larvae within, hence judicious pruning to let in the light is useful. Cultivation during late July and early August will destroy pupae in the soil. Thorough spraying with arsenate of lead two pounds to one hundred gallons of water just after the petals fall and again ten days later will be effective if the hibernating places have been destroyed."

1918. Pickett, B. S., Watkins, O. S., Ruth, W. A., and Gunderson, A. J. Illinois Agricultural Experiment Station, Bulletin 206. Contains much valuable information on orchard sprays for the curculio and their results are ably discussed in tables and text. Page 492, under General Summary: "Codling moth and curculio, as a rule, were well controlled by applications of arsenate of lead." Page 493, controls obtained "from 60 to 94 per cent. (in the most successful experiments in 1913) and the least effectively sprayed plats from 32 to 79 per cent. In 1914 the most effectively sprayed plats showed controls ranging from 81 to 97 per cent. and the least effectively sprayed plats from 45 to 87 per cent. In no case did spraying with arsenate of lead fail to exercise a decidedly beneficial effect."

1912. Quaintance, A. L. and Jenne, E. L. U. S. Department of Agriculture Bulletin No. 103. The most extensive single publication on the plum curculio and its control yet published. Contains summaries of all previous work data on life history and parasites and accurate studies of control measures. Page 200 under conclusions: "With a small amount of fruit and abundance of curculios the most thorough spraying will not serve to bring through a satisfactory amount of sound fruit"—"with a large crop of fruit and abundance of insects, results will likewise be disappointing." Recommends four sprays for apples using dilute fungicide and lead arsenate: (1) as cluster buds are out; (2) as petals fall; (3) three or four weeks after petals fall; (4) nine or ten weeks after petals fall. Secured controls amounting to from 19 to 77 per cent. increase in sound fruit from sprays tested. The best figures show 91.07 per cent. sound fruit as a maximum obtained by the method advocated.

1922. Quaintance, A. L. and Siegler, E. H. U. S. Department of Agriculture, Farmers' Bulletin 1270, pp. 7-10. "Most practical means of control are spraying with arsenate of lead, and cleaning up of trash from the orchards and vicinity as well as through cultivation during the summer—the prompt collection and destruction of infested fallen fruit will also aid in reducing this pest." The first spray application to poison the beetles should be applied in pink cluster bud stage, and the second as soon as the petals have dropped, using arsenate of lead at the rate of 1 pound of powder or 2 pounds of paste to 50 gallons of water or fungicide. Supplemental treatments are desirable in orchards where the curculio is more than ordinarily destructive.

1914. Singerland, M. V. and Crosby, C. R. Manual of Fruit Insects, pp. 243-251. Recommends for apples: two sprays as for codling moth just after petals fall and three weeks later—"but where the infestation is severe additional applications will be found necessary." Thoroughness of spraying is essential. Reliance should not be placed on any one method of attack. Clean cultivation, proper pruning, thorough cultivation at proper time are necessary.

1922. Snapp, O. I., Turner, William F., Roberts, J. W. U. S. Department of Agriculture Circular 216. Decribes methods used for controlling curculio in the Georgia fruit belt. Recommends destruction of early drops or disking to destroy pupae, and proper orchard sanitation. Jarring the trees also mentioned.

1924. Snapp, O. I., and Alden, C. H. U. S. Department of Agriculture, Bulletin 1205. Dusting and spraying peach trees after harvest for control of the plum curculio. General summary, p. 17: "Post-harvest treatments are not advisable except in cases where the curculio infestation has been severe during the peach season." Two applications of 10 per cent. lead arsenate and 90 per cent. hydrated lime dust are recommended for these treatments.

TESTS OF ALCOHOL-FORMALIN FOR CONTROL OF AMERICAN FOUL BROOD IN BEES

Philip Garman

Several combs containing American foul brood were received from two different sources in 1925, and treated with Hutzelman's solution or various modifications thereof, with the following results:

1. Comb received May 28 and examined carefully; gross characters were positive for American foul brood; microscopical examination positive; cultures made on egg-yolk agar—apparently positive in manner of growth and morphology of the organism. Treated with homemade Hutzelman's solution containing one-half gallon formaldehyde (40 per cent.) and two gallons of alcohol (completely denatured formula number 5). The comb was placed in a small three frame hive. It was examined August 4 by Inspectors Yates and Coley and no disease was found. The combs continued clean throughout the summer and on September 24 a full sheet of brood had been formed. There was no evidence of the disease or injury from the treatment.

2. A comb received May 28; gross characters positive; microscopical picture and cultural features positive. Treated with formaldehyde (40 per cent.), one-half gallon, and water two gallons. A full sheet of brood was allowed to develop and the colony dequeened. No sign of the disease was seen and no scales could be found after brood was out. Examined August 4 by our inspectors; no disease found.

3. Comb from same source as Nos. 1 and 2; gross characters, microscopical picture, and cultural features positive. Treated with Hutzelman's solution, commercial product. Continued brood rearing throughout the summer, the comb being examined

August 4, and found free of disease; comb continued clean throughout the summer and examination September 24 showed no disease.

4. Comb received June 19, from another source—fairly rotten with American foul brood. Gross characters and microscopical picture positive. Cultures not made. Comb treated with commercial Hutzelman's solution without uncapping brood, but after extracting honey. Soaked 48 hours; examined September 24, and no diseased brood was found.

Combs treated in 1924 were kept under observation and no signs of American foul brood developed. Two combs treated with homemade Hutzelman's solution in 1924 the same as No. 1, above, were found to be freely used by the bees for brood rearing and storing honey. One other comb, however, treated with paraformaldehyde, the latter being left in the comb, remained throughout the season without brood and with very little honey. Although placed in a very strong colony, the bees seemed to ignore this comb and would have nothing to do with it. It apparently retained enough paraformaldehyde to be objectionable, although it had no deleterious effect upon the colony as a whole.

Several other combs were treated by similar methods but results so far have been similar to those already described and no description of them will be attempted.

THE PEAR PSYLLA IN CONNECTICUT

Psylla pyricola Forster

PHILIP GARMAN

By far the most important enemy of pears to-day in Connecticut is the pear psylla. It is reported to have been introduced into this State from Europe about 1832 and is now found throughout the northeastern United States. Much and serious damage may result from an infestation, the leaves becoming stunted and black or sooty, many dropping prematurely. The fruit may become discolored and remain undersize and the fruit buds may be affected, resulting in a decreased yield the following year. Pear psyllas are present in many Connecticut orchards and cause considerable damage every year.

Life History: The winter is passed in the adult stage, the insects hiding under the bark usually near the ground, but also in other places. They emerge during warm days in spring and lay their eggs on growing shoots. According to published records, the eggs hatch in 12 to 18 days and the nymphs mature in about a month. Eggs of the second brood hatch in about 12 days and there are reported to be three or four broods in New York State (Hartzell). The separate broods are completed in about a month and a half.

The Different Stages: The egg is a small yellow pyriform object about one-eightieth of an inch in length, and under proper magnification may be seen to possess a short stalk at the larger end and a small thread at the other. The nymph is very much flattened, with very large rounded wing pads, and is able to secrete quantities of honey-dew in the early stages. There are reported to be five immature nymphal stages, the first three of which secrete honey-dew in which grows a black sooty mold responsible for the disgusting appearance of trees that are heavily infested.

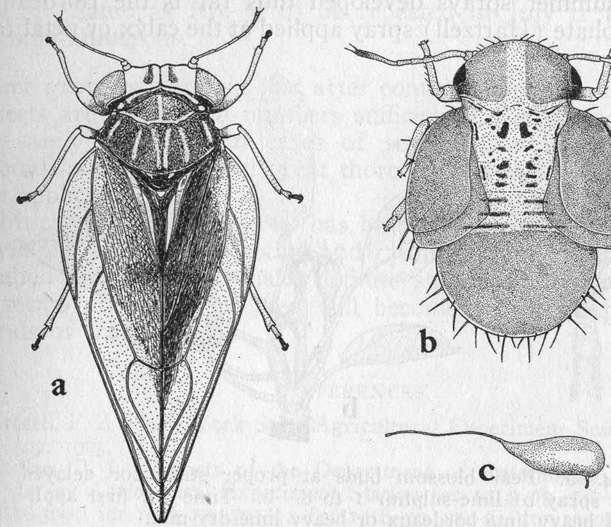


FIG. 43.—The Pear Psylla, *Psylla pyricola*. a. adult; b. nymph; c. egg. Enlarged about 25 times.

The adult is a small winged insect somewhat resembling a small fly or gnat when on the wing, but when magnified resembling a cicada in miniature. The egg, nymph and adult are shown in Figure 43, and egg on Plate XX, a.

Biology and Control Measures: In controlling the pest there are several points to be considered. First: the nymphs do not hibernate until late fall and they emerge very early in the spring, after a few days of warm weather. Headlee states that they may be found frequently in cool weather clinging to the smaller twigs "too stiff to move" and a spray with miscible oils or soaps and nicotine at this time should be very effective. The same condition exists in the spring after the insects have emerged from hibernation, which condition affords an opportunity to finish the spray, if not completed in the fall. The second point to be kept in mind is that the insects continue to lay eggs well up until the cluster buds of most varieties begin to separate and in some cases even longer—so that dormant sprays must be delayed as long as possible at this period in order to kill the greatest number. Thoroughness at this time is very essential. Even these sprays, however, (the dormant with miscible oil or soap and nicotine, and the delayed dormant egg spray of lime-sulphur at the cluster bud stage) may not kill a sufficient number to protect the orchard throughout the summer and other treatments must usually be considered if commercial control is secured. One of the most successful summer sprays developed thus far is the Bordeaux-nicotine-sulphate (Hartzell) spray applied at the calyx or petal fall

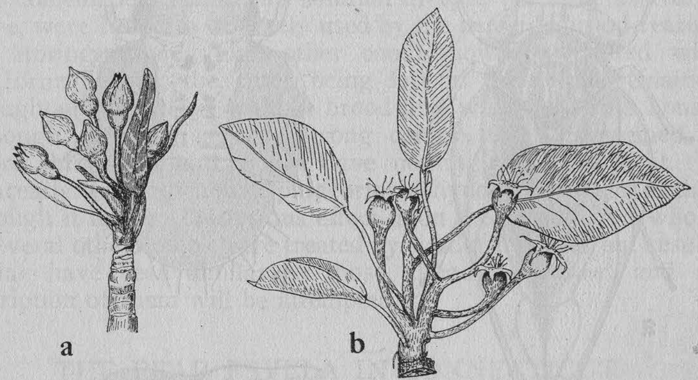


FIG. 44.—a. Pear blossom buds at proper stage for delayed dormant spray of lime-sulphur 1 to 8. b. Time for first application of heavy lime bordeaux or heavy lime-dry-mix.

period and often repeated in July. This spray has a decided effect in checking the development of the nymphs and has been used successfully in some Connecticut orchards. Others make use of a self-boiled lime-sulphur or dry mix formula with added nicotine, since pears usually need some form of fungicide to check scab or other diseases. It is very generally recognized, however, that commercial lime-sulphur is liable to burn the foliage severely if used as a summer spray. In general, considering work done in neighboring States, the following spray program for Connecticut is suggested as one likely to give the best results.

(1) In fall or spring when the temperature is above freezing and adult psylla are found on the twigs "too stiff to move,"—miscible oil 1 to 15, or nicotine sulphate 1 pint in 100 gallons with 4 pounds of soap added.

(2) When the blossom buds begin to separate in the cluster,—lime-sulphur (commercial 33° Be) 1 part in 8 parts of water. (See Figure 44, a.)

(3) At the calyx or petal fall period soon after the blossoms have fallen,—Bordeaux-nicotine-sulphate mixture composed of 2 pounds of copper sulphate, 40 pounds hydrated lime, and 1 pint of nicotine sulphate in 100 gallons of water; or dry mix consisting of superfine sulphur, 16 pounds, hydrated lime 8 pounds, and calcium caseinate 1 pound. The dry mix is first mixed with a small amount of water in the spray tank, 1 pint nicotine sulphate and 32 pounds hydrated lime are added, and the whole made up to 100 gallons. (See Figure 44, b.)

(4) Same as No. 3, to be repeated in July if the nymphs become numerous.

Some growers maintain that after control is once secured and the insects are reduced in numbers sufficiently, the winter spray can be safely omitted. In cases of severe infestations all sprays should be employed and great thoroughness exercised in making the applications.

Much experimental work has been done with control of adult psylla by means of nicotine and cyanide dusts. While not yet studied sufficiently to make definite statements regarding them, it seems probable that they will become useful weapons in the hands of the grower.

REFERENCES.

Hartzell, F. Z. New York State Agricultural Experiment Station, Bulletin 527, 1925.
Headlee, T. J. Reports of the Department of Entomology of the New Jersey Agricultural Experiment Station for 1914, pp. 346-70; for 1915, p. 309; for 1916, pp. 503-4; for 1918, pp. 210-2; for 1919, pp. 396-401; for 1920, 430-432; for 1922, p. 441; for 1923, pp. 282-284.
Herrick, Glenn W. In Injurious Insects, pp. 145-146.
Hodgkiss, H. E. New York State Agricultural Experiment Station, Bulletin 387, 1914.
Mundinger, F. G. New York State Agricultural Experiment Station, Bulletin 529, 1925.

OUTBREAK OF PEA APHID ON ALFALFA

B. H. WALDEN

One of the unusual insect problems in Connecticut during 1925 was the injury caused to alfalfa by aphids. On May 13, Mr. Raymond K. Clapp, Agent of the New Haven County Farm Bureau, called at the Department to obtain information regarding the control of aphids on alfalfa, stating that a field in Seymour belonging to Mr. Elmer R. Meade was badly infested and that many of the plants were turning yellow.

As this was the first time that our attention had been called to insect injury to alfalfa, a visit was made to the field on May 14. Fully half an acre near the center of a three-acre field was badly infested with large green aphids. Some of the plants, though still green, had the leaves curled and the growth was apparently checked; others had turned yellow and many were completely dried up; even the crown appeared to be dead. Many aphids were found throughout the remainder of the field, though the plants had not been seriously injured.

The identity of the species could not be determined in the field and material was collected and brought to the laboratory for study. It was suspected, however, that this was the pea aphid, which is known to live part of the season on various clovers, often causing considerable damage, and which has been taken on alfalfa, although according to Davis* the pea aphid was not formerly considered a serious pest of alfalfa. It was later found upon examining the insects under the microscope that this was the pea aphid, *Illinoia pisi* Kalt.

During the warm part of the previous day, Mr. Meade dusted a small section of the field with 2.7 per cent. nicotine dust, applied with a hand duster. The plants still showed a good coating of dust and there were many dead aphids on the ground, but there appeared to be about as many live ones on the plants, indicating that it would take more than one treatment to control the aphids. It was evident that it would not be practicable to treat the whole field with a hand duster, and Mr. Meade questioned whether the value of the crop would warrant two applications of dust, using a power duster.

Normally the alfalfa would not be cut for two or three weeks, but it was suggested that if the aphids remained on the plants and the injury increased, it would be well to cut it early, as the cutting and curing of the hay would kill many of the aphids and expose the survivors to the direct sunlight. A number of aphids that had been parasitized were observed. Lady beetle larvae and Syrphid larvae were present in limited numbers. No aphids which had been attacked by fungus were observed at that time.

On May 15, another field of alfalfa belonging to Doody Brothers of North Branford was examined. About one acre of three or four year old alfalfa was found to be infested with the pea aphid. Occasional plants were turning yellow, but the injury was not as severe as at Seymour. This field had suffered from drought the previous fall and the plants had not made a thrifty growth.

Some of the aphids were parasitized and many of them had been killed by a fungus, probably *Empusa aphidis*.

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* The Pea Aphis with Relation to Forage Crops, J. J. Davis, U. S. Department of Agriculture Bulletin 276, 1915.

Adjoining this piece of alfalfa was a five-acre field of younger plants. Many aphids were present near the margin next to the older field but the plants were more vigorous and showed very little injury. A second visit was made to the field on May 19. The condition of the plants appeared to be about the same as on May 15, but more than one-half of the aphids had been killed by the fungus. On May 28, the injury to the plants had not materially increased. Another generation of aphids was present and though the fungus did not seem to be increasing, a larger proportion of the aphids had been attacked by Hymenopterous parasites. The infestation had extended further into the younger field of alfalfa, but these plants did not as yet show any serious injury.

Reports of injury to alfalfa on three farms in Hartford County were received from Mr. B. G. Southwick, County Agent. These infestations were investigated on May 20. A field in East Windsor of about one acre owned by Mr. H. F. Barber was injured by drought during 1924 and came through the winter in poor shape. After the plants were found to be infested with aphids, the owner plowed the alfalfa under in order to use the land for some other crop.

About two acres of alfalfa belonging to Mr. G. A. Stoddard of West Simsbury were noticeably injured towards one end of the field where there was a pocket or depression in the surface of the field which may have held water and caused more or less winter injury to the crop. While aphids had been present over the whole field there were very few alive on May 20. A large percentage had been killed by fungus. Mr. Stoddard considered that the injury was practically over.

Mr. O. D. Fuller, a neighbor of Mr. Stoddard, owned the field where the third infestation was reported by Mr. Southwick. This was not seen by the writer, but Mr. Fuller stated that the conditions were similar, though the injury was somewhat less than in Mr. Stoddard's field.

Specimens of the pea aphid on alfalfa were brought into the office from Middletown on May 23. There were many specimens on the stems and leaves, but a large proportion of them had been attacked by the fungus.

Another report of aphids on alfalfa was received from Woodbridge but this infestation was not examined.

From observations made in these fields, it was quite evident that the plants most seriously injured by the aphids were those which had been weakened either by drought or winter injury. Many of the most vigorously growing plants, though badly infested with aphids, did not appear to be noticeably checked. It has also been observed that thrifty fields of red clover can stand comparatively heavy infestations without showing noticeable injury. It is impossible to predict whether or not the pea aphid will injure alfalfa again in 1926.

According to Davis, (l. c.) the pea aphid was introduced from Europe and reported as occurring in this country in 1878-79, although the first report of serious injury to peas was some 20 yeas later, in 1899. In 1907, the species was collected on alfalfa in Arkansas, but as late as 1915, Davis states that *M. sativa* (alfalfa) is not universally and commonly attacked by the pea aphid.

In 1921, however, the pea aphid was reported as injuring alfalfa in Colorado, Kansas, Missouri, Nebraska, Oklahoma, and Oregon.* In 1923 it was reported as infesting alfalfa in 12 states, and during the past season it was reported from six states besides Connecticut.

The pea aphid in the north passes the winter as small shiny black eggs on the stems of clovers. The eggs hatch early in spring and there are about 12 generations during the season. Some of the individuals usually remain on clover throughout the year. In years when they are abundant, about July 1 in Connecticut, the majority of the aphids migrate to peas.

The pea aphid has an unusually large number of natural enemies. The most important natural check is probably the aphid fungus *Empusa aphidis*. This was very abundant in the alfalfa fields in North Branford and West Simsbury and the specimens from Middletown showed many individuals which were infested with this disease. The appearance of aphids attacked by this fungus is shown on Plate XVIII. Many lady beetle larvae and larvae of Syrphid flies were feeding on the aphids in the various fields. Aphids that had been attacked by Hymenopterous parasites as shown on Plate XVII, b, were found in all the fields examined. Three species of these parasites were reared, and later determined by the U. S. Bureau of Entomology, as *Aphidius rosae* Haliday, *Megorismus fletcheri* Crawford and *Lygocerus niger* Howard. The first mentioned species was by far the most abundant.

INJURY TO APPLES BY THE RED BANDED LEAF-ROLLER AND ITS CONTROL

B. H. Walden

Injury to apples similar to that shown in Figure 45 has been frequent in Connecticut orchards during the past few years and is due to the work of the red banded leaf-roller, *Eulia velutinana* Walker, which feeds at the surface of the fruit. The injury is apparent at picking when the greenish larvae are often found at

*Insect Pest Survey Bulletin, Vol. 1, 3, 4, 1921-1924.

work beneath where a leaf had rested against the fruit or where two apples have touched when on the tree. The larvae also readily attack the fruit where there is no protection, working beneath a thin whitish web secreted by the larvae. The injury is frequently on the side of the apple, and the growers often call the trouble "side worm injury." The larvae, however, readily feed around the calyx and occasionally around the stem. Fruit thus injured gives trouble in storage since the injury occurring late in the season does not heal over and affords an entrance for rot-producing organisms.

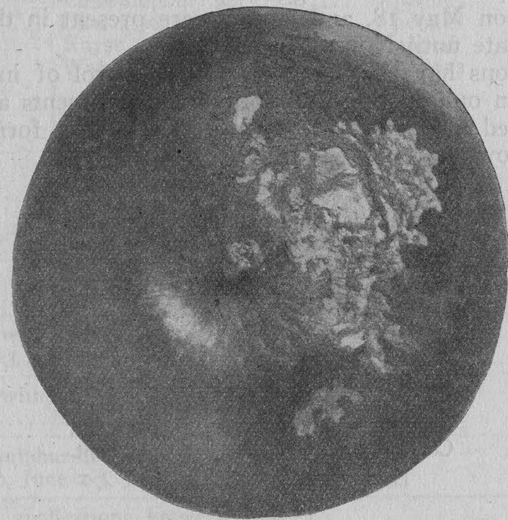


Fig. 45.—Work of red banded leaf-roller on fruit, natural size.

If any of the larvae are present on the fruit when stored, the injured area is often increased by further feeding, or the larvae may leave these apples and attack sound fruit.

Several other insects cause somewhat similar injuries on the surface of the fruit, but these can usually be distinguished from that of the red banded leaf-roller. The work of the lesser apple worm is often confused with that of this insect. The injury may be much the same shape but the lesser apple worm does not eat the skin of the fruit, but mines just beneath and when partly grown may tunnel into the core, while larvae of the red banded leaf-roller readily eat the skin and the injury is confined to the surface of the fruit.

Second brood codling moth larvae may feed on the surface but eat much smaller areas and soon tunnel into the fruit. The larvae of the red banded leaf-roller are light green in color with yellowish-brown heads, while the larvae of the codling moth and lesser apple worm are of a white or pinkish color with much darker brown heads.

The life history of the red banded leaf-roller has not been carefully worked out for Connecticut, but will probably be similar to the observations made in Pennsylvania,* where it has been found that this insect passes the winter in the pupa stage. Adults emerged in the spring and were most abundant in the orchard from May 4 to May 16. Eggs deposited on the branches May 11 hatched on May 18, and larvae were present in the orchard from that date until November 1.

Observations have been made on the control of injury from this insect in our dusting and spraying experiments at Milford Data collected in 1922 is given in Table I. The formulas used were as follows:

SPRAY

Commercial lime-sulphur ..	3 gallons
Lead arsenate (dry)	3 pounds
Nicotine sulphate	¾ pint
Water	100 gallons

DUST

Dusting sulphur	65 per cent.
Lead arsenate	10 per cent.
Nicotine sulphate	5 per cent.
Carrier	20 per cent.

TABLE I.

Plot	Treatment	Total Number of Apples	Per cent. of Injury by *Eulia*
1.	5 sprays, April 19, May 22, June 14, June 30, July 20	6,760	.32
2.	3 sprays, April 19, May 22, June 14	6,072	.69
3.	5 dust, April 19, May 22, June 14, June 30, July 20	4,881	.74
4.	3 dust, April 19, May 22, June 14 ..	3,137	.92
5.	Check	1,673	5.47

All plots shown in the table received three applications as follows: April 19, May 22 and June 14; while plots 1 and 3 received two extra applications on June 30 and July 20.

* Pennsylvania Agricultural Experiment Station Bulletin 169, p. 11, 1921.

Though the figures are not striking, the sprays were somewhat more effective than the dust treatments and where five sprays were given, the injury was reduced about one-half over three applications.

The results obtained in 1925 in the Milford orchard with spray in comparison with dust and combination spray and dust treatments are given in Table II. The following formulas were used:

SPRAY FORMULA

Lime-sulphur (dry)	6 pounds
Lead arsenate (dry)	3 pounds
Kayso	1 pound
Water	100 gallons

DUST FORMULA

Dusting sulphur	90 pounds
Lead arsenate	10 pounds

TABLE II.

Plot	Treatment	Total Number of Apples	Per cent. marked by *Eulia*
1.	Spray with Kayso, May 1, May 19, June 2-3, July 1, July 26	6,424	.3
2.	Spray without Kayso, same dates as above	3,600	.4
3.	90-10 sulphur-arsenate dust, May 1, May 19, June 2-3, July 1, July 26 ...	4,293	1.7
4.	4 dust applications between May 1 and July 1. 1 spray, July 26	5,285	.5
5.	Spray, May 1; Dust, May 19; Spray June 2-3; Dust, July 1; Spray, July 26	1,959	.5
6.	Spray, May 1, May 19; Dust, June 2-3, July 1, July 26	7,005	1.1
7.	Check, no treatment	2,250	11.2

Although all treatments gave fairly good control, the sprays (plots 1 and 2) gave the best control and the combination treatments with late sprays (plots 4 and 5) were next.

It is evident that if the red banded leaf-roller continues to be prevalent in certain seasons, that it will be necessary to spray apple orchards later than has been the general practice. In case the apple maggot and the apple and thorn skeletonizer are present, the same treatment should help control them.

THE RASPBERRY FRUIT WORM, BYTURUS UNICOLOR SAY, INJURING STRAWBERRY BLOSSOMS

B. H. Walden

On May 22, a visit was made by request to the fruit farm of Mr. C. Bussa at South Glastonbury, to examine some strawberries which were being injured by beetles feeding upon the blossoms. On several rows of Stevens, a late variety which was just beginning to bloom, adults of the raspberry fruit worm, *Byturus unicolor* Say, were feeding on the petals and centers of the blossoms as shown on Plate IX, a.

The plants on the opposite side of the field were uninjured, although there was a block of red raspberries a short distance beyond. As there were no raspberries near the infested side of the strawberry field, the situation was rather puzzling until the owner explained that there had been a badly infested raspberry field on this side which was removed in the spring. A large number of the beetles had evidently wintered in the soil and upon coming out in the spring were forced to feed upon the strawberries, in the absence of their natural food plant.

As there were only a small proportion of the strawberry blossoms open and no honey bees observed in the field, it was suggested that spraying at once with lead arsenate might help to check further injury.

The field was examined again on June 5. Though the owner had not sprayed the plants, the beetles had nearly all disappeared. No eggs were found on the strawberries, although beetles and eggs were present at this time on the raspberry plants.

The injury to the strawberries was probably less than it would have been to an earlier variety. There were a few less berries set on these rows than on the uninfested ones, and some of the first set fruit was deformed. The fact that there were fewer berries at the first picking would give the later berries a chance to grow larger than if there had been a full crop, so that it was hard to estimate the actual damage by the beetles. It probably did not exceed 10 per cent.

This is the first time that raspberry beetles have been observed feeding on strawberries in Connecticut and it was undoubtedly due to the removal of the adjoining raspberry field. There will probably be little or no damage to the strawberries next season as there were no indications that the raspberry beetles would develop on strawberries.

THE EUROPEAN CORN BORER IN CONNECTICUT

Pyrausta nubilalis Hubner

M. P. Zappe

This destructive insect was first discovered in Connecticut late in the fall of 1923. At this time Federal scouts found three small separate infestations along the shore region of Connecticut in the eastern part of the State, two in the town of Groton, and one in Niantic in the town of East Lyme. These were cleaned up and most of the infested material burned in the fall of 1923, the work being finished in the spring of 1924. No larvae of the European corn borer were found at these infestations the following year.

During the summer and fall of 1924, seven separate infestations of this insect were found in six shore towns of Connecticut by Federal scouts, in the following locations: Bridgeport, in a corn field at Hillside Home in the northeastern portion of the city; New Haven, at Granniss Corner, infestation in small gardens; Old Lyme, in a small corn field on the eastern side of the town; East Lyme, in a large field of corn near Crescent Beach; Groton, in a small corn field about one mile north of the Town Hall; Stonington, two infestations in small gardens in the village of Mystic.

Clean-up work began on December 1, and was completed December 12. This consisted of burning all corn and weed stems in the infestations and in surrounding fields and gardens. A total of 5,485 gallons of fuel oil was burned. An account of this clean-up work may be found in the Report of this Station for 1924, page 277.

In the summer of 1925, the scouting covered all the shore towns of Connecticut and also included the town of Orange and a part of the town of Woodbridge, which, together with Milford, forms an area where quantities of seed corn are grown and it was deemed advisable to have this area examined. All scouting in 1925 was done by Federal scouts, but the State of Connecticut co-operated by paying one-half of the wages of these men while scouting within the State. Besides the infestations of European corn borer found, 509 larvae were sent to the Federal laboratory at Arlington, Mass., and identified as not being the European corn borer.

Infestations of 1925

The scouting work of 1925 revealed the presence of the European corn borer in 20 separate infestations in the following five towns: Bridgeport, Saybrook, New London, Groton and Stonington. Nothing was found around the last year's infestations in New Haven, Old Lyme and East Lyme, these points being entirely free from any infestation.

Bridgeport Infestation

An infestation was found at Hillside Home near last year's infestation where European corn borer larvae were found in stems of smartweed in 1924. The clean-up work last year was not entirely satisfactory. The Superintendent of the Home promised to assist by having his men throw corn stalks, stubble and weeds into piles to make the burning easier. The men doing the work tried to plow out the stubble and as a result, some of it was left just below the surface of the ground where the larvae were safe from the fire.

This season the Superintendent had the corn fields plowed, the work being supervised by Federal men who followed the plow and threw all stubble and corn stalks into the furrow where the plow could cover it deeply on its next trip. This proved satisfactory and most of the material was well covered. After plowing, every bit of stubble, corn stalks or weeds that could be found above ground was collected into piles and burned. All weed areas within a reasonable distance of the infested fields and all weeds around fences, barns, and in a dump nearby were burned. Five entire days were spent in actual burning at this infestation by a force of 10 men, besides parts of several other days spent on clean-up work preparatory to burning. In all, 428,475 square feet of land was burned over, and 5,670 gallons of fuel oil were used. The work was finished on December 11, 1925.

Saybrook Infestation

This infestation was found in sweet corn growing in a garden just west of Oyster River on the State road betwen New Haven and New London. Part of one day was spent in clean-up work before burning. Eight men spent part of one day in burning, using about 300 gallons of fuel oil. About 10,800 square feet of ground was burned over, but operations at this infestation are not completed, as there are still two nearby gardens to be covered. We hope to finish work here early in the spring of 1926.

New London Infestation

This infestation was situated in the northern part of New London just inside the city limits. It was found in a large field of field corn owned by Mr. J. J. Higgins. This was a heavy infestation, 18 larvae being found in a very short time, all of which proved to be the European corn borer. There were no other fields of corn near the infested field and only a few small gardens, some of which had corn stalks in them. These were all included in the burning program. About 60 large shocks of corn were burned, as well as all stubble which had previously been dug out of the ground and soil removed from the roots. Weeds

and trash around the infested field, and other material which might harbor the larvae were burned in about eight nearby gardens. Two men spent two days in preparatory work and 11 men spent two whole days burning up this material. A total of 1,789 gallons of oil was consumed here, burning over an area of about 256,200 square feet. Work was completed on December 15, 1925.

Groton Infestations

In the town of Groton, a total of eight infestations was found. Two of these were in the borough of Groton, one at 50 Pleasant Street, west of the house of George Hempstead, where two larvae were collected in sweet corn; the other was at 97 Baker Avenue, in the garden of Mrs. J. E. Lamb, where a total of 10 larvae were collected in a small patch of sweet corn.

The preparatory work was done by five men working for two days on both infestations. These two infestations, being in the borough where nearly everyone has a garden, several adjoining gardens on both sides of each street were also cleaned up and burned. This required the time of 11 men for two and one-half days, it being necessary to burn over 172,855 square feet of land, using 1,921 gallons of fuel oil. Work on these two infestations was completed on December 18.

Owing to the fact that these infestations were in a thickly populated section of the town and that there was danger of setting fire to some of the many out-houses, chicken coops, fences, etc., it was thought advisable to have some fire-fighting apparatus immediately available if needed. One of the gipsy moth power sprayers was sent down from the State storehouse at Danielson, the tank filled with water, hose coupled together, and ready for use if occasion should require it.

In the section of Groton known as Noank, there were five separate infestations. Two of these were on Spicer Avenue, where 19 larvae were collected in sweet corn in small gardens; another was on Shore Street, where seven larvae were collected in sweet corn in a small back-yard garden. Another one was found in a good sized patch of sweet corn near the corner of Main and Church Streets, where 14 larvae were dug out of sweet corn.

An infestation was also found on Brook Street, Noank, where one larva and one pupa were found. Several corn stalks were found that showed the work of the European corn borer, but the larvae had pupated.

Some of the preliminary work has been done at the Noank infestations, but no actual burning has taken place on account of the area becoming covered with snow and ice. This area will have to be left until spring before it can be burned.

Two other infestations found in the town of Groton are located just at the western edge of the village of Mystic on what is known as Baptist Hill on the State road to New London. These were both in back-yard gardens, where a total of 12 larvae were found in sweet corn. These infestations have been prepared for burning but no actual burning has been done. Many adjoining gardens have also been cleaned and material in them will be burned this coming spring.

Still another infestation in Groton occurs in the garden of Mr. J. M. Whitman at 13 Grove Avenue, Mystic, where two larvae of the European corn borer were found. No control work has been done at this infestation but we expect to complete the clean-up work in the spring before the moths can emerge.

Stonington Infestations

In the town of Stonington five widely separated localities were found infested extending from the very eastern boundary of the town to the western edge in the village of Mystic. One was found in Pawcatuck, another at Lord's Hill, another on Pequotsepos road, still another on the Old Mystic road, while the infestation of several small back-yards on the Stonington side of Mystic may be considered to be the fifth. The latter infestation really consists of three small infestations near enough together to be considered as one infestation. They are all located within a few blocks of each other on the east bank of the Mystic river north of the main street in Mystic. No clean-up work nor burning has been done here yet, but we expect to burn this coming spring all material which may harbor larvae of the European corn borer.

In 1924, there were two infestations in this neighborhood, and it is quite probable that more existed, that were not discovered and adults from these may have been responsible for the reinfestation. The work to be done here must necessarily cover quite a large area of ground in order to be sure that all infestations found have been burned as well as covering some additional land for a margin of safety.

Only one infestation in Stonington has been burned. This is situated on the Mystic-Old Mystic road, east of the river, where 20 larvae and 11 pupae were collected in a large patch of sweet corn. Mr. Edward A. Smith, the owner of the farm, grew sweet corn and cut flowers to sell to people who were summering at Groton Long Point. All corn sold and removed from this farm was inspected by Federal men, to prevent any possible spread from this infestation.

All corn, weed and flower stalks here were burned, as well as the corn stalks on the adjoining farm. It took 11 men four days to burn over 58,400 square feet of ground, using about 1,587 gallons of fuel oil.

Another infestation was found about one mile east of the Smith farm on the Pequotsepos road on land belonging to Mr. H. Wilcox. This was in a small patch of field corn and only three larvae were found. The owner was allowed to feed the corn stalks to his cattle with the understanding that he would burn all stalks which the animals did not eat.

The stubble was dug and thrown on a pile of wood brush, etc., and though not yet burned, it will be very early in the spring and without oil if possible. As this infestation was quite distant from any other corn fields, it was not thought necessary to do any burning outside of the infestation itself. However, the owners of the adjoining farms promised to burn in the spring all corn stalks which the cows had not eaten during the winter.

About two miles west of Stonington village on the farm of James Lord at Lord's Hill, another infestation was found. This was in a large garden patch of sweet corn. Mr. Lord has been permitted to feed corn stalks from the infested fields to his cows, provided that he burns up all stalks left uneaten.

The corn stubble has all been dug from the ground and thrown into small heaps. A perennial garden just over the fence from the infested fields has also received attention; all flower stalks and weeds have been cut, raked and thrown over the fence into the corn field. An adjoining field of corn planted for ensilage and abandoned, contains much grass and weeds, which will also be burned in the spring when weather permits burning operations.

One infestation is located in lower Pawcatuck on land owned by Mr. W. E. Miner, where seven larvae were collected from a large patch of sweet corn. This corn patch is close to the Pawcatuck river, which is the boundary line between Rhode Island and Connecticut, and seems to be an isolated infestation, as the nearest known infestation is about five miles to the west.

The Pawcatuck infestation has been prepared for burning. The owner attempted to burn the corn stalks in the infested field, but was not entirely successful. These partially burned corn stalks have been gathered and weeds and grass cut off and raked away from fences and buildings preparatory to burning in the spring.

Extension Work

Before any actual clean-up work was started, it was thought advisable to enlist the co-operation of the householders near the infestations and ask them to clean their own yards and gardens by burning weeds, corn stalks, etc. If they could be induced to take care of their own yards, it would mean a considerable saving of work and expense for the State, as well as to reduce the chances of missing any undiscovered borers in material around the present known infestations. The territory which the State could clean up would necessarily be limited to a few yards surrounding each infestation.

A house-to-house canvass was made, in a one mile radius around each of the infestations. Three men spent seven days on this work.

To save time in explaining to the householders what they were requested to do, the following notice was either given to each one or left at the door.

EUROPEAN CORN BORER HERE

Will You Co-operate?

Some of you may have seen men looking over your corn and other crops. These men were hunting for the European Corn Borer, a very destructive pest from Europe now occurring in Eastern New England and around Lake Erie.

This pest has recently been found in small numbers in your vicinity. There is grave danger that it may soon spread throughout the State. Every reasonable measure is being used to control it, but you can help.

All cornstalks should be destroyed:—if fed to cows, the thick stalks which the cows do not eat should be burned. All large weeds, dahlia stalks, and other flower stalks should likewise be burned.

Please cut your stalks off close to the ground and not leave stubble five or six inches high. Some of the borers may be in the stubble, and digging and burning the stubble is expensive. When cut off at the surface of the ground, the borers are all in the tops. A sharpened hoe is an effective tool for cutting the stalks.

The scouting and control work is done by the Federal Bureau of Entomology and the State Entomologist of Connecticut in co-operation.

Further information regarding the pest may be obtained from

W. E. Britton, State Entomologist,
P. O. Box 1106, New Haven, Conn.

This work was done early in October. At the time the burning work was finished in the latter part of December, only one householder had completely cleaned up all material which might harbor larvae of the European corn borer. Several others had attempted to burn their corn stalks, but only the leaves and tassels had been consumed. The most important parts of the corn, the thick stalks, had not been burned at all. Perhaps early in the spring, when the material is drier, the gardeners will have more success.

In Mystic and Noank, many people were in the habit of throwing old stalks, rubbish, etc., into the river. We tried to discourage this practice, as the material would only drift ashore and, if infested, might start other infestations perhaps miles away from the origin of the material.

Summary of 1925 Work

Number of towns scouted	25
Number of towns infested	5
Number of infestations found	20
Number of square feet of land burned over	926,730
Gallons of fuel oil used	11,267
Amount of money spent by State	$4,739.63

FURTHER NOTES ON THE ASIATIC BEETLE

Anomala orientalis Waterhouse

W. E. Britton and M. P. Zappe

This introduced insect pest has been discussed in preceding Reports of this Station as follows: 1922, page 345; 1923, page 291; 1924, page 294. Bulletin of Immediate Information, No. 52, issued December 15, 1925, and entitled "A New Pest of Lawns,"

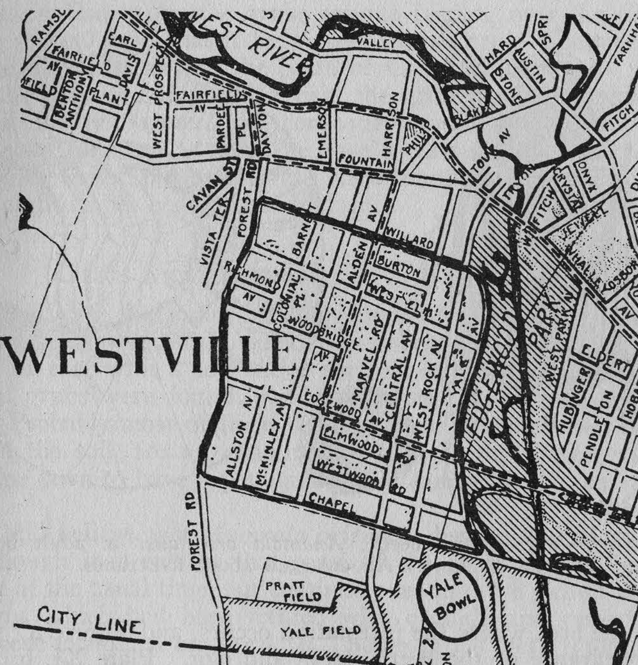


Fig. 46.—Map of Westville showing the portion infested by the Asiatic beetle, surrounded by black line.

also deals with this insect, and brief notes were published in the Journal of Economic Entomology, Vol. 15, page 311, and Vol. 17, page 309.

During the first half of the summer of 1925, this insect seemed to cause little damage, and very few inquiries and complaints were received regarding it. At a brief talk in Washington, D. C., July 28, 1925, before the summer field meeting of the Northeastern Entomologists, the senior author made statements to this effect. In fact, at that time it seemed to him that the insect was not increasing, that the injury was no worse than in 1924, and that it had spread only slightly. But later in the season he felt like telling a different story. During August and September, many inquiries and reports of injury were received at the Station. In passing through the streets of the infested region, more injured lawns were noticeable than have ever been seen before since the presence of this pest was discovered in New Haven. Figure 46

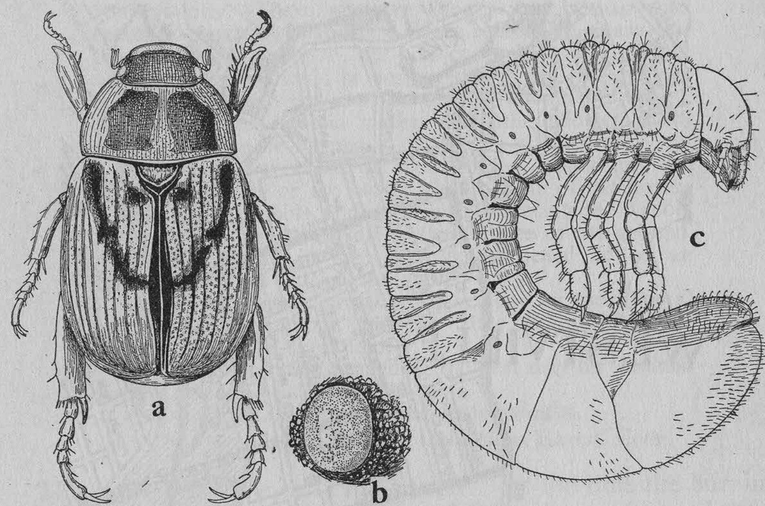


FIG. 47.—The Asiatic beetle, *Anomala orientalis*. a. adult beetle. b. egg. c. grub or larva. All enlarged about five times.

shows the area where the infestation occurs, and Figure 47 shows the appearance of the beetle, larva and egg. Plate XI, b, shows injury to lawns.

As the injury was more evident and the grubs more numerous than ever before, the matter was reported to the Federal Horticultural Board and the Bureau of Entomology, with a request that specialists be sent to review the situation. Consequently on October 29, 1925, Mr. Loren B. Smith in charge of Japanese beetle investigations, with Messrs. B. R. Leach and J. P. Johnson, all of Riverton, N. J., spent the day in New Haven, and with Director William L. Slate, Jr., and the writers, visited the infested area, observed conditions there, and conversed with residents and property owners. Mr. Smith expressed his opinion that the injury to lawns appeared more serious than similar injury in New Jersey

by the grubs of the Japanese beetle, *Popillia japonica,* which he had ever seen. Also Mr. Smith considered it not only unwise to allow this pest to continue to spread unchecked, but regarded it as a menace to the whole country. Especially if this insect should spread southward, he believed it might prove a very serious pest of various crops.

As a result of this visit, Mr. Smith submitted a report in which he advised an attempt to eradicate the pest by treating the entire area between Chapel Street and Willard Street, Yale Avenue and Forest Street, with carbon disulphide emulsion to kill the grubs. He recommended that the applications be made early next summer, perhaps in May, after the grubs resume feeding near the surface of the ground, and that it be a co-operative project between the Federal Government and the State of Connecticut.

At the time of Mr. Smith's visit, the grubs had descended into the soil for the winter, and consequently did not appear to be nearly as abundant as was the case a few weeks earlier. By digging, however, plenty of grubs were found, most of them being six to eight inches beneath the surface.

Tests and Observations Made in 1925

On April 16, the junior author examined some lawns near the corner of Edgewood and Alden Avenues by cutting out four-inch circles of turf with a sod cutter such as is used on golf greens. Several grubs were found, averaging about one to each circle of turf. Probably most of them had not come up from their winter level in the soil, for an examination later in the season showed the same lawn to have a population of about 40 grubs per square foot.

We still believe that *Anomala orientalis* has an annual generation, though it is evident that some of the grubs do not become mature at the usual time, but continue over into the second season.

Lawns which had been treated with cyanide and reseeded in 1924 were examined on April 16. Some grubs were found here, though the lawns presented a good appearance and no injury was apparent.

On September 25, one square yard of lawn was treated with eight ounces or one-half pound of granular calcium cyanide dissolved in two gallons of water, sprinkled over the surface and washed into the soil with eight gallons of clear water. Five grubs in a wire cage had been buried about two inches deep prior to the treatment. When examined September 30, all grubs were dead but the grass had been injured.

Another section of the same lawn was treated on the same day using calcium cyanide at the rate of four ounces per square yard, or half the amount mentioned above. On September 30, two square yards were dug up and the grubs counted. One had 39, and the other 44, dead grubs and no living ones were found.

An infested lawn at 39 Elmwood Road was treated with six ounces per square yard of calcium cyanide, late in September. When examined, 24 hours after treatment, there were some living grubs, but several days later, on September 30, all grubs had been killed. This lawn had been spaded prior to treatment and grubs were in the bits of sod that had been turned several inches below the surface.

On October 3, 60 square yards of lawn at 50 Marvel Road were treated with calcium cyanide at the rate of four ounces per square yard. When examined on October 13, no living grubs could be found but the grass had all been killed.

On October 19, four tests were made on grubs in soil buried in cages, with a finer grade of calcium cyanide known as "grade G" or "Cyanogas," using it at the rate of one, two, three and four ounces respectively, per square yard. When examined on October 31, all grubs had been killed and in each case there was slight injury to the grass. Grade G has the same analysis as the granular calcium cyanide but is considerably finer.

Two tests were made with home-made carbon disulphide emulsion; one of 28 square yards, using two fluid ounces per square yard, and the other of eight square yards, using four fluid ounces per square yard. Both applications were made on September 30, and well watered immediately afterward. When examined on October 3, only 2.6 per cent. in the former case and 15 per cent. in the latter case had been killed by the treatment. Emulsions made in this manner are not effective killing agents, but in New Jersey several formulas have been developed which are effective in killing the grubs of the Japanese beetles. One of these provides for emulsifying carbon disulphide with a water-soluble, resin-fish-oil soap, which is said to surround the globules of carbon disulphide and to hold the fumes so that they are given off more slowly and thus act throughout a longer period of time.

At the writing of this paper, plans are under way for carrying out the recommendations of Mr. Smith's report, and the treatment of the infested area, but the funds are not yet assured.

TOBACCO PLANTS SEVERELY INJURED BY WIREWORMS

Mention has already been made on page 227 of severe injury to newly-set tobacco plants in Windsor and other towns in the tobacco growing section of Hartford County. The matter was reported to this office by Dr. P. J. Anderson in charge of the Tobacco Sub-station at Windsor, and Dr. Garman and the writer visited one of the fields on June 2. Most of the damage occurred

to tobacco plants under cloth, but Dr. Anderson reports some wireworm injury to plants in open fields.

One grower had 84 acres under cloth, and on about 40 acres the plants were destroyed and reset. The plants of the second setting were also ruined and the ground set again, and a portion of the third setting had also been destroyed when the writer visited the field on June 2. Many wireworms were collected, 18 being taken around one plant. Adult Elaterid beetles were common, resting upon the cloth both inside and outside the tents. Both wireworms and beetles were identified as *Limonius agonus* Say. After a few days of the extreme heat of the first week in June, the wireworms disappeared so that on June 5, when a second visit was made, it was difficult to find them. Probably they went deeper into the ground to escape the heat, and a few were obtained several inches below the surface. The field was again planted and no further injury resulted.

In some of the fields, about 95 per cent. of the plants were dead when the writer first saw them, and Plate XII, b, shows a view taken at that time. The stems were completely riddled with tunnels, as shown on Plate XII, a.

Mr. B. H. Walden, Assistant Entomologist, identified the wireworms, by comparison with other material, as *Limonius agonus* Say, and this identification was afterwards confirmed by Mr. J. A. Hyslop of the Bureau of Entomology. Specimens of the adult click beetles found resting on the cloth of the tent were also sent to Mr. Hyslop, who reported that these were also *Limonius agonus,* and the adults of the destructive wireworms. The appearance of both adults and larvae is shown in Figure 48. This is not the first record of wireworm injury to tobacco by this species in Connecticut. Our collection contains material from Hockanum in stems of tobacco, June 1, 1920. Mr. Hyslop visited East Windsor Hill, where similar though less extensive injury took place. Mr. Hyslop calls *Limonius agonus* the eastern field wireworm, and it is perhaps the most common species attacking tobacco in Connecticut. It is not the only species, however, as we have material in the Station collection from tobacco and identified by Mr. Hyslop bearing the following records: *Asaphes* sp., Portland, June 12, 1906, B. H. Walden; *Melanotus* sp., Poquonock, May 28, Windsor, May 29, 1921, E. H. Jenkins.

It is quite probable that the wireworms descended into the ground on account of the extreme heat during the first week in June, but that they were able to feed upon the roots of the large plants later in the season, and possibly upon the old sprouting stumps after the tobacco crop had been harvested. Dr. Anderson observed some wireworms near the bottom of the furrows where one of the fields was being plowed late in the fall. Very little is known exactly about the life history of *Limonius agonus,* but some species require two years and others six years for the complete life cycle. Probably the period required for the complete development of the eastern field wireworm falls somewhere between these limits. All wireworms are the larvae of click beetles of the family Elateridae, of which nearly 100 species occur in Connecticut.

On June 2, some tests were made with carbon disulphide emulsion applied with the tobacco setter when plants were being reset. Two different proportions were used: (1) one part of carbon disulphide in 360 parts of water, and (2) one part of carbon disulphide in 720 parts of water. Three days later (June 5), when we visited the plantation, it was found that the first or stronger mixture had killed nearly all of the plants, and the second or weaker had not killed the wireworms.

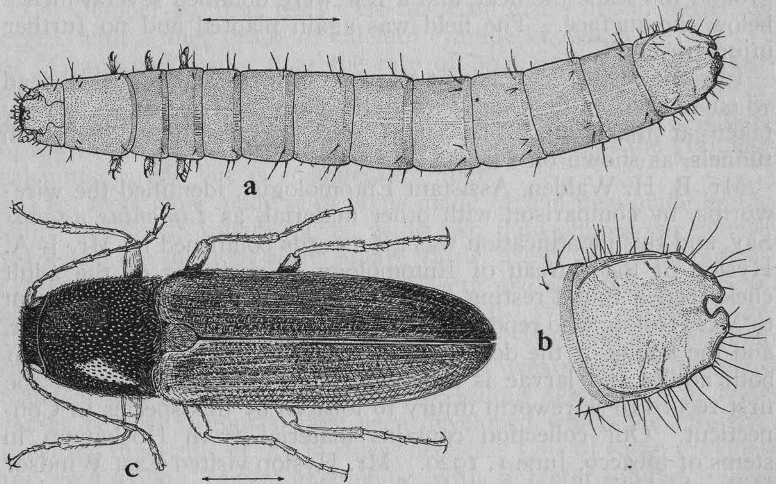


FIG. 48.—The Eastern Field Wireworm, *Limonius agonus*, a. larva; b. posterior segment of larva; c. adult beetle. All enlarged. Natural length of larva and adult indicated by the lines.

Tests were also made with calcium cyanide, which seemed to be effective in killing the wireworms, but also injured the plants. In California the bean crop is often severely injured by wireworms, and the growers now forestall injury by planting every fourth or fifth row with split seed which will germinate but not make strong plants. The wireworms are attracted to these weak plants and then calcium cyanide is drilled in along each row and kills both wireworms and plants. After waiting a few days, the crop can be planted without further injury.

Plans have been made for conducting further experiments next season, and it is hoped that we may be able to obtain some definite data regarding wireworm control.

MOSQUITO CONTROL WORK IN CONNECTICUT

Season of 1925

R. C. BOTSFORD

There are about 40 different species of mosquitoes in Connecticut, but for convenience in practical control work, the most important of these are included in four general groups, as follows: salt marsh, fresh water swamp, malaria, and rain barrel.

Mosquito control work in Connecticut as carried on by the Connecticut Agricultural Experiment Station is confined largely to the eradication of mosquito breeding places on the salt marshes. The salt marsh mosquitoes are considered the greatest nuisance. They breed periodically from April to October in certain depressions in the salt marshes. Their breeding areas occur near large centers of population and almost surround the cottages and summer homes which line our shores, and in addition they are known to fly five or 10 miles and infest areas where no breeding occurs.

Every intelligent person knows that mosquitoes can breed, or develop, through the egg, larval and pupal stages, only in still or stagnant water. This means that if there were no stagnant water, there would be no mosquitoes. Standing water on a salt marsh which tends to breed mosquitoes is removed through a simple system of ditches. These ditches are usually 24 inches deep, about 150 feet apart, and as wide as necessary to carry off the volume of water deposited on the salt marsh at high tide or by heavy rains. Fresh water swamps may be drained by a similar system of ditches, or if an outlet is impracticable, the surface water may be made to accumulate in a deep artificial pool stocked with larva-eating minnows. Receptacles holding water should be emptied once each week or, if in use, should be screened to prevent the adult mosquito from depositing its eggs upon the surface of the water.

Oiling or treating the water chemically are but temporary measures and are recommended only where drainage or fish control are impossible.

Unditched salt marshes which in some cases averaged as high as 80 per cent mosquito-breeding surface are now, since being ditched, practically free from breeding places and will remain so as long as the ditches function properly. It is just as important that the ditches be inspected regularly and kept open as to have the original ditching done; because clogged ditches will hold water and may breed mosquitoes in addition to all other depressions nearby, and the marsh would soon revert to its original condition and become a serious breeding place. Ditches should be inspected about once each month and stoppages removed. (See Plate XIV.)

There are over 5,000 acres of ditched salt marshes in Connecticut patrolled regularly throughout the mosquito breeding season under the supervision of the Connecticut Agricultural Experiment Station. Not only are ditches cleared and reconditioned, but tide-gates, dikes, culverts, etc., are kept in repair as far as funds will permit.

STATUS OF CONNECTICUT SALT MARSH AREAS, 1925.

Town	Salt Marsh Acres	Salt Marsh Ditched	Maintained by State	Total Cost of Ditching	Labor, Cost of Maintenance 1925	Labor, Cost to Complete
Greenwich			None			
Stamford	300	300	200	$2,800.00	$177.20	
Darien	300	300	None	3,800.00		
Norwalk	600	600	None	7,500.00		
Westport	350	50	50	Ditched with Fairfield		$5,500.00
Fairfield	1,200	1,200	1,200	8,400.00	971.50	
Bridgeport	173					3,000.00
Stratford	1,315					20,000.00
Milford	630					9,500.00
West Haven	463	222	222	Ditched with New Haven	52.00	3,500.00
New Haven	750	750	750	12,000.00	528.00	
Hamden, No. Haven	2,042					30,000.00
East Haven	482	150	50	Ditched with New Haven	44.00	6,500.00
Branford	895	578	578	20,000.00 (Branford, Guilford, Madison)	832.50	4,800.00
Guilford	1,085	1,085	1,085		1,140.68	
Madison	1,005	1,005	1,005		986.17	
Clinton	766					12,000.00
Westbrook	500	170	None	2,746.07	4.00	4,754.00
Old Saybrook	1,373	60	None			20,000.00
Lyme	493					7,500.00
Old Lyme	1,393					21,000.00
East Lyme	424					6,500.00
Waterford	204					3,500.00
New London	34					500.00
Groton	304	50	50	1,000.00	8.00	4,000.00
Stonington	555					8,500.00
	17,636	6,520	5,190	$58,246.07	$4,744.05	$171,054.00

According to old Government figures, there are about 22,000 acres of salt marsh in Connecticut. This figure, we believe, includes the grassy areas completely covered by normal high tides, which cannot breed mosquitoes. The mosquito-breeding areas are further reduced by fills, especially near large cities. For practical purposes we presume there are 18,000 acres of ditched and unditched salt marshes in Connecticut. In some instances mosquitoes migrate from unditched areas and infest communities where local control may be perfect. The remaining 13,000 acres of salt marsh should be ditched to make control work most effective. The cost of ditching has increased about 100 per cent. since 1916. The cost of maintenance, when extensive repairs are not included, averages about one dollar per acre.

Although salt marsh work claims most of our attention, we have some requests to investigate communities where fresh water species are troublesome. The fresh water species have a much shorter flight range from their breeding place than the salt water mosquitoes, and where they are troublesome, they are generally found breeding on the infested premises or within a few hundred yards.

The officers of the Boy Scouts of Meriden made arrangements with the local health officer to carry on some anti-mosquito work this summer in the City of Meriden. A careful survey of the possible breeding places was made, and maps prepared by the Scouts. It was rather late in the season (June 10) to expect great relief, but in sections where the swamps and pools were systematically oiled, a reduction in the number of mosquitoes was reported.

The town of Clinton voted $10,000 to ditch the salt marshes of the town for mosquito elimination.

Mosquito control is a vital factor in the progress and development of this State, and more State funds should be provided in order that the work may be completed and past expenditures made more effective.

The table on page 316 shows approximately the present condition of the salt marsh areas in Connecticut.

THE WORK BY TOWNS

New Haven

In spite of the wet season, there was less mosquito *breeding* in the New Haven salt marshes this year than the two previous years. This was due to the progress made in recutting and grading damaged ditches.

However, New Haven was badly infested with salt marsh mosquitoes this summer, especially in the Prospect Hill section. The salt marsh nearest this part of the city is the great Quinnipiac River marsh of over 2,000 acres. The greater area of this marsh lies above the New Haven line and is unditched and contains breeding places. Prolific breeding has also occurred this summer in certain salt marshes of East Haven and West Haven.

The large marsh area near Morris Cove was ditched in 1912 for mosquito elimination. This area was never accepted by the State for maintenance, and now only traces of ditches remain. It is doubtful, however, if this is a breeding place of the salt marsh or migrating mosquito such as infests the city each summer, because an excellent tide-gate on Morris Creek seals this area against entry of ocean water. It is probable that all native species of fresh water mosquitoes, including the malaria mosquito, breed in this swampy area and torment local residents. Mosquito breeding in this section would be much lessened if Morris Creek were dredged to the East Haven line at Dodge Avenue. Present insanitary conditions would be removed and property values tend to increase.

New Haven will have salt marsh mosquitoes so long as its neighboring towns remain unditched.

West Haven

Due to lack of State funds necessary to improve the outlet of Old Field Creek at Beach Street, immense broods of mosquitoes emerged from the Old Field Creek marsh this summer.

On June 6, 1925, Dr. Charles D. Phelps was appointed local Deputy in Charge of mosquito elimination. Through his efforts, enough local funds were made available to keep the outlet of Old Field Creek open the latter part of the season.

The key to the principal mosquito control problem in West Haven is the outlet of Old Field Creek at Beach Street. Our recommendations made in 1923 and 1924 offer a practical solution and are quoted: (1923) "The outlet from the gate to the harbor should be deepened about two feet and a sluiceway (pipe) installed to extend beyond the sand bar. A new tide-gate is required (on pipe) and the creek should be dredged from Beach Street to Peck Avenue," and (1924) "A sluiceway (pipe) with tide-gate should be installed in the outlet of the Old Field Creek, extending from Beach Street about 300 feet into the bay, and the creek dredged from Beach Street to Peck Avenue." After this is done it will be possible to clean out the ditches and keep them in good condition.

East Haven

The small salt marsh areas at Morris Creek and Caroline Creek under State care were practically free from mosquito breeding places the entire season. The other salt marsh areas in this town need more ditches in order to remove stagnant water from the marsh surface.

Mosquitoes of the fresh water species were very abundant and troublesome this year. The margins of Tuttle's Brook and the large swamps near the railroad track furnish typical breeding places. The presence of rain barrel mosquitoes indicated back-yard breeding places, such as barrels, tubs, pails, tin cans or other articles which may hold water.

Branford

The salt marsh of Stony Creek is in bad condition due to a leak under the foundation of the dike. Some temporary repairs were made, but it is planned to make permanent repairs on this dike this winter. The other salt marshes which were ditched for mosquito

elimination were patrolled throughout the season and the ditches kept open.

Mosquitoes were reported as being troublesome in certain localities and an investigation of the unditched salt marshes west of the Branford River revealed many breeding pools capable of supplying the town with mosquitoes.

Local interest in Pine Orchard and Indian Neck kept those communities free from fresh water species in spite of the frequent showers, which tend to keep fresh water swamps and hidden receptacles supplied with water.

The tide-gates on the Branford River were kept in fair service by constant patching. It is doubtful if these gates can be made to go through next season. A bid has been received for the complete reconstruction of these gates, but no money is available to carry on the work.

Conditions around Waverly Grove may be improved by a tile outlet near Lounsbury's Store.

Guilford

Extensive repairs were begun in September, recutting and grading ditches in the salt marshes of this town. It is planned to have all ditches open before next season.

Storm damage to the dike at Great Harbor is being repaired by the property owners.

Madison

The Town of Madison voted $200.00 for mosquito control work. This will be added to the regular State allotment for the town and will allow some much needed work to be done.

Iron culverts installed in the beaches functioned perfectly throughout the season. This resulted in much improved drainage which facilitated repair work on the ditches.

The State Park and Forest Commission has made available a limited amount of funds for anti-mosquito work in Hammonassett Park.

Westbrook

Another $1,000.00 was appropriated by the town to carry on their anti-mosquito program, and the work of ditching continued as usual.

Salt marshes near the center of the town and eastward to the Saybrook line have been ditched and are practically mosquito proof. Mosquitoes which were reported troublesome did not come from the ditched marshes. Breeding was heavy in the unditched marshes bordering the Patchog and Menunketesuck Rivers. Ditching of these marshes began this fall. (Plates XV and XVI.)

GROTON

Ditches in this area were cleaned, recut and graded as required.

FAIRFIELD

In the Town of Fairfield, $2,899.52 was expended for the maintenance and extension of fresh water drainage work. The bulk of this sum was furnished by popular town vote, the Fairfield Improvement Association and the Health Department each adding a good share. This sum does not include what the State regularly supplies.

The inspection work through the season was much handicapped by the continued ill health of Nicholas Matiuck. All infestations reported were investigated and breeding places destroyed. Most of the breeding places found were the result of recent construction work.

STAMFORD

The City of Stamford added $300.00 to the State funds for inspection and maintenance work. The work was carried on by experienced labor from Fairfield.

Following is a copy of an order and notice such as may be mailed to the land owners prior to ditching or otherwise treating such land for mosquito elimination:

ORDER AND NOTICE CONCERNING ELIMINATION OF MOSQUITO BREEDING PLACES IN THE TOWN OF ———.

Whereas, by the provisions of Chapter 68 of the Public Acts of 1923, the Director of the Connecticut Agricultural Experiment Station may make rules and orders concerning the elimination of mosquitoes and mosquito breeding places, and he or his agent may enter upon any swamp, marsh or land to ascertain if mosquitoes breed thereon or to survey, drain, fill or otherwise treat, or make any excavation or structure necessary to eliminate mosquito breeding on, such land or cause same to be done, and

Whereas, sufficient funds have been raised to so eliminate mosquito breeding places within the areas hereinafter mentioned and described,

Now Therefore, I, William L. Slate, Jr., Director of the Connecticut Agricultural Experiment Station, by authority of said Chapter 68 of the Public Acts of 1923, hereby order that all mosquito breeding places be eliminated in the following areas in the Town of .... in the County of ...., State of Connecticut, to wit: (Here follows a description of the areas and method to be used.)

Map showing these areas is on file in the office of the Town Clerk of the Town of ....

Said elimination shall be by the ditching of all marsh areas within the above mentioned territory where either storm water or tide water does or may stand for several days. Ditches to be near enough together and deep enough to drain all such areas effectively, and main ditches, and natural waterways made as required to carry the drainage. Tide gates, dikes and other structures shall be made, if necessary, and artificial outlets constructed where natural outlets may not be made effective.

All said work shall be under the supervision of and subject to the approval of the Director of the Connecticut Agricultural Experiment Station.

Dated at New Haven, Connecticut, ...

WILLIAM L. SLATE, JR., *Director.*
Connecticut Agricultural Experiment Station.

MISCELLANEOUS INSECT NOTES

A Scale Insect New to Connecticut: During the summer of 1925, the writer discovered a white scale of the genus *Eriococcus* on some shrubs of *Spiraea salicifolia* growing on his home grounds. Specimens were identified by Mr. Harold Morrison of the Bureau of Entomology as *Eriococcus borealis* Cockerell (shown on Plate XVII, b.), a species not before recognized as occurring in Connecticut.

Birch Twig Gall: On July 18, 1924, the writer observed a peculiar swelling at the base of a twig on paper or canoe birch, that resembled the swellings or galls caused by certain species of *Agrilus.* The twig was removed from the tree and placed in a cage in the insectary. On April 24, 1925, an adult beetle of *Neoclytus acuminatus* Fabr., emerged.

Lace-Bugs Injuring Elm Foliage: On August 27, Mr. W. O. Filley brought to the office some elm leaves from Canaan, which had the under sides covered with excrement and cast skins. On September 4, Mr. Filley brought similar material from West Cornwall. Both lots of leaves had been attacked by the elm lace-bug, *Corythucha ulmi* Osborn and Drake, and some adults were present. This species, first described from Ohio in 1916, was received on elm from Litchfield in 1922.

Conservatory or Asiatic Camel Cricket in Connecticut: On December 17, a specimen from a greenhouse in Southport was handed me for identification. Mr. Walden found it to be the conservatory or Asiatic camel cricket, *Diestrammena japonica* Blatchley (*marmorata* DeHaan), an Oriental species which has been reported from Minnesota, Wisconsin, Kansas, Illinois, Ohio, Canada, Maine, Massachusetts and Rhode Island, usually occurring in cellars or greenhouses. This is the first record for Connecticut and it is not known whether this cricket injured the plants. If so, some means of control must be devised.

Borer in Willow Twigs: On August 20, while inspecting nurseries in Durham, Mr. Zappe found some yellow bark willows with borers at work in the shoots some distance back from the tips, and where the shoots were about the size of one's finger. He gathered material and brought to the insectary, and on August 26 two adults emerged and on August 30 another adult appeared in the cage. These specimens seem to be identical with those of *Janus abbreviatus* Say, in the Station collection, and also run to it in the key to the species of *Janus* in the Hymenoptera of Connecticut.

Abundance of Cherry and Pear Slug: The cherry and pear slug, *Caliroa cerasi* Linn., has often been noticed feeding upon the leaves of small pear and cherry trees in nurseries or young orchards, but seldom does it attack and injure large trees. When inspecting nurseries, Mr. Zappe observed an old and large sweet cherry tree in Cromwell which was perhaps 35 feet tall and the foliage had been skeletonized and was brown from the feeding of the larvae. Particularly the top and the south side of the tree showed this condition. On the north side, the lower branches were somewhat greener. Mr. F. A. Bartlett reported to the writer that late in the season he had also seen large trees in Fairfield County with foliage brown from the attacks of this insect.

Abundance of Grasshoppers: Grasshoppers were very abundant in certain localities. Reports were received from Woodbridge and Guilford, and a visit was made to Guilford, August 15, where the second crop of grass had been cut. Grasshoppers were plentiful and rose in swarms from the grass, when the mowing machine passed through the field. Nearly all stages were present. A few mature specimens were collected and Mr. Walden identified them as the red legged grasshopper, *Melanoplus femur-rubrum* DeGeer. Another nearby farm had a 10-acre field of alfalfa which, according to report, had been nearly ruined by grasshoppers. Poisoned bait of bran mash scattered about the field is perhaps the best remedy and is used very extensively in some of the western states.

European Pine Mite in Connecticut: On November 12, 1924, in compliance with a request, the writer examined some conifers growing close to the front porch of the residence of Mr. Clarence L. Beardsley, 244 McKinley Avenue, New Haven. Some of these conifers had been attacked by mites and the leaves were light colored. Two Scotch pines had peculiar bunchy or "witches broom" growths at the upper terminals as shown on Plate XVII, a. Some of these growths were removed and taken to the laboratory, where they were examined by Dr. Garman. He found mites in them which he identified as the European pine mite, *Eriophyes pini* Nal., a species which at that time had not been reported as occurring in the United States. The record was overlooked and

therefore was not published. Recently this mite has been reported by Walther* as injuring pine trees on the Pacific Coast. Spraying with a miscible oil, one part in ten parts of water, has given promising results in California, but further investigations are needed before we can recommend any treatment for Connecticut.

Sawfly Larvae Feeding upon Rudbeckia "Golden Glow": In the Report of this Station for 1924, page 342, was published a note regarding sawfly larvae found feeding upon "golden glow" in Westport, and illustrations were shown on Plate XXXVI.

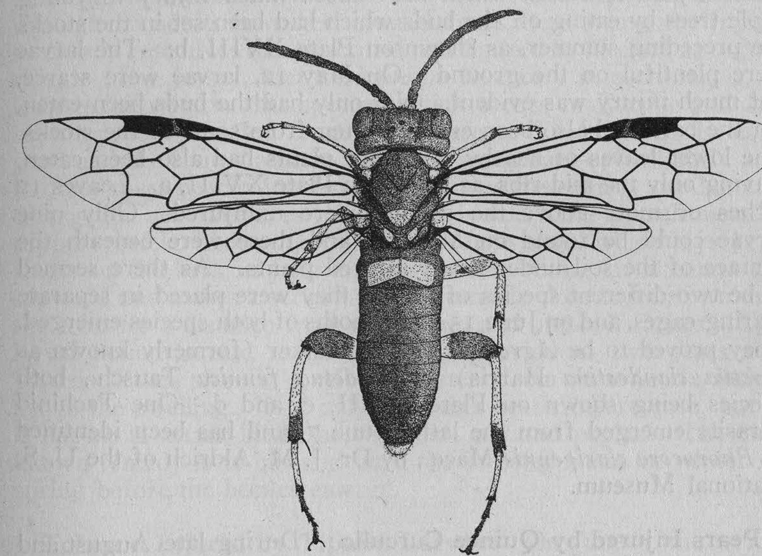


FIG. 49.—Adult Sawfly, *Macrophya simillima*. Enlarged about six times.

Mention was made of an adult sawfly of the species *Tomostethus inhabilis* Norton, which had been reared from the material, though probably occurring there accidentally. On May 26 and June 7, 1925, some much larger sawflies emerged from the soil in the same cage, and were identified by Mr. S. A. Rohwer of the U. S. National Museum as *Macrophya simillima* Rohwer. On May 25, Mr. Friend collected several specimens of the same species on the bed of "golden glow" at Westport, and on June 20, Mr. Friend and the writer collected many larvae there, and brought back plants upon which to feed them. Heretofore the food plant and

* Journal of Economic Entomology, Vol. 18, page 830, December, 1925.

habits of the species were unknown. It is also a species not before recorded as occurring in Connecticut. The original description was published in Entomological News, Vol. 28, page 265, 1917, and was drawn from material collected in St. Louis, Mo., and Lincoln, Nebraska. There is no doubt about this species being responsible for stripping the plants of "golden glow." The adult sawfly is shown in Figure 49, and the egg-blister on Plate XIX, b.

Noctuid Larvae Injuring Young Apple Trees: On May 6, Mr. Zappe brought to the insectary some Noctuid larvae found in a nursery in Durham, which has caused much injury to young apple trees by eating off the buds which had been set in the stocks the preceding summer, as shown on Plate XVIII, b. The larvae were plentiful on the ground. On May 12, larvae were scarce, but much injury was evident. Not only had the buds been eaten, but the bark had also been entirely eaten from some of the stocks. The lower leaves of nearby raspberry plants had also been eaten, leaving only the mid-ribs, as shown on Plate XVIII, a. Leaves 12 inches or more above the ground were uninjured. Only nine larvae could be found on May 12, and these were beneath the surface of the soil under newly-injured plants. As there seemed to be two different species of larvae, they were placed in separate rearing cages, and on June 15 adult moths of both species emerged. They proved to be *Agrotis unicolor* Walker (formerly known as *Noctua clandestina* Harris) and *Noctua fennica* Tausch., both species being shown on Plate XVIII, c, and d. One Tachinid parasite emerged from the latter June 7, and has been identified as *Phorocera claripennis* Macq., by Dr. J. M. Aldrich of the U. S. National Museum.

Pears Injured by Quince Curculio: During late August and September, Seckel pears in the writer's home garden dropped heavily before ripening, and usually on one side of each fruit there was a hard flattened area with indication of insect punctures. On cutting open the fruit, small legless grubs were found in cavities between the skin and the core. An examination of these grubs showed them to be curculio larvae. Messrs. Zappe and Stoddard made a trip into eastern New York State during June, and after their return reported much damage to pears during the preceding year from the attacks of the quince curculio, *Conotrachelus crataegi* Walsh. On December 17, 1925, Professor P. J. Parrott, Entomologist of the New York Experiment Station at Geneva, N. Y., gave an address before the Connecticut Pomological Society at Hartford, and from photographs of the injury, he identified it as the work of the quince curculio. Material was gathered and placed in cages in the insectary, but the adults have not yet been reared; they are not expected to emerge until May or June. There is

one generation each season and the grub on leaving the fruit goes into the soil and remains there through the winter. The grub and the appearance of injured fruit is shown on Plate XX, b, and c, of this Report.

The Rose Stem Girdler in Connecticut: On September 8, stems of *Rosa rugosa* were received from Darien, having the peculiar characteristic swellings or galls caused by the rose girdler, *Agrilus viridus*, var. *fagi* Ratz. These stems are shown on Plate XIX, a. On October 14, stems of *Rose hugonis* with similar swellings or galls were received from Norwalk, adjoining Darien. Though no adults have been reared from these stems, the injury so closely resembles that described and figured by Weiss* as occurring in New Jersey, that we have no hesitancy in ascribing it, at least tentatively, to that species, which occurs in Europe and has been recently recorded from New Jersey. The swelling is elongate, and the stem diameter increased sometimes only slightly and in other cases nearly doubled. Sometimes the stem is swollen and enlarged at several places. The adult is said to be a small metallic coppery beetle, about one-third of an inch long, which lays eggs singly on the bark in June and July. The young larva enters the sapwood and makes a series of spiral tunnels close together around the stem for a distance from one to two and one-half inches. The larval period is said to extend over a period of two years and pupation takes place in a cell in the stem from three to six inches above the swelling. Not only does this beetle injure rose, but it is known to attack birch, beech, alder, oak and poplar. The only known remedy is to cut and burn the infested stems in winter or spring before the beetles emerge.

Tobacco Injured by Tipulid Larvae: On June 5, the writer visited a large tent tobacco plantation in Windsor, where some maggot injury (probably seed-corn maggot, *Hylemyia cilicrura* Rond.) had been reported. Many injured plants were found, but no white maggots, though the foreman said that he had found some of them this season. Many of the plants had been injured near the surface of the ground, and the injury was somewhat larger than is usually caused by the seed-corn maggot, as well as being higher up on the side of the stem. There were many "leather jackets" or cranefly (Tipulid) larvae in the surface layer of the soil and we wondered whether or not they were responsible for the injury. A number of empty pupa cases were found protruding from the surface of the ground. Many larvae were collected and brought to the laboratory, and larvae and injured plants

* New Jersey State Department of Agriculture, Bureau of Statistics and Inspection, Circular No. 36, page 9, 1921; Circular No. 48, page 13, 1922.

were photographed. These larvae were placed in a cage outside the insectary and some uninjured plants set in the cage with the larvae, the surface of the soil being kept at the ground level. On June 8, two plants in the cage showed the same form of injury as those collected in the field. On September 9, one adult fly emerged. Adult, larva and injured plant are shown on Plate XIII. This was identified as *Nephrotoma ferruginea* Fabr., by Professor C. P. Alexander of Amherst, Mass. Two or three adults found resting on the tent June 5 proved to be the same species. Apparently this is one of the first records, if not the first, of Tipulid injury to young tobacco plants. According to the Insect Pest Survey Bulletin, Dr. H. T. Fernald observed similar injury to tobacco plants in Hadley, Mass., in June 1925, which he attributed to cranefly larvae.

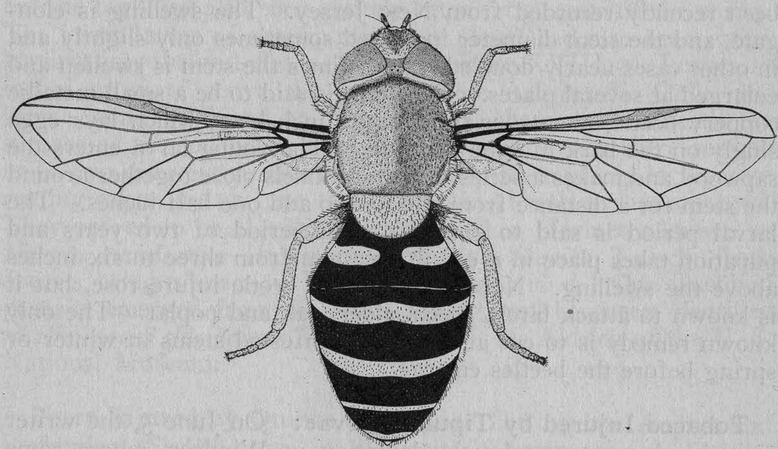


FIG. 50.—Adult Syrphid Fly, *Syrphus torvus*. Enlarged about five times.

Syrphid Eggs and Larvae on Apple: While engaged upon some fruit survey work in the spring of 1925, Mr. E. M. Stoddard and the writer found the eggs of Syrphid flies quite common on the young unfolding apple leaves. (See Plate XIX, c.) They were particularly abundant near colonies of aphids. The eggs are laid singly but frequently two or three could be found on a single leaf. The larvae of these Syrphid flies feed upon aphids. They have often been seen before, but for several years the eggs have not been as abundant as in the spring of 1925. The eggs of this insect were found in the following towns: Wallingford, Wilton, Middlefield, Middletown, Litchfield, Newington, Cheshire, Southington, Washington, Milford, Vernon, Durham and Groton.

Many of the orchards where Syrphid eggs were found were visited again later in the season and aphids had apparently been held in check by this insect; in some cases there were hardly enough aphids to satisfy the appetites of the Syrphid larvae. It was not uncommon to find a twig which bore evidence that many aphids had been present, but had all disappeared, having been eaten by Syrphid larvae, which could be found on the nearby leaves. Frequently a larva could be found in a leaf which had been rolled by a colony of aphids, but the aphids had been nearly all eaten. On April 17, 1925, a number of Syrphid eggs were collected and placed in breeding cages with aphid infested twigs. The eggs hatched and all larvae were full grown by May 9, and began to pupate. Adults began to emerge from the pupae on May 22, and the last one emerged May 27. An examination of the adults proved them to be *Syrphus torvus* O. S., a species which in the larval or worm stage commonly feeds on aphids. The flies themselves do not feed on aphids, but are said to feed on the nectar of flowers. The adult flies look very much like small bees, and are often mistaken for them. This insect was also reared from larvae collected on peach leaves where they were found feeding on aphids. At Cheshire, Hamden and Southington, these larvae were reported to be doing splendid work in checking an outbreak of peach aphids, probably *Myzus persicae* Sulzer. The adult fly is shown in Figure 50.

M. P. ZAPPE.

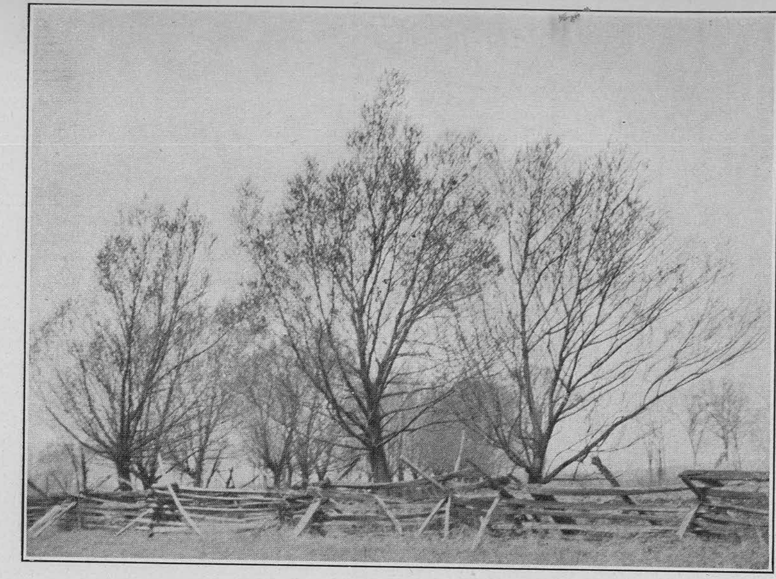
INDEX

PLATE I.

a. Infestation No. 5, Norfolk, 83 egg-clusters.

b. Infestation No. 3, Colebrook

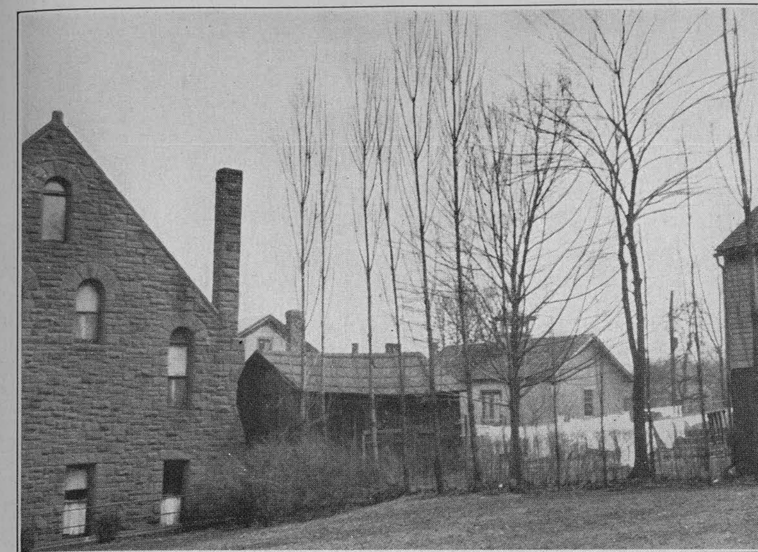
GIPSY MOTH INFESTATIONS.



a. Infestation No. 1, East Granby, 8 egg-clusters on willows.

b. Infestation No. 2, North Canaan, 208 egg-clusters.

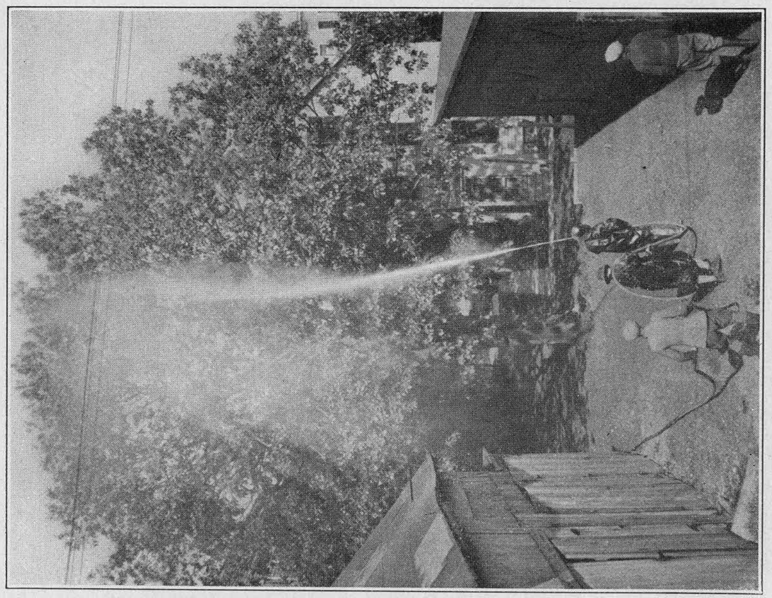
GIPSY MOTH INFESTATIONS.



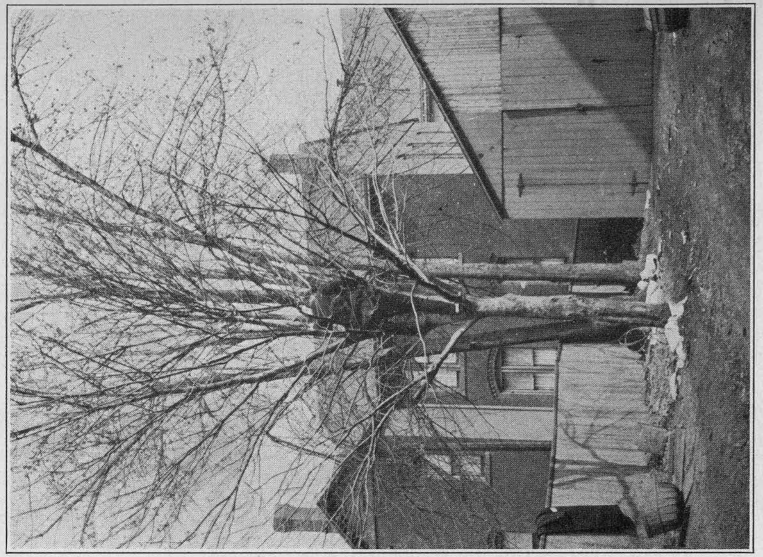
a. Infestation in Meriden, 11 egg-clusters.

b. New Haven infestation, 120 egg-clusters.

GIPSY MOTH INFESTATIONS.

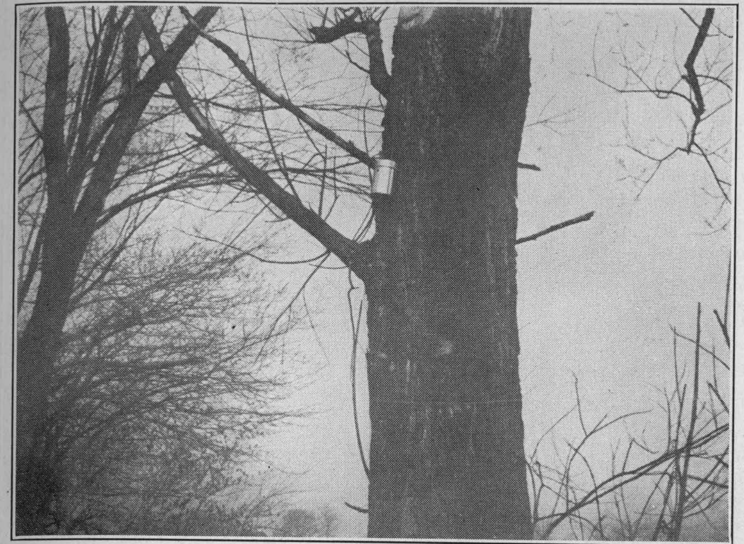


a. Spraying New Haven infestation.

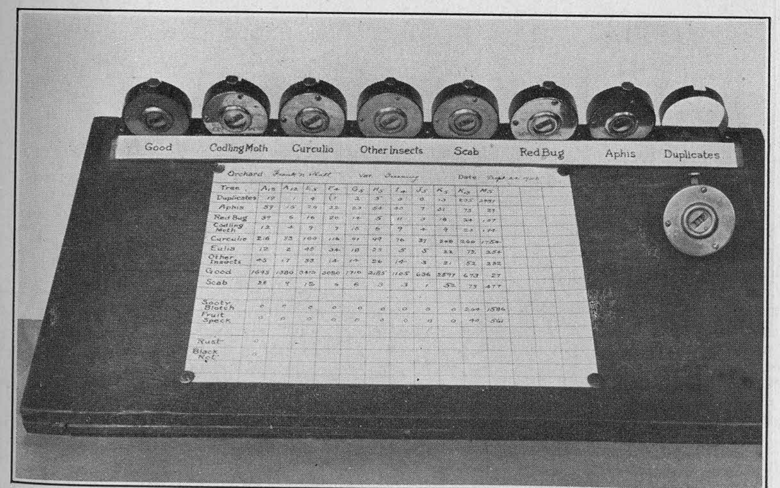


b. Infestation No. 7, Hartford, 4 egg-clusters on maple and fence.

GIPSY MOTH WORK.



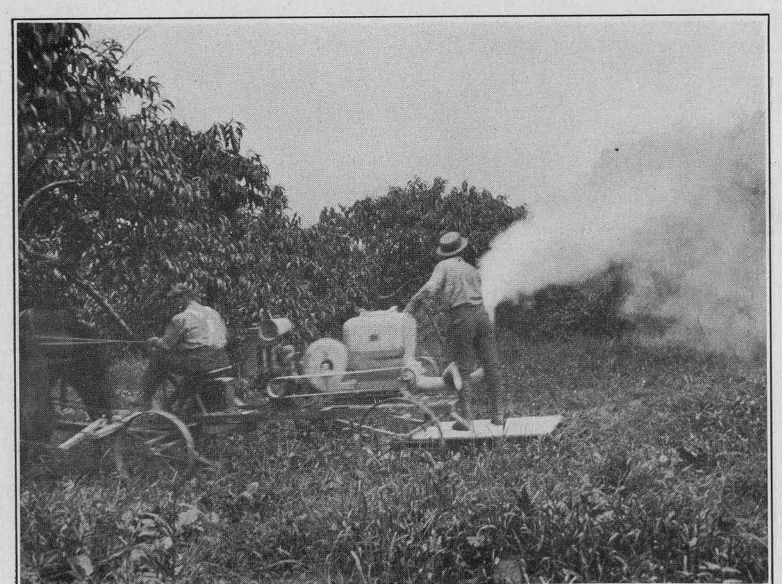
a. Gipsy moth parasite can containing *Anastatus bifasciatus*.



b. Battery of tally meters, with record sheet used in scoring fruit, much reduced.

GIPSY MOTH WORK AND FRUIT SCORING APPARATUS.

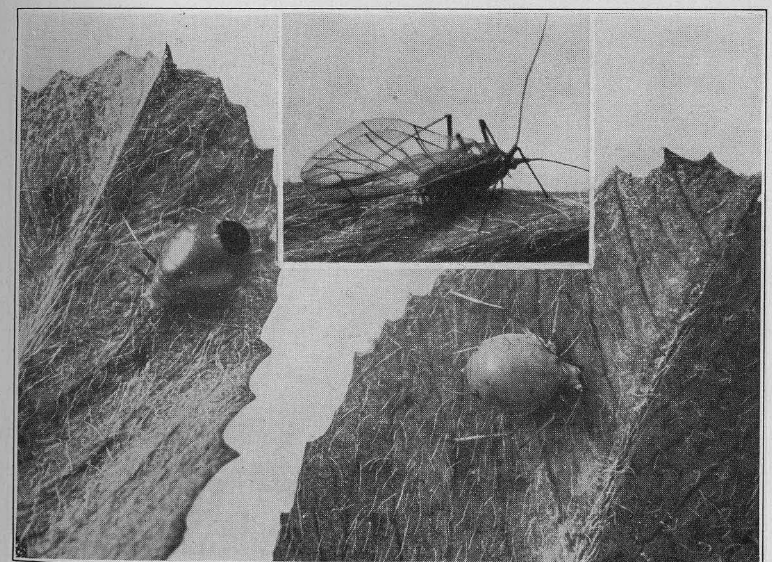
a. Outfit used in spraying peach trees, Conyer's farm, Greenwich.



b. Dusting outfit used at Conyer's farm, Greenwich.

ORIENTAL PEACH MOTH INVESTIGATIONS.

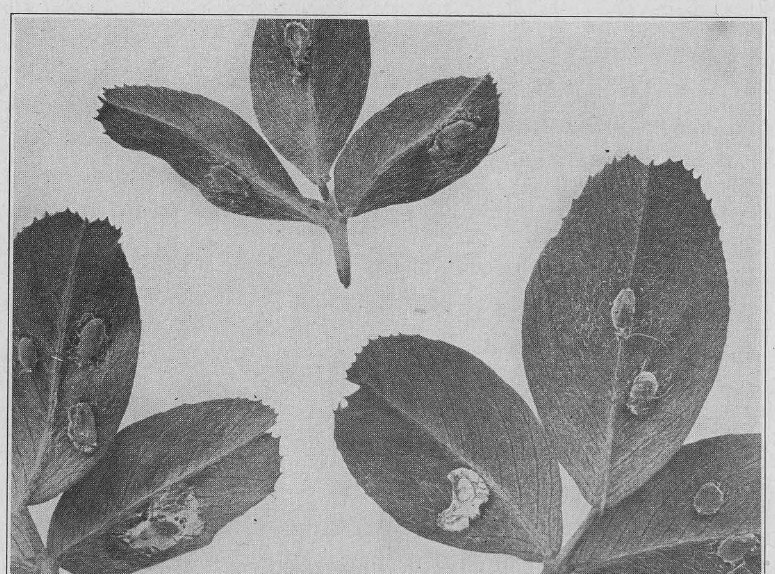
a. Alfalfa plants infested with aphids; two plants at left seriously injured. Somewhat reduced.



b. Wingless aphids killed by parasites, specimen at left showing exit hole of parasite; insert showing winged aphid killed by fungus. All enlarged six times.

PEA APHIDS ON ALFALFA.

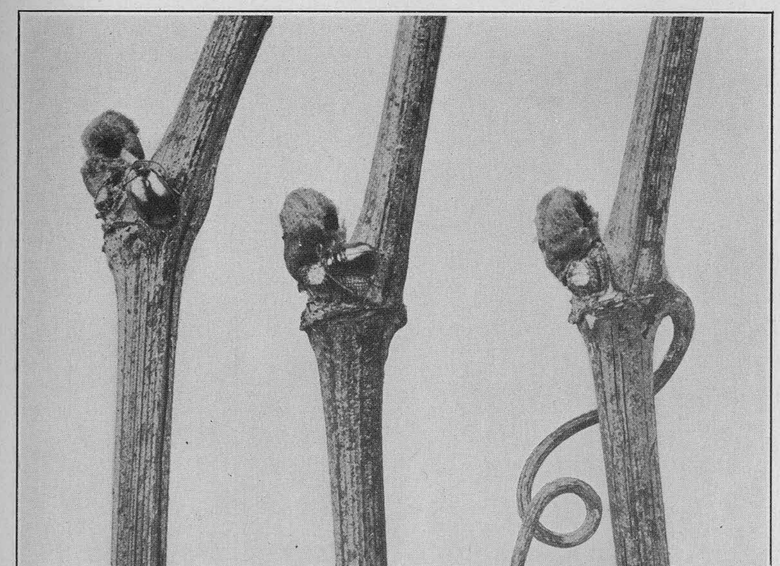
a. Alfalfa shoot showing aphids killed by fungus. Somewhat reduced.



b. Alfalfa leaves showing aphids killed by fungus. Twice enlarged.

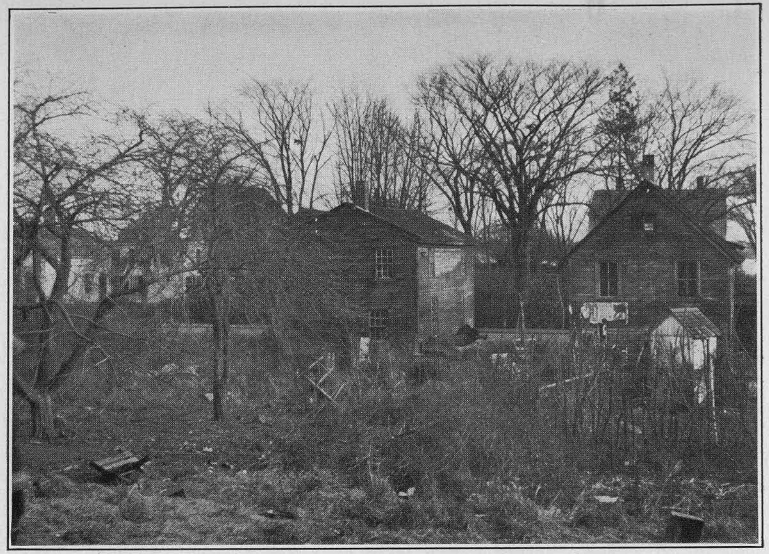
PEA APHIDS ON ALFALFA.

a. Strawberry blossoms, injured by adults of the raspberry fruit worm, natural size.



b. Grape vine buds injured by the grape vine flea beetle, *Altica chalybea,* twice enlarged.

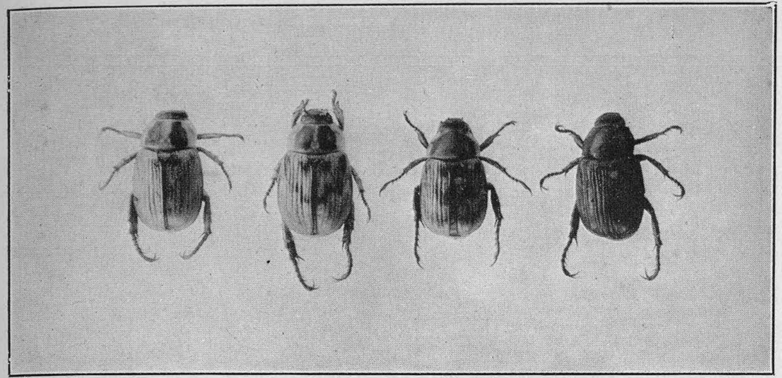
WORK OF RASPBERRY FRUIT WORM AND GRAPE VINE FLEA BEETLE.



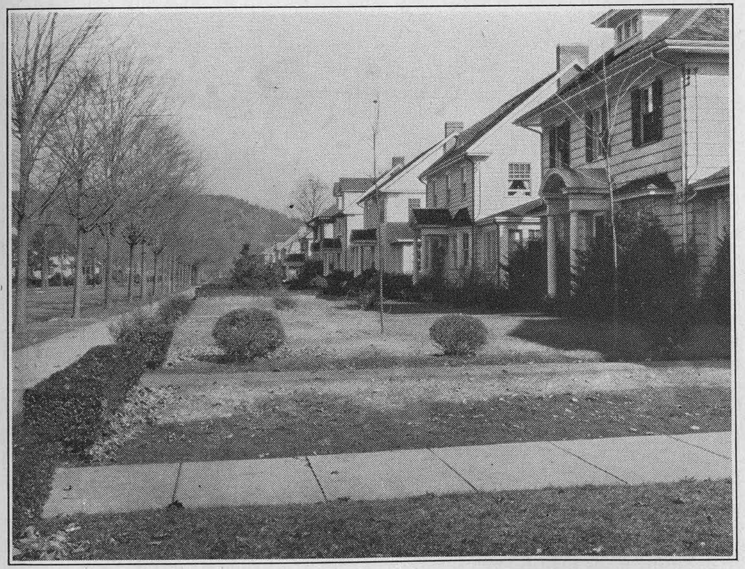
a. Weed area to be burned near infestation, Noank.

b. Burning cornstalks at infestation in Stonington.

EUROPEAN CORN BORER WORK.



a. Adults showing variation from light brown to black, twice natural size.



b. Lawn in Westville (New Haven); dark area shows grass killed by the grubs of the Asiatic Beetle.

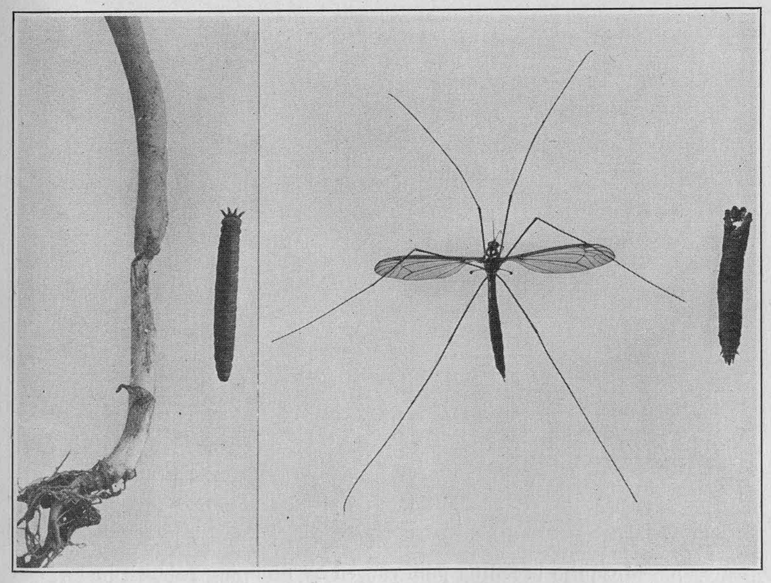
ASIATIC BEETLE.

a. Injury to young plants, natural size.

b. View in tobacco tent where nearly all of the plants have been destroyed by wireworms.

WIREWORM INJURY TO TOBACCO.

a. Injury to plants. Natural size.



b. Adult, larva and pupa skin. Natural size.

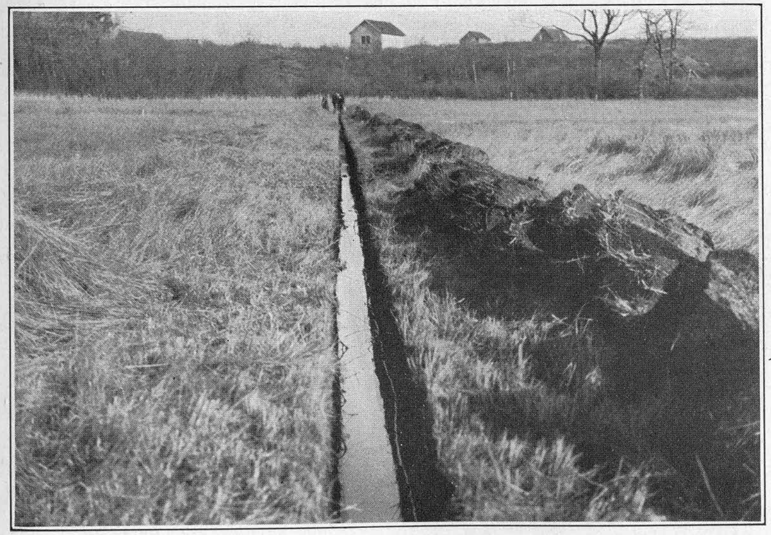
CRANEFLY INJURY TO TOBACCO.

a. A large breeding area caused by the deliberate closing of one ditch.

b. Mosquito breeding pool caused by dumping rubbish in front of roadway culvert.

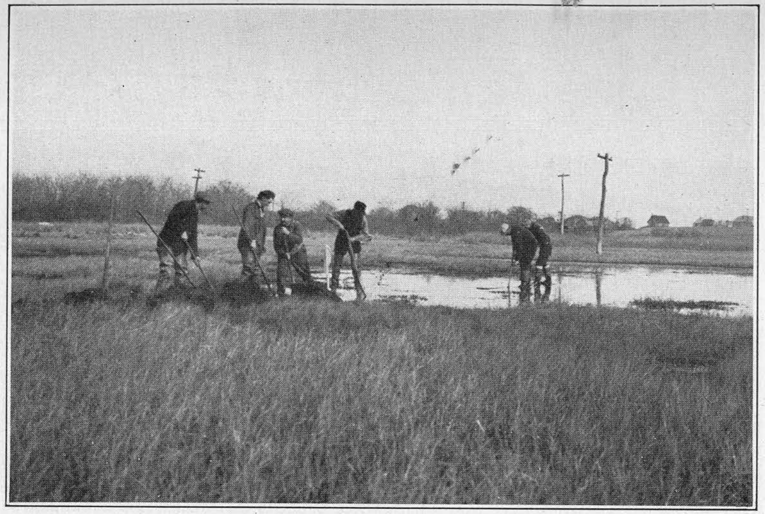
MOSQUITO CONTROL WORK.

a. Sods piled to prevent floating.

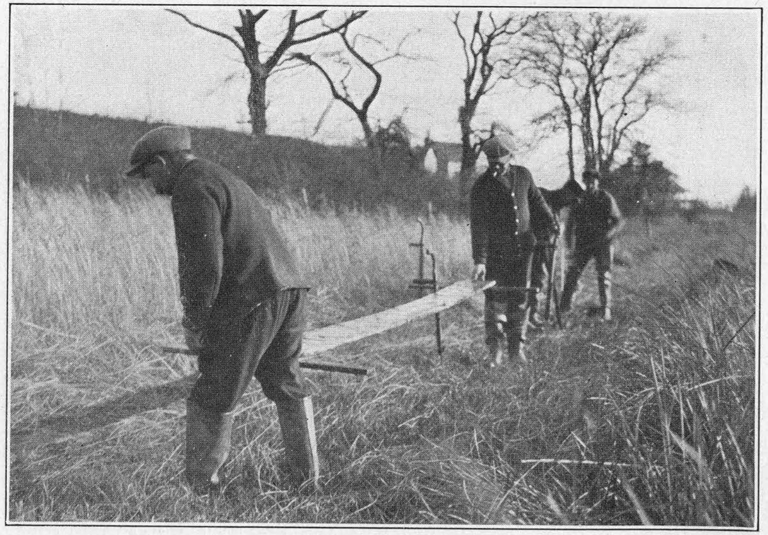


b. Hand cut ditch in salt marsh.

MOSQUITO WORK, WESTBROOK.

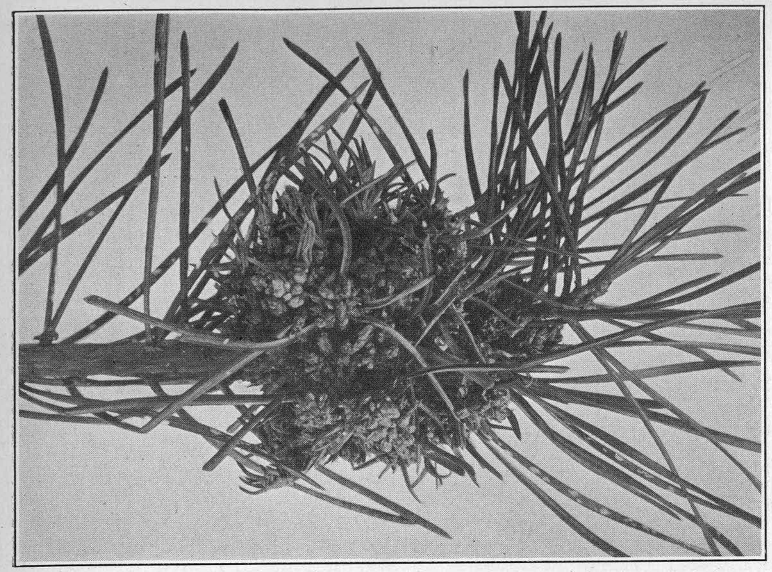


a. Draining salt marsh breeding pool.

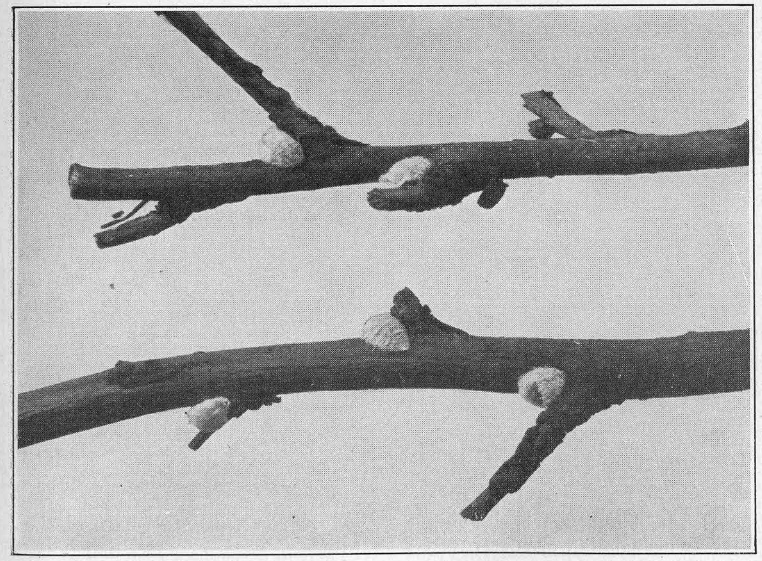


b. Guide board being placed in position for cutting ditch with hay knives.

MOSQUITO WORK, WESTBROOK.



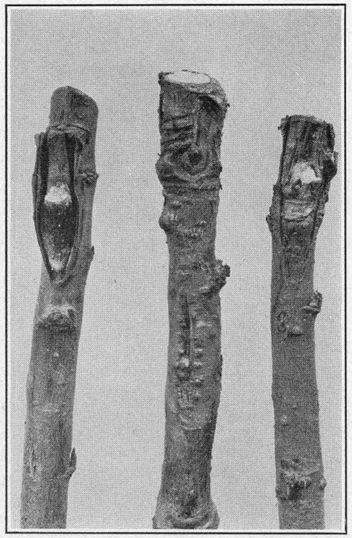
a. Gall of *Eriophyes pini* on Scotch pine, natural size.



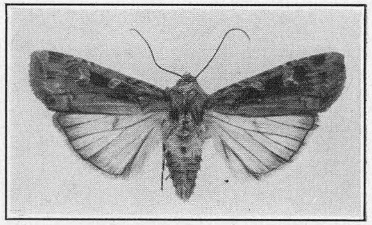
b. *Eriococcus borealis* on *Spiraea salicifolia,* twice enlarged.

MITE AND SCALE INSECT NEW TO CONNECTICUT.

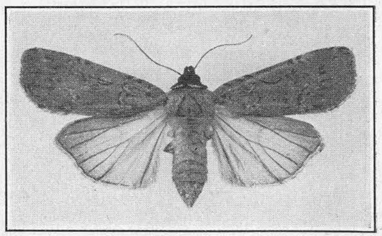
a. Raspberry plants stripped by Noctuid caterpillars.



b. Budded fruit trees, showing where buds were destroyed by Noctuid caterpillars; natural size.

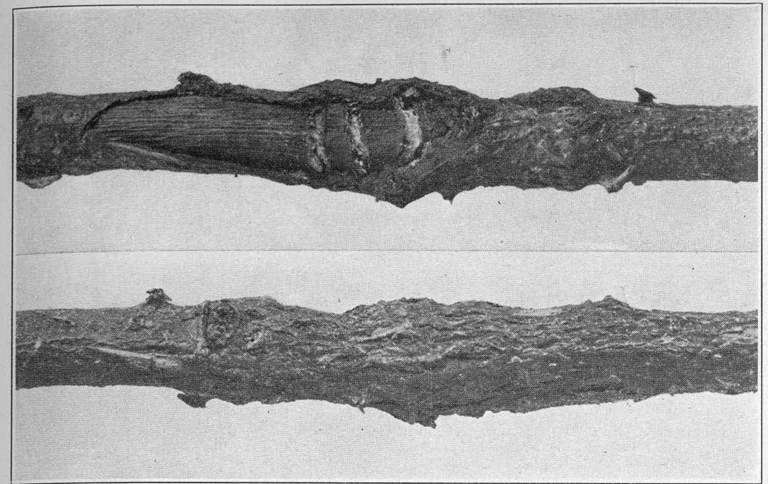


c. *Noctua fennica,* natural size.

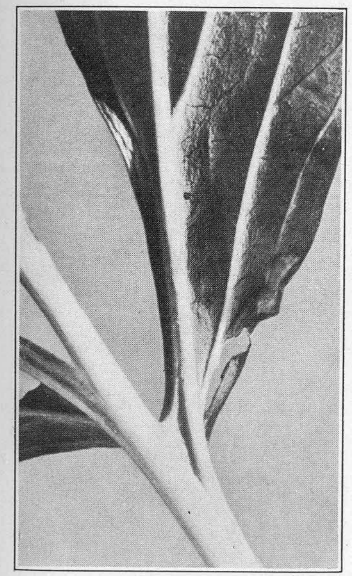


d. *Agrotis unicolor,* natural size.

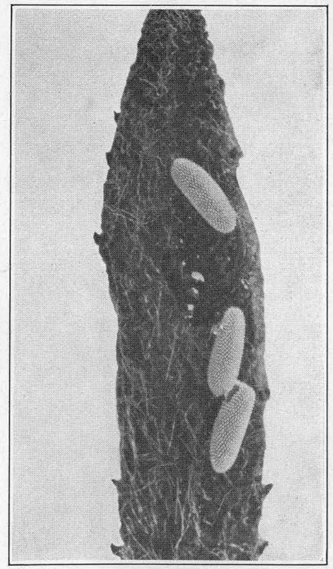
INJURY CAUSED BY NOCTUID LARVAE.



a. Galls of rose stem girdler, *Agrilus viridus* var. *fagi,* twice enlarged.

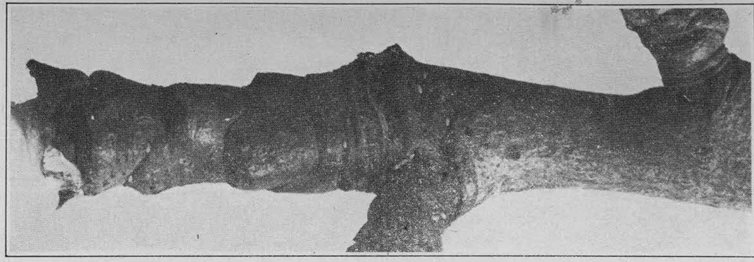


b. Leaf of "Golden Glow" showing on right an egg-blister of the sawfly, *Macrophya simillima,* twice enlarged.



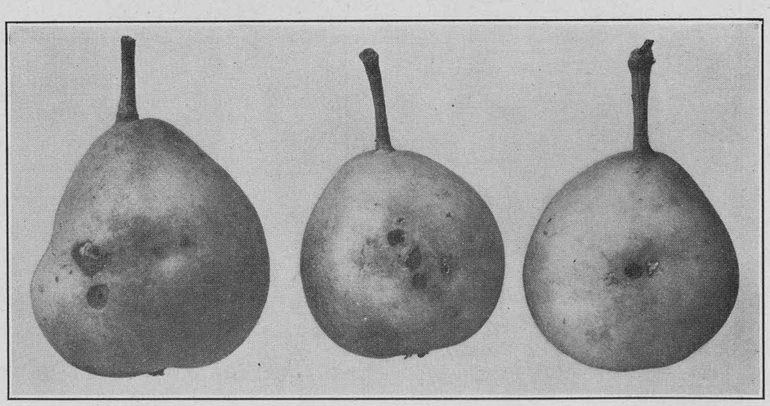
c. Eggs of *Syrphus torvus* on apple, enlarged ten times.

ROSE GALLS AND EGGS OF SAWFLY AND SYRPHID FLY.



a. Eggs of pear psylla on twig, about twice enlarged.

b. Section of Seckel pear infested with quince curculio, showing grubs, natural size.



c. External view of Seckel pears infested with quince curculio; somewhat reduced.

PEAR PSYLLA AND QUINCE CURCULIO.

BULLETIN 276 MARCH, 1926

Connecticut Agricultural Experiment Station

New Haven, Connecticut

The Thirtieth Report on

FOOD PRODUCTS

and the Eighteenth Report on

DRUG PRODUCTS

1925

By

E. M. BAILEY

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

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						
Bread	335	...	...	8	8	...
Carbonated Beverages	336	...	23	...	23	...
Cacao Products	337	3	...	2	5	...
Coffee	337	22	...	...	22	...
"Diabetic," Special and Miscellaneous foods	340	36	6	...	42	...
Eggs	349	...	24	...	24	16
Fats and Oils:						
Butter	350	...	23	...	23	5
Oleomargarine	350	...	3	...	3	1
Lard	350	...	16	...	16	...
Flavoring Extracts:						
Vanilla	352	...	5	...	5	2
Lemon, etc.	352	...	38	...	38	4
Orange	353	...	7	...	7	...
Gelatin	358	7	...	...	7	...
Ice Cream	358	...	405	7	412	3
Meat Products:						
Hamburg Steak	359	...	14	...	14	3
Frankfurts	359	...	16	...	16	11
Bologna, etc.	360	...	3	...	3	3
Pork Sausage	360	...	25	...	25	6
Milk and Milk Products:						
Market Milk	360	...	522	131	653	216[1]
Condensed Milk	361	...	1	...	1	...
Evaporated Cream	361	...	1	...	1	...
Colostrum	363	30	...	...	30	...
Malted Milk	363	1	...	...	1	...
Human	364	...	...	2	2	...
Tea	364	5	...	...	5	...
Vinegar	364	2	2	13	17	2
Miscellaneous	364	...	...	5	5	...
Total		106	1134	168	1408	272

[1] Includes 162 below standard only.

CONTENTS AND SUMMARY—*Concluded.*

The Thirtieth Report on Food Products and the Eighteenth on Drug Products

E. M. Bailey

This report summarizes the work done upon foods and drugs for the calendar year 1925 and includes a few samples of drugs taken in 1924 which could not be examined in time to be included in the report for that year.

As in past years, collaborative work for the Association of Official Agricultural Chemists has been done, the subjects this year being cacao products, vinegar and certain insecticides. The report on cacao products and analytical results on the other materials are reported elsewhere.[1] Coöperation has been continued also with the Council on Pharmacy and Chemistry of the American Medical Association in the examination of foods intended for diabetic dietaries; and the writer, as a member of the Joint Committee on Definitions and Standards, has attended the two meetings of that committee during the year.

Credit for the analytical work herein reported is due entirely to Messrs. Andrew, Shepard, Fisher, Nolan and Mathis. Miss Bacon has assisted materially in preparing this and other reports for publication.

I. FOODS.

Bread.

Eight samples of bread were examined for the County Commissioners of New Haven County, the samples being submitted by Deputy Jailer Baldwin. The breads were from four different bakeries and they were sampled at different times in two lots of four each, under as nearly the same conditions as possible. Analyses and other data obtained are given in Table I.

The loaves, particularly samples 2, 3 and 4, are very uniform in composition as shown by the results obtained at different intervals; and as regards the percentage amounts of food solids, and actual weights of food solids per loaf, the loaves are evaluated in the same order by each series of analyses. Caloric values are not very different, but loaf 3 derives a somewhat greater proportion of calories from protein and fat than the others.

We have no information as to the baking formulas of these products. If some of the breads are made with milk they will be superior to those not so made even though the caloric values are practically the same.

[1] Jour. A. O. A. C. Report of the Proceedings for 1925.

TABLE I. ANALYSES OF BREADS.

Sampler's No.	No. 1 First	No. 1 Second	No. 2 First	No. 2 Second	No. 3 First	No. 3 Second	No. 4 First	No. 4 Second
Station No.	2865	3031	2866	3032	2867	3063	2868	3034
Water	37.01%	38.16%	35.43%	35.78%	36.12%	36.69%	35.34%	34.94%
Ash	1.28	....	1.56	....	2.08	....	1.60	....
Protein (N x 6.25)	9.07	8.59	8.70	8.51	9.89	9.80	9.17	9.08
Fiber	0.17	....	0.14	....	0.16	....	0.17	....
Carbohydrates other than fiber	51.71	....	51.99	....	49.29	....	51.45	....
Fat	0.76	....	2.18	....	2.46	....	2.27	....
Calories per 100 gms.	250.00	....	262.00	....	259.00	....	263.00	....
Solid food material	62.99	61.84	64.57	64.22	63.88	63.31	64.66	65.06
Weight of loaf, ozs.	24.00	25.40	19.50	19.30	20.00	20.20	21.00	20.30
Solid food material per loaf, ozs.	15.10	15.70	12.60	12.40	12.80	12.80	13.60	13.20

CARBONATED BEVERAGES.

Chapter 102, Public Acts of 1925, concerning the manufacture and bottling of beverages provides, among other things, that beverages other than cereal beverages, cider and spring or mineral water, shall have a sugar content of not less than 5 per cent by weight.

Twenty-three samples were submitted by the Dairy and Food Commissioner and the same examined for total solids, sugar and saccharin.

The occurrence of saccharin in this type of products is now very rare and in none of the samples examined was this artificial sweetener found. Sugars were determined by reduction methods before and after inversion, the sugar content being taken as the sum of invert sugar and sucrose. Varying but substantial increases in reduction after inversion were found in all cases. Sugar exceeded 5 per cent in all samples, the highest amount found being 15.7 per cent.

The results are given in Table II.

TABLE II. ANALYSES OF CARBONATED BEVERAGES.

No.	City or Town	Manufacturer	Solids %	Sugar %
26278	*Ansonia*	Crystal Bottling Works	9.42	8.91
26263	*Bristol*	C. E. Perkins Bottling Works	9.66	9.49
26269		Perkins Bottling Works	9.66	9.61
26271		Perkins Bottling Works	10.55	9.82
26270	*Canton Center*	O'Keefe's Beverages, Limited	7.32	7.24
26273	*Hartford*	Bacon Bottling Works	10.82	10.26
26277		Bacon Bottling Works	10.27	9.71
26266	*New Haven*	Kene's Bottling Works	12.60	11.66
26274		Sweeney's Bottling Works	7.45	6.99
26251	*New London*	Nutmeg Bottling Works	11.42	10.87
26256		Purity Bottling Works	12.51	12.87

TABLE II. ANALYSES OF CARBONATED BEVERAGES—*Concluded.*

No.	City or Town	Manufacturer	Solids %	Sugar %
26264	*Stamford*	Silver Spring Water Co.	9.52	9.29
26272	*Torrington*	Fox Bottling Works	10.78	10.89
26254	*Waterbury*	Brass City Bottling Works	16.45	15.65
26253		Brooklyn Bottling Co.	12.17	11.63
26276		Diamond Beverage Corp.	7.90	7.59
26255		Hamilton Bottling Works	13.96	12.47
26261		Puritan Ale Co.	7.87	7.61
26257		Mascola Bottling Works	12.16	11.52
26260		C. Mascola Bottling Works	10.65	10.16
26252		Reiner Bros.	10.23	10.72
26258		Riverside Bottling Co.	13.62	12.93
26275	*Westville*	West Rock Bottling Works	12.83	12.07

CACAO PRODUCTS.

Only two samples of this class of foods were examined. One was Cho-Lay, a product made by the Saville Chocolate Products Co., Pittsburgh, Pa. It contained 7.38 per cent of protein and 7.60 per cent of fat. A more complete analysis of this product was made by us last year.[1] The other was a sample of cocoa submitted by the Hartford Tuberculosis Society to be examined for fat content. The sample contained 15.35 per cent of fat.

In connection with a critical study of the present official and tentative methods of the Association of Official Agricultural Chemists for the analysis of cacao products, complete analyses of a sample of bitter chocolate, of sweet chocolate and of sweet milk chocolate were made by Messrs. Shepard and Mathis. Their results, together with those of other collaborators, will be published elsewhere.[2]

COFFEE, ETC.

Twenty samples of coffee, one of Kaffee Hag, and one coffee substitute were collected by the station agent.

According to the present standard, coffee should contain not less than 10 per cent of fat and not less than 3 per cent of ash. Kaffee Hag is modified coffee, the caffeine being practically eliminated. In other respects, so far as determined, it corresponds to the limits of composition as given for coffee. Sample 454 is a coffee substitute, so labelled, and contains about 50 per cent of pure coffee.

For the determination of caffeine in coffee the Fendler-Stüber is the optional official method. The optional official method for caffeine in tea appears, however, to be equally well adapted to coffee according to the results here reported.

Analysis are given in Table III.

[1] Conn. Exp. Sta. Bull., 267, 428, 1924.
[2] Assoc. Off. Agr. Chemists, Proceedings, 1925.

TABLE III. ANALYSES OF COFFEE, ETC.

Station No.	Manufacturer or Dealer and Brand Name	Soluble Solids	Ash	Fat	Caffeine: Fendler-Stüber Method: Grav.	Caffeine: Fendler-Stüber Method: From N.	Caffeine: Bailey-Andrew Method: Grav.	Caffeine: Bailey-Andrew Method: From N.
	COFFEE.	%	%	%	%	%	%	%
442	Austin, Nichols & Co., Inc., N. Y. *Java and Mocha*	11.48	4.15	14.03	1.39	1.26	1.40	1.28
431	Austin, Nichols & Co., Inc., N. Y. *Sunbeam*	11.17	3.88	15.60	1.24	1.17	1.43	1.21
441	Baker Importing Co., N. Y. *Barrington Hall* Bakerized	11.00	4.15	15.58	1.29	1.21	1.27	1.18
433	Beech-Nut Packing Co., Canajoharie, N. Y. *Beech Nut*	11.50	4.38	14.83	1.42	1.33	1.42	1.34
440	The Wm. Boardman & Sons Co., Hartford. *Boardman's Gold Star*	11.43	4.38	12.10	1.63	1.36	1.58	1.37
411	Brownell & Field Co., Providence, R. I. *Autocrat*	11.10	4.03	14.00	1.25	1.15	1.32	1.18
457	Brown-Thompson & Co., Hartford	10.65	4.08	14.48	1.29	1.21	1.27	1.22
412	Cheek-Neal Coffee Co., N. Y. *Maxwell House* High Grade Coffee	11.48	4.23	14.95	1.37	1.19	1.33	1.19
443	Andrew Davey, Inc., N. Y. *Atlas*	11.18	3.98	14.53	1.37	1.29	1.34	1.28
409	Dwinnell-Wright Co., Boston. *White House*	11.55	4.08	15.10	1.40	1.17	1.37	1.19
424	B. Fischer & Co., Inc., N. Y. *Astor*	10.95	4.25	14.93	1.28	1.14	1.33	1.17
403	Hartford Market Co., Hartford	11.75	4.33	13.78	1.12	1.07	1.25	1.05
420	Francis H. Leggett & Co., N. Y. *Premier*	11.92	4.38	14.70	1.40	1.09	1.38	1.18
413	Lipton's, Hoboken, N. J. *Yellow Label*	11.09	4.25	15.25	1.51	1.16	1.44	1.19
495	Logan Bros. Co., Bridgeport. *Midas Highest Quality*	13.00	4.10	14.58	1.35	1.23	1.27	1.20
417	Logan Bros. Co., Bridgeport. *Mojav*	13.29	4.15	14.45	1.31	1.16	1.30	1.19

TABLE III. ANALYSES OF COFFEE, ETC.—*Concluded.*

Station No.	Manufacturer or Dealer and Brand Name	Soluble Solids	Ash	Fat	Caffeine: Fendler-Stüber Method: Grav.	Caffeine: Fendler-Stüber Method: From N.	Caffeine: Bailey-Andrew Method: Grav.	Caffeine: Bailey-Andrew Method: From N.
	COFFEE—*Continued.*	%	%	%	%	%	%	%
465	Wm. T. Reynolds & Co., Poughkeepsie, N. Y. *Reynolds' Reliance Steel Cut Coffee*	11.55	4.33	14.48	1.26	1.18	1.24	1.17
459	E. Schoenberger & Sons, New Haven. *Ground Coffee*	11.48	4.28	14.50	1.26	1.18	1.32	1.18
444	United States Stores System. *Rex Blend*	10.69	4.05	14.58	1.24	1.16	1.23	1.17
439	R. C. Williams & Co., Inc., N. Y. *Royal Scarlet Brand*	10.95	4.25	13.90	1.24	1.13	1.30	1.17
	Modified Coffee and Coffee Substitute.							
458	E. Schoenberger & Sons, New Haven. *Kaffee Hag*	10.29	4.05	13.58	0.16	0.10	0.20	0.09
454	Hartford Market Co., Hartford. *Coffee Substitute*	11.95	5.48	8.35	0.70	0.62	0.69	0.59

Diabetic, Special and Miscellaneous Foods.

(Analyses are given in Table IV.)

GLUTEN FLOUR, ETC.

Gluten Flour should contain, on the moisture-free basis, not less than 7.1 per cent of nitrogen and not more than 44 per cent of starch.[1] All of the six samples of this type of flour examined met these requirements.

Two samples of Diaban diabetic flour were analyzed. Literature accompanying the samples states that this flour is made from wheat, edible nuts, casein with flavoring and leavening agents. Wheat flour contains 75 to 80 per cent of carbohydrate, whereas the two samples of Diaban diabetic flour contained about 38.5 and 43.0 per cent respectively of this constituent, which is substantially one half the amount generally found in wheat flour.

Jireh "Starch-Treated" flour was not sold as "gluten" flour nor as "diabetic" flour. Whatever "treatment" the flour has undergone it contains practically the same amount of carbohydrate as the average of wheat flours, and over 60 per cent of starch as determined by the diastase method.

NON-NUTRITIVE FLOUR, ETC.

Cellulose flour and Vitae Special Starch-free Bran are both made from the husks of the soy bean. In both of these products the greater part of the carbohydrate belongs to the undetermined nitrogen-free extract and consists chiefly of hemicellulose complexes not generally regarded as a source of danger in the diabetic diet. The term "bran" indicates a cereal product, and generally in human foods, a wheat product. The term "starch-free bran," therefore, in this instance is misleading.

Callard's Washed Bran is free from any determinable amount of starch.

BAKERY PRODUCTS.

Since gluten flours vary greatly in composition, containing from 40 per cent protein (as required by the standard) to 80 per cent, it follows that gluten breads vary according to the flour used. These breads aim to fill a need in the diabetic diet for a bread of relatively low carbohydrate content. This reduction in carbohydrate is effected at the expense of an increase in protein and, when carried to extremes, the greatly increased protein becomes a disadvantage in itself. In advising a patient upon questions of diet the physician will, therefore, need to know the

[1] Circ. 136, Office of the Secretary, U. S. Dept. Agr.

composition of the particular bread in question, and he should keep in mind also the composition of ordinary wheat bread for comparison. On the basis of about 35 per cent of water, ordinary bread contains about 9 per cent of protein and 53 per cent of carbohydrate; or, on the basis of the moisture found in hard (dry) breads, viz., about 5 per cent, 13 per cent protein and 77 per cent of carbohydrate.

Of the gluten breads examined, the soft breads, i. e. those containing approximately 35 per cent of moisture, have a protein content of from 17 to 31 per cent and contain from 24 to 39 per cent of carbohydrate. This is excluding **32805** which does not differ from ordinary wheat bread. The hard (dry) breads contain about 5 per cent of moisture, from 21 to 73 per cent of protein and from 13 to 49 per cent of carbohydrate. The bread which is lowest in carbohydrate, **32810**, contains only 6 per cent of available carbohydrate, as such, but the 73 per cent of protein which accompanies it is a potential source of a very considerable amount of sugar. In the other dry bread, **2337**, the amount of carbohydrate is practically the same as in wheat bread.

The soluble carbohydrate, calculated as dextrose, in products containing agar, **2703** and **1204**, is enhanced somewhat by reducing sugars obtained from that substance after hydrolysis, but which are regarded as indigestible.

The fat content of two samples is high, due in one case, **2337**, to added vegetable oils, and in the other, **3175**, largely to butter.

The baked products of Callard & Co. are in most cases high in fat, which, so far as could be determined, is digestible fat or oil. No evidence of mineral oil was obtained. The "fat" in Nutrivoid Bran Wafers, **1240**, is largely mineral oil and is indigestible. Whether the fat in Cellu products, **1241**, **1242** and **1243** is, in part, due to mineral oil was not determined.

CONFECTIONS AND FRUIT PRODUCTS.

No evidence of mineral oil was found in the confections of Callard & Co. and the fat is, therefore, presumably assimilable. The chocolate creams, **2710**, and Marzipan chocolate, **2706**, contain glycerine according to information furnished by the manufacturer.

Our information from the same source is that the Callard jellies, jams, marmalade and fruit in syrup are packed with from 10 to 45 per cent of glycerine.

TABLE IV. SO-CALLED "DIABETIC," SPECIAL, AND MISCELLANEOUS FOODS.

No.	Manufacturer and Brand	Moisture	Ash	Nitrogen	Protein		Fiber	Nitrogen-free Extract			Fat, Ether Extract
					N x 6.25	N x 5.7		Starch	Sugar as Dextrose	Other N-free Extract	
	Flour, Meals, etc.	%	%	%	%	%	%	%	%	%	%
	Battle Creek Food Co., Battle Creek, Mich.										
31142	Gluten Flour	8.08	0.93	7.57	....	43.15	0.34	36.45	2.88	6.35	1.82
	Callard & Co., London										
2701	Washed Bran	8.60	4.37	1.66	10.38	....	21.48	none	2.31	46.41	6.45
	The Farwell & Rhines Co., Watertown, N. Y.										
31144	Gluten Flour	8.23	0.72	7.38	....	42.07	0.29	37.91	3.08	6.30	1.40
	Jireh Food Company, Inc., Morris Plains, N. J.										
32334	Jireh "Starch Treated" Flour	8.08	1.36	2.14	13.38	....	1.29	60.47	5.48	7.89	2.05
	MacDowell Bros., Ogdensburg, N. Y.										
1290	Diaban Diabetic Flour	6.78	6.46	4.48	28.00	....	2.15	32.06		6.48	18.07
3201	Diaban Diabetic Flour	5.95	6.15	4.17	26.06	....	1.35	28.13	5.04	9.97	17.35
	Potter-Wrightington, Inc., Boston, Mass.										
31143	Gluten Flour, Diet-Ease	7.93	1.18	7.12	....	40.58	0.44	33.58	4.80	8.89	2.60
32884	Gluten Flour, Diet-Ease	7.74	1.76	7.03	....	40.07	0.46	34.88	5.72	6.54	2.83

TABLE IV. SO-CALLED "DIABETIC," SPECIAL, AND MISCELLANEOUS FOODS—*Continued.*

No.	Manufacturer and Brand	Moisture	Ash	Nitrogen	Protein		Fiber	Nitrogen-free Extract			Fat, Ether Extract
					N x 6.25	N x 5.7		Starch	Sugar as Dextrose	Other N-free Extract	
	Flour, Meals, etc.—Concluded.	%	%	%	%	%	%	%	%	%	%
	Pieser-Livingston Co., Chicago, Ill.										
32643	Gluten Flour	8.78	0.89	7.37	....	42.01	0.30	35.33	4.04	6.96	1.69
	The Pure Gluten Food Co., New York City.										
32335	Gluten Flour (Hoyt's)	8.23	0.94	7.56	....	43.09	0.28	34.65	5.76	5.20	1.85
	Vitae Health Food Co., Seattle, Wash.										
2516	Cellulose Flour	9.95	4.18	1.85	11.56	....	32.33	none	3.76	35.42	2.80
2624	Vitae Special Starch-Free Bran	9.75	4.39	3.58	22.38	....	20.98	none	5.80	27.77	8.93
	Bakery Products, etc.										
	Barker System of Bakeries, Hartford, Conn.										
32734	Gluten Bread	38.71	1.91	2.93	....	16.68	0.40	26.38	5.92	6.45	3.55
	Beroth Bread Shop, Hartford, Conn.										
32735	Gluten Bread	33.28	2.65	5.02	....	28.60	0.42	19.04	4.28	7.13	4.60
	Bibeau, Meriden, Conn.										
32805	Gluten Bread	38.87	2.31	1.51	....	8.58	0.92	34.02	7.79	6.13	1.38

TABLE IV. SO-CALLED "DIABETIC," SPECIAL, AND MISCELLANEOUS FOODS—*Continued.*

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
	Bakery Products, etc.—Continued.	%	%	%	%	%	%	%	%	%	%
	Callard & Co., London.										
2703	Bran and Agar Biscuits ("Cellulon")	10.15	4.51	1.75	10.94	....	15.93	none	10.90	40.57	7.00
2709	Chocolate Biscuits ("Casoid")	4.30	4.25	3.68	23.00	....	2.00	5.44		9.43	51.58
2702	Starchless Ginger Biscuits	3.83	3.41	4.38	27.38	....	1.28	none	2.68	4.49	56.93
	Chicago Dietetic Supply House.										
1244	Bran Agar Agar Wafers	5.85	7.32	1.91	11.94	....	13.10	trace	8.24	47.86	5.69
1243	Cellu Bran Wafers	4.28	4.17	0.66	4.13	....	21.50	none	3.05	38.63	24.24
1241	Cellu Cheese Wafers	3.48	3.21	1.24	7.75	....	21.15	none	2.31	31.46	30.64
1242	Cellu Chocolate Wafers	4.08	3.43	1.04	6.50	....	19.18	2.11	1.44	34.93	28.33
	Community Bake Shop, Norwich, Conn.										
32800	Gluten Bread	33.37	2.37	5.42	....	30.88	0.51	18.33	3.99	5.76	4.79
	Fougeron, Paris.										
2337	Pain Anti-diabétique	6.75	2.95	3.34	20.88	....	0.48	34.34	9.04	5.51	20.05
	Hallinan's Bakery, New Britain.										
32728	Gluten Bread	33.40	1.97	4.83	....	27.54	0.46	19.30	4.08	7.50	5.75

TABLE IV. SO-CALLED "DIABETIC," SPECIAL, AND MISCELLANEOUS FOODS—*Continued.*

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
	Bakery Products, etc.—Concluded.	%	%	%	%	%	%	%	%	%	%
	Keney Tower Bakery, Hartford.										
32811	Gluten Bread	37.79	3.19	3.61	....	20.57	0.34	27.25	2.55	3.29	5.02
	Mory's Bakery, New Haven.										
32736	Gluten Bread	38.30	1.30	4.92	....	28.06	0.18	21.08	2.91	4.30	3.87
	Nutrivoid Diabetic Flour Co.										
1240	Nutrivoid Bran Wafers	4.98	6.33	0.92	5.75	....	8.68	none	4.20	38.98	31.08
	Mrs. Root's Food Shop, New Haven.										
32737	Gluten Bread	35.91	1.00	5.06	....	28.85	0.20	18.93	4.98	5.05	5.08
	Schaeffer Bros., Inc., Middletown										
32807	Gluten Bread	34.22	2.69	4.87	....	27.75	0.43	20.19	4.87	5.32	4.53
	Therapeutic Foods Co., Inc., New York.										
32810	Gluten Bread	5.67	4.59	12.81	....	73.02	0.26	4.67	1.26	6.85	3.68
	Washburn-Crosby Co., Minneapolis.										
3175	Gluten Bread	27.23	3.71	4.13	....	23.56	2.26	8.66	1.58	13.49	19.51

TABLE IV. SO-CALLED "DIABETIC," SPECIAL, AND MISCELLANEOUS FOODS—*Continued.*

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
	Confections.	%	%	%	%	%	%	%	%	%	%
	Callard & Co., London.										
2710	Chocolate Creams ("Casoid")	11.80	2.77	3.48	21.75	....	1.58	4.75		35.80	21.55
2708	Chocolate Peppermints ("Casoid")	12.98	2.66	3.57	22.31	....	1.48	4.06		36.03	20.48
2707	Chocolate Truffles ("Casoid")	5.90	3.43	4.44	27.75	....	1.78	5.19		9.25	46.70
2706	Marzipan Chocolate ("Casoid")	7.50	3.44	3.96	24.75	....	1.70	4.19		21.24	37.18
2704	Ponos Marzipan	13.42	2.38	3.22	20.13	....	2.50	none	3.08	23.83	34.66
2705	Ponos Marzipan (creme de menthe)	9.74	2.63	3.48	21.75	....	1.89	none	2.72	15.91	45.36
	Fruits and Vegetables (Fresh).										
2729	Des Moines Squash	84.42	1.13	0.25	1.55	....	1.56	5.18	3.48	2.58	0.10
2730	Des Moines Squash	87.96	0.83	0.21	1.33	....	1.23	3.77	2.60	2.17	0.11
	Fruits and Vegetables (Canned).										
	Callard & Co., London.										
2712	Cranberries, Callard's Sugarless Fruit	82.24	0.14	0.05	0.31	....	1.00	none	1.33	....	....
2711	Plums, Callard's Sugarless Fruit	76.44	0.17	0.04	0.25	....	0.28	none	1.46	....	....
	John Sexton & Co., Chicago.										
2629	Alp Rose Refugee Beans (small green)	95.26	0.33	0.17	1.03	....	0.48	0.09	1.35	1.41	0.05
1437	Alp Rose Beets (small)	84.17	0.48	0.20	1.28	....	1.04	0.31	8.08	4.59	0.05

TABLE IV. SO-CALLED "DIABETIC," SPECIAL, AND MISCELLANEOUS FOODS—*Continued.*

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
	Fruits and Vegetables (Canned)—Concl'd.	%	%	%	%	%	%	%	%	%	%
	John Sexton & Co., Chicago.										
2628	Alp Rose Black Cherries	82.60	0.40	0.09	0.56	....	0.19	none	9.95	6.04	0.26
2627	Alp Rose Red Pitted Cherries	86.76	0.34	0.08	0.51	....	0.19	none	6.99	4.94	0.27
2630	Alp Rose Peas (sifted early June)	90.16	0.32	0.42	2.64	....	1.06	2.62	1.55	1.45	0.20
2625	Alp Rose Black Raspberries	87.98	0.39	0.13	0.81	....	2.58	none	3.34	3.83	1.07
2626	Alp Rose Strawberries	93.83	0.30	0.07	0.43	....	0.72	none	2.03	2.37	0.32
1436	Edelweiss Sauer Kraut	93.60	1.77[1]	0.18	1.10	....	0.66	0.08	0.33	2.31	0.15
1438	Alp Rose Spinach	91.94	1.17[2]	0.46	2.87	....	0.65	0.19	0.80	1.92	0.46
1435	Alp Rose Sweet Corn	83.23	0.53[3]	0.34	2.11	....	0.31	2.42	7.85	2.46	1.09
	Washington County Company, Dennysville, Me.										
2031	Aunty's Mountain Cranberries	82.76	0.24	0.08	0.48	....	1.01	none	3.28	11.39	0.84
2030	Aunty's Blueberries	81.35	0.28	0.10	0.66	....	1.53	none	8.04	7.21	0.93

[1] Salt (NaCl), 1.29%.
[2] Salt (NaCl), 0.06%.
[3] Salt (NaCl), 0.04%.

TABLE IV. SO-CALLED "DIABETIC," SPECIAL, AND MISCELLANEOUS FOODS—*Concluded.*

No.	Manufacturer and Brand	Moisture	Ash	Nitrogen	Protein		Fiber	Nitrogen-free Extract			Fat, Ether Extract
					N x 6.25	N x 5.7		Starch	Sugar as Dextrose	Other N-free Extract	
		%	%	%	%	%	%	%	%	%	%
	Jams and Marmalades. *Callard & Co., London.*										
2717	Sugarless Jam (apricot)	61.62	0.43	0.71	3.94[1]	....	0.30	none	3.34	....	....
2714	Sugarless Jam (green gage plums)	60.68	0.39	0.90	5.00[1]	....	0.29	none	2.75	....	....
2715	Sugarless Marmalade (orange)	59.64	0.37	1.04	5.77[1]	....	0.55	none	1.15	....	....
2713	Sugarless Pineapple Jelly	80.44	0.28	1.23	6.83[1]	....	none	none	none	....	....
2716	Sugarless Jam (plum)	67.42	0.33	0.90	5.00[1]	....	0.28	none	1.68	....	....
	Miscellaneous.										
2384	Soy Bean Meal	....	6.63[2]	....	....	....	....	....	....	....	....

[1] Calculated as gelatine—factor N x 5.55.
[2] Lime (CaO), 0.42%; Phosphoric acid (P_2O_5), 1.92%.

EGGS.

Twenty-four samples of eggs were submitted by the Dairy and Food Commissioner, and one sample by the Department of Health of New Haven. The eggs were sold as "fresh eggs" and examinations were made to determine whether they showed the characteristics indicated by that description.

Eight samples were passed as fresh and sixteen were found to be not fresh although in most cases they were edible. In these eggs the air spaces were generally in excess of 1 inch in diameter, yolks were settled in the shell and ammoniacal nitrogen ranged from 1.4 to 3.6 mgms. per 100 gms. of egg, averaging 2.1 mgms.

In those samples which were passed the ammoniacal nitrogen ranged from 0.9 to 1.7 mgms. per 100 gms. and averaged 1.3 mgms. The air spaces were relatively small (less than 1 inch), in all cases.

TABLE V. EXAMINATION OF EGGS.

No.	City or Town	Dealer	Sold for	Remarks
32864	*Ansonia*	M. Gorosko	Cold storage eggs	Not Fresh
32865		A. Remkun	Fresh eggs	Not Fresh
32863		Lesko Dencsko	Fresh eggs	Not Fresh
32877	*Bloomfield*	H. Fairman	Fresh eggs	Not Fresh
29468	*Bridgeport*	E. Tancos	Fresh eggs	Not Fresh
32955	*Colchester*	C. H. Levine	Fresh eggs	Pass.
32951	*Glastonbury*	Joseph C. Tiboni	Fresh eggs	Pass.
32850	*Hartford*	Austin's Market Co.	Fresh eggs	Not Fresh
32956		Antonio Parano	Fresh eggs	Not Fresh
31125		S. Satriano	Western fresh eggs	Not Fresh
31271		West Hill Grocery	Fresh eggs	Pass.
32953	*Moodus*	I. Beckeroff	Fresh eggs	Pass.
32952		M. Elkin	Fresh eggs	Pass.
32954		M. Sonkin	Fresh eggs	Pass.
3111[1]	*New Haven*	Submitted by City Board of Health	Fresh eggs	Not Fresh
32646		A. Malfonte	Fresh eggs	Not Fresh
32957	*No. Westchester*	S. Elkin	Fresh eggs	Pass.
32958	*Rockville*	Sam Sokolor	Fresh eggs	Pass.
32627	*Waterbury*	C. Bencivenga	Fresh eggs	Not Fresh
32628		Eastern Provision Co.	Fresh eggs	Not Fresh
32629		Quality Market	Fresh eggs	Not Fresh
32625		United Meat Market & Groc. Co.	Fresh eggs	Not Fresh
32626		United Meat Market & Groc. Co.	Fresh eggs	Not Fresh
32799	*West Simsbury*	R. A. Fyler	Fresh eggs	Not Fresh

[1] Station No.

Fat and Oils.

Twenty-three samples of butter were examined, eighteen of which were not found adulterated. Four were adulterated by reason of an excess of water or deficiency of fat, or both, and one was short weight.

The water in the adulterated samples ranged from 19.6 to 29.7 per cent. The short weight sample was 1.1 ozs. short of one pound.

Adulterated and misbranded samples are listed as follows:

No.	City or Town	Dealer	Manufacturer	Sold for	Remarks
33063	*Bridgeport*	Oak Hill Dairy	Own make	Sweet butter	Excess water, Low in fat.
32251	*Hartford*	S. Gold	....	Butter	Excess water, Low in fat.
32961		S. Gold	....	Sweet butter	Excess water.
32959	*Moodus*	I. Buckeroff	....	Sweet butter	Short weight.
30573	*New Haven*	A. Gold	Own make	Sweet butter	Excess water.

OLEOMARGARINE.

Two samples of oleomargarine, **31268** and **31269**, made by the Verco Nut Products Co., Providence, R. I., were submitted by the Norwich State Hospital through the office of the Dairy and Food Commissioner. The analyses indicated that both were vegetable margarines.

35078. A sample labelled Higgins Nut Product made by the Higgins Manufacturing Co., Providence, R. I., was examined as follows:

Water 9.8 per cent; fat 87.9 per cent; nitrogen none; salt 2.3 per cent; Reichert-Meissel No. 5.8; Refraction at 40° C.-38.2; Halphen test for cottonseed oil positive; color turmeric.

This analysis is substantially the same as that of a similar product called Nut-z-all made by the same manufacturer and examined by us in 1923,[1] except that no cottonseed oil was detected at that time and the product was not found to be colored. The product has essentially the same composition as the vegetable margarines which we have examined; but it is our understanding that the product is not taxable as oleomargarine under a decision of the Treasury Department. The product, however, is imitation butter as that product is defined in the Statute (Sec. 2449).

LARD.

Sixteen samples of lard were submitted by the Dairy and Food Commissioner and all were passed as genuine. Refraction at 40° C was determined and the Halphen and Belfield-Gladding tests were applied. The melting point of the glycerides were also observed in some cases.

[1] Conn. Exp. Sta. Bull. 255, p. 188.

The list of brands examined is as follows:

No.	City or Town	Local Dealer	Manufacturer
33072	*Bridgeport*	Atlantic & Pacific Groc. Co.	International Provision Co., Brooklyn N. Y.
32739	*Bristol*	Bristol Public Market	Goebel's, New York
32798	*Meriden*	Atlantic & Pacific Tea Co.	....
33073		Atlantic & Pacific Tea Co. ...	Independent Packing Co.
32771		Bushnell's Grocery	Swift & Co.
32770		Economy Grocery Co.	Otto Stahl, New York
32780		Russell Bros.	Armour & Co.
33075	*New Haven*	Long Island Grocery	Federal Packing Co.
33076		People's Market	Morris & Co.
32745	*Plainville*	W. J. Hemingway	Parker, Webb, Detroit, Mich.
32803	*Waterbury*	Atlantic & Pacific Tea Co. ...	Danahy Packing Co., Buffalo
32802		B. M. Freeman	Sperry & Barnes, New Haven
32782	*Wallingford*	Central Market	John Morrello & Co., Boston
32781		Kelman's Market	Wilson & Co.
33069	*Winsted*	J. P. Gagner & Co.	Cudahy Packing Co.
33071		J. A. Redochio	Albany Packing Co., Albany, N. Y.

OLIVE OIL.

Twenty-two samples of olive oil, of which two samples were found to be adulterated with cottonseed oil, were examined for the Dairy and Food Commissioner. Two other samples were tested for the research laboratory of this station.

The official samples examined are listed as follows:

No.	City or Town	Local Dealer	Manufacturer, Importer or Jobber	Remarks
32738	*Bristol*	Bristol Public Market	Rome Importing Co., Italy ..	Passed
32740		A. J. Duval	Jose Ban, Tortosa, Spain....	Passed
32741		D. Nicotera	Musolino & Berger, Boston..	Passed
32742		D. Nicotera	Alberti Importing & Ex. Co., Boston	Passed
26916	*Hartford*	International Importing Co.	....	Adulterated
26917		International Importing Co.	....	Adulterated
32778	*Meriden*	Dubin Butter Co.	Jose Ban, Tortosa, Spain....	Passed
32779		Dubin Butter Co.	....	Passed
32806	*Middletown*	Main and Washington St. Fruitery	R. C. Williams Co., New York	Passed
32733	*New Britain*	Atlantic & Pacific Tea Co.	....	Passed
32730		Economy Grocery	Lamauro, Azema & Farnan, New York	Passed
32731		Mohican Co.	Austin, Nichols Co., New York	Passed
32732		Mohican Co.	Carmelo Co., New York	Passed
32729		James Spinetta	Parodi, Erminio & Co., Inc., New York	Passed

No.	City or Town	Local Dealer	Manufacturer, Importer or Jobber	Remarks
32801	*Norwich*	R. F. Smith	Los Angeles Olive Growers' Asso., Los Angeles, Cal....	Passed
32743	*Plainville*	W. J. Hemingway	Guglielmo Co., Genovo, Italy	Passed
32744		W. J. Hemingway	R. C. Williams Co., New York	Passed
32746		Modern Market Co.	L. A. Manzie, Worcester, Mass.	Passed
32804	*Waterbury*	Frank Pepe	Frank Pepe, Waterbury, Conn.	Passed
32747	*Willimantic*	F. B. Lombardo	Iwan Berger, Inc., New York	Passed
32748		F. B. Lombardo	Philip Berio & Co., Lucca, Italy	Passed
32749		C. Stomaton	Enrico Ganni Co., Italy	Passed

Flavoring Extracts.

(Analyses given in Table VI.)

VANILLA EXTRACTS.

Five samples of vanilla extract have been examined for the Dairy and Food Commissioner. Four of these, viz., Puritan. Royal Scarlet, Morrow's and Champion brands, were official samples taken in connection with the station's inspection of these products a year ago and the results substantiated those previously reported.[1] Morrow's was adulterated. Sample **33060**, sold for pure extract of vanilla and manufactured by Chas. H. Baldwin and Son, West Stockbridge, Mass., was found to be of substandard quality.

The analysis is as follows:

Lead precipitate, volume of, medium; color of, brown; color of filtrate from, dark brown. Vanillin 0.05 gm/100 cc; coumarin none; solids 34.38; ash 0.22; water-sol. ash 0.17; water insol. ash 0.05; alkalinity of ash 24.5 cc N/10 acid per 100 cc; alk. of sol. ash 15.5 cc; alk. of insol. ash 9.0 cc; acidity of total extract 25.0 cc N/10 alkali per 100 cc; acidity due to vanillin 3.8 cc; due to other than vanillin 21.2 cc; lead number 0.26.

No coumarin was found but the vanillin content is but 1/3 to 1/4 that of an extract of standard quality and the color is largely or in part due to caramel.

LEMON EXTRACT, ETC.

Thirty-eight samples of lemon extract, five samples of terpeneless lemon extract and one of lemon flavor were examined for the Dairy and Food Commissioner. Some of these were composites of two samples of the same brand taken at different sources.

Thirty-one samples of lemon extract equaled or exceeded the required 5 per cent of lemon oil, four were 90 per cent or more of the required standard, and three were less than 90 per cent strength. One sample, **32991**, bore no declaration of net volume and in the duplicate of the same brand the color was questionable. The sample was labelled as being prepared with non-beverage alcohol which may account for the character of the color present. The lemon flavor, **32971**, cnosisted of a mineral oil base with about 5 per cent of lemon oil, and artificial color. Color was declared.

[1] Conn. Exp. Sta. Bull. 267, p. 440.

ORANGE EXTRACTS.

The seven samples examined, all except one being composites, were of standard quality and strength.

TABLE VI. ANALYSES OF FLAVORING EXTRACTS.

Number	City or Town	Dealer	Manufacturer	Oil Per cent.	Refraction of oil 25° (Butyro-refrac.)	Alcohol by vol. Per cent.	Solids Gms. per 100 cc.	Color
		Lemon Extract.						
32870	*Bridgeport*	Bridgeport Public Market..	Baker Ext. Co.	5.3	69.5	80.00	0.130	natural
32761 32972	*Bristol*	L. L. Glasson	F. E. Harris Co.	6.2	69.3	83.36	0.120	"
32754 32895	*Bristol* *Hartford*	North Side Market .... Wm. Boardman & Sons Co.	Wm. Boardman & Sons Co...	5.8	69.0	85.92	0.130	"
32753 32980	*Bristol* *Hartford*	Public Market .... Conn. Grocery Co.	Hallock-Denton Co.	5.6	70.0	82.56	0.260	"
32750 32856	*Bristol* *Branford*	W. A. VanNess .... Charles Reynolds	Schlotterbeck & Foss	9.2	69.0	82.00	0.200	"
32755 32966	*Bristol* *Hartford*	W. B. Woodruff .... The Sisson Drug Co.	The Sisson Drug Co.	5.2	72.0	82.80	0.085	"
32762 32893	*Hartford*	Clark's Market	R. C. Williams & Co.	5.0	69.0	87.60	0.215	"
32769 32891	*Hartford*	G. Fox & Co.	The Belmont Co.	5.2	69.6	84.48	0.100	"
32763 32894	*Hartford*	A. H. Phillips, Inc.	A. H. Phillips, Inc.	5.2	68.8	79.36	0.100	"
32772 32890	*Hartford*	Sage-Allen Co., Inc.	Brewer & Co.	5.2	70.5	89.44	0.105	"
32764 32892	*Hartford*	Tunnell Grocery Co.	Loomis & Wilson Co.	5.1	69.3	88.96	0.135	"
32765 32852	*Hartford*	Tunnell Grocery Co. ...... Austin's Market, Inc.	Williams & Carlton Co.	6.4	70.5	81.92	0.335	"

TABLE VI. ANALYSES OF FLAVORING EXTRACTS—*Continued.*

Number	City or Town	Dealer	Manufacturer	Oil Per cent.	Refraction of oil 25° (Butyro-refrac.)	Alcohol by vol. Per cent.	Solids Gms. per 100 cc.	Color
		Lemon Extract—Con.						
32882	*New Britain*	Miller & Olson, Inc.	Sprague, Warner & Co.	10.8	69.2	78.00	0.815	natural
32883		Miller & Olson, Inc.	Baker Ext. Co.	6.8	69.0	84.00	0.140	"
32631 32793	*New Haven* *Stamford*	Atlantic & Pacific Tea Co...	Atlantic & Pacific Tea Co. ..	4.4	70.0	73.60	0.410	"
33054	*New London*	Atlantic & Pacific Tea Co...	Atlantic & Pacific Tea Co. ..	5.1	70.1	81.28	....	"
32649 32986	*New Haven*	Beirne's Pharmacy	Hance Bros. & White	2.0	70.2	67.60	0.070	"
32648 32857	*New Haven* *Branford*	Economy Grocery .... Economy Grocery	Garrett & Co.	11.4	70.0	80.00	0.280	"
32639 32860	*New Haven*	Grand Union Tea Co.	Grand Union Tea Co.	6.0	70.2	80.40	0.075	"
32640 32875	*New Haven* *New London*	The Mohican Co.	The Mohican Co.	6.2	70.0	80.56	0.090	"
32637 32789	*New Haven* *Westport*	R. J. Smith & Co. .... D. Sachs	Joseph Burnett & Co.	12.8	70.0	80.80	0.320	"
32642 32797	*New Haven* *Stamford*	Van Dyk Co. .... Van Dyk Co.	Van Dyk Co.	9.9	69.3	87.60	0.200	"
32786	*Norwalk*	James Butler, Inc.	James Butler, Inc.	5.7	69.5	88.40	0.100	"
32785	*So. Norwalk*	Andrew Davey, Inc.	Andrew Davey, Inc.	4.8	69.5	81.76	0.095	"
33061	*So. Norwalk*	Andrew Davey, Inc.	Andrew Davey, Inc.	4.7	70.2	82.00	....	"
32879	*Norwich*	The Cloverdale Co.	The Cloverdale Co.	5.7	69.0	87.20	0.140	"
32795	*Stamford*	V. Sessa	Albert Ehlers	6.4	71.5	86.00	0.115	"
32788	*Westport*	Modern Grocery Co.	McCormick & Co.	8.1	69.2	79.20	0.140	"

TABLE VI. ANALYSES OF FLAVORING EXTRACTS—*Continued.*

Number	City or Town	Dealer	Manufacturer	Oil Per cent.	Refraction of oil 25° (Butyro-refrac.)	Alcohol by vol. Per cent.	Solids Gms. per 100 cc.	Color
32878	*Norwich*	John Jordan	Seeman Bros.	6.3	69.3	79.60	0.370	natural
32633	*New Haven*	Frank Caro	Helwig & Leitch	7.0	71.0	....	....	......
32644 } 32999 }	*New Haven*	Shartenberg's	C. F. Sauer Co.	10.6	70.5	79.20	0.330	natural
32991	*New London*	The Nichols & Harris Co.	Own Make	5.8	70.0	....	0.115	"
			Own Make	6.2	69.3	82.00	....	?
33055	*New London*	The Nichols & Harris Co.	Own Make	6.9	69.9	81.60	....	?
32962	*Torrington*	M. Khoury	C. F. Slade Co.	5.5	69.4	87.20	0.125	natural
33070	*Winsted*	J. B. Nichols	C. F. Slade Co.	4.9	69.9	88.96	....	"
32898	*Winsted*	J. A. Reddocchio	C. H. Baldwin & Son	4.5	69.1	80.80	0.130	"
33059	*Winsted*	J. A. Reddocchio	C. H. Baldwin & Son	4.4	70.2	79.60	....	"
		Terpeneless Lemon Extract						
32899	*Bridgeport*	A. Klein	Ross W. Weir & Co.	0.0	....	45.36	0.260	"
32636 } 32984 }	*New Haven*	White Rose Food Shop; Star Paper Co.	Blackstone Mfg. Co.	trace	....	48.16	3.310	"
32635 } 32992 }	*New Haven*	M. Cretella	Diamond Seal Products Co., Inc.	trace	....	42.40	0.065	"
32634 } 32871 }	*New Haven*; *New London*	B. Dickstein; National Economy Grocery Co.	Boyce Extract Co.	none	....	43.60	0.025	"
32632 } 32794 }	*New Haven*; *Stamford*	T. J. Foley; B. Masone	Morrow & Co.	none	....	53.76	0.110	"

TABLE VI. ANALYSES OF FLAVORING EXTRACTS—*Concluded.*

Number	City or Town	Dealer	Manufacturer	Oil Per cent.	Refraction of oil 25° (Butyro-refrac.)	Alcohol by vol. Per cent.	Solids Gms. per 100 cc.	Color
		Lemon Flavor.						
32971	*Bristol*	W. B. Woodruff	Burrill's	4.8	....	none	80.81	artificial
		Orange Extract.						
32851	*Hartford*	Austin's Market, Inc.	R. C. Williams & Co.	5.6	67.5	85.60	0.680	natural
32630 } 32792 }	*New Haven*	Atlantic & Pacific Tea Co.	Atlantic & Pacific Tea Co.	5.4	67.0	86.00	0.385	"
33052	*New Haven*	Atlantic & Pacific Tea Co.	Atlantic & Pacific Tea Co.	5.4	68.4	86.00	....	"
32647 } 32985 }	*New Haven*	Dingwall Bros.	Van Duzer Extract Co.	6.0	67.0	85.12	0.085	"
32638 } 32859 }	*New Haven*	Grand Union Tea Co.	Grand Union Tea Co.	6.0	67.5	80.40	0.655	"
32645 } 32861 }	*New Haven*	Shartenberg's	Austin, Nichols & Co.	6.6	67.2	80.80	0.125	"
32641 } 32796 }	*New Haven*	Van Dyk Co.	Van Dyk Co.	10.0	67.0	84.48	0.145	"

Gelatin.

Seven samples of gelatin were collected by the station agent and analyses are given in Table VII. Arsenic did not exceed 1 part in 700,000 in any case, the fat and keratin were low, and the products were free from objectionable odor when dissolved in hot water.

Table VII. Analyses of Gelatin.

Sta. No.	Brand	Water	Ash	Nitrogen	Gelatin (N x 5.55)	Fat	Keratin
		%	%	%	%	%	%
475	A. & P. Gelatin	10.03	1.32	16.06	89.13	0.03	0.03
469	Boston Brand Crystal Gelatin	11.02	1.32	15.88	88.13	0.05	0.04
473	Cox's Instant Powdered Gelatin	10.67	1.58	15.86	88.02	0.06	0.05
477	Knox Plain Sparkling Gelatin	10.70	1.36	15.88	88.13	0.15	0.09
489	Peter Cooper's Clarified Gelatin	10.73	3.55	15.42	85.58	0.09	0.07
467	Plain Minute Gelatin ...	10.87	1.67	15.62	86.69	0.07	0.05
482	Plymouth Rock Phosphated Gelatin	7.52	1.96	14.35	79.64	0.11	0.07

Ice Cream.

Four hundred and five samples of ice cream were examined for the Dairy and Food Commissioner. Of the total number only seven samples contained less than the 8 per cent of fat required by the State standard, and four of these were but slightly deficient and were passed. The three which were deficient in substantial amounts were as follows:

			% Fat
31106	*Ansonia*	Purity Confectionery Co.	6.4
31113	*New Haven*	Olympia Candy Co.	6.8
32709	*New London*	College Pharmacy	5.6

The distribution of samples on the basis of fat content is as follows:

Per cent of fat	No. of Samples	Per cent of total 1925	Per cent for 1924	Per cent for 5 yr. period 1919-1923
8.0 to 9.9	69	17.0	17.4	26.1
10.0 to 11.9	140	34.6	24.8	23.2
12.0 and above	189	46.7	55.9	41.1
7.9 and below	7	1.7	1.9	9.6

This summary shows that for the past two years about 80 per cent of the samples examined have contained 10 per cent or more of fat; and about 50 per cent of all samples have contained 12 per cent or more. As compared with the 5 year period previous to 1924 the percentage of fat in ice cream appears to be on the increase.

Seven samples submitted by manufacturers for checking purposes require no special comment.

Meat Products.

All samples of meat products were submitted by the Dairy and Food Commissioner to be examined for the illegal use of cereal, color, or preservatives.

Hamburg Steak.

Of fourteen samples of hamburg steak three were found to contain sulphites and were, therefore, adulterated. The amounts found were equivalent to from 512 to 1144 mgms. of sulphur dioxide per kilo of meat.

These samples were as follows:

No.	City or Town	Dealer or Manufacturer
30567	*Ansonia*.....................	M. Brown & Co.
30562	*New Haven*..................	F. X. Hutmacher
30563	....	F. X. Hutmacher

Frankfurts.

Sixteen samples were examined and eleven found to contain undeclared cereal or other starchy material or undeclared color, or both.

The samples were as follows:

No.	Dealer	Manufacturer	Remarks
	Branford.		
30429	Branford Public Market.	T. J. McNamara, B'gp't	Color undeclared
	Bridgeport.		
30583	Cudahy Packing Co.	....	Color undeclared
30580	T. J. McNamara & Sons	....	Color undeclared
30582	New England Market ...	....	Color undeclared
	Hartford.		
30588	Hartford Center Bologna Co.	Own make	Color undeclared
	Meriden.		
30555	Henry Behrens	Own make	Starch undeclared
30554	M. Frost	T. J. McNamara & Sons, Bridgeport	Starch and color undeclared
	New Haven.		
30449	Carl Roessler	Own make	Color undeclared
	Taftville.		
30585	Otto Czikowsky	Own make	Color undeclared
30586	John Habberle	Own make	Starch and color undeclared
	Willimantic.		
30570	Joe Astmann	Own make	Starch undeclared

BOLOGNA AND BEEF SAUSAGE.

Two samples of bologna contained color which was not declared; and one sample of beef sausage contained cereal without declaration.

No.	City or Town	Dealer or Manufacturer
30581	*Bridgeport*	T. J. McNamara & Sons
30584	*New Haven*	Chas. Hertler
30441	*Bridgeport*	Coyne Bros.

PORK SAUSAGE.

Twenty-five samples of pork sausage were submitted and six were found to contain cereal or other starchy material which was not declared.

The samples were as follows:

No.	City or Town	Dealer or Manufacturer
30568	*Naugatuck*	Naugatuck Public Market
30569		P. Boylan
30411	*New Britain*	Miller & Olsen, Inc.
30419	*So. Manchester*	William Patterson
30445	*Waterbury*	S. Guiffre
30447		Verilante & Perrotti

MILK AND MILK PRODUCTS.

MARKET MILK.

Six hundred and fifty-three samples of milk have been analyzed. Of these 522 were submitted by the Dairy and Food Commissioner, 353 of them being official. One hundred and thirty-one were submitted by producers or consumers.

The results of the official inspection may be summarized as follows:

	No. of samples	Per cent
Not found adulterated	137	38.9
Adulterated by watering	42	11.9
Adulterated by skimming	10	2.8
Adulterated by watering and skimming	2	0.6
Below Standard:		
in solids and solids-not-fat	72	20.4
in solids and fat	3	0.8
in solids, fat and solids-not-fat	87	24.6
Total	353	100.0

The above classification does not at all represent the quality of our general milk supply because, as we have pointed out before, inspection samples very often are taken on complaints from distributors or from local milk inspectors.

Adulterated samples, other than those found to be substandard, are given in Table VIII.

CONDENSED MILK.

30541. A sample of sweetened condensed milk sampled at the plant of the New England Milk Products Co., Hawleyville was found to conform to the standard for condensed milk.

EVAPORATED CREAM.

30576. A sample of Walter Jahn's Evaporated Cream made by the Rico Milk Product Co., E. Troy, Wis., labelled as containing 24 per cent of fat and 31 to 33 per cent of total solids was found to conform to the declaration. It contained 25.2 per cent of fat and 31.5 per cent of solids. So-called "light" cream as obtained in the market contains from 18 to 20 per cent of fat and so-called "heavy" cream contains from 38 to 40 per cent. The term "evaporated" applied to a product containing only 25 per cent of fat is, at least, disappointing.

TABLE VIII. ADULTERATED MILK.

No.	Dealer	Solids	Fat
	Containing Added Water.		
	Bethel.		
30307	Mary Tesch	10.31	3.3
30308	Mary Tesch	10.06	2.8
	Bloomfield.		
30390	Louis Cardellico	11.29	3.5
30391	Louis Cardellico	10.64	3.2
30392	Louis Cardellico	10.66	3.3
	Bridgeport.		
30331	City Dairy Co.[1]	10.08	3.5
31561	City Dairy Co.[1]	10.86	3.3
31573	City Dairy Co.[1]	10.16	2.8
31657	John Turner	10.94	3.8
31658	John Turner	10.52	3.7
	Fairfield.		
29711	John Lucas	10.67	3.2
29709	Joseph Sleszak	10.17	3.1
	Greenwich.		
29733	Stony Wyld Farm ...	9.42	2.6
29734	Stony Wyld Farm ...	9.89	2.7
	Lebanon.		
31353	L. P. Smith	7.68	2.4
	Leonard's Bridge.		
31239	S. Hermowitz	10.07	3.2
	Mansfield Center.		
31336[2]	C. H. Kendall	....	..
31337	C. H. Kendall	7.92	2.4
	New Britain.		
30684	Joseph Scheidler	9.99	3.2
	New Hartford.		
31219	John Bullak	11.12	3.7
	New Milford.		
30322	Ed. Mitchell	11.44	3.9
30323	Ed. Mitchell	10.85	3.1
30327	A. Thompson	9.73	2.4
	Norfolk.		
31208	James Torrant	11.41	4.3
31209	James Torrant	11.36	3.6

No.	Dealer	Solids	Fat
	Containing Added Water—*Concluded.*		
	Northford.		
29882	Mrs. F. J. Buck	10.94	3.8
	Portland.		
31157	C. J. Bengstan	9.16	2.8
31160	Wm. Smoleski	11.48	4.0
31161	Wm. Smoleski	12.00	4.3
	Southbury.		
29878	Geo. Kuhne	10.65	3.0
29879	Geo. Kuhne	11.14	3.3
29880	Raymond Oberstedt ..	8.93	3.0
29881	Raymond Oberstedt ..	6.64	2.0
	Sterling.		
31313	Mrs. Frances Kasputas	10.10	3.0
	Terryville.		
29825	Frank Perkins	8.15	2.5
	Wallingford.		
30464	Wm. Quigley	10.12	3.1
30465	Wm. Quigley	10.58	2.9
	West Haven		
26948	S. J. Sorensen	10.72	3.6
26949	S. J. Sorensen	10.87	3.6
	Westport.		
29729	Wm. S. Daskam	9.05	2.6
29730	Wm. S. Daskam	10.24	3.2
29731	Wm. S. Daskam	10.15	3.0
	Skimmed Milk.		
	Berlin.		
30685	Aziz Milco	10.75	2.5
	Canaan.		
30745	Max Serlin	11.21	2.8
	Eagleville.		
30063	Stanley Trostofsky ..	11.77	2.8
	Fairfield.		
29712	C. L. & W. A. Jennings	11.24	2.8

[1] Sampled from deliveries to the dairy.
[2] Added water indicated. Sample sour.

No.	Dealer	Solids	Fat
	Skimmed Milk—*Continued.*		
	Leonard's Bridge.		
31247	Louis Himilstein	10.71	2.3
31248	Sam Lebetsky	11.14	2.4
31249	I. Lubin	10.50	2.1
	Norwich.		
30092	Joseph Lobe	10.51	2.4
	Plymouth.		
27187	Carl Schrager	10.34	1.8

No.	Dealer	Solids	Fat
	Skimmed Milk—*Concluded.*		
	Shelton.		
31222	J. H. Loverin	9.20	2.0
	Watered and Skimmed.		
	Bridgeport.		
31559	City Dairy Co.[1]	9.93	2.5
	Stepney.		
31470	Steve Gusko	10.19	2.7

[1] Sampled from delivery to dairy.

COLOSTRUM.

Collaborating with the Department of Dairy Husbandry at Storrs, Mr. Fisher has determined the nitrogen distribution in thirty samples of milk and colostrum. Total nitrogen and casein nitrogen were determined by the official methods of the A.O.A.C.; globulin nitrogen and non-protein nitrogen were determined substantially by the procedure suggested by Howe;[1] and albumin nitrogen was obtained by difference. No attempt was made to differentiate between the several globulins cited by Howe. The results are for study in connection with investigations being conducted by the department mentioned.

MALTED MILK.

2463. *Tiffy Malted Milk* made by the Niana Pure Food Co., Waukesha, Wis., was analyzed as follows:

Moisture 3.10 per cent; ash 3.45 per cent; nitrogen 1.35 per cent; equivalent to protein 8.44 per cent (factor 6.25); fiber 0.27 per cent; nitrogen-free extract 77.34 per cent; fat 7.4 per cent. The sample contained no free starch as shown by the iodine test.

[1] Jour. Biol. Chem., 52, 51 et seq. 1922.

HUMAN MILK.

Two samples of human milk were examined for physicians. Analyses:

	1431. %	1441 %
Solids	10.38	12.55
Ash	0.23	....
Protein	1.31	....
Sugar	6.64	....
Fat	2.20	3.88

TEA.

Analyses of a number of typical teas and representative commercial brands of tea together with descriptions of their "cupping" qualities as judged by expert tasters, were reported in a previous bulletin.[1] Similar data on five other samples have been obtained during the past year and the combined results summarized and discussed in an article published elsewhere.[2] Credit for the analytical work involved is due to Messrs. Shepard and Mathis.

VINEGAR.

Two samples of vinegar were submitted by the Dairy and Food Commissioner and thirteen were examined for individuals. Of the two official samples, one was slightly deficient in acidity and the other was below the state standard for solids. According to the revised definition and standard[3] for cider vinegar, however, no numerical limit for solids is recognized.

Two samples were analyzed by Mr. Fisher in collaboration with A. O. A. C. referee on vinegar.

MISCELLANEOUS FOODS TESTED FOR POISONS, ETC.

The following articles, five in number, were submitted through the office of the Dairy and Food Commissioner or otherwise to be examined for poisonous or deleterious substances.

31292. *Tomatoes,* canned. Chemical tests showed no evidence of arsenic and a feeding test on a small animal resulted in no unfavorable symptoms.

32374. *Pie Filler.* No evidence of poisons was found after tests similar to those described in the preceding paragraph.

1188. *Chili Sauce.* The sample was examined for metals only. Iron was present and insignificant traces of zinc and copper were found.

2745. *Water.* The sample contained a considerable amount of sediment consisting largely of iron. No symptoms of poison resulted on feeding the sample to a small animal.

1739. *Caramel.* The sample yielded about 0.9 per cent of ash in which iron was conspicuous.

[1] Conn. Exp. Sta., Bull. 267, p. 458, 1924.
[2] Tea and Coffee Trade Journal, January, 1926.
[3] Food Inspection Decision 193. August, 1924.

II. DRUGS.

The year's work on drugs includes about twenty-five samples left over from the inspection of 1924 and not included in our report for that year. Many of the drugs examined during the past year were purchased on prescriptions.

The samples may be classified as follows:

Tablets, etc., from physicians' stocks	15
Tincture of iodine	1
Lime water	12
Essence of peppermint	9
Prescriptions:	
Potassium iodide	56
Arsenous acid	22
Spirits of ammonia, aromatic	46
Silver preparations, colloidal	92
Proprietary remedies	4
Toilet preparations	4
Turpentine	20
Miscellaneous	22
Total	303

TABLETS, ETC. FROM PHYSICIANS' STOCKS.

The examination of tablets was the feature of last year's work and most of the samples taken have been reported in a previous bulletin.[1]

Many of the products held over from the previous inspection and reported here are complex mixtures in which it is difficult or impossible to detect or determine all of the medicaments claimed because of inadequate methods of analysis. While it was intended to limit the inspection to such products as could be assayed by recognized methods, nevertheless a number of preparations were accepted by the inspector at the request of the

[1] Conn. Exp. Sta. Bull. 267, 1924.

physicians visited for such examination as could be made. Some of these products, therefore, have been "passed" for lack of evidence upon which to base reasonable criticism.

29220. *Cold Laxative.* Stock of Dr. T. F. Rockwell. Manufacturer not stated.

Weights of tablets 6.9 to 7.5, avg. 7.1 grs.
Claimed. Acetanilid 2 gr.; quinine sulphate ½ gr.; camphor ¼ gr.; aloin 1/16 gr.; podophyllin 1/40 gr.; aconite ext. 1/20 gr.; capsicum ¼ gr.; atrophine sulphate 1/2000 gr.
Found. Acetanilid 1.83 gr.; total alkaloids 0.46 gr.; camphor 0.3 gr.; quinine, aloin and capsicum present; podophyllin indicated.
Tablets passed.

29227. *Nephritic Pills.* Chicago Pharmacal Co., Chicago. Stock of Dr. A. S. Brackett, Bristol.

Weights of tablets 11.5 to 13.2, avg. 12.4 grs.
Claimed. Extr. asparagus seed ½ gr.; potassium nitrate 1 gr.; uva-ursi 1 gr.; apocynum 1 gr.; digitalis 1 gr.; fl. ext. cactus ¼ min.
Found. Potassium nitrate 0.91 gr. Glucosides were indicated, but specific color tests for digitalis and apocynum glucosides and for arbutin (uva-ursi) were not obtained owing to interfering color reactions. Alkaloids were not determined. The only official variety of cactus (Cactus grandiflorus N. F. IV) is alkaloid-free.
Tablets passed.

30204. *Infantile Colic Tablets.* Direct Sales Co. Stock of Dr. J. L. Pons, Devon.

Weights of tablets 1.3 to 2.0, avg. 1.8 gr.
Claimed. Paregoric 2 min.; sodium bicarbonate 1 gr.; oil of fennel 1/10 min.
Found. Total alkaloids 0.065 per cent, (morphine from 2 min. paregoric = approx. 0.04 per cent); sodium bicarbonate 1.1 gr., benzoic acid present; anise and fennel indicated.
Tablets passed.

29231. *Cascarine Compound Tablets No. 2.* The Harvey Co. Stock of Dr. A. J. Barker, Torrington.

Weights of tablets 2.0 to 2.4, avg. 2.1 grs.
Claimed. Cascarine, aloin, podophyllin, belladona extr., strychnine and ginger.
Found. Aloin, ginger, strychnine identified; cascara indicated. Total alkaloids 0.47 per cent.

The principal constituents claimed were identified qualitatively. "Cascarine" is the name given to an alleged constituent of cascara but later investigation[1] has disproved the existence of such a constituent.

[1] J. Ind. Eng. Chem., 9, 518.

29977. *Rhubarb and Ipecac Comp. Tablets.* Tailby-Nason Co. Stock of Dr. J. A. Coogan, Windsor Locks.

Weights of tablets 6.9 to 7.3, avg. 7.0 grs.
Claimed. Rhubarb powder 1 gr.; sodium bicarbonate 5 grs.; ipecac powder ⅛ gr.; oil peppermint q. s.
Found. Rhubarb, peppermint and ipecac alkaloids indicated; sodium bicarbonate 4.8 grs.; total alkaloids 0.004 gr.
Tablets passed.

30213. *Rhubarb and Ipecac Comp. Tablets.* Stock of Dr. R. Howland, Stratford.

Weights of tablets 8.6 to 9.2, avg. 8.9 grs.
Claimed. Rhubarb powder 2 grs.; sodium bicarbonate 5 grs.; ipecac powder ¼ gr.; tinctr. nux vomica 5 mins.; oil peppermint q. s.
Found. Rhubarb, ipecac alkaloids and strychnine indicated; peppermint?; sodium bicarbonate 4.6 grs.; total alkaloids 0.007 gr.
Tablets passed.

30205. *Cathartic Compound Tablets.* Direct Sales Co. Stock of Dr. J. L. Pons, Devon.

Weights of tablets 2.1 to 2.6, avg. 2.3 grs.
Claimed. Aloin, extr. colocynth comp., extr. nux vomica, podophyllin, capsicum.
Found. Aloin, capsicum and strychnine. Total alkaloids 0.007 gr.
Tablets passed.

29925. *Strophanthus Comp. Tablets.* Standard Laboratories. Stock of Dr. C. T. Baldwin, Derby.

Weights of tablets 3.1 to 3.5, avg. 3.3 grs.
Claimed. Strychnine nitrate 1/100 gr.; tinctr. digitalis 4½ mins.; tinctr. strophanthus 1 min.
Found. Strychnine nitrate 0.011 gr.; digitalis and strophanthus not identified.
Tablets passed.

29909. *Kara Kara Comp. Tablets.* Daggett and Miller. Stock of Dr. E. R. Kelsey.

Weights of tablets 10.4 to 10.9, avg. 10.6 grs.
Claimed. Kara Kara extr. henbane, extr. cubeb, oil of sandalwood and potassium bicarbonate.
Found. Sandalwood and cubeb indicated. Potassium bicarbonate 66.9%; total alkaloids 0.025 gr.; test for atropine not conclusive.
Tablets passed.

29913. *Tono Effervescent Tablets.* National Drug Co. Stock of Dr. G. W. Eddy, Collinsville.

Weights of tablets 11.9 to 12.9, avg. 12.5 grs.
Claimed. Sodium bicarbonate 10 grs.; papain, pancreatin, ginger and oil of peppermint.

Found. Tablets effervesce in water solution; small amount of phosphate and tartaric acid present, odor of peppermint; sodium bicarbonate 10.2 grs. No action on starch was detected, but protein-digesting power was demonstrated by the methods of Rippetoe[1] indicating the presence of papain.

29976. *Tablets Blaud's Mass.* Tailby-Nason Co. Stock of Dr. J. A. Coogan, Windsor Locks.

Weight of tablets 10.0 to 10.8, avg. 10.5 grs.
Claimed. Blaud's mass 5 grs.
Found. Five grains of Blaud's mass should contain 1 grain of ferrous carbonate. Duplicate assays of these tablets showed averages of 0.20 and 0.28 grain of ferrous carbonate. Total iron calculated as ferrous carbonate 0.45 and 0.46 grain.
Tablets deficient in ferrous carbonate.

30215. *Blaud's Compound Tablets.* G. F. Harvey Co. Stock of Dr. R. Howland, Stratford.

Weights of tablets 7.0 to 7.6, avg. 7.3 grs.
Claimed. Blaud's mass 5 grs.; strychnine sulphate 1/60 gr.; corrosive sublimate 1/80 gr.; arsenous acid 1/50 gr.; capsicum; gentian extr.
Found. Ferrous carbonate 0.9 gr. (Five grains of Blaud's mass should contain 1 gr. of ferrous carbonate); total iron calculated as ferrous carbonate 0.91 gr.; arsenous acid 0.02 gr.; strychnine and mercury present.
Tablets satisfactory so far as tested.

29990. *Aspirin.* Tailby-Nason Co. Stock of Dr. W. E. Hills, Naugatuck.

Weights of tablets 5.4 to 5.8, avg. 5.6 grs.
Claimed. Aspirin 5 grs.
Found. 5.2 to 5.5, avg. 5.4 grs.
Tablets passed.

29232. *Morphine Sulphate Tablets.* Direct Sales Co. Stock of Dr. C. G. Rankin, Glastonbury.

Weights of tablets 0.57 to 0.67, avg. 0.62 gr.
Claimed. Morphine sulphate 1/4 gr.
Found. Morphine sulphate 0.28 to 0.34, avg. 0.31 gr.
Tablets high in morphine sulphate.

29958. *Elixir Peptenzyme.* Reed and Carnrick. Stock of Dr. J. F. Dowling, Hartford.

Claimed. Mixture of salivary, intestinal, peptic and splenic enzymes. Alcohol 16 per cent by volume.
Found. Alcohol 16.6 per cent. Proteolytic activity was demonstrated, but no action upon starch was detected.

[1] J. Ind. Eng. Chem., 4, 517.

Tincture of Iodine.

30575. Sampled from stock of T. F. Bannon, Winsted.

This preparation should contain from 6.5 to 7.5 grams of iodine and from 4.5 to 5.5 grams of potassium iodide, per 100 cc. The sample contained 3.78 grams of iodine and 2.97 grams of potassium iodide, per 100 cc.
Sample was below standard.

Lime Water.

Lime water should contain not less than 0.14 per cent of calcium hydroxide $Ca(OH)_2$ at 25° C.
The samples examined are listed in Table IX.

Table IX. Analyses of Lime Water.

D. C. No.	City or Town	Druggist	Calcium hydroxide found %
30438	*Bethel*	English Drug Store	0.17
30430	*Branford*	The Spalding Co.	0.16
30565	*Fairfield*	The Boyle Pharmacy	0.17
30550	*New Haven*	T. P. Gillespie & Co.	0.39[1]
30551		Wood's Drug Store	0.15
30558	*New London*	Starr Bros., Inc.	0.17
30443	*Milford*	J. H. Barnes	0.18
30579	*New Milford*	Albert Evitts	0.18
30566	*Unionville*	Paul F. Flynn	0.04
30448	*Waterbury*	Apothecaries Hall Co.	0.05
31138		Apothecaries Hall Co.	0.16
30571	*Willimantic*	The Wilson Drug Co.	0.16

Samples 30566 and 30448 are below standard.

Essence of Peppermint.

Essence of peppermint should contain not less than 10 per cent by volume of peppermint oil.
The samples examined are listed in Table X.

Table X. Analyses of Essence of Peppermint.

D. C. No.	City or Town	Druggist	Peppermint oil found %
30553	*Bristol*	The Madden Drug Store	9.67
30437	*Danbury*	Doran's Drug Store	9.87
30435		Kinner & Benjamin	10.50
30433		Simon's Pharmacy	10.40
30444	*Fairfield*	The Boyle Pharmacy	10.40
30560	*Guilford*	F. F. Douden	11.24
32321	*Putnam*	J. A. P. Gagne	2.52
32616	*Union City*	E. J. Sodolosky	10.92
32457	*Winsted*	The City Pharmacy	7.60

Samples 32321 and 32457 are distinctly below standard.

[1] Solution not clear.

Potassium Iodide.

The samples of potassium iodide were purchased on a prescription calling for 3.5 drachms of potassium iodide and sufficient distilled water to make 1 fluid ounce. Such a preparation should contain 45.5 grams of potassium iodide per 100 cc of solution, assuming the U. S. P. standard of purity for potassium iodide, viz. 99 per cent.

The results of the inspection are summarized in Table XI.

The data show that of the 56 samples examined, 27 were within 5 per cent of the strength demanded; 15 were within 10 per cent of that strength and were passed; 14 varied from that strength by more than 10 per cent. In all samples of the last named group the variations were deficiencies except in **32773** which contained an excess of medicament. In sample **32485** the two separate portions of the sample were not alike in concentration; one contained 37.83 per cent of potassium iodide and the other 41.55 per cent, the average being 39.69. This sample was improperly mixed before dispensing. In case of sample **32322**, through a misunderstanding at the time of sale, the druggist explained that the preparation was ⅓ strength which analysis showed it to be.

On the basis of a liberal tolerance, only 75 per cent of the samples examined can be regarded as satisfactory or passable.

Table XI. Analyses of Potassium Iodide.

No.	City or Town	Druggist	Potassium iodide, KI, gms. per 100 cc.	Remarks
32606	*Ansonia*	The Bristol Drug Co. ..	48.15	Pass
32605		McQuade's Drug Store..	34.88	Low
32886	*Bethel*	English Drug Store	41.69	Pass
32855	*Branford*	Williams Drug Store ...	45.25	O. K.
32950	*Bridgeport*	European Pharmacy	47.12	O. K.
32756	*Bristol*	Bristol Pharmacy	45.43	O. K.
32759		Boulevard Pharmacy ..	36.54	Low
32751		Holley's Drug Store ...	42.70	Pass
32896	*Canaan*	Farnum's Drug Store ..	40.62	Low
32897		Freeman Dempsey	42.96	Pass
32451	*Central Village*	Lewis Pharmacy	38.07	Low
32887	*Danbury*	Burn's Drug Store	42.14	Pass
32611	*Derby*	The Purdy Drug Co. ...	46.73	O. K.
32306	*East Hartford*	W. B. Noble	45.98	O. K.
32853	*East Haven*	Metcalf's Drug Store ..	47.71	O. K.
32868	*Fairfield*	Clampett's Pharmacy ...	48.27	Pass
32470	*Greenwich*	The Boswell Drug Co. ..	45.29	O. K.
32340	*Hartford*	G. Fox & Co.	48.78	Pass
32309		Griswold Drug Co.	45.64	O. K.
32766		Richard L. Jeffers	34.03	Low
32336		Lamagreas Pharmacy ..	33.42	Low
32767		H. F. Ruby	44.97	O. K.
32452	*Jewett City*	Chas. R. Carey	49.31	Pass
32977	*Manchester*	E. J. Murphy	37.60	Low

No.	City or Town	Druggist	Potassium iodide, KI, gms. per 100 cc.	Remarks
32974	*So. Manchester*	Miner's Pharmacy	37.35	Low
32602	*Milford*	John T. Howes	45.14	O. K.
32773	*New Britain*	Apothecaries Hall	51.84	Excess
32774		City Drug Store	44.42	O. K.
32477	*New Canaan*	Runyon's Pharmacy	44.22	O. K.
32874	*New London*	James Drug Store	45.53	O. K.
32873		Moon Pharmacy	9.65	Low
32784	*Norwalk*	The Bogardus Drug Store	45.36	O. K.
32787		H. Glendenning & Co. ..	46.07	O. K.
32485	*So. Norwalk*	Plaisted's Drug Store ..	39.69	Low
32328	*Norwich*	Broday Pharmacy	47.64	O. K.
32325		Rachbon's Drug Store ..	49.56	Pass
32319	*Putnam*	Edward H. Bust	42.15	Pass
32322		Farley's Pharmacy	15.66	Pass[1]
32978	*Rockville*	Vincent's Pharmacy	46.27	O. K.
32614	*Seymour*	Geo. Smith & Son	44.24	O. K.
32866	*Southport*	Luin B. Switzer	44.16	O. K.
32995	*Southington*	Chaffee's Drug Store ...	44.92	O. K.
32996		Oxley's Drug Store	40.58	Low
32474	*Stamford*	Chas. S. Finch	49.95	Pass
32498	*Stratford*	W. H. St. John & Co. ...	45.61	O. K.
32453	*Taftville*	Benoit's Pharmacy	41.78	Pass
32964	*Thomaston*	Doyle's Drug Store	44.11	O. K.
32963		G. A. Lemmon	32.42	Low
32315	*Thompsonville*	Steel's Corner Drug Store	49.76	Pass
32622	*Waterbury*	W. J. Dunphy	46.31	O. K.
32617	*Watertown*	D. Y. Sullivan	44.86	O. K.
32790	*Westport*	The Westport Drug Co.	38.99	Low
32490	*Willimantic*	The J. J. Hickey Drug Co.	46.18	O. K.
32316	*Windsor Locks*	R. J. Keef	49.61	Pass
32460	*Winsted*	Bannon's Drug Store ...	46.53	O. K.
32455		The Case Drug Store...	44.85	O. K.

[1] Explanation made at time of sale.

Solution of Arsenous Acid.

Fowler's solution, which is a solution of potassium arsenite, is sometimes dispensed, intentionally or otherwise, for this article. Both contain the same amount of arsenic trioxide (As_2O_3), 0.975 to 1.025 per cent, but they are different substances and the one should not be substituted for the other.

The samples examined are listed in Table XII.

Of the 22 samples obtained 10 were satisfactory, or were passed as substantially of the quality and strength demanded. Two, **32888** and **32783**, were not the article called for; one, **32324**, was twice the strength specified in the prescription; and 9 varied from the required strength by more than 10 per cent. Sample **32461** was not properly mixed, one portion containing 0.44 per cent of arsenic trioxide and the duplicate portion 1.27 per cent.

On the basis of a liberal tolerance, only about one-half of the preparations obtained on this prescription were satisfactory or passable.

TABLE XII. ANALYSES OF ARSENOUS ACID.

No.	City or Town	Dealer	As_2O_3 %	Remarks
32862	*Branford*	The Spalding Co.	0.85	Low
32757	*Bristol*	Leroy P. Tucker	0.55	Low
32889	*Danbury*	Kinner & Benjamin	0.97	O. K.
32888		Simon's Pharmacy	0.97	Fowler's solution
32472	*Greenwich*	Finche's Pharmacy	0.90	Pass
32768	*Hartford*	Snyder's Drug Store	0.91	Pass
32346	*Middletown*	Murphey's Drug Store	0.85	Low
32990	*Mystic*	Wheeler's Drug Store	0.91	Pass
32775	*New Britain*	The Dickenson Drug Co.	0.02	Low
32776		Liggett's Drug Store	0.64	Low
32880	*New London*	The Nichols & Harris Co.	1.00	O. K.
32876		Starr Bros., Inc.	0.98	O. K.
32783	*Norwalk*	McNichols Drug Co., Inc.	0.94	Fowler's solution
32327	*Norwich*	The Lee & Osgood Co.	0.96	Pass
32332		James C. Mara	0.89	Pass
32324	*Putnam*	George E. Dresser	2.05	Excess arsenic
32976	*So. Manchester*	J. H. Quinn & Co.	0.72	Low
32618	*Watertown*	Post Office Drug Store	0.87	Pass
32791	*Westport*	The Bridge Pharmacy	0.52	Low
32494	*Willimantic*	Bay State Drug Co.	0.70	Low
32313	*Windsor*	Robert H. Barnes	0.87	Pass
32461	*Winsted*	Albert Decsi	0.86	Low

AROMATIC SPIRITS OF AMMONIA.

Forty-three samples of this preparation were purchased, largely on prescriptions.

Limits for ammonia and oil contents are not stated in the Pharmacopoeia, but calculated from the formula there given, ammonia (NH_3), should be not less than 1.84 gms. per 100 cc and oils should constitute 1.2 per cent by volume. Ammonia is the essential ingredient, oils of lemon, lavendar and nutmeg being added to impart the aromatic character and make the preparation palatable.

A sample prepared in the laboratory according to the directions given in the Pharmacopoeia showed the following composition:

Sp. Grav. at 25° C.	0.8935
Ammonia (NH_3), gms/100 cc.	1.87
Oils, per cent by volume	1.16
Alcohol, per cent by volume	66.08

Results of the inspection are given in Table XIII. It appears that 25 samples are deficient in ammonia by amounts greater than 10 per cent. There are deficiencies in oil also, but only three of these are considerable.

TABLE XIII. ANALYSES OF AROMATIC SPIRITS OF AMMONIA.

No.	Town	Dealer	Manufacturer	Sp. Gr. at 25° C.	Ammonia gms/100 cc.	Oil % by volume	Alcohol % by volume	Remarks
32858	*Branford*	Branford Pharmacy	Sharp & Dohme	0.8925	1.82	0.96	65.36	Pass
32752	*Bristol*	B. L. Benett	Eastern Drug Co.	0.8970	1.66	1.08	64.56	Pass
32758		The Madden Drug Stores	The Madden Drug Stores.	0.8980	1.32	0.76	63.20	Low in ammonia
32760		Rickman's Drug Store		0.9030	1.08	1.08	61.60	Low in ammonia
32993	*Cheshire*	Edson N. Sperry		0.8820	1.58	0.92	69.60	Low in ammonia
32473	*Cos Cob*	Mead's Pharmacy	C. W. Whittlesey Co.	0.8930	1.92	1.08	65.76	Pass
32885	*Danbury*	Doran's Drug Store		0.8785	1.41	0.84	70.72	Low in ammonia
32601	*Devon*	J. L. Maillard Drug Co.		0.8845	0.95	1.00	69.36	Low in ammonia
32307	*East Hartford*	W. B. Noble	Lehn & Fink	0.8970	1.68	1.08	65.20	Pass
32869	*Fairfield*	The Boyle Pharmacy	L. Eisen & Co., Inc.	0.8980	1.73	1.04	63.20	Pass
32867		Randall's Pharmacy		0.8890	1.43	1.00	67.36	Low in ammonia
32998	*Guilford*	Frank J. Douden		0.9110	1.62	0.84	60.80	Low in ammonia
32310	*Hartford*	G. Fox & Co.	The Belmont Co.	0.8990	1.39	0.92	64.80	Low in ammonia
32311		The Sage-Allen Co.	Brewer & Co.	0.8977	1.62	0.68	66.08	Low in ammonia
32312		Albert Steiger, Inc.	The Sisson Drug Co.	0.8860	1.34	1.08	69.92	Low in ammonia
32997	*Madison*	J. Harrison Monroe		0.8930	1.08	0.92	66.00	Low in ammonia
32345	*Middletown*	Lincoln's Drug Store		0.8980	1.76	0.92	63.60	Pass
32604	*Milford*	J. H. Barnes		0.8930	1.92	1.08	66.80	Pass
32987	*Mystic*	Mystic Pharmacy		0.8950	1.55	1.08	65.20	Low in ammonia
31135	*Naugatuck*	Leary's Drug Store		0.8960	1.53	0.92	66.40	Low in ammonia
32478	*New Canaan*	Windt Pharmacy		0.8920	1.60	1.00	66.80	Low in ammonia
32872	*New London*	Downey's Pharmacy		0.9085	2.06	0.96	59.68	Pass
32333	*Norwich*	P. F. Bray	Brewer & Co.	0.8980	1.85	1.24	65.20	Pass
32326		The Lee & Osgood Co.		0.9037	1.39	1.08	63.60	Low in ammonia
32621	*Oakville*	Oakville Drug Co.	Bedeser Pharmical Co.	0.9020	1.48	1.00	64.00	Low in ammonia

Table XIII. Analyses of Aromatic Spirits of Ammonia—*Concluded.*

No.	Town	Dealer	Manufacturer	Sp. Gr. at 25° C.	Ammonia gms/100 cc.	Oil % by volume	Alcohol % by volume	Remarks
33053	*Plainville*	Thrall's Drug Store	....	0.8710	1.19	1.00	73.60	Low in ammonia
32994	*Plantsville*	W. E. Simpson	....	0.8870	1.64	1.00	68.32	Low in ammonia
32979	*Rockville*	Crosby's Pharmacy	Brewer & Co.	0.8935	1.73	1.08	65.20	Pass
32608	*Seymour*	E. J. Barden	....	0.8990	1.48	0.92	64.40	Low in ammonia
32613		Seymour Pharmacy	....	0.8985	1.39	0.92	64.00	Low in ammonia
32609	*Shelton*	Mahoney's Corner Drug Store	....	0.8870	1.70	0.92	68.40	Pass
32975	*So Manchester*	Magnell Drug Co.	Eastern Drug Co.	0.8968	1.88	1.00	64.80	Pass
32482	*So. Norwalk*	Clifford Pharmacy	....	0.8920	1.93	0.92	65.76	Pass
32496	*Stafford Springs*	D. H. McCormack	....	0.8625	1.64	0.92	75.60	Low in ammonia
32495		E. A. Wick's Pharmacy ...	....	0.8990	1.60	0.52	63.20	Low in ammonia
32989	*Stonington*	Burtch Drug Store	Nichols & Harris	0.8960	1.68	1.00	64.56	Pass
32988		J. F. Connors	....	0.9000	1.63	1.00	62.80	Low in ammonia
32499	*Stratford*	Onkey Drug Store, Inc. ..	....	0.8810	2.11	0.84	65.20	Pass
32317	*Thompsonville*	Thompsonville Drug Co. ..	Gibson-Honen, Inc.	0.8933	1.35	1.16	67.20	Low in ammonia
32462	*Torrington*	Charles D. Goodale	C. W. Whittlesey Co.	0.8905	1.90	0.92	65.92	Pass
32624	*Waterbury*	Liggett's Drug Store	....	0.8980	1.79	1.00	64.80	Pass
31134		South End Drug Store	....	0.8962	1.45	1.00	66.40	Low in ammonia
32314	*Windsor*	Edward Prouty	United Drug Co.	0.8978	1.70	0.68	65.36	Pass

Colloidal Silver Preparations.[1]

Colloidal silver preparations are used in medicine to produce germicidal and antiseptic effects when it is desired to avoid astringency and irritation so far as possible. In general, commercial articles of this class are mixtures of silver, silver oxide and silver-protein, all in colloidal form. The products are classified in several fairly well-defined groups, only two of which need be mentioned here, viz., Protargin Mild or the Argyrol type, and Protargin Strong or Protargol type. Each of these groups is represented by a number of commercial products many of which are patented or otherwise protected. So far as experimental or clinical evidence is concerned, there appear to be no significant differences in the therapeutic effects produced by the various preparations of the respective groups. There are, however, considerable differences in the prices charged for these products; thus argyrol, which is perhaps the best known, costs $1.50 per ounce while some of the silver preparations of the same type cost only one-half as much. It has been alleged among druggists that substitution of the cheaper articles for those of higher price is prevalent in retail practice, and the analytical evidence hereinafter given shows that such is the case. There is, however, some reason to believe that the name argyrol has acquired a generic sense; in other words, that the name is associated with, and used to designate, a type of silver preparation rather than a particular brand thereof. Nevertheless, if a physician prescribes argyrol it must be presumed that he wants that particular article; and if protargin mild of some other make and of lower price is supplied, as, and at the price of, the article demanded, the substitute article is technically misbranded and the retailer has profited unduly at the expense of his customer.

As a preliminary to the examination of argyrol and protargol solutions as retailed by druggists, a number of the commercial brands of each type were purchased and examined in 10 per cent and 2 per cent solutions respectively. The results are given in the following tabulation. (Table XIV.)

[1] For fuller discussion of these preparations see New and Non-official Remedies, 1924, p. 337. Jour. Am. Med. Assoc.; also Jour. Am. Pharm. Assoc., 7, 677. 1918.

TABLE XIV. PRELIMINARY ANALYSES OF SILVER-PROTEIN PREPARATIONS.

No.	Brand and Manufacturer	Solids, gms. per 100 cc.	Ash, gms. per 100 cc.	Silver, gms. per 100 cc.	Nitrogen, gms. per 100 cc.	Ratios Ash / Silver	Ratios Nitrogen / Silver
	Prepared in Laboratory.						
	Protargin Mild, 10% solution.						
2651	Argyrol (Barnes)	9.26	3.43	1.97	0.82	1.74	0.42
3208	Argyn (Abbott)	9.21	3.15	2.41	1.02	1.31	0.42
3211	Cargentos (Mulford)	9.10	3.51	2.09	0.84	1.67	0.40
3209	Solargentum (Squibb)	9.63	2.82	1.96	1.21	1.44	0.62
3210	Vargol (Heyden)	9.38	2.72	1.93	1.19	1.40	0.62
	Protargin Strong, 2% solution.						
2634	Protargol (Winthrop)	1.79	0.22	0.15	0.24	1.47	1.60
3207	Protargentum (Squibb)	1.84	0.26	0.16	0.28	1.62	1.75
3206	Proganol (Heyden)	1.84	0.44	0.17	0.19	2.60	1.12
	Purchased from Druggists.						
2632	Argyrol 10% solution	10.47	3.98	2.19	0.92	1.81	0.42
2633	" " "	6.59	2.44	1.38	0.58	1.77	0.42
2652	" " "	8.95	3.36	1.92	0.78	1.75	0.41
2653	" " "	9.38	3.55	1.98	0.84	1.79	0.42
2654	" " "	10.87	3.01	2.36	1.48	1.28	0.63
2655	" " "	8.43	3.15	1.75	0.77	1.80	0.44
2656	" " "	6.43	2.42	1.21	0.57	2.00	0.47
2657	" " "	8.53	3.23	1.83	0.75	1.77	0.41

Protargin mild should contain from 19 to 25 per cent of silver (metallic); and protargin strong should contain from 7.0 to 8.5 per cent of silver (metallic).[1] A ten per cent solution (10 grams in sufficient water to make 100 cc) of protargin mild should contain not less than 1.90 gms. of silver per 100cc and a two per cent solution of protargin strong should contain not less than 0.14 gm. of silver per 100 cc.

From the data given in Table XIV it appears that the silver content of samples of both types of silver-proteins are within the requirements for the respective groups; and that some of the commercial solutions of argyrol were deficient in this respect. Moreover, while the experimental results are based upon only one sample of each of the commercial brands cited, nevertheless the ratios of ash : silver and of nitrogen : silver suggest a basis for some conclusions as to the identity of products within the respective groups. Thus, considering these ratios jointly, Argyn is differentiated from the other four. In the instances of Solargentum and Vargol, the values of these ratios are very different from those of Cargentos and Argyrol; but as between the individuals of either pair, however, the ratios show no conspicuous distinction. Similarly in the protargol group there are certain differences which are significant. It is evident that these ratios depend chiefly upon the character of the protein material used in the manufacture of the several products. Gelatin, albumin, casein and so-called "denatured" proteins are employed.

ARGYROL.

In Table XV are given the analyses of the official samples collected by the Dairy and Food Commissioner, the inspector calling for a 10% solution of argyrol. From these data the following summary can be made.

Of 59 official samples given in Table XV, 46 show ratios for ash : silver and nitrogen : silver which are closely in accord with those found for argyrol, and these samples are, therefore, presumed to be the article called for, or a silver-protein having similar constants.

In thirteen samples the ratios mentioned are widely different in magnitude from those determined for argyrol. The following summaries show the data upon which these conclusions are based.

[1] Limits as given in New and Non-official Remedies. The U. S. P. gives for protargin-strong 7.5 to 8.5 per cent of silver (metallic).

	Ash	Silver	Nitrogen	Ash / Silver	Nitrogen / Silver	Retail price of article, cents per oz.
Passed as argyrol.						
Maximum	4.52	2.57	1.10	1.84	0.45	45
Minimum	2.14	1.19	0.51	1.68	0.39	25
Average	3.40	1.92	0.81	1.77	0.42	31
Not argyrol.						
Maximum	3.16	2.33	1.40	1.64	0.68	63
Minimum	1.27	1.02	0.62	1.25	0.52	23
Average	2.50	1.85	1.11	1.35	0.60	34
Known Solution.						
Argyrol	3.43	1.97	0.82	1.74	0.42	..

It will be noted that the retail price per ounce for the argyrol and non-argyrol samples averages about the same. If two samples are excluded from the non-argyrol group the price range is 23 to 45 cents which would make the range and the averages practically identical for the two groups.

PROTARGOL.

Of the 17 samples collected on request for a 2% solution of protargol, analyses of which are given in Table XV, the ash : silver and nitrogen : silver ratios in five cases vary widely from the values obtained on the experimental sample of protargol in 2% solution. Whether the others are protargol or some product having similar constants, protargentum for example, is not satisfactorily shown. The basis for these conclusions is found in the following data.

	Ash	Silver	Nitrogen	Ash / Silver	Nitrogen / Silver	Retail price of solution, cents per oz.
Passed as Protargol.						
Maximum	0.34	0.20	0.33	1.70	1.80	33
Minimum	0.18	0.13	0.22	1.40	1.41	14
Average	0.26	0.16	0.27	1.59	1.64	21
Not Protargol, or doubtful.						
Maximum	0.37	0.17	0.28	2.64	2.00	38
Minimum	0.06	0.04	0.05	1.10	1.25	23
Average	0.22	0.12	0.20	1.82	1.59	29
Known Solution.						
Protargol	0.22	0.15	0.24	1.47	1.60	..

SUMMARY.

The entire inspection of silver-protein preparations may be summarized as follows:

ARGYROL.

Number of official samples sold as argyrol	59
Number of samples below standard	9
Number of samples below standard and technically misbranded	3
Number of samples technically misbranded	10
Number of samples passed	37

The samples which are below standard in silver are as follows:

		Silver, gms./100 cc.
31147	G. Fox & Co., Hartford	1.64
31149	Apothecaries Hall, New Haven	1.31
32302	W. H. Wood, New Haven	1.66
32304	York Pharmacy, New Haven	1.31
32458	Apothecaries Hall, Winsted	1.64
32476	Jas. J. Cody, New Canaan	1.49
32480	W. H. Jones Drug Store, Stamford	1.49
32488	T. P. Gillespie & Co., New Haven	1.19
32620	Picarrelli Pharmacy, Inc., Waterbury	1.60

The samples which are below standard and technically misbranded are as follows:

		Silver found gms./100 cc.	Ash / Silver	Nitrogen / Silver
31137	E. J. Sodolosky, Union City	1.02	1.25	0.61
32303	Chas. T. Hall, New Haven	1.61	1.34	0.52
32808	Park Pharmacy, Middletown	1.26	1.33	0.61

The samples which are technically misbranded are as follows:

		Ash / Silver	Nitrogen / Silver
31133	Picarrelli Pharmacy, Inc., Waterbury	1.41	0.57
32301	T. P. Gillespie & Co., New Haven	1.29	0.61
32331	H. M. Lerou, Norwich	1.27	0.65
32338	Lamagreas Pharmacy, Hartford	1.26	0.68
32341	Misentis Drug Store, Middletown	1.39	0.57
32479	A. L. Embree, Stamford	1.28	0.58
32347	Hartman Drug Co., Middletown	1.64	0.54
32600	Botsford's Drug Store, Milford	1.44	0.62
32619	Apothecaries Hall, Waterbury	1.31	0.61
32881	E. J. Sodolosky, Union City	1.35	0.60

PROTARGOL.

Number of official samples sold as protargol	17
Number of samples below standard in silver and technically misbranded	2
Number of samples technically misbranded or doubtful	3
Number of samples passed	12

The two samples which are below standard and also technically misbranded are as follows:

		Silver, gms./100 cc.	Ash / Silver	Nitrogen / Silver
31136	E. J. Sodolosky, Union City	0.04	1.50	1.25
32475	McMahon's Pharmacy, Stamford	0.09	2.00	2.00

The samples which are technically misbranded or doubtful are as follows:

		Ash / Silver	Nitrogen / Silver
32469	D. H. McHugh, E. Portchester	2.64	1.64
31132	Buckingham Pharmacy, Waterbury	1.10	1.65
32497	Windham Pharmacy, Willimantic	1.88	1.41

TABLE XV. ANALYSES OF SILVER-PROTEIN SOLUTIONS.

No.	Town	Name	Total solids gms./100 cc.	Ash gms./100 cc.	Silver gms./100 cc.	Nitrogen gms./100 cc.	Ash / Silver	Nitrogen / Silver	Retail price, cents per oz.
		Argyrol, 10% solution.							
32349	*Danielson*	Borrough's Drug Store	9.13	3.37	1.95	0.79	1.73	0.41	30
32450		Woodward's Drug Store	11.13	4.14	2.33	0.96	1.78	0.41	25
32612	*Derby*	The Harding Drug Store	10.06	3.72	2.09	0.91	1.78	0.44	38
32471	*Greenwich*	Greenwich Drug Store, Inc.	9.31	3.53	1.92	0.83	1.84	0.43	33
32339	*Hartford*	Eddie's Pharmacy	10.62	3.93	2.19	0.94	1.79	0.43	33
31147		G. Fox & Co.	7.83	2.96	1.64	0.66	1.80	0.40	30
32338		Lamagreas Pharmacy	10.04	2.50	1.99	1.35	1.26	0.68	23
31145		Lester's Pharmacy	8.25	3.10	1.72	0.72	1.80	0.42	30
31146		Louis K. Liggett Co.	9.33	3.44	1.97	0.80	1.75	0.41	33
32308		O'Connell Drug Co.	9.22	3.48	2.00	0.79	1.74	0.40	25
32318		Wise Smith & Co.	11.41	3.57	2.01	0.91	1.77	0.45	35
32348	*Meriden*	Victor W. Schmelzer	9.90	3.64	2.04	0.87	1.78	0.43	30
32343	*Middletown*	John J. Cronin	8.98	3.30	1.86	0.79	1.77	0.42	45
32347		The Hartman Drug Co.	9.08	3.16	1.93	1.05	1.64	0.54	45
32341		Misentis Drug Store	8.45	2.55	1.83	1.04	1.39	0.57	25
32808		Park Pharmacy	5.95	1.68	1.26	0.77	1.33	0.61	38
32342		C. A. Pelton	8.80	3.26	1.83	0.77	1.78	0.42	33
32600	*Milford*	Botsford's Drug Store	9.34	2.73	1.90	1.17	1.44	0.62	63
32603		Milford Pharmacy	10.16	3.78	2.14	0.89	1.77	0.42	35
32777	*New Britain*	The Brooks Drug Co.	9.74	3.62	2.08	0.87	1.74	0.42	43
32476	*New Canaan*	James J. Cody	7.06	2.61	1.49	0.63	1.75	0.42	45
31149	*New Haven*	Apothecaries Hall	6.22	2.30	1.31	0.55	1.76	0.42	33
31130		De Vita Pharmacy	9.64	3.60	2.00	0.85	1.80	0.43	25
32301		T. P. Gillespie & Co.	9.82	2.67	2.07	1.27	1.29	0.61	50
32488		T. P. Gillespie & Co.	5.98	2.14	1.19	0.54	1.80	0.45	30
32305		The Hall-Benedict Co.	8.59	3.26	1.82	0.73	1.79	0.40	33

TABLE XV. ANALYSES OF SILVER-PROTEIN SOLUTIONS—*Continued.*

No.	Town	Name	Total solids gms./100 cc.	Ash gms./100 cc.	Silver gms./100 cc.	Nitrogen gms./100 cc.	Ash / Silver	Nitrogen / Silver	Retail price, cents per oz.
		Argyrol, 10% solution—Con.							
32303	*New Haven*	Chas. T. Hull	7.01	2.17	1.61	0.84	1.34	0.52	30
32981		Chas. T. Hull	12.43	4.69	2.66	1.12	1.77	0.42	45
32300		Liggett's Drug Store	9.23	3.32	1.91	0.83	1.74	0.43	33
31131		Volpes Pharmacy	8.93	3.37	1.86	0.78	1.81	0.42	25
31148		Wood's Drug Store	9.44	3.52	1.99	0.81	1.77	0.41	40
32302		W. H. Wood	7.79	2.92	1.66	0.67	1.76	0.40	33
32304		York Pharmacy	6.01	2.25	1.31	0.51	1.72	0.39	25
32329	*Norwich*	Broadway Pharmacy	8.88	3.16	1.76	0.80	1.80	0.45	25
32331		H. M. Lerow	11.34	2.93	2.30	1.50	1.27	0.65	25
32320	*Putnam*	W. B. Carroll	9.46	3.53	1.98	0.83	1.78	0.42	33
32323		J. A. P. Gagne	9.80	3.63	2.03	0.86	1.79	0.42	38
32610	*Shelton*	Shelton Pharmacy	9.92	3.68	2.06	0.90	1.79	0.44	25
32483	*So. Norwalk*	Stillson-Powell Corp.	11.06	4.05	2.34	0.99	1.73	0.42	30
32479	*Stamford*	A. L. Embree	9.23	2.62	2.05	1.19	1.28	0.58	25
32480		The W. L. Jones Drug Store	7.52	2.80	1.49	0.65	1.88	0.44	25
32454	*Taftville*	Taftville Pharmacy	10.07	3.79	2.10	0.87	1.80	0.41	33
32465	*Torrington*	Claxton's Pharmacy	10.25	3.80	2.10	0.90	1.81	0.43	33
32463		Opperman's Drug Store	9.07	3.36	1.88	0.81	1.79	0.43	30
32468		Park Pharmacy	9.12	3.42	1.90	0.78	1.80	0.41	38
32467		South End Pharmacy	9.23	3.38	1.96	0.81	1.72	0.41	43
31137	*Union City*	E. J. Sodolosky	4.80	1.27	1.02	0.62	1.25	0.61	33
32881		E. J. Sodolosky	9.58	2.76	2.05	1.22	1.35	0.60	23
32486	*Wallingford*	Moran's Drug Store	9.55	3.49	1.96	0.85	1.78	0.43	30
32619	*Waterbury*	Apothecaries Hall Co.	10.98	3.06	2.33	1.41	1.31	0.61	33
32623		E. H. Georgia	9.78	3.67	2.18	0.92	1.68	0.42	33
31133		Picarelli Pharmacy, Inc.	8.10	2.44	1.73	0.98	1.41	0.57	30
32620		Picarelli Pharmacy, Inc.	7.80	2.87	1.60	0.70	1.79	0.44	21

TABLE XV. ANALYSES OF SILVER-PROTEIN SOLUTIONS—*Concluded.*

No.	Town	Name	Total solids gms./100 cc.	Ash gms./100 cc.	Silver gms./100 cc.	Nitrogen gms./100 cc.	Ash / Silver	Nitrogen / Silver	Retail price, cents per oz.
		Argyrol, 10% solution—Concluded.							
31141	*Whitneyville*	Country Club Pharmacy	8.44	3.12	1.81	0.73	1.72	0.40	25
32492	*Willimantic*	Curran & Flynn	9.20	3.39	1.96	0.80	1.73	0.41	38
32489		The Vigeard Pharmacy	9.66	3.62	2.06	0.84	1.76	0.41	33
32458	*Winsted*	Apothecaries Hall Co.	7.70	2.87	1.64	0.67	1.75	0.41	35
32459		Frank L. Bunnell	12.33	4.52	2.57	1.10	1.76	0.43	25
32456		The City Pharmacy	9.00	3.36	1.89	0.82	1.78	0.43	25
		Protargol, 2% solution.							
32607	*Ansonia*	Buckley's Pharmacy	1.69	0.22	0.13	0.22	1.70	1.70	20
32469	*E. Port Chester*	D. H. McHugh	1.78	0.37	0.14	0.23	2.64	1.64	23
32337	*Hartford*	Lamagreas Pharmacy	1.88	0.30	0.18	0.28	1.67	1.56	33
32344	*Middletown*	United Chemists	1.55	0.18	0.13	0.22	1.40	1.70	25
32330	*Norwich*	Smith's Drug Store	1.88	0.26	0.16	0.27	1.62	1.70	15
32484	*So. Norwalk*	H. A. Mead	1.58	0.22	0.13	0.22	1.70	1.70	20
32481	*Stamford*	Ferguson's Pharmacy	1.95	0.27	0.17	0.27	1.59	1.59	25
32475		McMahon's Pharmacy	1.26	0.18	0.09	0.18	2.00	2.00	25
31136	*Union City*	E. J. Sodolosky	0.42	0.06	0.04	0.05	1.50	1.25	18
32615		E. J. Sodolosky	1.76	0.22	0.15	0.25	1.47	1.67	14
32464	*Torrington*	Collins & Collins	2.24	0.34	0.20	0.33	1.70	1.65	15
32466		Thurlough's Pharmacy	2.29	0.30	0.19	0.30	1.58	1.58	15
32487	*Wallingford*	F. W. Marx	2.36	0.29	0.19	0.28	1.53	1.47	18
31132	*Waterbury*	Buckingham Pharmacy	1.80	0.19	0.17	0.28	1.10	1.65	38
32493	*Willimantic*	Chas. deVillers	1.79	0.24	0.15	0.27	1.60	1.80	30
32491		The Wilson Drug Co.	1.97	0.26	0.17	0.27	1.53	1.60	25
32497		Windham Pharmacy	1.78	0.32	0.17	0.24	1.88	1.41	25

PROPRIETARY REMEDIES, ETC.

GADUOL.[1]

Modifications of cod liver oil, purporting to contain the therapeutic constituents of the oil, have long been offered as proprietary medicines. Some of these have been discussed in a previous report[2] of this laboratory. Because of the demonstrated worth of cod liver oil as a preventative and curative agent for certain nutritional disorders a new interest attaches to preparations of this oil which express or imply vitamine A potency.

Recently a product called "Gaduol" has been subjected to actual feeding tests in comparison with cod liver oil, of ordinary commercial grade; and the biological tests were supplemented with partial chemical analysis of the product. Gaduol is made by, or prepared for, Merck and Co., and is labeled merely as an "alcohol-soluble extract of cod liver oil." Its chief use is apparently as a basis for Wine of Gaduol, but it may have other uses, such, for example, as an ingredient of cod liver oil pills or tablets. No claims are made as to the relative potency of the extract as compared with cod liver oil, but such a comparison at once suggests itself as a matter of interest.

Gaduol is a dark brown, semisolid preparation with a strong fishy odor. Partial analyses of the two samples[3] examined are as follows:

	No. 2547 %	No. 2677 %
Moisture (in vacuum over H_2SO_4 room temp.)	4.73	3.09
Ash	0.92	2.02
Nitrogen	1.38	2.69
Fat (petroleum ether extract)	89.90	77.20

The second sample, **2677**, contains twice as much mineral matter and nitrogeneous material as the first, and distinctly less ether-soluble substances. Recently Epstein and Harris[4] have analyzed an alcohol extract which is typical of gaduol and found 3.18 per cent of total nitrogen with about 65 per cent of free fatty acids and saponifiable fat, and 30 per cent unsaponifiable matter.

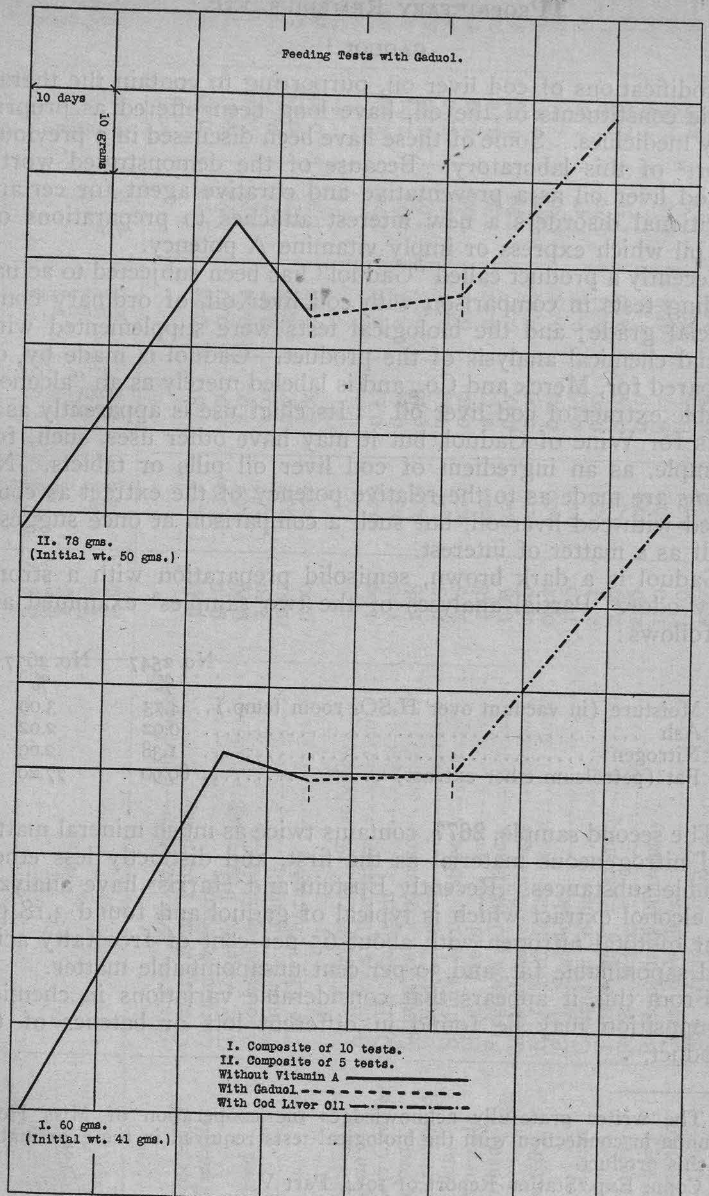
From this it appears that considerable variations in chemical composition may be found in different lots or batches of the product.

[1] The writer gratefully acknowledges the coöperation of Miss Helen Cannon in connection with the biological tests required in the examination of this product.

[2] Conn. Exp. Station Report of 1914, Part V.

[3] One sample was furnished by courtesy of the Bureau of Chemistry, U. S. Dept. of Agriculture. The other was purchased by the Station locally.

[4] J. Am. Pharm. Assoc., 14, 7, 590.



For feeding purposes the well-mixed sample was triturated with starch or yeast powder and the mass rolled into pills. Each pill contained 100 mgms. of gaduol and 200 mgms. of starch or yeast powder. Batches of pills were made at frequent intervals to insure freshness. When the gaduol-yeast mixture was fed, separate yeast rations were unnecessary as each pill contained the daily dosage of yeast ordinarily fed, viz., 200 mgms. The amounts of cod liver oil fed in the recovery (control) period were from one to five drops unmixed. Since the weight of 1 drop of oil was determined to be about 16 mgms., the comparisons are between 100 mgms. of gaduol and from 16 to 80 mgms. of cod liver oil.

The trials were made in two series, ten animals being fed with sample **2547** and five with **2677**. The individual growth curves are not shown, but for each series a resultant curve has been constructed which represents the average of results obtained in the feeding tests. These two curves are shown in the accompanying chart. The curves have been constructed on the basis of the following information:

1 Average of initial weights of animals.
2 Average duration of foreperiod.
3 Average duration of decline preceding foreperiod.
4 Average decline in weight during this period (3).
5 Average weight at beginning of experimental period.
6 Average duration of experimental (gaduol), period.
7 Average gain or loss during experimental period.
8 Average duration of recovery (cod liver oil), period.
9 Average gain during recovery period.

The balancing of gains against losses during the experimental periods results in each series in a slight net increase in weight. The true significance of this is that in some instances considerable gains in weight were made during the early part of the gaduol feeding period, but these gains were not sustained and cod liver oil was substituted for gaduol because of the serious rate of decline, or of other unfavorable symptoms, although body weights were not necessarily below these found at the beginning of the experimental feeding.

Experimental periods were made as long as possible, but in many cases, although body weights did not decline, the animals became so weakened, or the eye conditions became so aggravated, that changes were made to cod liver oil to avoid permanent injury or death of the animals.

During the periods of gaduol feeding the hemorrhagic condition of the eyes became aggravated in some cases and in others temporary improvement was noted. What appeared to be a permanent clearing of the eyes was noted in only one case but in this instance the symptoms were not very marked at any time. During the recovery period normal eye conditions were restored except in two cases where the injury (plaques) sustained during gadul feeding was of a permanent character.

The tests on the whole show that, from the standpoint of Vitamine A potency, gaduol is distinctly inferior to the straight cod-liver oil used as a control.

1545 and D. C. **30590**. *Chief Two Moon Bitter Oil.* The Chief Two Moon Herb Co., Waterbury, Conn. This preparation is described as "the wonder laxative tonic." No curative claims are made for the product; but in accompanying literature it is stated that the medicine, by keeping the organs of the body in good condition, defends against rheumatism, pneumonia, tuberculosis, and a number of other ailments. This language is fairly conservative, but the mention of specific diseases, especially tuberculosis, is objectionable.

The preparation was found to consist of about 95 per cent of mineral oil and 5 per cent of dilute alcoholic solution of vegetable bitters, chiefly aloes. On the basis of the entire mixture the amount of alcohol present was about 1 per cent. The medicine is essentially a laxative with probably some tonic properties due to the bitters.

Toilet Preparations.

Four samples of alcohol for massage purposes were examined. They were all specially denatured products and passed. The denaturants found were those approved for this type of products and were diethylphthalate, isopropyl alcohol, benzol, acetone, salicylates, and zinc, the latter presumably being present as zinc sulfocarbolate. No wood alcohol was found.

Turpentine.

Section 2501 of the General Statutes provides that no article shall be sold as "turpentine" or "spirits of turpentine" which is not wholly distilled from rosin, turpentine gum or scrapings from pine trees, and unmixed and unadulterated with oil, benzine or any other substance, unless the package containing the same shall be labelled "adulterated spirits of turpentine."

Twenty-two samples were examined for the Dairy and Food Commissioner. In the examination and judgment of the samples the specifications suggested by the U. S. government[1] have been followed.

Among these specifications are the following:

Specific gravity at 15.5° C.	0.875-0.862
Refractive index at 20° C.	1.478-1.468
Unpolymerized residue, per cent by volume, not over..	2.5
Distilling below 170° C., per cent not less than	90.00

[1] U. S. Dept. Agr. Bull. 898, Nov. 1920.

The product must be clear and free from suspended matter and water; and the color shall not exceed the shade known as "standard" as measured by the Lovibond colorimeter.

The samples examined were in all cases clear, excepting **33094**, which was turbid. They were also colorless or nearly colorless. The intensity of color was not exactly measured. The specific gravities were within the limits of the specifications given except in three cases which were explained by the probability of exposure of the samples before this determination was made. (Samples which had shown normal specific gravities were found to have increased appreciably on later examination.) The unpolymerized residues, which indicate mineral oil adulterants, were negligible, or within the limit set by the specifications, except in **33089** and **33225** where the amounts found were 6.8 and 8.4 per cent; and in **33094** and **33224** which samples were largely mineral oil. In the two last named samples only about 20 per cent distilled below 170° C. In all other samples substantially 90 per cent or more distilled below 170° C.

Of the twenty-two samples, therefore, only four failed to conform to the essential requirements for pure turpentine. These four are as follows:

No.		Dealer	Manufacturer
33094	*Bristol*	M. H. Herbert	?
33224			
33089	*New Britain*	O'Connor Drug Store	D. A. Rosan, Hartford
33225			

A summary of the data on samples which were passed is as follows:

	Maximum	Minimum
Specific gravity[1] at 20° C.	0.8787	0.8644
Refractive index at 20° C.	1.4770	1.4700
Unpolymerized residue, per cent	1.2	none
Distillation, 90 per cent at	168.9° C.	151.3° C.

[1] Excluding three results probably unreliable for the reason stated in the discussion.

Miscellaneous.

Miscellaneous materials, twenty-two in number, including samples examined for poisons, have been submitted by health officers or other public officials. The examinations made are summarized in Table XVI.

Table XVI. Miscellaneous Drugs, etc.

No.	Name of material	Remarks
2490	*Cakes and candy*	Examined for concealed drugs. No chemical analysis was made, but careful inspection revealed nothing suspicious.
2093	*Liver of cow*	No poison found.

3203	*Medicine*	Said to be a preparation of seaweed. Total iodine found 0.69%, practically all soluble in water and liberated completely from acid solution by ferric alum. The iodine is, therefore, probably all in inorganic combination.
32397	*Ointment*	Dark brown ointment with odor of creosote. Found to consist of a petrolatum base with zinc oxide as the chief medicament determined. Creosote and other vegetable principles were indicated. No salicylates, benzoates or resins were found.
942	*Poisoned bait*	Meat, apparently liver, showed an incision in which was found fragments of a wax ampule. No characteristic odor was noted in the meat as received. Cyanide was detected by reliable tests.
1439	*Prescription*	Powders, each supposed to contain codeine sulphate 12/100 grain, sodium salicylate 19.3 grains, ammonium bromide 19.3 grains. Found codeine sulphate 15/100 grain, sodium salicylate 19.9 grains, ammonium bromide 21.5 grains. Free salicylic acid 29/100 grain. Powders substantially as claimed.
2864	*Stomach contents (calf)*	Arsenic found. No lead or other heavy metals detected.
2523	*Stomach contents (cow)*	Both copper and arsenic were found, suggesting Paris green as the cause of death.
1205	*Toilet lotion*	Alleged to have been used for drinking purposes. Contained approximately 7% alcohol. No cocaine or opiates present.
2756	*Unknown liquid*	Found to be a 28% solution of calcium chloride.
1412	*Unknown powder*	Found to be citric acid, partly effloresced.
1206	*Viscera of fox*	Stomach contained a small amount of grain and much of what appeared to be rabbit hair. Strychnine was found in small amount. Evidence suggested use of poisoned rabbits for bait.
2621	*Viscera of pigeon*	No mineral poison found.
2491	*Water*	To identify sediment. Found to be largely or entirely iron.
2451	*Water*	Water from melting ice in fish carts. Examined for salt and found to contain only a trace, 0.02%.
2338	*Wall paper*	Tested for arsenic. None was found. (The laws of some States limit arsenic [As] to 0.1 grain per sq. yd.)

Five samples of oils and one of gasoline were examined upon which no particular comment is required.

WHISKEY.

About 20 years ago one of the vexed questions arising in connection with the enforcement of the Food and Drugs Act was "What is Whiskey?" After much debate and controversy a very simple official conclusion was reached which was, in effect, that the commodity which was then, and which has been for many years, commonly known and accepted in the trade and among consumers as whiskey, was whiskey. This interpretation did not limit the name to that product aged in wood whereby the aroma and flavor for which whiskey is prized are acquired; nor did it make the natural color developed by the aging process an essential. Thus, factitious whiskeys made largely, or in part, from mixtures of grain alcohol, caramel, beading oil and artificial flavor were widely sold as, and for, whiskey long before prohibition became operative.

Presumably under the influence of the Volstead Act, whiskey and brandy, which had hitherto been recognized as medicinal agents and included in the United States Pharmacopoeia, were omitted in the ninth revision of that text. But, in view of the fact that both of these commodities are legitimately obtainable under proper restrictions, it would be unfortunate if there were no official specifications for their substance and quality, and in the present (tenth) revision of the Pharmacopoeia these two products are again recognized.

The dangerous character of present day liquors in general, and of whiskey in particular, is a widely accepted opinion based, for the most part, upon frequent comment and criticism in the press and periodicals of the country. The serious symptoms which accompany intoxication, or the deaths which follow it, are generally alleged to be due to "poisoned rum," but seldom are the allegations supported by adequate, acceptable evidence as to what is the poisonous principle or constituent. Those who have had the most experience in the examination of bootleg liquor are more conservative in their conclusions. Thus, as one state chemist of wide experience says, "the most poisonous constituent of alcoholic liquors is the alcohol which they contain." In our own experience, aside from a series of samples in which wood alcohol has been substituted for grain alcohol and all of which were traced to one source, we have identified no foreign substance in bootleg liquor of the types ordinarily used as beverages, which in kind or amount could be regarded as a probable cause of death. There is substantial analytical and other evidence to show that much of the alcohol used in preparation of present day liquors is obtained by the rectification of denatured alcohol, particularly the specially denatured type. Such alcohol generally shows on analysis traces of denaturants which have carried over in the process of purification. What the physiological effects, cumulative or otherwise, of these small amounts of denaturants may be is speculative, but we are aware of no authoritative opinion that traces of such substances as diethylphthalate, isopropyl alcohol, benzol and acetone are likely to produce measurable effects of a dangerous character. However, with the evidence that much of the alcohol found in intoxicating liquors is derived from the denatured article, there is always the possibility of inefficient purification and hence such liquors constitute a potential source of danger.

Whiskey has never been entirely free from suspicion as to its quality. It was, indeed, upon representations of its dangerous character that bar whiskey of the cheaper sorts was examined in this laboratory about ten years ago. The following comment may be quoted from our report of 1915.

"It has been suggested that the sudden evil effect of certain bar whiskies on the users indicated that some harmful ingredient other than alcohol might be present, such as wood alcohol, ether or chloral hydrate. The present examination was undertaken, therefore, to determine the alcoholic content of bar whiskey, and the presence or absence of these foreign poisons. In the present state of official opinion it appeared futile to indulge in the niceties of a real whiskey analysis.

One hundred and twenty-three samples were analyzed, in most cases representing the cheapest grades of whiskey sold in our larger cities. In 15 of the samples wood alcohol was suspected from the differences between the actual and theoretical readings of the distillates as shown by the immersion refractometer. The most careful tests, however, failed to demonstrate the presence of wood alcohol in any case, other than possibly mere traces. Likewise neither ether nor chloral was found in any of the samples."

The samples which represent the period 1920-25[1] are such as have been submitted by police or prohibition enforcement officials in connection with the enforcement of our State liquor laws and include also a few submitted by Federal agents. A comparison of some of the essential features of "whiskey" as obtained in these two periods is of interest in connection with some of the comments which have appeared from time to time upon the character of the present day article.

ALCOHOLIC CONTENT.

The alleged pernicious effects of present day liquor have been explained as in part due to a greater alcoholic content than was formerly the case. The following summary throws light upon this point.

[1] Practically all of these samples were examined by Mr. Andrew who also has made, from time to time, critical studies of methods for the detection of denaturants.

	1915	6 yr. period 1920-25
Number of samples	123	274
Samples containing less than 30% alcohol ..	3	9
Maximum alcohol content	52.85%	59.60%
Minimum alcohol content	21.91%	16.40%
Average alcohol content	42.19%	42.40%

So far as whiskey is concerned, it does not appear that the bootlegger is any more generous with his alcohol than was the saloonkeeper of old.

SOLIDS.

According to official specifications, whiskey, when evaporated and the residue dried at 100° C., should not contain more than 0.5 gram of solids per 100cc.

In 1915 the range of solids in the 123 samples examined was 0.08 to 0.99 excluding two samples which contained 12 and 20 per cent of sugar respectively. The samples in the 6 year period already mentioned showed from 0.01 to 2.48 gms. per 100 cc excluding one sample which contained about 20 per cent of sugar. The average content of solids in 1915 was 0.53 as compared with an average of 0.38 for the later period.

COLOR.

The color of official whiskey should be that derived from the charred casks in which it is stored. Such color is largely or entirely soluble in amyl alcohol acidified with phosphoric acid (Marsh reagent). If the color is insoluble in this reagent, artificial color is indicated.

In 1915 only 13 of the 123 samples examined were regarded as being probably genuine with respect to color. In the remaining samples from 10 to 98 per cent of the color was insoluble in acidified amyl alcohol.

So far as whiskey of the later period has been examined in this particular, of 90 samples only 7 appeared to be of natural color. In the remaining samples caramel was found and in one case a coal tar color also. The proportion of naturally colored products found in the two periods is only about 10 per cent of the total in each case. In other words, artificially colored whiskey was about as prevalent before prohibition as it is now.

ODOR AND TASTE OF RESIDUE ON EVAPORATION.

The residue left after evaporating whiskey has a characteristic aromatic odor, a slightly astringent taste but is not distinctly sweet or bitter.

Of 78 samples recently tested only 6 appeared to be of a genuine character.

DENATURANTS.

Sixty samples were examined for traces of denaturants and in 26 samples positive tests for diethylphthalate were obtained and in one isopropyl alcohol was detected. Thus in nearly one-half of the samples tested the alcohol appears to have been derived wholly, or in part, from denatured alcohol. In no case was wood alcohol found.

CONCLUSIONS.

Insofar as the analytical data which forms the basis of this discussion can reflect the quality of whiskey for the two periods noted, it appears that the only significant difference between them is the presence of denaturants in the present day product, due to the source from which the alcohol is derived. As already pointed out, the possibility of clumsy manipulation of denatured alcohol in order to make it fit for beverage purposes constitutes a menace to health which cannot be ignored. This applies not only to whiskey but to similar liquors, e. g. gin, brandy, and cordials, of high alcoholic content, all of which may be produced factitiously.

III. BABCOCK GLASSWARE.

Three thousand, eight hundred and twenty-six pieces of Babcock glassware were examined in the calendar year of 1925, of which number only four pieces were rejected as inaccurate.

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BULLETIN 277 APRIL, 1926

Connecticut Agricultural Experiment Station

New Haven, Connecticut

REPORT ON INSPECTION

OF

COMMERCIAL FEEDING STUFFS

1925

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

Contents.

COMMERCIAL FEEDING STUFFS

E. M. Bailey.*

The Feed Law.

The law relating to concentrated commercial feeding stuffs was revised by the legislature of 1925. The new law differs from the previous one chiefly in that: (*1*) *registration is compulsory;* (*2*) *a registration fee is required;* (*3*) *the maximum percentage of crude fiber must be stated in the analysis; and* (*4*) *ingredients of mixed feeds must be declared.*

The law provides that the Director of this Station and the Dairy and Food Commissioner, acting jointly, may make rules and regulations for carrying out the provisions of the law. Such rules and regulations, together with the text of the law, were issued in a special bulletin of this Station under date of June 30, 1925. Copies of this bulletin of information may still be obtained by request addressed to this Station.

The essential provisions of the new law, and other information pertaining to it, may be briefly restated here.

"Concentrated Commercial Feeding Stuffs" defined. Section 1 of the law defines the term "concentrated commerical feeding stuffs" in substantially the same way that it is defined in the old law; and with the same exemptions. Scratch grains are classed as concentrated feeds.

Labelling. Section 2 defines how concentrated commercial feeding stuffs shall be labelled. The label must declare (1) the number of net pounds of feed in the package; (2) the name, brand or trade mark under which the article is sold; (3) the name and address of the manufacturer or importer; (4) a statement of the minimum percentages of (a) crude protein, (b) crude fat, and (c) the maximum percentage of crude fiber, and (5) in case of feeds composed of two or more ingredients, the name of each ingredient contained therein.

Registration and registration fee. Section 3 requires the annual registration of concentrated commercial feeding stuffs and a registration fee of fifteen dollars ($15.00) for each brand. Registration is to be made with the Connecticut Agricultural Experiment Station on or before September 1, 1925, and annually thereafter.

Duties of Manufacturers. Manufacturers, jobbers or individ-

* Analyses are chiefly by Messrs. Nolan and Mathis; inspection and sampling by Mr. Churchill; and compilation largely by Miss Bacon.

uals shipping feeds into Connecticut will be expected to register their brands and pay the necessary fees thereon. Connecticut dealers should assure themselves that the brands they handle are properly registered. In case the manufacturer or jobber outside the State neglects or refuses to register, the dealer who handles such feeds will be held responsible for such registration and registration fees.

Dealers within the State who mix their own brands are responsible for the registration and proper labelling thereof.

Cottonseed Meal. Cottonseed meal registered as required by the fertilizer law is not exempt from registration also under the feed law if sold for feeding purposes.

Meaning of "Brand." It is held that a distinct brand name or a distinct guaranty constitutes a distinct brand.

Affixing Tags. The use of wire or any metal in affixing tags is prohibited by law.

Explanation of Terms Used in an Analysis of Feeding Stuff.

In registering feeding stuffs the law requires that the minimum percentages of crude protein and crude fat, and the maximum percentage of crude fiber, shall be given; that is, the registrant must guarantee that the feeds registered will contain *not less* than the stated percentages of crude protein and of crude fat and *not more* than the stated percentage of crude fiber.

The term *crude protein* denotes those nutrients which contain nitrogen, and is obtained by multiplying the percentage of total nitrogen in the feed by the factor 6.25.

The term *crude fat* denotes those substances which are soluble in ether and includes, besides fat, such non-fatty materials as chlorophyll and coloring matter.

The term *crude fiber* denotes the coarse, woody tissues characteristic of all forms of roughage and which are present in the outer coats of cereal and other fodder grains.

While the law requires only a statement of the three nutrients just defined, no objection is taken to more complete statements of composition, but such further statements, if given, must be correct. Thus, tags sometimes bear guaranties for nitrogen-free-extract and for carbohydrates.

The term *nitrogen-free-extract* denotes those nutrients of the starch and the sugar types. This group is never determined directly but is obtained by subtracting from 100 per cent the sum of the percentages of moisture, ash, crude protein, crude fiber and crude fat.

The term *carbohydrates* denotes the combined percentages of crude fiber and nitrogen-free-extract.

Registrations.

(For the period September 1st, 1925 to August 31st, 1926.)

One hundred sixty-one firms and individuals have registered 651 brands of feeding stuffs. As required by Statute these registrations are listed as follows:

American Agricultural Chemical Co., New Haven, Conn.
Capitol Meat and Bone Scrap
Protox Meat and Bone Scrap

American Linseed Co., 297 Fourth Ave., New York, N. Y.
Alinco Old Process Linseed Meal

American Maize-Products Co., 41 East 42d St., New York, N. Y.
Cream of Corn Gluten Feed

American Milling Co., Peoria, Ill.
Amco Old Process Linseed Meal and Old Process Screenings Oil Feed
Empire Dairy Ration
Kick-A-Poo Horse Feed
Sucrene Dairy Feed
Universal Dairy Ration

Arcady Farms Milling Co., Chicago, Ill.
Advanced Registry Dairy
Peerless Milk Ration

Archer-Daniels Midland Co., Minneapolis, Minn.
Pure Old Process Linseed Meal

Ashcraft-Wilkinson Co., Atlanta, Ga.
Helmet Brand Cottonseed Meal
Monarch Brand Cottonseed Meal
Paramount Brand Cottonseed Meal

Atlan Mfg. Co., 142 Logan Ave., Jersey City, N. J.
Diamond Pick Meat and Bone Scrap

Aunt Jemima Mills Branch, The Quaker Oats Co., St. Joseph, Mo.
Hominy Feed

E. W. Bailey & Co., Montpelier, Vt.
Capitol Dairy Ration
Favorite Dairy Ration
Pennant Scratch Feed
Pennant Stock Feed

Basic Feeds Co., Lockport, Ill.
No. 455 Scratch Grain

Bay State Milling Co., Winona, Minn.
Wingold Diamond G Pure Hard Wheat Low Grade Flour
Wingold Fancy Pure Hard Wheat Mixed Wheat Feed
Wingold Pure Hard Wheat Bran
Wingold Pure Hard Wheat Fancy White Flour Middlings
Wingold Rye Middlings and Rye Screenings
Wingold Standard Hard Wheat Middlings and Wheat Screenings

Beach Soap Co., Lawrence, Mass.
Beach's Star Brand Beef Scraps

Beacon Milling Co., Inc., Cayuga, N. Y.
Auburn Dairy Feed
Auburn Scratch Feed
Beacon Calf Meal
Beacon Dairy Ration
Beacon Egg Mash
Beacon Horse Feed
Beacon Laying Mash
Beacon Scratch Grains
Cayuga Scratch Feed

Ira W. Beers, Hamden, Conn.
Beers' Dairy Ration
Beers' Laying Mash
Beers' Scratch Feed

Blatchford Calf Meal Co., Waukegan, Ill.
Blatchford's Calf Meal
Blatchford's Chick Mash
Blatchford's "Fill-The-Basket" Egg Mash

Amos D. Bridges' Sons, Inc., Hazardville, Conn.
Success Dairy Ration

Buckeye Cotton Oil Co., Cincinnati, Ohio.
Buckeye 36% Protein Cottonseed Meal
Buckeye 41% Protein Cottonseed Meal

C. Buckingham & Co., Inc., Southport, Conn.
Buckingham's Dry Mash

C. W. Campbell Co., 27 West Broad St., Westerly, R. I.
Egg-O Dry Mash
Egg-O Scratch Feed
No-Botheration Dairy Ration
No-Botheration Stock Feed
Provender

Chapin & Co., 327 South LaSalle St., Chicago, Ill.
Ajax Dairy Ration
Unicorn Dairy Ration

Clinton Corn Syrup Refining Co., Clinton, Iowa.
Clinton Corn Gluten Feed

The Coles Co., Middletown, Conn.
Albert Angell Jr.'s Chick Starter
Albert Angell Jr.'s Coarse Chick Scratch
Albert Angell Jr.'s Egg Mash
Albert Angell Jr.'s Fine Chick Scratch
Albert Angell Jr.'s Growing Mash
Albert Angell Jr.'s Scratch Feed

Collis Products Co., Clinton, Iowa.
Collis Process Pure Dried Buttermilk

G. E. Conkey Co., Cleveland, Ohio.
Conkey's Buttermilk Grain and Bone Starting Feed
Conkey's Buttermilk Meat, Grain and Bone Growing Mash
Conkey's Buttermilk Meat, Grain and Bone Laying Mash
Conkey's Chick Grains
Conkey's Dairy Ration
Conkey's Fattening Mash with Buttermilk
Conkey's Growing Grains
Conkey's Pigeon Feed
Conkey's Scratch Grains
Gecco Chick Grains
Gecco Dairy Ration
Gecco Egg Mash
Gecco Fattening Mash without Buttermilk
Gecco Growing Grains
Gecco Scratch Grains
Red Seal Dairy Ration
Red Seal Scratch Feed

Conn. Fat Rendering and Fertilizer Corp., New Haven, Conn.
Meat Scrap 40%
Meat Scrap 50%

Copeland Flour Mills, Limited, Midland, Ontario, Canada.
Copeland's Dandy Bran
Copeland's Dandy Shorts

Corn Products Refining Co., 17 Battery Place, New York, N. Y.
Buffalo Corn Gluten Feed
Co-Pro-Co. Horse and Mule Feed
Diamond Corn Gluten Meal

C. A. Cowles, Plantsville, Conn.
C. A. Blue Seal Mash
C. A. Meato Mash
Cowles' Dairy Ration

Chas. M. Cox Co., Boston, Mass.
Lakewood's Wheat Bran (Lake of the Woods Milling Co., Ltd., Montreal, P. Q.)
Lakewood's Pure Standard Middlings (Lake of the Woods Milling Co., Ltd., Montreal, P. Q.)
Pioneer Pure Wheat Bran (Western Canada Flour Mills, Ltd., Toronto, Ont.)
Pioneer Shorts (Western Canada Flour Mills, Ltd., Toronto, Ont.)
Rex Wheat Middlings (Maple Leaf Milling Co., Ltd., Toronto, Ont.)
Wheat Bran (Maple Leaf Milling Co., Ltd., Toronto, Ont.)

Crosby Milling Co., Brattleboro, Vt.
Crosby's Balanced Ration
Crosby's Egg Mash
Crosby's Ready Ration
Crosby's Scratch Feed
Crosby's Stock Food
Crosby's 22% Dairy Feed

The Cutler Co., North Wilbraham, Mass.
King Dairy Ration
King Mash Feed
King Scratch
King Stock Feed

R. G. Davis & Sons, Inc., New Haven, Conn.
Basic Dairy Ration
Davis Horse Feed
Davis Mash Feed
Davis Scratch Feed
Davis Stock Feed
No. 1 Provender (corn and oats ground)

S. P. Davis, Little Rock, Ark.
Beauty Brand Cottonseed Meal
Good Luck Brand Cottonseed Meal
Steerboy Brand Cottonseed Meal

Decatur Milling Co., Decatur, Ill.
Homco Hominy Feed

Delaware Mills, Inc., 88 Front St., Deposit, N. Y.
Delaware Chick Starting Mash
Delaware Dairy Feed
Delaware Intermediate Chick Grains
Delaware Scratch Grains
Delaware Stock Feed

The Denver Alfalfa Milling & Products Co., Lamar, Col.
Alfalfa Meal

Devon Coal & Ice Co., Devon, Conn.
Devon Dairy Ration
Devon Laying Mash
Devon Sweet Stock Feed

Dewey Bros. Co., Blanchester, Ohio.
Ricormalt (Waterloo Distilling Corp., Waterloo, N. Y.)

Duluth Superior Milling Co., 620 Board of Trade Bldg., Duluth, Minn.
Boston Mixed Feed
Duluth Imperial Wheat Bran

Eagle Roller Mill Co., New Ulm, Minn.
Eagle Flour Midds with Screenings
Eagle Wheat Red Dog

Eastern States Farmers' Exchange, 33 Lyman St., Springfield, Mass.
Eastern States Buttermilk Egg Mash
Eastern States Egg Mash
Eastern States Fitting Ration
Eastern States FulPail
Eastern States Growing Mash
Eastern States Horse Feed
Eastern States Milkmore Dairy Ration
Eastern Scratch Grains

Elmore Milling Co., Oneonta, N. Y.
Elmore's Baby Chick Mash with Dried Buttermilk
Elmore's Calf Meal
Elmore's Egg Mash
Elmore's Growing Mash
Elmore's Hog Ration
Elmore's Horse Feed with Molasses
Elmore's Mekemgrow Little Pig Ration
Elmore's Milk Grains
Elmore's Poultry Mash with Buttermilk
Elmore's Red Dog Flour Middlings
Elmore's 20% Ready Ration
Elmore's Scratch Feed
Elmore's Snow Middlings
Elmore's Stock Feed
Emco Stock Feed

John W. Eshelman & Sons, Lancaster, Pa.
Eshelman's Lancaster 20 Dairy Feed
Eshelman's Lancaster 60 Horse Feed
Eshelman's Laying Mash
Eshelman's Red Rose 24 Dairy Feed
Eshelman's Red Rose 85 Horse Feed
Eshelman's Scratch Feed
Eshelman's Stock Feed
Eshelman's Sugared Stock Feed
Eshelman's Susquehanna Dairy Feed
Imperial Scratch Feed

Evans Milling Co., Indianapolis, Ind.
Emco Hominy Feed

Everett, Aughenbaugh & Co., Minneapolis, Minn.
E-A-CO Hard Wheat Mixed Feed with Wheat Screenings
E-A-CO Pure Wheat Bran
E-A-CO Pure Wheat Flour Middlings
E-A-CO Standard Middlings with Wheat Screenings

Fairchild Milling Co., 1635 Merwin St., Cleveland, Ohio.
Special Fine Wheat Middlings
Standard Middlings
Wheat Bran with Ground Wheat Screenings

The Fairmont Creamery Co., Omaha, Neb.
Fairmont's Better Condensed Buttermilk
Fairmont's Better Pure Flake Buttermilk

Federal Mill & Elevator Co., Inc., Lockport, N. Y.
Dairy Maid Winter Wheat Middlings
Dairy Maid Winter Wheat Mixed Feeds
Lucky Hard Wheat Bran
Sphinx Fancy Hard Wheat Middlings

Flory Milling Co., Inc., Bangor, Pa.
Ata-Boy Horse Feed
Blue Mountain Horse Feed
Buzz Horse Feed
Flory's Special Stock Feed (Samp Mortar Milling Co., Fairfield, Conn.)
Flory's Superior Egg Mash
Flory's Superior Pure Wheat Middlings
Flory's Superior Scratch Grains
Globe Cow Feed
Golden Egg Laying Mash
Golden Egg Scratch Feed
National Cow Feed
Sunray Scratch Feed

A. W. Forbes, East Haven, Conn.
Dairy Ration
Laying Mash
R-OWN Scratch Feed

The L. T. Frisbie Co., New Haven, Conn.
Frisbie's Bone Meal 20-25% Protein (For cattle and poultry)
Frisbie's Bone and Meat Meal 35-45% Protein
Frisbie's Cracked Bone
Frisbie's Poultry Feed 45-55% Protein
Frisbie's Poultry Feed 55-65% Protein

The Galt Flour Mills, Limited, Galt, Ontario, Canada.
Rainbow Bran
Rainbow Shorts

Grain Belt Mills Co., St. Joseph, Mo.
Hunter Horse and Mule Feed

D. H. Grandin Milling Co., Jamestown, N. Y.
Grandin's Baby Chick Feed
Grandin's Baby Chick Starter with Buttermilk
Grandin's 24% Balanced Dairy Ration
Grandin's Growing Feed
Grandin's Intermediate Chick Feed
Grandin's Laying Mash with Buttermilk
Grandin's Milk Maker
Grandin's Screened Scratch Feed
Grandin's Stock Food
Grandin's 12 Twin Six 12 Dairy Feed

Hales & Hunter Co., 320 South LaSalle St., Chicago, Ill.
Red Comb Egg Mash with Dried Buttermilk
Red Comb Growing Mash

Wm. Hamilton & Son, Inc., Caledonia, N. Y.
Wheat Bran
Wheat Middlings

Dwight Hamlin Co., Pittsburgh, Pa.
H & S Horse and Mule Feed

The Hecker-H-O Co., Inc., Genesee Bldg., Buffalo, N. Y.
Algrane Horse Feed
Algrane Milk Feed
Algrane New England Stock Feed
Algrane Steam-Cooked Chick Feed

Hecker-Jones-Jewell Milling Co., 40 Corlears St., Buffalo, N. Y.
Choice Wheat Bran
Choice Wheat Bran with Ground Screenings
Extra Heavy Wheat Mixed Feed with Ground Screenings
H Wheat Middlings
Red Dog Flour
Wheat Flour Middlings
Wheat Red Dog Flour
Wheat Standard Middlings with Ground Screenings

Hirst & Begley Linseed Works, 2013 Mendel St., Chicago, Ill.
Hirst & Begley Linseed Works Old Process Linseed Meal

The J. C. Hubinger Bros. Co., Keokuk, Iowa.
Keokuk Corn Gluten Feed

L. W. Hudson, Windsor, Conn.
"Hudson's" 50/50 Scratch
"Hudson's" Laying Mash
"Hudson's" Cow Feed

Humphreys-Godwin Co., Memphis, Tenn.
Bull Brand Cottonseed Meal
Danish Brand Cottonseed Feed
Dixie Brand Cottonseed Meal

Imperial Grain & Milling Co., Toledo, Ohio.
Imperial Steam Cooked Feed

Z. C. Ingersoll, Stratford, Conn.
Ingersoll's Special Egg Mash

International Milling Co., Minneapolis, Minn.
Black Hawk Pure Wheat Bran (Minneapolis Mills, U. S. A.)
Black Hawk Pure Wheat Bran (Robin Hood Mills, Canada)
Black Hawk Pure Wheat Shorts (Robin Hood Mills, Canada)
Black Hawk Wheat Standard Middlings (Minneapolis Mills, U. S. A.)

Henry James & Son, Inc., Worcester, Mass.
H. J. Selected Meat Scraps

Kellogg & Miller, Amsterdam, N. Y.
Old Process Linseed Oil Meal

Kellogg Sales Co., Battle Creek, Mich.
K. B. C. White Hominy Feed

Spencer Kellogg & Sons, Inc., Buffalo, N. Y.
"Kellogg's" Pure Old Process Linseed Meal

H. H. King Flour Mills Co., 1010 Chamber of Commerce, Minneapolis, Minn.
"Gold Mine" Feed

Chas. A. Krause Milling Co., Milwaukee, Wis.
Badger Stock Feed

The Larrowe Milling Co., Box 68 North End Station, Detroit, Mich.
Dried Beet Pulp
Larrowe Brand Choice Cottonseed Meal
Larro Chick Grains
Larro Chick Starter
Larro Egg Mash
Larro Growing Grains
Larro Growing Mash
Larro Scratch Grains
Larro—The Ready Ration for Dairy Cows

Francis H. Leggett Co., 37 Jefferson St., Stamford, Conn.
Nabob Dairy Feed
Nabob Horse Feed
Nabob Scratch Feed
Nabob Stock Feed
Premier Dairy Feed
Premier Growing Mash
Premier Laying Mash
Premier Scratch Feed

C. W. Lines Co., Cor. Chestnut and Bigelow Sts., New Britain, Conn.
Homestead Dry Mash
Homestead Scratch Feed
Uniform Brand Dairy Ration
Uniform Brand Fancy Scratch Feed

Litchfield County Coöperative Association, Torrington, Conn.
Common Sense Dairy Ration

E. Manchester & Sons, Winsted, Conn.
Red Star Buttermilk Mash
Red Star Dairy Feed
Red Star Egg Mash
Red Star Special Dairy Feed
Red Star Wheat Mixed

The Mann Bros. Co., Buffalo, N. Y.
Pure Old Process Linseed Meal, 34% Protein

Mapl-Flake Mills, Inc., Chicago, Ill.
Armour's Cak-Cak Growing Feed
Armour's Cak-Cak Laying Mash
Armour's 24% Dairy Feed
Armour's Horse Feed
Armour's Stock Feed
Bufceco Hominy Feed
Iroquois Chop Feed
Iroquois 20% Dairy Ration

Iroquois Laying Mash
Iroquois Poultry Mash
Iroquois Scratching Grains
Iroquois Stock Feed
Iroquois Sweet Horse Feed
Oat Feed

Maritime Milling Co., Inc., Buffalo, N. Y.
Bull Brand Chick Feed
Bull Brand Chick Starter (with Dried Buttermilk)
Bull Brand Dairy Ration
Bull Brand Heavy Mixed Feed
Bull Brand Laying Mash (with Dried Buttermilk)
Bull Brand Scratch Feed
Bull Brand Stock Feed
Hi-Test Dairy Feed
Red Dog Wheat Flour
Red E Lay Laying Mash
Red E Mixt Scratch Feed

A. G. Markham & Co., Springfield, Mass.
Cooked Meat and Bone Scrap

The Geo. E. Marsh Co., Lynn, Mass.
Marsh's Pure Ground Scraps for Poultry

G. J. Martenis Grain Co., L-3 Produce Exchange, New York, N. Y.
Alco Dried Distilled Grains

Meech & Stoddard, Inc., Middletown, Conn.
Red Wing Dairy Ration (without Brewers' Grains)
Red Wing Mixed Feed
Red Wing Molasses Horse Feed
Red Wing Special Buttermilk Growing Feed
Red Wing Special Dairy Ration (without Brewers' Grains)
Red Wing Special Dry Mash
Red Wing Special Buttermilk Laying Mash
Red Wing Special Buttermilk Chick Starter
Red Wing Stock Feed
Red Wing Special Chick Feed
Red Wing Special Intermediate Chick Feed
Red Wing Scratch Feed
Red Wing Special Stock

Memphis Cottonseed Products Co., Memphis, Tenn.
Durham Fortythree Cottonseed Meal
Durham Fortyone Cottonseed Meal
Durham Thirtysix Cottonseed Meal

Middlesex Refining Co., Middletown, Conn.
Middlesex Beef Scrap

Miner-Hillard Co., Wilkes-Barre, Pa.
No. 1 Scratch Feed
Rye Middlings
Steam Cooked Hominy Feeds