State of Connecticut
PUBLIC DOCUMENT NO. 24

Fifty-Second Report

OF THE

CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

NEW HAVEN

FOR THE YEAR

1928

PRINTED IN COMPLIANCE WITH STATUTE

NEW HAVEN
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1929

PUBLICATION

APPROVED BY

THE BOARD OF CONTROL

Press of The Wilson H. Lee Co., New Haven, Conn.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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As of

October 31, 1928

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Tobacco Sub-station at Windsor.
PAUL J. ANDERSON, PH.D., *Pathologist in Charge.*
T. R. SWANBACK, M.S., *Agronomist.*
MISS DOROTHY LENARD, *Secretary.*

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Letter of Transmittal

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

The Board of Control of the Connecticut Agricultural Experiment Station, as required by law, herewith submits its fifty-second annual report for the year ending October 31st, 1928.

No extended statement is presented in this letter. The Report of the Director (Bulletin 298, pages 113 to 140), which constitutes a part of this report, is a summary of the work accomplished during the year, lists the changes in staff, the additions to equipment and the publications.

Immediately following this letter will be found the financial statements of the several appropriations for which the station is responsible. These are for the fiscal year ending June 30th, 1928.

All of which is respectfully submitted,

GEORGE A. HOPSON,

Secretary of the Board.

Report of the Treasurer

July 1, 1927—June 30, 1928

W. L. SLATE, in account with THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION for the fiscal year ended June 30, 1928.

RECEIPTS.

Balance on hand, July 1, 1927		
State Comptroller (General or Current Expense)	$53,000.00	
" " (General—Additions)	827.75	
" " (Food and Drug)	7,500.00	
United States Appropriation (Hatch)	7,500.00	
" " " (Adams)	7,500.00	
" " " (Purnell)	20,000.00	
" " " (Clark-McNary)	959.48	
Fertilizer Analysis Fees	13,000.00	
Feed Analysis Fees	7,000.00	
Lockwood Trust Fund	11,000.00	
		$128,287.23
Miscellaneous Receipts:		
Balance on hand, July 1, 1927	$201.46	
Sales of gasoline	$452.16	
Sales of automobile oil	36.85	
Mileage for use of automobiles	218.17	
Sale of waste paper	3.57	
Refund for damage to Station auto	31.85	
Interest on bank deposits	83.52	
	826.12	
	1,027.58	
LESS MISCELLANEOUS RECEIPTS DEPOSITED WITH STATE TREASURER	908.35	
		119.23
		$128,406.46

DISBURSEMENTS.

Salaries	$76,441.66
Labor	19,986.22
Stationery and Office Supplies	784.79
Scientific Supplies (chemicals)	1,074.25
" " (other laboratory supplies)	835.55
" " (photographic supplies)	192.71
Feeding Stuffs	77.22
Insecticides, etc	74.97
Lumber and Small Hardware	41.76
Miscellaneous Supplies	747.60

Automobile Oil	135.34	
Food and Drug Samples	4.38	
Fertilizers	774.65	
Telegraph and Telephone	549.26	
Postage	457.79	
Travel Expense (outlying-investigations)	2,886.85	
" " (meetings, conferences, etc.)	1,336.34	
" " (gasoline for automobiles)	1,041.06	
Freight, Express and Parcels Post	129.93	
Publications (bulletins, etc.)	126.70	
" (miscellaneous)	170.50	
Coal	2,330.00	
Gas and Electricity	1,849.34	
Water	204.55	
Furniture and Fixtures (new)	1,129.41	
" " (repairs)	111.39	
Library (books and periodicals)	1,063.61	
" (binding)	381.70	
Scientific Equipment (new)	2,093.28	
" " (repairs)	140.45	
Live Stock	110.00	
Automobiles (new)	1,653.75	
" (repairs)	533.71	
Tools, Machinery and Appliances (new)	1,205.91	
" " " (repairs)	300.09	
New Buildings and Structures	2,951.78	
Buildings (repairs and alterations)	3,142.13	
Grounds	6.80	
Insurance (fire, burglary and automobile)	1,079.48	
Miscellaneous Contingent Expenses	57.50	
Total Disbursements		$128,214.41
Balance on hand, June 30, 1928:		
State General Appropriation (in hands of State Comptroller)	72.82	
Miscellaneous Receipts (in hands of Station Treasurer)	119.23	
		192.05
		$128,406.46

REPORT OF

W. L. SLATE, Treasurer

IN ACCOUNT WITH

Insect Pest Appropriation

(Section 2109 of General Statutes, Revision of 1918)

July 1, 1927—June 30, 1928

RECEIPTS.

Balance on hand, July 1, 1927		.....
Insect Pest Appropriation	$30,000.00	
" " " (additions)	27.36	
		$30,027.36
Miscellaneous Receipts:		
Mileage for use of Automobiles...	$27.36	
LESS MISCELLANEOUS RECEIPTS DEPOSITED WITH STATE TREASURER...	27.36	.....
		$30,027.36

DISBURSEMENTS.

Salaries	$15,450.00	
Labor	16,709.25	
Stationery and Office Supplies	125.35	
Scientific Supplies (chemicals)	42.93	
" " (other laboratory supplies)	25.61	
" " (photographic supplies)	57.38	
Insecticides, etc	130.67	
Lumber and Small Hardware	.73	
Miscellaneous Supplies	841.64	
Automobile Oil	62.31	
Telegraph and Telephone	167.74	
Postage	91.22	
Travel Expense (outlying investigations)	2,219.31	
" " (meetings, conferences, etc.)	259.53	
" " (gasoline for automobiles)	507.06	
Freight, Express and Parcels Post	15.33	
Electricity	45.30	
Furniture and Fixtures (new)	180.65	
" " " (repairs)	19.15	
Library (books and periodicals)	201.05	
" (binding)	82.35	
Scientific Equipment (new)	21.48	
Livestock	1.35	
Automobiles (new)	544.00	
" (repairs)	256.90	
Tools, Machinery and Appliances (new)	48.63	
" " " " (repairs)	7.10	
New Buildings and Structures	234.24	
Buildings (repairs and alterations)	10.58	
Rent of Land and Buildings	314.66	
Insurance (automobile)	169.47	
Miscellaneous Contingent Expenses	72.44	
Total Disbursements		$38,915.41
Charged to allotment for second half of fiscal period (June 30, 1928)		8,888.05
		$30,027.36

REPORT OF

W. L. SLATE, Director

IN ACCOUNT WITH

Mosquito Elimination Appropriation

(Scetions 2409 and 2410 of General Statutes, Revision of 1918; amended by Chapter 68, Public Acts of 1923)

July 1, 1927—June 30, 1928

RECEIPTS.

State Appropriation	$7,500.00	
Addition	88.46	
Total		$7,588.46

DISBURSEMENTS.

Salary (R. C. Botsford)	$2,500.00	
Labor	4,668.39	
Stationery and Office Supplies	31.40	
Photographic Supplies	3.20	
Miscellaneous Supplies	32.11	
Automobile Oil	3.51	
Oil for Mosquito Spraying	2.00	
Telephone and Telegraph	4.45	
Travel (outlying investigations)	109.65	
" (gasoline)	225.64	
Tools, Machinery and Appliances (new)	34.20	
" " " (repairs)	8.50	
Automobile Repairs and Accessories	229.00	
Buildings and Land (Repairs and Alterations)	166.27	
Insurance (automobile)	59.97	
	$8,078.29	
Transferred to New Mosquito Elimination Fund	287.57	
		8,365.86
Charged to allotment for second half of fiscal period June 30, 1928		777.40
		$7,588.46

REPORT OF

W. L. SLATE, Director

IN ACCOUNT WITH

Tobacco Research Appropriation

(Public Acts, 1921, Chapter 184.)

July 1, 1927—June 30, 1928

RECEIPTS.

State Appropriation	$15,000.00	
Contributions	1,814.24	
Sales of Tobacco	1,860.49	
		$18,674.73

DISBURSEMENTS.

By the State Comptroller on vouchers submitted by W. L. Slate, Director:		
Salaries	$7,400.00	
Labor	6,863.93	
Stationery and Office Supplies	113.71	
Chemicals	111.82	
Laboratory Supplies	93.06	
Photographic Supplies	20.91	
Feeding Stuffs	25.01	
Insecticides and Fungicides	36.93	
Lumber and Small Hardware	31.81	
Miscellaneous Supplies	358.84	
Automobile Oil	28.08	
Fertilizer	512.36	
Telephone and Telegraph	75.07	
Travel (outlying investigations)	317.77	
" (meetings, conferences, etc.)	143.91	
" (gasoline)	89.07	
Freight, Cartage and Express	51.23	
Fuel	531.35	
Electricity	158.69	
Water	54.96	
Furniture and Fixtures (new)	272.77	
" " (repairs)	15.40	
Books, Periodicals and Subscriptions	18.92	
Scientific Apparatus (new)	562.50	
" " (repairs)	2.61	
Automobiles (repairs)	135.41	
Tools, Machinery and Appliances (new)	676.73	
" " " (repairs)	19.84	
Buildings and Land (repairs and alterations)	477.37	
Rent of Land	75.00	
Insurance (automobile and tobacco)	62.78	
		$19,337.84
Charged to allotment for second half of fiscal period June 30, 1928		663.11
		$18,674.73

REPORT OF

W. L. SLATE, Director

IN ACCOUNT WITH

White Pine Blister Rust Appropriation

(Section 2117 of General Statutes, Revision of 1918)

July 1, 1927—June 30, 1928

RECEIPTS.

State Appropriation		$7,500.00	
Refund for Labor	$1,318.88		
Refund for Experimental Work	204.83		
Refund for Camp Meals	7.83		
		1,531.54	
			$9,031.54

EXPENDITURES.

By the State Comptroller on vouchers submitted by W. L. Slate, Director:			
Salaries		$1,646.46	
Labor		7,365.28	
Stationery		31.88	
Lumber and Small Hardware		15.32	
Miscellaneous Supplies		12.72	
Telegraph and Telephone		31.05	
Travel (outlying investigations)		1,271.08	
" (meetings, conferences, etc.)		64.55	
Cartage		43.80	
Publications		5.50	
Furniture and Fixtures		45.00	
Automobiles (new)		657.70	
Tools, Machinery and Appliances (new)		41.16	
Automobiles (repairs)		45.35	
Insurance (automobile)		243.42	
Miscellaneous Contingent Expenses		60.19	
Total Disbursements			$11,580.46
Charged to allotment for second half of fiscal period June 30, 1928			2,548.92
			$9,031.54

Connecticut Agricultural Experiment Station
New Haven, Connecticut

Report on Inspection
of
Commercial Fertilizers for 1928

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

CONTENTS.

Press of The Wilson H. Lee Co., New Haven, Conn.

Report on Inspection of Commercial Fertilizers 1928

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

THE FERTILIZER LAW.

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

Significance of the Term "Commercial Fertilizers."

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

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

Concerning Cottonseed Meal.

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

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

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

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

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

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

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

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

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

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

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

Requirements to be Complied with by Sellers of Commercial Fertilizers.

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

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

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

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

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

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

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

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

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

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

Precautions to be Observed in Drawing Samples for Analysis.

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

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

Gratuitous Analyses.

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

REGISTRATIONS FOR 1928.

For 1928, 61 firms and individuals registered at this Station for sale in this State 433 brands of fertilizers. As required by Statute, the brands so registered are listed as follows:

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

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

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

Apothecaries Hall Company, Waterbury, Conn.
Acid Phosphate
Basic Slag Phosphate
Bone Meal 3-22
Bone Meal 4-20
Bone and Meat Tankage
Carbonate of Potash
Castor Pomace
Cotton Seed Meal
Dry Ground Fish
Liberty Corn and All Crops, 2-8-2
Liberty Corn, Fruit and All Crops, 2-12-4
Liberty Fish, Bone and Potash, 3-8-3
Liberty High Grade Market Gardeners, 5-8-7
Liberty High Grade Tobacco Manure, 7-3-7
Liberty Home Vegetable Garden Fertilizer
Liberty Lawn Fertilizer
Liberty Onion Special (Potash as Sulphate), 4-8-7
Liberty Potato and General Crops, 4-8-10
Liberty Potato and Market Gardener's Special, 4-8-4
Liberty Potato and Vegetable, 2-8-10
Liberty Special Fertilizer for Fruit, 7-8-6
Liberty Tobacco Special, 5-3-5
Liberty Tobacco Starter
Liberty Top Dresser for Grass and Grain, 10-3½-8
Muriate of Potash
Nitrate Soda
Nitrate Soda and Potash
Precipitated Bone
Sheep Manure
Sulphate Ammonia
Sulphate Potash
Sulphate Potash-Magnesia
Tankage

Armour Fertilizer Works, 50 Broad St., New York City.
Armour's Big Crop Bone Meal 3-48
Armour's Big Crop Fertilizer 2-12-4
Armour's Big Crop Fertilizer 3-8-4
Armour's Big Crop Fertilizer 4-8-4
Armour's Big Crop Fertilizer 4-8-7
Armour's Big Crop Fertilizer 4-6-10
Armour's Big Crop Fertilizer 4-16-4
Armour's Big Crop Fertilizer 5-8-7
Armour's Big Crop Fertilizer 7-11-10
Armour's Big Crop Fertilizer 7-12-7
Armour's Big Crop Fertilizer 8-6-6
Armour's Big Crop Super Phosphate (Acid Phosphate) 16%
Armour's Big Crop Super Phosphate 20%
Armour's Big Crop Tobacco Fertilizer 7-3-7
Armour's Big Crop Tobacco Special 5-3-5
Armour's Castor Pomace 5½%
Armour's Cotton Seed Meal 8%
Armour's Lawn and Garden Grower 6-8-6
Armour's Ground Tankage 9%
Armour's Muriate of Potash 48%

Armour's Nitrate of Soda 18%
Armour's Sheep and Goat Manure 1½-1-2
Armour's Sulphate of Ammonia 25%
Armour's Sulphate of Potash 48%

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

Atlantic Packing Company, New Haven, Conn.
Atlantic 5-4-16
Atlantic 5-8-7
Atlantic Grain Fertilizer 2-10-2
Atlantic Special Vegetable 4-8-4

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

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

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

The Berkshire Chemical Company, Bridgeport, Conn.
Berkshire Castor Pomace
Berkshire Complete Tobacco
Berkshire Dry Ground Fish
Berkshire Economical Grass
Berkshire Fine Ground Bone
Berkshire Grass Special
Berkshire Ground Tankage
Berkshire Long Island Special
Berkshire Market Garden Fertilizer
Berkshire Potato and Vegetable Fertilizer
Berkshire Sheep Manure
Berkshire Super Phosphate (Acid Phosphate)
Berkshire Tobacco Special
Berkshire Tobacco Starter
Berkshire Truck Fertilizer
Carbonate of Potash
High Grade Sulphate Potash
Muriate Potash
Nitrate of Soda
Precipitated Bone Phosphate

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

F. W. Brode Corp., 119 Madison Ave., Memphis, Tenn.
"Owl Brand," 36% Cotton Seed Meal

A. H. Case & Company, Inc., 965 William St., Buffalo, N. Y.
Par Plus Brand Pulverized Sheep Manure

The E. D. Chittenden Company, Bridgeport, Conn.

Chittenden's Basic Slag
Chittenden's Castor Pomace
Chittenden's Complete Grain
Chittenden's Dry Ground Fish
Chittenden's Fine Ground Bone
Chittenden's High Grade Potato
Chittenden's Potato Special 4% Potash
Chittenden's Special Top Dresser
Chittenden's Tobacco Special
Chittenden's Valley Wrapper Brand
Chittenden's Vegetable and Onion Grower
Special Mixture

Everett B. Clark Seed Company, Milford, Conn., Succeeded by Associated Seed Growers, Inc., New Haven, Conn.

Nitrate of Soda
16% Acid Phosphate
Special Mixture for General Use 4-8-4
Super Phosphate
Special Mixture with 6% Potash 4-8-6
Tip Top Brand

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

Tankage

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

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

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

C. & R. Lawn Shrub Fertilizer

The Davey Tree Expert Company, Kent, Ohio.

Davey Shredded Cattle Manure
Davey Tree Food

Eastern States Farmers' Exchange, 38 Lyman St., Springfield, Mass.

Buckland's Formula A 6-2-7 Special Tobacco Mixture
Eastern States Acid Phosphate
Eastern States Calcium Nitrate
Eastern States Dried Ground Fish
Eastern States Fine Bone Meal
Eastern States Ground Animal Tankage
Eastern States Muriate of Potash
Eastern States Nitrate of Potash
Eastern States Nitrate of Soda
Eastern States 0-16-8 Open Formula

Eastern States 3-12-3 Open Formula
Eastern States 4-8-10 Open Formula
Eastern States 4-16-4 Open Formula
Eastern States 5-8-7 Open Formula
Eastern States 5-10-5 Open Formula
Eastern States 8-6-6 Open Formula
Eastern States 8-16-8 Open Formula
Eastern States 8-16-20 Open Formula
Eastern States 10-16-14 Open Formula
Eastern States 10-16-14 (Potash from Sulphate) Open Formula
Eastern States Open Formula 9-3-7 Tobacco Fertilizer
Eastern States Open Formula 10-3-8 Tobacco Fertilizer
Eastern States Precipitated Bone
Eastern States Sulphate of Ammonia
Eastern States Sulphate of Potash
Eastern States Urea

Edward Eggert, 208 State St., Hartford, Conn.

Diamond E. E. Cotton Seed Hull Ashes

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

Essex A1 Super 2-10-2
Essex Complete Manure 5-8-7
Essex Fish Fertilizer For All Crops 3-8-4
Essex Market Garden 4-8-4
Essex Peerless Potato Manure 4-6-10
Essex Tobacco Manure 5-3-5
Essex Top Dressing 7-6-5

Ford Motor Company, Detroit, Michigan.

Ford Ammonium Sulphate

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

Four Seasons Fertilizer

The L. T. Frisbie Company, New Haven, Conn.

Frisbie's 5-8-7
Frisbie's Corn and Grain Fertilizer 2-10-2
Frisbie's Fine Bone Meal 4-22
Frisbie's Market Garden 4-8-7
Frisbie's Special 3-8-4
Frisbie's Tobacco Grower 5-3-5
Frisbie's Top Dresser
Frisbie's Special Vegetable and Potato Grower 4-8-4

Gash-Stull Company, Chester, Pa.

Young's Formula (8-7-6)

The Grasselli Chemical Company, Cleveland, Ohio.

Grasselli Odorless Plant Food

Humphreys-Godwin Company, Memphis, Tenn.

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

International Agricultural Corporation, 38 Chauncy St., Boston, Mass.
Cottonseed Hull Ashes
41% Cottonseed Meal
Cottonseed Meal 43%
I. A. C. Basic Slag
Nitrate of Lime
Tobacco Special 7-6-5
Vuelta Abajo 7-9-8

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

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

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

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

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

A. G. Markham & Company, Springfield, Mass.
4-8-4
4-6-10
5-8-7

Meech & Stoddard, Inc., Middletown, Conn.
Sheep Manure

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

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

Olds & Whipple, Inc., Hartford, Conn.
Favorite Brand Sheep Manure
High Grade Carbonate of Potash 96/98
High Grade Sulphate of Potash
O. & W. Acid Phosphate
O. & W. Blue Label Tobacco Fertilizer
O. & W. Castor Pomace
O. & W. Complete Market Garden
O. & W. Complete Tobacco Fertilizer
O. & W. Dry Ground Fish
O. & W. Grain and General Crop Fertilizer
O. & W. Grass Fertilizer
O. & W. High Grade Starter and Potash
O. & W. High Grade Tobacco Starter
O. & W. High Grade Vegetable & Potato
O. & W. Nitrate of Potash 90%
O. & W. Nitrate of Soda
O. & W. Precipitated Bone Meal
O. & W. Pure Bone Meal
O. & W. Sulphate of Ammonia

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

Parmenter & Polsey Fertilizer Company, 41 North Market St., Boston, Mass.
"P & P" "AA" Brand 5-8-7
"P & P" Maine Potato Fertilizer 4-6-10
Parmenter & Polsey Top Dressing 7-6-5

Piedmont Mt. Airy Guano Co., Baltimore, Md.
Harvest Brand 2-8-2
Harvest Brand 3-8-4
Harvest Brand 4-6-10
Harvest Brand 4-8-4
Harvest Brand 5-8-7
Nitrate Soda

Frank S. Platt Co., 450 State St., New Haven, Conn.
Platt's Concentrated Lawn Fertilizer
Platco Special 5-8-7

Premier Poultry Manure Company, 431 So. Dearborn St., Chicago, Illinois.
Premier Brand Poultry Manure
Premier Brand Sheep Manure

The Pulverized Manure Co., 828 Exchange Ave., Union Stock Yard, Chicago, Illinois.

Wizard Brand Cattle Manure
Wizard Brand Pulverized Sheep Manure

Rackliffe Bros. Co., Inc., New Britain, Conn.

Acid Phosphate 16%
Nitrate of Soda
Rackliffe Brand Corn Fertilizer 4-8-4
Rackliffe Brand Potato & Special Vegetable 5-8-7

The Rogers & Hubbard Company, Portland, Conn.

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

F. S. Royster Guano Company, 602 Citizens National Bank Bldg., Baltimore, Md.

Cotton Seed Meal
Royster's Comet Guano
Royster's Connecticut Tobacco Guano
Royster's Fine Ground Bone Meal
Royster's 5% Truck Guano
Royster's Gem Guano
Royster's Nitrate of Soda
Royster's Quality Trucker
Royster's Sheep and Goat Manure
Royster's 16% Acid Phosphate
Royster's Top Dresser
Royster's Trucker's Delight
Royster's Valley Tobacco Guano
Royster's Wrapper Brand

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

Bone Meal
Potato Special
"Swift-Sure" Tobacco Starter 4-10-0
"Swift-Sure" 4-8-5 Special Tobacco Formula
Tobacco and General Use

Springfield Rendering Company, Springfield, Mass.

Springfield 3-8-4
Springfield 4-8-4
Springfield 4-8-7
Springfield 5-8-7
Springfield Tobacco Special 5-3-5

Swift & Company Fertilizer Works, Baltimore, Maryland.

Vigoro

Synthetic Nitrogen Products Corp., 285 Madison Ave., New York City.

Calcium Nitrate Basf (Nitrate of Lime)
Calurea
Nitrophoska
Urea Basf (Floranid)

Tennessee Copper & Chemical Corp., Lockland, Cincinnati, Ohio.

Loma

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

Castor Pomace
Dairymen's Special 0-10-10
Economy Fertilizer 3-12-3
High Grade Potato Manure 4-8-10
I. P. Thomas 5-8-7
Long Island Special 4-8-7
Muriate of Potash
Nitrate of Soda
Pure Ground Bone
7% Guano 7-6-5
Sheep & Goat Manure
16% Acid Phosphate
Tankage—sold on analysis
Thomas Tobacco Grower 5-4-5
Tip Top Superphosphate 3-10-6
Truckers High Grade Guano 4-8-4
Victor Potash Fertilizer 2-8-5

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

Triton 4-8-4 Fertilizer
Triton 4-8-7 Fertilizer
Triton 5-8-5 Fertilizer
Triton 5-8-7 Fertilizer

United States Guano Co., care Standard Wholesale Phosphate & Acid Works, Baltimore, Md.

Standard United States Accomac Peninsula King
Standard United States Bone Meal 4-40
Standard United States 3 x 50 Bone Meal
Standard United States 4½ x 45 Bone Meal Raw
Standard United States Evergreen Fish Guano
Standard United States Fish Bone and Potash
Standard United States General Use Guano
Standard United States Grain Grower
Standard United States High Grade Phosphate and Potash

Standard United States Jersey Special
Standard United States Mammoth Potato Grower
Standard United States Muriate of Potash
Standard United States Nitrate of Soda
Standard United States Old Fertility
Standard United States Royal Potato Grower
Standard United States 16% Acid Phosphate
Standard United States Special Potato Grower
Standard United States Star Brand
Standard United States Sulphate of Ammonia
Standard United States Sure Growth
Standard United States 6 x 30 Tankage
Standard United States 9 x 20 Tankage
Standard United States 10% Fish
Standard United States Truckers Fish Guano
Standard United States 5 x 10 x 5
Standard United States 8 x 6 x 6

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

Bloomaid
V-C Aroostook Potato Grower
V-C Fish and Potash Compound
V-C Phospho-Tobacco
V-C 16% Acid Phosphate
V-C 20% Acid Phosphate
V-C XXXX Fish and Potash

Wessel, Duval & Co., 1 Broadway, New York City.

Nitrate of Soda

The Wilcox Fertilizer Company, Mystic, Conn.

Acid Phosphate
Ground Steamed Bone
Muriate of Potash
Nitrate of Soda
Wilcox Corn Special 3-10-4
Wilcox Drv Ground Fish
Wilcox H. G. Fish and Potash 4-8-4
Wilcox Potato and Vegetable Phosphate 5-8-7
Wilcox 7-6-5 Top Dresser

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

Woodruff's Home Mixed Fertilizer

Worcester Rendering Co., Auburn, Mass.

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

INSPECTION OF 1928.

During the past season the Station agent has visited 101 towns and villages in the State and has taken 536 official samples of fertilizers, including all of the registered brands which could be found. These, together with samples submitted by purchasers, and others interested, are classified as follows:

CLASSIFICATION OF FERTILIZERS ANALYZED IN 1928.

	No. of Samples	Page
I. *Containing Nitrogen as the chief active ingredient:*		
Nitrate of Soda	33	18
Calcium Nitrate (Nitrate of Lime)	4	18
Calurea	5	18
Urea	3	19
Sulphate of Ammonia	12	19
Castor Pomace	55	19
Cottonseed Meal	123	20
Linseed Meal	11	20
II. *Containing Phosphoric Acid as the chief active ingredient:*		
Precipitated Bone Phosphate	7	33
Superphosphate (Acid Phosphate)	18	33
Basic Slag	2	37
III. *Containing Potash as the chief ingredient:*		
Carbonate of Potash	16	37
Muriate of Potash	12	37
Sulphate of Potash	18	37
Sulphate of Potash-Magnesia	2	38
Cotton Hull Ashes	28	38
Wood Ashes	7	38
IV. *Containing Nitrogen and Potash:*		
Nitrate of Potash and Soda	2	45
Nitrate of Potash	5	45
V. *Containing Nitrogen and Phosphoric Acid:*		
Dry Ground Fish	39	46
Tankage	12	51
Ground Bone, etc	52	53
VI. *Mixed Fertilizer:*		
Containing Nitrogen and Phosphoric Acid	6	58
Containing Phosphoric Acid and Potash	4	58
Containing Nitrogen, Phosphoric Acid and Potash	265	59
Special and Home Mixtures	50	84
VII. *Miscellaneous fertilizers, amendments, waste products, etc.:*		
Sheep Manure, etc	26	84
Lime, etc	7	84
Other miscellaneous materials	35	84
Collaborative check meals and fertilizers	45	84
Total	904	

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA.

This raw material as used for fertilizer contains from 91 to 97 per cent of sodium nitrate which is equivalent to 15 to 16 per cent of nitrogen or 18.2 to 19.5 per cent of ammonia. The impurities in it are potassium and magnesium chlorides, sodium sulphate and sodium iodide of which there is, collectively, 2 to 3 per cent.

Nitrate of soda is obtained from the west coast of South America, chiefly from Chili. Until recently it has been practically the sole source of this form of agricultural nitrogen but it now encounters competition from synthetic nitrogen products. However, natural deposits of nitrate are not likely to be exhausted for many years to come and improved methods of production will no doubt enable this natural raw material to maintain an important place in the fertilizer trade.

Guaranties have ranged from 14.7 to 15.2 per cent. All samples, excepting **9557,** have exceeded guaranties by substantial margins, the average nitrogen content being 15.55 per cent. At the prices quoted nitrogen from this source has cost 22.5 cents per pound. Ton prices ranged from $63.00 to $90.00 there being only one quotation at the high figure.

Analyses are given in Table I.

CALCIUM NITRATE.

This is one of the artificial nitrates produced in large quantities where air nitrogen is converted into nitric acid and the nitric acid then treated with lime or limestone to form nitrate of lime. Because it absorbs moisture rapidly it is shipped in drums or in paper lined bags.

The four samples examined were all guaranteed to contain 15 per cent of nitrogen and this figure was met excepting sample **9611** which was 0.2% low. The average retail price is about $65.00 per ton which makes the cost of nitrogen per pound 21.7 cents.

Analyses are given in Table I.

CALUREA.

Calurea is one of the synthetic ammoniates and is a combination of calcium nitrate and urea. About 1/5 of the nitrogen is derived from nitrate and the remainder is in organic form from urea.

Five samples were examined, all guaranteed to contain 34 per cent of nitrogen or 41.3 per cent of ammonia. One sample, **9652,** was considerably deficient and two others were slightly under the guaranty.

The price quoted is about $110.00 per ton which, on the basis of 34 per cent nitrogen, makes the cost of nitrogen per pound 16.2 cents.

Analyses are given in Table I.

UREA.

This synthetic product is made in large quantities in Europe and is obtained by combining synthetic ammonia with pure carbon dioxide. The commercial article offered for fertilizer is generally guaranteed to contain 46 per cent of nitrogen which is equivalent to 55.5 per cent of ammonia. This form of nitrogen is soluble in water and is classed as organic.

Three samples were examined two of which were slightly under guaranties. At $165.00 per ton which is the retail price quoted to us the cost of nitrogen per pound is 17.9 cents.

Analyses are given in Table I.

SULPHATE OF AMMONIA.

This raw material is made almost entirely in this country from sulphuric acid and by-product ammonia, that is, ammonia obtained in the production of coke and illuminating gas. It may be made, and is made on a large scale in Europe, from synthetic ammonia, gypsum and carbon dioxide.

"Arcadian" sulphate of ammonia is specially treated, dried, and screened to remove lumps and to insure good mechanical condition.

This product is generally guaranteed to contain 20.5 per cent of nitrogen which is equivalent to 25 per cent of ammonia. The twelve samples examined equalled or exceeded their guaranties excepting four cases where slight deficiencies were noted. The average nitrogen found was 20.71 per cent. At $60.00 per ton the average price quoted, the cost of nitrogen per pound is 14.5 cents.

Analyses are given in Table II.

CASTOR POMACE.

This raw material is the ground residue left after the removal of oil from the castor bean. Caution should be used in storing it as it is very poisonous to farm animals. It is chiefly valuable for its nitrogen although it contains small amounts of phosphoric acid and potash.

Fifty-five samples were examined and only six failed to equal guaranties. The deficiencies were in most cases negligible, however, only two being in excess of 0.1 per cent and none were in excess of 0.2 per cent.

The average nitrogen found was 4.97 per cent and the average of quoted prices was about $30.00. Nitrogen from this source has cost about 30 cents per pound as compared with 24 cents last year.

Analyses are given in Table III.

COTTONSEED MEAL.

One hundred and twenty-three samples of cottonseed meal, most of them submitted by purchasers, were examined. The average of all for which guaranties were given, and exclusive of three sold under odd guaranties, is 6.56 per cent of nitrogen which is a 41% protein grade.

The classification of samples this year in comparison with similar data for several years past is given in the following summary:

Grade	No. of samples	Average nitrogen per cent	Average nitrogen per cent in 1927	1926	1925
36 per cent protein (5.76 N).....	15	5.75	5.78	5.84	5.79
41 per cent protein (6.58 N).....	71	6.58	6.56	6.60	6.76
43 per cent protein (6.88 N).....	30	6.88	7.05	6.78	7.02
No guaranty or odd guaranty.....	9	...	...	...	...
Total.....	123	6.56	6.61	6.57	6.63

So far as prices are available the range has been from $48.00 to $70.00 per ton and the average $54.00. On this basis nitrogen from this source has cost about 41 cents per pound during the past year.

One hundred and two substantially met or exceeded their guaranties and twenty-one did not.

Analyses are given in Table IV.

LINSEED MEAL.

Eleven samples of linseed meal were analyzed and all were of good qualtity. The average nitrogen content was 5.65 per cent. Prices quoted ranged from $49.00 to $57.50 and averaged slightly under $55.00 at which figure the cost of nitrogen per pound was about 48 cents.

Analyses are given in Table IV.

TABLE I. ANALYSES OF NITRATE OF SODA, ETC.

Station No.	Manufacturer or Jobber,	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Guaranteed.
	Nitrate of Soda			
8869	American Agricultural Chemical Co., New York.....	Station agent. Stock of Bristol Grain & Supply, Bristol.....	15.66	15.22
9530	American Agricultural Chemical Co., New York.....	Station agent. Stock of E. N. Austin, Suffield.....	15.56	15.22
8988	Apothecaries Hall Co., Waterbury, Conn.....	Station agent. Stock of J. A. Glasnap, West Cheshire. ..	15.52	14.80
8923	Apothecaries Hall Co., Waterbury, Conn.....	Edwards & Brewer, West Suffield.....	15.68	14.80
8331	Apothecaries Hall Co., Waterbury, Conn.....	Hatheway & Steane, Inc., Hartford.....	15.56	14.80
8657	Apothecaries Hall Co., Waterbury, Conn.....	Hatheway & Steane, Inc., Hartford.....	15.90	14.80
8835	Apothecaries Hall Co., Waterbury, Conn.....	Hatheway & Steane, Inc., Hartford.....	15.58	14.80
8941	Apothecaries Hall Co., Waterbury, Conn.....	Hatheway & Steane, Inc., Hartford.....	15.64	14.80
9330	Apothecaries Hall Co., Waterbury, Conn.....	A. N. Shepard & Son, Hartford.	15.48	14.80
8996	Armour Fertilizer Works, New York.....	Station agent. Stock of J. D. Kelsey, Madison.....	15.76	14.81
9549	Berkshire Chemical Co., Bridgeport, Conn.....	Station agent. Stock of Knowles Lombard, Guilford.....	15.56	15.00
9557	Everett B. Clark Seed Co., Milford, Conn.....	Station agent at factory.....	14.40	15.00
8889	Consolidated Rendering Co., Boston, Mass.....	C. R. Burr & Co., Inc., Manchester.....	15.66	15.22
9121	Consolidated Rendering Co., Boston, Mass.....	Walter T. Clark, Norwich.....	15.38	15.22
8882	Consolidated Rendering Co., Boston, Mass.....	Station agent. Stock of Laden Bros., Wallingford.....	15.74	15.22
9154	Eastern States Farmers' Exchange, Springfield, Mass..	Station agent. Stock of Ridgewood Farm, No. Haven.....	15.60	14.80
8303	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield.....	15.58	.....
8169	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield.....	15.16	.....
8170	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield.....	15.80	.....
8171	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield.....	15.88	.....
8172	W. R. Grace & Co., New York	American Sumatra Tobacco Co., Bloomfield.....	15.76	.....
8914	Mapes Formula & Peruvian Guano Co., New York....	Station agent. Stock of Mapes Branch, Hartford.....	15.52	14.81
8911	Olds & Whipple Inc., Hartford, Conn.....	Station agent at factory.....	15.76	15.00
9482	Piedmont Mt. Airy Guano Co., Baltimore, Md.....	Station agent. Stock of C. A. Cowles, Plantsville.....	15.80	15.00

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

Station No.	Manufacturer or Jobber,	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Nitrate of Soda.			
9501	Rackliffe Bros. Co. Inc., New Britain, Conn	Station agent at factory	15.68	.....
9291	The Rogers & Hubbard Co., Portland, Conn	Station agent. Stock of W. L. Richmond, New Milford	15.56	14.80
9497	F. S. Royster Guano Co., Baltimore, Md	Station agent. Stock of F. B. Newton, Plainville	15.68	15.00
9587	I. P. Thomas & Son, Philadelphia, Pa	Station agent. Stock of L. M. Benham, Highwood	15.66	15.00
9060	U. S. Guano Co., Baltimore, Md	J. A. Barrasso, Andover	15.38	14.80
8849	U. S. Guano Co., Baltimore, Md	Station agent. Stock of Frank Libner & Son, Norwalk	15.24	14.80
9341	Wessel Duval & Co., New York	Station agent. Stock of F. H. Woodruff & Son, Milford, Ct.	15.66	14.87
9122	Wilcox Fertilizer Co., Mystic, Conn	Walter T. Clark, Norwich	15.52	14.72
9353	Wilcox Fertilizer Co., Mystic, Conn	Station agent at factory	14.92	14.72
	Calcium Nitrate (Nitrate of Lime)			
9561	International Agricultural Corp., Woburn, Mass	Station agent. Stock of Lyman Farm, Middlefield	15.04	15.00
8899	Synthetic Nitrogen Products Corp., New York	The Allied Tobacco Co., Hartford	15.22	15.00
9039	Synthetic Nitrogen Products Corp., New York	Station agent. Stock of J. A. Glasnap, West Cheshire	15.06	15.00
9611	Synthetic Nitrogen Products Corp., New York	Station agent. Stock of Tobacco Station, Windsor	14.80	15.00
	Calurea.			
9652	Synthetic Nitrogen Products Corp., New York	J. E. Phelps, Suffield	32.38	34.00
9038	Synthetic Nitrogen Products Corp., New York	Station agent. Stock of Olds & Whipple, Inc., Hartford	34.54	34.00
9116	Synthetic Nitrogen Products Corp., New York	Station agent. Stock of Tobacco Station, Windsor	34.40	34.00
9331	Synthetic Nitrogen Products Corp., New York	A. N. Shepard & Son, Hartford	33.78	34.00
9392	Synthetic Nitrogen Products Corp., New York	Eastern States Farmers' Exchange, Springfield, Mass	33.80	34.00
	Urea.			
9456	Eastern States Farmers' Exchange, Springfield, Mass.	Station agent. Stock of Chester Beeman, Granby	45.40	45.24
9037	Synthetic Nitrogen Products Corp., New York	Station agent. Stock of Olds & Whipple, Inc., Hartford	45.80	46.00
9115	Synthetic Nitrogen Products Corp., New York	Station agent. Stock of Tobacco Station, Windsor	45.84	46.00

TABLE II. ANALYSES OF SULPHATE OF AMMONIA.

Station No.	Manufacturer or Jobber,	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
8954	American Agricultural Chemical Co., New York	Station agent at factory, West Haven	20.76	20.56
9532	American Agricultural Chemical Co., New York	Station agent. Stock of E. N. Austin, Suffield	20.42	20.56
8992	Apothecaries Hall Co., Waterbury, Conn	Station agent at factory	21.00	20.58
9030	Armour Fertilizer Works, New York	Station agent. Stock of F. A. Bartlett Tree Expert Co., Stamford	21.00	20.56
9546	The Barrett Co., New York	Station agent. Stock of Berkshire Chemical Co., Bridgeport	21.00	20.75
9547	The Barrett Co., New York	Station agent. Stock of Berkshire Chemical Co., Bridgeport	20.70	20.50
8957	Consolidated Rendering Co., Boston, Mass	Station agent. Stock of L. T. Frisbie Co., New Haven	20.68	20.50
9157	Eastern States Farmers' Exchange, Springfield, Mass.	Station agent. Stock of J. A. Sherwood, Bridgeport	20.56	20.55
9059	Olds & Whipple Inc., Hartford, Conn	J. A. Barrasso, Andover	20.50	20.60
9566	Olds & Whipple Inc., Hartford, Conn	Station agent at factory	20.54	20.60
8853	U. S. Guano Co., Baltimore, Md	Station agent. Stock of H. P. Beers, Southport	20.48	20.56
9057	U. S. Guano Co., Baltimore, Md	J. A. Barrasso, Andover	20.92	20.56

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.			
8953	.....	Station agent from factory....	4.78	4.53
9318	Car N. Y. C. 247062.....	Spencer Bros., Inc., Suffield....	4.67	4.53
	Apothecaries Hall Co., Waterbury, Conn.			
8982	.....	Station agent from factory.....	4.75	4.52
9610	.....	Station agent. Stock of Tobacco Station, Windsor.....	4.48	4.52
8897	Car No. 17816.....	The Allied Tobacco Co., Hartford.....	5.20	4.52
8922	.....	Edwards & Brewer, West Suffield.....	4.94	4.52
8353	Car No. 10777.....	Hatheway & Steane, Inc., Hartford.....	4.86	4.52
8361	Car No. 11712.....	Hatheway & Steane, Inc., Hartford.....	5.56	4.52
8362	Car No. 12075.....	Hatheway & Steane, Inc., Hartford.....	5.54	4.52
8387	Car No. 20404.....	Hatheway & Steane, Inc., Hartford.....	4.72	4.52
8388	Car No. 13462.....	Hatheway & Steane, Inc., Hartford.....	4.34	4.52
8389	Car No. 12952.....	Hatheway & Steane, Inc., Hartford.....	4.78	4.52
8390	Car No. 20415.....	Hatheway & Steane, Inc., Hartford.....	4.58	4.52
8391	Car No. 10919.....	Hatheway & Steane, Inc., Hartford.....	4.37	4.52
8392	Car No. 17915.....	Hatheway & Steane, Inc., Hartford.....	5.26	4.52
8393	Car No. 11624.....	Hatheway & Steane, Inc., Hartford.....	5.16	4.52
8451	Car No. 17229.....	Hatheway & Steane, Inc., Hartford.....	5.65	4.52
8656	Car No. 30368.....	Hatheway & Steane, Inc., Hartford.....	4.80	4.52
8688	Car No. 20448.....	Hatheway & Steane, Inc., Hartford.....	5.34	4.52
8689	Car No. 11172.....	Hatheway & Steane, Inc., Hartford.....	5.42	4.52
8824	Car No. 11104.....	Hatheway & Steane, Inc., Hartford.....	4.76	4.52
8825	Car No. 10720.....	Hatheway & Steane, Inc., Hartford.....	5.16	4.52

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

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Apothecaries Hall Co., Waterbury, Conn.			
8826	Car No. 11815.....	Hatheway & Steane, Inc., Hartford.....	5.56	4.52
8827	Car No. 13081.....	Hatheway & Steane, Inc., Hartford.....	5.36	4.52
8832	Car No. 10432.....	Hatheway & Steane, Inc., Hartford.....	4.32	4.52
8937	Car No. 97143.....	Hatheway & Steane, Inc., Hartford.....	4.65	4.52
9328	.....	A. N. Shepard & Son, Hartford.	4.92	4.52
9336	.....	A. N. Shepard & Son, Hartford.	5.43	4.52
	Armour Fertilizer Works, New York City.			
9441	.....	Station agent. Stock of A. R. Jones, Wallingford.....	4.58	4.52
	Baker Castor Oil Co., New York City.			
8251	Car No. 17093.....	American Sumatra Tobacco Co., Bloomfield.....	4.69	4.50
8252	Car No. 17018.....	American Sumatra Tobacco Co., Bloomfield.....	4.85	4.50
9145	.....	Station agent. Stock of Olds & Whipple, Inc., Hartford.....	4.92	4.50
	Berkshire Chemical Co., Bridgeport, Conn.			
8960	.....	Station agent. Stock of Ira Waters, Brookfield.....	5.12	4.52
9531	.....	Station agent. Stock of E. M. Austin, Suffield.....	4.96	4.52
8371	Car No. 226820.....	Cullman Bros., Hartford.....	5.00	4.52
8512	Car No. 252384.....	Cullman Bros., Hartford.....	5.24	4.52
8513	Car No. 252384.....	Cullman Bros., Hartford.....	5.18	4.52
8514	Car No. 252384.....	Cullman Bros., Hartford.....	4.95	4.52
8517	Car No. 240356.....	Cullman Bros., Hartford.....	4.91	4.52
8518	Car No. 240356.....	Cullman Bros., Hartford.....	4.88	4.52
8524	Car No. 245910.....	Cullman Bros., Hartford.....	5.22	4.52
8525	Car No. 213402.....	Cullman Bros., Hartford.....	4.97	4.52
9066	Car No. M. C. 91825.....	Spencer Bros., Suffield.....	4.64	4.52
9067	Car No. G. N. 33540.....	Spencer Bros., Suffield.....	4.82	4.52
9068	Car No. P. R. R. 517613....	Spencer Bros., Suffield.....	4.90	4.52
9069	Car No. P. R. R. 43189.....	Spencer Bros., Suffield.....	4.81	4.52
9651	.....	J. E. Phelps, Suffield.....	4.45	4.52

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

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	E. D. Chittenden Co., Bridgeport, Conn.			
9600	.....	Station agent. Stock of J. P. Norton, Broad Brook.....	4.61	4.50
	Consolidated Rendering Co., Boston, Mass.			
9161	.....	Station agent. Stock of L. T. Frisbie Co., New Haven.....	5.72	4.52
	Spencer Kellogg & Sons, Buffalo, N. Y.			
9233	.....	Station agent. Stock of H. H. McKnight, Ellington.....	4.65	4.52
	Olds & Whipple Inc., Hartford, Conn.			
9485	.....	Station agent. Stock of H. E. Wells, East Windsor Hill....	4.94	5.00
9393	No. 1.....	H. E. Wells, Warehouse Point..	5.26	5.00
9394	No. 2.....	H. E. Wells, Warehouse Point..	5.33	5.00
9098	Car C. N. J. 36426.....	L. Wetstone & Sons, Inc., Hartford.....	5.19	4.75
9099	Car C. N. W. 91660.....	L. Wetstone & Sons, Inc., Hartford.....	4.98	4.75

TABLE IV. ANALYSES OF COTTONSEED AND LINSEED MEALS.

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	American Agricultural Chemical Co., New York City	**Cottonseed Meal.**		
9519	.....	Station agent at factory.....	5.88	5.76
	Apothecaries Hall Co., Waterbury, Conn.			
8986	.....	Station agent at factory.....	6.46	6.58
9201	Car No. S. O. U. 155736....	The Allied Tobacco Co., Hartford.....	6.34	6.56
9202	Car No. S. O. U. 130013.....	The Allied Tobacco Co., Hartford.....	6.88	6.56
8328	Car No. 57701.....	Hatheway & Steane, Inc., Hartford.....	6.83	....
8329	Car No. 409501.....	Hatheway & Steane, Inc., Hartford.....	6.71	....
8347	Car No. 26782.....	Hatheway & Steane, Inc., Hartford.....	6.87	6.58
8348	Car No. 55896.....	Hatheway & Steane, Inc., Hartford.....	6.71	6.58
8349	Car No. 330185.....	Hatheway & Steane, Inc., Hartford.....	6.62	6.58
8350	Car No. 1048.....	Hatheway & Steane, Inc., Hartford.....	6.58	6.58
8351	Car No. 172008.....	Hatheway & Steane, Inc., Hartford.....	6.39	6.58
8352	Car No. 154294.....	Hatheway & Steane, Inc., Hartford.....	6.71	6.58
8357	Car No. 159218.....	Hatheway & Steane, Inc., Hartford.....	6.60	6.58
8358	Car No. 50232.....	Hatheway & Steane, Inc., Hartford.....	6.61	6.58
8359	Car No. 55303.....	Hathaway & Steane, Inc., Hartford.....	5.92	6.58
8360	Car No. 27478.....	Hatheway & Steane, Inc., Hartford.....	6.60	6.58
8394	Car No. 7052.....	Hatheway & Steane, Inc., Hartford.....	6.64	....
8447	Car No. 10234.....	Hatheway & Steane, Inc., Hartford.....	6.10	6.58
8448	Car No. 47475.....	Hatheway & Steane, Inc., Hartford.....	5.94	6.58
8449	Car No. 55923.....	Hatheway & Steane, Inc., Hartford.....	6.48	6.58
8450	Car No. 37052.....	Hatheway & Steane, Inc., Hartford.....	6.79	6.58
8655	Car No. 163453.....	Hatheway & Steane, Inc., Hartford.....	6.74	6.58

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

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Apothecaries Hall Co., Waterbury, Conn.	**Cottonseed Meal.**		
8684	Car No. 19120	Hatheway & Steane, Inc., Hartford	6.79	6.58
8685	Car No. 51268	Hatheway & Steane, Inc., Hartford	6.43	6.58
8686	Car No. 57978	Hatheway & Steane, Inc., Hartford	6.99	6.58
8687	Car No. 145866	Hatheway & Steane, Inc., Hartford	6.47	6.58
8943	Car No. 34009	Hatheway & Steane, Inc., Hartford	6.81	6.58
	Ashcraft-Wilkinson Co., Atlanta, Ga.			
9598	Helmet	Station agent. Stock of E. A. Root, East Granby	6.54	6.58
9597	Monarch	Station agent. Stock of W. E. Bostwick, New Milford	6.75	6.88
8876	Car A. C. L. 29646	Spencer Bros., Inc., Suffield	7.00	6.88
9014	Car N. Y. 66632	Spencer Bros., Inc., Suffield	6.44	6.56
9017	Car N. Y. 72370 and P. R. R. 37854	Spencer Bros. Inc., Suffield	6.47	6.56
	F. W. Brode Corp., Memphis, Tenn.			
8270	Cold Press Cottonseed Meal	Ed. Eggert, Hartford	4.58	....
9595	Owl Brand 41%	Station agent. Stock of Tobacco Station, Windsor	6.56	6.56
9650	Owl Brand 36%	J. E. Phelps, Suffield	6.58	5.76
	Humphreys-Godwin Co., Memphis, Tenn.			
8896	Dixie, Car No. 515977	The Allied Tobacco Co., Hartford	6.28	6.58
9010	Dixie, Car No. 193844	The Allied Tobacco Co., Hartford	6.50	6.58
9147	Dixie, Car No. B. & O. 193844	The Allied Tobacco Co., Hartford	6.66	6.58
9148	Dixie, Car No. B. & O. 176849	The Allied Tobacco Co., Hartford	6.52	6.58
9149	Dixie, Car L. & N. No. 49693	The Allied Tobacco Co., Hartford	6.57	6.58
8944	Dixie, Car No. 41347	Hatheway & Steane, Inc., Hartford	6.51	6.58
9232	Danish	Station agent. Stock of Amos D. Bridge's Sons, Hazardville	5.67	5.75

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

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Humphreys-Godwin Co., Memphis, Tenn.	**Cottonseed Meal.**		
8079	Dixie, Car Sou. No. 253049 (Off Color)	A. A. Clark, Windsor	6.56	6.58
8080	Dixie, Car C. & A., No. 36732 (Off Color)	A. A. Clark, Windsor	6.56	6.58
8364	Bull, Car No. 256123	Cullman Bros., Inc., Hartford	6.74	6.88
8365	Bull, Car No. 131981	Cullman Bros., Inc., Hartford	6.84	6.88
8366	Bull, Car No. 99263	Cullman Bros., Inc., Hartford	6.65	6.88
8515	Bull, Car No. 57752	Cullman Bros., Inc., Hartford	7.02	6.88
8516	Bull, Car No. 23062	Cullman Bros., Inc., Hartford	6.52	6.88
8519	Bull, Car No. 101022	Cullman Bros., Inc., Hartford	6.79	6.88
8520	Bull, Car No. 305291	Cullman Bros., Inc., Hartford	6.80	6.88
8521	Bull, Car No. 330868	Cullman Bros., Inc., Hartford	6.77	6.88
8522	Bull, Car No. 341282	Cullman Bros., Inc., Hartford	6.88	6.88
8523	Bull, Car No. 165243	Cullman Bros., Inc., Hartford	6.66	6.88
8526	Bull, Car No. 150145	Cullman Bros., Inc., Hartford	6.89	6.88
8527	Bull, Car No. 409874	Cullman Bros., Inc., Hartford	6.82	6.88
8528	Bull, Car No. 165472	Cullman Bros., Inc., Hartford	7.02	6.88
8600	Bull, Car I. E. No. 342963	Cullman Bros., Inc., Hartford	6.96	6.88
8602	Bull, Car No. 166272	Cullman Bros., Inc., Hartford	6.76	6.88
8604	Bull, Car No. 60522	Cullman Bros., Inc., Hartford	6.84	6.88
8605	Bull, Car No. 166496	Cullman Bros., Inc., Hartford	7.07	6.88
8606	Bull, Car No. 169463	Cullman Bros., Inc., Hartford	6.97	6.88
8607	Bull, Car No. 166290	Cullman Bros., Inc., Hartford	6.89	6.88
9090	Bull, Car No. 30226	Cullman Bros., Inc., Hartford	6.84	6.88
8269	Dixie, Car No. 55071	L. B. Haas & Co., Inc., Hartford	6.74	6.58
8305	Dixie, Car No. 60296	L. B. Haas & Co., Inc., Hartford	6.84	6.58
8442	Dixie, Car No. 135449	L. B. Haas & Co., Inc., Hartford	6.70	6.58
8443	Dixie, Car No. 409299	L. B. Haas & Co., Inc., Hartford	6.76	6.58
8382	Dixie, Car Sou., No. 304709	Huntington Bros., Windsor	6.66	6.58
8383	Dixie, Car C. of G., No.57786	Huntington Bros., Windsor	6.66	6.58
8384	Dixie, Car Sou., No. 121643	Huntington Bros., Windsor	6.56	6.58
9093	Dixie	H. C. Nelson, West Suffield	6.66	6.58
9754	Bull	G. A. Peckham, Suffield	6.56	6.88
9231	Dixie	E. H. Rollins, Granby	6.55	6.58
8377	Dixie, Car No. 7435	A. N. Shepard & Son, Hartford	6.27	6.58
8378	Dixie, Car No. 8054	A. N. Shepard & Son, Hartford	6.42	6.58
8379	Danish, Car No. 42746	A. N. Shepard & Son, Hartford	5.81	5.75
9126	Danish, Car A. C. L., No. 43846	A. N. Shepard & Son, Hartford	5.60	5.75
9015	Dixie, Car C. & F., No. 7064	Spencer Bros., Inc., Suffield	6.72	6.58
9070	Bull, Car N. Y., No. 164622 and S. P. 28675	Spencer Bros., Inc., Suffield	7.31	6.88
9072	Danish, Car A. C. L. No. 40349	Spencer Bros., Inc., Suffield	5.80	5.76

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

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Humphreys-Godwin Co., Memphis, Tenn.	**Cottonseed Meal.**		
9314	Danish, Car A. C. L. No. 41604	Spencer Bros., Inc., Suffield	5.67	5.75
9315	Dixie, Car M. & St. L. No. 20578	Spencer Bros., Inc., Suffield	6.62	6.58
9316	Bull, Car C. N., No. 307465 and S. A. 39754	Spencer Bros., Inc., Suffield	7.00	6.88
9317	Dixie, Car N. Y., No. 168144 and C. Ga. 51071	Spencer Bros., Inc., Suffield	6.74	6.58
9469	Danish, C. Ga. No. 57589	Spencer Bros., Inc., Suffield	5.62	5.75
9470	Danish, Car B. & O., No. 268990	Spencer Bros., Inc., Suffield	6.13	5.75
9471	Danish, Car C. & K. W., 141906	Spencer Bros., Inc., Suffield	5.69	5.75
9472	Danish, Car A. C. L. No. 50373	Spencer Bros., Inc., Suffield	5.74	5.75
9473	Danish, Car C. N. J., No. 17672	Spencer Bros., Inc., Suffield	5.70	5.75
9474	Danish, Car S. A. L. No. 12611	Spencer Bros., Inc., Suffield	5.70	5.75
9309	Dixie, Car No. 166221, No. 7.	L. Wetstone & Sons, Inc., Hartford	6.58	6.58
9310	Dixie, Car No. 82911, No. 8.	L. Wetstone & Sons., Inc., Hartford	6.48	6.58
9311	Dixie, Car No. 165007, No. 9.	L. Wetstone & Sons, Inc., Hartford	6.63	6.58
9094	Dixie, Car B.-O., No. 267964, No. 1	L. Wetstone & Sons, Inc., Hartford	6.49	6.58
9095	Dixie, Car C.R.G., No.57674, No. 2	L. Wetstone & Sons, Inc., Hartford	6.49	6.58
	International Agricultural Corporation, Boston, Mass.			
8440	Car No. C. Ga. 56996	L. B. Haas & Co., Inc., Hartford	6.61	6.56
8441	Car No. C. G. 55396	L. B. Haas & Co., Inc., Hartford	6.57	6.56
9011	Car No. 66246	The Allied Tobacco Co., Hartford	6.91	6.88
	L. B. Lovitt & Co., Memphis, Tenn.			
9016	"Lovit", Car No. M. & O. 24402	Spencer Bros., Inc., Suffield	7.00	6.88
9071	"Lovit", Car No. M. & O. 24299	Spencer Bros., Inc., Suffield	7.18	6.88

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

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	L. B. Lovitt & Co., Memphis, Tenn.	**Cottonseed Meal.**		
9073	"Lovit", Car M. & O. No. 23951	Spencer Bros., Inc., Suffield	6.90	6.88
8367	"Lovit, Car No. 15242	Cullman Bros., Inc., Hartford.	6.54	6.56
8368	"Lovit", Car No. 15296	Cullman Bros., Inc., Hartford..	6.30	6.56
8369	"Lovit", Car. No. 37091	Cullman Bros., Inc., Hartford..	6.47	6.56
8370	"Lovit", Car No. 37100	Cullman Bros., Inc., Hartford..	6.63	6.56
	Memphis Cottonseed Products Co., Memphis, Tenn.			
8237	Car M. P. No. 22172	Steane, Hartman & Co., Hartford	6.81	6.58
8238	Car C. M. No. 83294	Steane, Hartman & Co., Hartford	6.53	6.58
8239	Car M. P. No. 6575	Steane, Hartman & Co., Hartford	7.00	6.58
8240	Car M. P. No. 120094	Steane, Hartman & Co., Hartford	6.72	6.58
8241	Car M. P. No. 8696	Steane, Hartman & Co., Hartford	6.89	6.58
8242	Car N. Y. C. No. 96115	Steane, Hartman & Co., Hartford	6.45	6.58
8306	Car N. H. No. 71455	Steane, Hartman & Co., Hartford	6.75	6.58
8307	Car M. P. No. 120845	Steane, Hartman & Co., Hartford	6.84	6.58
8308	Car Sou. No. 155029	Steane, Hartman & Co., Hartford	6.71	6.58
8309	Car Ga. No. 19135	Steane, Hartman & Co., Hartford	6.76	6.58
	Olds & Whipple, Inc., Hartford, Conn.			
8217	Car No. 56539	L. B. Haas & Co., Hartford	6.74	6.58
	F. S. Royster Guano Co., Baltimore, Md.			
9568		Station agent. Stock of Chas. Handel, Glastonbury	6.81	6.88
	Simpson, Hendee & Co., Inc., New York			
8712		W. L. Richmond & Son, New Milford	3.40	3.20

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

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.
	Manufacturer Unknown	**Cottonseed Meal.**		
9130	Car A. C. L. No. 35998.....	James W. Shea, Feeding Hills..	5.85	....
9129	Car M. P. No. 120565.....	James W. Shea, Feeding Hills..	5.70	....
9128	Car A. C. L. No. 32569.....	James W. Shea, Feeding Hills..	5.63	....
9493	.....	E. N. & C. C. Austin, Suffield..	6.71	....
	Apothecaries Hall Co., Waterbury, Conn.	**Linseed Meal**		
8354	Car No. 8459.....	Hatheway & Steane, Inc., Hartford.....	5.64	....
8452	Car No. 60259.....	Hatheway & Steane, Inc., Hartford.....	5.79	....
	Archer-Daniels-Midland Co., Buffalo, N. Y.			
8395	Car No. 60493.....	Hatheway & Steane, Inc., Hartford.....	5.65	....
8453	Car No. 9312.....	Hatheway & Steane, Inc., Hartford.....	5.64	....
8895	Car LV, No. 60011.....	The Allied Tobacco Co., Hartford.....	5.53	5.44
8945	Car No. 76685.....	Hatheway & Steane, Inc., Hartford.....	5.65	....
8946	Car No. 114485.....	Hatheway & Steane, Inc., Hartford.....	5.75	....
9327	(Suffield).....	A. N. Shepard & Son, Hartford.	5.64	....
9335	(Pelton).....	A. N. Shepard & Son, Hartford.	5.50	....
	Olds & Whipple, Inc., Hartford, Conn.			
8216	Car No. 60427.....	L. B. Haas & Co., Hartford....	5.62	....
9096	Car N. H. No. 162502(No. 3)	L. Wetstone & Sons, Inc.....	5.69	5.35

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

PRECIPITATED BONE.

This raw material is a by-product obtained in the manufacture of gelatin and glue stock from bone. Bones are treated with hydrochloric acid and the acid solution then treated with lime or limestone to precipitate the phosphates.

Seven samples were examined all of which exceeded their guaranties in available phosphoric acid. The average was 38 per cent. Only one price quotation was obtained and this affords no very satisfactory basis for calculating the cost of available phosphoric acid in this material. At $56.00 per ton available phosphoric acid cost the purchaser 7.3 cents per pound.

Analyses are given in Table V.

SUPERPHOSPHATE (ACID PHOSPHATE).

This important raw material was formerly called acid phosphate but control officials, agronomists and the fertilizer industry are agreed that the term "acid phosphate" is not properly descriptive and otherwise undesirable and that it should be discontinued. The product is made by treating phosphate rock with sulphuric acid which results in mixture of mono-calcium phosphate and gypsum. The phosphoric acid is in available form and usually present in the proportion of 16 pounds in 100 or 16 per cent.

Eighteen samples were analyzed all of which met or exceeded guaranties. The average for available phosphoric acid found is 17.11 per cent and the average of prices quoted is $22.40 per ton. Available phosphoric acid from this source has, therefore, cost 6.5 cents per pound.

Analyses are given in Table VI.

Sample **8877,** Virginia-Carolina Phospho Tobacco drawn from stock of Stanley-Svea Grain Co., New Britain, was guaranteed to contain 13 per cent of total phosphoric acid. The available found was 12.90 per cent.

TABLE V. ANALYSES OF PRECIPITATED BONE PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer.	Place of Sampling.	Phosphoric Acid.			
			Citrate-insoluble.	Total.	"Available". Found.	"Available". Guaranteed.
	Sampled by Station.		%	%	%	%
8979	Apothecaries Hall Co., Waterbury	At factory	1.68	39.20	37.52	36.00
9609	Apothecaries Hall Co., Waterbury	Tobacco Station, Windsor	1.35	39.50	38.15	36.00
9405	Berkshire Chemical Co., Bridgeport	At factory	2.25	40.60	38.35	38.00
9212	Eastern States Farmers' Exchange, Springfield, Mass.	H. H. McKnight, Ellington	1.10	39.30	38.20	38.00
8908	Olds & Whipple, Inc., Hartford	At factory	1.88	40.20	38.32	38.00
	Sampled by Purchaser.					
8455	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	0.69	37.50	36.81	36.00
9326	Apothecaries Hall Co., Waterbury	A. N. Shepard & Son, Hartford	0.75	39.35	38.60	36.00

TABLE VI. ANALYSES OF SUPERPHOSPHATE (ACID PHOSPHATE).

Station No.	Manufacturer or Wholesale Dealer.	Dealer or purchaser.	Phosphoric Acid.				Station No.
			Citrate Insoluble.	Total.	"Available". Found.	"Available". Guaranteed.	
	Sampled by Station.		%	%	%	%	
8866	American Agricultural Chemical Co., New York	Bristol: Bristol Grain & Supply Co.	0.68	19.75	19.07	16.00	8866
8981	Apothecaries Hall Co., Waterbury	Sampled at factory, East Windsor	1.68	17.75	16.07	16.00	8981
9542	Armour Fertz. Works, New York	Seymour: Seymour Grain & Coal Co.	0.40	16.50	16.10	16.00	9542
9548	Berkshire Chemical Co., Bridgeport	Sampled at factory	0.20	18.65	18.45	16.00	9548
9451	E. B. Clark Seed Co., Milford	Sampled at factory	0.40	17.05	16.65	16.00	9451
8883	Consolidated Rendering Co., Boston, Mass.	Wallingford: Laden Bros.	1.70	18.15	16.45	16.00	8883
9152	Eastern States Farmers' Exchange, Springfield, Mass.	North Haven: Ridgewood Farm	1.13	17.30	16.17	16.00	9152
8907	Olds & Whipple, Inc., Hartford.	Sampled at factory	1.70	17.55	15.85	16.00	8907
9499	Rackliffe Bros. Co., Inc., New Britain	Sampled at factory	0.23	16.90	16.67	16.00	9499
9036	The Rogers & Hubbard Co., Portland	Sampled at factory	0.15	17.93	17.78	16.00	9036
9298	F. S. Royster Guano Co., Baltimore, Md.	Madison: J. D. Kelsey	1.35	17.40	16.05	16.00	9298
9582	I. P. Thomas & Son, Philadelphia, Pa.	Hamden: Ira W. Beers	0.86	18.35	17.49	16.00	9582
8855	U. S. Guano Co., Baltimore, Md.	Westport: Rippe Bros.	0.30	16.55	16.25	16.00	8855

TABLE VI. ANALYSES OF SUPERPHOSPHATE (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.						
8878	Virginia-Carolina Chemical Co., New York	New Britain: Stanley Svea Grain Co.	0.33	20.30	19.97	20.00	8878
8879	Virginia-Carolina Chemical Co., New York	New Britain: Stanley Svea Grain Co.	0.83	17.85	17.02	16.00	8879
9613	Wilcox Fertilizer Co., Mystic	Woodstock: H. F. Joy	0.63	17.85	17.22	16.00	9613
	Sampled by Purchaser.						
9649	Olds & Whipple, Inc., Hartford	Suffield: J. E. Phelps	1.80	18.20	16.40	16.00	9649
9061	U. S. Guano Co., Baltimore, Md.	Andover: J. A. Barrasso	0.35	18.50	18.15	16.00	9061

BASIC SLAG.

Basic slag is a by-product in the manufacture of steel from phosphatic iron ores. According to the A.O.A.C.[1] definition and standard it shall contain not less than 12 per cent of total phosphoric acid of which not less than 80 per cent shall be "available" by the Wagner method.

Two samples were examined.

Sample **8985** was from stock of Apothecaries Hall Co., drawn at the factory. It was guaranteed 15 available and 17 total phosphoric acid; 16.93 per cent and 18.85 per cent respectively were found.

Sample **9458**, sold by E. D. Chittenden Bridgeport, drawn from stock of Elijah Rogers, Southington, was guaranteed 18 per cent total phosphoric acid and 17.46 per cent was found. No guaranty for available was made but 15.20 per cent was found.

III. RAW MATERIALS CHIEFLY VALUABLE FOR POTASH.

CARBONATE OF POTASH.

In the pure, dry state this salt contains 68.2 per cent of actual potash (K_2O), but commercial grades generally contain from 60 to 65 per cent.

Sixteen samples were analyzed of which only one, **8938**, was notably deficient. The average potash content was 64.8 per cent and at $140.00 per ton potash from this source has cost 10.8 cents per pound.

Analyses are given in Table VII.

MURIATE OF POTASH.

The grades of this salt which we used for fertilizer contain from 48 to 50 per cent of actual potash (K_2O), the potash being largely in the form of chloride.

Twelve samples were examined all of which exceeded 48 per cent of potash and all exceeded guaranties except in case of **9159** which was about 0.5 per cent low. The average potash content was 51.6 per cent and the average ton price quoted was $41.00. Potash from this source cost about 4 cents per pound.

Analyses are given in Table VII.

SULPHATE OF POTASH.

This potash salt contains not less than 48 per cent of potash (K_2O), and not over 2.5 per cent of chlorine according to the tentative definition and standard adopted by the Association of Official Agricultural Chemists.

[1] Assoc. Official Agr. Chemists, Proc. of October, 1925.

Eighteen samples were examined. The average potash content found was 49.1 per cent. No considerable deficiencies were found, the greatest being 0.4 per cent. At $63.00 per ton, the prevailing price quoted, potash from this source cost 6.4 cents per pound.

Analyses given in Table VII.

SULPHATE OF POTASH-MAGNESIA.

Two samples of this material were examined both of which exceeded guaranties by good margins. This salt is generally sold on a guaranty of 26 per cent potash.

Analyses are given in Table VII.

COTTONHULL ASHES.

This raw material is so extremely variable in composition that there is a great deal of difficulty in arriving at a fair settlement between buyer and seller on the basis of chemical analysis. In the same shipment we have found bags which analyzed about 30 per cent potash and others which tested only about ½ as much. Bulk goods arriving in car lots have been in such coarse and lumpy condition in some cases that it was impossible to obtain any adequate sample until the whole lot was ground and mixed.

Twenty-eight samples were examined with the results as shown in Table VII.

WOOD ASHES.

Seven samples of wood ashes have been analyzed and all were of good grade except **8381** which was very inferior, due to leaching.

Analyses are given in Table VII.

TABLE VII. ANALYSES OF POTASH SALTS, ETC.

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Carbonate of Potash.				
	Sampled by Station.				
9194	Apothecaries Hall Co., Waterbury	Sampled at factory	% 67.52	% 60.00	**9194**
9439	Berkshire Chemical Co., Bridgeport	Sampled at factory	66.37	63.00	**9439**
8912	Olds & Whipple, Inc., Hartford	Sampled at factory	64.98	65.00	**8912**
	Sampled by Purchaser.				
8927	Apothecaries Hall Co., Waterbury, Conn	Edwards & Brewer, West Suffield	66.62	60.00	**8927**
8840	Apothecaries Hall Co., Waterbury, Conn., Car No. 137142	Hatheway & Steane, Inc., Hartford	61.80	60.00	**8840**
8841	Apothecaries Hall Co., Waterbury, Conn., Car No. 9510	Hatheway & Steane, Inc., Hartford	64.60	60.00	**8841**
8938	Apothecaries Hall Co., Waterbury, Conn., Car No. 76685	Hatheway & Steane, Inc., Hartford	56.54[1]	60.00	**8938**
8940	Apothecaries Hall Co., Waterbury, Conn., Car No. 80671	Hatheway & Steane, Inc., Hartford	63.24	60.00	**8940**
9324	Apothecaries Hall Co., Waterbury	A. N. Shepard & Son, Hartford	65.08	60.00	**9324**
9333	Apothecaries Hall Co., Waterbury	A. N. Shepard & Son, Hartford	65.43	60.00	**9333**
8445	Berkshire Chemical Co., Bridgeport	L. B. Haas & Co., Hartford	62.64	63.00	**8445**
8258	A. Klipstein, New York	American Sumatra Tobacco Co., Bloomfield	66.97	.....	**8258**
8259	A. Klipstein, New York	American Sumatra Tobacco Co., Bloomfield	67.23	.....	**8259**

[1] Moisture, 15.70%.

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

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Carbonate of Potash.				
	Sampled by Purchaser.		%	%	
9313	Olds & Whipple, Inc., Hartford	L. Wetstone & Sons, Inc., Hartford	66.66	65.00	9313
9012	Manufacturer unknown	The Allied Tobacco Co., Hartford	66.14	.....	9012
9653	Manufacturer unknown	J. E. Phelps, Suffield	64.85	.....	9653
	Muriate of Potash.				
	Sampled by Station.				
8955	American Agricultural Chemical Co., New York	Sampled at factory, West Haven	51.19	50.00	8955
9529	American Agricultural Chemical Co., New York	E. N. Austin, Suffield	51.50	50.00	9529
8980	Apothecaries Hall Co., Waterbury	Sampled at factory	50.85	50.00	8980
9029	Armour Fertz. Works, New York	F. A. Bartlett Tree Expert Co., Stamford	51.31	48.00	9029
9544	Berkshire Chemical Co., Bridgeport	Sampled at factory	51.40	50.00	9544
8887	Consolidated Rendering Co., Boston, Mass.	Cheshire Reformatory, Cheshire	52.30	50.00	8887
9159	Eastern States Farmers' Exchange, Springfield, Mass.	H. H. McKnight, Ellington	49.46	50.00	9159
9091	The Rogers & Hubbard Co., Portland	Lyman Farm, Middlefield	60.43	50.00	9091
8852	U. S. Guano Co., Baltimore, Md.	H. P. Beers, Southport	48.44	48.00	8852
8856	U. S. Guano Co., Baltimore, Md.	Rippe Bros., Westport	48.67	48.00	8856
9590	Wilcox Fertilizer Co., Mystic	Sampled at factory	54.34	50.50	9590
	Sampled by Purchaser.				
9054	U. S. Guano Co., Baltimore, Md.	J. A. Barrasso, Andover	49.78	48.00	9054

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

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sulphate of Potash.				
	Sampled by Station.		%	%	
8951	American Agricultural Chemical Co., New York	Sampled at factory, West Haven	50.30	48.00	8951
9533	American Agricultural Chemical Co., New York	E. N. Austin, Suffield	49.22	48.00	9533
8994	Apothecaries Hall Co., Waterbury	Sampled at factory	49.28	48.00	8994
9447	Armour Fertz. Works, New York	John Sestakanskas, Granby	48.94	48.00	9447
9543	Berkshire Chemical Co., Bridgeport	Sampled at factory	48.83	48.00	9543
8961	Consolidated Rendering Co., Boston, Mass.	L. T. Frisbie Co., New Haven	48.82	48.00	8961
8906	Olds & Whipple, Inc., Hartford	Sampled at factory	48.45	48.65	8906
9618	Olds & Whipple, Inc., Hartford	Sampled at factory	50.76	48.65	9618
	Sampled by Purchaser.				
8925	Apothecaries Hall Co., Waterbury	Edwards & Brewer, West Suffield	49.05	48.00	8925
8837	Apothecaries Hall Co., Waterbury, Car No. 10432	Hatheway & Steane, Inc., Hartford	50.01	48.00	8837
8838	Apothecaries Hall Co., Waterbury, Car No. 86709	Hatheway & Steane, Inc., Hartford	47.60	48.00	8838
8839	Apothecaries Hall Co.,Waterbury, Car No.180284	Hatheway & Steane, Inc., Hartford	49.72	48.00	8839
8939	Apothecaries Hall Co., Waterbury, Car No. 76685	Hatheway & Steane, Inc., Hartford	49.58	48.00	8939
9325	Apothecaries Hall Co., Waterbury (Suffield)	A. N. Shepard & Son, Hartford	48.57	48.00	9325
9332	Apothecaries Hall Co., Waterbury (Pelton)	A. N. Shepard & Son, Hartford	47.86	48.00	9332
8065	Hollingshurst Co., New York, Car No. 566200	American Sumatra Tobacco Co., Bloomfield	48.59	.....	8065
8066	Hollingshurst Co., New York, Car No. 3255	American Sumatra Tobacco Co., Bloomfield	48.21	.....	8066

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

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sulphate of Potash. *Sampled by Purchaser.*		%	%	
7900	Olds & Whipple, Inc., Hartford	American Sumatra Tobacco Co., Bloomfield	49.07	48.65	7900
	Sulphate of Potash and Magnesia. *Sampled by Station.*				
8952	American Agricultural Chemical Co., N. Y.	Sampled at factory, West Haven	31.74	26.00	8952
8995	Apothecaries Hall Co., Waterbury	Sampled at factory	27.96	26.00	8995
	Cotton Hull Ashes. *Sampled by Station.*				
8573	Ed Eggert, Hartford, Car No. R. I. 61821	American Agricultural Chemical Co., West Haven	26.81	.....	8573
8699	Ed. Eggert, Hartford	American Agricultural Chemical Co., West Haven	30.41	.....	8699
8773	Ed. Eggert, Hartford, Car R. I. No. 261016	American Agricultural Chemical Co., West Haven	34.52	.....	8773
8774	Ed. Eggert, Hartford, Car R. I. No. 261016	American Agricultural Chemical Co., West Haven	35.57	.....	8774
8164	Ed. Eggert, Hartford	L. B. Haas & Co., Hartford	16.03	.....	8164
9221	International Agricultural Corp., Boston, Mass.	L. B. Haas & Co., Hartford	18.46	.....	9221
9113	International Agricultural Corp., Boston, Mass.	J. E. Shepard, So. Windsor	18.19	.....	9113

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

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Cotton Hull Ashes. *Sampled by Station.*		%	%	
9220	International Agricultural Corp., Boston, Mass.	J. E. Shepard, So. Windsor	12.36[1]	.....	9220
9114	International Agricultural Corp., Boston, Mass.	Spencer Bros., Suffield	21.92	.....	9114
	Sampled by Purchaser.				
9643	F. W. Brode Co., Memphis, Tenn	J. B. Stewart, Windsor	21.69	.....	9643
9707	F. W. Brode Co., Memphis, Tenn	J. B. Stewart, Windsor	23.38	.....	9707
8398	Ed. Eggert, Hartford	The Allied Tobacco Co., Hartford	16.92	.....	8398
8921	Ed. Eggert, Hartford, Car No. 156355	Edwards & Brewer, West Suffield	28.61	.....	8921
9365	Ed. Eggert, Hartford, Car SL&SF No. 129344	P. J. Anderson, Windsor	31.98	.....	9365
9366	Ed. Eggert, Hartford, Car R. I. No. 350135	P. J. Anderson, Windsor	29.16	.....	9366
9367	Ed. Eggert, Hartford, Car K.C.M.& O., No. 6299	P. J. Anderson, Windsor	39.27	.....	9367
9634	Ed. Eggert, Hartford	Amos D. Bridge's Sons, Hazardville	32.48	.....	9634
8199	Ed. Eggert, Hartford	Ed. Eggert, Hartford	25.86	.....	8199
7761	Ed. Eggert, Hartford	L. B. Haas & Co., Inc., Hartford	25.70	.....	7761
7765	Ed. Eggert, Hartford	L. B. Haas & Co., Inc., Hartford	22.04	.....	7765
8165	Ed. Eggert, Hartford (Light Gray)	L. B. Haas & Co., Inc., Hartford	11.45	.....	8165
8166	Ed. Eggert, Hartford (Dark Gray)	L. B. Haas & Co., Inc., Hartford	11.78	.....	8166
8167	Ed. Eggert, Hartford (Brown)	L. B. Haas & Co., Inc., Hartford	28.97	.....	8167
9127	Ed. Eggert, Hartford	Will Hayes, Tariffville	16.89	.....	9127
9319	Ed. Eggert, Hartford	Spencer Bros., Inc., Suffield	32.25	.....	9319
9690	Olds & Whipple, Inc., Hartford	The Otee Tobacco Corp., Windsor	27.85	.....	9690

[1] Contained 21.5% moisture.

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

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.	Potash. Found.	Potash. Guaranteed.	Station No.
	Cotton Hull Ashes. *Sampled by Purchaser.*		%	%	
9628	Olds & Whipple, Inc., Hartford, Car 40438	J. B. Stewart, Windsor	21.41	.....	9623
9723	Olds & Whipple, Inc., Hartford, Car 252942	J. B. Stewart, Windsor	31.28	.....	9728
	Wood Ashes. *Sampled by Purchaser.*				
8385	John Joynt, Lucknow, Canada, Car No. 124904	Hatheway & Steane, Inc., Hartford	5.82	3.00	8385
8386	John Joynt, Lucknow, Canada, Car No. 93276	Hatheway & Steane, Inc., Hartford	5.03	3.00	8386
8651	John Joynt, Lucknow, Canada, Car No. 209938	Hatheway & Steane, Inc., Hartford	5.30	3.00	8651
8345	John Joynt, Lucknow, Canada	John B. Stewart, Windsor	5.17	3.00	8345
9312	John Joynt, Lucknow, Canada	L. W. Wetstone & Sons, Hartford	7.50	3.00	9312
8918	Manufacturer unknown	Benj. Fenn, Milford	7.26	.....	8918
8381	Manufacturer unknown	Henry Lanz, Ellington	1.08[1]	.....	8381

[1] Dry basis. Contained 20.35% moisture as received.

IV. RAW MATERIALS CONTAINING NITROGEN AND POTASH.

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

9504. Nitrate of Soda and Potash. Apothecaries Hall Co., Waterbury. Sampled by Station agent, stock of Barnes & Co., Wallingford.

9769. Nitrate of Soda and Potash. Wilcox Fertilizer Co., Mystic, Conn. Sampled by Station agent at factory.

8910. O & W Nitrate of Potash 90%. Olds & Whipple, Inc., Hartford, Conn. Sampled by Station agent at factory.

9117. Nitrate of Potash (for experiment). Synthetic Nitrogen Products Co., New York. Sampled by Station agent from stock of Tobacco Station, Windsor.

8444. Nitrate of Potash. W. R. Grace & Co., N. Y. Submitted by L. B. Haas & Co., Inc., Hartford.

9089. Nitrate of Potash. Manufacturer unknown. Submitted by Cullman Bros., Hartford.

9648. Nitrate of Potash. Olds & Whipple, Inc., Hartford. Submitted by J. E. Phelps, Suffield.

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

Station No.	9504	9769	9117	8444	9089	9648	8910
	%	%	%	%	%	%	%
Nitrogen:							
found	14.84	14.63	13.28	15.00	13.44	12.08	12.04
guaranteed	14.80	14.72	....	....	....	12.00	12.00
Equivalent to ammonia:							
found	18.04	17.79	16.15	18.24	16.34	14.69	14.64
guaranteed	18.00	17.90	....	....	....	14.50	14.50
Potash:							
found	14.08	11.70[1]	45.34	15.29	46.76	41.19	41.00
guaranteed	10.00	11.80	....	....	....	41.00	41.00

[1] Chlorine 0.46%.

V. RAW MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

DRY GROUND FISH.

This raw material is made from non-edible fish and from the offal from fish canneries. Oil is removed by steaming and pressing and the residue then dried and ground.

Thirty-nine samples were examined, in most cases samples being submitted by purchasers.

This material is usually sold on a guaranty of 8.20 per cent of nitrogen and 5 or 6 per cent. of phosphoric acid. The average nitrogen content of all samples was 8.6 per cent and the average phosphoric acid found was about 5 per cent.

The proportion of nitrogen in the form of ammonia salts was suspiciously high in a number of these samples and microscopic examinations confirmed the conclusion that ammonium sulphate was present. While the purchaser has received the total amount of nitrogenous plant food guaranteed to him he has not received it in the form in which he contracted to purchase it. Nitrogen in the form of ammonium sulphate has been bought this year for about 14.5 cents per pound whereas organic nitrogen in dry ground fish, making due allowance for the phosphoric acid present, has cost the purchaser about 44 cents per pound. *The sale of a mixture of ammonium sulphate and dry ground fish, as and for dry ground fish, constitutes the sale of an adulterated article.*

There should be no occasion to reinforce high grade dry ground fish which normally contains from 8 to 10 per cent of nitrogen. The increasing demand for fish, bone and tankage for animal and poultry feeding, for which purposes these materials are said to command better prices than for fertilizer purposes, suggests a possible reason for "stretching" the supply of high grade fish as much as possible or for using inferior materials reinforced with inorganic ammoniates to make a mixture appear high grade. However, since our investigation indicates that all of the samples of adulterated fish which we have found this year came from one source, there is no good reason to believe that the sale of spurious fish fertilizer is at all general.

Dry ground fish will ordinarily contain small amounts of ammonia nitrogen. Thus 115 samples examined over a period of three years showed an average ammonia nitrogen content of 0.30 per cent and rarely exceeded 1 per cent in any case. The average total nitrogen content for the series was 8.6 per cent. In general it may be expected that animal proteins will yield ammonia nitrogen to the extent of from 6 to 10 per cent of the total nitrogen content when completely hydrolyzed by laboratory methods. Fish protein according to analyses by Osborne and Hyle[1] yielded 1.09

[1] Am. Jour. Physiol., **23**, 81, 1908.

per cent of such nitrogen which was 5.85 per cent of the total nitrogen present. The acidulation of fish in commercial practice however, is not at all likely to produce the extent of hydrolysis obtained in laboratory procedure.

In the series of commercial samples examined this year 20 showed substantial or large amounts of ammonium sulphate and in 19 there was no evidence of excessive ammonia nitrogen and no ammonium sulphate could be detected by microscopic examination. Of the 20 samples showing ammonium sulphate the average proportion of ammonia nitrogen was 43 per cent of the total nitrogen and the maximum proportion was 52 per cent. Of the samples presumed to be genuine the average proportion of ammonia nitrogen was 2.6 per cent of the total and the maximum was a little over 10 per cent.

We have no information as to whether or not the fish examined this year was acidulated but in any case the data just given are pertinent to the issue involved.[1]

Of the samples listed in Table IX, 8155 to 8250 inclusive represented sales by J. W. Wilcox of Mystic, the fish being supplied, according to our information, by the Smith-Douglas Co. of Norfolk, Va. Other samples representing goods obtained through the above named jobber or directly from the Norfolk concern were 9550, E. D. Chittenden Co.; 8898, 9328, 9337, Apothecaries Hall Co.; and 8267, 8268, 8601 and 8603, Berkshire Chemical Co. These samples contained ammonium sulphate sufficient to supply from 10 to 40 per cent of the total nitrogen making due allowance for the ammonia nitrogen ordinarily found in fish fertilizer.

We have no evidence to warrant the conclusion that local dealers were aware of the spurious character of these goods and it is only fair to add that as soon as they were advised of our findings they took immediate steps to make adjustments with their purchasers by means of suitable rebates to cover the difference in cost between inorganic and organic ammoniates.

[1] The following experiment serves to give some idea of the extent to which nitrogen transformation may occur when fish is acidulated commercially.

Fish containing 9.5 per cent of total nitrogen and .08 per cent of ammonia nitrogen was moistened thoroughly with 50 per cent sulphuric acid and allowed to stand at room temperature for one week. Ammonia nitrogen determined at that time was found to be 0.33 per cent. This experiment represents more vigorous treatment than obtains in commercial practice because the entire sample came into intimate contact with the acid.

TABLE IX. 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.		%	%	%	%	%	
9379	American Agricultural Chemical Co., New York	Spencer Bros., Suffield	8.72	8.23	10.60	8.50	6.00	9379
9528	American Agricultural Chemical Co., New York	E. N. Austin, Suffield	8.92	8.23	10.84	8.52	6.00	9528
8983	Apothecaries Hall Co., Waterbury	Sampled at factory	9.83	8.20	11.95	6.55	5.00	8983
9545	Berkshire Chemical Co., Bridgeport	Sampled at factory	8.26	8.22	10.04	5.99	6.00	9545
9550	E. D. Chittenden Co., Bridgeport	J. P. Norton, Broad Brook	8.07	8.00	9.81	3.08	6.00	9550
9452	Consolidated Rendering Co., Boston, Mass	John P. Mason, Warehouse Point	8 31	8 22	10 10	8 03	6 40	9452
9022	Olds & Whipple, Inc., Hartford	Sampled at factory	9 48	8 23	11.53	7.48	5.00	9022
8857	U. S. Guano Co., Baltimore, Md	H. D. Peters, Highwood	8 01	8 22	9 74	6 28	....	8857
9354	Wilcox Fertilizer Co., Mystic	Sampled at factory	8 21	8.24	9.98	6.08	6.00	9354
	Sampled by Purchaser.							
8898	Apothecaries Hall Co., Waterbury	The Allied Tobacco Co., Hartford	8.02	8.20	9.75	3.83	5.00	8898
8926	Apothecaries Hall Co., Waterbury	Edwards & Brewer, West Suffield	8.48	8.20	10.31	4.53	5.00	8926
8330	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	8.36	8.20	10.16	4.22	5.00	8330
8396	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	7.92	8.20	9.63	4.58	5.00	8396
8454	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	8.26	8.20	10.04	4.59	5.00	8454
8690	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	7.80	8.20	9.48	4.25	5.00	8690

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

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.		%	%	%	%	%	
8817	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	8.41	8.20	10.22	4.10	5.00	8817
8818	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	8.23	8.20	10.01	3.60	5.00	8818
8834	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	8.56	8.20	10.41	3.85	5.00	8834
8936	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	7.96	8.20	9.68	3.63	5.00	8936
9328	Apothecaries Hall Co., Waterbury	A. N. Shepard & Son, Hartford	8.26	8.20	10.04	5.00	5.00	9328
9337	Apothecaries Hall Co., Waterbury	A. N. Shepard & Son, Hartford	8.77	8.20	10.66	4.30	5.00	9337
9526	The Berkshire Chemical Co., Bridgeport	E. N. & C. C. Austin, Suffield	7.90	8.22	9.60	5.85	6.00	9526
8267	The Berkshire Chemical Co., Bridgeport	L. B. Haas & Co., Inc., Hartford	9.74	8.22	11.84	6.84	6.00	8267
8268	The Berkshire Chemical Co., Bridgeport	L. B. Haas & Co., Inc., Hartford	9.75	8.22	11.85	7.37	6.00	8268
9097	Olds & Whipple, Inc., Hartford	L. W. Wetstone & Sons, Inc., Hartford	9.11	8.23	11.08	8.70	5.00	9097
8155	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.72	....	10.60	3.05	....	8155
8156	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.30	....	10.09	3.71	....	8156
8157	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.68	....	10.55	3.83	....	8157

TABLE IX. 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.							
8158	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.58	...	10.43	3.32	...	8158
8159	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.36	...	10.16	3.51	...	8159
8160	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.36	...	10.16	3.48	...	8160
8245	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.52	...	10.36	2.96	...	8245
8246	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.22	...	9.99	3.05	...	8246
8247	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.91	...	10.83	2.82	...	8247
8248	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.82	...	10.72	2.70	...	8248
8249	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.02	...	9.75	3.52	...	8249
8250	J. Waterman Wilcox, Mystic	American Sumatra Tobacco Co., Bloomfield	8.64	...	10.50	3.05	...	8250
8601	Car No. 34983	Cullman Bros., Hartford	10.18	...	12.38	7.18	...	8601
8603	Car No. P. A. 533730	Cullman Bros., Hartford	9.78	...	11.89	7.48	...	8603

TANKAGE.

This raw material is derived from refuse meat and bone. The refuse is treated with steam and then pressed to remove fat after which it is dried and ground. The composition depends upon the proportions of meat and of bone which are present; high nitrogen and low phosphoric acid indicates a preponderance of meat while the reverse is true if bone predominates. High grade tankage contains 8 to 10 per cent of nitrogen and 5 to 10 per cent of phosphoric acid.

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

Twelve samples were analyzed. All met nitrogen guaranties excepting **8683, 8858** and **9606** which were from 0.3 to 0.4 per cent low. Phosphoric acid guaranties were met or exceeded excepting **9135** which was considerably low.

Microscopic examinations were made to discover inorganic ammoniates and mineral phosphates if present. In two or three samples both of those substances were found but the amounts did not appear to be sufficient to materially enhance either the nitrogen or the phosphoric acid.

Analyses are found in Table X.

TABLE X. ANALYSES OF TANKAGE.

Station No.	Manufacturer	Dealer or Purchaser.	Nitrogen. Total found.	Nitrogen. Total guaranteed.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Total found.	Phosphoric Acid. Total guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.	Station No.
	Sampled by Station.		%	%	%	%	%	%	%	
8956	American Agricultural Chemical Co., New York	Sampled at factory	7.78	7.40	9.46	10.53	9.15	42.0	58.0	8956
8987	Apothecaries Hall Co., Waterbury	J. A. Glasnap, West Cheshire	4.03	3.29	4.90	20.25	20.00	36.0	64.0	8987
8993	Apothecaries Hall Co., Waterbury	Sampled at factory	8.38	7.40	10.19	9.25	3.00	51.5	48.5	8993
9612	Armour Fertilizer Works, New York	Geo. R. Davidson, So. Meriden	7.47	7.40	9.08	11.13	6.87	50.5	49.5	9612
9438	Berkshire Chemical Co., Bridgeport	Sampled at factory	7.34	7.40	8.92	8.78	6.86	35.0	65.0	9438
9135	Connecticut Fat Rendering & Fertilizer Co., New Haven	Sampled at factory	3.99	3.29	4.85	21.10	25.00	40.0	60.0	9135
8962	Consolidated Rendering Co., Boston, Mass.	L. T. Frisbie Co., New Haven	7.81	7.41	9.50	10.83	9.15	33.0	67.0	8962
8963	Consolidated Rendering Co., Boston, Mass.	L. T. Frisbie Co., New Haven	5.17	4.92	6.29	14.55	14.00	24.0	76.0	8963
8683	U. S. Guano Co., Baltimore, Md.	Geo. S. Jennings, Southport	7.02	7.40	8.53	10.15	9.15	38.0	62.0	8683
8858	U. S. Guano Co., Baltimore, Md.	H. D. Peters, Highwood	7.03	7.40	8.55	9.48	9.15	42.0	58.0	8858
9606	U. S. Guano Co., Baltimore, Md.	J. B. Lewis, Southington, Conn.	7.10	7.40	8.63	10.65	9.15	43.0	57.0	9606
	Sampled by Purchaser.									
8890	L. T. Frisbie Co., New Haven	C. R. Burr & Co., Inc., Manchester	5.16	....	6.27	14.00	....	26.0	74.0	8890

BONE MEAL.

Raw Bone Meal or Raw Ground Bone is the product made by drying and grinding animal bones which have not been previously steamed under pressure.

Steamed Bone Meal or Steamed Ground Bone is the product made by steaming bones under pressure after which they are dried and ground.

Steamed bone contains about one-half as much nitrogen as raw bone.

Fifty-two samples were examined, twenty-four of which were official samples drawn by the station agent. There were only three deficiencies found in nitrogen and four in total phosphoric acid.

There has been a scarcity of domestic bone during the past year and manufacturers have in some cases been obliged to fill their needs from foreign markets.

Although guaranties in nearly all cases were met or exceeded it was easy to see that some of the samples were not pure bone. This led us to examine microscopically all of the official samples, and many of those submitted by purchasers. All of the samples from stock sold by the U. S. Guano Company contained inorganic ammoniates or mineral phosphates or both. As in the case of dry ground fish, purchasers of this "bone" have received the amounts of nitrogen and of phosphoric acid which were guaranteed to them but it was not in the form in which they expected to obtain it. A mixture of ground bone, ammonium sulphate and mineral phosphate is not ground bone, but a mixed fertilizer containing *A mixture of ground bone, ammonium sulphate and mineral phosphate is not ground bone, but a mixed fertilizer containing nitrogen and phosphoric acid.* Moreover, there is a wide difference in price between nitrogen in ammonium sulphate and the organic nitrogen in bone.

8958. This sample was drawn from stock of the Eldredge Hardware Co. and sold by the Berkshire Chemical Co. A small amount of mineral phosphate and of ammonium sulphate was found. Information furnished by the manufacturer was to the effect that this was a small lot of bone mixture in which, however, no mineral phosphate or ammonium sulphate had been used. Samples of the ingredients used were submitted and the presence of these foreign materials in one of them was found, due, no doubt, to accidental contamination in the storage bins.

Analyses are found in Table XI.

TABLE XI. ANALYSES OF GROUND BONE.

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen.		Ammonia equivalent to total nitrogen.	Phosphoric Acid.		Mechanical Analysis.		Station No.
			Total found.	Total Guaranteed.		Total Found.	Total Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	
	Sampled by Station.		%	%	%	%	%	%	%	
8864	American Agricultural Chemical Co., New York	S. P. Strople, New Britain	2.58	2.06	3.14	24.40	22.88	41.0	59.0	8864
8984	Apothecaries Hall Co., Waterbury	Sampled at factory	4.00	3.29	4.86	23.10	20.00	48.5	51.5	8984
9190	Apothecaries Hall Co., Waterbury	C. A. Templeton, Waterbury	2.61	2.46	3.17	23.65	22.00	62.0	38.0	9190
9000	Armour Fertilizer Works, New York	Silliman Hardware Co., New Canaan	2.40	2.47	2.92	24.60	22.00	64.0	36.0	9000
9404	Berkshire Chemical Co., Bridgeport.	Sampled at factory	2.32	2.47	2.82	24.00	20.00	....	....	9404
9564	E. D. Chittenden Co., Bridgeport	J. E. Stoddard, Abington	2.66	2.47	3.23	24.60	22.00	66.0	34.0	9564
8965	Consolidated Rendering Co., Boston, Mass.	Lightbourn & Pond, New Haven	3.86	2.46	4.69	24.05	22.90	28.0	72.0	8965
9162	Eastern States Farmers' Exchange, Springfield, Mass.	H. H. McKnight, Ellington	2.72	2.46	3.31	25.20	23.00	62.0	38.0	9162
8964	L. T. Frisbie Co., New Haven	Sampled at factory	4.37	3.28	5.31	24.45	22.00	46.0	54.0	8964
8913	Mapes Formula & Peruvian Guano Co., New York	Mapes Branch, Hartford	4.16	3.29	5.06	21.40	20.00	32.0	68.0	8913
8909	Olds & Whipple, Inc., Hartford	Sampled at factory	2.15	2.50	2.61	26.15	22.00	61.5	38.5	8909
9619	Olds & Whipple, Inc., Hartford	Sampled at factory	2.50	2.50	3.04	25.70	22.00	64.5	35.5	9619
9019	The Rogers & Hubbard Co., Portland	Cadwell & Jones, Hartford	3.52	3.29	4.28	20.94	20.50	59.0	41.0	9019
9020	The Rogers & Hubbard Co., Portland	Cadwell & Jones, Hartford	3.60	3.82	4.38	25.70	24.70	73.0	27.0	9020
9503	F. S. Royster Guano Co., Baltimore, Md.	F. B. Newton, Plainville	2.83	2.47	3.44	23.05	22.90	66.0	34.0	9503

TABLE XI. ANALYSES OF GROUND BONE—*Continued.*

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen.		Ammonia equivalent to total nitrogen.	Phosphoric Acid.		Mechanical Analysis.		Station No.
			Total found.	Total guaranteed.		Total Found.	Total guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	
	Sampled by Station.		%	%	%	%	%	%	%	
9589	M. L. Shoemaker & Co., Philadelphia, Pa.	Geo. T. Soule, New Milford	4.19	3.69	5.09	22.20	22.88	37.0	63.0	9589
9580	I. P. Thomas & Son, Philadelphia, Pa.	Ira W. Beers, Hamden	2.81	2.45	3.42	24.40	23.00	64.0	36.0	9580
8949	U. S. Guano Co., Baltimore, Md.	Frank Libner & Son, Norwalk	2.43	2.47	2.95	18.25	22.00	41.0	59.0	8949
8950	U. S. Guano Co., Baltimore, Md.	H. P. Beers, Southport	2.62	2.47	3.19	21.45	22.00	32.0	68.0	8950
8854	U. S. Guano Co., Baltimore, Md.	Rippe Bros., Westport	2.69	2.47	3.27	22.20	22.00	37.0	63.0	8854
9343	U. S. Guano Co., Baltimore, Md.	E. O. Chapman, North Haven	4.05	3.70	4.92	19.50	22.00	38.0	62.0	9343
9607	U. S. Guano Co., Baltimore, Md.	J. B. Lewis, Southington	3.68	3.30	4.47	20.87	18.30	41.0	59.0	9607
9360	Wilcox Fertilizer Co., Mystic	Jordan Hardware Co., Williamantic	3.11	2.46	3.78	22.17	22.00	46.0	54.0	9360
	Sampled by Purchaser.									
8924	Apothecaries Hall Co., Waterbury	Edwards & Brewer, West Suffield	2.46	2.46	2.99	23.70	22.00	....	....	8924
8456	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	3.97	2.46	4.83	22.50	22.00	....	....	8456
8457	Apothecaries Hall Co., Waterbury	Hatheway & Steane, Inc., Hartford	4.20	3.29	5.11	22.59	20.00	38.0	62.0	8457
8652	Apothecaries Hall Co., Waterbury, Car No. 71092	Hatheway & Steane, Inc., Hartford	5.50	3.29	6.69	19.30	20.00	34.0	66.0	8652
8653	Apothecaries Hall Co., Waterbury, Car No. 92570	Hatheway & Steane, Inc., Hartford	3.83	3.29	4.66	23.83	20.00	47.0	53.0	8653

TABLE XI. ANALYSES OF GROUND BONE—*Continued.*

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen.		Ammonia equivalent to total nitrogen.	Phosphoric Acid.		Mechanical Analysis.		Station No.
			Total found.	Total guaranteed.		Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	
	Sampled by Purchaser.		%	%	%	%	%	%	%	
8654	Apothecaries Hall Co., Waterbury, Car No. 92666	Hatheway & Steane, Inc., Hartford	4.19	3.29	5.09	23.48	20.00	56.0	44.0	8654
8691	Apothecaries Hall Co., Waterbury, Car No. 10627	Hatheway & Steane, Inc., Hartford	4.74	3.29	5.76	20.40	20.00	43.0	57.0	8691
8819	Apothecaries Hall Co., Waterbury, Car No. 150058	Hatheway & Steane, Inc., Hartford	4.06	3.29	4.94	23.45	20.00	50.0	50.0	8819
8821	Apothecaries Hall Co., Waterbury..	Hatheway & Steane, Inc., Hartford	3.55	3.29	4.32	24.60	20.00	62.0	38.0	8821
8836	Apothecaries Hall Co., Waterbury, Car No. 10432	Hatheway & Steane, Inc., Hartford	4.35	3.29	5.29	19.60	20.00	41.0	59.0	8836
8942	Apothecaries Hall Co., Waterbury, Car No. 76685	Hatheway & Steane, Inc., Hartford	3.85	3.29	4.68	23.50	20.00	49.0	51.0	8942
9334	Apothecaries Hall Co., Waterbury..	A. N. Shepard & Son, Hartford..	2.48	....	3.02	27.95	.....	65.0	35.0	9334
8152	Armour Fertilizer Works, New York, Car No. 49435	American Sumatra Tobacco Co., Bloomfield	2.81	2.47	3.42	23.99	22.00	39.0	61.0	8152
8153	Armour Fertilizer Works, New York, Car No. 50832	American Sumatra Tobacco Co., Bloomfield	2.54	2.47	3.09	24.25	22.00	48.5	51.5	8153
8154	Armour Fertilizer Works, New York, Car No. 60953	American Sumatra Tobacco Co., Bloomfield	2.60	2.47	3.16	23.80	22.00	50.0	50.0	8154
8173	Armour Fertilizer Works, New York, Car No. 81780	American Sumatra Tobacco Co., Bloomfield	2.88	2.47	3.50	23.51	22.00	48.0	52.0	8173

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

Station No.	Manufacturer.	Dealer or Purchaser.	Nitrogen.		Ammonia equivalent to total nitrogen.	Phosphoric Acid.		Mechanical Analysis.		Station No.
			Total found.	Total guaranteed.		Total found.	Total guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	
	Sampled by Purchaser.		%	%	%	%	%	%	%	
8174	Armour Fertilizer Works, New York, Car No. 83734	American Sumatra Tobacco Co., Bloomfield	2.50	2.47	3.04	22.48	22.00	....	....	8174
8253	Armour Fertilizer Works, New York, Car No. 38146	American Sumatra Tobacco Co., Bloomfield	2.62	2.47	3.19	26.46	22.00	51.5	48.5	8253
8260	Armour Fertilizer Works, New York, Car No. 31595	American Sumatra Tobacco Co., Bloomfield	2.42	2.47	2.94	26.69	22.00	42.0	58.0	8260
8261	Armour Fertilizer Works, New York, Car No. 299937	American Sumatra Tobacco Co., Bloomfield	2.60	2.47	3.16	26.51	22.00	36.0	64.0	8261
8290	Armour Fertilizer Works, New York, Car No. 184241	American Sumatra Tobacco Co., Bloomfield	2.74	2.47	3.33	25.82	22.00	37.5	62.5	8290
8291	Armour Fertilizer Works, New York, Car No. 23930	American Sumatra Tobacco Co., Bloomfield	2.76	2.47	3.36	25.84	22.00	43.1	56.9	8291
8304	Armour Fertilizer Works, New York, Car No. 78349	American Sumatra Tobacco Co., Bloomfield	2.98	2.47	3.62	25.70	22.00	39.0	61.0	8304
8333	Armour Fertilizer Works, New York, Car No. 46186	American Sumatra Tobacco Co., Bloomfield	2.85	2.47	3.46	25.54	22.00	31.8	68.2	8333
9112	Consolidated Rendering Co., Boston, Mass	F. H. Smith, Hill Top Farm, Suffield	2.69	2.46	3.27	22.50	22.90	62.0	38.0	9112
8292	Car No. 95779	American Sumatra Tobacco Co., Bloomfield	2.82	....	3.43	24.95	.....	45.8	54.2	8292
9062	U. S. Guano Co., Baltimore, Md...	J. A. Barrasso, Andover	4.77	3.30	5.80	16.80	18.30	43.4	56.6	9062
9303	U. S. Guano Co., Baltimore, Md...	Frank Libner & Sons, Norwalk..	2.30	2.47	2.80	26.53	22.00	19.0	81.0	9303

VI. MIXED FERTILIZERS.

MIXTURES CONTAINING ONLY NITROGEN AND PHOSPHORIC ACID.

Six samples of this group of materials were analyzed.

9195. Ammo-Phos. American Cyanamid Co., New York. Sampled by Station agent from stock of Olds & Whipple, Inc., Hartford, Conn.

9191. Liberty Lawn Fertilizer. Apothecaries Hall Co., Waterbury. Sampled by the Station agent at factory.

9502. Liberty Tobacco Starter. Apothecaries Hall Co., Waterbury. Sampled by the Station agent at factory.

9266. O & W High Grade Tobacco Starter. Olds & Whipple, Inc., Hartford, Conn. Sampled by the Station agent from stock of E. O. Gates, New Hartford, Conn.

9511. "Swift-Sure" Tobacco Starter 4-10-0. M. L. Shoemaker & Co., Philadelphia, Pa. Sampled by the Station agent from stock of Olds & Whipple, Inc., Hartford, Conn.

9118. Diamonphos (for experiment). Synthetic Nitrogen Products Co., New York. Sampled by the Station agent from stock of the Tobacco Station, Windsor, Conn.

	9195	9191	9502	9266	9511	9118[1]
	%	%	%	%	%	%
Nitrogen, found	16.22	4.26	3.80	13.79	3.36	20.66
guaranteed	16.00	3.29	3.29	8.23	3.25	....
Ammonia equivalent to nitrogen	19.72	5.18	4.62	16.77	4.09	25.12
Phosphoric acid, total	19.75	12.68	11.20	2.78	11.98	53.70
available found	19.24	7.60	10.02	2.43	10.73	....
guaranteed	19.00	4.00	10.00	3.00	10.00	....

MIXTURES CONTAINING ONLY PHOSPHORIC ACID AND POTASH.

This group is represented by four samples examined.

9386. Tobacco Ash Elements. American Agricultural Chemical Co. sampled from stock of Spencer Bros., Suffield.

9727. Tobacco Ash Elements. This was a second sample of the above but drawn from another source, stock of Howard Bariesford, West Suffield.

9155. Eastern States Open Formula 0-16-8. Sampled from stock of J. A. Sherwood, Bridgeport.

9514. Dairymen's Special, 0-10-10. I. P. Thomas and Son, Philadelphia, sampled from stock of Hubert Smith, Milford.

[1] Chlorine none.

	9386	9727	9155	9514
	%	%	%	%
Available phosphoric acid, found	5.30	....	16.23	10.95
guaranteed	5.00	....	16.00	10.00
Potash found	14.00	15.05	8.21	10.95
guaranteed	15.00	15.00	8.00	10.00
Chlorine	1.05	....	....	7.15

Samples **9386** and **9727** require particular comment. These samples gave a great deal of trouble in the determination of potash. In spite of great pains taken to insure a uniform mixture very discordant results were obtained. Exchanges of samples with the manufacturers did not clarify the matter, they too having difficulty in securing satisfactory checks, although their guaranty was based upon factory tests which showed uniformly over 15 per cent according to advices received from them.

The second sample drawn by our agent analyzed slightly over the guaranty but in this case also the accepted figure is an average of several results which are not in as good agreement as could be desired.

MIXED FERTILIZERS CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH.

In this group of fertilizers 250 official samples have been analyzed in the past season. Analyses of these, and of samples submitted by purchasers, 265 in all, are given in Table XII. The following tabulated statement summarizes the results of the inspection.

Total number of official samples analyzed		250
Samples considerably deficient in		
one item	58	
two items	15	
three items	0	
total samples deficient		73
Total items of plant food guaranteed (250 x 3)		750
Total items found deficient:		
ammonia	27	
available P_2O_5	23	
potash	38	88
Total guaranties substantially met		662
Per cent of guaranties substantially met or exceeded		88
Commercial deficiencies exceeding $1.00 per ton		13

DEFICIENT SAMPLES.

The number of samples which were found considerably deficient in one or more items of plant food is nearly 30 per cent of the total number examined, but the money values of such deficiencies have exceeded $1.00 per ton in only about 5 per cent of the samples. Nearly 90 per cent of the total guaranties made have been substantially met or exceeded.

The distribution of deficiencies and the percentage of guaranties met is shown in the following summary, Table XIII:

TABLE XIII. SUMMARY OF DEFICIENCIES.

Manufacturer.	Number Samples.	Number Guaranties.	Number deficiencies in — Ammonia.	Avail P_2O_5.	Potash.	Per cent of guaranties met.
American Agricultural Chemical Co.	42	126	6	3	4	90
Apothecaries Hall Co.	13	39	1	0	2	92
Armour Fertilizer Works	13	39	2	1	5	80
Atlantic Packing Co.	3	9	0	0	0	100
Bartlett Tree Expert Co.	1	3	0	1	0	67
Berkshire Chemical Co.	9	27	0	0	1	96
A. D. Bridge's Sons, Inc.	2	6	0	0	0	100
E. D. Chittenden Co.	7	21	1	0	2	86
E. B. Clark Seed Co.	5	15	1	0	3	73
C. & R. Sales Co.	1	3	0	0	1	67
Davey Tree Expert Co.	1	3	0	0	0	100
Eastern States Farmers' Exchange	16	48	2	4	4	79
Essex Fertilizer Co.	7	21	2	1	1	81
L. T. Frisbie Co.	7	21	0	0	0	100
Gash-Stull Co.	1	3	1	0	1	33
Grasselli Chemical Co.	1	3	0	0	0	100
International Agricultural Corp.	2	6	1	0	1	67
Lowell Fertilizer Co.	11	33	0	3	0	91
Mapes Formula and Peruvian Guano Co.	14	42	0	1	0	98
A. G. Markham & Co.	3	9	0	0	0	100
New England Fertilizer Co.	7	21	0	0	1	95
Olds & Whipple, Inc.	7	21	0	0	0	100
Parmenter & Polsey Fertilizer Co.	3	9	1	0	1	78
Piedmont-Mt. Airy Guano Co.	2	6	1	0	0	83
Frank S. Platt Co.	2	6	0	0	0	100
Rackliffe Bros. Co., Inc.	2	6	0	0	1	83
The Rogers & Hubbard Co.	16	48	1	2	1	92
F. S. Royster Guano Co.	9	27	0	0	1	96
M. L. Shoemaker & Co.	3	9	0	2	1	67
Springfield Rendering Co.	3	9	0	0	0	100
Swift & Co.	1	3	0	0	0	100
Synthetic Nitrogen Products Co.	1	3	0	0	0	100
I. P. Thomas & Sons	8	24	1	0	3	83
Triton Oil and Fertilizer Co.	4	12	1	0	0	92
U. S. Guano Co.	8	24	2	1	3	75
Virginia-Carolina Chemical Co.	4	12	0	1	1	83
Wilcox Fertilizer Co.	4	12	2	1	0	75
Worcester Rendering Co.	7	21	1	2	0	83
Totals	250	750	27	23	38	88

COMMERCIAL DEFICIENCIES.

Deficiencies in money value in excess of $1.00 per ton have been shown in thirteen samples this year. This is an approximate value arrived at by balancing shortages against overages and reckoning ammonia at 20 cents, available phosphoric acid at 5½ cents, and potash at 5 cents per pound.

TABLE XIV. SAMPLES SHOWING COMMERCIAL DEFICIENCIES.

Sta. No.	Brand.	Approximate deficiency in money value per ton.
9200	Bradley's Complete Manure for Potatoes and Vegetables	$1.50[1]
9079	National Aroostook Special Fertilizer	1.64[1]
8997	Armour's Big Crop 8-6-6	1.94[1]
9146	Chittenden's Special Top Dresser	4.96
9592	E. B. Clark Tip Top Brand 5–10-5	1.99
9160	Eastern States 8-16-20	1.25
9622	Eastern States 8-16-20	2.07
9454	Eastern States 10-3-8, Open Formula	1.13
9210	Eastern States 10-16-14, Open Formula	1.99[1]
9565	Essex Top Dressing 7-6-5	1.85
9374	I. A. C. Tobacco Special 7-6-5	1.53
8884	Lowell Corn and Vegetable 4-8-4	1.51[2]
9356	Worcester Rendering Co., Prosperity Brand Complete Dressing	1.63[1]

[1] Second sample not deficient.
[2] Two other samples not deficient.

In a system of inspection where many brands are represented by single analyses the products of the several manufacturers may not be fairly evaluated in any one year. Although it is our purpose to examine at least two samples of any brand showing considerable deficiencies, a second sample is not always obtainable. Comparisons are more informing, therefore, if made upon data covering a period of years. A number of different bases might be chosen for such comparisons, but since it has been our practice for many years to cite brands in which commercial deficiencies amount to one dollar or more per ton, these data have been compiled for the 8-year period 1921-1928, and are tabulated in Table XV. No manufacturer is included unless ten or more samples have been analyzed in the period covered. The compilation shows that of a total of over 1,800 samples analyzed less than 10 per cent have fallen short of guaranties to any considerable extent in commercial value. Or, in other words, purchasers have received commercial values represented by the guaranties in over 90 per cent of purchases made.

TABLE XV. COMMERCIAL DEFICIENCIES FOR THE PERIOD 1921–1928.

Manufacturer.	Total number of samples.	Number equaling or exceeding guaranties in money value.	Per cent for 8 yr. period.	No. of samples for 1928.	Per cent for 1928.
American Agricultural Chemical Co	347	333	96	42	95
Apothecaries Hall Co	74	74	100	13	100
Armour Fertilizer Works	86	67	78	13	92
Atlantic Packing Co	51	47	92	3	100
Berkshire Chemical Co	69	69	100	9	100
Bridge's, A. D. & Sons, Co.	17	17	100	2	100
Chittenden, E. D. Co	52	47	90	7	86
Clark, E. B. Seed Co	37	34	92	5	80
Eastern States Farmers' Exchange	81	66	81	16	75
Essex Fertilizer Co	53	51	96	7	86
Frisbie, L. T. Co	81	71	88	7	100
International Agricultural Corp	61	55	90	2	50
Lowell Fertilizer Co	84	75	89	11	91
Mapes Formula and Peruvian Guano Co	104	103	99	14	100
New England Fertilizer Co.	62	59	95	7	100
Olds and Whipple, Inc	51	51	100	7	100
Parmenter & Polsey Fertilizer Co	28	27	96	3	100
Piedmont-Mt. Airy Guano Co	31	22	71	2	100
Rogers & Hubbard Co., The	113	110	97	16	100
Royster, F. S. Guano Co	63	50	79	9	100
Shoemaker, M. L. & Co	22	22	100	3	100
Springfield Rendering Co	32	30	94	3	100
Thomas, I. P. & Sons	32	32	100	8	100
United States Guano Co	24	23	96	8	100
Virginia-Carolina Chemical Co	57	53	93	4	100
Wilcox Fertilizer Co	60	56	93	4	100
Worcester Rendering Co	32	28	88	7	88
Totals	1804	1672	93	232	95

QUALITY OF THE INSOLUBLE ORGANIC NITROGEN.

In the absence of vegetation tests the character of the nitrogenous material which is insoluble in water is judged by chemical methods. Such methods do not show "availability" of nitrogen but they do distinguish between the better and the poorer sources of water-insoluble nitrogenous material.

Both of the accepted methods for judging the quality of insoluble organic nitrogen depend upon the behavior of such nitrogen when treated with permanganate solutions. When less than 50 per cent of the water-insoluble organic nitrogen is found to be "active" as determined by the alkaline permanganate method, and less than 80 per cent active by the neutral permanganate method, the quality of the insoluble nitrogen is rated as inferior. Both methods are applied before such nitrogen is classed as inferior.

By these methods inferior ammoniates have been indicated in eleven samples; but in some cases the amounts of insoluble organic nitrogen have been so small that they were without practical significance and in others the more active forms of nitrogen practically equalled the guaranties. The samples were, therefore, passed without question.

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station: **American Agricultural Chemical Co., New York.**		
9357	A. A. C. Acme Fertilizer	1-9-4	Woodbury
9358	A. A. C. Aroostook Potato Manure	5-8-7	North Haven
9362	A. A. C. Double A Tobacco Fertilizer	5-3-5	Gaylordsville
8865	A. A. C. Gladiator Fertilizer	4-8-7	New Britain
8850	A. A. C. Grass & Lawn Top Dressing	6-6-4	New Britain
8863	A. A. C. Monarch Fertilizer	4-8-4	New Britain
9520	A. A. C. Old Hickory Fertilizer	2-8-10	Rockville
9363	A. A. C. Princess Fertilizer	5-10-5	Gaylordsville
9105	Agrico Fertilizer for Corn	3-10-6	Danbury
9106	Agrico Fertilizer for Potatoes	4-8-6	Bethel
9107	Agrico Fertilizer for Truck	5-10-5	Bethel
9361	Complete General Fertilizer	3-8-4	West Haven
9380	Hi Grade Tobacco	7-3-7	Glastonbury
9082	Bowker's All Round Fertilizer	3-8-4	New Milford
8867	Bowker's Stockbridge Hill & Drill Fertilizer	4-8-7	Bristol
9382	Bowker's Lawn & Garden Dressing	5-8-7	West Haven
9085	Bowker's Market Garden Fertilizer	4-8-4	Collinsville
9081	Bowker's Potato and Vegetable Phosphate	2-9-3	New Milford
9084	Bowker's Stockbridge Early Crop Manure	5-8-7	Collinsville
9086	Bowker's Stockbridge Tobacco Manure	5-3-5	Thompsonville
9381	Bowker's Sure Crop Fertilizer	1-9-4	Willimantic
9111	Bradley's Blood Bone and Potash	5-8-7	Simsbury
9200	Bradley's Complete Manure for Potatoes and Vegetables	4-8-7	East River
9623	Bradley's Complete Manure for Potatoes and Vegetables	4-8-7	West Haven
9196	Bradley's Complete Tobacco Manure	5-3-5	Glastonbury
9076	Bradley's Eclipse Fertilizer	1-9-4	Meriden
9080	Bradley's Northland Potato Grower	4-8-4	Colchester
8978	Bradley's Potato Fertilizer	2-9-3	Meriden
9077	Bradley's Potato Manure	3-8-4	Suffield
8868	Bradley's XL Superphosphate of Lime	3-10-4	Bristol
9079	National Aroostook Special Fertilizer	5-8-7	Middletown
9518	National Aroostook Special Fertilizer	5-8-7	Wallingford
9390	National Complete Tobacco Fertilizer	5-3-5	Simsbury
9078	National Market Garden Fertlizer	3-8-4	Middletown
9512	National Pine Tree State Potato Fertilizer	4-8-4	Middletown
9083	National Premier Potato Manure	4-8-7	Danbury
9087	Sanderson's Atlantic Coast Mixture	3-10-4	West Cheshire
9198	Sanderson's Complete Tobacco Grower	5-3-5	Glastonbury
9593	Sanderson's Formula A	4-8-4	Guilford
9197	Sanderson's Formula B	4-8-7	Glastonbury

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

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.	
%	%	%	%	%	%	%	%	%	%	%	%
0.06	0.31	0.39	0.27	1.03	**1.25**	0.68	9.48	**8.80**	4.14	**4.14**	9357
0.04	3.11	0.33	0.43	3.91	**4.75**	0.50	8.75	**8.25**	7.04	**7.04**	9358
0.88	1.32	0.04	2.07	4.31	**5.24**	0.25	3.18	**2.93**	0.38	**5.29**	9362
0.42	2.00	0.46	0.47	3.35	**4.07**	0.55	8.63	**8.08**	7.18	**7.18**	8865
0.54	3.79	0.34	0.52	5.19	**6.31**	0.35	6.53	**6.18**	3.90	**3.90**	8850
0.38	2.01	0.49	0.52	3.40	**4.13**	0.65	8.65	**8.00**	4.04	**4.04**	8863
0.06	1.02	0.52	0.30	1.90	**2.31**	0.60	8.74	**8.14**	10.17	**10.17**	9520
0.50	2.56	0.52	0.52	4.10	**4.98**	0.65	10.55	**9.90**	5.25	**5.25**	9363
0.30	1.33	0.49	0.44	2.56	**3.11**	0.70	10.85	**10.15**	5.93	**5.93**	9105
0.44	1.68	0.66	0.52	3.30	**4.01**	0.70	8.78	**8.08**	5.71	**5.71**	9106
0.38	2.63	0.61	0.50	4.12	**5.01**	0.68	10.68	**10.00**	5.19	**5.19**	9107
0.02	1.60	0.45	0.63	2.70	**3.28**	0.75	8.79	**8.04**	3.95	**3.95**	9361
0.65	1.29	0.21	3.69	5.84	**7.10**	0.96	4.38	**3.42**	0.16	**8.01**	9380
0.08	1.58	0.31	0.30	2.27	**2.76**	0.55	8.90	**8.35**	3.92	**3.92**	9082
0.40	1.94	0.42	0.41	3.17	**3.85**	0.53	8.90	**8.37**	6.78	**6.78**	8867
0.58	2.92	0.07	0.54	4.11	**5.00**	0.68	9.00	**8.32**	6.31	**7.15**	9382
0.38	2.00	0.47	0.44	3.29	**4.00**	0.68	8.68	**8.00**	3.98	**3.98**	9085
0.08	0.95	0.47	0.29	1.79	**2.18**	0.78	9.43	**8.65**	3.03	**3.03**	9081
0.42	2.69	0.61	0.46	4.18	**5.08**	0.53	8.58	**8.05**	6.85	**6.85**	9084
0.74	1.22	0.02	2.18	4.16	**5.06**	0.38	4.20	**3.82**	1.73	**5.11**	9086
0.00	0.29	0.46	0.24	0.99	**1.20**	0.68	9.80	**9.12**	4.58	**4.58**	9381
0.97	2.16	0.41	0.52	4.06	**4.94**	0.60	8.78	**8.18**	7.04	**7.04**	9111
0.21	1.77	0.42	0.45	2.85	**3.46**	0.30	7.85	**7.55**	8.16	**8.16**	9200
0.31	2.03	0.53	0.46	3.33	**4.05**	0.38	8.95	**8.57**	7.40	**7.40**	9623
0.64	0.91	1.03	2.28	4.86	**5.91**	0.27	4.00	**3.73**	0.36	**6.73**	9196
0.03	0.28	0.41	0.28	1.00	**1.22**	0.60	9.48	**8.88**	4.52	**4.52**	9076
0.36	1.99	0.47	0.51	3.33	**4.05**	0.75	8.73	**7.98**	3.86	**3.86**	9080
0.07	0.86	0.43	0.42	1.78	**2.16**	0.80	9.43	**8.63**	2.94	**2.94**	8978
0.00	1.64	0.40	0.38	2.42	**2.94**	0.75	8.85	**8.10**	4.06	**4.06**	9077
0.22	1.46	0.24	0.59	2.51	**3.05**	0.90	10.70	**9.80**	4.06	**4.06**	8868
0.41	2.40	0.53	0.48	3.82	**4.64**	0.43	8.45	**8.02**	6.78	**6.78**	9079
0.42	2.52	0.56	0.44	3.94	**4.79**	0.48	8.43	**7.95**	7.26	**7.26**	9518
0.73	1.16	0.10	2.23	4.22	**5.13**	0.30	3.55	**3.25**	0.09	**4.57**	9390
0.05	1.60	0.51	0.40	2.56	**3.11**	0.65	8.93	**8.28**	4.01	**4.01**	9078
0.21	2.04	0.59	0.45	3.29	**4.00**	0.50	8.53	**8.03**	3.95	**3.95**	9512
0.33	1.98	0.51	0.48	3.30	**4.01**	0.50	8.98	**8.48**	7.07	**7.07**	9083
0.05	1.63	0.41	0.35	2.44	**2.97**	0.73	11.11	**10.38**	4.24	**4.24**	9087
0.39	1.22	0.40	2.49	4.50	**5.47**	0.30	3.35	**3.05**	0.39	**5.22**	9198
0.35	1.97	0.53	0.47	3.32	**4.04**	0.65	8.75	**8.10**	4.00	**4.00**	9593
0.77	1.11	0.26	1.30	3.44	**4.18**	0.09	8.43	**8.34**	0.78	**7.36**	9197

TABLE XII. ANALYSES OF MIXED FERTILIZERS

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available".	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	%
	Sampled by Station:														
	American Agricultural Chemical Co., New York.														
9384	Sanderson's Corn Superhphosphate	2-9-3	Clintonville	0.08	0.90	0.50	0.43	1.91	**2.32**	0.80	9.88	**9.08**	3.17	**3.17**	9384
9383	Sanderson's Potato Manure	3-8-4	Derby	0.08	1.48	0.40	0.51	2.47	**3.00**	0.95	9.23	**8.28**	3.98	**3.98**	9383
	Apothecaries Hall Co., Waterbury, Conn.														
9102	Liberty Corn and All Crops	2-8-2	Greenville	0.02	1.28	0.22	0.54	2.06	**2.50**	1.10	9.00	**7.90**	2.64	**2.64**	9102
9103	Liberty Corn, Fruit and All Crops 2-12-4	2-12-4	Greenville	0.05	1.75	0.28	0.16	2.24	**2.72**	1.20	12.40	**11.20**	5.61	**5.61**	9103
9110	Liberty Fish, Bone and Potash 3-8-3	3-8-3	Waterbury	0.05	1.33	0.30	1.40	3.08	**3.74**	1.05	9.05	**8.00**	3.73	**3.73**	9110
9101	Liberty H. G. Market Gardeners 5-8-7	5-8-7	West Cheshire	0.22	3.58	0.26	0.34	4.40	**5.35**	0.80	8.70	**7.90**	7.22	**7.22**	9101
9387	Liberty H. G. Tobacco Manure 7-3-7	7-3-7	East Windsor	0.00	2.43	0.54	2.88	5.85	**7.11**	0.66	6.33	**5.67**	0.20	**7.77**	9387
9385	Liberty Home Vegetable Garden Fertilizer	4-2-5	Waterbury	0.17	0.07	0.72	2.94	3.90	**4.74**	5.68	10.50	**4.82**	6.05	**6.05**	9385
9100	Liberty Onion Special (Potash as Sulphate) 4-8-7	4-8-7	East Windsor	0.34	2.00	0.57	0.88	3.79	**4.61**	3.65	14.68	**11.03**	0.61	**5.86**	9100
9193	Liberty Potato and General Crop 4-8-10	4-8-10	East Windsor	1.11	2.02	0.19	0.13	3.45	**4.19**	0.85	8.90	**8.05**	10.03	**10.03**	9193
9541	Liberty Potato and Market Garden Special 4-8-4	4-8-4	Cheshire	0.04	2.10	0.44	0.94	3.52	**4.28**	0.85	9.30	**8.45**	4.49	**4.49**	9541
9109	Liberty Potato and Vegetable 2-8-10	2-8-10	Waterbury	0.73	1.21	0.24	0.34	2.52	**3.06**	0.58	9.18	**8.60**	8.64	**8.64**	9109
9104	Liberty Top Dresser for Grass and Grain 10-3½-8	10-3½-8	New London	2.22	5.50	0.10	0.08	7.90	**9.60**	0.28	4.28	**4.00**	8.53	**8.53**	9104
9108	Liberty Special Fertilizer for Fruit 7-8-6	7-8-6	Waterbury	1.01	3.91	0.56	0.36	5.84	**7.10**	1.88	10.73	**8.85**	6.52	**6.52**	9108
9551	Liberty Tobacco Special 5-3-5	5-3-5	New Milford	0.10	1.50	0.26	2.34	4.20	**5.11**	0.36	5.50	**5.14**	0.77	**6.27**	9551
	Armour Fertilizer Works, New York.														
9443	Armour's Big Crop Fertilizer 2-12-4	2-12-4	Wethersfield	0.32	1.50	0.05	0.12	1.99	**2.42**	0.58	12.00	**11.42**	5.09	**5.09**	9143
9002	Armour's Big Crop Fertilizer 3-8-4	3-8-4	Danbury	0.21	2.55	0.01	0.18	2.95	**3.59**	0.73	8.73	**8.00**	4.58	**4.58**	9002
9446	Armour's Big Crop Fertilizer 4-6-10	4-6-10	Granby	0.07	2.26	0.83	0.08	3.24	**3.94**	0.50	6.70	**6.20**	10.56	**10.56**	9446
8888	Armour's Big Crop 4-8-4	4-8-4	Plainville	0.81	2.54	0.00	0.15	3.50	**4.26**	0.60	8.65	**8.05**	3.81	**3.81**	8888
9442	Armour's Big Crop Fertilizer 4-8-7	4-8-7	So. Glastonbury	0.57	2.41	0.12	0.15	3.25	**3.95**	0.58	8.85	**8.27**	6.76	**6.76**	9442
9389	Armour's Big Crop Fertilizer 4-16-4	4-16-4	So. Meriden	0.45	2.91	0.04	0.10	3.50	**4.26**	0.58	17.00	**16.42**	3.84	**4.17**	9389
9448	Armour's Big Crop Tobacco Special 5-3-5	5-3-5	Thompsonville	1.33	0.13	0.30	2.32	4.08	**4.96**	0.18	3.65	**3.47**	0.21	**4.84**	9448
9137	Armour's Big Crop Fertilizer 5-8-7	5-8-7	Milford	0.70	2.91	0.15	0.21	3.97	**4.83**	0.40	8.63	**8.23**	6.77	**6.77**	9137
9144	Armour's Big Crop Fertilizer 7-11-10	7-11-10	Wethersfield	1.09	4.55	0.13	0.10	5.87	**7.14**	0.80	12.02	**11.22**	9.65	**9.65**	9144
9388	Armour's Big Crop 7-12-7	7-12-7	Wallingford	0.99	4.48	0.26	0.11	5.84	**7.10**	0.35	12.48	**12.13**	6.02	**6.92**	9388
8997	Armour's Big Crop 8-6-6	8-6-6	Madison	1.21	4.61	0.33	0.06	6.21	**7.55**	1.13	7.55	**6.42**	5.40	**5.40**	8997
9621	Armour's Big Crop 8-6-6	8-6-6	Seymour	1.14	5.00	0.38	0.04	6.56	**7.98**	1.00	7.04	**6.04**	5.84	**5.84**	9621
9445	Armour's Big Crop Tobacco Fertilizer	7-3-7	Granby	1.88	0.18	0.05	3.66	5.77	**7.02**	0.20	3.33	**3.13**	0.07	**5.98**	9445
	Atlantic Packing Co., New Haven, Conn.														
9443	Atlantic 5-8-7	5-8-7	So. Windsor	2.65	0.07	0.54	0.97	4.23	**5.14**	1.29	9.40	**8.11**	0.36	**7.25**	9443
9602	Atlantic 5-4-16	5-4-16	Silver Lane	1.82	1.06	0.84	1.06	4.78	**5.81**	0.55	7.15	**6.60**	0.33	**18.24**	9602

TABLE XII. ANALYSES OF MIXED FERTILIZERS

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:														
	Atlantic Packing Co., New Haven, Conn.														
9437	Atlantic Special Vegetable 4-8-4	4-8-4	Waterbury	0.41	2.12	0.44	0.53	3.50	**4.26**	1.32	9.45	**8.13**	3.97	**3.97**	9437
	F. A. Bartlett Tree Expert Co., Stamford, Conn.														
9136	Bartlett's Green Tree Food	6-8-4	Stamford	0.00	4.10	0.18	1.19	5.47	**6.65**	3.36	10.96	**7.60**	4.33	**4.33**	9136
	Berkshire Chemical Co., Bridgeport, Conn.														
9440	Berkshire Complete Tobacco	5-3-5	Suffield												
9444	Berkshire Economical Grass Fertilizer	10-3-8	Broad Brook	1.09	0.07	0.46	2.86	4.48	**5.45**	0.56	3.63	**3.07**	0.52	**5.68**	9440
9138	Berkshire Grass Special	7-6-5	Waterbury	6.98	0.04	0.60	0.80	8.42	**10.24**	3.90	9.68	**5.78**	2.07	**8.37**	9444
9003	Berkshire Long Island Special	5-8-7	Brookfield	2.19	1.42	1.97	0.70	6.28	**7.64**	1.49	7.55	**6.06**	6.59	**6.59**	9138
9139	Berkshire Market Garden Fertilizer	4-8-4	Torrington	0.87	2.51	0.29	0.76	4.43	**5.39**	0.45	8.78	**8.33**	7.60	**7.60**	9003
9001	Berkshire Potato and Vegetable Fertilizer	2-9-3	New Canaan	0.55	1.94	0.18	0.83	3.50	**4.26**	0.18	8.87	**8.69**	4.55	**4.55**	9139
9376	Berkshire Tobacco Special	7-3-7	Hockanum	0.06	1.54	0.17	0.14	1.91	**2.32**	0.53	10.23	**9.70**	4.79	**4.79**	9001
9142	Berkshire Tobacco Starter	5-8-10	Ellington	2.20	0.10	0.51	3.30	6.11	**7.43**	0.15	3.80	**3.65**	0.70	**6.88**	9376
9141	Berkshire Truck Fertilizer	5-8-5	Ellington	1.56	2.37	0.22	0.63	4.78	**5.81**	0.93	10.25	**9.32**	0.82	**8.77**	9142
				0.09	3.12	0.32	1.00	4.53	**5.51**	0.45	8.70	**8.25**	5.94	**5.94**	9141
	Amos D. Bridges' Sons, Inc., Hazardville, Conn.														
9140	Corn, Onion, Potato and General Purpose Fertilizer	4-8-4	Hazardville	0.80	1.75	0.12	0.80	3.47	**4.22**	0.68	9.38	**8.70**	4.28	**4.28**	9140
9461	Special Tobacco Fertilizer	5-3-5	Hazardville	1.19	0.07	0.44	2.96	4.66	**5.67**	0.45	4.60	**4.15**	0.09	**5.45**	9461
	E. D. Chittenden Co., Bridgeport, Conn.														
9211	Chittenden's Complete Grain	2-9-3	Bloomfield	0.07	1.44	0.13	0.29	1.93	**2.35**	0.53	10.05	**9.52**	2.74	**2.74**	9211
9159	Chittenden's High Grade Potato	5-8-7	Tolland	0.08	3.64	0.12	0.30	4.14	**5.03**	0.18	8.40	**8.22**	7.09	**7.09**	9199
9192	Chittenden's Potato Special 4% Potash	4-8-4	Bloomfield	0.00	2.68	0.23	0.35	3.26	**3.96**	0.53	8.66	**8.13**	4.02	**4.02**	9192
9505	Chittenden's Tobacco Special	5-4-5	Wapping	0.00	2.48	0.28	1.64	4.40	**5.35**	0.20	5.20	**5.00**	1.06	**5.75**	9505
9146	Chittenden's Special Top Dresser	8-6-6	Tolland	0.00	4.47	0.53	0.32	5.32	**6.47**	0.23	7.88	**7.65**	5.34	**5.34**	9146
9459	Chittenden's Valley Wrapper Brand	6-3-5	Addison	0.00	2.19	0.22	2.65	5.06	**6.15**	0.56	4.96	**4.40**	0.32	**5.19**	9459
9214	Chittenden's Vegetable and Onion Grower	3-8-4	Tolland	0.07	2.29	0.23	0.30	2.89	**3.51**	0.23	8.88	**8.65**	3.69	**4.19**	9214
	E. B. Clark Seed Co., Milford, Conn.														
9205	Special Mixture for General Use	4-8-4	Branford	0.00	2.27	0.44	0.73	3.44	**4.18**	0.55	8.65	**8.10**	4.44	**4.44**	9205
9207	Special Mixture with 6% Potash	4-8-6	Branford	0.05	2.38	0.37	0.80	3.60	**4.38**	0.61	9.08	**8.47**	6.45	**6.45**	9207
9206	Super Phosphate	5-8-7	Branford	0.14	3.46	0.18	0.44	4.22	**5.13**	0.45	8.68	**8.23**	6.31	**6.31**	9206

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

TABLE XII. ANALYSES OF MIXED FERTILIZERS

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.
	Sampled by Station:		
	E. B. Clark Seed Co., Milford, Conn.		
9725	Super Phosphate	5-8-7	Milford
9592	Tip Top Brand	5-10-5	Milford
	C. &. R. Sales Co., Worcester, Mass.		
9562	C. & R. Lawn and Shrub Fertilizer	5-6-5	Norwich
	Davey Tree Expert Co., Kent, Ohio		
8998	Davey Tree Food	7-8-3	Sound Beach
	Eastern States Farmers' Exchange, Springfield, Mass.		
9457	Buckland's Formula A 6-2-7 Special Tobacco Mixture	6-2-7	So. Manchester
9209	Eastern States 3-12-3 Open Formula	3-12-3	Bridgeport
9208	Eastern States 4-8-10 Open Formula	4-8-10	Bridgeport
9151	Eastern States 4-16-4 Open Formula	4-16-4	North Haven
9153	Eastern States 5-8-7 Open Formula	5-8-7	North Haven
9158	Eastern States 5-10-5 Open Formula	5-10-5	Ellington
9156	Eastern States 8-6-6 Open Formula	8-6-6	Bridgeport
9213	Eastern States 8-16-8 Open Formula	8-16-8	Ellington
9160	Eastern States 8-16-20 Open Formula	8-16-20	Ellington
9622	Eastern States 8-16-20 Open Formula	8-16-20	West Simsbury
9455	Eastern States Open Formula 9-3-7 Tobacco Fertilizer	9-3-7	Granby
9454	Eastern States Open Formula 10-3-8 Tobacco Fertilizer	10-3-8	Ellington
9737	Eastern States 10-16-14 (Potash from Sulphate) Open Formula	10-16-14	Granby
9004	Eastern States 10-16-14 Open Formula	10-16-14	Ellington
9210	Eastern States 10-16-14 Open Formula	10-16-14	Bethel
9608	Eastern States 10-16-14 Open Formula	10-16-14	Branford
	Essex Fertilizer Co., Boston, Mass.		
9450	Essex A1 Super 2-10-2	2-10-2	Wallingford
9224	Essex Complete Manure 5-8-7	5-8-7	Wallingford
9204	Essex Fish Fertilizer for All Crops 3-8-4	3-8-4	Wallingford
9203	Essex Market Garden 4-8-4	4-8-4	Wallingford
9453	Essex Peerless Potato Manure 4-6-10	4-6-10	Warehouse Point
9567	Essex Tobacco Manure 5-3-5	5-3-5	New Milford
9565	Essex Top Dressing 7-6-5	7-6-5	So. Manchester

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

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.	
%	%	%	%	%	%	%	%	%	%	%	%
....	....	....	....	4.05	4.92	0.75	9.35	8.60	....	6.47	9725
0.19	2.70	0.39	0.44	3.72	4.52	0.43	10.78	10.35	4.54	4.54	9592
0.25	2.18	1.49	2.28	6.20	7.54	0.95	7.35	6.40	4.47	4.47	9562
0.00	3.50	0.54	2.02	6.06	7.37	5.15	13.68	8.53	3.21	3.21	8998
0.22	0.88	0.92	3.76	5.78	7.03	0.38	4.84	4.46	0.68	8.00	9457
0.73	1.25	0.32	0.30	2.60	3.16	0.45	12.18	11.73	3.24	3.24	9209
0.16	2.23	0.64	0.29	3.32	4.04	0.39	8.68	8.29	10.05	10.05	9208
0.89	1.98	0.30	0.38	3.55	4.32	0.48	15.00	14.52	5.90	5.90	9151
1.00	2.70	0.53	0.24	4.47	5.43	0.53	8.83	8.30	7.03	7.03	9153
0.64	2.52	0.82	0.35	4.33	5.26	0.18	11.00	10.82	5.44	5.44	9158
2.18	3.68	0.66	0.23	6.75	8.21	0.23	6.60	6.37	6.47	6.47	9156
1.26	4.67	0.73	0.34	7.00	8.51	0.38	16.05	15.67	11.91	11.91	9213
1.16	4.58	0.48	0.50	6.72	8.17	0.55	17.20	16.65	17.35	17.35	9160
1.32	4.22	0.12	0.86	6.52	7.93	0.68	16.05	15.37	18.90	18.90	9622
2.50	0.60	1.34	3.61	8.05	9.79	0.08	4.85	4.77	0.74	9.36	9455
2.08	0.85	1.44	2.88	7.25	8.81	0.50	6.25	5.75	1.83	8.61	9454
1.66	5.92	0.26	0.94	8.78	10.67	0.30	16.55	16.25	1.38	14.00	9737
1.64	5.44	0.26	0.80	8.14	9.90	0.58	17.38	16.80	14.38	14.38	9004
1.00	5.51	1.02	0.42	7.95	9.67	0.63	17.20	16.57	12.70	12.70	9210
1.36	5.85	0.65	0.44	8.30	10.09	0.85	18.65	17.80	13.21	13.21	9608
0.00	0.92	0.43	0.30	1.65	2.01	0.65	11.43	10.78	1.92	1.92	9450
0.18	2.97	0.66	0.52	4.33	5.26	1.20	9.53	8.33	7.36	7.36	9224
0.03	1.36	0.52	0.58	2.49	3.03	0.75	8.35	7.60	4.13	4.13	9204
0.31	1.80	0.47	0.74	3.32	4.04	0.88	11.10	10.22	4.41	4.41	9203
0.35	1.70	0.57	0.55	3.17	3.85	0.58	6.60	6.02	9.93	9.93	9452
1.65	0.14	0.41	2.30	4.50	5.47	0.50	4.57	4.07	0.61	5.29	9567
0.00	5.08	0.29	0.09	5.46	6.64	0.33	6.35	6.02	4.57	4.57	9565

TABLE XII. ANALYSES OF MIXED FERTILIZERS

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available".	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	
	Sampled by Station:														
	L. T. Frisbie Co., New Haven, Conn.														
9225	Frisbie's 5-8-7	5-8-7	Wethersfield	0.27	2.90	0.51	0.64	4.32	**5.25**	0.93	9.53	**8.60**	7.25	**7.25**	9225
9227	Frisbie's Corn and Grain Fertilizer 2-10-2	2-10-2	Danbury	0.04	0.78	0.51	0.58	1.91	**2.32**	1.08	11.33	**10.25**	2.26	**2.26**	9227
9229	Frisbie's Market Garden	4-8-7	North Woodbury	0.40	1.92	0.50	0.77	3.59	**4.36**	1.15	9.23	**8.08**	6.90	**6.90**	9229
9223	Frisbie's Special 3-8-4	3-8-4	New Haven	0.01	1.52	0.51	0.69	2.73	**3.32**	1.03	9.20	**8.17**	4.27	**4.27**	9223
9226	Frisbie's Special Vegetable and Potato Grower 4-8-4	4-8-4	Danbury	0.29	2.22	0.55	0.64	3.70	**4.50**	1.05	9.45	**8.40**	4.12	**4.12**	9226
9460	Frisbie's Tobacco Grower 5-3-5	5-3-5	So. Windsor	1.41	0.13	0.43	2.74	4.71	**5.73**	0.57	4.30	**3.73**	0.16	**5.11**	9460
9230	Frisbie's Top Dresser 7-6-5	7-6-5	Watertown	1.04	3.52	0.68	0.66	5.90	**7.17**	0.65	7.20	**6.55**	5.19	**5.19**	9230
	Gash-Stull Co., Chester, Pa.														
9488	Young's Formula 8-7-6	8-7-6	Mfg.'s sample	2.16	3.18	0.48	0.50	6.32	**7.68**	0.58	8.15	**7.57**	5.73	**5.73**	9488
	Grasseli Chemical Co., Cleveland, Ohio														
9234	Grasselli Odorless Plant Food	5-13-4	Fair Haven	0.00	4.24	0.00	0.11	4.35	**5.29**	1.08	16.90	**15.82**	4.42	**4.42**	9234
	International Agricultural Corp., Boston, Mass.														
9374	I. A. C. Tobacco Special 7-6-5	7-6-5	Hockanum	1.43	2.01	0.11	1.97	5.52	**6.71**	0.28	6.40	**6.12**	0.54	**4.50**	9374
9375	Vuelta Abajo Special Tobacco Formula	7-9-8	Hockanum	0.82	1.76	0.83	2.29	5.70	**6.93**	0.53	9.43	**8.90**	0.72	**8.21**	9375
	Lowell Fertilizer Co., Boston, Mass.														
8871	Lowell Animal Brand for All Crops 3-8-4	3-8-4	Southington	0.00	1.41	0.61	0.38	2.40	**2.92**	0.93	8.68	**7.75**	1.78	**3.98**	8871
9563	Lowell Bone Fertilizer 2-10-2	2-10-2	Moosup	0.00	1.04	0.51	0.30	1.85	**2.25**	1.20	10.48	**9.28**	2.15	**2.15**	9563
8873	Lowell Corn and Vegetable 4-8-4	4-8-4	Southington	0.39	1.76	0.50	0.55	3.20	**3.89**	0.85	8.85	**8.00**	3.94	**3.94**	8873
8884	Lowell Corn and Vegetable 4-8-4	4-8-4	Cheshire	0.36	1.87	0.40	0.60	3.23	**3.93**	1.13	8.08	**6.95**	3.93	**3.93**	8884
9521	Lowell Corn and Vegetable 4-8-4	4-8-4	Cheshire	0.31	2.10	0.49	0.70	3.60	**4.38**	1.08	8.40	**7.32**	4.43	**4.43**	9521
8885	Lowell Market Garden Manure 5-8-7	5-8-7	Cheshire	0.38	2.55	0.50	0.67	4.10	**4.98**	0.65	9.03	**8.38**	7.11	**7.11**	8885
8872	Lowell Market Garden Manure 5-8-7	5-8-7	Southington	0.35	2.74	0.53	0.52	4.14	**5.03**	0.70	8.75	**8.05**	6.82	**6.82**	8872
9228	Lowell Potato Grower 4-6-10	4-6-10	Southbury	0.34	1.86	0.52	0.64	3.36	**4.09**	0.60	6.85	**6.25**	10.48	**10.48**	9228
9243	Lowell Tobacco Manure 5-3-5	5-3-5	Ellington	1.69	0.11	0.35	2.44	4.59	**5.58**	0.63	4.85	**4.22**	0.61	**5.46**	9243
9244	Lowell Top Dressing 7-6-5	7-6-5	Ellington	1.09	3.49	0.65	0.65	5.88	**7.15**	0.78	7.03	**6.25**	5.13	**5.13**	9244
9245	Lowell 5-10-5	5-10-5	New Haven	1.80	1.16	0.58	0.70	4.24	**5.15**	1.13	11.15	**10.02**	5.40	**5.40**	9245
	Mapes Formula and Peruvian Guano Co., New York.														
9247	Mapes Conn. Valley Special	6-4-7	East Granby	2.06	0.00	0.20	2.83	5.09	**6.19**	1.28	6.03	**4.75**	0.54	**7.67**	9247
8972	The Mapes Corn Manure	3-8-3	Hartford	0.10	1.84	0.00	0.50	2.44	**2.97**	1.18	10.40	**9.22**	3.46	**3.69**	8972
9027	The Mapes General Truck Manure	5-6-5	Hartford	0.00	3.50	0.23	0.58	4.31	**5.24**	1.18	8.78	**7.60**	5.48	**5.48**	9027
9246	The Mapes General Tobacco Manure	5-4-5	East Granby	1.48	0.04	0.16	2.80	4.48	**5.45**	1.35	5.40	**4.05**	0.36	**5.34**	9246

TABLE XII. ANALYSES OF MIXED FERTILIZERS

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available".	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	%
	Sampled by Station:														
	Mapes Formula and Peruvian Guano Co., New York														
8966	The Mapes General Use Manure	3-6-4	Windsor Locks	0.00	2.40	0.11	0.53	3.04	**3.70**	0.83	7.38	**6.55**	4.91	**4.91**	8966
9241	The Mapes Onion Manure	4-6-4	Hartford	0.54	2.40	0.18	0.37	3.49	**4.24**	0.75	8.70	**7.95**	0.11	**4.48**	9241
8967	The Mapes Potato Manure	4-7-5	Windsor Locks	0.00	3.00	0.00	0.43	3.43	**4.17**	0.93	9.18	**8.25**	4.91	**4.91**	8967
9240	The Mapes Special Trucker "S.P."	5-8-7	Hartford	0.00	3.36	0.21	0.54	4.11	**5.00**	1.03	11.30	**10.27**	0.51	**7.38**	9240
9242	The Mapes Special Trucker	5-8-7	Bloomfield	0.00	3.07	0.17	0.53	3.77	**4.58**	1.20	10.30	**9.10**	6.93	**6.93**	9242
9248	The Mapes Tobacco Ash Constituents	1-4-15	East Granby	0.01	0.07	0.18	0.93	1.19	**1.45**	1.38	6.45	**5.07**	0.56	**15.67**	9248
9486	The Mapes Tobacco Ash and Starter	4-6-15	East Granby	3.10	0.00	0.51	0.32	3.93	**4.78**	1.70	7.33	**5.63**	0.86	**15.12**	9486
9251	The Mapes Tobacco Manure Wrapper Brand	7.5-2-10.5	East Granby	2.97	0.16	0.48	3.15	6.76	**8.22**	1.40	5.20	**3.80**	0.98	**11.51**	9251
9026	The Mapes Tobacco Starter Improved	5-6-1	Windsor Locks	1.51	1.70	0.29	1.02	4.52	**5.50**	3.28	10.03	**6.75**	1.61	**1.61**	9026
8968	The Mapes Top Dresser	10-4-2	Windsor Locks	2.43	5.89	0.19	0.34	8.85	**10.76**	0.40	6.13	**5.73**	1.55	**2.42**	8968
	A. G. Markham & Co., Springfield, Mass.														
9249	4-8-4	4-8-4	Mansfield Depot	0.43	1.87	0.49	0.65	3.44	**4.18**	0.85	9.00	**8.15**	4.24	**4.24**	9249
9250	4-6-10	4-6-10	Mansfield Depot	0.43	1.89	0.67	0.63	3.62	**4.40**	0.65	6.78	**6.13**	10.39	**10.39**	9250
9490	5-8-7	5-8-7	Stafford Springs	0.71	2.13	0.74	0.62	4.20	**5.11**	1.13	9.30	**8.17**	7.30	**7.30**	9490
	New England Fertilizer Co., Boston, Mass.														
9260	New England Complete Manure 4-6-10	4-6-10	Meriden	0.26	1.86	0.58	0.64	3.34	**4.06**	0.58	6.63	**6.05**	10.45	**10.45**	9260
8971	New England Corn Phosphate 2-10-2	2-10-2	Rockville	0.01	1.40	0.33	0.36	2.10	**2.55**	1.40	11.55	**10.15**	2.25	**2.25**	8971
8970	New England Market Garden Manure 5-8-7	5-8-7	Rockville	0.44	2.50	0.60	0.66	4.20	**5.11**	0.30	8.88	**8.58**	6.90	**6.90**	8970
9259	New England Potato and Vegetable Manure 4-8-4	4-8-4	Meriden	0.34	1.90	0.50	0.60	3.34	**4.06**	0.93	9.85	**8.92**	4.35	**4.35**	9259
8969	New England Super, A High Grade Fertilizer for all Crops	3-8-4	Rockville	0.04	1.50	0.36	0.58	2.48	**3.02**	1.00	9.05	**8.05**	3.78	**3.78**	8969
9265	New England Tobacco Manure 5-3-5	5-3-5	Warehouse Point	1.37	0.14	0.23	2.60	4.34	**5.28**	0.45	4.10	**3.65**	0.41	**5.17**	9265
9599	New England Tobacco Manure 7-3-7	7-3-7	Glastonbury	1.59	0.51	0.40	3.28	5.78	**7.03**	0.33	4.55	**4.22**	0.20	**7.64**	9599
	Olds & Whipple, Inc., Hartford, Conn.														
9483	O & W Blue Label Tobacco Fertilizer	6-3-6	Hockanum	1.12	0.06	0.46	3.42	5.06	**6.15**	0.25	4.43	**4.18**	0.49	**6.38**	9483
9023	O & W Complete Market Garden	4-8-4	So. Manchester	0.64	1.76	0.35	0.73	3.48	**4.23**	1.08	9.40	**8.32**	4.16	**4.16**	9023
9489	O & W Complete Tobacco Fertilizer	5-3-5	Hockanum	1.11	0.07	0.51	2.75	4.44	**5.40**	0.25	4.05	**3.80**	0.54	**5.52**	9489
9591	O & W Grain and General Crop Fertilizer	2-9-3	So. Manchester	0.54	0.90	0.03	0.53	2.00	**2.43**	0.88	10.53	**9.65**	3.33	**3.33**	9591
9024	O & W Grass Fertilizer	6-6-4	So. Manchester	2.18	2.50	0.33	0.18	5.19	**6.31**	0.75	7.35	**6.60**	4.00	**4.00**	9024
9484	O & W H. G. Starter and Potash	5-4-15	Burnside	0.76	0.88	0.40	2.04	4.08	**4.96**	0.45	5.13	**4.68**	0.98	**16.36**	9498
9025	O & W High Grade Vegetable and Potato Fertilizer	5-8-7	So. Manchester	1.09	2.72	0.16	0.53	4.50	**5.47**	0.65	8.93	**8.28**	8.76	**8.76**	9025

TABLE XII. ANALYSES OF MIXED FERTILIZERS

CONTAINING NITROGEN, PHOSPHORIC ACID AND POTASH

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available".	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	%
	Sampled by Station:														
	Parmenter & Polsey Fertilizer Co., Boston, Mass.														
9481	P & P Top Dressing	7-6-5	Wallingford	0.06	5.18	0.29	0.08	5.61	**6.82**	0.35	6.53	**6.18**	4.66	**4.66**	9481
9487	P & P "AA" Brand 5-8-7	5-8-7	Plainville	0.25	2.65	0.81	0.52	4.23	**5.14**	0.78	9.05	**8.27**	7.15	**7.15**	9487
9261	P & P Maine Potato Fertilizer 4-6-10	4-6-10	Wallingford	0.34	1.82	0.59	0.56	3.31	**4.02**	0.65	6.55	**5.90**	10.19	**10.19**	9261
	Piedmont Mt. Airy Guano Co., Baltimore, Md.														
9263	Harvest Brand 4-8-4	4-8-4	Plantsville	0.53	1.63	0.42	0.66	3.24	**3.94**	1.28	9.20	**7.92**	4.11	**4.11**	9263
9262	Harvest Brand 5-8-7	5-8-7	Plantsville	0.04	3.08	0.47	0.36	3.95	**4.80**	0.58	8.58	**8.00**	7.22	**7.22**	9262
	Frank S. Platt Co., New Haven, Conn.														
9558	Platt's Concentrated Lawn Fertilizer	16-5-5	New Haven	0.00	13.57	0.11	0.48	14.16	**17.22**	0.03	5.15	**5.12**	0.28	**5.18**	9558
9559	Platco Special 5-8-7	5-8-7	New Haven	0.08	2.95	0.79	0.62	4.44	**5.40**	0.98	9.65	**8.67**	7.17	**7.17**	9559
	Rackliffe Bros. Co., Inc., New Britain, Conn.														
9500	Rackliffe Brand Corn Fertilizer 4-8-4	4-8-4	New Britain	0.32	2.19	0.46	0.59	3.56	**4.33**	1.30	9.55	**8.25**	4.05	**4.05**	9500
9480	Rackliffe Brand Potato and Spec. Vegetable 5-8-7	5-8-7	New Britain	1.54	1.98	0.44	0.16	4.12	**5.01**	0.50	9.05	**8.55**	5.57	**6.41**	9480
	The Rogers and Hubbard Co., Portland, Conn.														
9034	4-8-4	4-8-4	Hartford	0.17	2.09	1.01	0.18	3.45	**4.19**	1.05	8.65	**7.60**	4.26	**4.26**	9034
9617	4-8-4	4-8-4	Wallingford	0.86	1.50	0.63	0.32	3.31	**4.02**	0.38	8.53	**8.15**	4.26	**4.26**	9617
9035	5-8-7	5-8-7	Hartford	0.07	2.93	1.08	0.13	4.21	**5.12**	0.70	8.40	**7.70**	7.14	**7.14**	9035
9620	5-8-7	5-8-7	Branford	0.05	2.93	1.07	0.13	4.18	**5.08**	0.63	8.45	**7.82**	7.00	**7.00**	9620
9255	Hubbard's Bone Base Fertilizer for Seeding Down	3-5-6	Portland	0.00	0.80	0.40	1.27	2.47	**3.00**	6.78	12.63	**5.85**	6.49	**6.49**	9255
9256	Hubbard's Bone Base Oats and Top Dressing	10-3-8	Willimantic	4.52	0.14	3.26	0.32	8.24	**10.02**	3.28	8.43	**5.15**	2.88	**8.70**	9256
9258	Hubbard's Bone Base Soluble Corn and General Crops Manure	3-8-6	Branford	0.07	0.95	0.93	0.58	2.53	**3.08**	1.45	10.30	**8.85**	5.98	**5.98**	9258
9297	Hubbard's Bone Base Soluble Potato Manure	6-8-5	Branford	1.08	2.16	0.83	0.95	5.02	**6.10**	1.98	10.64	**8.66**	0.73	**4.49**	9297
9624	Hubbard's Bone Base Soluble Potato Manure	6-8-5	Glastonbury	0.86	2.08	1.37	0.66	4.97	**6.04**	1.30	10.25	**8.95**	0.70	**4.95**	9624
9301	Hubbard's Bone Base Soluble Tobacco Manure	6-8-10	New Milford	0.79	2.24	1.19	0.57	4.79	**5.82**	1.13	10.38	**9.25**	2.75	**9.92**	9301
9045	R & H All Soils All Crops Fertilizer	4-10-4	New Milford	0.09	2.04	0.69	0.72	3.54	**4.30**	0.65	10.63	**9.98**	4.20	**4.20**	9045
9506	Rogers & Hubbard's Climax Tobacco Brand	5-3-5	Granby	1.23	0.05	0.23	2.62	4.13	**5.02**	0.39	3.85	**3.46**	0.64	**5.01**	9506
9042	Rogers & Hubbard's Corn and Grain Fertilizer	1-10-3	Willimantic	0.12	0.23	0.36	0.44	1.15	**1.40**	0.70	11.50	**10.80**	3.36	**3.36**	9042
9498	Rogers & Hubbard's High Potash Fertilizer	3-8-10	Branford	0.06	1.27	0.67	0.70	2.70	**3.28**	0.78	9.38	**8.60**	10.53	**10.53**	9498
9041	Rogers & Hubbard's Potato Fertilizer	2-10-4	Willimantic	0.12	0.63	0.66	0.56	1.97	**2.40**	0.60	10.33	**9.73**	4.93	**4.93**	9041
9300	R & H Tobacco Grower Vegetable Formula	6-3-5	Suffield	1.43	0.09	0.66	2.86	5.04	**6.13**	0.30	3.50	**3.20**	0.46	**5.43**	9300

TABLE XII. ANALYSES OF MIXED FERTILIZERS

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:														
	F. S. Royster Guano Co., Baltimore, Md.														
9513	Royster's Conn. Tobacco Guano	5-3-5	Granby	0.44	0.93	0.22	2.52	4.11	**5.00**	0.20	4.08	**3.88**	0.90	**6.09**	9513
9294	Royster's Comet Guano	3-10-6	Granby	0.00	1.52	0.33	0.62	2.47	**3.00**	0.83	10.73	**9.90**	6.24	**6.24**	9294
9296	Royster's Gem Guano	2-12-4	Thompsonville	0.06	1.16	0.28	0.34	1.84	**2.24**	0.70	13.82	**13.12**	4.06	**4.06**	9296
9293	Royster's Quality Trucker	4-8-7	Granby	0.00	2.12	0.45	0.69	3.26	**3.96**	0.63	8.60	**7.97**	7.13	**7.13**	9293
9295	Royster's Top Dresser	8-6-6	Granby	2.49	3.34	0.39	0.33	6.55	**7.96**	0.20	6.85	**6.65**	6.33	**6.33**	9295
9290	Royster's Truckers Delight	4-8-4	Plainville	0.00	2.10	0.56	0.70	3.36	**4.09**	0.95	9.08	**8.13**	4.30	**4.30**	9290
9299	Royster's 5% Truck Guano	5-8-7	Madison	0.00	2.46	0.81	0.80	4.07	**4.95**	0.78	9.68	**8.90**	6.66	**6.66**	9299
9614	Royster's Valley Tobacco Guano	5-4-5	Windsor Locks	0.32	0.88	0.29	2.86	4.35	**5.29**	0.65	4.73	**4.08**	1.29	**5.11**	9614
9516	Royster's Wrapper Brand 7-3-7	7-3-7	Burnside	0.60	1.20	0.14	3.72	5.66	**6.88**	0.08	3.65	**3.57**	0.47	**7.29**	9516
	M. L. Shoemaker & Co., Philadelphia, Pa.														
9588	Potato Special	5-8-7	New Milford	0.33	2.52	0.32	1.07	4.24	**5.15**	1.88	9.45	**7.57**	5.90	**5.90**	9588
9601	"Swift-Sure" Special Tobacco Formula	4-8-5	New Milford	0.00	2.10	0.12	1.32	3.54	**4.30**	0.60	9.00	**8.40**	0.28	**5.45**	9601
9560	Tobacco and General Use	3-10-3	Granby	0.08	1.50	0.17	0.90	2.65	**3.22**	1.20	10.68	**9.48**	0.27	**3.17**	9560
	Springfield Rendering Co., Springfield, Mass.														
9510	Springfield, 3-8-4	3-8-4	Thompsonville	0.03	1.45	0.48	0.60	2.56	**3.11**	0.79	9.18	**8.39**	4.12	**4.12**	9510
9517	Springfield 4-8-4	4-8-4	Suffield	0.88	1.38	0.54	0.78	3.58	**4.35**	0.73	8.75	**8.02**	4.09	**4.09**	9517
9515	Springfield 5-8-7	5-8-7	Hazardville	1.20	1.68	0.74	0.54	4.16	**5.06**	1.15	10.40	**9.25**	7.17	**7.17**	9515
	Swift & Co., Baltimore, Md.														
9065	Vigoro	4-12-4	Waterbury	0.32	2.74	0.05	0.39	3.50	**4.26**	0.28	13.00	**12.72**	4.28	**4.28**	9065
	Synthetic Nitrogen Products Co., New York.														
9605	Nitrophoska	18.2-30-15	Southington	0.00	13.30	1.44	0.26	15.00	**18.24**	0.00	30.30	**30.30**	15.21	**15.21**	9605
	I. P. Thomas & Sons, Philadelphia, Pa.														
9342	Economy Fertilizer 3-12-3	3-12-3	Ansonia	0.08	1.96	0.23	0.44	2.71	**3.29**	2.13	14.30	**12.17**	2.35	**3.25**	9342
9585	I. P. Thomas 5-8-7	5-8-7	Milford	0.46	2.96	0.31	0.69	4.42	**5.37**	1.05	9.90	**8.85**	6.43	**6.43**	9585
9044	Long Island Special 4-8-7	4-8-7	Branford	0.30	2.29	0.23	0.58	3.40	**4.13**	0.78	9.45	**8.67**	7.05	**7.05**	9044
9345	Thomas Tobacco Grower 5-4-5	5-4-5	East Granby	0.18	0.90	0.50	2.52	4.10	**4.98**	3.20	12.00	**8.80**	0.72	**5.85**	9345
9584	Tip Top Superphosphate 3-10-6	3-10-6	Milford	0.36	1.64	0.27	0.39	2.66	**3.23**	0.64	11.55	**10.91**	4.98	**6.16**	9584
9586	7% Guano 7-6-5	7-6-5	Milford	0.34	4.06	0.42	0.72	5.54	**6.74**	0.50	7.55	**7.05**	4.48	**5.29**	9586
9344	Truckers High Grade Guano 4-8-4	4-8-4	North Haven	0.46	2.08	0.35	0.71	3.60	**4.38**	0.85	9.72	**8.87**	3.38	**3.78**	9345
9581	Victor Potash Fertilizer 2-8-5	2-8-5	Hamden	0.08	1.18	0.12	0.40	1.78	**2.16**	1.35	9.68	**8.33**	4.19	**4.68**	9581

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

TABLE XII. ANALYSES OF MIXED FERTILIZERS

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In Ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available".	Potash. As muriate.	Potash. Total.	Station No.
				%	%	%	%	%	%	%	%	%	%	%	%
	Sampled by Station:														
	Triton Oil and Fertilizer Co., New York.														
9339	Triton 4-8-4 Fertilizer	4-8-4	Milford	0.73	1.30	0.48	0.64	3.15	**3.83**	0.37	8.52	**8.15**	4.69	**4.69**	9339
9349	Triton 4-8-7 Fertilizer	4-8-7	New London	0.73	1.53	0.50	0.59	3.35	**4.07**	0.30	9.03	**8.73**	7.34	**7.34**	9349
9348	Triton 5-8-5 Fertilizer	5-8-5	New London	0.85	1.98	0.56	0.76	4.15	**5.05**	0.48	9.50	**9.02**	5.02	**5.02**	9348
9340	Triton 5-8-7 Fertilizer	5-8-7	Milford	1.26	1.99	0.46	0.92	4.63	**5.63**	0.23	9.28	**9.05**	7.21	**7.21**	9340
	U. S. Guano Co., Baltimore, Md.														
9186	Accomac Peninsular King	5-8-5	No. Haven	1.28	0.34	2.18	0.15	3.95	**4.80**	0.55	8.77	**8.22**	4.13	**4.86**	9186
9188	General Use Guano	2-12-4	No. Haven	0.70	1.50	0.12	0.30	2.62	**3.19**	0.68	11.12	**10.44**	4.03	**4.32**	9188
9185	Jersey Special	4-8-10	No. Haven	2.52	0.22	0.29	0.22	3.25	**3.95**	0.19	8.63	**8.44**	10.16	**10.16**	9185
9187	Royal Potato Grower	4-8-7	No. Haven	1.30	1.22	0.28	0.52	3.32	**4.04**	0.83	9.07	**8.24**	6.73	**6.73**	9187
8847	Standard United States Evergreen Fish Guano	4-8-4	Norwalk	0.00	2.84	0.06	0.52	3.42	**4.16**	0.40	8.85	**8.45**	3.93	**4.81**	8847
8851	Standard United States Fish, Bone and Potash	5-8-7	Southport	0.22	3.50	0.01	0.54	4.27	**5.19**	0.48	8.85	**8.37**	6.43	**6.43**	8851
8848	Standard United States Old Fertility	2-8-3	Norwalk	0.18	1.00	0.04	0.72	1.94	**2.36**	0.73	9.85	**9.12**	3.08	**3.08**	8848
9184	Standard United States 5-10-5	5-10-5	Orange	0.60	2.72	0.36	0.22	3.90	**4.74**	0.48	11.00	**10.52**	4.76	**4.76**	9184
	Virginia-Carolina Chemical Co., New York.														
9350	Bloomaid	6-10-4	Mfg's Sample	1.11	2.75	0.22	1.16	5.24	**6.37**	0.65 1.10	11.45 9.30	**10.80** **8.20**	0.76 6.66	**4.96** **6.66**	9350
8881	V. C. Aroostook Potato Grower	5-8-7	New Britain	0.00	2.78	0.60	0.69	4.07	**4.95**	1.08	9.93	**8.85**	4.54	**4.54**	8881
8880	V. C. Fish and Potash Compound	2-9-3	New Britain	0.15	1.07	0.39	0.50	2.11	**2.57**	0.73	8.30	**7.57**	4.29	**4.29**	8880
8874	V. C. XXXX Fish and Potash	4-8-4	New Britain	0.93	2.20	0.00	0.34	3.47	**4.22**						8874
	Wilcox Fertilizer Co., Mystic, Conn.														
9347	Wilcox Corn Special 3-10-4	3-10-4	Willimantic	1.34	0.10	0.55	0.70	2.69	**3.27**	0.73	10.98	**10.25**	3.40	**4.11**	9347
9346	Wilcox H. G. Fish and Potash 4-8-4	4-8-4	Willimantic	1.73	0.26	0.91	0.78	3.68	**4.47**	0.58	8.16	**7.58**	3.90	**4.66**	9346
9359	Wilcox Potato and Vegetable Phospate 5-8-7	5-8-7	Willimantic	1.26	1.36	0.43	0.71	3.76	**4.57**	0.54	9.00	**8.46**	7.40	**7.40**	9359
9355	Wilcox 7-6-5 Top Dresser	7-6-5	Mystic	2.55	1.71	0.72	0.32	5.30	**6.44**	0.20	7.05	**6.85**	2.98	**5.25**	9355
	Worcester Rendering Co., Auburn, Mass.														
9356	Prosperity Brand Complete Dressing	6-6-4	Groton	0.67	2.83	0.49	0.50	4.49	**5.46**	0.83	7.30	**6.47**	4.01	**4.01**	9356
56	Prosperity Brand Complete Dressing	6-6-4	Colchester	.....	.....	.....	.....	4.87	**5.92**	0.64	7.07	**6.43**	.....	**4.34**	56
9040	Prosperity Brand Corn and Grain Fertilizer	2-10-2	Colchester	1.21	0.76	0.58	0.35	2.90	**3.53**	0.95	10.70	**9.75**	2.07	**2.07**	9040
58	Prosperity Brand Corn and Grain Fertilizer	2-10-2	Putnam	.....	.....	.....	.....	2.29	**2.78**	1.05	12.04	**10.99**	.....	**2.50**	58
9352	Prosperity Brand Market Garden Fertilizer	5-8-7	Colchester	0.77	2.23	0.67	0.64	4.31	**5.24**	0.95	8.48	**7.53**	7.75	**7.75**	9352
57	Prosperity Brand Market Garden Fertilizer	5-8-7	Groton	.....	.....	.....	.....	4.22	**5.13**	0.84	7.88	**7.04**	.....	**6.85**	57
9043	Prosperity Brand Potato and Vegetable Fertilizer	4-8-4	Groton	0.82	1.34	0.64	0.46	3.26	**3.96**	1.10	9.43	**8.33**	3.90	**3.90**	9043

TABLE XII. ANALYSES OF MIXED FERTILIZERS

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

Station No.	Manufacturer and Brand.	Grade.	Place of Sampling.	Nitrogen. In Nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic water-soluble.	Nitrogen. Organic water-insoluble.	Nitrogen. Total.	Ammonia equivalent to total nitrogen.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total.	Phosphoric Acid. So-called "Available".	Potash. As muriate.	Potash. Total.	Station No.
	Sampled by Purchaser:														
	Berkshire Chemical Co., Bridgeport, Conn.														
9527	Complete Tobacco Fertilizer	5-3-5	Suffield	....	....	....	....	4.61	5.60	0.20	3.65	3.45	0.93	4.78	9527
	Lowell Fertilizer Co., Boston, Mass.														
8085	Lowell 5-10 5	5-10-5	Storrs	....	....	....	....	4.22	5.13	0.97	11.19	10.22	....	5.27	8085
	The Rogers & Hubbard Co., Portland, Conn.														
8916	Tunacre Fertilizer	.....	Middletown	....	....	....	....	8.15	9.91	0.18	4.73	4.55	....	10.54	8916
	Swift & Co., Baltimore, Md.														
9018	Vigoro	4-12-4	Norwich	....	....	....	....	3.42	4.16	0.33	13.05	12.72	....	4.07	9018
	Standard Wholesale Phosphate & Acid Works, Baltimore, Md.														
8254	5-8-7 Fertilizer	5-8-7	New Britain	....	....	....	....	4.38	5.33	0.84	8.88	8.04	5.07	5.07	8254
8255	4-8-4 Fertilizer	4-8-4	New Britain	....	....	....	....	3.38	4.11	0.71	8.94	8.23	4.21	4.21	8255
9052	Standard United States Buyers Mixture Fertilizer	.....	Andover	....	....	....	....	5.20	6.32	1.13	8.28	7.15	7.04	7.04	9052
9053	Standard United States Buyers Mixture Fertilizer	.....	Andover	....	....	....	....	4.25	5.17	0.60	11.00	10.40	4.31	4.94	9053
9058	Standard United States Fish, Bone and Potash.	5-8-7	Andover	....	....	....	....	4.14	5.03	0.43	8.50	8.07	6.66	7.01	9058
9492	Standard United States Fish, Bone and Potash.	5-8-7	Rockville	....	....	....	....	4.00	4.86	....	9.05	....	6.13	6.13	9492
9252	Standard United States Fish, Bone and Potash.	5-8-7	Bridgeport	....	....	....	....	4.37	5.31	0.55	8.65	8.10	6.45	6.79	9252
9253	Standard United States Fish, Bone and Potash.	5-8-7	Bridgeport	....	....	....	....	4.25	5.17	0.48	8.50	8.12	6.43	6.60	9253
	Wilcox Fertilizer Co., Mystic, Conn.														
9119	Wilcox Fertilizer 4-8-4	4-8-4	Norwich	....	....	....	....	3.37	4.10	0.18	9.03	8.95	3.18	4.24	9119
9120	Wilcox Fertilizer 5-8-7	5-8-7	Norwich	....	....	....	....	4.31	5.24	0.05	8.53	8.48	7.45	7.45	9120
9055	Wilcox Fertilizer 7-6-5	7-6-5	Andover	....	....	....	....	5.66	6.88	0.23	6.88	6.65	4.59	5.61	9055

SPECIAL MIXTURES AND HOME MIXTURES.

Fifty samples of mixed fertilizers have been examined for individuals such samples for the most part being drawn by the persons interested. The Station is responsible only for the analysis of these samples as received.

Analyses are given in Table XVI.

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

SHEEP MANURE, ETC.

Twenty-six samples of sheep manure and other farm manures were analyzed. The identity of two of these products is uncertain. Nos. **8959** and **9495** did not have the appearance of sheep manure and did not contain appreciable amounts of phosphoric acid or potash.

Analyses are given in Table XVII.

LIME.

Lime is not classed as a fertilizer in this State but seven samples have been analyzed for purchasers. The results are given in Table XVIII.

OTHER MISCELLANEOUS MATERIALS.

Other miscellaneous materials, 35 in number, have been examined during the year and the results, with comments where necessary, are given in Table XIX.

COLLABORATIVE WORK.

The laboratory has collaborated in the check meal program of the American Oil Chemists' Society, and in the check fertilizer program sponsored by the F. S. Royster Guano Co. Mr. Nolan has collaborated with the Referee of the Association of Official Agricultural Chemists upon methods for determining activity of insoluble organic nitrogen in fertilizers. This work has involved the examination of 45 samples.

TABLE XVI. ANALYSES OF SPECIAL AND HOME MIXTURES.

Station No.	Manufacturer or Brand.	Place of Sampling.	Total Nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
					Citrate-insoluble.	Total.	So-called "Available".	As muriate.	Total.	
			%	%	%	%	%	%	%	
9667	*Sampled by Station.* Sanderson's B Formula (Old Stock)	John B. Laydon, North Haven.	3.34	**4.06**	0.25	8.43	**8.18**	1.28	**6.75**	**9667**
9596	Special Mixture for Tobacco	Chas. Maag, Manchester	6.52	**7.93**	0.08	2.38	**2.30**	0.40	**7.35**	**9596**
9534	Home Mixture for Corn	E. N. Austin, Suffield	3.74	**4.55**	0.18	4.86	**4.68**	5.23	**5.23**	**9534**
9594	Home Mixture for Corn	John Luginbuhl, Ellington	3.90	**4.74**	0.15	3.68	**8.85**	3.68	**3.68**	**9594**
9603	Home Mixture for Potatoes	John Luginbuhl, Ellington	4.54	**5.52**	1.68	8.73	**7.05**	4.05	**4.05**	**9603**
9604	Home Mixture for Grass	John Luginbuhl, Ellington	6.88	**8.36**	0.08	6.35	**6.27**	6.07	**6.07**	**9604**
9768	Wilcox 4-8-4 Fertilizer	P. Cutler, Inc., Colchester	3.17	**3.85**	0.10	8.58	**8.48**	3.43	**4.26**	**9768**
9771	Wilcox 5-8-7 Fertilizer	W. A. Howard, Woodstock	4.04	**4.91**	0.13	8.33	**8.20**	7.36	**7.36**	**9771**
9770	Wilcox 5-10-5 Fertilizer	H. F. Joy, Woodstock	4.18	**5.08**	0.35	10.55	**10.20**	4.90	**4.90**	**9770**
9579	Woodruff Home Mixture	S. D. Woodruff & Sons, Orange	4.00	**4.86**	1.10	7.48	**6.38**	7.19	**7.19**	**9579**

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

Station No.	Manufacturer or Brand.	Place of Sampling.	Total Nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
					Citrate-insoluble.	Total.	So-called "Available".	As muriate.	Total.	
	Sampled by Purchaser.		%	%	%	%	%	%	%	
9013	Special Mixture Fertilizer..	The Allied Tobacco Co., Hartford	6.41	7.79	0.33	1.85	1.52	....	11.87	9013
8263	Formula A	American Sumatra Tobacco Co., Bloomfield	6.00	7.29	0.65	5.24	4.59	....	4.76	8263
8337	Formula A	American Sumatra Tobacco Co., Bloomfield	6.02	7.32	0.48	4.69	4.21	....	5.08	8337
8262	Formula B	American Sumatra Tobacco Co., Bloomfield	5.36	6.52	1.11	6.30	5.19	....	6.54	8262
8302	Formula B	American Sumatra Tobacco Co., Bloomfield	5.46	6.64	1.06	6.05	4.99	0.25	6.22	8302
8343	Formula C	American Sumatra Tobacco Co., Bloomfield	5.90	7.17	0.82	4.73	3.91	....	3.91	8343
8458	Formula E	American Sumatra Tobacco Co., Bloomfield	4.98	6.05	0.45	3.48	3.03	....	5.79	8458
8816	Formula F	American Sumatra Tobacco Co., Bloomfield	5.70	6.93	0.28	5.23	4.95	....	4.56	8816
8920	Formula G	American Sumatra Tobacco Co., Bloomfield	5.36	6.52	0.38	3.63	3.25	....	5.79	8920
8344	Drill Fertilizer	American Sumatra Tobacco Co., Bloomfield	9.77	11.88	0.22	2.04	1.82	....	1.07	8344
8006	Fall Top Bed Fertilizer....	American Sumatra Tobacco Co., Bloomfield	5.44	6.61	0.65	4.72	4.07	....	5.80	8006

TABLE XV ANALYSES OF SPECIAL AND HOME MIXTURES.

Station No.	Manufacturer or Brand.	Place of Sampling.	Total Nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
					Citrate-insoluble.	Total.	So-called "Available".	As muriate.	Total.	
	Sampled by Purchaser.		%	%	%	%	%	%	%	
8692	Apothecaries Hall Co., Waterbury, Car No. 168774.	Hatheway & Steane, Inc., Hartford	4.12	5.01	0.30	8.58	8.28	....	7.05	8692
9629	Home Mixture	E. N. & C. C. Austin, Suffield..	4.78	5.81	....	4.60	....	....	5.45	9629
9351	Nature's Own Fertilizer., Bestivall Mfg. Co., Philadelphia, Pa	Mfr.'s Sample	7.50	9.12	....	1.80	....	....	0.99	9351
9463	Special Mixture Fertilizer..	William J. Burgess, Thompsonville	6.37	7.74	0.43	4.53	4.10	0.62	6.91	9463
9048	Fertilizer	Daigle Bros., Marion	4.68	5.69	0.50	10.53	10.03	....	6.95	9048
9572	Eastern States Farmers' Exchange, Springfield, Mass.	Leslie W. Newberry, So. Windsor	6.06	7.37	0.05	4.73	4.68	0.32	7.43	9572
9654	Special Mixture Fertilizer..	J. E. Phelps, Suffield	4.86	5.91	1.90	6.78	4.88	0.52	5.04	9654
9535	Home Mixed Fertilizer....	The Hartman Tobacco Co., Hartford	6.96	8.46	0.40	3.44	3.04	0.21	6.47	9535
7786	Platt's Concentrated Lawn Fertz., Frank S. Platt Co. New Haven	Mfr's Sample	15.86	19.28	....	...	. .	....	....	7786

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

Station No.	Manufacturer or Brand.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
					Citrate-insoluble.	Total.	So-called "Available".	As muriate.	Total.	
	Sampled by Purchaser.		%	%	%	%	%	%	%	
9395	Special Mixture Fertilizer No. 3	H. E. Wells, Warehouse Point..	6.25	7.60	0.10	7.30	7.20	1.04	15.89	9395
9396	Special Mixture Fertilizer No. 4	H. E. Wells, Warehouse Point..	6.22	7.56	0.15	7.38	7.23	0.80	16.43	9396
9397	Special Mixture Fertilizer No. 5	H. E. Wells, Warehouse Point..	5.00	6.08	0.55	6.00	5.45	6.67	6.85	9397
9398	Special Mixture Fertilizer No. 6	H. E. Wells, Warehouse Point..	3.60	4.38	0.83	8.13	7.30	5.25	5.43	9398
8297	Complete Fertilizer Grower	The Rogers & Hubbard Co., Portland	4.91	5.97	0.32	3.41	3.09	....	5.19	8297
8376	"Climax" Fertilizer	The Rogers & Hubbard Co., Portland	4.27	5.19	0.50	4.02	3.52	....	5.08	9376
9716	5-8-7 Fertilizer No. 1	The Rogers & Hubbard Co., Portland	4.18	5.08	0.33	8.70	8.37	7.27	7.27	9716
9717	5-8-7 Fertilizer No. 2	The Rogers & Hubbard Co., Portland	4.21	5.12	0.35	8.50	8.15	7.28	7.28	9717
9666	Special Mixture Fertilizer..	Paul P. Rostek, Melrose	6.04	7.34	....	4.05	....	1.20	6.55	9666

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

Station No.	Manufacturer or Brand.	Place of Sampling.	Total nitrogen.	Ammonia equivalent to total nitrogen.	Phosphoric Acid.			Potash.		Station No.
					Citrate-insoluble.	Total.	So-called "Available".	As muriate.	Total.	
	Sampled by Purchaser.		%	%	%	%	%	%	%	
9709	Special Home Mixture (Rosenblum)	Consolidated Cigar Co., Hartford	5.83	7.09	0.68	3.65	2.97	0.74	6.35	9709
9710	Special Home Mixture (Myers)	Consolidated Cigar Co., Hartford	6.16	7.49	0.45	4.40	3.95	0.03	4.43	9710
9711	Special Home Mixture (Shaker)	Consolidated Cigar Co., Hartford	6.40	7.78	0.55	4.40	3.85	0.04	4.21	9711
9712	Special Home Mixture (Winton)	Consolidated Cigar Co., Hartford	5.92	7.20	0.90	3.95	3.05	0.33	6.19	9712
9713	Special Home Mixture (Kanter)	Consolidated Cigar Co., Hartford	6.02	7.32	0.38	3.65	3.27	0.49	4.12	9713
9714	Special Home Mixture (Huntting)	Consolidated Cigar Co., Hartford	6.14	7.47	0.58	4.58	4.00	0.11	4.47	9714
9715	Special Home Mixture (Barton)	Consolidated Cigar Co., Hartford	5.80	7.05	0.40	4.18	3.78	0.24	6.21	9715
7997	Fertilizer No. 1	Truman H. Hale, Gildersleeve..	5.62	6.83	0.97	4.39	3.42	....	5.39	7997
7998	Fertilizer No. 2	Truman H. Hale, Gildersleeve..	5.78	7.03	0.91	4.27	3.36	....	5.72	7998
8096	Fertilizer	S. D. Woodruff & Sons, Orange	.45	1.76	1.35	8.30	6.95	....	11.36	8096
8341	Clay's Fertilizer	J. P. Johnson, Entomology Dept.	4.87	5.92	6.65	9.66	3.01	....	0.16	8341

TABLE XVII. ANALYSES OF SHEEP MANURE, ETC.

Station No.	Manufacturer or Brand.	Place of Sampling.	Total Nitrogen.	Ammonia equivalent to total nitrogen. Found.	Ammonia equivalent to total nitrogen. Guaranteed.	Phosphoric acid. Available. Found.	Phosphoric acid. Available. Guaranteed.	Phosphoric acid. Total Found.	Phosphoric acid. Total Guaranteed.	Potash. Found.	Potash. Guaranteed.	Station No.
	Sampled by Station.		%	%	%	%	%	%	%	%	%	
8870	A. A. C. Pulverized Sheep and Goat Manure. American Agricultural Chemical Co., New York	Bristol Grain & Supply Co., Bristol	1.47	1.79	1.50	1.67	0.50	1.90	....	3.10	2.00	8870
9189	Sheep Manure. Apothecaries Hall Co., Waterbury	F. T. Blish Hardware Co., So. Manchester	2.93	3.56	1.80	....	....	2.93	1.00	2.52	2.00	9189
9028	Armour's Sheep and Goat Manure 1½-1-2. Armour Fertilizer Works, New York	F. A. Bartlett Tree Expert Co., Stamford	1.64	1.99	1.50	0.80	....	1.45	1.00	2.36	2.00	9028
8959	Berkshire Sheep Manure. Berkshire Chemical Co., Bridgeport	Eldredge Hardware Co., Norwich	3.02	3.67	3.00	....	....	....	....	....	....	8959
9540	Par Plus Brand Pulverized Sheep Manure. A. H. Case & Co., Buffalo, N. Y.	S. D. Woodruff & Son, Orange.	2.29	2.78	2.25	....	....	3.08	1.50	1.65	1.50	9540
8886	Corenco Sheep Manure. Consolidated Rendering Co., Boston, Mass.	Cheshire Reformatory, Cheshire	1.67	2.03	1.50	....	....	1.20	0.50	3.26	2.00	8886
8999	Davey Shredded Cattle Manure, Davey Tree Expert Co., Kent, Ohio	R. E. Landis, Sound Beach	1.86	2.26	1.27	1.40	1.00	1.78	1.00	2.71	1.00	8999
9495	Sheep Manure. Meech & Stoddard, Inc., Middletown	Meech & Stoddard, Middletown	3.08	3.74	3.52	0.15	0.23	0.30	....	0.12	0.12	9495
9021	"Sheep's Head" Pulverized Sheep Manure. Natural Guano Co., Aurora, Ill.	Cadwell & Jones, Hartford	1.84	2.24	2.73	1.08	1.00	1.93	1.25	2.32	2.00	9021
9479	Favorite Brand Sheep Manure. Olds & Whipple, Inc., Hartford	Sampled at factory	1.36	1.65	1.65	....	....	1.00	0.75	2.75	2.50	9479
9257	Groz-It Brand (Pulverized Sheep Manure). Pacific Manure & Fertilizer Co., San Francisco, Cal.	F. F. Hitchcock Co., Woodbury	1.47	1.79	1.82	0.75	0.75	0.95	1.25	3.04	3.00	9257
8903	Premier Brand Poultry Manure, Premier Poultry Manure Co., Chicago, Ill.	Lightbourn & Pond, New Haven	4.86	5.91	6.10	2.38	2.50	2.53	2.75	1.20	1.30	8903
8904	Premier Brand Sheep Manure. Premier Premier Poultry Manure Co., Chicago, Ill.	Lightbourn & Pond, New Haven	1.87	2.27	2.00	0.93	0.80	1.08	1.00	2.09	2.00	8904
8905	Wizard Brand Pulverized Sheep Manure. Pulverized Manure Co., Chicago, Ill.	Comstock-Ferre & Co., Wethersfield	1.78	2.16	2.43	1.03	1.25	1.28	....	2.77	2.00	8905
8989	Wizard Brand Pulverized Sheep Manure. Pulverized Manure Co., Chicago, Ill.	H. E. Meeker, Danbury	2.23	2.71	2.43	1.68	1.25	1.78	....	2.72	2.00	8989
9264	Wizard Cattle Manure. Pulverized Manure Co., Chicago, Ill.	S. P. Strople, New Britain	2.04	2.48	2.10	1.30	1.00	1.60	....	1.58	1.00	9264
9292	Sheep Manure. The Rogers & Hubbard Co., Portland	W. L. Richmond, New Milford.	2.50	3.04	2.25	....	....	1.28	....	1.72	1.50	9292
9496	Royster's Sheep & Goat Manure. F. S. Royster Guano Co., Baltimore, Md.	F. B. Newton, Plainville	1.76	2.14	2.00	1.20	1.00	1.40	....	3.68	2.00	9496
9583	Sheep and Goat Manure. I. P. Thomas & Son, Philadelphia, Pa.	Ira W. Beers, Hamden	1.24	1.51	1.50	....	....	2.00	1.00	2.24	2.00	9583
	Sampled by Purchaser.											
7656	Poultry Manure	Z. N. Beach, Wallingford	2.19	2.66	....	....	....	3.92	....	1.38	....	7656
9755	Poultry Manure[1]	Charter Bros., Stafford Springs,	2.58	3.14	....	....	....	3.05	....	1.30	....	9755
9655	Chicken Manure	Raymond C. Bugbee, Groton	1.84	2.24	....	....	....	3.88	....	1.69	....	9655
9056	Favorite Brand Sheep Manure. Olds & Whipple, Inc., Hartford	J. A. Barrasso, Andover	1.50	1.82	1.65	....	....	1.10	0.75	3.28	2.50	9056
8324	Chicago Stock Yard Sheep Manure. Pulverized Manure Co., Chicago, Ill.	Geo. C. Meachen, Stratford	2.03	2.47	....	....	....	1.47	....	2.35	....	8324
8325	Venezuelan Goat Manure. Summer Fertilizer Co., Baltimore, Md.	Geo. E. Meachen, Stratford	1.66	2.02	....	....	....	1.28	....	3.45	....	8325
8008	Sheep Manure. S. D. Woodruff & Sons, New York	Mfr.'s Sample	4.26	5.18	....	....	....	0.26	....	0.12	....	8008

[1] 16.93% moisture.

TABLE XVIII. ANALYSES OF

LIMESTONE, ETC.

Station No.	Manufacturer or Brand.	Sampled by.	Chemical Analysis.						Mechanical Analysis.					Station No.
			Lime (CaO).		Magnesia (MgO).		Total Oxides.	Insoluble in acid.	20 mesh.	40 mesh.	50 mesh.	80 mesh.	100 mesh.	
			Found.	Guaranteed.	Found.	Guaranteed.								
			%	%	%	%	%	%	%	%	%	%	%	
	American Lime & Stone Co., Bellefonte, Pa.													
8610	Lime	Blue Hills Farm, Wallingford	71.38	.....	0.94	.....	72.32	.....	.....	.....	.....	.....	....	8610
	The Connecticut Agstone Co., Danbury.													
9051	Limestone	J. A. Barrasso, Andover	39.67	.....	4.51	.....	44.18	.....	93.0	83.0	73.0	58.0	28.0	9051
	Grangers Mfg. Co., West Stockbridge, Mass.													
9222	Grangers Agricultural Limestone	Mehmel & Sarvi, Plantsville	.....	.....	.....	.....	.....	.....	97.0	87.0	75.0	61.0	57.0	9222
9254	Grangers Lime	C. R. Treat, Orange	41.39	.....	6.98	.....	48.37	.....	100.0	100.0	99.8	93.5	85.0	9254
	Lee Lime Corporation, Lee, Mass.													
8081	Limestone, unground	W. L. Wallace, Canaan	55.08	.....	0.41	.....	55.49	.....	.....	.....	.....	.....	....	8081
	Manufacturer Unknown.													
8266	Lime	E. C. P. Sanger, Falls Village	29.85	.....	20.45	.....	50.30	.....	.....	.....	.....	.....	....	8266
9573	Limestone	John Swanson, Bolton	46.91	.....	0.33	.....	47.24	.....	50.0	38.0	24.0	14.0	12.0	9573

Table XIX. Miscellaneous Materials.

No.	Material	Nitrogen	Phosphoric acid	Potash	Remarks
		%	%	%	
8041	Ashes from corn cobs	....	6.98	13.96	.....
9050	Cottonhull bran	0.48	0.20	1.23	.....
7972	Cottonseed hulls	0.74	0.11	1.11	.....
8007	Cottonseed hulls	0.60	0.24	1.14	.....
8078	Cottonseed hulls	0.79	0.05	1.05	.....
9571	Cottonseed meal	6.21	....	....	Check test for another laboratory.
9046	Fertilizer	....	....	....	Identified as precipitated bone.
9047	Fertilizer	....	....	....	Mixture of limestone and burned lime.
9088	Fertilizer	....	....	....	Identified as muriate of potash.
9406	Fertilizer	....	....	....	Nitrate of potash or nitrate of soda and potash.
8042	Fertilizer (cottonseed cake)	3.94	....	....	.....
8625	"Fertilizer" (Lawn)	....	....	....	Limestone. CaO 49.12%, MgO 2.08%
9508	Fertilizer, mixed	....	....	....	Identified as acid phosphate.
9536	Fertilizer, mixed	....	....	....	Thought to have caused injury to tobacco plants. No borax found and only 0.16% of chlorine.
9687 9688	Fertilizer, mixed	....	....	....	Microscopic examination only.
9763	Fertilizer, mixed	....	....	....	Microscopic examination only.
9724	Fertilizer (tankage)	....	....	....	Microscopic examination. Only meat and bone detected. Chlorine 0.44%, sulphuric acid, none.

Table XIX. Miscellaneous Materials—*Concluded.*

No.	Material	Nitrogen	Phosphoric acid	Potash	Remarks
		%	%	%	
8845	Fish (whole)	2.75	3.30	....	Water and oil 72.70%.
9734	Humus	....	....	....	Moisture 27.69%, ash 1.71%, organic matter 70.60%.
9302	Lime, hydrated	....	....	....	Passed 300 mesh, 94.1%.
8110	Manganese sulphate	....	....	....	Contained 33.92% MnO.
9689	Mineral	....	....	....	Identified by Dept. of Mineralogy, Yale University, as blast furnace slag.
8286	Molasses waste	0.15	0.03	0.40	Analysis on material as submitted. Solids 7.51%. Plant food in a ton worth about $1.50.
9638	Nova Scotia Plaster	....	....	....	CaO 33.25%. MgO none or trace.
9733	Sheep Manure	....	....	....	Moisture 12.00%, ash 39.35%, organic matter 48.65%.
9049	Soy bean meal	7.95	1.43	2.11	.....
9063	Sulphur, dusting	....	....	....	All passed 300 mesh.
9064	Sulphur, dusting	....	....	....	73% passed 300 mesh.
8043	Tobacco dust	1.36	0.05	1.72	Nicotine 0.56%.
8068	Tobacco dust	....	....	....	Nicotine 1.62%.
7941	Tobacco leaves, deposit on.	....	....	....	Partly silica. Not completely identified.
7699	Tobacco stems	2.21	0.75	5.11	.....
9219	Tobacco stems	2.58	0.80	9.66	.....
9491	Volcanic deposit	none	trace	trace	Water 0.71%, ash 95.16%, organic and volatile 4.13%.

BULLETIN 297 NOVEMBER, 1928

Connecticut Agricultural Experiment Station
New Haven, Connecticut

THE EFFECT
OF
TOPPING AND SUCKERING
ON
HAVANA SEED TOBACCO

BEING A REPORT
OF THE
TOBACCO SUB-STATION
AT
WINDSOR

NOTE TO LIBRARIANS

The separate series, "Tobacco Station Bulletins" has been discontinued, No. 10 being the last. Hereafter, reports of the Tobacco Substation will be included in the regular Station series, this bulletin, No. 297 being the first to so appear.

Press of The Wilson H. Lee Co., New Haven, Conn.

Topping and Suckering Practices As Related to the Yield and Quality of Havana Seed Tobacco

N. T. Nelson[1]

The maturity of a tobacco leaf probably determines quality to a greater extent than any other single factor. The accepted practice among tobacco growers is to go through the crop some time during the blossoming period and break off the tops. The purpose of this operation is to hasten the development of the leaves by retarding or preventing the formation of seeds. Since rapid and important changes are occurring in all plants during the blossoming period, it would seem that the grower had a powerful means of either retarding or accelerating these chemical changes by topping. Similar results (1) have been found to hold true for such plants as alfalfa, timothy, bluegrass and redtop. Important effects (2) also have been obtained by removal of young fruits from the tomato, and much work on the effects of pruning fruit trees have been reported indicating similar trends. All of these experiments indicate that pruning has an important influence on plant growth. Topping and suckering of tobacco is in fact a pruning operation and therefore should exert a marked influence on the metabolic changes occuring in the plant during the period of ripening.

Among tobacco growers there is considerable variation in the time when topping is done and the size of the portion removed from the plant. The time of topping varies from the bud to the full bloom stages. Also, the number of leaves allowed to remain on the plant varies from twelve to eighteen. In view of the results obtained on other plants this operation, as well as the frequency of suckering, should be standardized to such a time and manner so as to permit the most profitable production of leaf by the plant.

Considerably greater difficulty is encountered in determining the most favorable degree of ripeness with the stalkcut than with those varieties which are primed. The primed leaves are picked when the grower judges they are ripe; but the stalk cut varieties, such as Havana seed and Broadleaf, are harvested when the plant as a whole represents the best quality. Therefore, although rules may be laid down as to when certain operation are to be done, the grower must exercise good judgment to obtain best results.

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[1]Until July 1928 Plant Physiologist at Connecticut Tobacco Substation, Windsor, Conn. Now Chief, Tobacco Division, Central Experimental Farm, Ottawa, Canada.

Review of Literature

In reviewing the work of other investigators on topping and suckering of tobacco, one is impressed with the apparent disagreement in conclusions reached. For instance, Olson (3) of Pennsylvania, obtained increased yields from high topping as compared with low topping. Johnson (4) of Wisconsin, found that high topping did not necessarily increase the yield. Low topping is advocated by some workers as the most satisfactory; others maintain that low topping produces coarse, low-quality tobacco. In regard to suckering, Olson (3) finds that two suckerings improved the quality of Pennsylvania tobacco, whereas Kentucky workers (5) (6) find that a lighter, thinner leaf is produced with less suckering. In the Pennsylvania experiments covering a period of ten years. the results on height of topping were measured in terms of yield only, nothing specific being stated regarding the effect on quality. In their suckering experiments, however, during 1912 and 1913 the best yield and also the best quality was obtained on the plots suckered twice. The plots suckered once not only gave inferior quality but the yields averaged over 300 pounds less per acre.

These illustrations are typical of the diversity of results on experiments in this country relative to the effects of topping and suckering on the yield and quality of tobacco. Experimental workers are more or less agreed that low topping reduces the variability in the size of the leaves and tends to hasten maturity. The evidence also indicates that a thick, heavy-bodied leaf, better adapted for use as a filler or a cheap binder is produced by frequent suckering.

Plan of Experiments.

Purpose.—An attempt was made to determine the relation between common practices of topping and suckering and the subsequent yield and quality of the crop. Experiments were begun at the Connecticut Tobacco Substation in 1925 and continued for three years.

Stages of topping.—Four stages of plant growth were selected, namely: bud, early bloom, full bloom and seed pod. The *bud stage* was when the top of the plant had elongated to a considerable extent, but the upper stem portion was still succulent. This somewhat immature stage was about three or four days before blossoming commenced. The *early bloom* stage was when the first blossom opened. The upper stem was more rigid than it was in the bud stage but was still somewhat succulent and could be broken easily. The *full bloom* stage was represented by an advanced maturity of three or four days when fifteen to twenty blossoms were open. At this stage the stem had become somewhat stiff and woody. The *seed pod* stage was not topped, nor suckered, until the day of

harvest. This stage represents the normal growth and development of the plant. This stage was used as a standard, any deviations from which indicate the extent to which the plant can be changed.

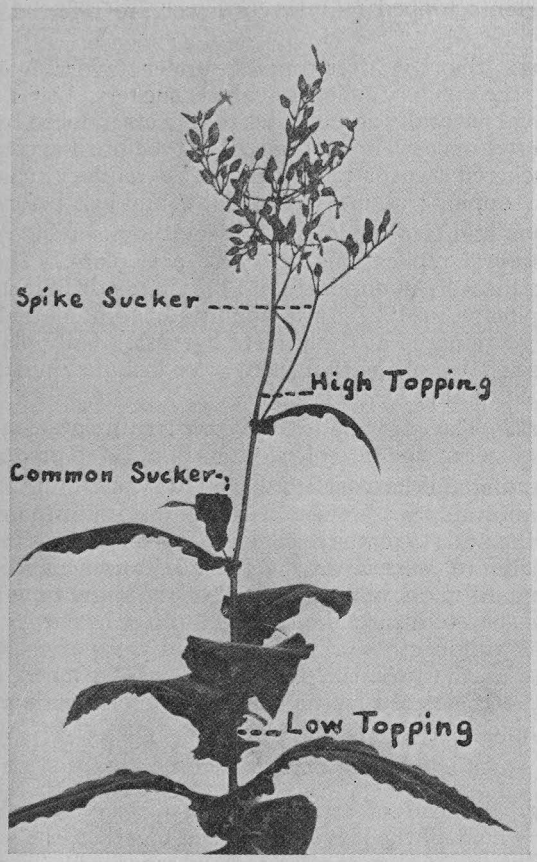

Figure 1.

Top portion of a tobacco plant showing the bare, leafless, spikelike stem of the lowest "spike" sucker. This is sometimes called the "bald" sucker. The ordinary or common suckers growing lower on the stalk have two or more leaves. *High topping*, as used in the text, refers to plants topped at the internode immediately above the "spike" sucker; *low topping* is four leaves below this.

Height of topping. All references to *high topping* as used in this work refer to plants at such a height that approximately eighteen leaves were allowed to remain on the plant after topping. The

point selected was the internode above the so-called "spike" sucker, sometimes called the lowest "bald" sucker. (See Figure 1.) The "spike" sucker is the lowest sucker having a bare, leafless, spike-like stem. All suckers below this have two or more leaves. Topping in the above manner is referred to in this study as *high topping*. Plants topped four leaves lower are referred to as *low topping*.

Suckering. Shortly after topping, under favorable conditions of growth, the axillary shoots, called suckers, begin to grow. Their removal naturally accentuates the effects induced by topping. Plots suckered once were so treated just before harvesting. On tobacco suckered two or more times, the axillary shoots were removed at topping ; about ten days later, and just before harvest.

Replication and size of plots. All yields and sorting records are based on several replications of 1/200 acre plots. The plots of each treatment were in duplicate in 1925; in quadruplicate in 1926; and in triplicate in 1927. All abnormal, stunted and diseased plants were eliminated at the time of harvest. Only plants which were representative of the treatment were included in determining the yield and quality.

Fertilizers. The plots had a uniform treatment of a standard tobacco fertilizer at the rate of two tons of a 5–4–5 mixture.

Transplanting and harvest. All plots were set on the same day to insure uniformity in starting. Growth was uniform on all of the plots until the bud stage was reached. The differences in yield and quality, therefore, were a direct effect of topping and suckering treatments. All plots were harvested at the same time and cured in the same shed to insure like treatment after harvest. Since the tobacco was uniform in size, maturity and vigor of growth, on all of the plots at the time the bud stage was reached, important trends on the effects of topping and suckering are indicated in the results obtained.

Special Methods.

Stripping. Instead of stripping the tobacco in the ordinary manner by which all the leaves are mixed together, the leaves from different portions of the plant were kept separate. The upper six leaves in high topping and the upper two leaves in low topping were called "*tops*". The next four leaves were called "*upper leaves*"; the next four were designated as "*middle leaves*"; and the remaining leaves at the bottom of the plant (three to five leaves) constituted the "*lower leaves.*" In using this method the effects of the different topping treatments could be traced to specific portions of the plant.

Sorting. The tobacco from these several treatments and plant regions was carefully sorted into the various commercial grades, which were immediately weighed and the results computed on a percentage basis. Also, from the total weight of tobacco from each plot the acre yields were determined.

Experimental Results.

stage of topping.

Yield. As previously mentioned, the treatments were in duplicate, quadruplicate, and triplicate for the years 1925, 1926, and 1927, respectively. These results are presented in Table 1.

Table 1. Yields of Plots Topped at Different Stages of Growth, 1925-1927.

Stage of topping	Average of yield per acre of cured leaf. 1925	1926	1927	3 year average
Bud	1638	1398	1148	1395
Early bloom	1800	1478	1192	1490
Full bloom	1710	1476	1182	1456
Seed pod	1512	1322	900	1245

These results indicate that the early bloom period is the best time to top Havana seed tobacco. The results are particularly pronounced in a favorable year. When the season is exceptionally dry (as in 1926) or exceptionally wet (as in 1927) the difference between early bloom and full bloom is not significant. Abnormal years like these tend to smooth out quantity of growth differences, due to treatment, because the seasonal conditions are the limiting factors. In general, it may be said that an early blossom stage of topping gives better yields than when this is done at too immature or succulent stage or at too woody or ripe stage. If topping is done when the plant is too young growth is checked to such an extent that its adverse effect is reflected in the yield. If topped too late, after seed production has progressed to a considerable degree, topping will have less effect in activating the plant to further vegetative growth. One should not top the plant when it is too immature and succulent, not wait until it becomes old and woody

Quality. The effects of stage of topping on the quality as determined by sorting records is computed to a single figure called the *grade index* and presented in Table 2. The grade index is a single

Table 2. Grade Index of Tobacco Topped at Different Stages, 1925-1927.

Year	Average grade index of tobacco topped at different stages. Bud	Early bloom	Full bloom	Seed pod
1925	.393	.451	.409	.326
1926	.483	.489	.469	.437
1927	.471	.459	.432	.226
3 year average	.449	.466	.437	.330

number, expressing the quality of a particular lot of tobacco. It is based on the percentage of carefully assorted grades and the relative price values. Although market prices for grades vary

from year to year the relative ratio of prices remains fairly constant. The price relationship as used in these experiments is as follows: Light wrappers, 1.00; mediums .75; seconds .50; darks .30; fillers and brokes .10. The grade index is obtained by multiplying the percentage of each grade by the prices indicated above and adding the products.

These results show that the early blossom stage is the best time to top Havana seed tobacco when quality is desired. It is decidedly better than topping at more mature stages.

There are other substantial reasons for topping the tobacco at an early bloom stage. It is desirable to do so early in order to reduce the hazard of winds blowing the crop down. Winds may do serious damage at this time. However, if the plants are topped before the tops become too large they are less liable to be damaged. Also, at this early stage the tops are easily broken because the stems are still succulent. If topped earlier the tops do not develop sufficiently to indicate the proper place to top. Hence, for these additional reasons, it seems better to top tobacco when it begins to blossom rather than at the bud or full bloom stages.

HEIGHT OF TOPPING

Yield. The height of topping does not have as much influence on the yields as one might anticipate. The results in 1925 did not give any decrease in yield due to low topping, but on the contrary an increase. The low topping yielded 1,850 pounds; high topping 1,810 pounds per acre.

The average results for 1926 and 1927 are given in Table 3.

TABLE 3. EFFECTS OF HEIGHT OF TOPPING AT VARIOUS STAGES ON THE YIELDS, 1926-1927.

		Yield per acre (lbs.) at different topping stages.		
Height of topping	Year	Bud	Early bloom	Full bloom
Low	1926	1412	1467	1462
	1927	1145	1172	1192
	Average	1278	1319	1327
High	1926	1385	1490	1462
	1927	1148	1192	1182
	Average	1266	1341	1322

Within the limits of these experiments, the height of topping did not affect the yields. When the tobacco was topped low the remaining leaves increased in size and weight to counterbalance the loss incurred at topping. It is conceivable, however, that still lower topping might reduce the yield. Four leaves below the spike sucker apparently is as low as a plant can be topped without causing a loss in yield.

Quality. Low topping had a marked beneficial effect on the quality. The effect of height of topping on the percentage of lights, mediums and darks is given in Table 4.

TABLE 4. SHOWING THE EFFECTS OF HEIGHT OF TOPPING IN EARLY BLOOM ON THE PERCENTAGE OF DARKS, MEDIUMS AND LIGHTS FOR THREE YEARS, 1925-1927.

	% Light				% Mediums				% Darks			
Height of topping	1925	1926	1927	Ave.	1925	1926	1927	Ave.	1925	1926	1927	Ave.
Seed pod (high)...	0	4	0	1	0	0	1	0	37	28	32	32
High	15	15	9	13	13	11	4	9	39	26	31	32
Low	23	31	20	25	16	18	11	15	32	18	28	26

Nearly twice as high a percentage of lights and mediums was produced by low topping as by high topping. The tobacco when allowed to go to seed without topping, until the day of harvest, resulted in very poor quality. Chemical conditions within the plant brought about by seed formation are not correlated with high quality leaf. High topping does not counteract this as effectively as low topping. The percentages of lights and mediums is practically midway between those of low topping and those resulting from the normal development of the plant. Severe pruning, i.e., low topping, in an early bloom stage produces high quality tobacco.

Grade index. The simplest way of indicating the relative qualities is probably by expressing it in terms of the grade index. These averages are presented in Table 5.

TABLE 5. SHOWING EFFECTS OF HEIGHT AND STAGE OF TOPPING ON THE QUALITY AS REPRESENTED BY THE GRADE INDEX, 1926-1927.

		Average grade index in relation to height and stage of topping		
Stage of topping	Year	Low	High	Not topped
Bud	1926	.524	.442	.437
	1927	.514	.439	.276
	Average	.517	.440	.331
Early bloom	1926	.523	.455	.437
	1927	.524	.395	.276
	Average	.523	.425	.331
Full bloom	1926	.491	.447	.437
	1927	.497	.368	.276
	Average	.494	.407	.331
General average		.512	.426	.331

The best quality tobacco was produced by low topping in the early bloom stage. This tobacco averaged 8.6 cents more a pound than high topped tobacco for the two years, 1925 and 1926. In every instance the tobacco excelled the corresponding plots topped high. The evidence is conclusive that low topping of Havana seed tobacco results in better quality than high topping.

Regional distribution of grades. Since the quality is improved to such an extent by low topping, it is of interest to note the particular portions of the plant affected. In table 6, the percentage of lights, mediums and darks, produced at different levels on the plant is given.

TABLE 6. SHOWING THE EFFECTS OF HEIGHT OF TOPPING ON THE PERCENTAGE OF DARKS, MEDIUMS AND LIGHTS AT DIFFERENT LEVELS OF THE PLANT, 1925-1927.

Grade	Year	Tops		Upper leaves		Middle leaves		Lower leaves	
		Low	High	Low	High	Low	High	Low	High
		%	%	%	%	%	%	%	%
Darks	1925	84	93	10	23	0	0	0	0
	1926	66	82	11	5	0	0	0	0
	1927	100	100	55	51	0	0	0	0
Average		83	92	25	26	0	0	0	0
Mediums	1925	16	7	3	31	0	5	0	0
	1926	27	8	38	13	0	38	0	0
	1927	0	0	27	12	4	0	0	0
Average		14	5	23	18	1	14	0	0
Lights	1925	0	0	36	25	54	40	5	4
	1926	3	4	42	36	60	16	17	5
	1927	0	0	7	5	51	14	12	0
Average		1	1	28	22	55	23	11	3

There seem to be two opposing tendencies in the plant: first, a decreasing tendency to produce darks extending from the top of the plant toward the base; second, an increasing tendency to produce lights as the lower leaves are approached. There is evidently a point along the stalk where the tendency to produce darks is equal to that of producing lights. This point is higher up on plants that are topped low. Accordingly, the tendency to produce the less desirable darks does not extend as low down on the plant when the plant is topped low. This is indicated by the lower percentage of mediums found in middle leaves under low topping, 1% compared with 14%. The difference between the percentage of darks and lights in the different regions under the two methods is consistently in favor of the lower topping. The tendency to produce inferior quality is consistently associated with high topping, particularly in the middle portion of the plant.

Grade index. To further illustrate the effects of topping on the quality of tobacco in different regions of the plant, comparisons of the grade index are given for two years 1926 and 1927. These results are given in Table 7.

TABLE 7. SHOWING EFFECTS OF HEIGHT OF TOPPING ON THE GRADE INDEX IN DIFFERENT REGIONS OF THE PLANT WHEN TOBACCO IS TOPPED AT DIFFERENT STAGES OF GROWTH.

Stage of topping	Height of topping	Grade index in different plant regions (1926-1927)								
		Upper			Middle			Lower		
		1926	1927	Ave.	1926	1927	Ave.	1926	1927	Ave.
Bud	Low	.651	.487	.569	.829	.806	.817	.498	.333	.415
	High	.664	.463	.564	.672	.646	.659	.408	.290	.349
Early bloom	Low	.717	.508	.613	.900	.756	.828	.546	.382	.464
	High	.659	.479	.569	.672	.614	.643	.418	.305	.362
Full bloom	Low	.753	.455	.604	.776	.740	.758	.494	.351	.423
	High	.801	.507	.654	.649	.547	.598	.453	.218	.336
Seed pod		.587	.421	.502	.630	.437	.534	.450	.221	.336
Average	Low	..	..	.595	..	...	801	...	..	.434
Average*	High	...	...	.596	...	...	.633	...	...	.349
Average not topped		...	...	.501	...	...	534	...	...	.336

*Not including seed pod plots.

Tobacco topped later than the early bloom stage rapidly deteriorates in quality. The middle and lower leaves are affected to a greater extent than any other portion of the plant. This undesirable effect is characterized by an overripe condition of these leaves which is associated with yellow, variegated, and mottled colors, when the tobacco is cured

It will be noted in Table 8 that the quality of the middle and lower leaves of the plant is improved the most by low topping. It has been observed that this is the region immediatetly below the maximum sucker development.

TABLE 8. AVERAGE RELATIVE QUALITY ON BASIS OF 100 IN DIFFERENT PLANT REGIONS AS EFFECTED BY TOPPING.

Topping treatment	Relative quality, index in different portions of the plant (1926-1927)		
	Upper leaves	Middle leaves	Lower leaves
Seed pods†	100.0	100.0	100.0
High topping	118.7	118.5	100.4
Low topping	118.7	150.0	129.1

†Not topped until harvest.

High and low topping improved the upper leaves 18.7%, but the middle leaves were improved 50%, by low topping and only 18.5% by high topping. The lower leaves were improved 29.1% by low topping. High topping had practically no effect, only .4%, on the bottom leaves.

Burn tests. The fire holding capacity of the unfermented leaves as affected by the height of topping, was tested by counting the number of seconds a leaf continued to glow after it had been

ignited by an electric match. To facilitate this work a metronome was standardized so that there were exactly sixty beats a minute. Each figure recorded was the average of a burn test on each side of at least twenty leaves taken at random from the grades represented. These burn tests indicated that low topping improved burn. The average burn of darks was 6.2 seconds for high and 9.0 seconds for low topping. The medium averaged 10.7 seconds for high topping and 11.7 for low topping. This difference between the lights was not great. Low topping averaged 13.9 and high 13.4 seconds. There also was a consistent relationship between the duration of burn and the portion of the plant from which the leaves were taken. The tobacco became progressively poorer in burn as the top of the plant was approached. The top, upper, and middle leaves averaged 7.5, 11.5, 13.2 seconds respectively.

These figures indicate that the burn of tobacco is intimately associated with the chemical transformations taking place in the plant after the plant is topped. It also shows the farmer has some degree of control over these changes by the manner of topping.

Low topping of Havana seed not only increases the percentage of desirable grades but also results in an improved burn.

DEGREE OF SUCKERING

Yield. The degree of suckering exerts a marked influence on yield. These results for 1925 are given in Table 9. The plots suckered once were so treated the day before harvest. Those plots suckered twice had an earlier suckering two weeks before harvest.

TABLE 9. YIELDS OF TOBACCO AS AFFECTED BY NUMBER OF TIMES CROP WAS SUCKERED, 1925.

Stage of topping	Yields per acre (lbs.) Suckered once	Suckered twice	% increase from two suckerings
Budded*	1377	1674	21.6
Bud	1530	1746	13.5
Early bloom	1746	1854	6.2
Full Bloom	1674	1746	.3
Average	1582	1755	41.4

*Topped to desired height ten days after the buds were removed.

In 1926, three suckerings in early bloom averaged 1592 pounds per acre as compared with 1,412 pounds when suckered only once.

In all of these trials two or more suckerings consistently yield higher than a single suckering. The average increase per acre was 173 pounds in 1925 and 180 pounds in 1926. These differences are more striking when tobacco is topped in the immature bud stage. This relation is made clear by comparing the percentage increase of the yields resulting from more than one suckering. The average increase for the bud stages was 17.5% while the more mature blossom stages averaged only 5.2%.

Quality. As previously noted, the yields of the three earliest topping stages were affected more by the number of suckerings than the later stages. These three stages are used to show comparative effects on quality. The percentage of assorted grades from these treatments is given in Table 10.

TABLE 10. PERCENTAGE OF DARKS, MEDIUMS, LIGHTS AND SECONDS ON PLOTS SUCKERED TWICE AS COMPARED WITH THOSE SUCKERED ONCE, 1925.

Number times suckered	Stage of topping	Percentage of indicated grades. Darks	Mediums	Lights	Seconds
Once	Budded	25	3	5	39
	Bud	25	4	4	35
	E. bloom	32	10	15	37
	Average	27.3	5.7	8.0	37.0
Twice	Budded	37	7	7	27
	Bud	37	8	11	26
	E. bloom	38	10	9	26
	Average	37.3	8.3	9.0	26.3

These data indicate that if the sucker growths on tobacco are removed too diligently, there is a resultant tendency to produce high percentages of heavy dark tobacco. The growth of suckers appear to be a desirable characteristic in the production of light colored, free burning tobacco. These actively growing suckers are instrumental in drawing from the leaf materials which are detrimental to quality. These translocation phenomena are intimately associated with the removal of nitrogenous compounds, whose presence in the leaf is associated with dark colors and poor burn. Considering the tobacco taken from any particular plant, high quality is always correlated with a reduction in the amount of these nitrogenous constituents. These changes are most active during the ripening period between early topping and harvest.

SUMMARY

With a given fertilizer treatment, the quality of leaf for any particular season is largely determined by the extent of the changes occurring in the plant between the bud and the harvest stages. The grower can control these changes by judicious topping and suckering.

The best topping stage for Havana seed tobacco is when it begins to blossom. If it is topped at too mature a period of growth the quality deteriorates as evidenced by increased percentages of mottled, yellow-spotted and variegated colors. This over-maturity effect may be avoided by earlier harvest.

Low topping does not necessarily reduce the yield. The remaining leaves grow larger.

High topping increases the percentage of short, low-priced darks. Furthermore, it promotes the production of dark tobacco in regions nearer the base of the plant than is the case with low topping.

Low topping (three to four leaves below the "spike" sucker) consistently gives better quality than high topping (at "spike" sucker).

Low topping stimulates the growth of the lower nine to eleven leaves.

Low topping has a marked beneficial effect on the burn.

There is a regional distribution of grades. The tendency of the plant is to produce darks and mediums in the upper leaves, and lights and seconds in the lower portion of the plant. The lower nine to eleven leaves usually include the bulk of high quality tobacco.

Several suckerings tend toward higher yields but a heavier, darker leaf.

Abundant growth of suckers suggests the removal from the leaf of substances deleterious to quality.

Topping retards the process of seed formation and activates the plant to vegetative growth.

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Connecticut Agricultural Experiment Station
New Haven, Connecticut

REPORT OF THE DIRECTOR

FOR THE

YEAR ENDING OCTOBER 31

1928

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For the Year Ending October 31, 1928

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

In accordance with the usual custom, I have the honor to submit herewith a statement regarding the work of the Station for the past twelve months, together with other information of a pertinent nature. Our Station, the first to be established in this country, has now completed fifty-three years of service to Connecticut agriculture. With this in mind, the following note on its history and record may be appropriate.

The agricultural experiment station had its origin in Europe, the first having been established at Mockern, Germany, in 1851. By 1873 there were sixty-three such stations in continental Europe supported by agricultural societies or by the states in which they were located. The first privately endowed station was established at Rothamsted, England.

In 1853, Samuel W. Johnson, a young graduate of Yale University went to Germany to study chemistry, particularly its application to agriculture. While there he visited several of the experiment stations and studied under some of the famous agricultural chemists of that day. Returning to Yale as an instructor in chemistry, he was appointed Chemist to the State Agricultural Society. During the next twenty years he never ceased to urge in his lectures and in the press, the need of agricultural stations in this country, and as a result of his labors, the Legislature of 1875 secured to Connecticut the honor of establishing the first agricultural experiment station in America. Connecticut having pioneered in the movement, several other states followed, until in 1887 Congress passed the Hatch Act, providing for a station in each state.

The duties of the Station as defined in the statute are three-fold: the analysis of fertilizers, feeds, drugs, foods and other products for the protection of the people of the State; the conduct of "scientific investigation and experiments" in agriculture and related sciences; the dissemination of the results.

As an example of the first, the fertilizer inspection of 1928 disclosed the sale of a brand of fish meal to which had been added sulfate of ammonia, thus causing a low grade fish to show the same amount of total nitrogen as does the high grade product. These facts were made known immediately and the purchasers have been reimbursed by the dealers who unwittingly sold the goods.

Other direct services include the inspection of nurseries and orchards, the control of insect pests and plant diseases, the dis-

tribution of forest planting stock, the testing of seeds, advice on the management of land and the like.

Under the head of "experiments" might be listed a long series of investigations covering the fifty-three years of the Station's existence. Notable among them are those dealing with corn breeding, the white pine blister rust, the chestnut bark disease, tobacco wild fire, tobacco root rot, the nature of the vegetable proteins, the discovery of the vitamines and studies on the food value of milk. For this last it is fair to say that most of our recent knowledge of the food value of milk and the resulting increase in its consumption are traceable to the contributions of the Station.

The dissemination of results is accomplished through bulletins, lectures, the work of the Extension Service, correspondence and many personal visits to farms and orchards. The Station is not only a research institution—it is and always has been a service agency for the people of the State. The following quotation from the Report for 1902 truly describes the policy that the Station has always tried to follow: "It is the wish of the Board of Control to make the Station as useful as its resources will admit. Every Connecticut citizen who is concerned in agriculture, whether farmer or resident of a city, has the right to apply to the Station for any assistance that comes within its province to render, and the Station will respond as far as lies in its power."

REVIEW OF THE YEAR

The Station has been unusually fortunate in the number of outstanding scientists who have been members of its staff since its establishment. Among those deserving highest honor is Dr. Thomas B. Osborne, who at his own request has been relieved of active charge of the Biochemical Laboratory and given the title of Consulting Biochemist. Coming to the Station in 1886, Dr. Osborne soon began his life work, the study of the Nature of the Vegetable Proteins, for which his name is known and honored throughout the scientific world. In collaboration with Dr. Lafayette B. Mendel of Yale University, he has pioneered in the newer phases of nutrition, thus adding to the reputation of the Station for fundamental contributions to agriculture and science. It is a source of satisfaction to all interested in the Station to know that Dr. Osborne is to maintain his active interest in the work he established and carried on so well and that we will continue to have the benefit of his advice and counsel.

The annual reports of the Station now number fifty-two and constitute a record of unusual value. Included in each report is an index but a cumulative index has never been prepared except for two subjects, Entomology and Food and Drugs. Dr. Jenkins volunteered to undertake this task and a complete index of all

matters of permanent value is now ready for the printer. With this will be included several special sections such as Analyses of Unusual Fertilizer Materials, A Complete List of Members of the Staff, and the like. Not only the Station but all those having occasion to consult agricultural literature will be indebted to Dr. Jenkins.

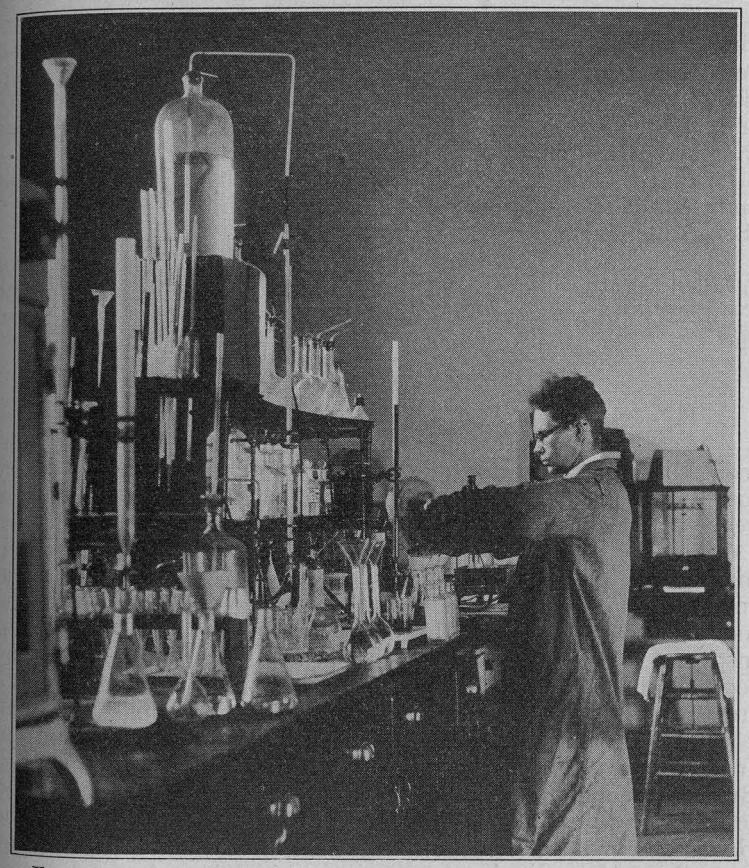

FIGURE 2. Analyzing Foods and Drugs—Analytical Laboratory.

CONTROL AND SERVICE WORK

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

In accordance with the statutes relating thereto, the Analytical Laboratory has analyzed 900 samples of *Fertilizers and Fertilizer materials*. Of these, 536 were drawn officially by the Station Agent and the balance were received from farmers. The Report

on Fertilizers will appear in December, 1928, as Bulletin 296 of the Annual Report of the Station.

The *Feed Inspection* has involved the analysis of 800 samples, the report on which will be printed early in 1929. Over 800 brands of feeding stuffs are now registered for sale in Connecticut.

The examination of *Foods and Drugs* occupies a considerable portion of the time of the laboratory. During the past year 1,288 samples were analyzed, including such a wide variety of foods as pickles, sweet chocolate, breads and ice cream; and of drugs, powdered pepsin, Fowler's solution and many proprietary preparations. Special studies were made of cod liver oils (for vitamine A) and of "denicotinized" tobaccos, the latter especially attracting wide attention among physicians and laymen.

Of *Babcock Glassware*, 2,540 separate pieces have been calibrated and 134 dairy thermometers standardized, in accordance with the statutes.

In addition to the above regular duties, a large amount of detailed analytical work has been done in collaboration with the Tobacco Substation at Windsor, the Storrs Experiment Station and the Association of Official Agricultural Chemists.

CONTROL OF INSECT PESTS

The constantly increasing number of insect pests, the establishment and enforcement of quarantines, together with the necessary inspections and scouting, require more attention each successive year.

The State quarantine on account of the *Asiatic Beetle* has been maintained and enforced, and 426 certificates have been issued covering 2,951 cubic yards of soil and for 4,394 plants to be moved out of the restricted area. About 1,194 plants have been inspected by one of the staff, who has also examined 55 lawns by request and shown the owners how to apply the lead arsenate treatment. No carbon disulphide emulsion was applied in 1928.

The *Japanese Beetle* has been the subject of much attention. In 1927, the beetles were discovered in rather large numbers in Bridgeport, and on December 1, 1927, the quarantine was extended to cover two rows of shore towns from the New York line to the Housatonic River, in conformity with the Federal quarantine. From June 15 to October 1, all principal highways leading out of the quarantined area were patrolled during the day time, and a 24-hour patrol service was maintained at the eastern end of the Washington Bridge on the Boston-New York Post Road, to prevent the movement of farm products out of the quarantined area except in conformity with the regulations. An inspection stand was established in Bridgeport to facilitate the inspection of truck loads of produce to be shipped out of the area.

During the summer of 1928, Federal men scouted for the beetles in nearly all cities and larger towns of Connecticut outside the quarantined area, resulting in the discovery of infestations in New Haven, New London and Hartford. Only a few beetles were found at each of the first two places but the Hartford infestation was larger and the number of beetles probably ran into the hundreds. At Springfield, Mass., not far from the Connecticut line an infestation was found containing nearly 5,000 beetles. As yet there has been no Federal action regarding quarantines but it is probable that the present quarantine will be extended to include New Haven and adjacent towns, and that the other colonies will be treated as "outside" infestations. This work is conducted in co-operation with the Federal Plant Quarantine and Control Administration.

FIGURE 3. Burning Corn Stalks and Stubble in Stonington—European Corn Borer Control.

The *European Corn Borer* has spread markedly during the season. Clean-up measures around the 1927 infestations were conducted partly in the fall and completed the following spring by State and Federal forces working in co-operation. In 1928, 21 new towns were found to be infested. These with the five already under quarantine make 27 towns in which the Corn Borer was found in 1928. A continuation of the clean-up methods practiced in the past seems to be out of the question on account of the expense and legislation compelling the owners or tenants to dispose of their corn stalks is now being considered.

There has been no important spread of the *Gipsy Moth* in Connecticut during the season. No stripping has occurred within the

State but larger areas than ever before were defoliated in Massachusetts, New Hampshire and Maine.

The annual *Inspection of Nurseries* has been conducted with greater care and thoroughness than ever before on account of the new pests to be looked for. The Station has also inspected the fruit and rose stocks imported from foreign countries into Connecticut nurseries for propagation.

The work of *Mosquito Elimination* has been continued as usual. Considerable new ditching work has been done during the year with funds raised by town appropriations and private contributions. The ditching in Hamden, East Haven and Old Saybrook

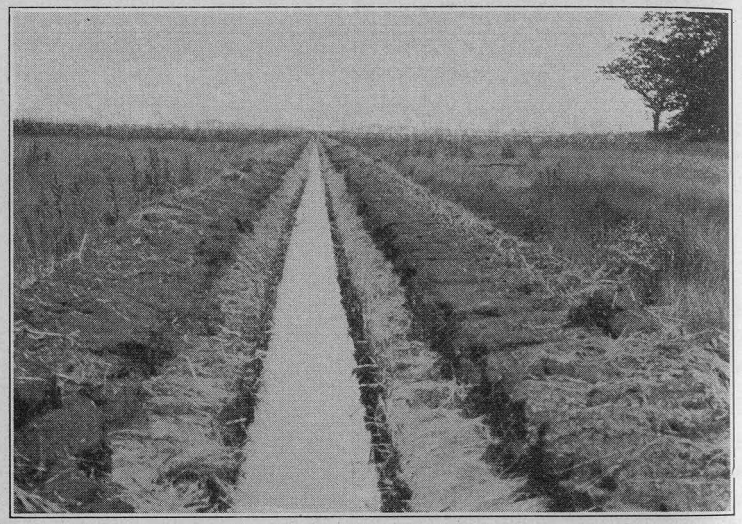

FIGURE 4. A New Double-width Ditch at Hammonasset Park—Mosquito Elimination.

is not completed, but funds will be provided. The City of New Haven has installed a new tide gate at the Little River bridge on Middletown Avenue, which will make possible the ditching of a considerable area in North Haven. All of this work means a greater cost for maintenance, for according to the law the State is morally, if not legally responsible for maintenance after the areas have been properly ditched and the work approved and accepted. The appropriation for this work must be increased if the Station is to carry out the provisions of the statute.

WHITE PINE BLISTER RUST

During the past season 123,385 wild Ribes and 1,151 cultivated Ribes were destroyed on 75,102 acres. The work was conducted in 26 towns. Approximately one and a half percent of the acreage

covered this year was a re-eradication of areas worked in previous years. 245,045 acres of non-pine land in the general pine region were eliminated from control.

The nursery sanitation project undertaken in 1927 was extended to include 3,962 acres surrounding commercial nurseries and 1,480 acres of water company plantings. These figures are included in the 75,102 acres reported above.

SUMMARY OF WHITE PINE BLISTER RUST CONTROL—1925 to 1928

Year.	Initial Erad. A.	Re-Erad. Acres.	Tot. A. Erad.	Wild Ribes	Cult. Ribes.	Estimated Pine A. Protected.	Nursery Sanitation Acres.
1925	6,688	40	6,728	258,515	684		0
1926	21,687	570	22,256	182,826	330	7,400	0
1927	12,068	8,836	20,904	159,121	2,235	10,400	1,000
1928	68,539	1,122	69,661	123,383	1,151	34,800	3,962

All eradication in 1927 and 1928 represents co-operative effort on the part of towns, individuals, pine owners, and the state. There is a noticeable reduction in the number of wild Ribes destroyed each year which indicates that initial eradication is effective in the areas of heaviest Ribes concentration. Blister Rust has been arrested on protected areas, but some re-eradication will be necessary each year if previously eradicated areas are to be kept in a sanitary condition.

SEED TESTING

This year a special study was made of the quality of Flower Seed offered on the Connecticut market and the inspection of Vegetable Seed was continued. The following table shows the extent of this work:

Kinds.	Number of samples.	Number of varieties.	Number of strains.
Vegetables	190	25	71
Flowers	62	26	14
Field Crops	33	14	18
Trees	20	8	5

SPRAY SERVICE

In continuation of the plan developed some years ago, the Station collaborated with the Extension Service and the Pomological Society in a Spray Service for orchardists. Two members of the Staff visited orchards regularly during the spring and summer, thus keeping in close touch with the appearance and development of insect pests and fungus diseases. The data collected, together with the weather predictions, provided the basis of advice on spraying and dusting.

DISTRIBUTION OF PLANTING STOCK

One and a quarter million trees were distributed during the past year for forest planting purposes, 333,000 of these going to farmers under the Clark-McNary Act. This is almost twice the number distributed in 1927.

Progress of Investigations

Here follow brief notes on those projects of greatest interest or on which definite results have been obtained during the year. No attempt is made to discuss all of the investigations under way, a list of which will be found on page 134.

BIOCHEMISTRY

Chemistry of the Proteins. As a part of the study of the methods for the separation of the basic amino-acids of proteins, highly purified crystalline samples of several of these substances have been prepared and photomicrographs published. A crystalline preparation of lysine had not been obtained previously.

Convenient methods for the preparation of both arginine and histidine on a large scale have also been developed. Analyses of the basic amino-acids of two proteins, edestin and oxyhemoglobin have been made and a full review of current speculations upon the constitution of proteins has been published in Physiological Reviews. Papers describing the other phases of the work have been published in the Journal of Biological Chemistry.

Nitrogenous Constituents of Plants. Progress has been made in the investigation of the simpler nitrogenous constituents of fresh green tobacco leaf although no papers have as yet been published. This work is being actively continued.

Experiments in Nutrition. Extensive data have been collected on the effect of diets deficient in various respects upon growth and the composition of the bones. A method has been developed for modifying the determining factors, one at a time. Thus the influence of the fat-soluble vitamine, the proportions of the inorganic nutrients and the potential reaction of the diet is being investigated.

In connection with extended earlier observations on the influence of green leaves on nutrition the potency of watercress with respect to some of its constituent vitamines has been investigated. This substance is found to be comparatively rich in vitamine A. The content of vitamine "B" in liver and preparations thereof is also being studied anew.

BOTANY

Mosaic. The rogueing experiment for the control of mosaic in Cuthbert Raspberries, in co-operation with the U. S. Bureau of Plant Industry has been continued. Because of unusual spread

in 1927, many plants were removed. Plot I, consisting of plants received from Massachusetts, still shows the greatest amount of mosaic, although the disease is now general in all of the five plots.

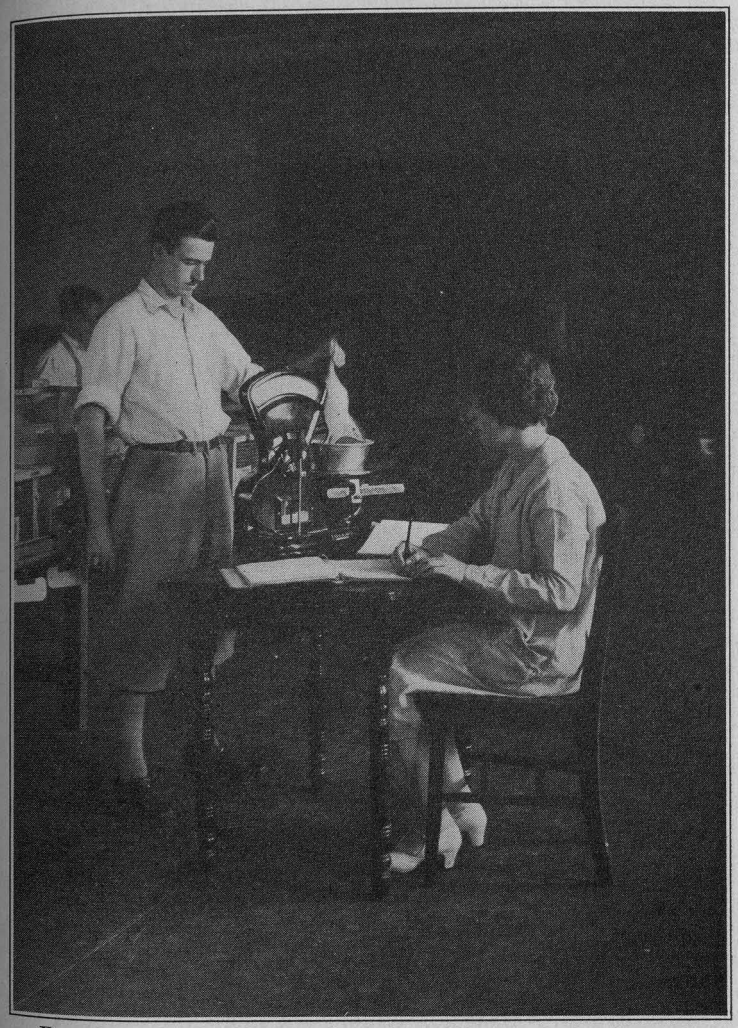

FIGURE 5. Weighing White Rats in the Nutrition Laboratory.

The practicability of this method of control has not yet been demonstrated by this experiment.

Infection of tobacco plants with "white-pickle" mosaic of cucumber produced some leaf mottling, but failed to produce plate

crystals in these mottled leaves and also seemed to disappear in the new growth. Last year somewhat similar results occurred with infection of cucurbits with "white-pickle" that seemed more or less temporary.

Plant Disease Survey. Because of the very wet summer the year has been unusually favorable for the development of plant diseases. As a result we have secured a greater number of diseases new to

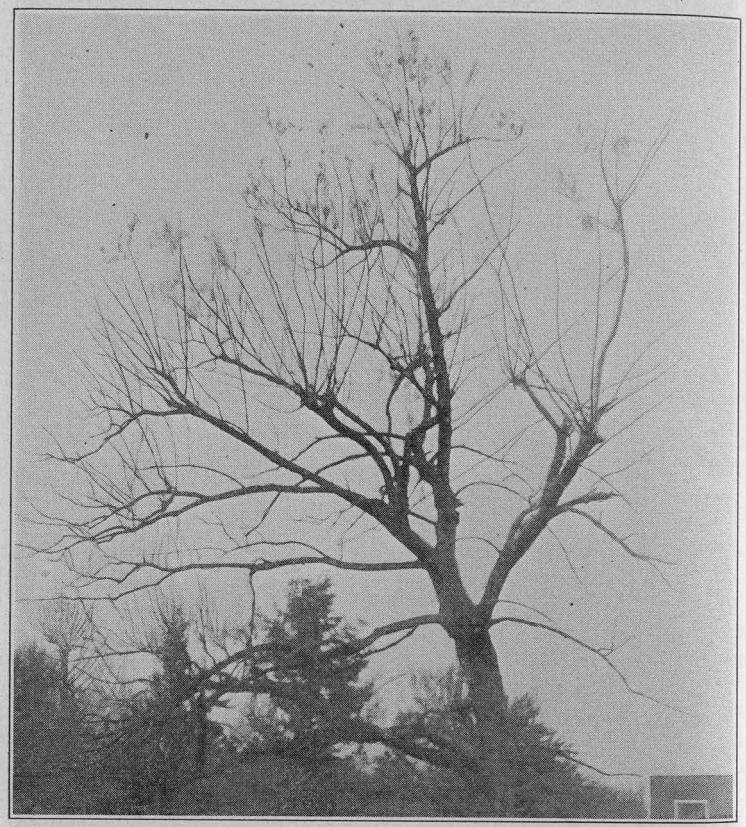

FIGURE 6. A Tree Practically Defoliated by Willow Scab.

the state than for sometime. Among the more important of these are bacterial leaf diseases of corn and horse radish, a Fusicladium disease of poplar similar to the new willow disease of last year, several Helminthosporium diseases of grains and grasses, a fungous leaf-scorch of maple, the Macrosporium blight of carrots, a Phytophthora rot of tomato fruit, and a number of new hosts for the Sclerotium stem-rot of herbaceous perennials. Besides these,

potato blight made its earliest recorded appearance in the state and caused some damage to the vines and rot of the tubers. The Fusicladium scab continued its destruction of willows, being even worse than last year.

Chestnut Blight. Last spring about 1,300 one-year-old chestnut seedlings were planted in two new places, Southport and Redding Ridge. This makes four locations in the State on which over 2,500 seedlings have been set out in recent years to see whether they would survive the blight. So far considerably more than half of the seedlings have died from unfavorable environment but none from blight. It seems to be difficult to carry the seedlings through the first season, especially when set out in the sun. This year's plantings, however, have apparently done better than usual due to the wet summer. A quantity of this year's nuts has been secured from the South for starting more seedlings. Records have also been made of two marked plots of native seedlings and sprouts in the woods to determine the progress of the blight from year to year.

Tree Diseases. The most important and extensive work in this field has been the new willow scab or blightfungus, *Fusicladium saliciperdum*. Considerable time has been spent in determining the distribution of this fungus, especially in this state and Canada, in noting its damage and the species of willows attacked. Cultures of the fungus were obtained and successful inoculations made in producing the disease similar to that in nature. Successful spraying experiments have also been carried on for its control.

ENTOMOLOGY

Asiatic Beetle. The investigations on the life history, habits and methods of control of the Asiatic beetle, *Anomala orientalis*, are completed and the data has been assembled, analyzed and prepared for publication. During 1928 much attention has been given to control by applications of lead arsenate, both mixed with the top layer of soil before seeding, and washed into the turf where re-seeding was unnecessary.

Plum Curculio. The six year study of the control of this insect in Connecticut apple orchards has been completed and the data is now nearly ready for publication. It was found that four applications of lead arsenate, preferably the pink, calyx, 7-day and 2-weeks sprays will give fair control.

Oriental Peach Moth. No satisfactory method of artificial control has yet been discovered. During the year, the ichneumonid parasite *Glypta rufiscutellaris*, was reared for the first time in considerable numbers in Connecticut from the Oriental fruit moth, and it was more abundant than the other ichneumonid parasite, *Macrocentrus ancylivora*, which has heretofore been the principal parasite of the Oriental fruit moth in the state. The egg parasite, *Trichogramma minuta*, was also present in 1928. Nearly 2,500

larvae of the Oriental fruit moth have been collected and reared for the experimental work of 1929. Over 600 of these were obtained from a bushel of quinces grown in Cheshire.

FORESTRY

Treatment to Prolong the Life of Timber. In co-operation with the Tobacco Substation at Windsor, the Forestry Department has undertaken to demonstrate the value of preservative treatment for tobacco shade-tent poles and the relative value of various native woods so treated, compared with chestnut. Posts of all the species common in Connecticut were peeled and seasoned last fall. In the spring they were treated with creosote and set in rows

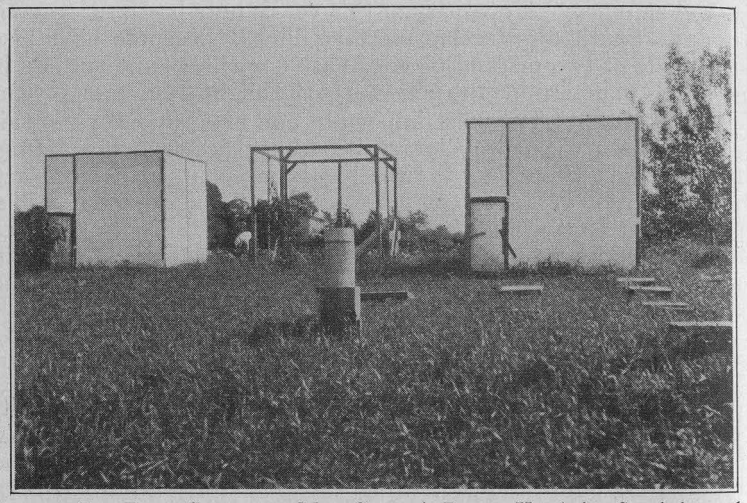

FIGURE 7. Tree Cages at Mt. Carmel Farm Used in Studying the Oriental Peach Moth.

on the Tobacco Station farm. Untreated check posts were included. Naturally no data will be available for some years.

In the meantime there is a demand for information on methods of treating posts. Tobacco Station Bulletin No. 9 was therefore prepared and distributed last fall. It is a short, illustrated paper describing the methods of treatment adapted to farm use and the results that may be expected therefrom.

The Rainbow Plantations. Begun in 1902, these plantings have reached an age where they are yielding much valuable information. In addition to the comparisons between the several species, pruning and thinning experiments are now possible. Also these plots are furnishing an excellent opportunity for studying the effects of pure and mixed stands on the soil conditions which determine rate of growth.

A minor project undertaken during the year in co-operation with the Botany Department, was one to determine the effect of calcium chloride washed from roadways on ornamental Norway spruce trees planted close by. The first results indicate that a solution of more than five percent strength is necessary to seriously damage the trees.

The Relation of Soil Type to Forest Composition and Rate of Growth. The work on this project was continued during the 1928 field season with a study of growth of pine plantations as related to soil type. It was originally planned to carry on the work with both red and white pine, but because of damage done by the weevil to white pine, investigation of this species was temporarily

FIGURE 8. White Pine Plantation after "Cordwood" Thinning.

abandoned and efforts were confined to red pine. Two hundred stations in red pine plantations were established as temporary plots. The data included:

a. The height of ten or more dominant trees.
b. Detailed notes on soil type and other soil factors.

From the tree measurements a "site index curve" for red pine has been prepared and tables derived therefrom. By the use of these tables any plantation or portion thereof may be given an "index number" which denotes the site quality or growing capacity of the land. At an age of fifteen years, the range in height (site index) varied from nine to twenty-two feet. The correlation between soil type and site quality is now being determined.

Using the data taken during the past season it is planned to select some twenty permanent plots where a careful study of soil

conditions will be begun in red pine plantations to ascertain what soil factors are important in determining the growth of this species, and the effect of the forest planting upon the soil.

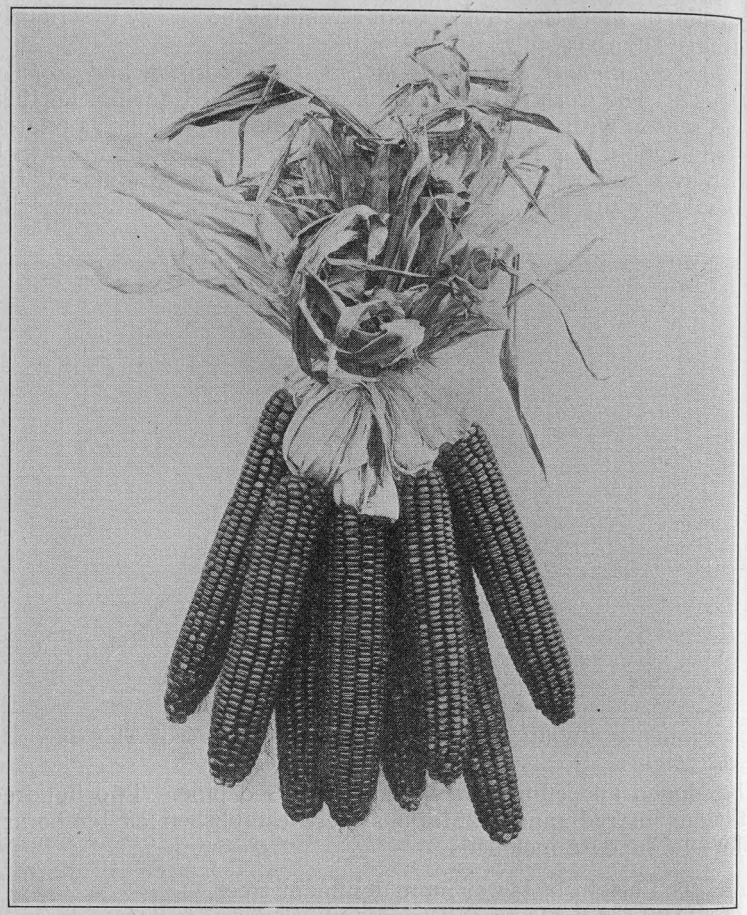

FIGURE 9. Canada Leaming. A new type of Crossed Corn. As early as Canada Flint and as productive as Leaming.

PLANT BREEDING

Corn Breeding. A new type of "crossed" field corn has been distributed for trial. This is a first generation combination of inbred strains of Leaming dent and Canada Yellow Flint and is called Canada Leaming. It unites the high yielding power and stalk growth of the dent type with the early maturity and good grain quality of the flint. This corn is being tested in Southern New England as a husking corn and in Northern New England for silage purposes.

About 150 crosses of inbred strains of Whipples Early Yellow sweet corn have been grown in a preliminary trial and some combinations have shown outstanding productiveness and uniformity in size and shape of ear and in time of ripening and at the same time have been as early or earlier in maturity than the original variety.

A new variety of sweet corn, not a first generation cross, has been produced by combining a number of inbred strains of Golden Bantam and Crosby. This new variety, which reproduces itself each year, is called Golden Crosby and in preliminary tests has met with favor from some of the Connecticut seedsmen who are growing it for canning purposes.

Abnormal segregation of the sugary factor in certain families of corn has given widely deviating ratios, in most cases a large excess of recessive seeds and in other cases a marked deficiency. The ratios show larger variations from normal than have been found previously and indicate a new mode of inheritance that is not clearly understood.

Vegetable Breeding. Crosby Egyptian beets have been completely self-sterile, no seed having been produced from bagged flowers nor from isolated plants. Breeding methods with this plant will necessarily be limited to open pollinated selections and to sib-matings. The effect of environmental conditions on the color of garden beets is being studied also.

Selections have been made in the second generation of a cross between a late and unproductive straightneck type of summer squash with an early crookneck in an attempt to fix an early straightneck type of good quality.

A new variety of spinach is now in the third generation of selection from a cross of Virginia Savoy, Viroflay and King of Denmark. It combines in a large measure size, earliness and long keeping qualities from its parental types.

A large number of selections from the cross of Alacrity and Earliana tomatoes have been grown in the attempt to produce a strain of the Earliana season, but with better shape and quality of fruit. Some of the selections which are now in the third generation are promising.

A remarkably productive and early-ripening pepper has been developed from a cross of Sweet Spanish by Harris Earliest. Several selections are being put through a careful test and will soon be available for preliminary trial by market gardeners.

SOIL INVESTIGATIONS

The Soils of Connecticut. Detailed investigations of the supply and availability of plant nutrients in the important soil types of the State have been continued. During the 1928 season two crops

of tobacco and one crop of oats have been grown in the greenhouse on twenty-four soils. Tobacco has proven to be an ideal crop to reveal differences in the availability of the several plant nutrients contained in the soil. The most striking results may be summarized as follows:

Twenty-two of the twenty-four soils showed marked deficiency of potash and twenty exhibited more or less pronounced lack of available phosphorus. Results of greenhouse tests can be correlated very closely with the rapid method for the determination of

FIGURE 10. A Field Party Studying Connecticut Soils.

available phosphorus now used in the soils laboratory. None of the soils were able to supply sufficient nitrogen for normal growth of tobacco, although some contained as high as 10,000 pounds of total nitrogen per acre.

Tobacco showed abnormal growth on two very acid soils (3.9-4.0 pH). On these particular soils, this reaction was correlated with abnormally high concentrations of soluble manganese and aluminum. All the other soils, even with pH values as low as 4.6, showed little or no response to lime for the tobacco crop.

Forest Soils. A study of the characteristics of various types of soil under forested conditions is in progress, with a view to determining the soil factors which have a definite relation to silvicultural practice in Connecticut. Most forest soils that have never been farmed have been found to be considerably more acid than ordinary agricultural soils. Several extremely acid (as low as 3.2 pH) forest soils have been encountered. This phase of the program will be more actively followed than heretofore.

Co-operation with the Storrs Station. During the summer of 1928 one hundred and twenty-five farms distributed over the eastern highland of the State have been surveyed as to soil type in co-operation with the Agricultural Economics Department of the Storrs Experiment Station, which is studying the "Economic Significance of Soil Type." Soil maps of each farm were prepared, and samples of soil from over a thousand fields were tested for acidity. Soil samples from sixteen of these farms have been collected and are to be studied intensively in the greenhouse and laboratory.

Lawn Management. Lawn fertilization experiments have been conducted for the past three years. For average lawn turf on soils similar to that at the Station, top dressing with a readily available nitrogeneous fertilizer like sulfate of ammonia has proven to be the most important requirement. Moderate applications of phosphoric acid and potash help to keep up the fertility of the soil, but without a fertilizer containing available nitrogen, they are of little or no benefit.

Seeding trials with various lawn grasses, particularly the bent grasses, are being conducted. Stolon plantings of several strains of creeping bent have been successful, but are not proving thoroughly satisfactory to maintain under average lawn conditions. Seedings of several strains of bent grass produced commercially have demonstrated that native grown seed of creeping bent, velvet bent and Rhode Island bent are well adapted to local conditions where excellent drainage is provided. Fully as good turf has been produced by seeding creeping bent as by planting the stolons.

Connecticut River Flood Plain Studies. At the request of the Attorney General's office the Soils Department has undertaken a special study of the soils of the Connecticut River Flood Plain and the effects of periodic flooding on their productivity. A detailed soil and land cover survey has been completed of over 20,000 acres adjacent to the Connecticut River north of Middletown and laboratory and greenhouse studies are being made of the characteristics of these soils and of the sediments deposited upon them by floods.

TOBACCO SUBSTATION

Relation of Fertilizer Ingredients to the Burn of Tobacco. Sulfate of ammonia has seriously lowered the fire holding capacity of the leaf. Dry ground fish in large quantities has had the same effect

but to a less degree. Urea, tankage and nitrate of soda have had no pronounced effect in either direction. Muriate of potash has been extremely injurious to burn. Double sulfate of potash-magnesia slightly reduced the fire holding capacity when compared with sulfate of potash. Both carbonatate and nitrate of potash gave a better burn than sulfate. Lime produced a very white ash but lowered the fire holding capacity.

The Effect of Various Fertilizers on the Chemical Composition of Tobacco. Different carriers of nitrogen have not changed the total amount of nitrogen absorbed by the plant. The lower leaves of the plant have higher percentages of total ash, potassium, calcium, and nitrate nitrogen than the upper leaves.

The upper leaves have higher percentages of phosphorus, ammonia nitrogen, nicotine and chlorine than the lower leaves.

Plants treated with sulfate of ammonia show increased percentages of manganese, sulfur and aluminum.

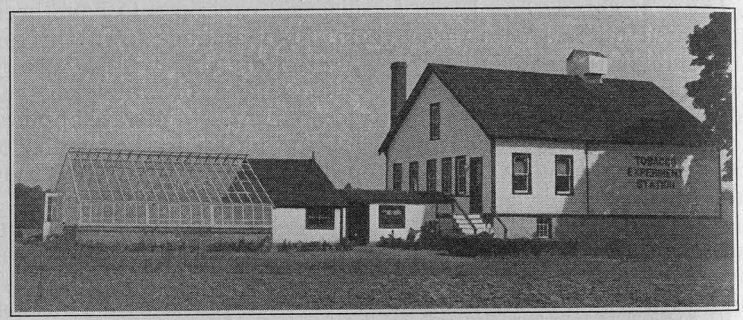

FIGURE 11. Laboratory and Greenhouse at the Tobacco Substation at Windsor.

The potash content of the plant is reduced appreciably by ommitting potash from the fertilizer even though the soil naturally contains a large supply of potash.

Effect of Some Nitrogenous Fertilizers on Soil Reaction. Sulfate of ammonia has had the strongest influence in making soil more acid. Dry ground fish and tankage have had an acidifying tendency but to a less degree. Urea made the soil more acid after the initial alkaline effect had disappeared. Nitrate of soda reduced soil acidity, but nitrate of potash had no pronounced effect.

Urea as a Source of Nitrogen. Results with this fertilizer have been very satisfactory when it was used in moderate amounts. Two other synthetic nitrogen compounds, nitrate of potash and nitrate of lime also have given good results.

Increasing the Organic Matter in the Soil. Manure as a supplement to commercial fertilizer has given somewhat increased yields and better quality on a very sandy soil. A similar effect has been

produced by the use of a commercial "humus" product or by covering the sandy plots with muck soil.

Cover Crops for Tobacco Soils. During wet years on a sandy soil the yield and quality have been increased by the use of certain winter cover crops. Oats, barley and rye have been most effective. Wheat, alfalfa and red top have had a slightly beneficial effect while timothy has been detrimental.

Field Days and Exhibits

The Mt. Carmel Farm Field Day was held on July 18, the New Haven County Farm Bureau joining with the Station in the same

FIGURE 12. Station Exhibit at the State Fair, 1928.

manner as in 1926. The general topic was Plant Pests. Professor W. H. Whetzel of Cornell University and Professor W. C. O'Kane of New Hampshire University were the speakers.

The Field Day at the Tobacco Substation was unique in that some two hundred tobacco farmers from Pennsylvania spent the afternoon inspecting the plots.

A general Station exhibit was made at the State Fair in Hartford and also a special tobacco exhibit.

Library

During the year there were added to the Station Library 900 accessions of permanent value. Journals purchased now number 50, in addition to which some 30 farm papers and journals are received as exchanges. For a few of the old farm papers we have complete files. The total number of bound volumes is now 16,800.

Physical Equipment

Additions to the Station's scientific equipment include a rotary microtome, an apochromatic objective, an electric warming table for slides, a Berkefeld filter, an electric incubator, a steam pressure sterilzer, a moisture equavalent centrifuge, two analytical balances, a wide field binocular microscope, two experimental tobacco curing chambers with temperature and humidity controls and an electirc computing machine.

An addition to the barn at the Mt. Carmel Farm provides much needed space for the Botany and Entomology departments.

Changes in Staff

Appointments;

Herbert A. Lunt, M.S., Research Assistant in Forest Soils, August, 1928.

George W. Pucher, Ph.D., Research Assistant in Biochemistry, September, 1928.

Mrs. Gladys Brooke, B.A., Secretary in Entomology Department, September, 1928.

Harold B. Bender, B.S., Graduate Assistant in Botany, October, 1928.

Resignations;

H. J. Lutz, M. F., Assistant Forester, June, 1928.

George Zundel, Ph.D., Graduate Assistant in Botany, July,1928.

Grace A. Foote, B. A., Secretary in Entomology Department, August, 1928.

ACTIVE PROJECTS.

ANALYTICAL CHEMISTRY.

Dr. E. M. Baily in charge.

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

BIOCHEMISTRY.

Dr. T. B. Osborne, Consulting Biochemist.

Dr. H. B. Vickery, Biochemist in charge.

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

1. Cell Chemistry.
   a. A detailed investigation of the nitrogenous constituents of plant cells including not only the protein components but also the hitherto scantily considered non-protein substances. The methods developed and successfully applied to the green leaf in the case of alfalfa are now being extended to the *tobacco leaf*.
   b. The investigation of the nature of the simpler nitrogenous constituents of yeast.

2. Protein Chemistry.
   a. The methods for the determination of the basic amino acids of proteins are under investigation with the object of effecting improvements.
   b. Methods for the preparation of pure proteins on a large scale with the object of obtaining material for chemical and nutritional study.
3. Nutrition Investigations.
   a. The relation of diet to the rate of growth with especial attention to certain factors which appear to determine rapid growth.
   b. The investigation of the relation of diet to opthalmia.
   c. Experiments on the relation of diet to fertility in cooperation with Dr. Mason of Vanderbilt University.

BOTANY.

Dr. G. P. Clinton in charge.

2. The Nature and Cause of Mosaic Disease of Plants.
3. The Ustilaginales of North America.
4. The Rusts of Connecticut.
5. Plant Disease Survey of Connecticut.
6. Thielavia basicola; a Study of the Perfect Stage.
7. A Study of Pythiums.
8. Spraying and Dusting Experiments on Apples and Peaches. (With Entomology.)
12. Seed Testing.
13. Peach "Yellows."
15. Chestnut Blight—virulence studies.
18. Tobacco Diseases—especially Black and Brown Root Rot. (Experiments at Tobacco Substation.)
20. Tree Diseases.
23. Rogueing as a Control for Raspberry Mosaic. (With U. S. D. A.)

ENTOMOLOGY.

Dr. W. E. Britton in charge.

3. Spraying and Dusting Experiments on Apples and Peaches. (With Botany.)
6. Control of Foul Brood of Bees.
7. A Study of the Asiatic Beetle, *Anomala orientalis*.
9. Insect Survey of Connecticut.
16. Experiments with the Cabbage Maggot.
17. Life History and Methods of Controlling the Oriental Peach Moth, *Laspeyresia molesta*.
18. Life History of Imported Currant Worm.
20. Life History, Habits and Control of the Imported Birch Leaf-Miner, *Fenusa pumila*.
21. Life History and Control of the Spinach Leaf-Miner.
26. Experiments on the Control of Squash Vine Borer.

Control Projects.

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

FORESTRY.

Mr. W. O. Filley in charge.

1. Experimental Plantations on a Sandy Tract at Rainbow.
   a. Comparison of a wide variety of conifers and 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 Quassipaug Lake).
5. Distribution of Forest Planting Stock. (Under Clark-McNary Act.)
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. An Investigation of the Distribution and Growth of Forest Trees as Influenced by Soil Conditions and Other Site 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. (With U. S. D. A.)

GENETICS (PLANT BREEDING)

Dr. D. F. Jones in charge.

1. A Genetic Study of Hereditary Characters in Corn Involving Their Linkage Relations and Variability, with particular attention to characters directly influencing yield.
2. The Effect 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 field corn for grain and ensilage, alfalfa, and to some of the more important Vegetable Crops such as sweet corn for market gardening and canning, beets, cabbage, carrots, cucumbers, melons, onions, radish, rutabagas, squash and some Fruits such as bush fruits and strawberries.
4. Methods for the Improvement of Naturally Self-Fertilized Plants, with particular attention to Tobacco and Vegetable Crops such as lettuce, lima beans and tomatoes.

SOILS

Mr. M. F. Morgan in charge.

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

TOBACCO SUB-STATION AT WINDSOR

Dr. P. J. Anderson in charge.

1. Fertilizer Experiments:
   Various Sources and Rates of Nitrogen, Phosphoric Acid and Potash.
2. Experiments with Farm Manure.
3. Experiments with Manure Substitutes.
4. Tobacco Nutrition Studies: the Rôle of Nitrogen, Sulfur, Chlorine, Potassium, Calcium, Manganese, Boron, Magnesium.
5. Improvement of Havana Seed Tobacco.
6. Improvement of Broadleaf Tobacco.
7. Improvement of Cuban Shade Tobacco.
8. The Effect of Various Winter Cover Crops used on Tobacco Land.
9. Brown Root Rot of Tobacco (with U. S. D. A.).
10. Studies on Black Root Rot of Tobacco.
11. Soil Reaction in Relation to Tobacco.
13. Preservative Treatment of Shade Tent Poles.
14. Tests of Wires for Shade Tents.
15. The Effects of Topping and Suckering at Different Heights and Dates.
16. The Effect of Stage of Picking Shade Tobacco.
17. The Rôle of Humidity and Temperature in Curing Tobacco.
19. Tobacco Diseases—Miscellaneous.
20. Tobacco Insects—Miscellaneous.
21. A Study of the Root Development of the Tobacco Plant.

PUBLICATIONS

BULLETINS

No. 290. Fertilizer Report for 1927.
No. 291. Report of the Director for 1927.
No. 292. Some Insect Pests of Nursery Stock in Connecticut.
No. 293. The Quality of Vegetable Seed bought by Market Gardeners in Connecticut in 1927.
No. 294. Report of the State Entomologist for 1927.
No. 295. Report on Foods and Drugs for 1927.

TOBACCO SERIES

No. 9. Prolonging the Life of Tobacco Shade Tent Poles.
No. 10. Report of Tobacco Station at Windsor for 1927.

CIRCULARS OF IMMEDIATE INFORMATION.

No. 61. Regulations Concerning the Transportation of Nursery Stock in the United States and Canada.

JOURNAL PAPERS.

Mendel, Lafayette B. and Cannon, Helen C. The relation of the rate of growth to diet. II. Jour. Biol. Chemistry, v. 75, (1927), No. 3, p. 779.

Vickery, Hubert Bradford and Leavenworth, Charles S. On the separation of Histidine and Arginine III. The preparation of Arginine. Jour. Biol. Chem., v. 75, (1927), p. 115-122. October, 1927.

Vickery, Hubert Bradford and Leavenworth, Charles S. A note on the crystallization of free Lysine. Jour. of Biol. Chemistry, v. 76, (1928), No. 3, p. 437.

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Vickery, Hubert Bradford and Leavenworth, Charles S. Modifications of the method for the determination of the Basic Amino Acids of Proteins. The bases of Edestin. Jour. Biol. Chemistry, v. 76, (1928), No. 3, p. 707.
Vickery, Hubert Bradford and Leavenworth, Charles S. On the separation of Histidine and Arginine IV. The preparation of Histidine. Jour. Biol. Chemistry, v. 76, (1928), No. 3, p. 627.
Britton, W. E. Insects attacking vegetable crops in 1927. Report Conn. Vegetable Growers' Assoc. 1927. (1928), p. 66-70.
Britton, W. E. Report of Committee on Injurious Insects. Conn. Pomol. Soc. Proc., v. 37, (1927), p. 16-19.
Britton, W. E. Oil sprays and oil injury. Jour. Economic Entomology, v. 21, p. 418-421. April, 1928.
Britton, W. E. The Elm Leaf Beetle. Tree Talk, v. 8, No. 4, p. 32. March, 1928.
Britton, W. E. Some Insect Pests of Cultivated Plants. Garden Guide (Revision A. T. de La Mare Co.), (1928), p. 293-308.
Britton, W. E. and Botsford, R. C. Anti-mosquito activities in Connecticut in 1927. Proceedings, Fifteenth Annual Meeting New Jersey Mosquito Extermination Assoc. (In press).
Garman, Philip. The European red mite, peach moth and plum curculio. Conn. Pomol. Soc. Proc., v. 37, (1927), p. 28-34.
Garman, Philip. Dusting menaces fruit growers. Gleanings in Bee Culture, v. 61, p. 293-329. May, 1928.
Zappe, M. P. Fighting the apple maggot and the control of aphids. Connecticut Pomol. Soc. Proc., v. 37, (1927), p. 24-27.
Jones, D. F. Like father like son-in-law. Scientific Monthly, v. 26, (1928), p. 557-560.

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 corn, sweet corn, fruits and vegetables.
Lawns, establishment and care.
Bees.
Mosquito Elimination.
Tobacco culture.

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

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

The Station cannot furnish information on:

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

REQUESTS FOR INFORMATION ON THESE SUBJECTS SHOULD BE SENT TO THE CONNECTICUT AGRICULTURAL COLLEGE AT STORRS.

The Station cannot make analyses and examinations of:

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

All of which is respectfully submitted,

WILLIAM L. SLATE,

Director.

BULLETIN 299 JANUARY, 1929

Connecticut Agricultural Experiment Station
New Haven, Connecticut

REPORT OF

THE TOBACCO SUBSTATION

AT WINDSOR

FOR

1928

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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Paul J. Anderson, Ph.D., *Pathologist in Charge.*
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Miss Dorothy Lenard, *Secretary.*

Press of The Wilson H. Lee Co., New Haven, Conn.

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Report of the Tobacco Substation

1928

P. J. Anderson and T. R. Swanback.

This, the seventh annual report of the Tobacco Substation is presented to the growers of Connecticut to inform them of the progress of experiments which are being conducted at this station.

On account of excessive rains, the season has not been a favorable one for the grower but in our experiments, definite progress has been registered in several of the lines of investigation and we feel that it has been a successful year from that standpoint.

The year has again been marked by increased requests from the growers for service in visiting farms, plantations and warehouses, soil testing, seed testing, personal conferences and public talks, correspondence and preparation of articles for the press. This service and contact work is extremely important, is welcomed and will be continued to the limit of our ability but the inroads which it is making on time of the station staff which can be devoted to more fundamental research emphasizes the early necessity of increasing the research staff. Mr. J. S. Owens, Extension Crop Specialist from the Agricultural College at Storrs gave a part of his time to this work and rendered valuable assistance, especially during the curing season, but the limited time which he is able to give falls far short of meeting the needs of the situation. Valuable work along this line is also being conducted by the Hartford County Farm Bureau through the efforts of the county agent, Mr. C. D. Lewis.

Especially significant has been the establishment of the tobacco advisory committee of twelve growers representing the three types of tobacco grown in the state. This committee functions both for the station and for the farm bureau and their advice and suggestions have been helpful in guiding the work of the station and in keeping it in constant touch with the growers. The members of this committee are:

Mr. Ralph G. Tryon, Glastonbury Chairman	Mr. Louis L. Grant, Manchester
	Mr. T. F. Holcomb, West Granby
Mr. S. R. Spencer, Suffield	Mr. J. E. Phelps, Suffield
Mr. A. T. Pattison, Simsbury	Mr. R. D. Steane, Hartford
Mr. W. H. Gowdy, Hazardville	Mr. J. B. Stewart, Windsor
Mr. J. E. Shepard, South Windsor	Mr. S. F. Brown, Windsor
Mr. R. E. Case, Granby	

The annual field day was held at the station on July 30 in co-operation with the New England Tobacco Growers Association.

It was not only largely attended by our own growers but also by ninety growers from Pennsylvania who contributed much to the success of the meeting.

In co-operation with the Connecticut Leaf Dealers Association we also prepared an exhibit for the Connecticut State Fair during the first week of September.

For some of our lines of investigation this report presents a complete discussion with all pertinent data tabulated. However, the report would be too lengthy if all projects were presented in such detail and it has seemed advisable to merely summarize the points of progress on the others and reserve for future bulletins the more complete presentation.

Potash Fertilizer Experiments

The potash requirement of the tobacco crop is very high when compared with other agricultural plants. A good potash supply is not only essential to the growth of the tobacco plant but also the presence of an abundance of potash in the proper combination in the leaf is the most important factor in producing good combustion.

Potash has at least three functions in the tobacco. 1. It acts as a catalizer or condensing agent in the formation of carbohydrates and proteins; hence the plant would cease to grow if potash were not supplied. 2. It neutralizes acids which develop during the normal metabolism of the cell and removes them to older parts of the plant where they are precipitated and rendered harmless. Otherwise these acids would accumulate in the cells to such an extent as to poison them. The spots which appear on leaves starved for potash may be due to the accumulation of these acids. This may also account for the belief by some that potash makes leaves more resistant to disease. 3. Potash acts as a catalytic agent in combustion. In this role it is absolutely necessary for the type of slow combustion which we wish in tobacco. If it is absent, the leaf burns up like paper. In these important roles potassium does not function properly when combined with the mineral radicals such as chloride or sulfate, but must be present in an organic salt like malate, tartrate or citrate. From the results of several investigations it is now generally agreed that the fire holding capacity is governed largely by the abundance of organic salts of potash which are in the leaves. The potash problem then may be summed up in one question: How can we put into the plant the maximum amount of potash in these desirable organic combinations? Obviously its supply must come from the soil through the roots since there is no other way that the plant can obtain potash. There are two possible sources of potash for the roots, (1) the native potash which is normally in the soil and, (2) fertilizer potash which the grower adds to the soil. With

respect to the first source we should inquire how much is present in our tobacco soils? In what combinations? How available to tobacco plant? How fast does it become available? Are there methods of making it more available? What is the effect of various cultural practices on its availability? With respect to the second source there arise the questions: To what extent can we

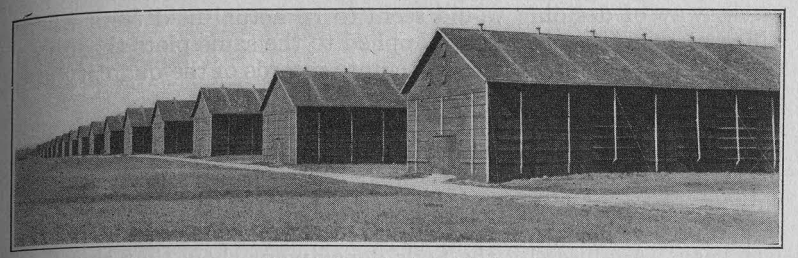

Fig. 13. Curing Sheds.

increase the potash content of the plant by increasing the soil supply? What is the optimum quantity of potash to add in fertilizers? In what carriers or combinations of carriers is it supplied to the greatest advantage? Will the plant absorb more potash from one carrier than from another? To what extent are the acid radicals with which potash is combined also absorbed and what is their effect on the tobacco? What are the effects of various potash compounds on the soil and are these effects beneficial or harmful to the crop? To what extent is potash leached? Does unused potash accumulate in the soil?

Some of these questions have been answered by the experiments of the last few years, some have been partially answered. We hope to answer others before the series of experiments is closed. The present report brings together the data which have been obtained to date and shows how far we have progressed toward answering the questions.

How much fertilizer potash should be applied?

It is a common practice in Connecticut to apply about 200 pounds of potash (K_2O) to an acre of tobacco although some have applied much more while others have grown good tobacco on less. There are no recorded local experiments on which to base a decision as to whether as good a crop may be produced by a smaller quantity or whether better quality would be produced by a still larger quantity. According to analyses which were made in Connecticut by Jenkins (Conn. Bul. 180:7. 1914) an 1,800 pound crop of tobacco removes from the soil about 133 pounds of potash in

leaves and stalks. If the stalks are returned, the amount removed is only 85 pounds. These figures, however, give us little basis for deciding on the amount which is most advantageous since we know on the one hand that plants may take up quantities of elements which are in excess of their requirements and on the other hand that they may not be able to obtain as large a quantity as they need at a certain period even though that quantity has actually been applied to the soil and is there at the time. The safest way of deciding would seem to be actual field tests where different quantities have been applied to the same plots through a series of years and by making accurate records of the quantity and quality of the tobacco produced.

Such an experiment was begun in 1926 with six one-fortieth acre plots on Field V of the station farm. The soil here is coarse sandy loam of the Merrimac series with coarse sandy, open subsoil, subject to rapid leaching. The crop suffers here from lack of moisture during a dry year and from leaching of nitrogen in a wet year. Analyses by the Soils department show that this field contains about 35,000 lbs. of total potash per acre in the upper 8 inches of soil.

Two of the plots (K11, K11-1) received no potash in the fertilizer (except for the small quantity in the cottonseed meal and castor pomace of the formula). Two others (K12, K12-1) received 100

Composition of the three formulas was as follows:

PLOT K11. NO MINERAL POTASH

Carriers		Lbs. plant nutrient per acre		
Name	Lbs. per acre	NH_3	P_2O_5	K_2O
Cottonseed meal	1463.4	120	42.4	21.9
Castor pomace	588.2	40	10.6	5.9
Nitrate of soda	212.7	40		
Precipitated bone	277.9		107.0	
Total	2542.2	200	160.0	27.8

PLOT K12. ONE HUNDRED POUNDS POTASH

Carriers		Lbs. plant nutrient per acre		
Name	Lbs. per acre	NH_3	P_2O_5	K_2O
Cottonseed meal	1463.4	120	42.4	21.9
Castor pomace	588.2	40	10.6	5.9
Nitrate of soda	170.2	32		
Precipitated bone	277.9		107.0	
Sulfate of potash	48.0			24.0
Carbonate of potash	37.1			24.1
Nitrate of potash	53.5	8		24.1
Total	2638.3	200	160.0	100.0

PLOT K9. TWO HUNDRED POUNDS POTASH

Carriers		Lbs. plant nutrient per acre		
Name	Lbs. per acre	NH_3	P_2O_5	K_2O
Cottonseed meal	1463.4	120.0	42.4	21.9
Castor pomace	588.2	40.0	10.6	5.9
Nitrate of soda	107.4	20.2		
Precipitated bone	277.9		107.0	
Sulfate of potash	114.8			57.4
Carbonate of potash	88.3			57.4
Nitrate of potash	132.3	19.8		57.4
Total	2772.3	200.0	160.0	200.0

lbs. of potash per acre. The other two (K9, K9-1) received the standard quantity, 200 lbs. per acre. Potash was supplied in equal amounts from sulfate, nitrate and carbonate because previous experiments had shown most favorable results from this triple combination of potash salts, and also in order to minimize the effect of possible accumulation of any one acid radical.

During the first year of the experiment no differences in growth were observed. The growth on all of these plots, however, was unsatisfactory on account of the dry weather and no conclusion was drawn from the records.

However, when the same plots were treated in the same way the second year (1927), the growth throughout the season appeared smaller on the no-potash plots but no differences between the others were apparent.

When sorted, the tobacco from the no-potash plots, was found to be short, yellow and of poor quality but as between the others the differences were not large. The sorting records are presented in Table 1.

TABLE I. QUANTITY OF POTASH SERIES. CROP OF 1927 ON FIELD V

Potash lbs. per A.	Plot No.	Acre Yield		Percentage of grades								Grade index*	
		Plot	Ave.	L	M	LS	SS	LD	DS	F	B	Plot	Ave.
0	K11	1150	1144	..	..	18	6	36	7	20	13	.281	.290
	K11-1	1137		..	..	18	11	41	4	16	10	.298	
100	K12	1247	1194	6	7	15	9	42	2	16	3	.368	.366
	K12-1	1141		6	5	14	8	42	5	16	4	.364	
200	K9	1152	1152	10	10	15	8	38	4	10	6	.411	.411

* *The Grade Index.* In comparing the quality of tobacco grown on different plots it is very difficult to keep in mind the percentage of six to eight commercial grades of tobacco from one plot and compare with a like number from another. To simplify these comparisons a grade index was devised. The grade index is a single number expressing the quality of *all*

These data show that there was a slight reduction in yield but a very decided reduction in grading during the second year where no potash was added.

The same treatment was repeated on the same plots in 1928 (3d year). During the summer it was quite apparent that the plots which received no potash were not making as good growth as the others. Distinct symptoms of acute potash hunger, however, were not seen.

In taking down the tobacco from the shed it was found that tobacco from the no-potash plots did not come "into case", i. e., become soft and pliable, during the "damps". Adjacent plots were in excellent condition for handling while this tobacco was hard and dry and never became really ready to take down. The same was true, but to a smaller degree, with tobacco from the plots where only 100 lbs. per acre of potash had been applied.

FIG. 14. Feeding the crop. Shade growers use two tons of fertilizer to the acre.

On the sorting bench, the tobacco from the no-potash plots was found to be yellow, short, thick, "boardy", entirely lacking in elasticity and of such inferior quality generally that it was not fit to sort. Tobacco from the 100 lbs.-potash plots was somewhat

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the tobacco grown on a particular plot. It is based on the percentage of carefully assorted commercial grades and the relative price value of the different grades. Although market prices vary from year to year, it was found, after consultation with experienced dealers, that the ratios of prices between the different grades are fairly constant. These adopted price relationships for the different grades are as follows:

(L)	Light wrappers.....	1.00	(LD)	Long darks (19″ up).	.30
(M)	Medium wrappers...	.60	(DS)	Dark stemming (17″)	.20
(LS)	Long sec. (19″ up)...	.60	(F)	Fillers.....	.10
(SS)	Short seconds (15″ and 17″).....	.30	(Br)	Brokes.....	.10

The grade index of any plot is obtained by multiplying the percentage of each grade by the price in the above schedule and adding the products.

longer but showed much of the same characters as above but to a less degree. Tobacco from the "200 lbs.-potash" plots was rated as satisfactory.

The sorting records for the 1928 crop are presented in Table 2.

TABLE 2. QUANTITY OF POTASH. SERIES OF 1926. ACRE YIELD AND GRADING OF CROP OF 1928

Quantity of potash	Plot No.	Acre Yield		Percentage of grades								Grade Index	
		Plot	Ave.	L	M	LS	SS	LD	DS	F	B	Plot	Ave.
0	K11	1107	1135	..	..	..	21	..	67	27	..	.194	.214
	K11-1	1163		..	..	..	21	38	15	21	5	.233	
100	K12	1107	1092	3	7	9	25	24	16	16	..	.321	.322
	K12-1	1076		3	5	13	15	31	15	18	..	.324	
200	K9	1178	1199	13	9	12	18	31	8	9	..	.428	.463
	K9-1	1221		22	16	5	17	30	1	9	..	.498	

It appears from these data that the reduction in quality is much more serious than the decrease in yield when potash is omitted from the fertilizer. When 100 lbs. of potash was supplied the quality was somewhat improved but was still much inferior to the tobacco receiving the regular ration. Tobacco from the 200 lbs.-plots was of good quality exhibiting none of the dry, thick, non-elastic, yellow characters of the other plots.

In the Field V experiments just described all treatments were in duplicate. After the first year it was decided to increase the number of replications and enlarge the experiment also by adding 300 lbs.-potash plots. These additional plots were on Field I, a soil of a somewhat different type, being a fine sandy Merrimac loam with a more compact subsoil and less subject to leaching. This field usually grows better tobacco than Field V. The complete lay-out of plots was now as follows:

K11	No potash	6 plots
K12	100 lbs. potash	5 "
K9	200 " "	6 "
K13	300 " "	5 "

During the first year of the new series no differences in growth were observable in the field but the sorting records as presented in Table 3 show that there was a slight reduction both in yield and grading when potash was omitted from the fertilizer.

During the second season (1928) when all treatments were repeated on the same plots on Field I, the effect of the entire omission of potash was apparent in the field. The plants appeared smaller and less "leafy", i. e., they did not seem to fill out the rows as well. The sorting records for this crop, however, do not indicate a reduction in yield. Probably the thickness of the leaves com-

FIG. 15. Transplanter at work under the tent.

TABLE 3. QUANTITY OF POTASH. FIELD I SERIES. SORTING RECORDS ON CROP OF 1927

Potash lbs. per A	Plot No.	Acre Yield		Percentage of grades								Grade index	
		Plot	Ave.	L	M	LS	SS	LD	DS	F	B	Plot	Ave.
0	K11-2	1230	1184	8	9	17	6	40	3	11	6	.397	.369
	K11-3	1213		7	5	25	6	36	4	11	6	.401	
	K11-4	1160		2	4	14	6	39	6	16	13	.304	
	K11-5	1152		3	5	19	6	42	2	13	10	.345	
	K11-6	1163		8	7	20	7	38	2	13	5	.399	
100	K12-2	1287	1274	7	8	18	4	38	4	13	8	.381	.386
	K12-3	1384		9	11	18	9	35	4	10	4	.418	
	K12-4	1152		4	7	19	7	38	2	14	9	.358	
200	K9-5	1321	1286	4	8	22	4	40	3	14	5	.377	.374
	K9-6	1312		6	6	21	5	37	3	13	9	.364	
	K9-7	1258		6	4	18	7	37	6	14	8	.358	
	K9-8	1254		8	6	19	6	43	2	11	5	.397	
300	K13	1230	1264	7	4	24	7	36	2	10	10	.391	.397
	K13-2	1316		9	10	19	5	36	4	12	5	.412	
	K13-3	1325		11	8	19	7	36	3	13	3	.423	
	K13-4	1205		8	7	23	6	34	3	12	7	.405	
	K13-5	1246		2	4	25	10	33	5	12	9	.354	

TABLE 4. QUANTITY OF POTASH. FIELD I SERIES. ACRE YIELD AND GRADING OF CROP OF 1928

Quantity of potash	Plot No.	Acre Yield		Percentage of Grades							Grade index	
		Plot	Ave.	L	M	LS	SS	LD	DS	F	Plot	Ave.
0	K11-2	1259	1206	4	4	22	12	32	11	15	.365	.357
	K11-3	1114		2	8	29	10	33	6	12	.395	
	K11-4	1152		7	3	11	24	29	12	14	.351	
	K11-5	1185		4	7	9	25	32	7	16	.337	
	K11-6	1312		5	5	19	16	32	7	16	.368	
	K11-7	1216		1	3	17	22	32	11	14	.328	
100	K12-2	1202	1197	7	6	30	11	34	2	10	.435	.419
	K12-3	1306		18	8	17	11	33	3	10	.478	
	K12-4	1083		7	7	7	28	20	17	14	.346	
200	K9-5	1403	1238	15	13	17	11	31	3	10	.472	.458
	K9-6	1229		8	9	29	9	32	5	8	.449	
	K9-7	1063		9	6	17	14	21	18	15	.394	
	K9-8	1257		25	10	13	11	26	4	11	.518	
300	K13	1106	1207	13	10	22	11	26	7	11	.464	.446
	K13-1	1200		24	12	9	12	22	9	12	.498	
	K13-2	1355		5	5	27	15	36	2	10	.409	
	K13-3	1234		12	10	19	13	34	2	10	.449	
	K13-4	1138		11	6	19	16	19	18	11	.412	

pensated for their smaller size. There was, however, a decided reduction in quality when no potash was applied, the cured leaves being short, yellow, heavy and non-elastic. This is reflected in the lower grade index (Table 4). Tobacco from the 100 lbs.-potash plots was not quite as good as that from the 200 lbs.-plots. There were no significant differences between the 200 lbs. and the 300 lbs.-plots.

In general, the results from the Field I series confirm those from Field V series.

Wilting due to lack of potash. During hot days, tobacco leaves wilt and flag. During the summer of 1928 it was commonly observed on the above experiments and also in other tests on shade tobacco that the no-potash plots wilt first, and at all times the wilting is more pronounced on these plots.

Effect of quantity of fertilizer potash on burn. Strip burn tests were made on the crops of 1926 and 1927 as recorded on p. 171 These showed only a slight reduction in fire holding capacity the first year after potash is omitted, but serious reduction during the second year. One hundred pounds of potash per acre seems to have been enough to keep up the fire holding capacity, during two years.

Effect on the chemical composition of the leaves. Samples from the crop of 1926 (first year of test) were analyzed by Dr. E. M. Bailey of the chemistry department to see what effect the omission or reduction of fertilizer potash would have on the quantity of potash absorbed. The results presented in Table 5 show a consistent reduction in potash even for the first year and furnish reason to believe that the potash content of the leaves may be very materially affected by the quantity applied to the soil.

TABLE 5. QUANTITY OF POTASH IN LEAVES FROM PLOTS WITH REDUCED FERTILIZER POTASH. CROP OF 1926

Grades	Percent of potash in leaves when each acre received		
	No. Fert. potash	100 lbs. Fert. potash	200 lbs. Fert. potash
Darks	6.96	7.20	7.97
Seconds	7.03	7.33	8.32
Both	**7.00**	**7.27**	**8.15**

Conclusions. Despite the fact that this soil contains naturally very large quantities of potash it is obvious from these experiments that the availability of the native supply is so low that regular yearly applications in the fertilizer are necessary. When all potash is omitted from the fertilizer, the quality is slightly reduced the first year, seriously reduced the second year and the product is so inferior the third year that it is not worth sorting. The reduction in weight has not been so serious as in quality. One hundred pounds of potash per acre is not enough to keep up the quality for more than one year. As between 200 and 300 pounds, no differences have appeared in two years. Until further data are at hand it would seem best to use 200 pounds per acre although the possibility is not precluded that the minimum application may be somewhat lower or higher.

WHAT CARRIERS OF POTASH ARE BEST?

There are a number of forms (carriers) in which potash may be added to the fertilizer mixture. Although the element, potassium, is the same from all sources, nevertheless it is a mistake to believe that equal results can be secured irrespective of the form in which it is supplied. New England tobacco growers learned, for instance, many years ago that potash could not be supplied in the form of muriate because it ruined the burn. Such differences and resultant preferences are due to the acid radicals and other undesirable companions of potassium which may either affect the soil adversely or produce unfavorable effects when they enter the plant and change the composition of the leaves. Thus sulfate of potash and double sulfate of potash-magnesia are objectionable because too much sulfur in the plant reduces the fire holding capacity. Carbonate may cut down the yield. Nitrate may introduce too much nitrogen in the nitrate form. Cottonhull and wood ashes may have an unfavorable effect on soil because of caustic lime, etc. When one tries to make selection among them by theorizing on their possible effects he is confronted with so many conflicting possibilities that he is forced to the final conclusion that the only way of coming to a decision is through actual field tests. It is for this reason that a large number of the experimental plots on the station farm are now devoted to a comparison of different forms of potash. These experiments are being conducted under the most carefully controlled conditions we are able to maintain and every record possible is being made on them. Such experiments must ultimately answer the question proposed, at least as far as this type of soil is concerned.

In Table 6 all the sources of potash which have been used commonly in this section are listed with their essential analyses. Most of these are now included in the tests at the station or elsewhere.

TABLE 6. AVERAGE ANALYSES OF POTASH CARRIERS WHICH MAY BE USED FOR TOBACCO

Name of Carrier	Percentage of plant food						
	Potash (K_2O)	Nitrogen (N)	Phos. Acid (P_2O_5)	Lime (CaO)	Magnesia (MgO)	Sulf. Acid (SO_3)	Chlorine (Cl)
Sulfate of Potash	50	....	....	0.2	1.3	43.6	1.6
Nitrate of Potash[1]	44	12.5	....	....	....	....	0.6
Nitrate of Potash-Soda	12.0	14.5	....	....	....	....	0.7
Carbonate of Potash	64	....	....	....	....	....	0.5
Sulf. Potash-Magnesia	28	....	....	....	11.3	46.7	2.0
Wood Ashes[2]	6.6	....	2.1	36.6	5.7	1.2	0.5
Cottonhull ashes[2]	25	....	9.8	5.2	11.2	2.4	0.2
Tobacco Stems[2]	6.4	2.1	0.6	3.8	0.5	0.5	0.5
Cow manure[3]	0.5	0.4	0.3	0.2	0.1	0.1	0.1
Horse manure[3]	0.6	0.4	0.7	0.5	0.2	0.1	0.1

Since the purpose and progress of these experiments have been discussed in previous reports, they will not be repeated here but the present discussion will be confined to results of the last year or two and comparisons with those of the preceding years.

[1] German synthetic or Calcutta.
[2] Composition variable.
[3] Containing 60-70% water.

COMPARISON OF HIGH GRADE SULFATE WITH SULFATE OF POTASH-MAGNESIA

The possible benefit to be derived from the substitution of sulfate of potash-magnesia (double manure salts) for the more common sulfate of potash, lies in its content of magnesia which is essential for the growth of tobacco and without which the plant suffers from the malnutrition trouble commonly called sand-drown.

TABLE 7. COMPARISON OF HIGH GRADE SULFATE OF POTASH WITH DOUBLE MANURE SALTS. YIELD AND GRADES FOR CROP OF 1928

Source of potash	Plot No.	Acre Yield		Percentage of Grades							Grade index	
		Plot	Ave.	L	M	LS	SS	LD	DS	F	Plot	Ave.
High Grade Sulphate	K1	1309	1295	24	14	13	13	24	4	8	.529	.522
	K1-1	1280		24	10	14	12	27	2	11	.516	
Double Man. Salts	K2	1313	1315	22	13	14	13	28	2	8	.517	.499
	K2-1	1318		16	9	21	13	29	3	9	.481	
Half from Each	K3	1341	1354	19	8	19	11	28	4	01	.488	.480
	K3-1	1378		17	10	17	13	27	4	12	.472	

Just as in the preceding five years (See Tob. Sta. Buls. 5, p. 24; 6, p. 22; 8, p. 36), two of the plots (K1, K1-1) had all of their potash in the form of high grade sulfate, two more (K2, K2-1) all from double manure salts, and the other two (K3, K3-1) had the potash derived equally from the two sources. The growth in 1928 was uniform but light on account of the heavy rains during the growing season. No differences were observed during the summer between the various plots except for a trace of sand-drown on the K1 plots just before harvest but this never became of any importance. It was not observed at any time during the preceding five years. When the tobacco from these six plots was sorted, no signs of magnesia hunger were observed, all the tobacco being rated as satisfactory and of good quality.

Table 7, showing sorting results of the season of 1928, indicates a somewhat higher yield from the use of the two potash carriers in combination but a somewhat higher grade index from the use of high grade sulfate alone. Table 8, showing yields during six years of this experiment, indicates only a very slight difference (about 1%) in favor of the combination. Table 9, showing the grade index for 5 years, shows a very slight higher average for the high grade sulfate.

Differences in chemical composition. In order to see whether any chemical changes in the composition of the leaf had been caused by the substitution of double manure salts for high grade

TABLE 8. COMPARISON OF HIGH GRADE SULFATE WITH DOUBLE MANURE SALTS. ACRE YIELDS FOR SIX YEARS

Source of potash	Plot No.	Grade index by years						Plot Ave.	Average 12 replications
		1923	1924	1925	1926	1927	1928		
High Grade Sulfate	K1	2056	1333	2054	1739	1223	1309	1619	1630
	K1-1	2056	1387	2061	1832	1223	1280	1640	
Double Man. Salts	K2	1966	1413	1932	1831	1355	1313	1635	1622
	K2-1	1966	1413	1892	1833	1234	1318	1609	
Half from each	K3	2039	1467	2029	1712	1364	1341	1669	1638
	K3-1	2039	1333	1929	1648	1382	1378	1618	

sulfate, samples of seconds and darks for all plots were analyzed by the Station Chemistry Department. Since in double manure salts, considerably more magnesia and sulfur are added to the soil it was anticipated that a larger percentage of these elements would be found in the leaf. In view of the importance of potash in the burn, it also seemed desirable to learn whether the amount of

TABLE 9. COMPARISON OF HIGH GRADE SULFATE WITH DOUBLE MANURE SALTS. GRADE INDICES FOR 5 YEARS

Source of potash	Plot No.	Grade index by years					Plot Ave.	Average 12 replications
		1924	1925	1926	1927	1928		
H. G. Sulfate	K1	.281	.475	.471	.356	.529	.422	.436
	K1-1	.291	.475	.505	.457	.516	.449	
Double Manure Salts	K2	.281	.476	.479	.468	.517	.444	.433
	K2-1	.273	.471	.500	.383	.481	.422	
Half from each	K3	.316	.461	.475	.466	.488	.441	.425
	K3-1	.270	.483	.461	.357	.472	.409	

potash absorbed had been affected. Since calcium and magnesium have a somewhat complementary relation in the tobacco plant it was also decided to determine the percentage of calcium. The results of the chemical analyses for crop of 1926 are summarized in Table 10.

From these analyses it is apparent that the use of double manure salts has greatly increased the magnesia content of the leaves and correspondingly reduced the calcium. Both total sulfur and sulfate sulfur have been increased. The percentage of potash absorbed was slightly reduced, especially in the seconds.

Effect on the burn. Since it is generally conceded that burn is roughly proportional to the potash which may form combinations with the organic acids after the mineral acids(sulfuric, hydrochloric, nitric, phosphoric) have been neutralized, it would be

anticipated that the small increase in sulfate sulfur and reduction in potash would be reflected in a corresponding reduction in fire holding capacity. Burn tests on these same samples of 1926, published in Bul. 10, Table 5 (before the chemical analyses were made) show that such was the case. This is confirmed by tests for two more years reported on p. 168 of the present bulletin.

TABLE 10. SUMMARY OF CHEMICAL ANALYSES OF TOBACCO FROM HIGH GRADE SULFATE AND DOUBLE SULFATE PLOTS. CROP OF 1926

Averages of duplicate plots

Source of potash	Grade of leaf	Percentage in water free leaf				
		Potash (K_2O)	Total Sulfur	Sulfate Sulfur	Lime (CaO)	Magnesia (MgO)
H. G. Sulfate	Darks	7.23	0.84	0.72	5.81	1.17
	Sec.	8.07	0.72	0.58	6.84	1.41
	Both	**7.65**	**0.78**	**0.65**	**6.32**	**1.29**
Double manure salts	Darks	7.05	1.00	0.87	4.76	1.97
	Sec.	7.54	0.81	0.69	5.94	2.28
	Both	**7.30**	**0.90**	**0.78**	**5.35**	**2.13**
Half from each	Darks	6.98	0.86	0.73	5.84	1.49
	Sec.	7.33	0.70	0.59	6.88	1.64
	Both	**7.16**	**0.78**	**0.66**	**6.36**	**1.56**

Character of soil. The soil on which these plots are located is a Merrimac sandy loam with some fragments of red sandstone in the surface. It has never leached seriously nor does it suffer excessively from dry weather. It produces a heavier and better crop on a relatively dry year than on a wet year. It is not the type of soil which suffers excessively from sand-drown.

Conclusions from the six year experiments. The original purpose of this experiment was to find whether any advantage would accrue from the substitution of sulfate of potash-magnesia (25% K_2O) for high grade sulfate (48% K_2O) as a source of potash in the tobacco mixture. At the end of six years we believe this question has been answered for this particular type of soil as nearly as it can be answered by field and laboratory tests. Two of these years were excessively wet (conducive to sand-drown), one was excessively dry, one just a little too dry, and the other two about optimum in rainfall.

When the records of the six years are averaged, the differences in yield and quality are found to be very small—probably too small to be important. Offsetting a somewhat larger yield from the use of the combination of the two carriers, there is a small advantage in grading and fire holding capacity from use of high grade sulfate. It may be stated definitely that there is no advantage in taking **all** the potash from double manure salts. On this

type of soil there has been no advantage in getting **any** of it from that source. In more sandy, "leachy" locations, however, it is conceivable that the use of 100 or 200 pounds of double sulfate per acre might result in some advantage unless there are other sources of magnesia present. If our tobacco mixtures of the future are to include a smaller amount of vegetable organics (which contain magnesia)—as seems likely from present trends—it is certain that some carriers of magnesia must be included.

The disadvantages attending the use of double manure salts are (1) somewhat higher cost of the potash, (2) handling of a greater bulk of low grade material, (3) raising the sulfur content of soil and leaf, (4) lowering the potash content, and (5) consequent reduction of fire holding capacity.

COMPARISON OF SULFATE, CARBONATE AND NITRATE OF POTASH

This experiment was begun in 1925. Results of first two years are given in Tobacco Sta. Bul. 6, p. 25 and Bul. 8, p. 39. The object of the experiment is to compare the effect of these three carriers of potash on the yield and quality of tobacco. Using our standard formula as a base and with all other ingredients the same in all, the following five sources of potash, or combinations of sources were used:

PLOT
K1, all potash in H. G. Sulfate.
K5, all potash in carbonate.
K7, 2–3 of the potash in nitrate*, the other 1–3 in carbonate.
K8, ½ of the potash in sulfate, ½ in carbonate.
K9, potash derived equally from sulfate, carbonate and nitrate.

The exact formula for each of these plots is tabulated in Bul. 6. The quantity of ammonia, phosphorus and potash was the same for all plots. The experiment was begun with 10 plots on Field V where the soil is very sandy and the yield is never large. Each treatment is in duplicate on these original plots.

Since growth on this part of the field is usually not as good as might be wished and since results can be obtained more quickly and with more certainty by using a larger number of replications, the experiment was enlarged in 1927 by repeating the same treatments in triplicate on Field I. These two sets of plots give us five replications of each treatment every year. It is believed that this number is sufficiently large to ensure reliable data in a few years.

It will be noted from the above that the two series of plots (series of 1925 and series of 1927) are on somewhat different types

*In explanation of the K7 formula, it did not seem desirable to derive all the potash from nitrate because this would make a greater proportion of the nitrogen from mineral sources (in nitrate form) than we had in the other formulas and would thus introduce another variable.

of soil, the first being Merrimac coarse sandy loam with rapid drainage and therefore suffering from dry weather and from leaching, the second series on Merrimac sandy loam with a tighter subsoil giving slower drainage and therefore better for a dry year but too slow for a wet year. It is not prone to leaching. It will be most convenient to discuss these two series separately.

Series of 1925. Composition of the fertilizer mixtures applied to these plots is described in Bul. 6, p. 27. Significant differences in growth between the various plots were not observed during the summer of any of the four years of this test.

Sorting results for 1928 are presented in Table 11. These data indicate somewhat the best yield for the combination of sulfate, carbonate and nitrate and the best grading for nitrate and carbonate. The differences, however, are quite small. Carbonate alone has the lowest grading, due to the very poor showing of the single plot, K5. Yield on all plots was unusually light due to the very wet season.

TABLE 11. COMPARISON OF SULFATE, CARBONATE AND NITRATE OF POTASH. SERIES OF 1925. YIELD AND GRADING FOR CROP OF 1928

Carriers of potash	Plot No.	Acre yield lbs.		Percentage of Grades							Grade Index	
		Plot	Ave.	L	M	LS	SS	LD	DS	F	Plot	Ave.
Sulphate	K1-2	1095	1169	19	10	5	18	27	13	8	.449	.447
	K1-3	1234		17	12	5	18	32	8	8	.446	
Carbonate	K5	1077	1134	7	10	11	14	25	20	13	.366	.443
	K5-1	1190		28	14	3	15	20	13	7	.520	
⅔ Nitrate ⅓ Carbonate	K7	1126	1158	21	14	9	11	28	6	11	.488	.478
	K7-1	1190		17	15	11	11	27	9	9	.468	
½ Sulphate ½ Carbonate	K8	1139	1179	14	9	14	17	20	17	9	.432	.459
	K8-1	1220		21	14	7	17	26	6	9	.486	
⅓ Carbonate ⅓ Sulfate ⅓ Nitrate	K9	1178	1199	13	9	12	18	31	8	9	.428	.463
	K9–1	1221		22	16	5	17	30	1	9	.498	

In Table 12 the yield and grading data on these plots for 4 years are summarized. The low average for both yield and grading on the sulfate and carbonate plots are due to the poor showing of plots K1-2 and K5. These two plots are in one corner of the field where a building previously stood. As a result, these two plots have not grown as well as the others of this series. If, for the sake of fairness, these two plots were excluded from our calculations the average yield for the K1 plots would be 1,325 lbs. and grade index, .405. For the carbonate plots the corresponding figures

would be 1,305 and .425. Carbonate would thus have the highest grade index but lowest yield, which is in accord with our previous observations. The excellent showing which the triple combination (K9) has shown both in yield and grading throughout the series leads us to favor this as the best source of potash.

TABLE 12. COMPARISON OF SULFATE, CARBONATE AND NITRATE OF POTASH. SERIES OF 1925. YIELD RECORDS AND GRADE INDEX FOR 4 YEARS.

Source of potash	Plot No.	Acre yield by years				Ave. of Treatment	Grade index by years				Ave. of Treatment
		1925	1926	1927	1928		1925	1926	1927	1928	
Sulfate	K1-2	1418	1135	1099	1095	1256	.316	.307	.276	.449	.371
	K1-3	1553	1294	1222	1234		.412	.351	.409	.446	
Carbonate	K5	1425	1325	1089	1077	1267	.317	.331	.273	.366	.373
	K5-1	1545	1312	1176	1190		.405	.343	.430	.520	
⅔ Nitrate ⅓ Carb'ate	K7	1434	1350	1100	1126	1305	.407	.328	.337	.488	.392
	K7-1	1695	1393	1155	1190		.409	.381	.317	.468	
½ Sulfate ½ Carb'ate	K8	1458	1362	1164	1139	1308	.381	.353	.322	.432	.392
	K8-1	1497	1403	1222	1220		.396	.388	.377	.486	
⅓ Sulfate ⅓ Carb'ate	K9	1563	1372	1152	1178	1316	.369	.364	.411	.428	.399
	K9-1	1524	1424	1093	1221		.382	.388	.350	.498	

TABLE 13. COMPARISON OF SULFATE, CARBONATE AND NITRATE OF POTASH. SERIES OF 1927. ACRE YIELD AND GRADING OF CROP OF 1928

Carriers of potash	Plot No.	Acre yield		Percentage of grades							Grade index	
		Plot	Ave.	L	M	LS	SS	LD	DS	F	Plot	Ave.
Sulfate	K1-4	1410	1397	13	16	16	12	21	12	10	.455	.437
	K1-5	1335		..	3	39	11	35	3	9	.405	
	K1-6	1476		3	6	36	9	34	2	10	.425	
	K1-7	1366		3	5	33	11	32	5	11	.408	
	K1-8	1356		10	9	26	11	31	2	11	.511	
	K1-9	1442		6	6	31	10	27	7	13	.420	
Carbonate	K5-2	1320	1333	11	5	24	16	20	15	9	.431	.470
	K5-3	1261		16	10	21	8	32	2	11	.481	
	K5-4	1419		15	13	24	9	30	1	8	.499	
⅔ Nitrate ⅓ Carbonate	K7-2	1394	1380	6	8	26	14	28	8	10	.416	.438
	K7-3	1330		20	11	18	11	29	2	9	.507	
	K7-4	1416		0	4	37	15	24	9	11	.392	
½ Carbonate ½ Sulfate	K8-2	1331	1389	2	4	40	11	25	6	12	.416	.421
	K8-3	1391		3	5	28	19	25	9	11	.389	
	K8-4	1445		12	9	22	15	31	3	8	.458	
⅓ Carbonate ⅓ Sulfate ⅓ Nitrate	K9-2	1194	1347	3	3	28	21	27	7	11	.385	.426
	K9-3	1353		5	6	37	8	31	3	10	.441	
	K9-4	1495		9	11	26	12	30	2	10	.452	

Series of 1927. This series is a duplicate of the 1925 series (three additional replications of each treatment) on Field 1 as explained above. The fertilizer treatment for 1928 was identical with that for the previous series but ground limestone at the rate of 400 lbs. per acre was added because this soil was considered too acid for best results. Growth was satisfactory and uniform but yield was much reduced by the extremely wet season.

Sorting results on this series, presented in Table 13, indicate slightly highest yield for the sulfate plots and best grading for the carbonate plots.

Summary of results for two years in Table 14 also show the best grading for the carbonate plots but the lowest yield. The triple combination (K9) had somewhat the best average yield.

TABLE 14. COMPARISON OF SULFATE, CARBONATE AND NITRATE OF POTASH. SERIES OF 1927. SUMMARY OF 2 YEARS

Source of potash	Plot No.	Acre yield			Average for Treatment.	Grade index			Average for Treatment.
		1927	1928	Ave.		1927	1928	Ave.	
Sulfate	K1-4	1273	1410	1342	1342	.394	.455	.425	.417
	K1-6	1261	1476	1318		.372	.425	.399	
	K1-8	1276	1356	1316		.345	.511	.428	
Carbonate	K5-2	1230	1320	1275	1297	.410	.431	.421	.439
	K5-3	1246	1261	1254		.394	.481	.438	
	K5-4	1307	1419	1363		.421	.499	.460	
⅔ Nitrate ⅓ Carbonate	K7-2	1271	1394	1333	1330	.419	.416	.418	.407
	K7-3	1250	1330	1290		.380	.507	.444	
	K7-4	1318	1416	1362		.326	.392	.359	
Sulfate	K1-5	1250	1335	1293	1329	.389	.405	.397	.403
	K1-7	1258	1366	1312		.413	.408	.411	
	K1-9	1320	1442	1381		.380	.420	.400	
½ Sulfate ½ Carbonate	K8-2	1319	1331	1325	1352	.396	.416	.406	.415
	K8-3	1280	1391	1336		.369	.389	.379	
	K8-4	1345	1445	1395		.463	.458	.461	
⅓ Sulfate ⅓ Carbonate ⅓ Nitrate	K9-2	1292	1394	1343	1356	.414	.385	.400	.410
	K9-3	1319	1353	1336		.365	.441	.403	
	K9-4	1284	1495	1390		.403	.452	.428	

TOBACCO STEMS AS A SOURCE OF POTASH

Tobacco stems (midribs of the leaf) contain about 6% of potash and for many years have been used by some growers for tobacco land. Besides potash, they also contain around 2.1% nitrogen, .5% phosphoric acid and about 4% of lime. They also add organic matter to the soil.

In order to see whether they can be used to advantage as the only source of potash, three plots were included in the potash series of Field 1 in 1927. The formula for these plots was as follows:

Carrier	Pounds per acre	Nutrients per acre		
		NH_3	P_2O_5	K_2O
Stems	2810	73.1	14	179.8
Cottonseed meal	1060	86.9	30.7	20.2
Nitrate of soda	212.7	40.0		
Total.....		200	44.7	200

The stems were applied at the same time as the fertilizer in 1927. The yield and sorting data are presented in Table 15.

TABLE 15. YIELD AND SORTING DATA ON STEMS PLOTS. CROP OF 1927

No. of plot	Yield per acre		Percentage of grades								Grade index	
	Plot	Ave.	L	M	LS	SS	LD	DS	F	B	Plot	Ave.
K14	1222		9	7	12	8	40	4	13	7	.376	
K14-1	1186	1266	4	4	25	5	39	3	12	8	.372	.394
K14-2	1390		12	7	19	7	41	1	9	4	.435	

The replicates in this series are not very consistent since the K14-2 plot was very much higher than the others both in yield and quality. The average of both yield and grade index is about the same as for the sulfate of potash plots (K1-5, K1-7, K1-9) which were immediately adjacent to them.

This series of three plots on Field 1 was continued in 1928, the fertilizer being the same except for the addition of 400 lbs. of limestone per acre. The stems were plowed under in the spring.

The sorting data for 1928 are presented in Table 16 along with corresponding data from the sulfate and carbonate plots for comparison. From these data it is apparent that there has been as good yield and quality as where other sources of potash have been used. The grading is particularly good.

TABLE 16. STEMS AS A SOURCE OF POTASH. ACRE YIELD AND GRADING OF CROP OF 1928

Source of potash	Plot No.	Acre yield		Percentage of grades							Grade index	
		Plot	Ave.	L	M	LS	SS	LD	DS	F	Plot	Ave.
Stems	K14	1292	....	11	11	24	14	24	8	8	.498	.486
	K14-1	1369	1346	..	..	..	..	..	..	..	....	
	K14-2	1378	....	15	12	18	12	31	4	8	.475	
Sulfate	6 plots		1397	..	..	..	..	..	..	..	....	.437
Carbonate	3 plots		1333	..	..	..	..	..	..	..	....	.470

EFFECT OF DIFFERENT POTASH CARRIERS ON REACTION OF THE SOIL

In order to see whether the continuous application of any one or any combination of these potash carriers would shift the reaction of the soil, samples were taken from the ten plots in the 1925 series, (1) before sowing the fertilizer each year and (2) just after harvesting the crop. The reaction was determined electrometrically with results as follows:

TABLE 17. SOIL REACTION (pH) OF POTASH PLOTS. SERIES OF 1925

Source of potash	Plot No.	1925		1926		1927		1928		
		May	Sept.	May	Aug.	May	Sept.	May	July 13*	Aug. 7
Sulfate	K1-2	6.02	5.84	6.03	5.73	6.08	5.94	5.81	5.74	5.79
	K1-3	5.09	5.00	5.21	4.65	5.10	4.75	5.08	4.67	4.82
Carbonate	K5	5.53	5.45	5.72	5.45	5.89	5.42	5.59	5.51	5.39
	K5-1	5.21	5.25	5.31	5.11	5.32	5.25	5.24	4.99	5.02
⅔ Nitrate ⅓ Carbon.	K7	5.31	5.40	5.47	4.93	5.62	5.09	5.31	5.04	5.03
	K7-1	5.30	5.03	5.12	4.41	5.19	4.71	5.10	4.93	4.87
½ Sulfate ½ Carbon.	K8	5.26	5.27	5.41	4.93	5.54	5.29	5.40	5.05	5.23
	K8-1	5.10	5.05	5.04	5.19	5.18	4.81	5.08	4.92	4.96
⅓ Sulfate ⅓ Carbon. ⅓ Nitrate	K9	5.05	5.15	5.19	5.02	5.47	5.06	5.16	5.09	5.15
	K9-1	5.05	5.12	4.95	4.84	5.33	5.05	5.02	4.95	5.00

* Crop two-thirds grown.

Although the reactions have varied considerably during the four years of this test, there seems to be no definite trend in any one direction for any of the plots. Comparing the reactions of May, 1925 with those of May, 1928, they are found to be almost identical in all cases. The result is the same when the reactions of September, 1925 are compared with those of August, 1928. We may conclude from this that when such potash carriers in these quantities are applied annually to this type of soil there is very little if any permanent change in reaction.

EFFECT OF POTASH CARRIERS ON THE CHEMICAL COMPOSITION OF THE TOBACCO

For reasons previously mentioned it is desirable to get the plant to absorb as much potash as possible and to keep the sulfur content low. In order to see whether the potash carrier has any effect on the quantity of these elements absorbed, samples from the ten plots of the series of 1925 were analyzed by the Station Chemistry Department. Two grades, seconds and darks of the crop of 1926, were taken from each plot. Summary of the analyses are presented in Table 18.

TABLE 18. POTASH AND SULFUR CONTENT OF TOBACCO TREATED WITH DIFFERENT CARRIERS OF POTASH. AVERAGES OF DUPLICATES

Source of potash	Grades	Total Sulfur	Potash
Sulfate	Darks	0.57	8.31
	Seconds	0.57	8.66
	Both	**0.57**	**8.49**
Carbonate	Darks	0.50	7.76
	Seconds	0.43	8.47
	Both	**0.46**	**8.13**
⅔ Nitrate ⅓ Carbonate	Darks	0.43	8.38
	Seconds	0.43	8.62
	Both	**0.43**	**8.50**
½ Carbonate ½ Sulfate	Darks	0.53	8.09
	Seconds	0.51	8.18
	Both	**0.52**	**8.13**
⅓ Sulfate ⅓ Carbonate ⅓ Nitrate	Darks	0.57	7.97
	Seconds	0.51	8.32
	Both	**0.54**	**8.15**

It will be noted in this table that the most sulfur is found in the leaf when sulfate of potash is used as the source of potash. The least amount of sulfur is found when nitrate or carbonate are used. Increase in the sulfur content of leaves following increase in fertilizer sulfur has been noted in our previous experiments at this station (Bul. 10, p. 46) as well as by other investigators there mentioned. The differences in the potash content of the leaves are perhaps too small to be of importance.

CONCLUSIONS FROM ALL POTASH EXPERIMENTS TO DATE

1. There are about 35,000 pounds of potash per acre in the upper eight inches of soil on the experiment station farm. This soil is typical of a large part of the tobacco section.

2. This supply of potash is not sufficiently available to meet the needs of a tobacco crop and yearly additions of fertilizer potash are necessary.

3. When all potash is omitted from the fertilizer, the grading of the tobacco is affected, beginning with a decline the first year and rendering the leaves worthless in about three years.

4. Such leaves are thick, dry, non-elastic (boardy) yellow and of very inferior quality generally.

5. One hundred pounds of potash per acre is not sufficient to maintain the quality of the leaf.

6. Up to the present there has been no benefit from raising the quantity of potash to 300 pounds in the fertilizer.

7. Reducing the potash has not seriously affected the acre yield of tobacco.

8. It has had an injurious influence on the fire holding capacity.

9. Reducing the quantity of potash in the fertilizer has materially reduced the percentage of potash in the leaf.

10. The substitution of sulfate of potash-magnesia for high grade sulfate of potash has been of no advantage on the soil where tested but may be beneficial in preventing sand-drown in lighter soils.

11. Its use has lowered the grading and fire holding capacity. It has not increased the yield.

12. It increased greatly the magnesia content of the leaves but reduced the calcium and to a less degree, the potash.

13. It increased the sulfur content of the leaves.

In comparing sulfate, carbonate and nitrate of potash:

14. Carbonate gave the best grading but the lowest yield. It also gave the best fire holding capacity.

15. Nitrate was satisfactory from all standpoints but should not be used in excess on account of its high nitrate content.

16. Most consistently good results were secured from a combination of the three sources of potash, deriving one-third of the required potash supply from each carrier.

17. The quantity of potash absorbed has not been influenced by the carriers used.

18. The use of sulfate has increased the sulfur content of the leaves. The use of carbonate or nitrate gave a smaller quantity of sulfur in the leaves.

19. The reaction of the soil has not been changed perceptibly by using any of these carriers for four years.

20. Tobacco stems have also been a favorable source of potash for tobacco.

Effect of Fertilizers on the Combustion of Tobacco

In the Report of the Tobacco Station for 1927 (Tob. Sta. Bul. 10) an introductory article on this subject was published and all data on the crops of 1925 and 1926 were presented. The present report is a continuation of that account and gives results of burn tests on the crop of 1927.

When the Havana Seed crop of 1927 was sorted, sample hands of the four grades were taken from each plot, labelled and fermented for six to eight weeks in the sweat room of the W. S. Pinney warehouse in Suffield. The case of samples was left undisturbed to undergo a natural sweat at the warehouse until October, 1928 when it was taken to the Station where strip burn tests were made

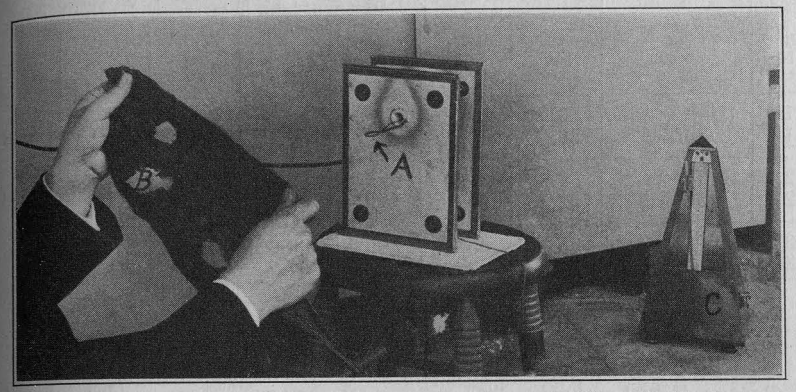

Fig. 16. Making strip tests on combustion. A, Electrically heated coil for ignition. B, Holes burned in leaf. C, Metronome for timing.

with an electrically heated filament. Five leaves were tested from each hand, each in four different places making a total of 20 tests from each hand. The leaves were just moist enough to handle well without breaking. The leaf was ignited near the midrib and held in such position that the flame progressed straight upward between the lateral veins. A metronome was used for counting and 60 seconds was considered the maximum, i. e., the count was stopped at 60 even though the leaf continued to burn.

The crop as a whole had an unusually long fire holding capacity. On most of the plots so many of the tests ran to 60 seconds that the averages showed only very small differences. The unusually long duration of burn—longer than any station crop yet tested—is probably due to the wet growing season of 1927.

The Potash Series

There are five series of potash plots, each of which will be discussed separately.

High Grade Sulfate of Potash vs. Double Sulfate of Potash-Magnesia. The crop of 1927 was the fifth consecutive crop raised on these six plots. Burn records for the two preceding crops are

recorded and discussed in Tobacco Station Bul. 10, p. 30. Burn records for the 1927 crop and three year average are presented in Table 19 below.

TABLE 19. SULFATE OF POTASH VS. SULFATE OF POTASH-MAGNESIA. STRIP BURN TESTS FOR 1927 CROP

Plot No.	Source of potash	Duration of burn in seconds						
		Darks	Mediums	Lights	Seconds	Ave. of all grades	Both plots	3 year average
K1	High grade	59.5	58.4	....	58.8	58.9	57.7	41.2
K1-1	sulfate	55.0	59.4	54.6	57.8	56.7		
K2	Sulfate of	59.9	58.8	....	52.6	57.1	56.7	36.6
K2-1	Pot. Magn.	52.1	56.7	57.3	59.2	56.3		
K3	One half	55.0	58.8	59.5	60.0	55.8	56.6	38.7
K3-1	from each	56.9	59.3	55.8	57.2	57.3		

The fire holding capacity of all grades on all six plots was very high and the differences are probably too small to be significant. Comparing the three year averages (each figure representing 480 tests) there appears to be a small but constant difference in favor of high grade sulfate. It is questionable whether this difference is sufficiently large to offer serious objection to the use of double manure salts.

TABLE 20. CARBONATE, NITRATE AND SULFATE OF POTASH. SERIES OF 1925. STRIP BURN TESTS FOR 1927 CROP

Plot No.	Source of potash	Duration of burn in seconds.						
		Darks	Mediums	Lights	Seconds	All grades	Ave. for treatment	3 year average
K1-2	Sulfate	58.2	54.3	56.6	48.3	54.4	52.6	44.2
K1-3		51.5	47.7	54.3	49.5	50.7		
K5	Carbonate	54.9	56.6	54.8	53.5	55.0	55.8	49.9
K5-1		58.0	49.8	59.6	59.3	56.7		
K7	2/3 Nitrate	55.5	55.5	48.1	57.2	54.1	53.1	45.9
K7-1	1/3 Carbon.	56.3	....	49.7	49.7	51.9		
K8	1/2 Sulfate	55.3	56.4	57.4	53.4	55.6	55.4	45.2
K8-1	1/2 Carbon.	53.5	56.9	56.7	53.9	55.3		
K9	1/3 Sulfate	59.6	50.2	50.1	58.8	54.7	55.4	47.8
K9-1	1/3 Carbon. 1/3 Nitrate	59.2	....	58.0	52.1	56.4		

Comparison of carbonate, sulfate and nitrate of potash. Ten of these plots were started in 1925, the other 22 in 1927. Burn tests on the series of 1925 are recorded in Bul. 10, p. 32. No previous report on the 1927 series has been made. Strip burn tests for the 1927 crop are presented in Table 20 and Table 21.

The results agree with those of the two previous years. The carbonate plots have a slightly higher fire holding capacity than the others while the sulfate tobacco is lowest. These differences, however, are quite small. It will be noted that the heavier grades have a somewhat longer fire holding capacity which in general is not in agreement with results of previous years. This is partly due to the fact that the light grade leaves were so thin that the line of fire consumed to the margin of the leaf before 60 seconds elapsed, thus lowering the average.

TABLE 21. CARBONATE, SULFATE AND NITRATE OF POTASH. SERIES OF 1927. STRIP BURN TESTS FOR 1927 CROP

Source of potash	Plot No.	Duration of burn in seconds					
		Darks	Med'ms	Lights	Seconds	All grades	Average for treatment.
Sulfate	K1-4	....	51.7	48.3	56.9	52.3	53.4
	K1-5	34.9	49.5	46.6	55.9	46.5	
	K1-6	57.8	55.8	47.3	58.5	54.8	
	K1-7	5 3.7	54.3	55.6	57.6	55.3	
	K1-8	55.1	56.9	....	....	56.0	
	K1-9	58.1	57.2	53.4	57.7	56.6	
Carbonate	K5-2	56.4	60.0	58.7	58.9	58.5	56.0
	K5-3	58.6	59.2	59.8	58.0	58.9	
	K5-4	51.9	52.8	46.9	51.2	50.7	
2/3 Nitrate 1/3 Carbonate	K7-2	59.0	....	51.7	58.0	56.2	56.2
	K7-3	55.8	57.7	55.2	54.6	55.8	
	K7-4	59.3	....	55.6	55.7	56.9	
1/2 Sulfate 1/2 Carbonate	K8-2	56.7	54.3	57.7	59.7	57.1	56.5
	K8-3	52.7	53.8	51.7	59.2	54.3	
	K8-4	56.3	59.9	56.8	59.3	58.1	
1/3 Sulfate 1/3 Carbonate 1/3 Nitrate	K9-2	51.2	54.6	47.0	57.5	55.1	55.4
	K9-3	53.9	51.3	56.9	54.8	54.2	
	K9-4	51.6	49.6	54.7	56.3	53.1	
	K9-5	57.3	57.7	55.8	59.5	57.6	
	K9-6	56.6	52.0	51.3	57.2	54.3	
	K9-7	52.6	56.1	58.3	58.6	56.4	
	K9-8	58.7	58.1	54.8	55.5	56.8	

As shown in Table 21, the fire holding capacity of the series of 1927 was somewhat the lowest on the sulfate plots but practically the same in all the others.

Tobacco Stems. In the 1927 series of potash plots, there were three plots which received all their potash from tobacco stems.

These were the N4 plots of previous years (1922-26) which received the largest application of sulfate of ammonia and consequently had the poorest burn (Bul. 10, p. 24). It is not unlikely that there was a carry-over effect from previous treatment and this should be kept in mind in judging the tests of at least the first year.

Results of the tests on the 1927 crop are presented in Table 22.

TABLE 22. STEMS PLOTS. STRIP BURN TEST ON CROP OF 1927

Plot No.	Duration of burn in seconds					
	Darks	Med'ms	Lights	Seconds	All grades.	Average for treatment.
K14	51.1	52.3	45.8	53.4	50.7	
K14-1	45.9	59.6	57.1	58.2	55.2	53.8
K14-2	56.5	55.9	52.5	57.5	55.5	

The average burn of all (53.8 seconds) is practically the same as for the adjacent sulfate of potash plots.

Quantity of potash. In order to determine the optimum quantity of potash which should be applied in the fertilizer, six plots were started in 1926. The 1927 crop was therefore the second one. Burn tests for this year, presented in Table 23, show that there has been a decided drop in fire holding capacity where no potash has been applied for two years but that otherwise 100 pounds per year has been just as effective as 200 pounds in keeping up the burning quality. Whether this will be true for a longer period of years is yet to be tested.

TABLE 23. QUANTITY OF POTASH, SERIES OF 1926. STRIP BURN TESTS ON THE 1927 CROP

Quantity of potash	Plot No.	Duration of burn in seconds.					
		Darks	Med'ms	Lights	Seconds	Average of All grades	Average of Both plots
None	K11	37.0	....	....	34.2	35.6	36.3
	K11-1	37.7	....	....	36.3	37.0	
100 lbs.	K12	57.1	58.8	57.1	58.4	57.8	57.0
	K12-1	55.6	53.8	55.9	60.0	56.3	
200 lbs.	K9	59.6	50.2	50.0	58.8	54.5	55.6
	K9-1	59.2	....	58.0	52.1	56.8	

Comparison of Table 23a with Table 23 shows that the reduction in fire holding capacity was not serious the first year.

TABLE 23A. QUANTITY OF POTASH; SERIES OF 1926. STRIP BURN TESTS ON THE CROP OF 1926

Quantity of potash	Plot No.	Duration of burns in seconds					
		Darks	Med'ms	Lights	Seconds	Average of All grades	Average of Both plots
None	K11	23.0	31.9	49.4	40.8	36.3	38.9
	K11-1	26.0	45.3	41.4	52.9	41.4	
100 lbs.	K12	22.0	46.4	50.6	40.6	39.9	39.9
	K12-1	18.1	35.9	57.2	48.8	40.0	
200 lbs.	K9	11.5	59.0	58.9	53.6	....	45.2
	K9-1	41.5	42.2	56.9	41.7	....	

In 1927 the series was extended by the addition of 18 plots on Field 1. Burn tests for the first year (presented in Table 24) show only a small reduction in fire holding capacity for the first year where all carriers of potash were omitted.

TABLE 24. QUANTITY OF POTASH; SERIES OF 1927. STRIP BURN TEST FOR 1927 CROP

Pounds of potash	Plot No.	Duration of burn in seconds					
		Darks	Med'ms	Lights	Seconds	Average of All grades	Average of Treatment.
None	K11-2	52.7	56.3	51.5	57.4	54.5	53.9
	K11-3	55.2	36.8	56.2	58.0	51.5	
	K11-4	53.6	60.0	60.0	54.4	56.5	
	K11-5	54.4	55.5	52.1	49.7	52.9	
	K11-6	53.6	52.5	58.1	55.1	54.8	
	K11-7	57.5	48.4	54.3	52.2	53.1	
100 lbs.	K12-2	49.7	....	58.5	58.3	55.5	57.2
	K12-3	53.9	60.0	58.6	58.8	57.8	
	K12-4	58.2	57.6	58.0	....	57.9	
200 lbs.	K9-5	57.3	52.7	55.8	59.5	57.6	56.2
	K9-6	56.6	52.0	51.3	57.2	54.3	
	K9-7	52.6	56.1	58.3	58.6	56.4	
	K9-8	58.6	58.0	54.8	55.5	56.7	
300 lbs.	K13	60.0	57.8	58.7	52.0	57.1	56.9
	K13-2	56.9	57.0	56.0	59.4	57.6	
	K13-3	58.5	55.0	55.5	....	56.3	
	K13-4	56.9	58.0	59.0	....	58.0	
	K13-5	51.0	58.0	57.8	57.1	56.0	

NITROGEN SERIES

In 1927 we had four sets of plots where nitrogen fertilizers were under comparison. Each is discussed separately below.

Urea plots. Burn tests for previous years on some of these plots were discussed in Bulletin 10, p. 29. Three plots received all their nitrogen from urea, three received one-half of their

nitrogen supply from urea, while three others, which received none of their nitrogen from urea, served as controls. Total quantity of nitrogen as well as the other food elements were the same on all.

Strip burn tests on the crop of 1927, presented in Table 25 below indicate a slight reduction in fire holding capacity when the entire nitrogen supply was from urea but there was no reduction when one-half of the supply was from urea. The differences, however, are small and would probably not constitute serious objection to a full urea formula if it were desirable from all other standpoints.

TABLE 25. UREA PLOTS. STRIP BURN TESTS ON CROP OF 1927

Plot No.	Amount of urea	Duration of burn in seconds.						
		Darks	Mediums	Lights	Seconds	All grades	Treatment	3 year average
N1-5	None	53.6	58.8	55.8	56.4	56.3	57.7	33.1
N1-6		60.0	57.3	....	60.0	59.1		
N1-7		58.3	56.7	59.1	58.9	58.2		
N8	½ nitrogen from urea	58.9	56.3	57.7	59.9	58.2	57.1	34.1
N8-1		56.9	55.9	57.4	58.7	57.2		
N8-2		57.3	50.4	57.2	58.7	55.9		
N9	All nitrogen from urea	45.2	57.7	50.3	59.5	53.2	54.1	31.9
N9-1		53.1	55.4	55.9	58.6	55.8		
N14		52.6	59.8	53.5	47.3	53.3		

Single sources of nitrogen. On these plots (started in 1926) six different nitrogen carriers, each used in turn as the only source of nitrogen in the formula, are under comparison. Tests of the previous year are discussed in Bulletin 10, pp. 26 and 60. The strip tests of the 1927 crop presented in Table 26, show that sulfate of ammonia gave the lowest fire holding capacity. In this and other

TABLE 26. SINGLE SOURCE OF NITROGEN PLOTS. STRIP BURN TESTS ON CROP OF 1927

Plot No.	Sources of potash	Duration of burn in seconds.						
		Darks	Mediums	Lights	Seconds	All Grades	Ave. of treatment	2 year average
N11	C. S. Meal	50.6	.....	.....	55.1	52.9	52.9	43.5
N12	Nitrate Soda	56.1	.....	.....	59.9	58.0	58.0	47.5
N13	Sulfate Am.	44.3	.....	.....	55.6	49.9	49.9	35.4
N14	Urea	52.6	59.8	53.5	47.3	53.3	53.3	41.2
N22	Nitr. Lime	55.2	.....	.....	59.7	57.5	.....	.....
N23	Nitr. Lime	55.4	.....	.....	59.7	57.5	57.5	.....
N24	Castor Pom.	57.7	.....	.....	59.7	58.7	58.7	.....

tests of the same year it has been noted that the depression of fire holding capacity from the use of sulfate of ammonia was not so pronounced as in the two previous years. The heavy rainfall of 1927 may have had an influence. The fire holding capacity of the nitrate of soda plot is very high again in 1927, as it was in the preceding year. The same was true of the nitrate of lime plots. All of these plots showed distinct signs of nitrogen starvation during the latter part of the wet growing season and the cured tobacco was of poor quality. The long fire holding capacity may be due to the absence of hindering nitrogen compounds in the leaf rather than to any specific effect of the nitrates of lime and soda. Contrary to the popular impression, castor pomace had no unfavorable influence.

Concentrated formula. The trend of recent years is toward a very concentrated fertilizer. This has obvious advantages provided the quality and yield of the crop are not adversely affected. The concentrated formula (18-14-18) described in Bul. 6, p. 16, was slightly modified in 1927 and was composed as follows:

CONCENTRATED FORMULA (PER ACRE)

Urea	286 lbs.
Nitrate of potash	250 lbs.
Carbonate of potash	129 lbs.
Carbonate of magnesia	31.3 lbs.

This extremely concentrated formula (28.5-0-28.5) contained no phosphorus because experiments on this field indicated no benefit from use of phosphorus.

Since no previous report on the burn tests of tobacco from these plots has been made, records for the crops of three years are presented in Table 27. There is a small reduction in fire holding capacity due to the concentrated formula. Since, however, it is not certain just which constituent of this fertilizer is responsible, one would not be justified in concluding that other concentrated mixtures would have the same effect.

TABLE 27. CONCENTRATED FERTILIZER. STRIP BURN TESTS ON CROPS OF 1925-26-27

Plot No.		Duration of burn in seconds													
		Darks			Mediums			Lights			Seconds			3 yr. ave.	
		1925	1926	1927	1925	1926	1927	1925	1926	1927	1925	1926	1927	Plot all Gr.	Treatment
N1-3	Stand	49.3	9.7	54.4	48.1	23.3	59.9	49.4	56.8	59.2	56.1	52.4	59.0	48.2	46.8
N1-4		49.0	9.9	50.9	42.1	33.0	58.4	41.9	45.9	59.4	48.1	49.0	57.9	45.5	
N10	Conc	34.8	6.9	57.4	44.0	32.2	56.8	40.5	47.3	53.6	46.9	45.0	59.6	44.0	41.0
N10-1		32.2	19.1	50.7	21.8	13.0	44.5	44.3	47.3	54.2	40.2	45.2	47.1	38.3	

Nitrate of soda *vs.* **nitrate of lime.** The object of this series of eight plots was to compare nitrate of soda with nitrate of lime as the source of mineral nitrogen of the fertilizer. In the first comparison one-fifth of the nitrogen was in mineral form, while in the second, one-half was in mineral form. The series was begun in 1927. Results of the burn tests of the first crop, presented in Table 28, indicate that the burn was excellent on all plots and there were no significant differences where the two kinds of nitrate were compared.

TABLE 28. NITRATE OF LIME PLOTS. STRIP BURN TESTS ON 1927 CROP

Plot No.	Nitrogen Source	Duration of burn in seconds					
		Darks	Med'ms	Lights	Seconds	All grades	Average of treatment.
N1-8	⅕ N. in	47.0	52.7	58.5	55.9	53.5	55.8
N1-9	Nitr. Soda	58.4	57.3	59.0	57.4	58.0	
N16	⅕ N. in	60.0	58.5	59.2	60.0	59.4	59.2
N16-1	Nitr. Lime	58.1	59.8	58.7	60.0	59.1	
N2-3	½ N. in	58.8	54.4	56.4	58.9	57.1	57.0
N2-4	Nitr. Soda	52.0	59.8	59.3	56.7	57.0	
N18	½ N. in	59.8	59.2	56.3	58.9	58.5	58.2
N18-1	Nitr. Lime	....	58.3	55.9	58.9	57.7	

LIME SERIES

Field VIII was heavily limed each year up to 1925. Since the soil was then found to have a reaction somewhat above neutral no more was applied. Strip tests on the crops of 1925 and 1926 are recorded in Bulletin 10, p. 33. Tests on the 1927 crop, recorded below in Table 29 agree with those of preceding years in showing a

TABLE 29. LIME PLOTS. STRIP BURN TESTS ON FIELD VIII TOBACCO COMPARED WITH NO-LIME PLOTS. CROP OF 1927

Plot No.	Lime treatment	Duration of burn in seconds					
		Darks	Med'ms	Lights	Seconds	All grades	Treatment average
L1	Lime	47.1	....	....	34.0	40.6	45.7
L2		....	....	....	54.6	54.6	
L3		46.0	....	....	43.5	44.8	
L4		55.3	42.6	....	42.7	46.9	
N1-5	No Lime	53.6	58.8	55.8	56.4	56.3	57.3
N1-6		60.0	57.3	....	60.0	59.1	

distinct reduction in fire holding capacity where lime is heavily applied.

On another series of plots on Field I where the effect of different fertilizers on black rootrot was being tested, one-half of each plot was heavily limed each year beginning with 1924. Burn tests for 1925 and 1926 were recorded in Bul. 10, p. 33. Those for the 1927 crop, given in Table 30 below, show some depressing effect of lime

TABLE 30. LIME PLOTS. STRIP BURN TESTS ON LIMED AND UNLIMED ENDS OF THE BLACK ROOTROT SERIES. CROP OF 1927

Plot No.	Lime treatment	Duration of burn in seconds					
		Darks	Med'ms	Lights	Seconds	Treatment Ave.	Three year Average
T1a	Lime	....	....	....	....	20.8	
T1ax		34.1	....	....	7.5		
T1b	No Lime	52.9	57.5	....	56.8	54.1	
T1bx		53.6	43.9	57.2	57.0		
T2a	Lime	....	....	....	34.2	43.9	
T2ax		55.4	....	....	42.3		
T2b	No Lime	60.0	....	....	58.8	58.9	
T2bx		60.0	59.4	56.3	58.7		
T3a	Lime	37.4	....	....	42.8	36.3	
T3ax		42.2	....	....	22.9		
T3b	No Lime	59.7	59.5	58.1	59.4	59.2	
T3bx		59.9	60.0	59.7	58.3		
Average of all lime plots						35.4	26.5
Average of unlimed plots						56.5	39.8

when measured by the strip test. In this table it will be noted that the acid fertilizer (T1) still further reduced the fire holding capacity. This effect, which is probably due to sulfate of ammonia, was also very evident in the preceding years.

Reasons for the depressing effect of lime are discussed on p. 198.

UNFERTILIZED TOBACCO

There are two small plots on the station farm where tobacco has been grown continuously since 1924 but without the addition of any fertilizer. The tobacco grown here has been short and very inferior, in fact, not worth harvesting. In order to see what effect the fertilizer as a whole has on burn, the crops of 1926 and 1927 were tested. The results, presented below in Table 31, show that

the fire holding capacity of this tobacco was just as inferior as the quality. This was probably due to the potash shortage because the plants in the field showed symptoms of shortage of this element and also because other tests have not shown such a depression from shortage of either nitrogen or phosphorus in the fertilizer.

TABLE 31. UNFERTILIZED PLOTS COMPARED WITH STANDARD FERTILIZED PLOTS. BURN TESTS ON CROPS OF 1926-27

Plot No.	Fertilizer	Duration of burn in seconds								Average for treatment
		Darks		Mediums		Lights		Seconds		
		1926	1927	1926	1927	1926	1927	1926	1927	
Ntr1	None	4.6	....	5.4	....	....	....	7.2	....	16.4
Ntr 2		8.0	....	....	42.0	....	25.8	5.4	33.	
N1	Standard	10.6	....	16.2	....	39.8	....	44.0	....	37.1
N1-5		....	34.9	....	48.5	....	46.6	....	55.9	

INFLUENCE OF THE SEASON ON COMBUSTION

In making the fire holding capacity tests on the crop of 1927 it was observed that, irrespective of fertilizer treatment, all the tobacco had a much better fire holding capacity than the tobacco of the preceding year. In order to check on our impressions, an average of all burn tests on crops of the two seasons was calculated. The average of 7,460 tests for 1927 was 54.6 seconds as compared with an average of 27.4 seconds for 5,400 tests on the 1926 crop. Since the fertilizer treatment, except for a small number of plots, had been the same and the tests were made in the same way at the same time of year and under the same conditions, the conclusion seemed warranted that the difference was due to the season. Inquiry among tobacco dealers disclosed the general opinion among them that the crop of 1927 was an unusually free burning one.

When the weather records for the two seasons, as recorded at the station farm, were compared, the most apparent difference was found to be in rainfall. During the period from the application of the fertilizer to the last day of harvesting the rainfall in 1926 was 6.33 inches and in 1927 for the same period it was 13.26 inches, i. e., when the rainfall was doubled, the fire holding capacity was also doubled.

In order to see whether this same rule would apply to the preceding years, the rainfall for 1924 and 1925 was tabulated (Table 32) along with the average burn. As indicated in this table the correlation in the extremely dry year 1924 was about as anticipated, viz., extremely poor fire holding capacity. It is a matter of history well known to all dealers that the 1924 crop was the

poorest burning crop in many years. The correlation in 1925, however, is not so good, i. e., the fire holding capacity was lower than expected. This may be partially explained by the fact that some of the burn tests for that year were made before sweating the tobacco, and unsweat tobacco never burns as well, but even when allowances are made for this, it is apparent that the 1925

FIG. 17. Rainfall records during tobacco growing season for six years. Height of black column indicates amount of rainfall in one day.

TABLE 32. CORRELATION OF RAINFALL AND FIRE HOLDING CAPACITY

Year	Date of application of fertilizer	Last day of harvesting	Rainfall during this period	Average Fire Holding capacity	Number of test made
1924	June 1(?)	Aug. 12	3.57	9.2	720
1925	May 25	Aug. 10	12.02	32.1	4,360
1926	May 23	Aug. 16	6.33	27.4	5,400
1927	May 20	Aug. 10	13.26	54.6	7,460
1928	May 22	Aug. 10	12.66	.....	.....

crop did not burn so well as that of 1927. The explanation probably lies in the **distribution** of the rainfall particularly the time of

occurrence of leaching rains and a record of the leaching for each season might be instructive. Distribution of rainfall at the station in Windsor (supplemented where necessary by the U. S. Weather Bureau in Hartford) is presented in Tables 33, and Figure 4.

This same relation of rainfall to fire holding capacity has been observed by Haley and Olson (Rpt. Dir. Pa. Agr. Exp. Station for 1927). They explain it as due to the greater absorption of basic potassium, and the consequent increase in the water soluble alkalinity of the ash of the plant during seasons of high rainfall when the crop is maturing.

TABLE 33. DISTRIBUTION OF RAINFALL IN INCHES ON TOBACCO EXPERIMENT STATION FARM. 1922-28*

By 10 day Periods

Period	Year						
	1922	1923	1924	1925	1926	1927	1928
May 1–10	3.01	1.24	1.44	.08	.43	.83	.....
May 11–20	2.20	.45	1.35	.73	1.66	.97	.6
May 21–31	.21	.64	.91	1.55	.22	3.24	1.70
June 1–10	.87	2.05	.71	.49	.37	.39	1.62
June 11–20	1.38	.07	.01	1.61	.10	1.33	1.57
June 21–30	4.67	1.72	.90	1.28	1.39	.56	.97
July 1–10	2.28	1.77	.01	1.02	.....	.87	2.20
July 11–20	1.39	.01	.22	.27	.93	2.51	1.64
July 21–31	.89	3.24	.31	3.71	1.33	1.79	1.08
Aug. 1–10	.85	1.17	1.41	3.5	.26	2.57	1.88
Aug. 11–20	3.60	1.40	1.99	.35	2.73	1.77	3.18

By Months

Month	Year						
	1922	1923	1924	1925	1926	1927	1928
May	5.42	2.33	3.70	2.36	2.21	5.04	2.30
June	6.92	3.84	1.62	3.38	1.86	2.28	4.16
July	5.16	5.02	.54	5.00	2.26	5.17	4.92
Aug. 20	4.45	2.57	3.40	3.85	2.99	4.34	5.06

*Records of 1922-23-24 and May and June of 1925 from the Hartford Station of the U. S. Weather Bureau.

MAGNESIA HUNGER, OR SAND-DROWN

This malnutrition trouble has been more prevalent during the season of 1928 than any other year the writers recall. Many

growers who never saw it before are now quite familiar with it. In the field it has very distinct symptoms which are easy to diagnose after one has seen it a few times. The leaves fade out between the veins to a light yellow or almost white, contrasting strongly with the dark green pattern of the vein system. They do not crinkle or turn down at the margins, as is the case with potash hunger, but remain smooth and feel thick and stiff between the fingers. The lower leaves are affected first but afterward the symptoms may advance up the plant, even to the top leaves in extreme cases. In very advanced stages the yellow areas between the veins may die and turn brown. The most serious damage, however, comes from checked growth of the plant and the lifeless character of the cured leaves. On the sorting bench we have found these sand-drown leaves characterized by "double colors", a serious defect in tobacco. The areas between the veins which were yellow or white in the field now are either brick red or yellow, contrasting with the greenish brown of the remainder of the leaf.

The trouble occurs only during the years of heavy rainfall and almost always on porous sandy parts of the field where leaching may be expected. Hence the popular name, "sand-drown".

The malady is caused by the inability of the tobacco plant to get from the soil its required amount of magnesium, an element which is just as essential to the proper development of tobacco as nitrogen, phosphorus or potassium. Like salt for the human being, a very small amount will suffice but it is absolutely essential. The fact that in Connecticut we have rarely been troubled with magnesia shortage is due to its presence, in small amounts, in other ingredients of the fertilizer. Unintentionally we have been giving the plant a sufficient ration for ordinary seasons in cottonseed, castor pomace, linseed, stems, manure and the like. All vegetable organic fertilizers contain small quantities of magnesia. Until the present year we have never observed sand-drown on our station plots where we used as much as a ton of cottonseed meal or a ton of combined meal and pomace per acre. But the occurrence of heavy rains for two years in succession has apparently so depleted the available supply of magnesia that in 1928 we have found trouble even under these conditions on light land. Another possible explanation of its prevalence in 1928 may be the *frequency* of leaching rains during the growing season resulting in constant removal of the magnesia as fast as it came into solution.

The substitution of concentrated synthetic products for a part of the vegetable organics may have made the trouble more wide spread this year, since these materials contain little if any magnesia. At the station we observed sand-drown to be worst where sulfate of ammonia was the only source of nitrogen. It is probable that the sulfate united with the magnesia and in this very soluble form was leached away. This would account for the severity of the trouble immediately after heavy rains. It was also quite common

on the nitrate of soda and nitrate of lime plots. Where a large part of the nitrogen was in urea it was also common in 1928 but not in 1927 and never so severe as on the sulfate of ammonia plots.

The obvious remedy lies in putting more magnesia in the fertilizer ration. Up to the present year we have thought that 15 pounds of magnesia per acre—about the amount in a ton of

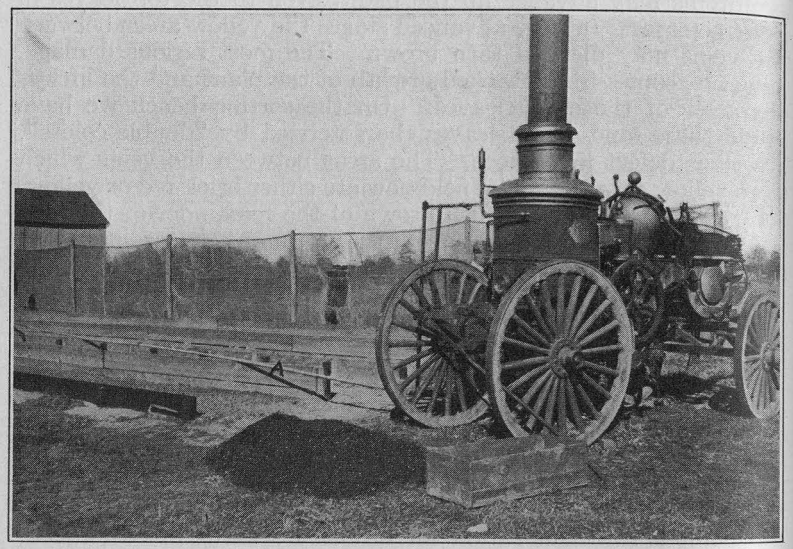

FIG. 18. Steam sterilizing the seed beds with the antiquated town fire engine. Soil can be sterilized to a depth of six inches in 20 minutes with this outfit. Steam supply line at A goes to pan.

cottonseed—was sufficient. As a matter of precaution against the unusual year, however, it may be a good policy for those who have observed this trouble or who have unusually sandy land to add more—perhaps double the dose.

There are a number of materials which may be used. Magnesian lime or limestone (dolomitic limestone) may be applied to lands which are acid enough to stand it. A hundred pounds of double manure salts contain 10 to 12 pounds of magnesia. Cottonhull ashes contain about the same amount. Wood ashes or other vegetable ashes contain a somewhat smaller but valuable supply. A ton of stems contains about 10 pounds.

THE EFFECT OF SULFUR, AMMONIUM SULFATE, AND ALUMINUM SULFATE ON THE REACTION OF SOILS

In previous work at the Tobacco Station in Windsor (Tobacco Station Bulletins 6 and 8) it has been shown that on account of the danger of black rootrot it is desirable to keep tobacco soils fairly acid. The safety point was determined to be near 5.6 pH. Soils less acid than this (above 5.6 pH), especially during cold wet summers, are favorable to black rootrot.

On many tobacco soils where lime and wood ashes have been used too freely the reaction has reached a point far beyond the limit mentioned, i. e., too alkaline, to produce a good crop of tobacco. Hence, it would be beneficial to the grower if some method could be found to increase the acidity of such soils. With this in mind the present investigations were made.

Numerous workers (see Bul. 189 of Rhode Island station with extensive references and Tobacco Station Bul. 10) have found that ammonium sulfate increases the acidity of soils. Doran (2), Hibbard (3), de Long (6), Lipman and co-workers (4, 5), Simon and Schollenberger (7) also found that sulfur caused considerable increase in acidity.

Aluminum sulfate is found to be useful in controlling soil reaction as reported by Amsler (1). To what extent, however, the reaction is affected is not mentioned.

LABORATORY EXPERIMENTS*

In preliminary tests, where 100-gram samples of sandy soil were used, sulfur (fine powder) applied equivalent to 200 pounds per acre, decreased the pH value about one-half unit. The results were corroborated with similar treatments on 500-gram samples of the same soils. The equivalent of 500 pounds of sulfur per acre caused a decrease of about one unit. Increased application of sulfur did not seem to decrease the pH value correspondingly. This preliminary test seemed to indicate that an application at the rate of 500 pounds per acre would be the optimum quantity for an optimum increase in acidity.

Another set of laboratory experiment was made in which three different kinds of soil were used and having the following original pH values:

Clay soil	6.27
Organic soil	6.25
Sandy soil	5.42

*Credit is due to Dr. A. B. Beaumont, Mass. Agr. College, for suggesting the laboratory phases of this work.

As previously, 100-gram samples of these various soils were made up to furnish four non-treated and triplicates of the following treatments:

		Pounds per acre			
1.	Sulfur	250	500	750	1000
2.	Ammonium Sulfate	1032	2060	3090	4120
3.	Aluminum Sulfate	1732	3465	5197	6930
4.	Sulfur	500	500	500	500
	Ammonium Sulfate	1030	2060	3090	4120
5.	Sulfur	500	500	500	500
	Aluminum Sulfate	1732	3465	5197	6930

The amount of sulfur represents low, medium, high, and very high applications Ammonium sulfate and aluminum sulfate are taken in chemically equivalent amounts of sulfate, i. e., in the first three treatments the quantities of sulfur is the same in the various applications. In treatments 4 and 5, combinations of sulfur with the other materials, 500 pounds of sulfur has been taken as a medium constant amount of sulfur to use together with the other two materials.

The samples were kept at normal moisture (most suitable for growing conditions) during the course of the experiments. Reactions were determined electrometrically after four and eight weeks and the results are recorded in Tables 34, 35 and 36. Abbreviations used in the tables are:

S = Sulfur
AlS = Aluminum Sulfate
AmS = Ammonium Sulfate
1, 2, 3, 4, = low, medium, high, and very high applications of the various treatments.

Influence of treatments on clay soil. From Table 34 it is seen that the original pH value of the clay soil was 6.27 (the figure in parenthesis). Receiving nothing but distilled water, the pH had decreased to 5.84 after four weeks and to 5.82 after the lapse of eight weeks, thus showing practically no change after the first decrease. In this case sulfur had apparently been oxidized, although not added. Simon and Schollenberger (7) in sulfofication studies obtained a similar result in a field test, where no sulfur was supplied. They report that the acidity was increased by 0.4 pH as compared with 0.45 obtained in the results above. In computing the actual decrease in pH values, it seemed most reasonable to consider the difference between the value of the checks after eight weeks and those of the various treatments after the same time interval.

Applying *sulfur* at a rate of 250 pounds per acre decreased the pH by 0.48; 500 pounds of sulfur gave exactly the same results in four weeks, but at the end of eight weeks the difference between the two applications was hardly significant, since the actual decrease in the latter case was 0.54. Applying 750 pounds did not seem to work as quickly as the previous treatment, but had decreased the pH by 0.65 at the end of eight weeks. A similar result was obtained in four weeks by an application of 1,000 pounds per acre, which after eight weeks had caused a decrease of 0.74.

TABLE 34. REACTIONS OF CLAY SOIL TREATED WITH SULFUR, ALUMINUM SULFATE AND AMMONIUM SULFATE AFTER FOUR AND EIGHT WEEKS

Treatments	Average pH of triplicate treatments			Treatments	Average pH of triplicate treatments		
	After 4 weeks	After 8 weeks	Decrease in pH		After 4 weeks	After 8 weeks	Decrease in pH
Check (6.27)	5.84	5.82	0.45				
S1	5.77	5.34	0.48				
S2	5.36	5.28	0.54	Combined	Treatme	nts	
S3	5.50	5.17	0.65				
S4	5.22	5.08	0.74				
AlS1	5.47	5.15	0.67	S+AlS1	5.23	4.95	0.87
AlS2	5.17	5.20	0.62	S+AlS2	5.09	4.96	0.86
AlS3	5.15	5.07	0.75	S+AlS3	4.86	4.83	0.99
AlS4	4.76	4.84	0.98	S+AlS4	5.24	5.11	0.71
AmS1	6.16	5.38	0.44	S+AmS1	5.33	4.97	0.85
AmS2	5.72	5.44	0.38	S+AmS2	5.22	4.86	0.96
AmS3	5.68	5.41	0.41	S+AmS3	5.31	4.98	0.84
AmS4	5.76	5.37	0.45	S+AmS4	5.41	4.89	0.93

An application of *aluminum sulfate* at a rate 1,732 pounds per acre resulted in a decrease of 0.67 after eight weeks. The same result was obtained in four weeks when 3,465 pounds were used. At the end of eight weeks, however, the total decrease of the latter treatment did not quite measure up to the result obtained by the lower application. Applying at a rate of 5,197 pounds showed about the same result as for 3,465 pounds, although the final results showed a decrease of 0.75. The highest application of aluminum sulfate (6,930 pounds) decreased the pH value by more than a unit after four weeks, after which time the maximum decrease apparently was reached as the values increased after the lapse of eight weeks, making the final result 0.98.

Using 500 pounds of *sulfur* in *addition* to the various applications of *aluminum sulfate*, the same relationship seemed to occur between the individual treatments, with exception of the highest application which markedly deviated from the rest. The sulfur added, on the average caused a decrease in pH values of about 0.2 unit below the aluminum sulfate alone at various applications

save the maximum application. Unless some error in the procedure unnoticed crept in, it is hard to explain that the highest application showed a lower result than the lowest amount applied, or 0.87 as compared with 0.71 pH decrease after eight weeks.

With respect to ammonium sulfate the various amounts applied did not show significant differences in results after eight weeks as the average decrease after this time was close to 0.40. Sulfur added to the treatments about doubled the effect, but showed the same general trend.

The ammonium radical in these cases may have had a buffering effect, as very little ammonia could have escaped during the experiment.

Influence of the treatments on the organic soil. In Table 35 the results from the various treatments on the organic soil are listed. It is shown that the original pH value of this soil, 6.25, after four weeks was 6.12 and after eight weeks 5.59. Here the untreated soil had turned more acid than the clay soil.

With respect to the various treatments, 250 pounds of *sulfur* had practically no desirable effect on the reaction; 500 pounds a very slight effect and 750 pounds were able to decrease the pH value only 0.3, and the highest application, 1,000 pounds, 0.55 pH.

On the other hand, *aluminum sulfate*, applied at a rate of 1,732 pounds per acre decreased the pH value by 0.38 after eight weeks. The double amount, however, was not more effective, neither was the next higher application. Using the rate of 6,930 pounds, caused a decrease of 0.85 after four weeks, but the total decrease after eight weeks amounted to practically the same as for the lowest application.

TABLE 35. REACTIONS OF ORGANIC SOIL, TREATED WITH SULFUR, ALUMINUM SULFATE AND AMMONIUM SULFATE, AFTER FOUR AND EIGHT WEEKS

Treatments	Average pH of triplicate treatments			Treatments	Average pH of triplicate treatments		
	After 4 weeks	After 8 weeks	Decrease in pH		After 4 weeks	After 8 weeks	Decrease in pH
Check (6.25)	6.12	5.59	0.66				
S1	6.18	5.70	0.00				
S2	5.92	5.51	0.08	Combined	Treatme	nts	
S3	5.65	5.29	0.30				
S4	5.46	5.04	0.55				
AlS1	5.77	5.21	0.38	S+AlS1	5.44	5.04	0.55
AlS2	5.74	5.32	0.27	S+AlS2	5.37	5.20	0.39
AlS3	5.65	5.28	0.31	S+AlS3	5.22	5.03	0.56
AlS4	5.27	5.18	0.41	S+AlS4	5.79	4.83	0.76
AmS1	5.80	5.65	0.00	S+AmS1	5.19	5.18	0.41
AmS2	5.67	5.53	0.06	S+AmS2	5.24	5.12	0.47
AmS3	5.75	5.04	0.55	S+AmS3	5.30	4.99	0.60
AmS4	5.77	5.08	0.51	S+AmS4	5.53	4.94	0.65

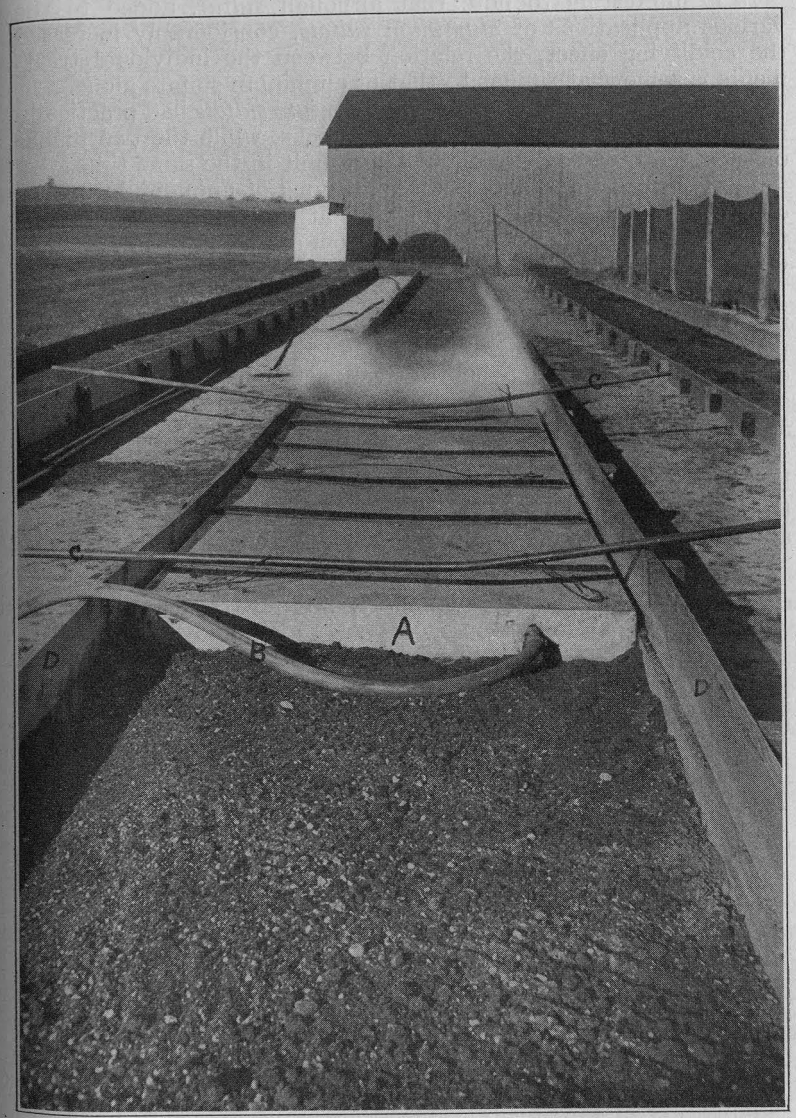

FIG. 19. Steam pan in position. A, Pan; B, Steam supply line; C, Cross bars for lifting pan; D, Sides of seed beds. Steam beyond pan is rising from soil from which pan has just been removed.

It is interesting to note that although *sulfur*, added to the various applications of *aluminum sulfate*, considerably increased the acidifying effect, the relation between the individual treatments is somewhat similar to that of aluminum sulfate alone.

The lowest two applications of *ammonium sulfate* had practically no effect on the reaction after eight weeks, while the two higher ones caused a decrease of about half a unit in the same time.

Sulfur added to the various applications of ammonium sulfate caused a decrease of about 0.40, while at the two highest applications the decrease below the results from ammonium sulfate alone was hardly 0.1 of a unit.

Influence of the treatments on sandy soil. Of the three soils included in this study, the sandy soil untreated having an initial pH value of 5.42, had increased in acidity the least, only 0.17 after eight weeks. This soil, being relatively poor in content of buffering substances, showed the largest response to the various treatments, as may be seen in Table 36.

Sulfur at the lowest application resulted in a decrease less than half a unit pH, but doubling the application, more than doubled the decrease. Although further decreases were noted at higher applications, they were not in proportion to the materials supplied.

TABLE 36. REACTIONS OF SANDY SOIL TREATED WITH SULFUR, ALUMINUM SULFATE AND AMMONIUM SULFATE ATFER FOUR AND EIGHT WEEKS

Treatments	Average pH of triplicate treatments			Treatments	Average pH of triplicate treatments		
	After 4 weeks	After 8 weeks	Decrease in pH		After 4 weeks	After 8 weeks	Decrease in pH
Check (5.42)	5.47	5.25	0.17				
S1	5.18	4.82	0.43				
S2	4.87	4.31	0.94	Combined	Treatme	nts	
S3	4.84	4.17	1.08				
S4	4.74	4.00	1.25				
AlS1	4.95	4.60	0.65	S+AlS1	4.83	4.33	0.92
AlS2	4.66	4.62	0.63	S+AlS2	4.58	4.30	0.95
AlS3	4.42	4.37	0.88	S+AlS3	4.29	4.01	1.24
AlS4	4.11	4.12	1.13	S+AlS4	4.15	4.00	1.25
AmS1	4.86	3.94	1.31	S+AmS1	4.86	4.25	0.99
AmS2	4.94	4.08	1.17	S+AmS2	4.94	4.30	0.95
AmS3	5.01	4.61	0.64	S+AmS3	5.01	4.29	0.96
AmS4	5.11	4.32	0.93	S+AmS4	5.11	4.23	1.02

The low and medium applications of *aluminum sulfate* seemed to have about equal effect after eight weeks. With the two higher applications the actual decrease was reached after the first four weeks as after this time the reaction was not markedly changed.

Adding sulfur to the treatment of *aluminum sulfate* had a marked effect at the low, medium and high applications. The highest application caused a decrease about similar to the high one after eight weeks.

The low application of *ammonium sulfate* to this soil resulted in the largest decrease in pH value recorded in this experiment as a whole. Doubling the application, however, did not measure up to the effect of the former and trebling the low application had only half of the effect of this one, while the effect of the highest application falls between these two.

On the other hand, when *sulfur* was added to the various applications of *ammonium sulfate* the effect was not nearly so great as in the case of the two first applications of ammonium sulfate alone, but instead the sulfur added seemed to balance the reaction, so as to give about equal effect of the four treatments.

Discussion of results from laboratory experiments. In the preliminary study it was found that sulfur applied at a rate of 500 pounds per acre would be about the proper amount to cause an optimum increase of acidity in sandy soils. As a similar result was obtained on the sandy soil in a later experiment, it seems reasonable to assume that in this case 500 pounds of sulfur would best serve the purpose of increasing the acidity.

No optimum application of sulfur could be established for the clay soil or the organic soil as the increased acidity quite uniformly corresponded to the amounts applied. Results from sulfur treatments in Tables 34 and 35 may thus serve as an indication of the difficulties that occur in highly buffered soils. The fact, emphasized by Lipman and co-workers (8), that sulfur is oxidized more rapidly in the absence of organic matter may also have played an important part in case of the organic soil. In general, however, the buffer action of this soil is prominent for all of the treatments used.

The results obtained with ammonium and aluminum sulfate and the combinations of these with sulfur, considering the large quantities used, do not favor a competition with sulfur alone for any of the soils used. The important factor of leaching was entirely eliminated in these experiments. A field study of the treatments discussed is thus needed to justify recommendations for practical purposes.

FIELD EXPERIMENTS

Field experiments on soil acidification by the use of sulfate of ammonia and inoculated sulfur were made in co-operation with the Hartford County Farm Bureau. The experiment was begun in the spring of 1927. Three fields were chosen where the reaction

was known to be nearly or quite neutral. Eight plots, each 2 x 4 rods (1/20 acre) were measured and treated as follows:

Plot 1. No sulfate of ammonia or sulfur.
3. 300 lbs. sulfate of ammonia per acre
3. 500 lbs. " " "
4. 800 lbs. " " "
5. 200 lbs. inoculated sulfur
6. 400 lbs. " "
7. 600 lbs. " "
8. 800 lbs. " "

In applying the fertilizer, the nitrogen of the formula was reduced on the sulfate of ammonia plots so that each of the eight plots received the same amount of nitrogen. On the 800 lb. plot only 500 lbs. were applied at first, the 300 being applied to the crop later.

Location of fields and times of application in 1927 were as follows:

1. Farm of R. E. Distin, Unionville. Field not previously in tobacco. Chemicals applied on June 13th. Land had previously had a heavy coat of manure. The soil showed a content of 7.43% organic matter. Plot 8 received the second application of sulfur on July 11th.

2. Farm of E. H. Sloan, Broadbrook. Field many years in tobacco; content of organic matter, 6.18%. Chemicals applied on June 8th. Second application on July 11th.

3. Farm of W. G. Phelps, Glastonbury. Old tobacco field; had a content of 6.72% organic matter. Chemicals applied on June 2d. Second application July 11th.

Organic matter was determined by Mr. Jacobson of the Station Soils Department.

At the time of the second application of sulfate of ammonia no differences in growth could be observed; neither were consistent

TABLE 37. REACTIONS OF SOILS TREATED WITH SULFATE OF AMMONIA AND SULFUR

Plot No.	Lbs. chemicals per Acre		Reaction of soil in the fall (pH)					
	Sulfate of ammonia	Inoculated sulfur	Sloan		Phelps		Distin	
			1927	1928	1927	1928	1927	1928
1	0	...	6.58	6.62	6.21	6.00	6.34	6.03
2	300	...	6.73	6.86	5.77	5.77	6.37	6.18
3	500	...	6.58	6.79	5.70	5.60	6.28	6.18
4	800	...	6.56	6.69	5.61	5.40	6.35	6.10
5	...	200	6.18	6.18	5.99	6.01	6.11	6.00
6	...	400	6.07	6.01	6.10	5.67	5.96	6.00
7	...	600	5.83	5.93	5.79	5.60	5.70	5.77
8	...	800	5.81	5.77	5.87	5.50	5.66	5.93

differences noticed later in the season. Therefore, the tobacco was not kept separate at time of harvest.

On May 9th and 10th in 1928 all the plots were treated as in previous year and chemicals applied all at one time before plowing. Also in the growing season of 1928 no differences in growth could be observed between the various treatments.

Both in the late fall of 1927 and 1928 soil samples were taken from the different plots and their reactions determined electrometrically. The results are presented in Table 37.

In regard to the effect of the chemicals on soil reaction a glance at Table 37 shows that sulfate of ammonia did not increase the acidity on the Sloan and Distin farms but had some effect on the Phelps farm. On the other hand, inoculated sulfur in every case increased the acidity. However, it is also apparent that continued applications of sulfate of ammonia and sulfur do not increase the acidifying effect. With respect to sulfur, the optimum effect seems to fall between 400 and 600 pounds per acre which is in fairly good agreement with the laboratory tests, previously discussed. The high content of organic matter in all these soils is probably one reason why they were so slightly affected by the treatments.

In order to observe the effect of aluminum sulfate adapted to field conditions, two 1/80 acre plots were laid out on a field* at the Tobacco Station in Windsor in the spring of 1928. In addition to general fertilizers the plots each received aluminum sulfate at a rate of 250 lbs. per acre. During the growing season no significant difference in the growth of tobacco was observed between these and adjacent check plots.

Reactions of the soil was determined in the spring before applying sulfate and in the fall after harvest and were as follows:

Adjacent check	Spring	5.77 pH	Fall	5.70 pH
Plot 1.	"	5.77 "	"	5.38 "
Plot 2.	"	5.72 "	"	5.17 "

This relatively low application of aluminum sulfate was thus able to increase the acidity considerably.

Discussion of results from field experiments. The use of sulfur, ammonium sulfate and aluminum sulfate has been tried out under field conditions. Sulfur has increased the acidity in all instances, the optimum effect being obtained by applications between 400 lbs. and 600 lbs. per acre. On the average, 500 lbs. of sulfur will cause a decrease in acidity of about 0.5pH. On many soils, however, a decrease of only 0.2 to 0.3 pH would be beneficial in order to approach the safety point from black rootrot. Laboratory as well as field tests have shown that up to 500-600 lbs. of sulfur per acre the acidity increases rather uniformly with the amounts

*Classified by the Soils Dept. as Merrimac loamy coarse sand.

applied. Hence there is no object in applying more sulfur than needed, especially since it is shown that sulfur may impair quality and burn, as discussed in Tobacco Station Bulletin 10.

The same bulletin also contains data on the use of ammonium sulfate in fertilizer for tobacco. An extensive use of sulfate of ammonia injures the burn, hence it should be used cautiously. Its greatest effect as acidifying agent would be on sandy soils, low in organic matter and also where lumps of limestone are not visible in the surface soil.

As for aluminum sulfate, its use still being in the experimental stage, no recommendations can be made at this time. However, since this chemical is now put on the market as a comparatively inexpensive product it may be advisable to make trials on a small scale, using up to 500 lbs. per acre.

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Summary of Progress on Projects

There are a number of lines of investigation on which distinct progress has been made during the year but which cannot be discussed in detail in the present report. These are briefly summarized below without citation of supporting data. They will be presented more completely in later publications.

UREA AND CALUREA AS SOURCES OF NITROGEN IN THE FERTILIZER

Results of urea tests during three years have been reported in previous bulletins from this station. Results for 1928 are in line with those of the preceding three years. When one-half of the nitrogen of the formula is derived from urea the resulting yields and quality have been just as satisfactory as for a standard formula in which four-fifths of the nitrogen is from cottonseed meal and castor pomace. When all the nitrogen is from urea the tobacco is

not of such good quality. Sand-drown also affected the all-urea plots. More recently, another urea compound, calurea has appeared on the market and experiments were begun with calurea in 1928. Calurea has 4/5 of its nitrogen from urea and the other 1/5 from calcium nitrate. Tests of one year on calurea are in line with the results from urea. It is a less expensive source of nitrogen than urea because of the high import duty on the latter. Nitrogen in both of these carriers is quickly available and has shown no signs of serious leaching. In this form, nitrogen costs less than half of what it does in cottonseed meal and is much less bulky in handling. Up to the present there has been found no good reason why these cheaper synthetic products should not be used to supplant a part of the more expensive vegetable organic constituents of the fertilizer, but more data are needed before definite recommendations can be made.

NITRATE OF LIME AS A SOURCE OF MINERAL NITROGEN

It is a generally recognized principle that the tobacco fertilizer mixture should have a minor part of its nitrogen in a mineral carrier. The purpose of this is to furnish nitrogen in a quickly available form and thus function as a "starter" when the plants are first set in the field. Nitrate of soda is most extensively used for this purpose because of the immediately available nitrate it contains and because it is cheap and always plentiful on the market. Two objections to the use of nitrate of soda are: (1) during heavy rains the nitrogen in it leaches away very quickly, and (2) the sodium which it contains may raise the soil reaction. We have shown elsewhere that it causes the soil to become alkaline.

Within recent years, another quickly available mineral nitrate, nitrate of lime (calcium nitrate), has come into the market as a competitor of nitrate of soda. This material contains the same amount of nitrogen as nitrate of soda, is just as reasonable in cost (quoted somewhat lower in 1927 and 1928) and otherwise is very similar to nitrate of soda. It has the disadvantage of being somewhat more deliquescent than nitrate of soda. In our experience of 1927-28 we have not found that this property has caused the mixture in which it was used to "cake" or become lumpy even when it was used to supply as much as one-half of the nitrogen and permitted to stand for six weeks after mixing. It is marketed in paper-lined bags to prevent its becoming over-damp or hard during storage. From a theoretical standpoint it should be more suitable for use on tobacco because it contains calcium which is used in large amount by the tobacco crop and because calcium salts are known to give a desirable white color to the ash.

These two materials have been tested side by side for two years on the station farm deriving, (1) 1/5 of the nitrogen from these mineral sources and (2) ½ of the nitrogen from them. Averaging

the results of the two years we find no significant differences between them in yield, grading, or fire holding capacity. There appeared to be serious leaching of the nitrogen from both when they were used to supply one-half the fertilizer nitrogen. There did not seem to be any great difference between them in this respect. When the soil was tested one year after starting the series, the nitrate of soda plots were slightly more alkaline than the nitrate of lime plots. Cigars from these plots have not yet been tested; hence we have no data as to the effect of each on ash color.

COMPARISON OF SINGLE NITROGEN SOURCES

Results on this series in 1928 were about the same as for 1927 (fully reported in Tob. Sta. Bul. 10, p. 60). The four sources tested at station farm were cottonseed meal, nitrate of soda, sulfate of ammonia and urea. All fertilizer was applied at one time before setting. The nitrate of soda leached so badly that the tobacco made less than half a crop and on the sorting bench was of such inferior quality it was not fit to sort. Besides nitrogen starvation it also showed severe sand-drown. Fire holding capacity, however, was excellent—possibly because of absence of hindering nitrogen compounds. Nitrogen also leached seriously from the cottonseed meal plots, growth was checked and the cured tobacco was yellow and lifeless. It was considerably better than the nitrate of soda tobacco, however. Fire holding capacity was good but was surpassed by nitrate of soda. The sulfate of ammonia plot showed no signs of nitrogen starvation but remained rank and green except for sand-drown which was especially prevalent here. The yield was highest of all the plots but the quality was poor because of the double colors previously mentioned. Fire holding capacity was less than that of the other plots. No leaching of nitrogen was apparent on the urea plot but there was considerable sand-drown. Growth was good, yield being only slightly less than that of sulfate of ammonia. The quality was best of all these four plots.

Monthly soil tests which have been made for a year on these plots show little change in the cottonseed meal plot; the nitrate of soda plot is progressively more alkaline, the sulfate of ammonia plot is the most acid, the urea plot is progressively slightly more acid than the cottonseed meal plot.

MANURE AS A SUPPLEMENT TO COMMERCIAL FERTILIZER

The 1928 tests confirm those of 1927 (fully discussed in Tob. Sta. Bul. 10, p. 62). The tobacco remained greener and somewhat larger in the field than on adjacent unmanured plots. On the sorting bench it was found to have a better grade index and higher yield. This was true both for stable manure and for artificial Adco manure. The differences, however, were not large.

FRACTIONAL APPLICATION OF NITROGEN

This experiment was continued on the same six plots as in 1927 (Tob. Sta. Bul. 10, p. 57). The extremely wet year was favorable for this kind of a test. One-half of the quickly available nitrogen (in nitrate of lime and nitrate of potash) was deducted from the

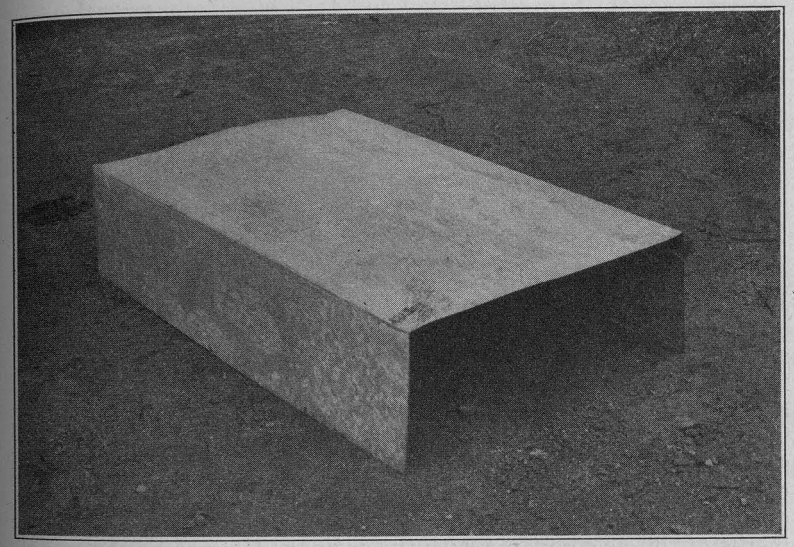

FIG. 20. Metal Fire Cover for spreading the heat.

first (broadcast) application and divided between two later applications. The second application (delayed by mistake) was made on July 2. On July 5 there was a heavy rain (over 2 inches) which caused serious leaching. The last application was therefore made on July 7. Within a few days the yellow color of the check plots showed that they did not have sufficient nitrogen. The fractional plots remained green. On the sorting bench the tobacco from the check plots was found to be yellow and lifeless, much inferior to the fractional plots. The yield was also less. The benefit from fractional application was unquestionable in 1928. This is the first year this has been true. It may be due to the fact that the later applications were made at exactly the critical time with respect to the heavy rains. The only objectional quality noted in the tobacco from the fractional plots was that the veins were

somewhat prominent. This soil is very sandy and subject to easy leaching.

These results and the observations on many other fields in 1928 show that if later nitrogen applications are to be used, they should be made *immedately* after the heavy rains *before* any fading of the leaves appears. Delay until the leaves appear yellow results in checked growth from which the plant never entirely recovers and reduced yield results.

COVER CROP TESTS

Records for 1928 show that every cover crop used both increased the yield and improved the grading of the tobacco grown on it. Rye gave the highest yield closely followed by vetch and oats. These three also had the best grade index. Timothy, barley, redtop, alfalfa and wheat were not so beneficial as the others but were better than no cover.

ROOTROT RESISTANT STRAINS OF TOBACCO

Experiments have been continued with resistant strains of Havana Seed, Broadleaf and Shade Cuban.

Wisconsin Havana No. 142 has again been shown to be highly resistant to Black Rootrot and it produces a heavier yield of leaf than any of the ordinary Connecticut Havana Seed strains. On account of the thinner, larger leaves, set closer together on a larger stalk this appears to suffer more than the others from pole sweat. In setting this type it would be advisable to increase the distance between plants in the row by at least two inches. Packers and manufacturers do not agree among themselves as to the merits of this as compared with the ordinary Havana Seed strains.

Broadleaf tobacco is not as susceptible to rootrot as the other two types but still the reduction in yield from this cause is so serious on some fields that a resistant strain is much needed if one that is desirable from other standpoints could be found or developed. One promising strain has been under test on the station farm for the last two years. Compared with the John Williams strain it yielded more leaf and the quality appeared as good. It seems to be more subject to pole sweat, however, possibly on account of thinner leaves and unusually large succulent stalks. Tests have not been conducted long enough to state whether it will meet the requirements of the trade. It is undoubtedly much more resistant than the John Williams type.

In 1927, in a shade field which was badly dwarfed from black rootrot, fifteen scattered plants were found which were making perfectly normal growth. Seed was saved separately from each of these. After harvest, the roots of these and many adjacent

plants were examined and relatively few lesions were found on these while the others about them were severely rotted. A row was planted from the seed of each one of these plants in 1928 and compared with alternate rows from common Cuban seed. Rootrot was not very severe on this field in 1928 and the contrast was not as marked as could be desired. Nevertheless it was apparent both from the growth and from the condition of the roots that some of these had considerably more resistance than the common Cuban plants. Further selections and tests are necessary and it is hoped that a satisfactory Cuban resistant strain may be secured from this chance find. Other resistant Cuban strains from another source are also under test but it is too early to predict what the results will be.

TOPPING AND SUCKERING EXPERIMENTS

Results of three years experiments at the station on these practices have just been published by N. T. Nelson as Bul. 297 of the Connecticut Agricultural Experiment Station.

FIRE CURING OF STALK TOBACCO

The importance of curing tobacco by charcoal fires is so fully recognized by the growers of shade tobacco that the practice is universal among them. The stalk tobacco growers, however, are inclined to "take a chance" on the weather and only a few of them practice charcoal firing.

Therefore when weather conditions are favorable for pole sweat —as they were in 1928—the amount of loss from this source is very large. A conservative estimate of the loss to the Connecticut growers this year is over a million dollars. With an expenditure of one-fifth of that amount, most of this could have been prevented.

Experiments which have been conducted in the experiment station sheds during the last four years and in the sheds of practical growers of both broadleaf and Havana Seed lead us to believe that fire curing should be practiced universally by stalk growers at least during seasons when the weather is conducive to sweat. In a later separate bulletin, full data on these experiments and more complete discussion of the practice will be published.

At this time, for the benefit of those who have not been accustomed to fire curing, the following recommendations are made, based on our experiments:

For every acre of tobacco a minimum of 50 bushels of charcoal should be on hand, *before* harvesting starts.

A larger number of small fires is better than a small number of large fires. The air drafts which are created by the fires are as important, if not more so than the actual heat produced. These drafts, therefore, should be distributed as much as possible over

the shed. A large number of fires prevents "dead air pockets'. The same result is obtained by the use of metal "spreaders" or covers over the fires. They also prevent scorching the tobacco directly over the fires.

The temperature should be kept between 85° and 95° F in the second tier. In very warm weather it may be necessary to raise this to 100° at times.

Firing to wilt, i. e., within a few days after filling the shed and while the leaves are still green is a good practice but is not always necessary for prevention of sweat. Pole sweat never attacks leaves when they are in the green stage. The late yellow and early brown stages are the danger stages.

If the tobacco is in those stages and wet weather sets in, with high humidity preventing evaporation of moisture from the leaves, it is time to start firing. Don't wait until the leaves begin to "puff" and the midribs "strut".

The condition of the tobacco should be the guide in firing. The minimum period of firing should be thirty-six hours. Frequently two or three times as long is necessary. When the leaves become dry in the green or yellow stage it is a sign you are firing too much.

The temperature should then either be reduced or the firing stopped entirely for a day and then started again if weather conditions demand. Intermittent firing is better than continuous firing except where pole sweat has already started and rapid drying is required.

All brown parts of the leaf should be dry. This is the best guide by which to know that you are firing enough.

During firing, the ridge and gable ventilators should be open but the side ventilators (boards) should be closed.

Some have the impression that fire cured tobacco is not so elastic as that which is cured naturally. We believe that this is due to curing too rapidly. Tobacco properly fire-cured is just as good as naturally cured tobacco in this respect.

EFFECT OF LIMING THE SOIL ON COMPOSITION OF TOBACCO

Tobacco from limed soils exhibits characters of combustion which are different from those of tobacco grown on soils which have not been limed. Some of these characters, particularly the whiteness of ash and closeness of burn are desirable; others, such as the "flaking" of ash and reduction in fire holding capacity, are objectionable. These differences in burn are probably correlated with changes which liming produces in the chemical composition of the leaf. From the standpoint of good growth of tobacco, heavy liming of the soil is not desirable but it is not beyond the range of possibility that the good effects on combustion may be produced by application of some material other than lime. Whether or not there is such a possibility can be intelligently determined

TABLE 38. ANALYSES OF TOBACCO FROM LIMED AND UNLIMED PLOTS. CROP OF 1926. WATER FREE BASIS

Plot No.	Grade	Lime	Percentage of minerals.						
			Total ash	P_2O_5	K_2O	CaO	MgO	Mn_2O_3	Al_2O_3
					FIELD VIII				
L	M	Lime	23.89	0.78	6.52	4.72	3.79	.01	.09
L1	M	Lime	23.05	0.73	6.38	4.82	3.58	.01	.08
L2	M	Lime	22.63	0.73	5.92	4.73	4.21	.01	.06
L3	M	Lime	22.90	0.74	6.06	4.79	3.89	.01	.08
L38	M	Lime	23.49	0.75	6.87	4.52	3.61	.01	.11
L39	M	Lime	21.83	1.05	6.37	4.13	3.12	.01	.08
C3-1	M	No lime	26.92	0.85	8.90	5.67	1.16	.10	.09
F6-1	M	No lime	28.15	0.87	8.36	6.55	1.19	.06	.21
N1-5	M	No lime	25.20	0.88	7.51	6.53	1.38	.06	.07
N1-6	M	No lime	25.22	0.93	7.62	6.13	1.29	.07	.07
					POQUONOC FIELD				
4A	All	Lime	24.57	0.77	6.79	4.98	3.11	.03	.17
15A	All	No lime	27.26	0.77	7.23	5.30	1.55	.21	.23
6A	All	No lime	28.19	0.85	7.80	5.84	1.18	.12	.31
					THIELAVIA PLOTS				
T1A	M	Lime	22.83	0.72	5.12	5.53	3.49	.01	.08
T1B	M	No lime	24.78	0.84	6.67	6.11	1.56	.29	.14
T1A	S	Lime	25.33	0.62	4.18	6.38	4.54	.02	.11
T1B	S	No lime	27.43	0.76	6.62	7.04	1.57	.28	.31
T2A	M	Lime	23.86	0.82	6.10	5.37	3.13	.01	.05
T2B	M	No lime	24.63	0.84	7.37	5.62	1.18	.04	.11
T2A	S	Lime	25.70	0.60	5.52	6.00	3.15	.02	.14
T2B	S	No lime	26.82	0.75	7.10	6.42	1.18	.04	.13
T3A	M	Lime	23.83	0.69	5.73	5.15	3.58	.01	.11
T3B	M	No lime	25.43	0.85	6.81	6.19	1.62	.06	.06
T3B	S	No lime	27.49	0.68	7.17	6.89	1.59	.09	.17

only after we have found out what changes lime has produced in the composition of the leaf.

Tobacco (of the crop of 1926) from limed and adjacent unlimed plots—which otherwise were identical in character of soil and previous treatment—was therefore analyzed by the Station Chemistry Department with respect to those elements which it was believed might be affected by liming. Three different series of plots were used in these Analyses as follows:

Limed plots on Field VIII. Beginning with 1922 these plots were limed heavily each year. With the last application in the spring of 1925 they had received during these four years five tons of hydrated lime per acre and the reaction of the soil was slightly above 7.0 pH.

Thielavia series. These consisted of three plots. One-half of each received an application of one ton of hydrated lime per acre each spring, beginning in 1924.

Poquonoc field. Plots on this field were limed at the same rate as the Thielavia series in the spring of 1925 and 1926.

The lime was not analyzed each year but it was commercial lime from western Massachusetts and unquestionably all of it had some magnesia in it. Some samples from that section have as high as 30% MgO.

Results of the analyses presented in Table 38 show that:

1. In every comparison, liming reduced the percentage of total ash, of calcium, phosphorus, manganese and potash. Aluminum was reduced in some cases but not in all.

2. In every case, liming approximately doubled the percentage of magnesium.

In experiments with tobacco in Ohio, Ames and Boltz (Ohio Sta. Bul. 285, 1915) also found that liming a soil reduced the percentage of calcium, potassium, manganese, phosphorus and sulfur but increased the magnesium.

Garner (U. S. D. A., Bur. Pl. Indus., Bul. 105) found that magnesium salts are injurious to fire holding capacity of tobacco (more so than the calcium salts). He also found that all magnesium salts produce a white ash.

Apparently the white ash and reduced fire holding capacity which we find on our limed plots are due to magnesium rather than to calcium.

The Effects of Magnesia, Sulphur and Chlorine on the Growth and Quality of Tobacco[1]

H. F. Murwin[2]

With the coming use of more concentrated fertilizers and synthetic nitrogen products in the tobacco growing industry it would be well to keep in mind the nutritional disturbances which may result. The trend today is toward the use of more concentrated mixtures which necessitates the use of more chemicals to replace some of the cottonseed meal or the like. We usually consider the value of a tobacco fertilizer in terms of nitrogen, phosphoric acid and potash. While these three elements are absolutely essential, the tobacco plant requires more than these three for normal growth. In this connection fertilizer tests have been conducted over a period of six years at the Tobacco Station in an effort to determine some specific effects of magnesia, sulphur and chlorine on the growth, quality and burn of Havana seed tobacco.

These fertilizer tests consisted of six treatments in duplicate on 1/40 acre plots. A basal ration which furnished only nitrogen, phosphoric acid and potash was applied on all plots. During the first three years of the experiment 40 pounds of nitrogen, 64 pounds of phosphoric acid and 80 pounds of potash were furnished annually in the basal ration. Starting with the 1925 season the quantities of nitrogen and potash applied annually were increased from year to year and in 1927 the basal mixture furnished about 200 pounds of nitrogen, 64 pounds of phosphoric acid and 200 pounds of potash per acre. The exact amounts and types of carriers used in this mixture are given in Table 39.

[1]The plots were conducted on a cooperative arrangement between the United States Department of Agriculture and the Connecticut Agricultural Experiment Station.

[2]Agent, Office of Tobacco and Plant Nutrition, Bureau of Plant Industry, United States Department of Agriculture.

Table 39. Composition of Basal Ration. Magnesia, Sulphur and Chlorine Plots—1927

Materials	Lbs. per acre	NH_3	P_2O_5	K_2O
Nitrate of potash	460.0	72.63	.....	199.6
Precipitated bone	166.5	.....	64.1	.....
Dried blood	200.0	31.56	.....	.....
Urea	119.0	65.45	.....	.....
Nitrate of soda	324.0	60.58	.....	.....
Total	1269.5	230.22	64.1	199.6

Table 40. Per Acre Amounts of Pure Chemicals Applied in Magnesia, Sulphur and Chlorine Treatments

Plot	Chemicals applied	Nutrients supplied
1 & 1+	Control	Control
2 & 2+	185 lbs. Magnesium Sulphate 88 lbs. Sodium Chloride	30 lbs. MgO; 60 lbs. SO_3 53 lbs. Cl; (50 lbs. Na_2O)
3 & 3+	185 lbs. Magnesium Sulphate	30 lbs. MgO; 60 lbs. SO_3
4 & 4+	150 lbs. Magnesium Chloride	30 lbs. MgO; 53 lbs. Cl
5 & 5+	185 lbs. Magnesium Sulphate 150 lbs. Magnesium Chloride	60 lbs. MgO; 60 lbs. SO_3 53 lbs. Cl
6 & 6+	107 lbs. Sodium Sulphate 88 lbs. Sodium Chloride	60 lbs. SO_3; 53 lbs. Cl; (96 lbs. Na_2O)

In addition to the basal ratio, magnesia, sulphur and chlorine were supplied annually as shown in Table 40. No magnesia has been applied on plots 1, 1+, 6 and 6+, no sulphur on plots 1, 1+, 4 and 4+, and no chlorine on plots 1, 1+ 3 and 3+ during the six years period. All other plots received applications of magnesia, sulphur and chlorine at the rates specified in the preceding table. Part of these fertilizers was uniformly drilled in the row a few days before transplanting the tobacco. The remaining portion was applied as top dressing at the time of the first hoeing. There were no great differences in field growth, but plots 1, 1+, 6 and 6+ were smaller and plots 4, 4+, 5 and 5+ were somewhat larger than the average.

The tobacco on all plots that received no magnesia in the fertilizer exhibited the light colored mottling characteristic of magnesium starvation during the seasons of 1922, '24, '25 and '27. Nearly one hundred percent of the leaves on some plots were mottled in 1927. This condition we term sand-drown. It might be well to briefly describe this malady. Magnesia deficiency results in a very characteristic mottling which ordinarily develops first on the lower leaves of the plant and usually begins at the tip and progresses inward toward the base of the leaf, more particularly between the veins and along the margins. When magnesia is not sufficiently available in the soil these symptoms appear and as magnesia is very mobile in the plant that which is already taken into the lower leaves is transferred to meet new needs in the growing region. Thus the malady progresses from the lower leaves upward as the season advances. The leaves do not become deformed as in the case of potash hunger because symptoms ordinarily develop on mature leaves.

It will be noted that no sand-drown was present in 1923 and '26. Sand-drown has not occurred in the Valley to any extent in the past except on sandy soil during seasons with heavy rainfall. This explains in part the irregularity of occurrence on these plots. Both surface and subsoil samples were analyzed for magnesia, sulphur and calcium in the Washington laboratories. These data show that the total magnesia content of this sandy soil was nearly equal to the content of calcium which is much higher than would be expected. There were no significant differences in treatments 1, 3 and 5 where 0, 30, and 60 pounds of magnesia, respectively, have been supplied annually for six years. Neither were there any differences in sulphur content but the total amount of sulphur was so low that accurate data could not be expected. With as high a total magnesia content as shown in these analyses evidently enough became available to the plant during the dry years to promote a normal growth. If the magnesia content of this soil had been depleted the absence of magnesia in the fertilizer would have greatly lowered both yield and quality. This has been shown by experiments in other sections. It has been reported by

the Tobacco Station that fifteen pounds of magnesia per acre has prevented the occurrence of sand-drown on the Station fertilizer plots. A number of cases of sand-drown were reported during the past season resulting from a combination of two things, an insufficient amount of magnesia applied, together with the heavy rainfall. This is just an indication of what may happen in the future when less nitrogen is supplied from organic sources which carry magnesia. The point is, if a shortage does occur, it must be corrected in one way or another if yield and quality are to be expected. But if the rate of application is excessive there is a tendency to decrease the quality of leaf. These tests have shown that 30 pounds of magnesia has been sufficient to prevent sand-drown in any year during the experiment but a number of instances can be cited where 15 pounds was not sufficient during the past season. No effects of sulphur or chlorine were discernible in the field except for slight differences in growth.

Plants were selected at harvest in 1925 from treatments 1, 3 and 5. The cured leaf and stalk were analyzed for magnesia in the laboratories at Washington. The results are given in Table 41.

TABLE 41. MAGNESIA CONTENT OF CURED TOBACCO

Plot	Magnesia (MgO) supplied in Fert. per acre	Condition of leaf	% Magnesia (MgO) in water-free material	
			Leaf	Stalk
1	None	Sand-drown	.30	.25
3	30 lbs.	Normal	1.40	.37
5	60 lbs.	Normal	2.07	.45
1+A	None	Normal	.57	.27
1+B	None	Sand-drown	.27	.23

These data show that the amount of magnesia taken up by the plant is influenced by the amount applied to the soil. In other words, if sufficient magnesia is available in the soil sand-drown will not occur. They also show that the leaf is influenced much more than the stalk because of the greater metabolic activity in the leaf as compared with the stalk.

TABLE 42. SUMMARY OF THE YIELDS PER ACRE

Plot	1924	1925	1926	1927	Average	Plots	Ave. of 8 replications.
1	880	1456	1368	1266	1242	1 & 1+	1192
1+	780	1290	1392	1105	1142	....	....
2	1140	1465	1392	1364	1340	2 & 2+	1302
2+	1000	1425	1342	1288	1264	....	....
3	920	1490	1488	1362	1315	3 & 3+	1293
3+	900	1490	1379	1314	1271	....	....
4	1000	1537	1414	1347	1324	4 & 4+	1345
4+	1000	1582	1534	1348	1366	....	....
5	960	1443	1466	1448	1329	5 & 5+	1344
5+	1000	1540	1534	1368	1360	....	....
6	900	1321	1388	1250	1215	6 & 6+	1286
6+	1067	1477	1533	1352	1357	....	....

Yield and quality data were obtained from these plots the last four years of the experiment. A summary of these yields are presented in Table 42. We could not expect great differences in yield of cured leaf from such treatments unless either magnesia or sulphur was so depleted or unavailable to the plant as to be a limiting factor in growth processes. From the data presented this appears to be the case on plots which received no magnesia. The yields from the control plots which received no magnesia, sulphur or chlorine are considerably lower than the rest. Where only one of the elements was lacking the effect was not as marked. It is quite evident from a comparison of treatments 3 and 4, however, that somewhat larger yields were consistently obtained from the application of chlorine in absence of sulphur than from the application of sulphur in the absence of chlorine.

The cured leaf was assorted into the various commercial grades at the Tobacco Station shop. As it is rather difficult to keep a number of figures in mind, such as the percentages of assorted grades, when comparing two treatments, a single figure was devised to represent the quality of cured leaf from the entire plot. This single figure is termed the average price per pound and was computed from arbitrary values given to assorted grades. The average prices over a four year period are summarized in Table 43.

TABLE 43. A COMPARISON OF THE AVERAGE PRICE PER POUND

Plot	1924	1925	1926	1927	3 yr. ave. 1925-1927	Plots	Ave. of 8 replications.
1	.179	.277	.395	.316	.329	1 & 1+	.327
1+	.158	.262	.427	.285	.325	....	....
2	.148	.258	.329	.398	.328	2 & 2+	.340
2+	....	.298	.383	.378	.353	....	....
3	.155	.320	.408	.403	.377	3 & 3+	.377
3+	....	.340	.406	.388	.378	....	....
4	.169	.310	.368	.372	.350	4 & 4+	.369
4+	....	.342	.404	.420	.388	....	....
5	.151	.288	.401	.383	.357	5 & 5+	.350
5+	....	.282	.369	.380	.344	....	....
6	.175	.313	.408	.329	.350	6 & 6+	.356
6+	....	.357	.346	.385	.362	....	....

If quality is considered on this basis we obtained the lowest average price per pound when no magnesia, sulphur or chlorine were supplied in the fertilizer, and the highest average price when magnesia and sulphur were applied in the absence of chlorine. It will be noted that the quality of cured leaf improved from year to year with the increased annual application of nitrogen and potash but the relative effects of magnesia, sulphur and chlorine remained the same aside from effects on quality when sand-drown occurred.

Burn tests were conducted on samples of sweated tobacco from the four principle commercial grades in each treatment. An

electric resistance coil was used to initiate the burns in these tests. Two burns, one on either side of the mid rib and approximately in the center of the leaf were made on ten leaves from each grade.

TABLE 44. BURN TESTS ON THE 1925 SWEATED TOBACCO

Fire holding capacity of the leaf (Seconds)

Plot	Light Wrappers	Medium Wrappers	Light Seconds	Darks	Plot Average	Average of duplicate plots
1	13.7	....	14.5	11.8	13.3	11.2
1+	10.5	9.9	9.6	5.9	9.0	
2	3.0	3.2	3.1	3.1	3.1	3.1
2+	3.3	2.6	3.9	2.7	3.1	
3	12.4	16.0	15.5	9.5	13.4	13.8
3+	17.5	13.9	....	11.2	14.2	
4	2.8	2.4	2.9	2.9	2.8	3.4
4+	5.9	2.8	3.0	....	3.9	
5	3.2	3.4	5.2	3.5	3.8	3.8
5+	3.1	2.9	6.1	2.6	3.7	
6	3.5	3.0	3.9	3.4	3.5	3.6
6+	3.2	4.2	3.7	....	3.7	

Each plot average represents eighty burn tests.

The decidedly harmful effect of chlorine is demonstrated in Table 44 where the average length of burns is recorded on the 1925 crop. While the fire-holding capacity, as determined by leaf tests, was poor throughout the experiment in 1925 the burn was three to four times as great in the no chlorine treatments. At the rates supplied in these tests sulphur and magnesia failed to show any harmful effects on the burn.

SUMMARY

The necessity for including magnesia in the fertilizer mixture is demonstrated by these data. This is of special importance at this time when the trend is toward more concentrated fertilizers.

If magnesia is deficient in the soil and is not supplied in the fertilizer both yield and quality of cured leaf may be greatly lowered.

The amount of magnesia taken up by the plant is influenced by the amount applied to the soil.

Both chlorine and magnesia increased the yields to some extent in these tests.

The treatments do not show any great differences in quality, although the poorest quality resulted from the control plots where no magnesia, sulphur or chlorine were supplied in the fertilizer.

Chlorine almost destroyed the fire-holding capacity of the cured leaf in these tests. Sulphur or magnesia failed to show any harmful effects on the burn at the rates supplied.

BULLETIN 300 JANUARY, 1929

Connecticut Agricultural Experiment Station
New Haven, Connecticut

THE COMPOSITION OF SOME COMMERCIAL INSECTICIDES, FUNGICIDES, BACTERICIDES, RODENTICIDES AND WEED KILLERS

A COMPILATION

H. J. FISHER AND E. M. BAILEY

Press of The Wilson H. Lee Co., New Haven, Conn.

The Composition of Some Commercial Insecticides, Fungicides, Bactericides, Rodenticides and Weed Killers. A Compilation.

H. J. Fisher and E. M. Bailey.

Frequent requests for information as to the composition of commercial insecticides, fungicides and similar materials suggested the desirability of assembling the data on this subject to be found not only in various bulletins of this station but in those of institutions in other States where similar work is carried on. Designed at first for our own convenience, it was later felt that the information would be useful also to others interested. No pretense is made that the compilation is complete, but it is, at least, fairly comprehensive. For the most part the data were obtained from regular or special bulletins submitted by experiment stations or other state departments in response to our request for information on this subject. If any important sources of information are omitted it is because our requests were not referred to, or did not reach, the proper authorities.

In the case of insecticides which are definite compounds, sold under their own or well recognized names, such as arsenate of lead, Paris green, sulphur, etc., the publication of very old analyses did not seem to be warranted, and only those analyses reported from 1918 to the present are included in this index. In the case of products sold under proprietary names which do not make their composition readily evident, all analyses found are included however long ago they may have been published.

Only one analysis is given for each product except in those cases where different analyses have shown widely different composition. In such cases several analyses are included. An attempt was made to insert the latest analysis found in each case. When the latest publication found containing analyses of a certain insecticide or other product has given several analyses of that product, the figures in the index are usually averages.

It should be noted that the percentages given under "guaranteed" in the index represent maximum amounts in the case of water, inert matter and water-soluble arsenic, while the guaranties for other constituents are usually stated by the manufacturers as "not less than" the amount specified.

The index is arranged in alphabetical order by names of the products. Names beginning with arabic numerals are indexed as they would be if the numeral were spelled, - i.e., "20" is listed under "T". Certain common classes of insecticides are grouped together in tables alphabetically by the names of the manufacturers, but they are also cross-indexed by the names of the brands. An exception to this rule is made in the case of arsenate of calcium, arsenate of lead, Bordeaux mixture, lime-sulphur, London purple, Paris green and sulphur, which will not be found listed separately by the brand names, but only under the tables for these respective classes of insecticides.

Reference is made after each analysis to the source from which it was obtained. Some of the analyses are those made at this Station and not previously published. After such analyses the sample number and "Conn. Agr. Expt. Sta." is given in place of a publication reference.

No responsibility is assumed for the correctness of any analyses other than those made by this Station.

The following publications were abstracted:

California Department of Agriculture, Special Publications 34 (1923); 51 (1925); 58 (1925); 66 (1926); 75 (1927).

Canada Laboratory of the Inland Revenue Department, Bulletins 158 (1908); 205 (1910); 284 (1914); 303 (1915); Department of Agriculture, Division of Chemistry, Report of the Dominion Chemist (1928).

Colorado Sixteenth Annual Report of State Entomologist, Circular 47 (1925).

Connecticut Agricultural Experiment Station, Bulletins 157 (1907); 242 (1922); 258 (1924); 272 (1925).

Maine Agricultural Experiment Station, Bulletin 154 (1908); Official Inspections 110 (1923); 114 (1924); 118 (1925); 122 (1926); 126 (1927).

Michigan Agricultural College Experiment Station, Special Bulletin 74 (1915).

New Jersey Agricultural Experiment Stations, Bulletins 214 (1908); 222 (1909); 262 (1913); 273 (1914); 286 (1915); 301 (1916); 407 (1924); 424 (1925); 441 (1926); 459 (1927).

New York Agricultural Experiment Station, Bulletin 348 (1912); 384 (1914).

North Dakota Office of the State Food Commissioner and Chemist, Bulletin 17 (1927).

Oregon Agricultural College Experiment Station, Circular 64 (1925); 84 (1927)

Pennsylvania Department of Agriculture, Bureau of Chemistry, Bulletins 166 (1910); 192 (1909).

University of California College of Agriculture, Agricultural Experiment Station Bulletin 151 (1903).

U. S. Department of Agriculture, Bureau of Chemistry, Bulletin 68 (1902).

U. S. Department of Agriculture, Department Bulletin 1439 (1926).

U. S. Department of Agriculture Farmers' Bulletin 146 (1902).

A

Ace-Hy.

(GENERAL CHEMICAL CO., NEW YORK, N. Y.)

Guaranteed: Inert matter (water), not more than 40 per cent.

Found: The preparation is an emulsion in which a cyanide, equivalent to 2.29 grams CN per 100 cc was the chief active ingredient detected. The ash, 3.58 per cent, consisted chiefly of iron and copper oxides. Water and volatile matter (at 100° C), made up 77.3 per cent of the material.—*Conn. Agr. Expt. Sta. Bull.* 242, 161 (1922).

Acid Carbolic.

See "Phenol."

Acid Hydrocyanic.

See "Hydrocyanic Acid."

Acme Garden Guard.

(ACME WHITE LEAD & COLOR WORKS, DETROIT, MICH.)

	Guaranteed.	Found.
Copper	....	1.77
Total arsenic, metal	1.70	1.98
Water-soluble arsenic, metal	0.25	0.50
Copper aceto-arsenite	4.50	....
"Copper of bordo"	0.50	....
Sulphur	4.00	3.90

Cal. Dept. Agr., Spec. Pub. 75, 44 (1927).

Acme Sheep and Cattle Dip.

See "Phenol-Soap Solutions."

Acme 2-way Spray.

See "Bordeaux Mixture—Lead Arsenate."

Acto.

See "Oils, Mineral."

Adheso Green Label.

(ANSBACHER INSECTICIDE CO., INC., NEW YORK, N. Y.)

	Guaranteed.	Found.
Moisture	....	58.39
Total arsenic, metal	5.50	5.56
Water-soluble arsenic, metal	0.50	0.05
Copper	4.00	4.15

N. J. Agr. Expt. Sta., Bull. 459, 10 (1927).

Adheso 7 O-Blue Dust.

(ANSBACHER INSECTICIDE CO., INC., NEW YORK, N. Y.)

	Guaranteed.	Found.
Copper	7.00	7.25

N. J. Agr. Expt. Sta., Bull. 459, 10 (1927).

Adheso-Yellow Label.

See "Concentrated Adheso."

A D S Rat and Roach Paste.

See "Phosphorus Preparations."

Aero Brand Hydrocyanic Acid.

See "Hydrocyanic Acid."

Aero Rodent Exterminator.

See "Calcium Cyanide."

Agricultural Sulphur Compound.

(TOYAH VALLEY SULPHUR CO., NEW ORLEANS, LA.)

Found: Sulphur 21.50 per cent.—*N. J. Agr. Expt. Sta., Bull.* 441, 7 (1926).

Agri-Pax.

(PAX MFG. CO., NEW YORK, N. Y.)

Declared: "A contact spray insecticide based on the extract of pyrethrum. Inert material water 77 per cent."

Found: Chloroform extract 20.54 per cent; fatty acids 18.83 per cent; moisture 74.2 per cent. Calculated composition: soap 21.37 per cent; pyrethrum extract 1.71 per cent; moisture 74.2 per cent; undetermined 2.72 per cent.—*Conn. Agr. Expt. Sta.*, Sample 9305.

Albatross Puritol.

(GENERAL BASIC PRODUCTS CO.)

	Guaranteed.	Found.
Active Ingredients:	3.00	....
Oils	....	1.20
Phenols	....	0.40
Inert Ingredients:		
Whiting	91.50	90.50
Glue	5.00	5.40
Volatile at 100° C.	0.50	1.50

Cal. Dept. Agr., Spec. Pub. 75, 66 (1927).

Alcopol Oil.

Aleph Oil

See "Oils, Mineral."

Alhambra Nico-Soap.

See "Nicotine Soaps."

Alhambra Spray.

See "Oil Emulsions, Mineral."

Allan's Lightning Roach Paste.

See "Phosphorus Preparations."

Allen's Kilto, Paste.

(W. A. ALLEN, PITTSTOWN, N. J)

	Guaranteed.	Found.
Moisture	....	55.17
Total arsenic, metal	6.52	4.73
Water-soluble arsenic, metal	0.50	0.08
Copper	4.00	5.02

N. J. Agr. Expt. Sta., Bull. 441, 10 (1926).

All in One.

See "Niagara All in One" and "No. 6 All in One Dust."

Altair Oil.

See "Oils, Mineral."

American Jazz Spray.

See "Oil Emulsions, Mineral."

Ammonia Spray.

(BEAR AMMONIA CO., RIVERSIDE, CAL.)

Found: Moisture 18.33 per cent; sodium carbonate 63.50 per cent; sodium chloride 3.20 per cent; soap 12.85 per cent; calcium carbonate 2.09 per cent.—*Cal. Dept. Agr., Spec. Pub.* 51, 58 (1925).

Anchor Brand Hellebore.

See "Hellebore."

An-Fo Disinfectant.

(AN-FO MFG. CO., OAKLAND, CAL.)

See "Phenol-Soap Solutions."

An-Fo Louse Powder.

(ANIMAL FOOD CO., OAKLAND, CAL.)

Not chemically analyzed.—*Cal. Dept. Agr., Spec. Pub.* 58, 48 (1925).

An-Fo Nicotine Spray.

(AN-FO MFG. CO., OAKLAND, CAL.)

See "Nicotine Soaps."

An-Fo Round Worm Capsules.

(AN-FO MFG. CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Nicotine	15.00	16.36

Cal. Dept. Agr., Spec. Pub. 66, 26 (1926).

An-Fo Sheep Dip.

See "Phenol-Soap Solutions."

Ansbor Green.

(ANSBACHER INSECTICIDE CO., INC., NEW YORK, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	12.50	16.14
Water-soluble arsenic, metal	3.00	0.27
Copper	....	17.62

N. J Agr. Expt. Sta., Bull. 459, 10 (1927).

Ant Destroyer.

(PETER HENDERSON, NEW YORK, N. Y.)

Found: Borax 54.12 per cent; cane sugar 44.80 per cent.—*U. S. D. A., Bur. Chem., Bull.* 68. 43 (1902).

Ant Eater.

(AN-FO MFG. CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Total arsenic	0.17	0.16

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

Ant Foil Ant Poison.

(AN-FO MFG. CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Arsenious oxide	....	0.16
Arsenic, metal	0.10	0.12

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Anthracine Oil Emulsion.

(THE SHERWIN-WILLIAMS CO., CLEVELAND, OHIO.)

Guaranteed: Anthracene oil 75 per cent; fish oil soap 3 per cent; water 22 per cent.

Found: Total oil 72.63 per cent; water 25.08 per cent; soap and undetermined 2.29 per cent.—*Conn. Agr. Expt. Sta., Bull.* 272, 148 (1925).

Anti-Ant Argentine Ant Poison.

(BRUNSWIG DRUG CO., LOS ANGELES, CAL.)

Guaranteed: Arsenic metal 0.20 per cent.

Found: Arsenious oxide 0.76 per cent; arsenic metal 0.057 per cent; dextrose 45.36 per cent; maltose 5.87 per cent; dextrin 0.54 per cent; moisture 46.61 per cent.—*Cal. Dept. Agr., Spec. Pub.* 58, 16 (1925).

Antiseptic Sheep Dip.

See "Phenol Soap Solutions."

Ant Poison.

(ALDERMAN CO., INC., PASADENA, CAL.)

Found: Arsenious oxide 0.19 per cent; arsenic metal 0.14 per cent.—*Cal. Dept. Agr., Spec. Pub.* 58, 16 (1925).

Antrol Argentine Ant Syrup.

(ANTROL LABORATORIES, INC., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Arsenic, metal	0.10	0.12

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

Ant Syrup.

(SMALLS SEED CO., RIVERSIDE, CAL.)

	Guaranteed.	Found.
Arsenic, metal	0.10	0.17

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

A-1 Dust Mixture.

See "Nicotine Dusts."

Aphid Spray.

(RADIUM SPECIALTIES MFG. CO., SAN FRANCISCO, CAL.)

Found: Light rosin oil 95.4 per cent; water 4.6 per cent.—*Cal. Dept. Agr., Spec. Pub.* 34, 58 (1923).

Aphine.

(APHINE MFG. CO., MADISON, N. J.)

Guaranteed: Nicotine 0.90 per cent.

Found: Nicotine 1.07 per cent. Cedar and pine oils and potassium hydroxide present.—*N. J. Agr. Expt. Sta., Bull.* 407, 10 (1924)—*N. Y. Agr. Expt. Sta., Bull.* 384, 301 (1914).

Aphis Getter.

(WALNUT CREEK SPRAY CO., WALNUT CREEK, CAL.)

	Guaranteed.	Found.
Water	92.00	69.20

Cal. Dept. Agr., Spec. Pub. 66, 36 (1926).

Aphistrogen.

(CHEMICAL PRODUCTS DIVISION, ROSE MFG. CO., PHILADELPHIA. PA.)

Guaranteed: $C_{35}H_{46}O_{10}$ about ¾-1 per cent; "trioxymethaline" about ¾-1 per cent; available nitrogen about 0.4 per cent; "inert remedial substances" about 94 per cent. "Aphistrogen is the active glucoside content of a vegetable substance. Aphistrogen being highly concentrated goes 60 times farther than the amount you pay for. Aphistrogen is prepared after the famous Rosenbluth formula, combined with a fertilizer as used with unprecedented success at the nationally known Rose Gardens at Wallingford, Pa."

Found: The preparation is a soap emulsion. Total nitrogen 0.14 per cent; water 80.9 per cent; formaldehyde recovered by steam distillation 0.05 per cent.—*Conn. Agr. Expt. Sta.*, Sample 9306.

Apricot Oil.

See "Oil Emulsions, Mineral."

Arcol.

See "Phenol Soap Solutions."

Arctic Whale Oil Soap.

See "Soaps."

Argentine Ant Poison.

(COFFIN-REDINGTON CO., SAN FRANCISCO, CAL.)

Guaranteed: Arsenious oxide 0.20 per cent; arsenic metal 0.15 per cent.

Found: Arsenious oxide 0.26 per cent; arsenic metal 0.20 per cent; invert sugar 10.79 per cent; cane sugar 17.47 per cent; dextrin, etc., 11.53 per cent. water 59.94 per cent.—*Cal. Dept. Agr., Spec. Pub.* 58, 16 (1925).

Argentine Ant Poison

(FEDERAL DRUG CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Arsenious oxide	....	0.11
Arsenic, metal	0.25	0.08

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Argentine Ant Poison.

(C. W. HILL CHEMICAL CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Total arsenic, metal	0.10	0.097
Water-soluble arsenic, metal	0.10	0.097

Cal. Dept. Agr., Spec. Pub. 34, 18 (1923).

Argentine Ant Poison.

(LOS ANGELES CHEMICAL CO., LOS ANGELES, CAL.)

Guaranteed: Arsenic metal 0.10 per cent.

Found: Arsenious oxide 0.13 per cent; arsenic metal 0.099 per cent; invert sugar 8.64 per cent; cane sugar 39.66 per cent; dextrin, etc. 0.21 per cent; water 51.64 per cent.—*Cal. Dept. Agr., Spec. Pub.* 58, 17 (1925).

Argentine Ant Poison.

(PHILIP & PHILIP, OAKLAND, CAL.)

	Guaranteed.	Found.
Arsenious oxide	....	0.16
Arsenic, metal	0.11	0.12

Cal. Dept. Agr., Spec. Pub. 58, 17 (1925).

Argentine Ant Poision.

(ROSE WATERMAN DRUG CO.)

	Guaranteed.	Found.
Arsenious oxide	....	0.20
Arsenic, metal	0.20	0.15

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Argentine Ant Poison.

(TOWNE ALLISON DRUG CO., SAN BERNARDINO, CAL.)

Found: Total arsenious oxide 0.60 per cent; water-soluble arsenious oxide 0.60 per cent.—*Cal. Dept. Agr., Spec. Pub.* 34, 18 (1923).

Argentine Ant Poison.

(WEBB & SEWARD, PASADENA, CAL.)

	Guaranteed.	Found.
Arsenious oxide	....	0.09
Arsenic, metal	0.20	0.07

Cal. Dept. Agr., Spec. Pub. 58, 17 (1925)

Argo Ant Poison.

(BOWMAN DRUG. CO.)

	Guaranteed.	Found.
Arsenic, metal	0.11	0.15

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

A. R. M. Liquid Lice Killer.

(ARTHUR R. MAAS CHEMICAL CO.)

Guaranteed: Water 5.00 per cent.
Found: Phenols 14.50 per cent; coal-tar oils 84.80 per cent; water 0.40 per cent.—*Cal. Dept. Agr., Spec. Pub.* 75, 56 (1927).

Arsenate of Calcium. Arsenate of Lead.

See Tables I and II.

Arsenate of Barium.

See "White Arsenoid."

Arsenite of Lead.

See "Pink Arsenoid."

Arsenite of Zinc.

See Table III.

Arsenoid, Pink.

See "Pink Arsenoid."

Arsenoid, Soluble.

See "Watson."

Arsenoid White.

See "White Arsenoid."

Arsite.

(MORRIS HERRMANN & CO., NEW YORK, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	28.8	31.05
Water-soluble arsenic, metal	28.8	31.05

Mich. Agr. College, Expt. Sta., Spec., Bull. 74, 10 (1915).

At-Ko Brand Sheep Dip.

See "Phenol Soap Solutions."

Atlas "A" Weed Killer.

(CHIPMAN CHEMICAL CO., NEW YORK, N. Y.)

Guaranteed: Sodium arsenite 45 per cent.
Found: Total arsenic metal 23.67 per cent; sodium arsenite (Na_2HAsO_3) 53.64 per cent.—*Conn. Agr. Expt. Sta., Bull.* 272, 149 (1925).

Atlas Weed Killer.

(CHIPMAN CHEMICAL ENGINEERING CO., INC. NEW YORK, N. Y.)

Found: Sodium chlorate 19.22 per cent; sodium chloride 18.73 per cent; water 57.59 per cent.—*Cal. Dept. Agr., Spec. Pub.* 75, 65 (1927).

Avenarius Carbolineum.

(CARBOLINEUM WOOD PRESERVING CO.)

	Guaranteed.	Found.
Water	1.50	1.43
Carbon	0.50	0.97

Cal. Dept. Agr., Spec. Pub. 75, 65 (1927).

Avon Brown Neutral.

See "Oils, Mineral."

Axfixo.

See "Nicotine Dusts."

B.

B. A. Cartridges.

See "Key Brand B. A. Cartridges."

Bacili-Kil.

See "B-K Bacili-Kil."

Barium Arsenite.

See "White Arsenoid."

TABLE I. ARSENATE OF CALCIUM.

Manufacturer or Distributor and Brand	Arsenic Oxide, As_2O_5				Calcium Arsenate, $Ca_3(AsO_4)_2$	Publication
	Total.		Water-soluble			
	Guaranteed	Found	Guaranteed	Found		
Ansbacher Insecticide Co., Inc., New York, N. Y.	39.87	41.79	1.53	0.31	72.39	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).
Apothecaries Hall Co., Waterbury, Conn.	39.87	38.89	1.15	0.67	67.34	Maine Agr. Expt. Sta., Official Inspection 126, 84 (1927).
Joseph Beech, Boston, Mass.	39.87	41.58	1.15	0.15	72.02	Maine Agr. Expt. Sta., Official Inspections 114, 86 (1924).
Bowker Chemical Co., New York, N. Y. Bowker's Calcide	39.87	41.17	1.15	0.24	71.30	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).
Chipman Chemical Engineering Co., Inc., New York, N. Y.	39.87	41.92	0.75	0.57	72.60	N. J. Agr. Expt. Sta., Bull. 407, 8 (1924).
Deloro Chemical Co., Deloro, Ont., Canada	....	44.06	....	0.08	....	Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).
Dow Chemical Co., Midland, Mich. Dow	40.00	39.89	0.75	0.54	69.01	Cal. Dept. Agr., Spec. Pub. 75, 21 (1927).
General Chemical Co., New York, N. Y. Orchard	41.00	41.86	0.75	0.52	72.42	Cal. Dept. Agr., Spec. Pub. 75, 21 (1927).
The Glidden Co., Reading, Pa.	45.84	41.51	1.53	2.41	71.89	N. J. Agr. Expt. Sta., Bull. 407, 8 (1924).
Interstate Chemical Co., Jersey City, N. J. Key	39.87	42.03	1.15	0.18	72.79	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).
Leggett & Bro., Inc., New York, N. Y. Anchor	39.87	42.76	1.15	0.61	74.05	N. J. Agr. Expt. Sta., Bull. 424, 9 (1925).
John Lucas & Co., Inc., Philadelphia, Pa.	39.87	40.97	1.15	0.43	70.95	N. J. Agr. Expt. Sta., Bull. 424, 9 (1925).
Lucas-Kil-Tone Co., Vineland, N. J., Green Cross	39.87	40.61	0.77	0.21	70.32	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).
Manufacturer unknown	20.14	....	....	0.82	....	Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).
Mechling Bros. Chemical Co., Camden, N. J.	39.87	39.10	1.00	0.12	67.72	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).
Michel & Pelton Co., San Francisco, Cal.	40.00	43.47	1.15	0.69	75.20	Cal. Dept. Agr., Spec. Pub. 75, 21 (1927).
National Chemical Co. of California, El Centro, Cal. Flag	40.00	41.53	0.77	0.43	71.85	Cal. Dept. Agr., Spec. Pub. 75, 21 (1927).
Niagara Sprayer Co., Middleport, N. Y. Niagara	40.00	41.04	0.77	0.49	70.99	Cal. Dept. Agr., Spec. Pub. 75, 21 (1927).
Nitrate Agencies Co., New York, N. Y. Naco	40.02	42.76	0.75	0.74	74.05	N. J. Agr. Expt. Sta., Bull. 424, 9 (1925).
Pittsburgh Plate Glass Co., Newark, N. J. Corona Calsenate	40.00	40.71	1.15	0.46	70.42	Cal. Dept. Agr., Spec. Pub. 75, 21 (1927).
Riches, Piver & Co., New York, N. Y. Ceres	39.87	44.70	1.15	0.72	77.42	N. J. Agr. Expt. Sta., Bull. 424, 9 (1925).
Sherwin-Williams Co., Cleveland, Ohio.	40.00	41.49	0.77	0.44	71.78	Cal. Dept. Agr., Spec. Pub. 75, 22 (1927).
Vreeland Chemical Mfg. Co., Little Falls, N. J. Electro	39.87	42.33	1.15	0.06	73.30	N. J. Agr. Expt. Sta., Bull. 441, 6 (1926).
Western Wholesale Drug Co., Los Angeles, Cal. Devoe	40.00	41.01	0.77	1.66	70.95	Cal. Dept. Agr., Spec. Pub. 75, 22 (1927).

Table II. Arsenate of Lead

Manufacturer or Distributor and Brand	Water		Arsenic Oxide, As_2O_5				Lead Oxide, PbO		Publication
			Total		Water-Soluble				
	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	
	%	%	%	%	%	%	%	%	
Acme White Lead & Color Works, Detroit, Mich. Acme	....	....	30.00	33.12	1.00	0.14	....	63.65	Conn. Agr. Expt. Sta., Bull. 242, 151 (1922).
Ansbacher Insecticide Co., New York, N. Y.	....	....	30.00	32.22	1.00	0.59	....	65.16	N. J. Agr. Expt. Sta., Bull. 459, 5 (1927).
The James Blanchard Co., New York, N. Y.	....	....	....	30.80	....	0.23	....	66.90	Ore. Agr. Expt. Sta., Cir. 64, 8 (1925).
Bowker Insecticide Co., Boston, Mass. Bowker's	50.00	49.45	15.00	15.60	0.60	0.09	....	32.37	Conn. Agr. Expt. Sta., Bull. 272, 145 (1925).
Bowker Insecticide Co., Boston, Mass. Bowker's	....	....	30.00	30.59	0.77	0.38	....	66.31	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
California Rex Spray Co., Benicia, Cal. NuRexform	....	....	30.00	31.51	0.77	0.45	....	64.50	Cal. Dept. Agr., Spec. Pub. 75, 14 (1927).
California Rex Spray Co., Benicia, Cal. Rex Basic	....	....	22.00	22.23	0.77	0.21	....	74.93	Cal. Dept. Agr., Spec. Pub. 75, 17 (1927).
California Rex Spray Co., Benicia, Cal. Rex Neutral Dry	....	....	24.00	32.77	0.77	0.46	....	64.70	Cal. Dept. Agr., Spec. Pub. 66, 16 (1926).
California Spray Chemical Co., Watsonville, Cal. Ortho Spray Basic	....	....	22.00	22.62	....	0.12	....	75.19	Cal. Dept. Agr., Spec. Pub. 75, 17 (1927).
California Spray Chemical Co. Watsonville, Cal. Ortho Spray Standard	....	....	30.00	31.97	....	0.23	....	65.25	Cal. Dept. Agr., Spec. Pub. 75, 14 (1927).
Chipman Chemical Engineering Co., New York, N. Y. Chipman	....	....	30.00	31.00	1.07	0.21	....	63.95	Conn. Agr. Expt. Sta., Bull. 272, 145 (1925).
Corona Chemical Co., Milwaukee, Wis. Corona Dry	....	....	30.00	32.20	0.77	0.18	....	64.25	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
Deloro Chemical Co., Deloro, Ont., Canada	....	0.28	....	31.71	....	0.08	....	64.80	Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).
Detroit White Lead Works, Detroit, Mich. Rogers	....	....	30.00	31.51	1.00	0.18	....	63.23	Conn. Agr. Expt. Sta., Bul. 242, 150 (1922).
Devoe & Raynolds Co., Inc., New York, N. Y. Devoe Standard	....	....	31.00	32.66	1.00	0.97	63.00	63.65	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
John Dorland, Cobalt, Ont., Canada[1]	....	....	....	....	....	....	....	....	Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).
The Dow Chemical Co., Midland, Mich. Dow	....	....	30.00	31.59	0.99	0.72	....	64.03	Cal. Dept. Agr., Spec. Pub. 75, 14 (1927).
General Chemical Co., New York, N. Y. Orchard	....	....	30.00	31.74	1.50	0.18	....	65.07	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
General Chemical Co., New York, N. Y. Orchard Basic	....	....	22.00	22.35	0.38	0.18	....	72.73	Cal. Dept. Agr., Spec. Pub. 75, 17 (1927).
General Chemical Co., New York, N. Y. Orchard Paste	....	51.00	15.00	15.48	0.38	0.17	....	31.16	Cal. Dept. Agr., Spec. Pub. 75, 14 (1927).
General Chemical Co., New York, N. Y. Orchard Tri Plumbic	....	....	25.00	26.80	0.38	0.34	....	69.90	Cal. Dept. Agr., Spec. Pub. 75, 20 (1927).
General Chemical Co., New York, N. Y. Orchard Tri Plumbic, Paste	52.00	52.93	12.50	12.99	0.38	0.31	....	33.51	Cal. Dept. Agr., Spec. Pub. 66, 16 (1926).
The Glidden Co., Cleveland, Ohio. Glidden	....	....	31.00	31.97	0.77	0.44	....	63.46	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
The Grasselli Chemical Co., New York, N. Y. Grasselli	....	....	31.00	31.00	1.15	0.16	....	62.65	Conn. Agr. Expt. Sta., Bull. 272, 145 (1925)
The Grasselli Chemical Co., New York, N. Y. Basic Powder	....	....	23.00	23.57	0.75	0.17	....	74.10	Cal. Dept. Agr., Spec. Pub. 66, 16 (1926).
The Grasselli Chemical Co., Cleveland, Ohio. Grasselli Paste	50.00	43.73	15.00	17.80	0.50	0.29	....	36.47	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
C. W. Hill Chemical Co., Los Angeles, Cal. Mission	....	0.18	....	31.28	....	0.33	....	64.84	Cal. Dept. Agr., Spec. Pub. 34, 15 (1922).
Interstate Chemical Co., Jersey City, N. J. Key-Dry	....	....	30.00	30.88	0.75	0.23	....	63.18	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922) and Bull. 272, 145 (1925).
Interstate Chemical Co., Jersey City, N. J. Key Brand Paste	....	....	15.50	17.04	....	0.60	....	35.16	N. J. Agr. Expt. Sta., Bull. 424, 8 (1925).
The Kil-Tone Co., Vineland, N. J.	....	....	30.00	30.24	1.15	0.18	....	63.55	Conn. Agr. Expt. Sta., Bull. 272, 145 (1925).

[1]Found to be ground gypsum.

TABLE II. ARSENATE OF LEAD—*Concluded.*

Manufacturer or Distributor and Brand	Water		Arsenic Oxide, As_2O_5				Lead Oxide, PbO		Publication
			Total		Water-Soluble				
	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	
	%	%	%	%	%	%	%	%	
Latimer-Goodwin Chemical Co., Latimer	....	....	28.38	30.94	0.77	0.32	....	64.07	Cal. Dept. Agr., Spec. Pub. 75, 15 (1927).
Leggett & Bro., New York, N. Y.	50.00	44.23	14.00	18.03	0.75	0.11	30.00	36.43	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
Leggett & Bro., New York, N. Y.	....	....	30.00	32.66	1.00	0.28	61.00	64.50	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
John Lucas & Co., Inc., Philadelphia, Pa.	....	....	30.00	32.31	1.15	0.40	....	64.40	Cal. Dept. Agr., Spec. Pub. 75, 15 (1927).
Lucas Kil-Tone Co., Vineland, N. J. Green Cross	....	....	30.00	30.30	1.01	0.58	....	66.25	Cal. Dept. Agr., Spec. Pub. 75, 20 (1927).
R. G. Maxtone-Graham, Berkeley, Cal.	....	0.40	....	30.38	....	0.38	....	63.50	Cal. Dept. Agr., Spec. Pub. 34, 15 (1922).
Mechling Bros. Chemical Co., Camden, N. J. Paste and Water	....	68.28	10.00	9.89	0.75	0.07	....	20.94	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).
Mechling Bros. Chemical Co., Camden, N. J. Powder	....	....	31.00	31.80	0.75	0.21	....	65.20	N. J. Agr. Expt. Sta., Bull. 459, 5 (1927).
Merrimac Chemical Co., Boston, Mass. Swift's	50.00	50.43	12.50	14.61	0.75	0.26	31.50	33.48	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
Montgomery Ward & Co., Portland, Ore.	....	....	30.00	31.50	1.00	0.20	63.00	65.10	Ore. Agr. Expt. Sta., Cir. 84, 8 (1927).
National Chemical Co., Pittsburg, Pa. Flag	....	....	30.00	31.39	0.77	0.27	....	64.26	Cal. Dept. Agr., Spec. Pub. 75, 15 (1927).
National Chemical Co., Pittsburg, Pa. Flag Basic	....	....	22.00	22.16	0.77	0.11	....	74.36	Cal. Dept. Agr., Spec. Pub. 75, 18 (1927).
Niagara Sprayer Co., Middleport, N. Y. Niagara	....	....	30.00	31.54	1.15	0.18	....	64.35	Conn. Agr. Expt. Sta., Bull. 272, 145 (1925).
Niagara Sprayer Co., Middleport, N. Y. Niagara Basic	....	....	22.00	22.52	0.77	0.11	....	75.28	Cal. Dept. Agr., Spec. Pub. 75, 18 (1927).
Niagara Sprayer Co., Middleport, N. Y. No. 1 Niagara Entodust	....	....	30.00	31.17	0.77	0.29	....	66.20	Cal. Dept. Agr., Spec. Pub. 75, 15 (1927).
Nitrate Agencies Co., New York, N. Y. Naco	....	....	30.00	30.59	1.53	1.10	62.00	65.50	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
The Oderberg Chemical Works, Ltd., Oderberg, Czechoslovakia	....	....	....	27.06	....	2.16	....	59.96	Conn. Agr. Expt. Sta., Sample 420.
Pittsburgh Plate Glass Co., Newark N. J. Corona Dry	....	....	....	31.86	....	0.14	....	65.65	Conn. Agr. Expt. Sta., Bull. 272, 145 (1925).
Powers-Weightman-Rosengarten Co., Philadelphia, Pa.	....	....	30.00	32.78	2.30	0.77	....	64.59	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922).
Riches, Piver & Co., New York, N. Y.	50.00	35.17	15.00	20.02	0.50	0.18	31.00	41.80	Conn. Agr. Expt. Sta., Bull. 272, 145 (1925).
Riches, Piver & Co., New York, N. Y. R. P. & Co	....	0.12	30.00	30.80	1.53	1.20	62.00	64.61	Cal. Dept. Agr., Spec. Pub. 51, 15 (1925).
Schiefelin & Co., New York, N. Y. Powder	....	....	30.00	31.93	1.00	0.20	....	63.50	N. J. Agr. Expt. Sta., Bull. 441, 6 (1926).
W. M. Sheldon, Vacaville, Cal.	....	0.21	30.00	30.00	1.00	0.29	....	63.50	Cal. Dept. Agr., Spec. Pub. 34, 15 (1922.)
The Sherwin-Williams Co., Cleveland, Ohio. Sherwin-Williams	....	....	30.00	31.46	1.00	0.23	....	64.48	Conn. Agr. Expt. Sta., Bull. 242, 150 (1922) and Bull. 272, 145 (1925).
The Sherwin-Williams Co., Cleveland, Ohio. Sherwin-Williams, Basic	....	....	....	21.95	0.77	0.13	....	73.38	Cal. Dept. Agr., Spec. Pub. 75, 19 (1927).
D. B. Smith & Co., Utica, N. Y. Lightening	....	....	30.00	31.05	0.77	0.18	....	63.30	Conn. Agr. Expt. Sta., Bull. 272, 145 (1925).
Standard Chemical Works, Reading, Pa. Standard	....	....	31.00	32.86	0.46	0.22	....	64.47	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).
Toledo Rex Spray Co., Toledo, Ohio. Rex	....	....	15.00	17.45	1.15	0.73	....	34.20	N. J. Agr. Expt. Sta., Bull. 424, 8 (1925).
U. S. Smelting, Refining & Mining Co., Redding, Cal.	....	0.20	30.00	32.95	0.75	0.36	63.00	63.45	Cal. Dept. Agr., Spec. Pub. 34, 15 (1922).
Vreeland Chemical Mfg. Co., Little Falls, N. Y. Electro	....	....	30.00	30.24	0.77	0.18	....	64.40	Conn. Agr. Expt. Sta., Bull. 272, 145 (1925).

Table III. Arsenite of Zinc

Manufacturer or Distributor and Brand	Arsenic, Metal: Total, Guaranteed	Arsenic, Metal: Total, Found	Arsenic, Metal: Water-Soluble, Guaranteed	Arsenic, Metal: Water-Soluble, Found	Publication
	%	%	%	%	
California Spray Chemical Co., Watsonville, Cal. Ortho	30.31	30.75	0.38	0.07	Cal. Dept. Agr., Spec. Pub. 34, 16 (1923).
General Chemical Co., New York, N. Y. Orchard	30.50	32.03	1.00	0.24	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).
Interstate Chemical Co., Jersey City, N. J. Key	30.00	31.44	1.00	0.20	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).
The Kil-Tone Co., Vineland, N. J. Dry Powdered	29.00	30.80	0.75	0.20	N. J. Agr. Expt. Sta., Bull. 407, 13 (1924).
Lucas Kil-Tone Co., Vineland, N. J. Green Cross	28.40	29.98	0.75	0.16	N. J. Agr. Expt. Sta., Bull. 459, 6 (1927).

Barium Tetrasulphide.

B. T. S. Manufacturer not stated. *Cal. Dept. Agr., Spec. Pub.* 34,34 (1923).

Orchard Brand B. T. S. General Chemical Co., San Francisco, Cal. *Cal. Dept. Agr., Spec. Pub.* 34, 34 (1923).

Solbar. The Bayer Co., New York, N. Y. *Conn. Agr. Expt. Sta., Bull.* 258, 371 (1924).

Analyses:	**B.T.S.**	**Orchard Brand B.T.S.**		**Solbar.**
	Found.	Guaranteed.	Found.	Found.
WATER-SOLUBLE.				
Total	96.10	....	58.95	59.58
Sulphide sulphur	40.05	....	29.10	15.04
Thiosulphate	3.50	....	1.42	2.55
Total sulphur	43.80	....	30.52	17.59
Barium	....	....	....	43.42
Barium sulphide	....	38-44	57.38	....
Barium thiosulphate	....	1-4	5.54	....
WATER-INSOLUBLE.				
Total	....	....	40.51	....
Silica (S_1O_2)	....	....	9.77	....
Iron and Aluminum Oxide ($Fe_2O_3+Al_2O_3$)	....	....	1.98	....
Ferrous sulphide (FeS)	....	....	0.15	....
Barium sulphite ($BaSO_3$)	....	....	1.01	....
Barium sulphate ($BaSO_4$)	....	....	7.60	....
Free sulphur (S)	....	....	13.61	....
Barium oxide (BaO)	....	....	6.39	....
Carbon dioxide, carbon, etc.	....	....	traces	....
Total sulphur	....	....	....	6.13
Total barium	....	....	....	9.35

Barnes Worm Emulsion.[1]

(S. O. BARNES & SON).

	Guaranteed.	Found.	Guaranteed.	Found.
Water	50.00	94.00	94.00	93.60

Cal. Dept. Agr., Spec. Pub. 75, 64 (1927).

Bayer Dipdust.

Guaranteed: Hydroxymercurichlorphenol sulphate 6.00 per cent; hydroxymercurinitrophenol sulphate 2.00 per cent.

Found: Mercury 5.17 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 62 (1927).

Bean's Bug-Go; Crude.

See "Oil Emulsions, Mineral."

Beck's Flea Powder.

(CHAS. H. BECK MFG. CO., LOS ANGELES, CAL.)

Guaranteed: Talc. 17.50 per cent.

Found: Ash 10.43 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).

Beetle Mort.

See "Green Cross".

[1] Two grades.

Be-Health.

(GENERAL LABORATORIES, MADISON, WIS.)

Guaranteed: Active ingredients 8.50 per cent; inert matter 91.50 per cent.

Found: (grams per 100 cc.) Available chlorine 3.77; total chlorine 3.81; sodium hypochlorite 3.96. Trace of sulphate, no calcium.—*Conn. Agr. Expt. Sta., Bull.* 258, 376 (1924).

Bejo Orchard Spray.

See "Oil Emulsions, Mineral."

B-K Bacili-Kil.

(GENERAL LABORATORIES, MADISON, WIS.)

Guaranteed: Inert matter; calcium chloride 1.71 per cent; water 89.64 per cent.

Found: Available chlorine 3.20 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).

Black Death.

(BLACK DEATH CO., BINGHAMTON, N. Y.)

Found: Carbon 17.11 per cent; sand 5.86 per cent; moisture 10.18 per cent; carbon dioxide 12.39 per cent; sulphur trioxide 23.15 per cent; arsenic trioxide 0.97 per cent; cupric oxide 0.59 per cent; ferric oxide 0.46 per cent; calcium oxide 24.97 per cent; magnesium oxide 5.03 per cent.—*U. S. D. A., Bur. Chem., Bull.* 68, 28 (1902).

Black Leaf 40.

See "Nicotine Sulphate Solutions."

Black Leaf F-2 Nicotine Dust.

See "Nicotine Dusts."

Bleaching Water.

See "Wescco."

Bleach-It.

(GILT EDGE PACKING CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Available chlorine	4.00	4.99

Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).

Bliss's Bedbug Exterminator.

(FRANK BLISS, ST. LOUIS, MO.)

Found: Borax 20.00 per cent; ether extract 6.79 per cent. A mixture of borax and pyrethrum.— *U. S. D. A., Bur. Chem., Bull.* 68, 43 (1902).

Bliss's Cockroach Exterminator.

(FRANK BLISS, ST. LOUIS, CHICAGO AND CINCINNATI.)

Found: Borax 81.89 per cent. The balance is pyrethrum and pink coloring matter.— *U. S. D. A., Bur. Chem., Bull.* 68, 43 (1902).

Blue Dust.

See "Adheso" and "Sanders."

Blue Label Tonicide.

(MORRIS HERRMANN & CO., NEW YORK, N. Y.)

	Guaranteed.	Found.
Water	....	57.25
Total arsenic, metal	3.70	5.48
Water-soluble arsenic, metal	0.25	0.15
Lead oxide	....	13.51
Copper oxide	....	5.65

N. J. Agr. Expt. Sta., Bull. 301, 13 (1916).

Blue Ribbon Orchard Spray.

See "Oil Emulsions, Mineral."

Borco.

See "Bordeaux Mixture."

Bordeaux Cal-Arsenate, Powdered.

(RICHES, PIVER & CO., NEW YORK, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	15.00	16.07
Water-soluble arsenic, metal	0.50	0.18
Copper	5.00	4.99

N. J. Agr. Expt. Sta., Bull. 286, 13 (1915).

Bordeaux Dust with Poison.

(MECHLING BROS. CHEMICAL CO., CAMDEN, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	6.00	7.46
Water-soluble arsenic, metal	1.00	0.20
Copper	6.00	7.50

N. J. Agr. Expt. Sta., Bull. 459, 12 (1927).

Bordeaux-Green Powder.

(ANSBACHER INSECTICIDE CO., NEW YORK, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	11.00	13.82
Water-soluble arsenic, metal	2.25	2.06
Copper	16.00	19.44

N. J. Agr. Expt. Sta., Bull. 286, 11 (1915).

Bordeaux Mixture.

See Table IV.

Bordeaux Mixture—Lead Arsenate.

Tee Table V.

Bordeaux-Paris Green.

(LIGGETT & BRO., NEW YORK, N. Y.)

(See also "Naco-Bordeaux-Paris Green.")

	Guaranteed	Found.
Copper oxide, CuO	17.50	17.37
Total arsenious oxide, As_2O_3	16.50	17.69
Water-soluble arsenious oxide, As_2O_3	2.64	2.72

Conn. Agr. Expt. Sta., Bull. 242, 153 (1922).

Table IV. Bordeaux Mixture

Manufacturer or Distributor and Brand	Copper		Calcium Hydroxide—Found	Calcium Carbonate—Found	Inert Calcium Compounds—Guaranteed	Publication
	Guaranteed	Found				
	%	%	%	%	%	
Acme White Lead & Color Works, Detroit, Mich. Acme	12.75	12.72	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).
Ansbacher Insecticide Co., Inc., New York, N. Y.	16.00	16.27	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 7 (1927).
James A. Blanchard Co., New York, N. Y. Lion	11.00	14.43	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 21 (1925).
Bowker Chemical Co., New York, N. Y.	13.00	12.73	....	....	....	N. J. Agr. Expt. Sta., Bull. 441, 7 (1927).
California Rex Spray Co., Benicia, Cal. Borco	17.00	19.63	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).
California Rex Spray Co., Benicia, Cal. Rex Bordeaux Materials Package 1	25.00	26.06	....	....	....	Cal. Dept. Agr., Spec. Pub. 66, 20 (1926).
California Rex Spray Co., Benicia, Cal. Rex Bordeaux Materials Package No. 2	....	....	91.91	4.30	....	Cal. Dept. Agr., Spec. Pub. 66, 20 (1926).
California Rex Spray Co., Benicia, Cal. Rex Bordeaux Powder	12.75	13.08	....	....	....	Cal. Dept. Agr., Spec. Pub. 66, 20 (1926).
California Spray Chemical Co., Watsonville, Cal. Ortho	12.75	13.58	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).
Chipman Chemical Engineering Co., Bound Brook, N. J.	12.50	12.50	....	....	....	Ore. Agr. Expt. Sta., Cir. 84, 12 (1927).
Devoe & Raynolds, New York, N. Y.	18.00	11.15	....	....	....	Ore. Agr. Expt. Sta., Cir. 84, 12 (1927).
Dow Chemical Co., Midland, Mich. Dow Powdered Magnesium Bordo	25.00	24.99	....	....	75.00	Cal. Dept. Agr., Spec. Pub. 34, 22 (1922).
E-Z Way Co., Oakland, Cal. E-Z Burgundy	15.30	11.86	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 21 (1925).
F. A. Frazier Co., Pt. Richmond, Cal. Dosch Copper Lime Dust	3.50	4.48	....	....	90.00	Cal. Dept. Agr., Spec. Pub. 34, 23 (1922).
F. A. Frazier Co., Pt. Richmond, Cal. Dosch Copper Lime Dust	2.54	2.84	....	....	90.00	Cal. Dept. Agr., Spec. Pub. 34, 23 (1922).
F. A. Frazier Co., Pt. Richmond, Cal. Frazier's Bordo "A"	24.00	24.49	....	....	....	*Cal. Dept. Agr., Spec. Pub. 58, 21 (1925).*
F. A. Frazier Co., Pt. Richmond, Cal. Frazier's Bordo "A"	24.50	24.64	....	....	....	*Cal. Dept. Agr., Spec. Pub. 58, 21 (1925).*
F. A. Frazier Co., Pt. Richmond, Cal. Frazier's Bordo "B"	....	....	93.96	....	....	Cal. Dept. Agr., Spec. Pub. 58, 21 (1925).
General Chemical Co., New York, N. Y. Orchard	12.50	12.31	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).
The Glidden Co., Cleveland, Ohio. Glidden	16.00	15.24	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 22 (1925).
The Glidden Co., Cleveland, Ohio. Glidden Dry Powdered	22.00	18.85	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 22 (1925).
The Grasselli Chemical Co., Cleveland, Ohio	13.00	14.78	....	....	....	Conn. Agr. Expt. Sta., Bull. 242, 153 (1922).
Hammond's Paint & Slug Shot Works, Beacon, N. Y. Pulp[1]	5.50	4.15	....	....	....	N. J. Agr. Expt. Sta., Bull. 441, 7 (1926).
Hood River Spray Co., Hood River, Ore[2]	24.00	24.60	....	....	....	Ore. Agr. Expt. Sta., Cir. 84, 12 (1927).
J. H. Howell, Planada, Cal. Dried Bordeaux Paste	....	19.80	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 23 (1922).
Interstate Chemical Co., Jersey City, N. J. Key	12.50	14.58	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 7 (1927).
The Kil-Tone Co., Vineland, N. J. Modified Kil-Tone[3]	8.00	11.91	....	....	....	N. J. Agr. Expt. Sta., Bull. 407, 9 (1924).
The Kil-Tone Co., Vineland, N. J. Modified Kil-Tone, Dry Form	22.50	23.20	....	....	....	N. J. Agr. Expt. Sta., Bull. 407, 9 (1924).
Kirk, Geary & Co., Sacramento, Cal. Paste[4]	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 19 (1925).
Leggett & Bro., New York, N. Y. Anchor[5]	4.50	4.79	....	....	....	Conn. Agr. Expt. Sta., Bull. 242, 153 (1922).
John Lucas & Co., Inc., Philadelphia, Pa. Bordo Mixture Dry Powder 25%	25.00	27.14	....	....	....	N. J. Agr. Expt. Sta., Bull. 407, 9 (1924).
John Lucas & Co., Inc., Philadelphia, Pa. Lucas Dry Powdered[4]	16.00	15.84	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).
Lucas-Kil-Tone Co., Vineland, N. J. Green Cross	21.50	21.28	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 7 (1927).
Lucas-Kil-Tone Co., Vineland, N. J. Green Cross Dry Bordo	22.00	25.44	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 7 (1927).
Mechling Bros. Chemical Co., Camden, N. J.	12.50	12.73	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 7 (1927).
Mechling Bros. Chemical Co., Camden, N. J. Powder	16.00	17.80	....	....	....	N. J. Agr. Expt. Sta., Bull. 441, 7 (1926).
Miller Products Co., Portland, Ore.[2]	24.00	25.20	....	....	....	Lre. Agr. Expt. Sta., Cir. 84, 12 (1927).
Montgomery, Ward & Co., Portland, Ore	14.00	12.50	....	....	....	Ore. Agr. Expt. Sta., Cir. 84, 12 (1927).
National Chemical Co., Pittsburg, Pa. National Bordo "A"	24.00	24.90	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).

[1] 68.64% water.

[2] A two powder preparation. One package contains partially dehydrated copper sulphate, the other hydrated lime. Copper is reported as found in the copper sulphate package.

[3] 50.71% water.

[4] Decomposed.

[5] 58.03% water.

TABLE IV. BORDEAUX MIXTURE—*Concluded.*

Manufacturer or Distributor and Brand	Copper		Calcium Hydroxide—Found	Calcium Carbonate—Found	Inert Calcium Compounds—Guaranteed	Publication
	Guaranteed	Found				
	%	%	%	%	%	
National Chemical Co., Pittsburg, Pa. National Bordo "B"	....	....	93.70[6]	....	....	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).
Chas. C. Navlet Co., Inc., San Jose, Cal. Navco Powder	12.75	10.79	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 22 (1925).
Chas. C. Navlet Co., Inc., San Jose, Cal. Navco Home-made Bordeaux	24.00	24.35	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 22 (1925).
Chas. C. Navlet Co., Inc., San Jose, Cal. Navco Home-mixed Bordeaux Package No. 1	24.00	24.26	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 22 (1925).
Chas. C. Navlet Co., Inc., San Jose, Cal. Navco Home-mixed Bordeaux Package No. 2	....	....	93.91	....	....	Cal. Dept. Agr., Spec. Pub. 58, 22 (1925).
Nitrate Agencies Co., Bayonne, N. J.	13.00	14.14	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 7 (1927).
Pittsburgh Plate Glass Co., Newark, N. J. Corona Dry	18.00	20.34	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).
Riches, Piver & Co., New York, N. Y.	15.00	17.50	....	....	....	N. J. Agr. Expt. Sta., Bull. 407, 9 (1924).
San Jose Spray Mfg. Co., San Jose, Cal.	12.75	11.51	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 22 (1925).
San Jose Spray Mfg. Co., San Jose, Cal. Twin Bordeaux, Package 1	24.00	25.09	....	....	....	Cal. Dept. Agr., Spec. Pub. 66, 20 (1926).
San Jose Spray Mfg. Co., San Jose, Cal. Twin Bordeaux, Package 2	....	....	....	83.32	12.70	Cal. Dept. Agr., Spec. Pub. 66, 20 (1926).
Sherwin-Williams Co., Cleveland, Ohio. Fungi-Bordo	12.75	12.90	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).
Sherwin-Williams Co., Cleveland, Ohio. Hemmingway Dry	12.75	13.13	....	....	....	Cal. Dept. Agr., Spec. Pub. 66, 20 (1926).
Sterling Chemical Co., Cambridge, Mass. Sterlingworth	10.00	11.96	....	....	....	Conn. Agr. Expt. Sta., Bull. 242, 153 (1922).
Vreeland Chemical Mfg. Co., Little Falls, N. J. Electro	18.00	19.78	....	....	....	N. J. Agr. Expt. Sta., Bull. 424, 9 (1925).

[6] Includes casein spreader. Guaranteed hydrated lime with casein spreader, 100 per cent.

Bordeaux Zinc.

(THOMSEN CHEMICAL CO., BALTIMORE, MD.)

	Guaranteed.	Found.
Water	....	53.02
Total arsenic, metal	7.63	7.53
Water-soluble arsenic, metal	0.57	0.08
Copper	4.50	4.57

N. J. Agr. Expt. Sta., Bull. 286, 13 (1915).

Bordeth.

(KILTONE CO., NEWARK, N. J.)

	Guaranteed.	Found.
Total arsenic oxide	20.00	18.01
Water-soluble arsenic oxide	1.00	0.28
Copper hydroxide	15.00	15.44

N. J. Agr. Expt. Sta., Bull. 273, 12 (1914).

Borecide.

(MASON DRUG & CHEMICAL CO., HANCOCK, MD).

Found: Ash 58.14 per cent; loss on ignition 41.86 per cent; insoluble in boiling water 65.35 per cent; melting-point of sublimate, 31.0° C. The substance had the odor of naphthalene, and the sublimate combined with picric acid, but the melting-point was nearer that of methyl naphthalene.—*Conn. Agr. Expt. Sta., Bull.* 242, 160 (1924).

Boxal.

(BOWKER INSECTICIDE CO., BOSTON, MASS.)

Found: Copper 12.08 per cent; arsenious oxide 13.52 per cent.—*N. Y. Agr. Expt. Sta., Bull.* 384, 289 (1914).

Brazilian Insecticide Powder.

(I. MAJORA CO. ALA MARA, BRAZIL.)

Found: Borax 8.84 per cent; sodium carbonate 37.52 per cent; sulphur 13.57 per cent. Balance pyrethrum and ultramarine.— *U. S. D. A., Bur. Chem., Bull.* 68, 43 (1902).

Brininstool's Coal Tar Creosote.

(THE BRININSTOOL CO.)

Found: Oils 94.80 per cent, phenols 3.90 per cent, trace of water and ash, no rosin. Baumé gravity of separated oil, 17.3; per cent unsulphonated oil, 24.60—*Cal. Dept. Agr., Spec. Pub.* 51, 45 (1925).

Brown's Pink Powder Insecticide.

(BROWN'S INSECTICIDE CO., SYRACUSE, N. Y.)

Found: Borax 88.55 per cent. Balance cloves and pink coloring matter.— *U. S. D. A., Bur. Chem., Bull.* 68, 43 (1902).

Brunswig Squirrel Annihilator.

See "Strychnine Preparations".

Bug and Blight Dust.

(LEGGETT & BRO., NEW YORK, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	16.00	16.21
Water-soluble arsenic, metal	3.00	2.25
Copper	6.00	6.44

N. J. Agr. Expt. Sta., Bull. 273, 12 (1914).

TABLE V. BORDEAUX MIXTURE—LEAD ARSENATE

Manufacturer or Distributor and Brand	Arsenic Oxide, As_2O_5				Copper, (Cu)		Lead Oxide, (PbO)		Water	Publication
	Total		Water-Soluble							
	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	Found	
	%	%	%	%	%	%	%	%	%	
Acme White Lead & Color Works, Detroit, Mich. Acme 2-way Spray	4.29	5.11	0.46	0.31	11.00	11.25	....	9.28	....	Cal. Dept. Agr., Spec. Pub. 75, 44 (1927).
Bowker Chemical Co., New York, N. Y. Bowker's Dry Powdered Bordeaux Arsenate	7.96	8.11	0.77	0.41	15.00	14.62	....	....	....	N. J. Agr. Expt. Sta., Bull. 407, 12 (1924).
Bowker Chemical Co., New York, N. Y. Pyrox	5.00	5.57	0.46	0.06	....	6.70	....	1.28	65.95	Conn. Agr. Expt. Sta., Bull. 272, 146 (1925).
California Sprayer Co. Calispray Dust No. 86	13.46	13.92	1.15	0.44	3.80	4.45	....	27.67	....	Cal. Dept. Agr., Spec. Pub. 75, 44 (1927).
Chipman Chemical & Engineering Co., New York, N. Y. Bordo-Lead	7.29	8.73	0.38	0.18	....	16.47	....	15.24	....	Conn. Agr. Expt. Sta., Bull. 272, 146 (1925).
General Chemical Co., New York, N. Y. Orchard Bordeaux Lead	9.37	10.25	1.50	0.06	15.00	15.95	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 10 (1927).
The Glidden Co., Cleveland, Ohio, Glidden Bordo-Arsenate	15.50	17.54	0.50	0.20	....	9.32	....	31.71	....	Conn. Agr. Expt. Sta., Bull. 242, 154 (1922).
The Glidden Co., Cleveland, Ohio. Glidden Bordo-Arsenate	5.90	14.77	0.50	0.18	....	13.31	....	26.64	....	Conn. Agr. Expt. Sta., Bull. 272, 146 (1925).
Interstate Chemical Co., Jersey City, N. J. Key Bordo-Lead	4.45	6.65	0.77	0.60	....	6.05	....	13.76	60.85	Conn. Agr. Expt. Sta., Bull. 242, 153 (1922).
Interstate Chemical Co., Jersey City, N. J. Key Bordo-Lead	7.67	7.82	0.77	0.09	....	2.99	....	....	60.83	Conn. Agr. Expt. Sta., Bull. 242, 153 (1922).
Interstate Chemical Co., Jersey City, N. J. Key-Cide	4.22	5.75	....	0.18	10.00	10.06	....	9.90	....	Conn. Agr. Expt. Sta., Bull. 242, 158 (1922).

Riches, Piver & Co., New York, N. Y. Ceres Bordeaux-Lead Powdered	5.20	8.02	0.77	0.86	11.59	11.65	....	....	....	N. J. Agr. Expt. Sta., Bull. 424, 16 (1925).
Sherwin-Williams Co., Cleveland, Ohio. Pestroy	4.28	3.52	0.46	0.32	11.00	11.02	....	6.61	....	Cal. Dept. Agr., Spec. Pub. 75, 44 (1927).
Skinner Machinery Co., Dunedin, Fla. Skinner's Arsenate Bordeaux	26.01	28.25	....	0.28	4.00	2.64	....	....	....	N. J. Agr. Expt. Sta., Bull. 407, 16 (1924).
H. J. Smith Co., Utica, N. Y. Hexpo	6.90	8.37	0.50	0.28	....	18.07	....	18.89	....	Conn. Agr. Expt. Sta., Bull. 272, 146 (1925).
H. J. Smith Co., Utica, N. Y. Hexpo	6.88	7.33	0.50	0.57	15.40	19.27	....	14.33	....	Conn. Agr. Expt. Sta., Bull. 242, 158 (1922)
Vreeland Chemical Mfg. Co., New York, N. Y. Bordo-Lead Mixture	5.58	8.91	0.78	0.11	....	2.57	....	18.32	44.23	Conn. Agr. Expt. Sta., Bull. 272, 146 (1925)

Bug Death.

(DANFORTH CHEMICAL CO., LEOMINSTER, MASS.)

	Guaranteed.	Found.
Zinc oxide	47.00	54.15
Lead oxide	5.00	14.11

Conn. Agr. Expt. Sta., Bull. 242, 159 (1922).

Bug Death Alpha.

(DANFORTH CHEMICAL CO., LEOMINSTER, MASS.)

	Guaranteed.	Found.
Nicotine	0.05	trace
Sulphur	20.00	18.20
Zinc oxide	15.00	16.50
Lead oxide	1.00	4.80

Ore. Agr. Expt. Sta., Cir. 84, 11 (1927).

Bug Death Aphis.

(DANFORTH CHEMICAL CO., LEOMINSTER, MASS.)

	Guaranteed.	Found.
Nicotine	0.05	present
Sulphur	20.00	19.29
Zinc oxide	15.00	23.63
Lead oxide	1.00	5.69

Maine Agr. Expt. Sta., Official Inspections 110, 55 (1923).

Bug Dope.

(H. J. SMITH & CO., UTICA, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	0.37	0.62
Water-soluble arsenic, metal	2.70	0.23
Copper	....	0.30

N. J. Agr. Expt. Sta., Bull. 286, 13 (1915).

Buhack Insect Powder.

See "Pyrethrum".

Buker's Sheep Dip.

See "Phenol Soap Solutions".

By-Sul.

(GEO. H. CORSE, JR. & CO., SAN FRANCISCO, CAL.)

Two samples:

Sample 1.

Guaranteed: Carbon disulphide 41.00 per cent; inert matter 52.00 per cent.

Found: Carbon disulphide 37.98 per cent; water 50.82 per cent; calcium carbonate 4.06 per cent; calcium polysulphide 6.06 per cent.

Sample 2.

Guaranteed: Carbon disulphide 41.48 per cent; inert matter 52.59 per cent.

Found: Carbon disulphide 46.20 per cent; water 46.00 per cent; clay and oil 6.18 per cent; calcium polysulphide none.

Cal. Dept. Agr., Spec. Pub. 51, 60 (1925).

Caascu.

(HEMINGWAY & CO., INC., BOUND BROOK, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	16.00	18.23
Water-soluble arsenic, metal	4.00	0.12
Copper	....	7.73

N. J. Agr. Expt. Sta., Bull. 459, 11 (1927).

Caasen.

(HEMINGWAY LONDON PURPLE CO., LONDON & NEW YORK).

Found: Arsenious oxide 34.13 per cent; copper 8.10 per cent.

N. Y. Agr. Expt. Sta., Bull. 384, 301 (1914).

Cabot's Gypsy Moth Creosote.

(SAMUEL CABOT, INC., BOSTON, MASS.)

Guaranteed: Not more than 10 per cent inert matter.

Found: Substance is composed of tarry matter like gas-house wastes. There are no oils present.

Maine Agr. Expt. Sta., Official Inspections 114, 88 (1924).

Calcium Arsenate.

See "Arsenate of Calcium".

Calcium Caseinate.

See Table VI.

Calcium Cyanide.

See Table VII.

Calcium Fluosilicate Compound.

(VICTOR CHEMICAL WORKS, NEW YORK, N. Y.)

Guaranteed: Calcium fluosilicate not less than 15 per cent; inert matter not over 85 per cent.

Found: Phosphorus pentoxide 28.37 per cent; calcium oxide 21.80 per cent; iron and aluminum oxides 20.60 per cent; silica 11.00 per cent; fluorine 11.95 per cent.

Conn. Agr. Expt. Sta., Bull. 272, 149 (1925).

Calco-Green.

(Manufacturer not stated).

Found: Total arsenious oxide 30.0 per cent; water-soluble arsenious oxide 7.0 per cent.

Univ. of Cal., Coll. of Agr., Expt. Sta., Bull. 151, 24 (1903).

Calcyco Braun Gas.

Calcyco Hydrocyanic Acid.

See "Hydrocyanic Acid".

California C & G Brand Bleaching Water.

(CALIFORNIA BLEACHING WATER CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Available chlorine	4.00	5.17

Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).

TABLE VI—CALCIUM CASEINATE

Manufacturer or Distributor and Brand	Nitrogen	Casein N x 6.38	Calcium Oxide CaO	Publication
	%	%	%	
California Central Creameries, San Francisco, Cal. Kayso	3.28	20.93	46.29	Conn. Agr. Expt. Sta., Bull. 258, 369 (1924); 272, 149 (1925).
Casein Mfg. Co., New York, N. Y. A-7-ML	7.92	50.53	27.27	Conn. Agr. Expt. Sta., Bull. 258, 369 (1924).
Rosin & Co., Philadelphia, Pa. Red Diamond	3.31	21.12	50.64	Conn. Agr. Expt. Sta., Bull. 258, 369 (1924).

TRBLE VII. CALCIUM CYANIDE

Manufacturer or Distributor and Brand	Cyanogen, CN		Calcium, Ca.	Chlorine, Cl.	Calcium Cyanide, $Ca(CN)_2$		Publication
	Guaranteed	Found			Guaranteed	Found	
	%	%	%	%	%	%	
American Cyanamid Co., New York, N. Y. G Grade	40.00	40.30	....	....	....	71.35	N. J. Agr. Expt. Sta., Bull. 424, 12 (1925).
American Cyanamid Co., New York, N. Y. Cyanogas	....	....	....	....	40.00	43.17	Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).
California Cyanide Co., Southgate, Cal. Calcanide Fumigant Grade No. 1	....	....	....	....	88.00	91.73	Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).
California Cyanide Co., Southgate, Cal. Cal-Sy	....	....	....	....	25.00	27.73	Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).
California Cyanide Co., Southgate, Cal. Citrofume Citrus Fumigant	....	....	....	....	53.00	54.30	Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).
L. E. Neville, Los Angeles, Cal. Aero Rodent Exterminator	20.00	23.71	32.77	43.68	....	41.98	Cal. Dept. Agr., Spec. Pub. 34, 57 (1923).

California Spray.

(UNITED STATES SPRAY CO., SAN BERNARDINO, CAL.)

Guaranteed: Inert matter 65.00 per cent.
Found: Oils 29.00 per cent; inert matter 69.00 per cent. Sodium fluoride and rosin present.
Cal. Dept. Agr., Spec. Pub. 34, 37 (1923).

Calispray Combined Insecticide and Fungicide Dust No. 3.

See "Nicotine-Sulphur Dusts".

Calispray Complete Garden Dust No. 83.

(CALIFORNIA SPRAYER CO.)

	Guaranteed.	Found.
Nicotine	1.25	0.85
Total arsenic, metal	1.76	1.69
Water-soluble arsenic, metal	0.50	0.26
Lead oxide	....	8.17
Sulphur	50.00	46.95

Cal. Dept. Agr., Spec. Pub. 75, 38 (1927).

Calispray Dust No. 1.

Calispray Dust No. 2.

See "Nicotine-Sulphur Dusts".

Calispray Dust No. 12.

See "Nicotine Dusts".

Calispray Dust No. 86.

See "Bordeaux Mixture-Lead Arsenate".

Calispray Insecticide Dust No. 11.

Calispray Insecticide Dust No. 15.

See "Nicotine Dusts".

Calispray Insecticide Dust No. 81.[1]

(CALIFORNIA SPRAYER CO.)

	Guaranteed.	Found.	Guaranteed.	Found.
Nicotine	2.00	2.21	2.00	2.28
Total arsenic, metal	3.50	3.39	3.80	4.06
Water-soluble arsenic, metal	0.50	0.18	0.50	0.29
Lead oxide	....	13.87	....	13.02

Cal. Dept. Agr., Spec. Pub. 75, 38 (1927).

Calispray Nico-Dust No. 82

(CALIFORNIA SPRAYER CO.)

	Guaranteed.	Found.
Nicotine	2.50	1.22
Total arsenic, metal	3.50	4.30
Water-soluble arsenic, metal	0.50	0.46
Lead oxide	....	12.76
Copper	5.00	4.85

Cal. Dept. Agr., Spec. Pub. 75, 38 (1927).

[1] Two samples.

Calite.

(MORRIS HERRMANN & CO., NEW YORK, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	11.40	11.55
Water-soluble arsenic, metal	0.5	0.45
Water	....	67.07

Mich. Agr. Coll. Expt. Sta., Spec. Bull. 74, 10 (1915).

Calox.

See "Oil Emulsions, Mineral".

Calpest Garden Dust.

See "Nicotine Dusts".

Calpest Sow Bug Killer.

(CALIFORNIA PEST CONTROL CO., BURLINGAME, CAL.)

Guaranteed: Copper aceto-arsenite, 8.00 per cent.
Found: Arsenious oxide, 11.04 per cent.
Cal. Dept. Agr., Spec. Pub. 75, 26 (1927).

Calpest Summer Spray.

See "Oil Emulsions, Mineral".

Calpest Weed Killer.

(CALIFORNIA PEST CONTROL CO., BURLINGAME, CAL.)

	Guaranteed.	Found.
Arsenious oxide	30.00	31.30

Cal. Dept. Agr., Spec. Pub. 75, 25 (1927).

Calpest Whale Oil Soap.

See "Soaps".

Calpro Ant Syrup.

(THE CALPRO SALES CO., LOS ANGELS CAL.)

	Guaranteed.	Found.
Arsenic, metal	0.10	0.22

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

Cal-Sy.

See "Calcium Cyanide".

Cann's Ant Exterminator.

(ARTHUR CANN CO., SAN JOSE, CAL.

Guaranteed: Inert matter 10.00 per cent.
Found: Phenols 12.20 per cent, inert matter 9.60 per cent. Rosin present.
Cal. Dept. Agr., Spec. Pub. 34, 36 (1923).

Cann's Canco.

See "Phenol Soap Solutions".

Cann's Carco.

(ARTHUR CANN CO., SAN JOSE, CAL.)

Found: Phenols 7.30 per cent. Rosin present.
Cal. Dept. Agr., Spec. Pub. 34, 36 (1923).

Capital Sheep Dip and Cattle Wash.

See "Phenol Soap Solutions".

Capital Squirrel Poison.

See "Strychnine Preparations".

Carboleine, Pratt's.

See "Oil Emulsions, Mineral".

Carbolic Acid.

See "Phenol".

Carbolicide.

See "Hockwald".

Carbolineum.

See "Avenarius Carbolineum".

Carbon Disulphide.

See Table VIII.

Carbon Disulphide Emulsion.

(I. P. THOMAS & SON CO., PHILADELPHIA, PA.)

Found: Carbon Disulphide 68.62 per cent.

Conn. Agr. Expt. Sta., Sample 3893.

Carbo-White Disinfectant.

(R. L. STEVENS BROKERAGE CO., SAN FRANCISCO, CAL.)

Found: Phenols 1.40 per cent; organic matter, partly glue and water, 6.50 per cent; mineral matter, mostly calcium carbonate, 92.10 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 58 (1925).

Carco.

(SUNSET SALES CO., TACOMA, WASH.)

Carco.

(See also "Cann's Carco".)

Claimed phenols, soap and hydrocarbons present.

Ore. Agr. Expt. Sta., Cir. 64, 15 (1925).

Carco Natholeum Dip.

See "Phenol Soap Solutions".

Caustic Soda Arctic Whale Oil Soap.

See "Soaps".

Cedar Blocks.

See "Paradichlorbenzene".

"Cee-Pee-Dee" Carbolized Petroleum Distillate.

See "Oil Emulsions, Mineral".

Cenol Ant Destroyer.

(CENTRAL CITY CHEMICAL CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Sodium fluoride	25.00	30.82
Ash	....	1.00

Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).

TABLE VIII. CARBON DISULPHIDE

Manufacturer or Distributor	Carbon Disulphide, CS_2		Residue on Evaporation	Hydrogen Sulphide	Publication
	Guaranteed	Found			
	%	%	%	%	
Brunswig Drug Co.	99.00	99.56	0.02	none	Cal. Dept. Agr., Spec. Pub. 51, 47 (1925).
Sun Drug Co., Pasadena, Cal.	97.00	98.50	0.02	none	Cal. Dept. Agr., Spec. Pub. 51, 47 (1925).
Herbert F. Dugan, San Francisco, Cal. Kilmol Squirrel-gophene[1]	99.22	99.23	....	....	Cal. Dept. Agr., Spec. Pub. 66, 36 (1926).
Towne-Allison Drug Co., San Bernardino, Cal.	....	99.90	0.09[2]	none	Cal. Dept. Agr., Spec. Pub. 51, 47 (1925).
Western Wholesale Drug Co., Los Angeles, Cal.	97.00	99.94	0.03[3]	none	Cal. Dept. Agr., Spec. Pub. 51, 47 (1925).
Wheeler, Reynolds & Stauffer, San Francisco, Cal.	99.98	99.97	....	none	Cal. Dept. Agr., Spec. Pub. 51, 47 (1925).
Wheeler, Reynolds & Stauffer, San Francisco, Cal.	97.00	97.18	2.25	present	Cal. Dept. Agr., Spec. Pub. 51, 47 (1925).

[1] Free sulphur guaranteed 0.08 per cent; found 0.10 per cent. Irritant chemicals dissolved in oil, guaranteed 0.70 per cent; found 0.67 per cent.

[2] Chiefly ferric oxide.

[3] Guaranteed not more than 3.00 per cent.

Cenol Argentine Ant Poison.

(CENTRAL CITY CHEMICAL CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Arsenic, metal	0.11	0.17

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

Cespi Poisoned Barley.

Cespi Poisoned Wheat.

See "Strychnine Preparations".

Cespi Rat Poison.

(SCOTT & GILBERT CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Barium carbonate	95.00	98.06

Cal. Dept., Agr., Spec. Pub. 75, 66 (1927).

Chemco Insect & Germ Destroyer.

See "Oils, Mineral".

Chlorafectant.

(AMERICAN OIL CO., NEW YORK.

	Guaranteed.	Found.
Sodium hypochlorite	4.0	3.55

Conn. Agr. Expt. Sta., Sample 516.

Chloride of Lime.

(GREAT WESTERN ELECTRO CHEMICAL CO.)

Available chlorine	30.00	35.26

(WESTERN WHOLESALE DRUG COMPANY)

	Guaranteed.	Found.
Available chlorine	....	34.30

Cal. Dept. Agr., Spec. Pub. 51, 53 (1925).

Chloro Naptholeum.

(WEST DISINFECTING CO., NEW YORK, N.Y.)

A creosote oil and napthalene soap emulsion.

U. S. D. A., Bur. Chem., Bull. 68, 58 (1902).

Citro-Mulsion.

See "Oil Emulsions, Mineral".

Citrospray.

(CITROSPRAY CHEMICAL CO. LTD., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Total arsenic, metal	4.50	4.31
Water-soluble arsenic, metal	1.00	1.48
Lead oxide	12.50	12.89
Sulphur	20.00	19.17
Sodium oxide	13.00	....
Sodium carbonate	....	27.56
Sodium oleate	16.50	8.20
Sodium phosphate	10.00	7.16
Water	....	19.58
Inert matter	23.50	....

Cal. Dept. Agr., Spec. Pub. 58, 19 (1925).

Citrus Washing Powder.

See "Soaps".

Clay.

(COLLODITE MFG. CO., LOS ANGELES, CAL.)

The clay used in the manufacture of "Collodite" sprays.

Found: Water 9.60 per cent; silica 60.90 per cent; aluminum oxide 19.77 per cent; ferric oxide 1.15 per cent; calcium oxide 0.22 per cent; magnesium oxide 0.57 per cent; sulphur trioxide 0.22 per cent; sodium and potassium oxides 0.77 per cent; water of constitution 6.80 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 61 (1923).

Clensel.

See "Soaps".

Clorox Liquid Cleaning Compound.

(CLOROX CHEMICAL CORPORATION, OAKLAND, CAL.)

	Guaranteed.	Found.
Available chlorine	4.50	5.50

Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).

Clumina.

(L. S. B. A. I., ROME, ITALY).

Found: Free chlorine 0.004 per cent; total chlorine 1.08 per cent.

Cal. Dept. Agr., Spec. Pub. 66, 35 (1926).

C. N.

See "Coro Noleum".

Coal Tar Insecticide Oil.

(SCOTT & GILBERT CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Phenols	40.00	39.00
Coal-tar oils	55.00	59.30
Water	2.00	1.60

Cal. Dept. Agr., Spec. Pub. 75, 56 (1927).

Collodite Arsenical Spray.

(COLLODITE SPRAY MFG. CO., LOS ANGELES, CAL.)

Found: Total arsenic oxide 8.87 per cent; water-soluble arsenic oxide 1.89 per cent. Contains calcium arsenate.

Cal. Dept. Agr., Spec. Pub. 34, 61 (1923).

Collodite Copper Spray.

(COLLODITE MFG. CO., LOS ANGELES, CAL.)

Found: Copper 5.26 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 62 (1923).

Collodite Nicotine Spray.

(COLLODITE MFG. CO., LOS ANGELES, CAL.)

Found: Nicotine 2.93 per cent; sodium carbonate 37.10 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 62 (1923).

Collodite Rosin Paste.

(COLLODITE MFG. CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Water	36.00	29.40

Cal. Dept. Agr., Spec. Pub. 58, 46 (1925).

Collodite Scale Spray.

(COLLODITE MFG. CO., LOS ANGELES, CAL.)

Found: Sodium carbonate 28.19 per cent; soap 4.50 per cent; sulphur 2.16 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 61 (1923).

Collodite Sulfur Spray.

(COLLODITE MFG. CO., LOS ANGELES, CAL.)

Found: Sulphur 25.44 per cent; soda ash large.

Cal. Dept. Agr., Spec. Pub. 34, 26 (1923).

Columbian Insecticide.

(COLUMBIAN INSECTICIDE CO., BOSTON, MASS.)

Found: Borax 94.74 per cent; sand 2.52 per cent; cloves 3.28 per cent. Blue coloring matter present.

U. S. D. A., Bur. Chem., Bull. 68, 43 (1902).

Common Sense Rat Exterminator.

See "Phosphorus Preparations".

Concentrated Adheso Yellow Label.

(ANSBACHER INSECTICIDE CO., INC., NEW YORK, N.Y.)

	Guaranteed.	Found.
Copper	10.38	13.84
Water	....	52.02

N. J. Agr. Expt. Sta., Bull. 441, 10 (1926).

Condensed Rosin Spray.

See "Soap".

Conkey's Noxicide.

See "Phenol Soap Solutions".

Conkey's Poultry Worm Remedy.

(THE G. E. CONKEY CO., CLEVELAND, OHIO.)

Guaranteed: Pelletierine 0.200 per cent; arecoline 0.020 per cent; nicotine 0.100 per cent; oil of chenopodium 0.120 per cent.

Found: Nicotine 0.22 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 65 (1927).

Cooper's Sheep Dipping Powder.

(S. COOPER & NEPHEWS, CHICAGO, ILL.)

	Guaranteed.	Found.
Total arsenic, metal	16.75	14.00
Water-soluble arsenic, metal	17.48	14.18

Maine Agr., Expt. Sta., Official Inspections 114, 88 (1924).

Copodust.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Copper sulphate	14.0	12.0

Ore. Agr. Expt. Sta., Cir. 64, 11 (1925).

Copotex.

See "Niagara Copotox".

Copper-Calcium Arsenate Dust, 13-8-79.

(DORCH CHEMICAL CO., LOUISVILLE, KY.)

	Guaranteed.	Found.
Total arsenic oxide	3.00	1.39
Water-soluble arsenic, metal	0.50	....
Copper	4.40	5.20

Conn. Agr. Expt. Sta., Bull. 242, 152 (1925).

Copper Carbonate.

See Table IX.

Copper Sulphate.

See Table X.

Coreco Argentine Ant Poison.

(COFFIN-REDINGTON CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Arsenic, metal	0.15	0.21

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

Coro Natholeum Dip.

(WEST DISINFECTING CO., SAN FRANCISCO, CAL.)

Found: Phenols 9.00 per cent; water 11.20 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 45 (1925).

Coro Noleum and C. N. Disinfectant.

(WEST DISINFECTING CO., SAN FRANCISCO, CAL.)

Found: Phenols 28.00 per cent; water 8.80 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 44 (1925).

Cot Oil.

See "Oil Emulsions, Mineral".

Coulson's Poultry Spray.

See "Oil Emulsions, Mineral".

County Farm Bureau Mixture.

County Squirrel Poison (Barley).

See "Strcyhnine Preparations".

C. P. Lice and Mite Liquid.

See "Lime-Sulphur".

C. P. Lice and Mite Tablets.

(CHICKEN PHARMACY, PETALUMA, CAL.)

Found: Calcium sulphide 16.13 per cent; silica 7.38 per cent; iron and aluminum oxides 0.14 per cent; gypsum 6.47 per cent; sugar 57.80 per cent; starch 11.63 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 11 (1925).

TABLE IX. COPPER CARBONATE

Manufacturer or Distributor and Brand	Copper, Cu.		Publication
	Guaranteed	Found	
	%	%	
Braun-Knecht-Heimann Co., San Francisco, Cal.	50.00	52.10	Ore. Agr. Expt. Sta., Cir. 84, 12 (1927).
California Spray Chemical Co., Watsonville, Cal. Ortho	51.92	52.40	Cal. Dept. Agr., Spec. Pub. 51, 19 (1925).
Miller Products Co., Portland, Ore.	53.00	55.50	Ore. Agr. Expt. Sta., Cir. 84, 12 (1927).
Montgomery, Ward & Co., Portland, Ore.	54.00	54.00	Ore. Agr. Expt. Sta., Cir. 64, 12 (1925).
The Mountain Copper Co., San Francisco, Cal.	54.00	54.10	Ore. Agr. Expt. Sta., Cir. 84, 12 (1927).
Nichols Copper Co., New York, N.Y.	53.00	54.00	Ore. Agr. Expt. Sta., Cir. 84, 12 (1927).
Pittsburgh Plate Glass Co., Newark, N. J. Corona Copper-carb Dry	18.00	20.09	Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).
Roessler & Hasslacher Chemical Co., New York, N. Y.	53.00	49.30	Ore. Agr. Expt. Sta., Cir. 64, 12 (1925).
San Jose Spray Mfg. Co., San Jose, Cal.	.....	53.30[1]	Cal. Dept. Agr., Spec. Pub. 51, 19 (1925).
Sherwin-Williams Co., Emeryville, Cal.	50.00	51.30	Ore. Agr. Expt. Sta., Cir. 64, 12 (1925).
Wheeler, Reynolds & Stauffer, San Francisco, Cal. Stauffer's	50.00	50.13	Cal. Dept. Agr., Spec. Pub. 58, 22 (1925).

[1] 99.90 per cent passes a 200 mesh sieve.

TABLE X. COPPER SULPHATE

Manufacturer or Distributor and Brand	Copper, Cu.		Copper Sulphate		Publication
	Guaranteed	Found	Guaranteed	Found	
	%	%	%	%	
California Spray Chemical Co., Watsonville, Cal. Ortho Instant Bluestone	23.00	24.41	....	....	Cal. Dept. Agr., Spec. Pub. 66, 20 (1926).
California Spray Chemical Co., Watsonville, Cal. Ortho Powdered Bluestone, Package B.	24.00	23.06	....	....	Cal. Dept. Agr., Spec. Pub. 58, 21 (1925).
Manufacturer unknown. Monohydrated Copper Sulphate[1]	....	....	....	....	Conn. Agr. Expt. Sta., Sample 6913 (1928).
Mountain Copper Co., San Francisco, Cal. Mococo Bluestone	....	25.30	99.00	99.38	Cal. Dept. Agr., Spec. Pub. 66, 20 (1926).
Nichols Copper Co., New York, N. Y.	....	....	25.20	24.90	Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).

[1] 94 per cent passed a 300-mesh sieve.

Edward I. Creeley's Insect Powder.

(ARBURUA & MC INNES, SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Nicotine	0.002	0.04
Naphthalene	3.00	3.20
Sulphur	5.00	5.60
Phenols	1.00	0.40
Pyrethrum	6.00	....

Cal. Dept. Agr., Spec. Pub. 75, 40 (1927).

Creo Fenol Sheep Dip.

See "Phenol Soap Solutions".

Creolineum.

(H. S. FAWCETT, RIVERSIDE, CAL.)

Found: Light oils 17.10 per cent; medium oils 27.20 per cent; heavy oils 49.00 per cent; total oils 93.30 per cent; phenols 2.90 per cent; inert matter 3.80 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 39 (1923).

Creosote.

See "Brininstool".

Creosote Oil.

(AN-FO MFG. CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Phenols	25.00	26.70
Coal-tar oils	....	72.10
Water	10.00	1.20

Cal. Dept. Agr., Spec. Pub. 75, 56 (1927).

Cresol.

(WESTERN WHOLESALE DRUG CO., LOS ANGELES, CAL.)

Found: Phenols 45.30 per cent; water 21.80 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 43 (1925).

Cresolite Sheep Dip.

See "Phenol Soap Solutions".

Crestall Dip.

(BAIRD & MC GUIRE, HOLBROOK, MASS.)

Found: Phenols 51.90 per cent; water 12.40 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 43 (1925).

Cresylic Acid, Pure.

(PURITY CHEMICAL PRODUCTS CO., SANTA ROSA, CAL.)

	Guaranteed.	Found.
Phenols	98.00	96.85
Water	2.00	3.20

Cal. Dept. Agr., Spec. Pub. 75, 56 (1927).

Cresy-Lol.

See "Phenol Soap Solutions".

Crude Oil.

See "Oils, Mineral".

Crude Oil Emulsion.

See "Oil Emulsions, Mineral".

Cut Worm and Grub Destroyer.

(CARPENTER-UDELL CHEM. CO., GRAND RAPIDS, MICH.)

	Guaranteed.	Found.
Arsenic, metal	0.95	0.83

Mich. Agr. Coll. Expt. Sta., Spec. Bull. 75, 9 (1915).

Cyanide-Chloride Marl Dust Mixture.

(J. S. MUNROE, SAN JOSE, CAL.)

Found: Pounds per ton: sodium cyanide, 4.24; sodium chloride 4.7.

Cal. Dept. Agr., Spec. Pub. 34, 57 (1923).

D.

D. C. Dust No. 3

See "Niagara D. C. Dust No. 3".

Dead Shot Squirrel and Gopher Killer.

See "Strychnine Preparations".

Death Dust for Insects.

See "Pyrethrum".

D 18 Dust Mixture.

See "Niagara D 18 Dust Mixture".

De Lapp's Improved Lice Powder.

(W. C. DE LAPP).

	Guaranteed.	Found.
Nicotine	0.10	0.11
Naphthalene	3.00	1.02
Sulphur	15.00	12.40
Phenols	0.50	0.60
Hydrocarbons	7.00	4.20
Sodium Fluoride	7.00	3.44

Cal. Dept. Agr., Spec. Pub. 75, 40 (1927).

Del Monte Bleaching Fluid.

(DEL MONTE BLEACHING FLUID CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Available chlorine	5.00	4.82

Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).

Delousing Grease.

(PETALUMA AVIAN PATHOLOGY, LABORATORY, PETALUMA, CAL.)

	Guaranteed.	Found.
Sodium fluoride	50.00	55.93

Cal. Dept. Agr., Spec. Pub. 75, 62 (1927).

Dendrol.

See "Oils, Mineral".

Derrisol

(WILLIAM COOPER & NEPHEWS, INC., CHICAGO, ILL.)

Guaranteed: Derris extract 5 per cent; fatty acid 50 per cent; inert matter 45 per cent.

Found: Non-volatile chloroform extract 60.45 per cent; water 18 per cent; ash 8.08 per cent; combined fatty acids (calculated from alkalinity of soluble ash) 0.62 per cent. The fatty acids if present must be present in the free form and not as soap.

Conn. Agr. Expt. Sta., Sample 8931.

Derris Root.

(MANUFACTURER UNKNOWN)

Found: Moisture 6.48 per cent; ether extract 8.79 per cent; methoxyl content 14.90 per cent; alcohol extract after ether extraction 14.25 per cent; passing 20 mesh, 100 per cent; 40 mesh, 100 per cent; 60 mesh, 91 per cent; 80 mesh, 79 per cent; 100 mesh, 72 per cent.

Canada Dept. Agr., Div. Chem., Rept., Dominion Chemist (1928).

Destroyer, Argentine Ant Syrup.

(TOWNE-ALLISON DRUG CO., SAN BERNARDINO, CAL.)

Found: Arsenious oxide 0.11 per cent; total arsenic, metal 0.083 per cent; invert sugar 32.10 per cent; cane sugar 20.86 per cent; water 47.25 per cent.

Cal. Dept. Agr., Spec. Pub. 58, 17 (1925).

Destruxol.

(PARAGON CHEMICAL CO.)

	Guaranteed.	Found.
Nicotine	12.00	18.54
Sodium cyanide	8.00	15.67
Carbolic acid	2.00	2.39
Wood creosote oils	20.00	17.27
Water	....	27.36

Cal. Dept. Agr., Spec. Pub. 75, 42 (1927).

Dethol Fly Spray.

(DETHOL MFG. CO., RICHMOND, VA.)

Not analyzed.

Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).

Di-Fli Home Spray.

See "Oils, Mineral".

Dr. Baker's Liquid Death Drops.

(JAMES AINSLIE, BROOKLYN, N.Y.)

Found: The substance is gasoline.

U. S. D. A., Bur. Chem., Bull. 68, 57 (1902).

Dipdust.

See "Bayer Dipdust".

Dips.

See "Phenol Soap Solutions".

Dr. David Robert's Poultry Louse Powder.

(DR. DAVID ROBERTS VETERINARY CO., INC.)

	Guaranteed.	Found.
Nicotine	0.04	0.28
Naphthalene	9.00	9.98
Sulphur	18.00	19.80
Sodium fluoride	5.00	0.54

Cal. Dept. Agr. Spec. Pub. 75, 40 (1927).

Dr. G. Z. Wait's Sheep Dip.

Dr. Hess Dip & Disinfectant.

Dr. Le Gear's Dip & Disinfectant.

See "Phenol Soap Solutions".

Dr. Pierce's Bug Killer.

(THE KELLEY ISLAND LIME & TRANSPORT CO., CLEVELAND, OHIO.)

	Guaranteed.	Found.
Total arsenic (metallic)	0.56	1.33
Water-soluble arsenic (metallic)	0.03	0.30
Copper	....	0.53

N. J. Agr. Expt. Sta., Bull. 286, 13 (1915).

Dormant Dust.

(NIAGARA SPRAYER CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Sodium polysulphide	40.00	22.3

Ore. Agr. Expt. Sta., Cir. 84, 11 (1927).

Dormant Soluble Oil.

See "Oil Emulsions, Mineral".

Dosch B-12 Green Copper Arsenic Dust.

(DOSCH CHEMICAL CO., LOUISVILLE, KY.)

	Guaranteed.	Found.
Copper	5.75	5.79
Arsenic, metal	2.75	3.39

The arsenic is present as calcium arsenate.

Conn. Agr. Expt., Sta., Bull. 258, 370 (1924).

Dosch 85-15 Sulfur-Lead Arsenate.

(DOSCH CHEMICAL CO., LOUISVILLE, KY.)

Found: Moisture 0.50 per cent; free sulphur none; lead oxide 8.60 per cent; arsenic oxide 4.80 per cent; silica 0.50 per cent; sodium sulphate 2.33 per cent; calcium carbonate 0.23 per cent; calcium hydroxide 79.52 per cent; magnesium carbonate 2.41 per cent; iron and aluminum oxides, none.

Cal. Dept. Agr., Spec. Pub. 34, 56 (1923).

Dosch Nicotine-Sulfur Dust.

See "Nicotine-Sulphur Dusts".

Dosch No. 6 Nicotine Dust.

Dosch No. 10 Nico-Dust.

See "Nicotine Dusts".

Dosch Sulfur-Arsenate Dust.

(DOSCH CHEMICAL CO., LOUISVILLE, KY.)

	Guaranteed.	Found.
Sulphur	84.00	84.00
Lead Arsenate	14.70	14.80

Cal. Dept. Agr., Spec. Pub. 34, 56 (1923).

Dosch Tobacco Dust.

See "Tobacco Dusts".

Double Nico-Dust.

Double Nicotine Dust.

See "Nicotine Dusts".

Dry Mix Sulfur-Lime.

(MECHLING BROS. CHEMICAL CO., CAMDEN, N. J.)

See also "New Jersey Dry Mix Sulfur-Lime", and "Niagara Dry Mix."

	Guaranteed.	Found.
Sulphur	62.00	62.80

N. J. Agr. Expt. Sta., Bull. 424, 10 (1925).

D 6 Dust.

See "Niagara D 6 Dust".

D 20 Dust.

See "Niagara D 20 Dust".

D 25 Potato Dust.

See "Niagara D 25 Potato Dust".

Du Pont Semesan, Jr.

(E. J. DU PONT DE NEMOURS & CO., INC., WILMINGTON, DEL.)

Guaranteed: Hydroxymercurichlorphenol 10.00 per cent.
Found: Mercury 6.59 per cent.
Cal. Dept. Agr. Spec. Pub. 75, 62 (1927).

Dustall No. 3.

Dustall No. 6.

Dustall No. 8.

Dustall No. 10.

See "Nicotine Dusts".

Dust Mixture No. 3, Niagara.

See "Nicotine Dusts".

Dust Mixture with Sulphur and Nicotine, Niagara.

See "Nicotine-Sulphur Dusts".

Dyke's Louse Paint.

(RAYMOND & CO., LAWRENCE, KANSAS)

Found: Petroleum, coal-tar, and carbon in suspension.
U. S. D. A., Bur. Chem., Bull. 68, 58 (1902).

E.

Earwig Bait.

(CITY OF PORTLAND, PORTLAND, ORE.)

	Guaranteed.	Found.
Sodium fluoride	4.3	4.9

Ore. Agr. Expt. Sta., Cir. 64, 14 (1925).

Earwig Bait.

(HARDY MFG. CO., PORTLAND, ORE.)

	Guaranteed.	Found.
Sodium fluoride	4.3	4.8

Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).

Earwig Bait.

(MILLER PRODUCTS CO., PORTLAND, ORE.)

	Guaranteed.	Found.
Sodium fluoride	4.3	4.7

Ore. Agr. Expt., Sta., Cir. 64, 14 (1925).

Economy Germicide Dip.

See "Phenol Soap Solutions".

85-15 Dusting Mixture.

80-10-10 Mixture.

See "Nicotine Dusts".

80 Sulphur-20 Lime.

(MECHLING BROS. CHEMICAL CO., CAMDEN, N. J.)

	Guaranteed.	Found.
Sulphur	79.00	77.99

N. J. Agr. Expt. Sta., Bull. 441, 7 (1926).

80-20.

(J. R. GILLAM & BRO., BURLINGTON, N. J.)

	Guaranteed.	Found.
Sulphur	78.00	74.60

N. J. Agr. Expt. Sta., Bull. 441, 7 (1926).

80-20 Mixture.

See "Niagara 80-20 Mixture".

80-20 Sulphur-Lime Dust.

(LUCAS KIL-TONE CO., VINELAND, N. J.)

Guaranteed: Sulphur 80.00 per cent.
Found: Sulphur 76.49 per cent. Fineness: coarser than 100 mesh, 0.80; passes 100 mesh, 99.2; 200 mesh, 77.1; 300 mesh, 24.60.
N. J. Agr. Expt. Sta., Bull. 459, 8 (1927).

80-20 Sulfur-Lime Mixture.

(LUCAS KIL-TONE CO., VINELAND, N. J.)

Guaranteed: Sulphur 80.00 per cent.
Found: Sulphur 77.84 per cent. Fineness: passes 100 mesh, 55.50; 200 mesh, 37.80; 300 mesh, 6.70.
N. J. Agr. Expt. Sta., Bull. 459,8 (1927).

Electric Rat & Roach Paste.

See "Phosphorus Preparations".

Electric Vermin Exterminator.

(F. B. SMITH, CANTON, OHIO.)

Found: Sand 0.69 per cent; carbon dioxide 5.22 per cent; phenol anhydride 2.25 per cent; calcium oxide 58.28 per cent; magnesium oxide 12.77 per cent; water and pink dye, by difference, 20.79 per cent. Material is partially air-slaked lime treated with crude phenol and dyed pink.

U. S. D. A., Bur. Chem., Bull. 68, 51 (1902).

Electro Micro.

(VREELAND CHEMICAL MFG. CO., LITTLE FALLS, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	9.25	10.73
Water-soluble arsenic, metal	0.50	0.08
Sulphur	48.00	46.21

N. J. Agr. Expt. Sta., Bull. 459, 16 (1927).

Electro Micro ½ and ½.

(VREELAND CHEMICAL CO., LITTLE FALLS, N. J.)

	Guaranteed.	Found.
Total arsenic oxide	12.60	14.36
Water-soluble arsenic oxide	0.77	0.57
Lead oxide	....	29.49
Sulphur	32.00	39.71

N. J. Agr. Expt. Sta., Bull. 301, 16 (1916).

Elkay's Rat and Roach Paste.

See "Phosphorus Preparations".

El Roy Argentine Ant Poison.

(ROY SPECIALTY CO.)

	Guaranteed.	Found.
Arsenic, metal	0.20	0.11

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

El Roy Gopher Poison.

See "Strychnine Preparations".

El Vampiro.

(ALLAIRE, WOODWARD & CO.)

Guaranteed: Pyrethrum 75.00 per cent.
Found: Ash 6.98 per cent; organic matter 93.02 per cent.
Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).

E. M. F. Orchard Spray.

Emulso.

See "Oil Emulsions, Mineral".

Entodust.

See "Arsenate of Lead".

Entomocide.

(SACRAMENTO CHEM. CO., SACRAMENTO, CAL.)

Claimed to contain phenol, carbon tetrachloride, oil of citronella and mineral oil.

Ore. Agr. Expt. Sta., Cir. 64, 15 (1925).

Estes's Roach Powder.

(N. T. ESTES & CO., OMAHA, NEB.)

Found: Borax 93.31 per cent; balance is pink coloring matter.

U. S. D., A. Bur. Chem., Bull. 68, 43 (1902).

Exelol.

See "Oil Emulsions, Mineral".

Extermo.

(L. T. GRAVES FERTILIZER CO., PASADENA, CAL.)

Claimed to be both a fertilizer and an insecticide.

Found: Nitrogen 0.18 per cent; phosphoric acid 0.06 per cent; potassium oxide 0.08 per cent; organic matter 62.19 per cent; mineral matter 32.21 per cent; sodium carbonate 4.66 per cent; soap 1.10 per cent; moisture 5.60 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 60 (1923).

E-Z Burgundy.

See "Bordeaux Mixture".

E-Z Spray.

(E-Z WAY CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Sodium polysulphide	33.00	33.62
Sodium thiosulphate	3.00	6.97
Soap	5.00	8.08

Cal. Dept. Agr., Spec. Pub. 58, 34 (1925).

F.

Fancier's Friend.

(JAMES BLANCHARD, NEW YORK, N.Y.)

Found: Moisture 5.03 per cent; ash 7.21 per cent; sulphur 30.77 per cent. Colored with lead chromate. Apparently intended as an imitation of pyrethrum.

U. S. D. A., Bur. Chem., Bull. 68, 53 (1902).

Felbro Whale Oil Soap.

See "Soaps".

Fertilizer and Insect Exterminator.

(MANUFACTURER NOT STATED).

Found: Moisture 7.60 per cent; organic matter 53.60 per cent; ash 39.80 per cent; sodium carbonate 5.30 per cent; nitrogen 0.69 per cent; phosphoric acid none; potassium trace. Probably a mixture of straw and sawdust, limestone, charcoal and ashes.

Cal. Dept. Agr., Spec. Pub. 34, 60 (1923).

Fertilore Soil Stimulant.

(FERTILORE CO., LOS ANGELES, CAL.)

WATER-SOLUBLE	Guaranteed.	Found.
Ferric oxide	23.98	19.25
Aluminum oxide	0.52	0.75
Copper oxide	0.40	1.25
Sulphur trioxide	39.75	25.80
WATER-INSOLUBLE		
Acid-insoluble	8.95	30.15
Ferric oxide	7.64	21.65
Aluminum oxide	0.11	0.50
Sulphur trioxide	6.72	45.93

CALCULATED COMPOSITION

Ferric sulphate	36.64
Copper sulphate	3.92
Aluminum sulphate	5.02
Iron Pyrites	3.50
Silica	9.25

Cal. Dept. Agr., Spec. Pub. 51, 58 (1925).

Fibro-Ferro Feeder.

(FIBRO-FERRO-FEEDER CO., GLENROSE, OHIO.)

Found: Moisture 7.80 per cent; sand 5.56 per cent; sulphur trioxide 22.37 per cent; chloride 7.70 per cent; ferric oxide 16.06 per cent; ferrous oxide 8.06 per cent. The substance is a mixture of organic matter (wood fibers) and partially oxidized ferrous chloride and sulphate.

U. S. D. A., Bur. Chem., Bull. 68, 52 (1902).

Fidelity Cockroach Paste.

See "Phosphorus Preparations".

50-50.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Lead arsenate	48.00	48.10

Ore. Agr. Expt. Sta., Cir. 64, 11 (1925).

Fir-Tree Oil Soap.

Fish Oil.

See "Oil, Fish".

Fish Oil Soap.

See "Soaps".

5 X.

See "Nicotine-Sulphur Dusts".

Flea-Off-Flea Powder.

(OSGOOD DRUG STORES, OAKLAND, CAL.)

Not analyzed.

Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).

Fleck's Lice Exterminator.

(J. J. FLECK, TIFFIN, OHIO.)

Found: Insoluble in hydrochloric acid 4.20 per cent; carbon dioxide 9.56 per cent; sulphur trioxide 1.99 per cent; ferric oxide 1.43 per cent; calcium oxide 31.90 per cent; magnesium oxide 21.61 per cent; volatile matter other than carbon dioxide 29.88 per cent. The substance is a mixture of naphthalene, tobacco, partially air-slaked lime and pink dye.

U. S. D. A., Bur. Chem., Bull. 68, 54 (1902).

Fli-Mo-Cide.

See "Oils, Mineral".

Flit.

(THE STANDARD OIL CO., BAYONNE, N. J.)

Found: Specific gravity, 19° C., 0.810; flash point 60° C.; fire point 69° C.; residue at 100° C., 0.28 per cent; methyl salicylate 0.75 per cent. The base is kerosene.

Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).

Floraferro.

(CALIFORNIA COPPER PRODUCERS TRUST.)

	Guaranteed	Found.
Ferrous sulphate	25.00	29.74
Ferric sulphate	20.00	24.34
Copper sulphate	5.00	5.61

Cal. Dept. Agr., Spec. Pub. 75, 45 (1927).

Floral Nicotine.

See "Nicotine Sulphate Solutions".

Fluoricide.[1]

(NITRATE AGENCIES, BAYONNE, N. J.)

	Guaranteed.	Found.	Guaranteed.	Found.
Fluorine	15.00	15.31	7.00	7.88

Conn. Agr. Expt. Sta., Samples 7506 and 7507.

Fly Croke.

See "Oils, Mineral".

Fly Foil.

Not analyzed.

Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).

Fly-Tox.

(CANADA REX SPRAY CO., BRIGHTON, ONT., CANADA)

(See also "Rex Fly Tox").

Found: Specific gravity, 19°C., 0.830; flash point 66° C.; fire point 78° C.; residue at 100° C., 0.31 per cent; methyl salicylate 3.13 per cent; pyrethrum present. Base is kerosene.

Canada Dept. Agr., Div. Chem. Rept. Dominion Chemist (1928).

Fly X.

See "Sapho Fly X".

[1] Two grades.

Ford's Ant Powder.

(FORD CHEMICAL CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Insect powder	7.00	....
Sodium fluoride	76.00	76.30
Organic matter	....	10.29

Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).

Formaldehyde (Formalin).

TABLE XI. FORMALDEHYDE

Manufacturer or Distributor and Brand	Formaldehyde: Guaranteed	Formaldehyde: Found	Publication
	%	%	
Braun-Knecht-Heimann Co	37.00	36.80	Cal. Dept. Agr., Spec. Pub. 51, 54 (1925).
Minneapolis Drug Co	.....	36.21	North Dakota Bull. 17, 52 (1927).
Noyes Bros. & Cutler	.....	37.22	North Dakota Bull. 17, 52 (1927).
Perth Amboy Chem. Wks., P.A.C.	37.00	36.82	Cal. Dept. Agr., Spec. Pub. 58, 50 (1925).
Perth Amboy Chem. Wks., U. S. P. Solution	37.30	35.60	Cal. Dept. Agr., Spec. Pub. 51, 54 (1925).
Roessler & Hasslacher Chem. Co., New York, N. Y.	37.00	37.70	Ore. Agr. Expt. Sta., Cir. 84, 14 (1927).
Western Wholesale Drug Co., Los Angeles, Cal., U. S. P. Solution	37.30	37.28	Cal. Dept. Agr., Spec. Pub. 51, 54 (1925).

"40" Dust.

(VAYCIDE CHEMICAL CORP., BINGHAMTON, ALA.)

	Guaranteed.	Found.
Total arsenic, metal	1.80	2.33
Water-soluble arsenic, metal	0.75	0.37
Copper	1.05	0.55
Sulphur	25.00	22.73
Nicotine	1.00	0.34

N. J. Agr. Expt. Sta., Bull. 424, 16 (1925).

40% Nicotine Sulphate.

See "Nicotine Sulphate Solutions".

Four and One Spray.

No. 14 Spray Oil.

See "Oils, Mineral."

Frazier's 5X.

See "Nicotine-Sulphur Dusts."

Frazier's Wet-O-Dry Sulphur.

(F. A. FRAZIER CO.)

	Guaranteed.	Found.
Sodium polysulphide	21.00	18.71
Sodium thiosulphate	12.00	13.15
Free sulphur	60.00	61.43

Cal. Dept. Agr., Spec. Pub. 58, 34 (1925).

Frazier's XX Sulphur.

(F. A. FRAZIER CO.)

	Guaranteed.	Found.
Sodium polysulphide	21.00	15.84
Sodium thiosulphate	12.00	10.09
Free sulphur	60.00	69.36
Inert matter	7.00	....

Cal. Dept. Agr., Spec. Pub. 51, 29 (1925).

Free Mulsion.

See "Oil Emulsions, Mineral".

Fresno.

(SCHOONMAKER & SONS, CEDAR HILL, N.Y.)

Found: This is an ammoniacal solution of copper carbonate containing 2.69 per cent. cupric oxide.

N. Y. Agr. Expt. Sta., Bull. 348, 98 (1912).

Fuller's Carbolic Insecticide Sheep Dip.

Fuller's Sheep Dip and Cattle Wash.

See "Phenol Soap Solutions".

Fumigator.

See "Nicotine Dusts."

Fumispray.

See "Oil Emulsions, Mineral".

Fungi-Bordo.

See "Bordeaux Mixture".

Fungine.

(APHINE MFG. CO., MADISON, N. J..

Found: Soluble sulphur 4.95 per cent.

N. Y. Agr. Expt. Sta., Bull. 384, 296 (1914).

Fungtrogen.

(CHEMICAL PRODUCTS DIVISION, ROSE MFG. CO., PHILADELPHIA, PA.)

	Guaranteed.	Found.
Copper	0.47	0.43
Nickel	0.47	0.32
Inert matter	99.06	....

Conn. Agr. Expt. Sta., Sample 9307.

Fungtrogen.

(GERMAIN SEED & PLANT CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Copper	10.00	0.86

Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).

G.

Garden Dust.

(DOSCH CHEMICAL CO., LOUISVILLE, KY.)

	Guaranteed.	Found.
Nicotine	2.00	2.24

A mixture of lead arsenate, sulphur and nicotine.

Conn. Agr. Expt. Sta., Bull. 242, 154 (1922).

Garden Guard.

See "Acme Garden Guard".

Garden Insecticide.

(GEO. H. LEE, OMAHA, NEB.)

Guaranteed: Nicotine, sodium fluoride, sulphur, naphthalene and pyrethrum present.

Found: There is a small deficiency in the sodium fluoride and sulphur.

Ore. Agr. Expt. Sta., Cir. 64, 15 (1925).

Germain Crude Carbolic Acid.

See "Phenol."

Germain Fish Oil Soap.

Germain's Rosin Wash.

See "Soaps".

Germain's Soluble Sulfur Compound.

(GERMAIN SEED & PLANT CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Water-soluble	....	95.85
Polysulphide sulphur	....	37.22
Thiosulphate sulphur	....	13.57
Sulphate and sulphite sulphur	....	0.66
Total sulphur	....	51.45
Sodium polysulphide	56.00	48.95
Sodium thiosulphate	25.00	33.50
Free sulphur	4.00	4.00
Inert matter	15.00	....

Cal. Dept. Agr., Spec. Pub. 34, 32 (1923).

Germo.

See "Oils, Mineral."

Germo Carboline.

See "Phenol Soap Solutions."

Germo Cresolis.

(GERMO MFG. CO., LOS ANGELES, CAL.)

Found: Phenols 56.25 per cent; water 10.00 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 43 (1925).

Germo Cresosote Dip.

See "Phenol Soap Solutions".

Germo Magic Lice Powder.

(GERMO MFG. CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Nicotine	0.40	0.42
Naphthalene	10.00	11.12
Sulphur	20.00	14.16
Phenols	1.83	1.22

Cal. Dept. Agr. Spec. Pub. 75, 40 (1927).

Germo Rat Death.

(GERMO MFG. CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Barium carbonate	96.50	98.50

Cal. Dept. Agr., Spec. Pub. 66, 34 (1926).

Germosol Special Disinfectant.

Germo Sheep Dip.

See "Phenol Soap Solutions."

Germo Worm Powder.

(GERMO MFG. CO., LOS ANGELES, CAL.)

Found: Volatile and organic matter 64.50 per cent; insoluble matter 2.35 per cent; calcium oxide 7.07 per cent; sulphur trioxide 10.81 per cent; ferric oxide 15.30 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 65 (1927).

Getsem Gopher Exterminator.

(RICHERT AND ROYER.)

	Guaranteed.	Found.
Phenols	....	4.40
Water	1.00	trace

Cal. Dept. Agr., Spec. Pub. 75, 56 (1927).

Go-For Gopher.

See "Strychnine Preparations."

Gold Crown Poison.

Gold Crown Poison Barley.

See "Phosphorus Preparations."

Gopher Death.

Gopher-Get-er.

Gopher-Go.

Gopher-Scent.

See "Strychnine Preparations."

Government Formula Argentine Ant Poison.

(F. A. GARDNER & CO., RIVERSIDE, CAL.)

	Guaranteed.	Found.
Arsenious oxide	....	0.17
Total arsenic, metal	0.20	0.13

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Go-West

(M. J. FORSELL & CO., SEATTLE, WASH.)

	Guaranteed.	Found.
Calcium arsenate	5.00	5.40

Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).

Grape Dust.

See "Hammond's Grape Dust."

Grasshopper Poison.

(EXCHANGE ORANGE PRODUCTS CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Arsenious oxide	16.66	16.63
Arsenic, metal	12.00	12.58

(All water-soluble).

Cal. Dept. Agr., Spec. Pub. 34, 21 (1923).

Grasshopper Poison.

(SMITH-FRANK PACKING CO., SACRAMENTO, CAL.)

	Guaranteed.	Found.
Arsenious oxide	10.00	14.41
Arsenic metal	7.50	10.91

(All water-soluble).

Cal. Dept. Agr., Spec. Pub. 34, 21 (1923).

Gray Arsenoid (Calcium and Copper Arsenite).

(ADLER COLOR & CHEMICAL WORKS, NEW YORK, N.Y.

Found: Water 16.10 per cent; combined arsenious oxide 21.24 per cent. soluble arsenious oxide 13.76 per cent; cupric oxide 15.10 per cent; calcium oxide 27.10 per cent; carbon dioxide, Prussian blue, sodium sulphate, etc., 6.70 per cent.

Univ. of Calif., Coll. of Agr., Expt. Sta., Bull. 151, 25 (1903).

Graylawn Farm Louse Chase.

(GRAYLAWN FARMS, INC., NEWPORT, VT.)

Guaranteed: Asagrea officinalis 10 per cent; sulphur 30 per cent; nicotine not less than 0.5 per cent; inert matter 59.50 per cent.

Found: Sulphur 32.21 per cent; nicotine 0.03 per cent; non-volatile alkaloids 1.88 per cent. Sabadilla alkaloids present. Inert matter mostly calcium hydroxide.

Conn. Agr. Expt. Sta., Sample 3432.

Green Arsenoid (Copper Arsenite).

(ADLER COLOR & CHEMICAL WORKS, NEW YORK, N.Y.)

Found: Cupric oxide 28.83 per cent; combined arsenious oxide 53.51 per cent; free arsenious oxide 7.82 per cent; moisture 2.77 per cent; silica 0.40 per cent; organic matter, sodium sulphate, etc. 6.67 per cent. Is dyed with "soluble blue".

Univ. of Calif., Coll. of Agr., Expt. Sta., Bull. 151, 26 (1903).

Green Cross Beetle Mort.

(LUCAS-KIL-TONE CO., VINELAND, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	18.00	18.53
Water-soluble arsenic, metal	1.00	0.12
Copper	5.00	5.90

N. J. Agr. Expt. Sta., Bull. 459, 12 (1927).

Green Cross Copper Lime Dust.

(LUCAS-KIL-TONE CO., VINELAND, N. J.)

Found: Copper 10.99 per cent.

N. J. Agr. Expt. Sta., Bull. 459, 11 (1927).

Green Cross Nico-Tone.

(LUCAS-KIL-TONE CO., VINELAND, N. J.)

	Guaranteed.	Found.
Nicotine	2.75	2.86

N. J. Agr. Expt. Sta., Bull. 459, 7 (1927).

Green Cross P. B. K.

(LUCAS-KIL-TONE CO., VINELAND, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	21.00	20.23
Water-soluble arsenic, metal	1.00	0.16
Copper	6.00	11.72

N. J. Agr. Expt. Sta., Bull. 459, 12 (1927).

Green Cross Sulpho-Arsenate Powder.

(THE KIL-TONE CO., NEWARK, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	10.10	15.39
Water-soluble arsenic, metal	0.66	0.71
Lead oxide	....	33.17
Sulphur	48.00	49.20

N. J. Agr. Expt. Sta., Bull. 301, 14 (1916).

Green Death.

(FARMERS' INDUSTRIAL UNION, SYRACUSE, N. Y.)

Found: The substance is artificially colored calcium arsenite, containing 35.94 per cent arsenious oxide.

N. Y. Agr. Expt. Sta., Bull. 348, 98 (1912).

Green Label Hydroxide Paste.

See "Mechling."

Gregory's Special Ant Syrup.

(GREGORY INSECTICIDE CO., BERKELEY, CAL.)

Guaranteed: Arsenic 2.56 per cent.

Found: Arsenious oxide 1.01 per cent; arsenic metal 0.77 per cent; cane sugar 18.45 per cent; water 77.72 per cent.

Cal. Dept. Agr., Spec. Pub. 58, 16 (1925).

Gregory's Standard Ant Destroyer.

(GREGORY INSECTICIDE CO., BERKELEY, CAL.)

	Guaranteed.	Found.
Invert sugar	2.00	1.57
Cane sugar	38.00	20.78
Water	56.00	76.21
Tartar emetic	....	1.74

Cal. Dept. Agr., Spec. Pub. 58, 18 (1925).

Grub and Canker Worm Exterminator.

(G. H. MORRILL & CO., BOSTON, MASS.)

Found: Linseed oil 87.28 per cent; carbon 11.40 per cent; Prussian blue 1.32 per cent. This substance is printers' ink.

U. S. D. A., Bur. Chem., Bull. 68, 54 (1902).

H.

Hall's Lightning Squirrel and Gopher Poison.

See "Strychnine Preparations".

Hall's Nicotine Sulphate Solution.

See "Nicotine Sulphate Solutions."

Hammond's Copper Solution.

(HAMMOND'S SLUG SHOT WORKS, BEACON, N.Y.)

	Guaranteed.	Found.
Copper	3.05	3.70

N. J. Agr., Expt. Sta., Bull. 441, 11 (1926).

Hammond's Grape Dust.

(HAMMOND'S PAINT & SLUG SHOT WORKS, BEACON, N. Y.)

	Guaranteed.	Found.
Sulphur	64.00	63.87
Cupric oxide	0.7969	0.87
Nicotine	trace	present
Passing 100 mesh sieve	....	98.00
Passing 200 mesh sieve	....	88.00

Cal. Dept. Agr., Spec. Pub. 58, 50 (1925).

Handy Killer.

(RALPH B. ADAMS, LAKEVILLE, N. B., CANADA).

Found: Arsenious oxide 40.67 per cent. A strongly alkaline solution of sodium arsenite with a slight residue of iron oxide.

Canada Dept., Agr., Div. Chem., Rept. Dominion Chemist (1928).

He-Bo.

(STERLING CHEMICAL CO., CAMBRIDGE, MASS.)

	Guaranteed.	Found.
Barium carbonate	36.00	34.41
Total arsenic, metal	2.00	1.35
Water-soluble arsenic, metal	0.30	0.12

Conn. Agr., Expt. Sta., Bull. 242, 159 (1922).

Heine's Liquid Insect Destroyer and Disinfectant.

(HEINE CHEMICAL CO., HOLLIS, L. I.)

Found: The substance is a mixture of turpentine and kerosene.

U. S. D. A., Bur. Chem., Bull. 68, 57 (1902).

TABLE XII. HELLEBORE

Manufacturer or Distributor and Brand	Total Ash	Acid-Insoluble Ash	Alkaloids		Nitrogen	Publication
			Guaranteed	Found		
	%	%	%	%	%	
J. L. Hopkins & Co., New York, N. Y. White Hellebore Root	11.83	6.97	0.79	1.07	1.21	Conn. Agr. Expt. Sta., Bull. 242, 156 (1922).
Interstate Chemical Co., Jersey City, N. J. Key	10.56	5.03	0.25	1.43	1.29	Conn. Agr. Expt. Sta., Bull. 242, 156 (1922).
Leggett & Bro., New York, N. Y. Anchor	7.50	3.23	0.20	1.26	1.59	Conn. Agr. Expt. Sta., Bull. 242, 156 (1922).
Lehn & Fink, New York, N. Y.[1]	....	....	....	....	....	Ore. Agr. Expt. Sta., Cir. 64, 15 (1925).
S. B. Penick & Co., New York, N. Y. Hellebore Root	9.25	5.40	1.14	1.27	....	Conn. Agr. Expt. Sta., Bull. 242, 156 (1922).
S. B. Penick & Co., New York, N. Y. Hellebore Root	4.46	1.05	1.00	2.70	1.48	Conn. Agr. Expt. Sta., Bull. 242, 156 (1922).

[1] Guaranteed to contain the alkaloids of powdered hellebore. Not analyzed.

Herbicide.

(READE MFG. CO., JERSEY CITY, N. J.)

Found: Solids 31.09 per cent; arsenious oxide 24.30 per cent; sodium arsenite ($NaAsO_2$), 31.90 per cent. A green alkaline solution.

Conn. Agr. Expt. Sta., Bull. 258, 376 (1924).

Herbicide (Concentrate) Arsenic.

(STRAUSS-LASHER LABORATORIES, LOS ANGELES, CAL.)

Found: Baumé gravity 50.40 ; arsenious oxide none; arsenic oxide 43.99 per cent. The preparation is a solution of arsenic acid.

Cal. Dept. Agr., Spec. Pub. 51, 17 (1925).

Hercules Carbolic Acid.

See "Phenol."

Herold Poultry Worm Capsules.

	Guaranteed.	Found.
Nicotine	15.00	15.05

Cal. Dept. Agr., Spec. Pub. 75, 35 (1927).

Hexol.

(SANITARY SUPPLY CO., SAN FRANCISCO, CAL.)

Guaranteed: Water 20.00 per cent.

Found: Soap 14.20 per cent; oils 61.80 per cent; water 23.40 per cent. Probably a pine oil preparation.

Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).

Hexpo.

See "Bordeaux Mixture-Lead Arsenate."

Hirschey's Ant Control.

(HIRSCHEY'S ANT CONTROL)

Found: Arsenic 0.04 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

Hirschey's P. D. Q. Argentine Ant Solution.

(HIRSCHEY'S ANT CONTROL).

	Guaranteed.	Found.
Arsenic, metal	0.05	0.04

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Hockwald's Carbolicide.

(HOCKWALD CHEMICAL CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Water	1.00	0.05

Cal. Dept. Agr., Spec. Pub. 75, 66 (1927).

Hockwald's Creosote Oil.

(HOCKWALD CHEMICAL CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Oil	58.00	....
Phenols	40.00	43.60
Water	2.00	3.00
Baumé gravity of oil	....	1.20
Unsulphonated oil	....	1.80

Cal. Dept. Agr., Spec. Pub. 58, 46 (1925).

Hockwald's Sheep Dip.

See "Phenol Soap Solutions".

Hooper's Fatal Food.

(O. HOOPER JADWIN, NEW YORK, N. Y.)

Found: Borax 92.44 per cent. The balance is corn meal and red coloring matter.

U. S. D. A., Bur. Chem., Bull. 68, 43 (1902).

Hydrated Lime.

See "Lime."

Hydro-Cy.

See "Hydrocyanic Acid."

TABLE XIII. HYDROCYANIC ACID

Manufacturer or Distributor and Brand	Hydrogen Cyanide: Guaranteed	Hydrogen Cyanide: Found	Publication
	%	%	
California Cyanide Co., Cudahy, Cal. Calcyco Braun Gas	80.00	82.30	Cal. Dept. Agr., Spec. Pub. 58, 47 (1925).
Morago & Woodhead, Whittier, Cal. Hydro-Prussic Acid	96.98	96.80	Cal. Dept. Agr., Spec. Pub. 34, 24 (1923).
Owl Fumigating Co., Aero	96.00	97.50	Cal. Dept. Agr., Spec. Pub. 66, 34 (1926).
Owl Fumigating Corporation. Owl Prussic Acid	.....	97.60	Cal. Dept. Agr., Spec. Pub. 34, 24 (1923).
The Pacific R & H Chemical Corp. Hydro-Cy	96.00	97.27	Cal. Dept. Agr., Spec. Pub. 66, 34 (1926).
The Pacific R & H Chemical Corp., Pacific R & H	96.98	97.19	Cal. Dept. Agr., Spec. Pub. 51, 20 (1925).

Hydro-Prussic Acid.

See "Hydrocyanic Acid."

Hydroxcide Paste.

(MECHLING BROS. MFG. CO., CAMDEN, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	6.50	4.90
Water-soluble arsenic, metal	0.75	0.07
Copper	5.00	4.89
Water	....	64.84

N. J. Agr. Expt. Sta., Bull. 407, 14 (1924).

Hydroxcide Powder.

(MECHLING BROS. CHEMICAL CO., CAMDEN, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	12.50	16.33
Water-soluble arsenic, metal	1.50	0.23
Copper	12.50	12.92

N. J. Agr. Expt., Sta., Bull. 459, 12 (1927).

I.

Impco Brand Nicotine Sulphur Dust.

See "Nicotine-Sulphur Dusts".

Impco Complete Garden Dust.

(INTERNATIONAL MILLING CO.)

	Guaranteed.	Found.
Nicotine	0.50	0.52
Sulphur	25.00	27.82
Arsenic oxide	....	4.11
Lead oxide	....	5.75
Passing 100 mesh	....	85.00
Passing 200 mesh	....	66.00

Cal. Dept. Agr., Spec. Pub. 58, 26 (1925).

Impco Extra Strong Insecticide Dust.

Impco Insecticide Dust.

Impco Poultry Tobacco Dust Worm Cure.

Impco Strong Insecticide Dust.

See "Nicotine Dusts."

Imperial Lice and Mite Remedy.

See "Lime-Sulphur."

Improved Kil-Tone.

(THE KIL-TONE CO., VINELAND, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	5.80	7.48
Water-soluble arsenic, metal	0.50	0.19
Copper	2.45	2.14

N. J. Agr. Expt. Sta., Bull. 407, 13 (1924)

Individual Single Treatment for Round Worms.

(AN-FO MFG. CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Nicotine	15.00	15.61

Cal. Dept. Agr., Spec. Pub. 75, 35 (1927).

Insecticide.

(A. ST. LEGER, LAGO MAGGIORE, ITALY.)

A dark-colored odoriferous liquid, strongly alkaline; a sulphonated tar oil neutralized with ammonia and apparently containing "Rotenone", the active principle of derris.

Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).

Insectonos.

(WILLIAM BRANSON)

Found: Pyrethrum is the active ingredient. The inert ingredients are charcoal and essential oils.

Mich. Agr. Coll. Expt. Sta., Spec. Bull. 74, 10 (1915).

Insecto No. 1.

See "Oil Emulsions, Mineral".

Insect Powder.

See "Pyrethrum."

Insectrogen.

(CHEMICAL PRODUCTS DIVISION, ROSE MFG. CO., PHILADELPHIA, PA.)

	Guaranteed.	Found.
Total arsenic, metal	1.75	2.69
Water-soluble arsenic, metal	0.15	0.27
Lead arsenate ($PbHAsO_4$)	10.53	12 47
Nickel	0.47	0.44
Soap	13.05	10.89
Inert matter	73.95	....

Conn. Agr. Expt. Sta., Sample 9308.

Instant Louse Killer.

(DR. HESS & CO., ASHLAND, OHIO.)

Found: Moisture, 1.21 per cent; ash insoluble in hydrochloric acid, 27.10 per cent; ash soluble in hydrochloric acid, 64.78 per cent; carbon dioxide, coal-tar products and tobacco by difference, 6.91 per cent. Large amounts of iron, aluminum, calcium and carbonate, some magnesium, a little sulphate and phosphate. The substance consists of small amounts of calcium phenate and tobacco with large amounts of lime, calcium carbonate and clay.

U. S. D. A., Bur. Chem., Bull. 68, 51 (1902).

Iricide.

(GRING'S IRICIDE CO., BERKELEY, CAL.)

	Guaranteed.	Found.
Arsenic	0.10	0.15

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

J.

Jebl.

(J. H. RICE, ASHTABULA, OHIO.)

Guaranteed: Nicotine 0.80 per cent; inert matter 99.20 per cent.
Found: Nicotine 1.08 per cent; water and volatile matter 79.29 per cent; solids 20.71 per cent; ash 7.85 per cent.

Conn. Agr. Expt. Sta., Bull. 242, 154 (1922).

Jenning's Soluble Pine Oil.

(SANITARY SUPPLY CO.)

	Guaranteed.	Found.
Soap	....	12.10
Water	....	34.80
Pine Oil	55.00	53.32

Cal. Dept. Agr., Spec. Pub. 75, 55 (1927).

J. & M. Reliable Insecticide.

See "Soaps".

K.

Kalibor.

(NITRATE AGENCIES CO., BAYONNE, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	18.20	18.18
Water-soluble arsenic, metal	0.75	0.12
Copper	3.50	3.51

N. J. Agr. Expt. Sta., Bull. 459, 15 (1927).

Kamforite "H".

(HENEMAN BROS., HORNCASTLE, ENGLAND).

Claimed to be a combined pest destroyer, fumigant and fertilizer.

Found: Naphthalene 25.41 per cent; nitrogen 0.25 per cent; phosphoric anhydride 4.33 per cent; potassium none. Ground bone, soot, lime and iron.

Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).

Karspray.

See "Phenol Soap Solutions".

Kasulime.

(NITRATE AGENCIES CO., BAYONNE, N. J.)

Guaranteed: Sulphur 60.00 per cent.

Found: Sulphur 49.82 per cent; coarser than 100 mesh, 2.15 per cent; passing 100 mesh sieve, 86.35 per cent; 200 mesh 10.25 per cent; 300 mesh 1.25 per cent.

N. J. Agr. Expt. Sta., Bull. 459, 8 (1927).

Keresol.

Kerosene Emulsion.

See "Oil Emulsions, Mineral".

Key Brand B. A. Cartridges.

(INTERSTATE CHEMICAL CO., JERSEY CITY, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	4.50	6.39
Water-soluble arsenic, metal	0.75	0.68
Copper	9.00	10.14

N. J. Agr. Expt. Sta., Bull. 424, 13 (1925).

Key Brand B. Beetle Destroyer.

(INTERSTATE CHEMICAL CO., JERSEY CITY, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	14.00	19.40
Water-soluble arsenic, metal	1.00	0.20
Copper	5.00	5.02

N. J. Agr. Expt. Sta., Bull. 459, 11 (1927).

Key Brand Key B.

(INTERSTATE CHEMICAL CO., JERSEY CITY, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	14.00	18.90
Water-soluble arsenic, metal	1.00	1.21
Copper	5.00	4.93

N. J. Agr. Expt. Sta., Bull. 441, 12 (1926).

Key Brand No. 7 Key Green.

(INTERSTATE CHEMICAL CO., JERSEY CITY, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	15.00	16.02
Water-soluble arsenic, metal	3.00	0.34
Copper	....	17.33

N. J. Agr. Expt. Sta., Bull. 441, 12 (1926).

Key-Cide.

See "Bordeaux Mixture-Lead Arsenate".

K-G Ant Poison.

(KIRK-GEARY CO., SACRAMENTO, CAL.)

Guaranteed: Arsenic 0.10 per cent.

Found: Arsenic 0.13 per cent; invert sugar 39.50 per cent; cane sugar 19.38 per cent; dextrin, etc., 4.22 per cent; water 35.01 per cent.

Cal. Dept. Agr., Spec. Pub. 58, 16 (1925).

Kill-A-Mite.

(GRANT-ERICSON CO., SAN DIEGO, CAL.)

Guaranteed: Carbolic acid a certain per cent, inert matter none.

Found: Oils 94.11 per cent; phenol 1.84 per cent free sulphur 2.17 per cent; water 1.40 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 60 (1925).

Kill Hopper.

(GERMAIN SEED & PLANT CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Arsenic	12.00	12.78

Cal. Dept. Agr., Spec. Pub. 75, 26 (1927).

Kill-Well Worm Expeller.

(CHICKEN PHARMACY, PETALUMA, CAL.)

	Guaranteed.	Found.
Water	54.00	76.60

Cal. Dept. Agr., Spec. Pub. 75, 64 (1927).

Kilmol Squirrel-zophene.

See "Carbon Disulphide."

Kilto.

See "Allen's Kilto Paste."

Kil-Tone, Improved.

See "Improved Kil-Tone."

Kil-Tone, Modified.

See "Bordeaux Mixture."

Kirk Geary Dipsol Sheep Dip.

See "Phenol Soap Solutions."

Kisants.

(BRUNSWIG DRUG CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Arsenious oxide	11.00	7.78
Arsenic, metal	8.60	5.89

Cal. Dept. Agr., Spec. Pub. 58, 16 (1925).

Kleenup Oil.

See "Oils, Mineral."

Kloral.

(A. R. MAAS CHEMICAL CO.)

	Guaranteed.	Found.
Available chlorine	5.00	4.18

Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).

K. M. G. Kills Morning Glory.

(WEED CONTROL CO. OF CALIFORNIA, BERKELEY, CAL.)

	Guaranteed.	Found.
Arsenic chloride ($AsCl_5$)	5.00	8.02
Arsenic acid (H_3AsO_4)	....	4.79

Cal. Dept. Agr., Spec. Pub. 66, 18 (1926).

Kolodust.

See "Sulphur".

Koloform.

Kolotax.

See "Nicotine Dusts."

Krelos.

See "Phenol Soap Solutions."

Krenol Dip.

See "Phenol Soap Solutions."

Kreo Phene.

(PURITY CHEMICAL PRODUCTS CO., SANTA ROSA, CAL.)

Guaranteed: Coal-tar oils 97.00 per cent.

Found: Phenols 41.40 per cent; coal-tar oils 57.60 per cent; moisture 1.00 per cent.

Cal. Dept. Agr. Spec. Pub. 75, 56 (1927).

Kreso Dip No. 1

See "Phenol Soap Solutions."

K. S. Q.

(HEMINGWAY & CO., INC., BOUND BROOK, N. J.)

	Guaranteed.	Found.
Total arsenic oxide	35.00	31.00
Water-soluble arsenic oxide	0.50	0.27
Cupric hydroxide [$Cu(OH)_2$]	....	14.16

N. J. Agr. Expt. Sta., Bull. 273, 11 (1914).

L.

Lambert's Death to Lice.

(D. J. LAMBERT, APPONAUG, R. I.)

Found: Moisture 3.97 per cent; ash insoluble in hydrochloric acid 35.91 per cent; ash soluble in hydrochloric acid 31.40 per cent; volatile matter other than moisture 28.72 per cent; a large amount of calcium, some iron, magnesium, potassium, sodium and carbonate, traces of sulphate and phosphate. The substance is a mixture of tobacco, lime, coal-tar products and dirt.

U. S. D. A., Bur. Chem., Bull. 68, 50 (1902).

Larvex.

(LARVEX CORP., BROOKLYN, N.Y.)

Guaranteed: Sodium aluminum silicofluoride 0.52 per cent; inert matter 99.48 per cent.

Found: Total solids 0.89 per cent; fluorine 0.41 per cent; silica 0.15 per cent; aluminum oxide 0.02 per cent; sodium and organic matter 0.40 per cent.

North Dakota, Bull. 17, 52 (1927).

Laurel Green.

(NICHOLS CHEMICAL CO., NEW YORK, N. Y.)

Found: Gypsum 50.00 per cent; greensand 20.20 per cent; copper arsenite 24.70 per cent; moisture, etc., 5.1 per cent; soluble arsenic compounds, 0.8 per cent.

Univ. of Cal., Coll. of Agr., Expt. Sta. Bull. 151, 24 (1903).

Lead Arsenate.

See "Arsenate of Lead."

Lead Arsenite.

See "Pink Arsenoid".

Lead Phenate.

(These are experimental preparations made by Dr. Friend of the Entomology Department of the Connecticut Agricultural Experiment Station.)

Sample No.	**3351**	**7523**	**8257**
Lead oxide	62.64	62.00	66.23
Phenol	31.61	38.82	33.25
Water	2.65	....	0.05

Sample **8257** corresponds approximately to the formula $6PbO.\ 7C_6H_5OH$

Lee's Insect Powder.

(G. H. LEE CO., OMAHA, NEB.)

Found: Sulphur 47.93 per cent; arsenious oxide 5.00 per cent. Remainder probably tobacco and pyrethrum.

U. S. D. A., Bur. Chem., Bull. 68, 31 (1902).

Lee's Lice Killer.

(G. H. LEE CO., OMAHA, NEB.)

Found: Sample is probably creosote oil.

U. S. D. A., Bur. Chem., Bull. 68, 55 (1902).

Lee's Louse Powder.

(GEO. H. LEE CO., OMAHA, NEB.)

	Guaranteed.	Found.
Naphthalene	2.00	0.60
Free sulphur	43.00	43.80
Pyrethrum	2.00	....
Sodium fluoride	3.00	3.01

Cal. Dept. Agr., Spec. Pub. 75, 40 (1927).

Leggett's Killer.

(LEGGETT & BRO., NEW YORK, N. Y.)

Found: The substance is oil of turpentine.

U. S. D. A., Bur. Chem., Bull. 68, 56 (1902).

Leggett's Roach Destroyer.

(LEGGETT & BRO., NEW YORK, N. Y.)

Found: Borax 22.22 per cent; pyrethrum and blue coloring matter present.

U. S. D. A., Bur. Chem., Bull. 68, 43 (1902).

Leinen's Mildew Go.

(BAY CITY SEED CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found
Free sulphur	75.00	73.34
Calcium hydroxide	25.00	23.84

Cal. Dept. Agr., Spec. Pub. 34, 57 (1923).

Leinen's Poisoned Barley.

See "Strychnine Preparations."

Leinen's Rat-Go.

(JOHN F. LEINEN CHEMICAL CO.)

Guaranteed: Active ingredients 97.50 per cent; barium sulphate 0.30 per cent; silica 0.40 per cent; water 1.80 per cent.

Found: Barium carbonate 98.33 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 66 (1927).

Leinen's Sow-Bug Go.

(JOHN F. LEINEN CHEMICAL CO.)

	Guaranteed.	Found,
Total arsenic, metal	37.00	5.05
Water-soluble arsenic, metal	2.80	0.64

Cal. Dept. Agr., Spec. Pub. 75, 26 (1927).

Lemon Oil Company's Standard Insecticide.

(GERMAIN SEED & PLANT CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Dry Soap	6.00	11.85
Potassium carbonate	0.50	1.11
Vegetable oil	3.50	7.45
Terebenthine	5.00	
Water	85.00	79.20

Cal. Dept. Agr. Spec. Pub. 75, 65 (1927).

Lennox Tobacco Soap.

See "Nicotine Soaps".

Lice-Go-Powder.

(S. O. BARNES & SON, GARDENA, CAL.)

Guaranteed: Talc 70.00 per cent.

Found: Naphthalene 3.71 per cent; sodium fluoride 3.30 per cent; essential oils present; loss at 400° C., 3.78 per cent; water 1.40 per cent; talc 11.16 per cent; calcium carbonate 70.10 per cent; calcium hydroxide 7.62 per cent; iron and aluminum oxides 1.10 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 59 (1925).

Licresol.

Licresolis.

See "Phenol Soap Solutions."

Lilacko Spray

See "Oils, Mineral."

Lilly Pulvules No. 142.

(ELI LILLY & CO., INDIANAPOLIS, IND.)

	Guaranteed.	Found.
Nicotine	13.00	12.88

Cal. Dept. Agr., Spec. Pub. 75, 35 (1927).

Lime Hydrated.

Manufacturer or Distributor	Passing 300 mesh sieve
The Miller Co., Stockbridge Mass	84.00%

Conn. Agr. Exp. Sta., Sample 9509.

Limestone, Ground.

(MANUFACTURER UNKNOWN.)

Found: Magnesium oxide 30.86 per cent; calcium oxide 45.87 per cent.

Conn. Agr. Expt. Sta., Sample 8168.

Lime-Sulphur, Dry.

See Table XIV.

Lime-Sulphur Solution.

See Table XV.

Lion Brand Whale Oil Soap.

See "Soaps."

Liquid Insecticide.

(MERRITT CHEMICAL SPECIALTIES, OAKLAND, CAL.)

	Guaranteed.	Found.
Petroleum	94.00	92.00
Essential oils	6.00	present
Water	....	none

Cal. Dept. Agr., Spec. Pub. 34, 58 (1923).

Liquid Lice Killer.

See "A. R. M. Liquid Lice Killer".

Liquor Cresolis Compound.

See "Phenol Soap Solutions".

Lockman's Worm O-Tone.

(KIRK, GEARY & CO.)

	Guaranteed.	Found.
Water	75.00	77.00
Oil	....	22.76

Cal. Dept. Agr., Spec. Pub. 75, 64 (1927).

London Purple.

See Table XVI.

Long and Gretter's Squirrel Poison.

See "Strychnine Preparations".

TABLE XIV. LIME SULPHUR, DRY

Manufacturer or Distributor and Brand.	Total Sulphur.	Calcium Polysulphide		Calcium Thiosulphate		Free Sulphur.		Publication.
		Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	
	%	%	%	%	%	%	%	
Acme White Lead & Color Works, San Francisco, Cal. Acme	...	65.00	65.85	5.00	6.22	10.00	11.36	Cal. Dept. Agr., Spec. Pub. 75 32 (1927).
Bowker Chemical Co., New York N. Y.	59.10	. ..	....	....	....	....	....	N. J. Agr. Expt. Sta., Bull. 441 8 (1926).
California Rex Spray Co., Benicia, Cal. Horseshoe	....	63.00	72.62	5.00	9.16	12.00	6.76	Cal. Dept. Agr., Spec. Pub. 66, 23 (1926).
California Spray Chemical Co , Watsonville, Cal. Ortho	....	64.00	69.30	6.00	11.10	15.00	9.38	Cal. Dept. Agr., Spec. Pub. 75, 32 (1927).
W. C. Collins, San Francisco, Cal	....	....	53.91	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 30 (1923).
Devoe & Raynolds Co , New York, N. Y.	....	70.00	70.30	5.00	13.50	8.00	11.20	Ore. Agr. Expt. Sta., Cir. 84, 7 (1927).
The Dow Chemical Co., Midland, Mich.	....	64.00	67.04	6.00	12.92	15.00	9.94	Cal. Dept. Agr., Spec Pub. 75 32 (1927).
The Glidden Co., Cleveland, Ohio. Glidden	...	63.00	59.27	5.00	7.45	12.00	18.42	Cal. Dept. Agr., Spec. Pub. 58, 32 (1925).
The Glidden Co., Cleveland, Ohio. Glidden	....	71.00	52.45	5.00	10.64	8.00	21.35	Cal. Dept. Agr., Spec. Pub. 58, 32 (1925).
Grasselli Chemical Co.	....	....	61.10	...	6.85	. ..	8.23	Conn. Agr. Exp. Sta., Sample 9806.
Hemmingway's, Oakland, Cal	....	65.00	63.80	5.00	6.80	15.00	15.40	Ore Agr. Expt. Sta., Cir. 84, 7 (1927).
Interstate Chemical Co., Jersey City, N. J. Key	62.43	....	....	....	....	....	....	N. J. Agr. Expt. Sta., Bull. 441, 8 (1926).
Leggett & Bro , Inc., New York, N. Y.	60.79	....	....	....	....	....	....	N. J. Agr. Expt Sta., Bull. 441 8 (1926).
John Lucas & Co., Inc., Philadelphia, Pa. Lucas	....	70.00	64.44	5.00	6.38	10.00	13.08	Cal. Dept. Agr., Spec. Pub. 75, 32 (1927).

John Lucas & Co., Inc., Philadelphia, Pa. Lucas	....	65.00	64.27	5.00	8.80	15.00	13.00	Cal. Dept. Agr., Spec. Pub. 75, 32 (1927).
Montgomery Ward & Co., Portland, Ore.	....	70.00	64.00	5.00	8.70	10.00	12.00	Ore. Ag . Expt. Sta., Cir. 84, 7 (1927).
Chas. C. Navlet Co., San Jose, Cal. Navco	....	65.00	63.98	5.00	6.08	15.00	13.08	Cal. Dept Agr., Spec. Pub. 75, 32 (1927).
Nitrate Agencies Co., Bayonne, N. J.	60.88	....	....	...	....	....	....	N. J. Agr. Expt. Sta., Bull 459, 9 (1927).
Sherwin-Williams Co., Cleveland, Ohio. S.-W	....	65.00	62.31	5.00	6.26	15.00	14.25	Cal. Dept. Agr., Spec. Pub. 75, 32 (1927).
Sherwin-Williams Co., Cleveland, Ohio. S.-W	....	60.00	62.68	5.00	6.08	20.00	13.56	Cal. Dept. Agr., Spec. Pub. 75, 32 (1927).
Sherwin-Williams Co., Cleveland, Ohio. S.-W	....	68.00	62.40	5.00	6.99	12.00	14.88	Cal. Dept. Agr., Spec. Pub. 75, 32 (1927).
Sherwin-Williams Co., Cleveland, Ohio. S.-W	....	63.00	66.15	5.00	6.36	12.00	14.60	Cal. Dept. Agr., Spec. Pub. 75, 32 (1927).
Sherwin-Williams Co., Cleveland, Ohio S.-W	....	65.00	66.43	5.00	6.36	10.00	11.68	Cal. Dept. Agr., Spec. Pub. 75, 32 (1927).
Sherwin-Williams Co., Cleveland, Ohio. S.-W	....	62.00	64.04	5.00	6.38	13.00	12.04	Cal. Dept. Agr., Spec. Pub. 75, 32 (1927).
E. H. Smith, Berkeley, Cal	25.02	....	33.05	....	6.10	...	35.36	Cal. Dept. Agr., Spec. Pub. 34, 30 (1923).

TABLE XV. LIME-SULPHUR SOLUTION

Manufacturer or Distributor and Brand.	Polysulphide Sulphur Found	Thiosulphate Sulphur Found	Total Sulphur		Calcium Polysulphide		Calcium Thiosulphate		Baumé Gravity, degrees		Publication.
			Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	
	%	%	%	%	%	%	%	%			
W. A. Allen, Pittstown, N. J. Allen's Concentrated	....	...	....	18.17	....	....	...	...	....	24.00	N. J. Agr. Expt. Sta., Bull. 424, 10 (1925).
Banning Spray Mfg. Co., Banning, Cal.	....	...	....	....	....	21.10	...	7.90	....	30.00	Cal. Dept. Agr., Spec, Pub. 58, 27 (1925).
Bear Creek Spray Co., Medford, Ore.	....	...	....	22.90	....	24.20	...	...	30.00	29.10	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).
James A. Blanchard Co., New York, N. Y. Lion	....	...	....	....	24.00	25.04	1.00	2.13	....	30.00	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
California Growers' Association, Inc., Los Angeles, Cal	24.07	1.09	....	25.16	....	....	...	...	....	34.07	Cal. Dept. Agr., Spec. Pub. 34, 28 (1923).
California Paint Co., Oakland, Cal.	24.32	0.95	....	25.26	....	....	...	...	....	33.90	Cal. Dept. Agr., Spec. Pub. 34, 28 (1923).
California Rex Spray Co., Benicia, Cal. Rex	....	...	....	....	27.90	30.22	2.10	1.75	32.00	32.64	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
California Spray Chemical Co., Watsonville, Cal. Ortho	....	...	....	....	28.00	30.30	2.00	1.75	....	32.75	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
Chicken Pharmacy, Petaluma, Cal. C. P. Lice and Mite Liquid	....	...	....	....	....	35.34	...	1.52	....	35.00	Cal. Dept. Agr., Spec. Pub. 51, 10 (1925).
Chino Valley Apple Growers' Association, Chino, Cal	....	...	....	....	26.50	22.22	3.50	6.84	30.00	29.70	Cal. Dept. Agr., Spec. Pub. 58, 27 (1925).
Lowell M. Clark. Home	....	...	....	....	28.00	28.52	1.00	2.12	....	31.75	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
Cunningham & Thomas, Ukiah, Cal. C & T	....	...	....	....	30.00	28.32	2.00	2.43	30.00	31.00	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
Farm Bureau Coop. Exchange, Eugene, Ore	....	...	....	18.70	....	19.40	...	...	....	29.00	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).
T. A. Felton's, Portland, Ore	....	...	....	23.10	26.00	27.00	...	...	30.00	31.10	Ore. Agr. Expt. Sta., Cir. 64, 6 (1925).
F. A. Frazier Co	....	...	....	....	28.50	30.95	1.50	1.90	32.00	32.63	Cal. Dept. Agr., Spec. Pub. 66, 22 (1926).
General Chemical Co., San Francisco, Cal. Orchard	....	...	....	....	29.00	29.07	1.50	1.59	32.50	32.50	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
General Chemical Co., San Francisco, Cal. Orchard	....	...	....	....	29.00	30.00	...	1.54	32.00	32.38	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
Germain Seed & Plant Co., Los Angeles, Cal.[1]	....	...	25.00	25.54	....	31.31	...	1.75	....	33.50	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
The Grasselli Chemical Co., New York, N. Y. Grasselli's	....	...	....	....	26.35	....	...	...	....	34.10	Conn. Agr. Expt. Sta., Bull. 272, 147 (1925).
Herbert & Herbert, Inc., Perth Amboy, N. J.	....	...	....	....	25.64	....	...	...	....	32.50	N. J. Agr. Expt. Sta., Bull. 441, 8 (1926).
Hood River Spray Co., Hood River, Ore.	....	...	24.00	24.70	....	27.10	...	...	32.00	31.00	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).
Hood River Spray Co., Hood River, Ore.	....	...	22.00	24.50	....	28.20	...	...	30.00	30.40	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).
Imperial Laboratories, Kansas City, Mo. Imperial Lice and Mite Remedy	25.28	1.22	....	26.50	....	31.98	...	2.90	....	33.50	Cal. Dept. Agr., Spec. Pub. 34, 29 (1923).
J. G. Orchards, Newburg, Ore	....	...	....	22.70	....	24.00	...	...	30.00	29.10	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).
Leffingwell Rancho Co. X X X	....	...	....	....	30.00	30.62	1.50	2.00	32.00	33.00	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
Leggett & Bro., Inc., New York, N. Y. Anchor	....	...	....	25.82	....	....	...	...	....	33.00	N. J. Agr. Expt. Sta., Bull. 441, 8 (1926).
B. Leis, Beaverton, Ore	..	...	24.00	24.10	....	26.70	...	...	30.00	30.20	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).

[1] Calcium oxide, guaranteed 10.00 per cent; found 9.85 per cent.

TABLE XV. LIME-SULPHUR SOLUTION—*Concluded*

Manufacturer or Distributor and Brand	Polysulphide Sulphur Found	Thiosulpate Sulphur Found	Total Sulphur		Calcium Polysulphide		Calcium Thiosulphate		Baumé Gravity, degrees		Publication
			Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found	
	%	%	%	%	%	%	%	%			
Los Angeles Chemical Co., Los Angeles, Cal. Mission	.. .	..	....	....	28.00	31.24	4.00	2.12	32.00	32.00	Cal. Dept. Agr., Spec. Pub. 66, 22 (1926).
A. R. Maas Chemical Co., Los Angeles, Cal.	....	...	....	....	28.50	29.92	1.50	2.43	....	32.50	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
A. R. Maas Chemical Co., Los Angeles, Cal.[1]	13.80	4.80	20.00	18.60	....	....	...	...	30.00	35.10	Cal. Dept. Agr., Spec. Pub. 34, 29 (1923).
Mechling Bros. Chemical Co., Camden, N. J. Concentrated	....	...	25.00	25.68	....	....	...	...	....	32.50	N. J. Agr. Expt. Sta., Bull. 459, 8 (1927).
Miller Products Co., Portland, Ore.	....	...	22.10	24.60	....	26.20	...	...	30.00	32.30	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).
Montgomery Ward & Co.	....	...	....	24.50	26.40	26.20	....	....	30.00	32.40	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).
Murphy Oil Co., East Whittier, Cal.	12.95	3.39	....	16.34	....	19.55	...	8.05	....	25.00	Cal. Dept. Agr. Spec. Pub. 34, 29 (1923).
National Chemical Co., Pittsburgh, Pa. Flag	....	...	....	....	28.50	32.56	1.50	1.25	32.00	34.71	Cal. Dept. Agr., Spec. Pub. 75, 30 (1927).
Chas. C. Navlet Co., Inc., San Jose, Cal. Navco	....	...	....	....	....	31.73	...	1.34	32.00	32.80	Cal. Dept. Agr., Spec. Pub. 58, 28 (1925).
Parker's Laboratories, South Pasadena, Cal. Parker's Magic Discovery[2]	....	...	....	....	....	4.71	...	2.43	....	....	Cal. Dept. Agr., Spec. Pub. 51, 10 (1925).
Pomona Valley Lime & Sulphur Co. Gold Buckle	....	...	....	....	25.00	31.32	1.50	1.71	32.00	32.50	Cal. Dept. Agr., Spec. Pub. 75, 31 (1927).

San Jose Spray Mfg. Co., San Jose, Cal.[3]	....	...	....	....	....	30.65	. .	1.44	32.00	33.17	Cal. Dept. Agr., Spec. Pub. 75, 31 (1927).
Sherwin-Williams Co., Cleveland, Ohio. Hemmingway's	....	...	....	....	29.00	30.30	...	1.52	32.00	32.25	Cal. Dept. Agr., Spec. Pub. 75, 31 (1927).
Standard Chemical Works, Reading, Pa.	....	...	25.00	25.72	....	....	...	...	....	32.50	N. J. Agr. Expt. Sta., Bull. 459, 8 (1927).
Gideon Stolz, Salem, Ore	....	...	....	23.20	27.20	26.20	...	...	30.00	29.90	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).
Sutherlin Spray Plant, Sutherlin, Ore.	....	...	....	22.40	....	23.20	...	...	30.00	30.00	Ore. Agr. Expt. Sta., Cir. 84, 6 (1927).
S. Tinel, Yucaipa, Cal	15.39	3.46	....	18.35	....	19.33	...	8.21	....	29.50	Cal. Dept. Agr., Spec. Pub. 34, 29 (1923).
Valley Fruit Co., Walla Walla, Wash.	....	...	....	25.20	31.80	30.90	...	...	30.00	31.90	Ore. Agr. Expt Sta., Cir. 84, 6 (1927).
G. P. Weldon, Ontario, Cal	17.82	1.18	. ..	19.00	....	....	...	...	....	27.00	Cal. Dept. Agr., Spec. Pub. 34, 28 (1923).
Yucaipa Valley Fruit Co. Mountain Boy	....	...	....	....	28.00	28.20	2.00	2.43	32.00	31.50	Cal. Dept. Agr., Spec. Pub. 75, 31 (1927).

[1] Calcium oxide 11.2 per cent; sodium chloride 0.12 per cent; potassium and sodium sulphates, 0.38 per cent; cyanogen compounds as ferrocyanide 3.13 per cent. Polysulphide sulphur guaranteed 11.69 per cent; thiosulphate sulphur guaranteed 5.21 per cent. Made with refuse gas-house lime.

[2] Sugar 0.46 per cent.

[3] Guaranteed water 70.00 per cent; calcium sulphate 1.00 per cent.

TABLE XVI. LONDON PURPLE

Manufacturer or Distributor and Brand	Total arsenic, metal		Water-soluble arsenic, metal		Publication
	Guaranteed	Found	Guaranteed	Found	
	%	%	%	%	
Acme White Lead & Color Works, Detroit, Mich. Acme	26.00	25.42	0.30	0.17	Cal. Dept. Agr., Spec. Pub. 75, 26 (1927).
Sherwin-Williams Co., Cleveland, Ohio	21.00	24.08	1.50	0.75	Cal. Dept. Agr., Spec. Pub. 75, 27 (1927).

Lotol.

(GARDEN CHEMICAL CO., NEW YORK, N. Y.)

	Guaranteed.	Found.
Water	40.00	12.20

Cal. Dept. Agr., Spec. Pub. 66, 36 (1926).

M.

Maggi's Ant Poison.

(PAUL MAGGI, SANTA CLARA, CAL.)

	Guaranteed.	Found.
Sodium arsenate	0.20	0.26

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Maggotbait.

(CHAS. H. LILLY CO., SEATTLE, WASH.)

	Guaranteed.	Found.
Anthracene oil	0,80	1.40

Ore. Agr. Expt. Sta., Cir. 64, 15 (1925).

Magnesium Chloride, Flake.

(DOW CHEMICAL CO., MIDLAND, MICH.)

Found: Magnesium oxide 11.99 per cent; magnesium chloride ($MgCl_2$-$6H_2O$) 60.45 per cent. Nearly all water-soluble. Traces of iron, aluminum and calcium present.

Conn. Agr. Expt. Sta., Sample 6831.

Mag-O-Tite.

(RANDALL-MC LAUGHLIN, SEATTLE, WASH.)

	Guaranteed.	Found.
Total arsenic, metal	0.06	....
Water-soluble arsenic, metal	0.002	0.06
Naphthalene	4.39	6.35

Conn. Agr. Expt. Sta., Bull. 242, 159 (1922).

Mapco Miscible Oil.

See "Oil Emulsions, Mineral."

Mapco Nicotine Miscible Oil.

(MICHEL & PELTON CO.)

Found: Nicotine 0.90 per cent; soap 6.50 per cent; phenols 6.00 per cent; oils 79.30 per cent; water 6.20 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 39 (1927).

Mapco Nicotine Spray.

(MICHEL & PELTON CO.)

	Guaranteed.	Found.
Nicotine	1.00	1.20
Soap	20.00	20.20
Water	78.00	75.20
Pine oil	1.00	....

Cal. Dept. Agr., Spec. Pub. 75, 39 (1927).

Mapco Rosin Soap for Spray.

See "Soaps."

Mapco Sheep Dip.

See "Phenol Soap Solutions."

Mapco Whale Oil Soap.

See "Soaps."

Marcol.

See "Oils, Mineral".

Marvel Ant Gelatin.

(H. W. MC SPADDEN)

	Guaranteed.	Found.
Arsenious oxide	0.10	0.11

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

Mattes Ant Paste.

(L. A. MATTES.)

	Guaranteed.	Found.
Arsenic, metal	0.75	0.82

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

McClellen's Sodium Fluoride.

See "Sodium Fluoride".

McNear's Poultry House Spray.

See "Oils, Mineral."

F. W. McNess Krenol Dip & Dininfectant.

See "Phenol Soap Solutions".

F. W. McNess Lice Powder and Insecticide.

(FURST-MC NESS CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Nicotine	1.00	1.36
Naphthalene	9.00	11.90
Sulphur	9.50	10.30

Cal. Dept. Agr., Spec. Pub. 75, 40 (1927).

Mealy Bug Spray Oil.

See "Oil Emulsions, Mineral."

Mechling's Dry Mix.

(MECHLING BROS. CHEMICAL CO., CAMDEN, N. J.)

Guaranteed: Sulphur 60.00 per cent.

Found: Sulphur 60.93 per cent; coarser than 100 mesh, 2.23 per cent; passes 100 mesh, 97.77 per cent; 200 mesh, 25.13 per cent; 300 mesh, 3.03 per cent.

N. J. Agr. Expt. Sta., Bull. 459, 8 (1927).

Mechling's Green Label Hydroxide Paste.

(MECHLING BROS. MFG. CO., CAMDEN, N. J.)

	Guaranteed.	Found.
Water	....	56.30
Total arsenic, metal	3.25	2.70
Water-soluble, arsenic, metal	0.25	0.12
Copper	4.50	3.50
Lead oxide	....	9.95

N. J. Agr. Expt. Sta., Bull. 286, 13 (1915).

Mechling's P. T. B.

See "Paradichlorbenzene."

Mechling's Yellow Label Hydroxide Paste.

(MECHLING BROS. MFG. CO., CAMDEN, N. J.)

	Guaranteed.	Found.
Water	....	59.02
Total arsenic, metal	5.50	3.90
Water-soluble arsenic, metal	0.50	0.13
Copper	2.25	2.46
Lead oxide	....	17.55

N. J. Agr. Expt. Sta., Bull. 286, 13 (1915).

Medol Emulsion.

See "Oil Emulsions, Mineral."

Melrosine.

(THE GARDEN CHEMICAL CO., NEW YORK, N. Y.)

Guaranteed: Inert matter (water) not over 85 per cent.

Found: Chloroform extract 12.94 per cent; water 79.70 per cent; ash 2.93 per cent; fatty acids (oleic) 10.92 per cent. Potassium present, arsenic absent. Small amount of essential oil probably present. The solid matter is mostly potassium oleate.

Conn. Agr. Expt. Sta., Sample 8933.

Mercury Preparations, Organic.

See "Bayer Dipdust," "DuPont Semesan, Jr," "Semesan," "Semesan Bel" and "Uspulun".

Merit Lice Powder.

(TERRY PRODUCTS CO., PASADENA, CAL.)

Two samples:

Sample 1.

Found: Calcium hydroxide 59.08 per cent; calcium carbonate 17.64 per cent; calcium sulphate 0.34 per cent; magnesium carbonate 1.06 per cent; silica 12.80 per cent; iron and aluminum oxides 1.98 per cent; organic matter and water of constitution 6.72 per cent. Red coloring matter present.

Sample 2.

Guaranteed: Talc 67.00 per cent.

Found: Calcium carbonate 1.36 per cent; sodium carbonate 2.91 per cent; ferric oxide 0.66 per cent; water 3.61 per cent; phenols 3.60 per cent; naphthalene 8.44 per cent; talc 78.33 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 57 (1923).

Merit Worm Expeller.

(TERRY PRODUCTS CO., PASADENA, CAL.)

Two samples:

Sample 1.

Found: Talc 40.62 per cent; magnesium sulphate 12.04 per cent; calcium sulphate 9.05 per cent; calcium silicate 6.85 per cent; Venetian red 7.34 per cent; sand 2.11 per cent; loss on ignition 21.18 per cent; nicotine 0.22 per cent.

Sample 2.

Found: Calcium hydroxide 1.55 per cent; magnesium sulphate 15.79 per cent; iron and aluminum oxides 6.00 per cent; sand 24.59 per cent; loss on ignition 51.60 per cent; nicotine 0.06 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 58 (1923).

Mildew-Go.

See "Leggett."

Mildew Killer.

See "M. K."

Miko Argentine Ant Poison.

(OSGOOD BROS. DRUG STORES).

	Guaranteed.	Found.
Arsenious oxide	0.10	0.10
Arsenic, metal	0.075	0.08

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Mirto.

(H. HUNTER).

Found: Calcium hydroxide and calcium carbonate present, reaction alkaline.

Cal. Dept. Agr., Spec. Pub. 75, 66 (1927).

Miscible Oil.

Mission Brand Insecto No. 1.

See "Oil Emulsions, Mineral".

Mission Rat Poison.

See "Phosphorus Preparations."

Mixture 154 A Special.

Mixture S 155 A Special.

See "Nicotine-Sulphur Dusts."

Mixture M 163 Special.

Mixture No. 150.

Mixture No. 274 Special.

Mixture No. 221 Special.

See "Nicotine Dusts."

M. K. Mildew Killer (Unburnt Sulfur Ore).

(CHAS. A. LEE CO., KERMAN, CAL.)

Found: Moisture 2.68 per cent; free sulphur 48.15 per cent; free sulphuric acid 1.67 per cent; silica 43.50 per cent; iron and aluminum oxides 0.26 per cent; loss on ignition 3.12 per cent; passing 200 mesh sieve, 60.0 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 58 (1925).

Modified Kil-Tone.

See "Bordeaux Mixture".

Moore's Prepared Squirrel Poison.

See "Strychnine Preparations".

David C. Moore U. C. Chicken Worm Capsules.

(PALMER DRUG CO.)

	Guaranteed.	Found.
Nicotine	13.00	13.46

Cal. Dept. Agr., Spec. Pub. 75, 35 (1927).

Moor Mans Stock and Poultry Dip and Disinfectant.

See "Phenol Soap Solutions."

Morehead's Ant Killer.

(MOREHEAD ANT KILLER CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Tartar emetic	....	1.05
Glucose	23.18	large amount
Cane sugar	46.38	large amount
Water	26.09	25.27

Trace of arsenic present.

Cal Dept. Agr. Spec. Pub. 34, 18 (1923).

Morse's Gopher Poison.

See "Strychnine Preparations."

Morse's Snail and Slug Destroyer.

(C. C. MORSE & CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Crystallized potash alum	99.00	99.42

Cal. Dept. Agr., Spec. Pub. 75, 66 (1927).

Moth Exterminator and Ovicide.

(H. LIEBES CO., SAN FRANCISCO, CAL.)

Found: Naphthalene 87.20 per cent; aldehydes 12.00 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 59 (1923).

Mulford Phosphorus Paste.

See "Phosphorus Preparations."

Muller's Grand Tobacco.

See "Tobacco Dusts."

Munn's Argentine Ant Poison.

(COFFIN-REDINGTON CO.)

	Guaranteed.	Found.
Arsenic, metal	0.15	0.21

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Edgar A. Murray Roach Doom.

(EDGAR A. MURRAY CO.)

Guaranteed: Inert ingredients: curcuma 5.00 per cent; sodium carbonate 2.00 per cent; sodium sulphate 2.00 per cent; sodium chloride 2.00 per cent; iron oxide 1.00 per cent; insoluble in acids, 2.00 per cent.

Found: Sodium fluoride 91.99 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 62 (1927).

Mystic Spray Insecticide.

(MYSTIC MFG. CO., GLENDALE, CAL.)

	Guaranteed.	Found.
Water	3.00	0.05

Cal. Dept. Agr., Spec. Pub. 75, 64 (1927).

Mystic XX Spray.

See "Oils, Mineral."

N.

Nabob Oil.

See "Oils, Mineral."

Naco Bordeaux-Paris Green.

(NITRATE AGENCIES CO., NEW YORK, N. Y.)

	Guaranteed.	Found.
Cupric oxide	18.00	16.23
Total arsenious oxide	17.00	17.32
Water-soluble arsenious oxide	2.00	0.82

Conn. Agr. Expt. Sta., Bull. 242, 153 (1922).

Naco Brand Sulfur Dusting Mixture Formula No. 5

(NITRATE AGENCIES CO., BAYONNE, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	1.95	2.22
Water-soluble arsenic, metal	0.50	0.23
Sulphur	70.00	67.12

N. J. Agr. Expt. Sta., Bull. 441, 16 (1926).

Naco Brand Sulphur Smoke Dusting Mixture.

(NITRATE AGENCIES CO., BAYONNE, N. J.)

	Guaranteed.	Found.
Sulphur	80.00	79.58

N. J. Agr. Expt. Sta., Bull. 441, 7 (1926).

Naco Dust Special.

(NITRATE AGENCIES CO., BAYONNE, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	6.50	7.56
Water-soluble arsenic, metal	0.50	0.08
Copper	7.30	5.82

N. J. Agr. Expt. Sta., Bull. 459, 16 (1927).

Naco Kalibor.

See "Kalibor."

Naphicide.

(NITRATE AGENCIES CO., BAYONNE, N. J.)

	Guaranteed.	Found.
Nicotine	2.00	2.23

N. J. Expt. Sta., Bull. 407, 11 (1924).

Naptho.

(MILLER PRODUCTS CO., PORTLAND, ORE.)

	Guaranteed.	Found.
Naphthalene	9.10	9.8

Ore. Agr. Expt. Sta., Cir. 64, 15 (1925).

Naptholene.

(MILLER PRODUCTS CO., PORTLAND, ORE.)

	Guaranteed.	Found.
Naphthalene	85.00	89.00

Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).

Navco Crude Oil Emulsion.

Navco Miscible Oil.

See "Oil Emulsions, Mineral."

Navco Weed Destroyer.

(CHAS. C. NAVLET CO., INC., SAN JOSE, CAL.)

	Guaranteed.	Found.
Arsenious oxide	30.00	31.48

Cal. Dept. Agr., Spec. Pub. 75, 25 (1927).

Navco Whale Oil Soap.

See "Soaps."

Neutral Emulsion.

See "Oil Emulsions, Mineral."

New Insect Destroyer.

(DEWANE BOGUE, MEDINA, N. Y.)

Found: The substance is largely kerosene oil.

N. Y. Agr. Expt. Sta., Bull. 284, 301 (1904).

New Jersey Dry-Mix-Sulfur-Lime.

(J. R. GILLAM & BRO., BURLINGTON, N. J.)

Guaranteed: Sulphur 62.00 per cent.

Found: Sulphur 55.58 per cent; coarser than 100 mesh, 5.70 per cent; passes 100 mesh, 94.30 per cent; 200 mesh, 35.00 per cent; 300 mesh, 1.80 per cent.

N. J. Agr. Expt. Sta., Bull. 459, 8 (1927).

New Jersey Dry Mix Sulfur-Lime.

(JERSEY ORCHARD SUPPLY CO., BURLINGTON, N. J.)

	Guaranteed.	Found.
Sulphur	62.00	66.74

N. J. Agr. Expt. Sta., Bull. 424, 10 (1925).

New Nicotine Contact Mixture.

See "Nicotine Dusts."

Niagara "All in One".

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Copper	4.00	6.30
Total arsenic, metal	1.80	1.82
Water-soluble arsenic, metal	0.50	....
Nicotine	1.10	1.11
Sulphur	19.00	....

Guaranteed lead arsenate 9.5 per cent; Bordeaux mixture 19 per cent; inert matter 51.40 per cent.

Conn. Agr. Expt. Sta., Bull. 242, 157 (1922).

Niagara All-in-One Dust No. 6.

See "No. 6 All-in-One Dust."

Niagara A-1 Dust Mixture.

See "Nicotine Dusts."

Niagara Copodust.

See "Copodust."

Niagara Copotex.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	6.25	6.58
Water-soluble arsenic, metal	0.50	0.27
Copper	6.80	6.62

N. J. Agr. Expt. Sta., Bull. 459, 13 (1927).

Niagara D. C. Dust No. 3.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Copper	6.80	8.40

Maine Agr. Expt. Sta., Official Inspections 122, 86 (1926).

Niagara D 18 Dust Mixture.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y)

	Guaranteed.	Found.
Total arsenic, metal	6.25	7.02
Water-soluble arsenic, metal	0.50	0.20
Copper	6.80	6.70

N. J. Agr. Expt. Sta., Bull. 459, 14 (1927).

Niagara Dormant Dust.

See "Dormant Dust".

Niagara Dry Mix.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Sulphur	61.00	63.39

Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).

Niagara D 6 Dust

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Copper	6.80	6.94

Cal. Dept. Agr., Spec. Pub. 75, 43 (1927).

Niagara D 20 Dust.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Copper	6.80	6.99
Total arsenic, metal	4.74	5.10
Water-soluble arsenic, metal	0.50	0.04

Guaranteed: Monohydrated copper sulphate 19.00 per cent; calcium arsenate 13.30 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 44 (1927).

Niagara D 25 Potato Dust.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Copper	8.60	8.90

Guaranteed: Monohydrated copper sulphate 24.00 per cent.

Conn. Agr. Expt. Sta., Bull. 258, 370 (1924).

Niagara Dust Mixture No. 3 with Nicotine.

See "Nicotine Dusts."

Niagara Dust Mixture with Sulphur and Nicotine.

See "Nicotine-Sulphur Dusts."

Niagara 85-15 Dusting Mixture.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

Guaranteed: Total arsenic 2.92 per cent; water-soluble arsenic not more than 0.50 per cent; sulphur 83.00 per cent; lead arsenate 14.70 per cent; inert matter 2.30 per cent.

Found: Total arsenic 3.02 per cent.

Conn. Agr. Expt. Sta., Bull. 242, 157 (1922).

Niagara 80-10-10 Mixture.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

Guaranteed: Total arsenic 1.95 per cent; water-soluble arsenic not more than 0.50 per cent; sulphur 78.00 per cent; lead arsenate 9.80 per cent; inert matter 12.20 per cent.

Found: Total arsenic 2.26 per cent.

Conn. Agr. Expt. Sta., Bull. 242, 157 (1922).

Niagara 80-20 Mixture.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Total arsenic, metal	3.90	4.67
Water-soluble arsenic, metal	0.50	0.18
Sulphur	77.00	79.26

Cal. Dept. Agr. Spec. Pub. 75, 27 (1927).

Niagara Entodust, No. 1

See "Arsenate of Lead."

Niagara "50-50".

See "50-50".

Niagara Kolodust.

See "Sulphur."

Niagara Koloform.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

Guaranteed: Sulphur 61.00 per cent.

Found: Sulphur 71.11 per cent; coarser than 100 mesh, 1.53 per cent; passes 100 mesh, 98.47 per cent; 200 mesh, 53.67 per cent; 300 mesh, 10.50 per cent.

N. J. Agr. Expt. Sta., Bull. 459, 8 (1927).

Niagara Kolotax.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Total arsenic, metal	1.95	2.16
Water-soluble arsenic, metal	0.50	0.15
Sulphur	77.00	88.52

N. J. Agr. Expt. Sta., Bull. 459, 13 (1927).

Niagara Mixture No. 150, 70-10-20.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Total arsenic, metal	1.95	1.90
Water-soluble arsenic, metal	0.50	0.20
Sulphur	67.00	69.85

N. J. Agr. Expt. Sta., Bull. 459, 15 (1927).

Niagara Mixture S 303.

Niagara New Nicotine Contact Mixture D-1

Niagara New Nicotine Contact Mixture D-11

Niagara Nicotine Contact Mixture.

See "Nicotine Dusts."

Niagara Nicotine Sulfur Dust No. 7.

See "Nicotine-Sulphur Dusts."

Niagara 90-10 Dusting Mixture (Pomodust).[1]

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.	Guaranteed	Found.
Sulphur	88.00	87.79	87.00	89.73
Total arsenic, metal	1.95	1.84	1.76	1.84
Water-soluble arsenic, metal	0.50	0.24	0.50	0.12
Lead Arsenate	9.80	....	....	....

Conn. Agr. Expt. Sta., Bull. 258, 370 (1924) and *Bull.* 272, 146 (1925)

Niagara No. 4 Nicotine-Lime Dust.

Niagara No. 6 Dust Mixture, with Nicotine.

Niagara No. 10 Dust Mixture, with Nicotine.

See "Nicotine Dusts."

Niagara No. 3 Dust Mixture with Nicotine and Basic Lead Arsenate.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Nicotine	1.00	1.25
Total arsenic, metal	2.10	2.25
Water-soluble arsenic, metal	0.50	0.06
Lead oxide	....	12.50

Cal. Dept. Agr., Spec. Pub. 75, 38 (1927).

Niagara P. D. B. Paradichlorobenzene.

See "Paradichlorbenzene."

[1] Two Samples.

Niagara Potato Dust Mixture without Poison.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

Guaranteed: Copper 6.50 per cent; monohydrated copper sulphate 19.50 per cent; inert matter 80.50 per cent.

Found: Copper 7.56 per cent.

Conn. Agr. Expt. Sta., Bull. 242, 157 (1922).

Niagara 70-10-20 Mixture.

See "Niagara Mixture No. 150."

Niagara Soluble Sulphur Compound.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

Guaranteed: Sodium polysulphide 40.00 per cent; sodium thiosulphate 18.00 per cent; free sulphur 3.00 per cent; inert matter 39.00 per cent.

Found: Total sulphur 41.40 per cent, present mostly as thiosulphate and free sulphur. Not in original package and probably decomposed.

Conn. Agr. Expt. Sta., Bull. 258, 370 (1924).

Niagara Soluble Sulphur Solution.

See "Soluble Sulphur Solution."

Niagara Special Mixture M. 163.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Copper	10.40	10.90

N. J. Agr. Expt. Sta., Bull. 459, 15 (1927).

Niagara Special Mixture No. 161.

See "Special Mixture No. 161."

Niagara Special Mixture No. 274.

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Total arsenic, metal	0.98	1.27
Water-soluble arsenic, metal	0.50	0.20
Sulphur	82.00	82.78

N. J. Agr. Expt. Sta., Bull. 459, 15 (1927).

Niagara Special Mixture No. 221

(NIAGARA SPRAYER CO., MIDDLEPORT, N.Y.)

	Guaranteed.	Found.
Total arsenic, metal	0.98	1.51
Water-soluble arsenic, metal	0.50	0.35
Sulphur	73.00	71.70

N. J. Agr. Expt. Sta., Bull. 459, 15 (1927).

Niagara Special Mixture 154 A.

Niagara Special Mixture S 155 A.

See "Nicotine-Sulphur Dusts."

Niagara Special 68.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	1.94	2.31
Water-soluble arsenic, metal	....	0.20
Copper	3.93	4.10

Maine Agr. Expt. Sta., Official Inspections 114, 88 (1924).

Niagara Special 210 Dust Mixture.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	7.40	2.68
Water-soluble arsenic, metal	0.50	0.24
Copper	6.80	8.21

N. J. Agr. Expt. Sta., Bull. 459, 15 (1927).

Niagara Sulphur Dust.

See "Sulphur Dust."

Niagara Sulphur with 7 per cent Nicotine Solution.

Niagara Sulphur with 10 per cent Nicotine Solution.

See "Nicotine-Sulphur Dusts".

Niagara Vitedust.

See "Vitedust."

Nickel Carbonate.

(MANUFACTURER UNKNOWN)

Found:Nickel 44.64 per cent; nickel carbonate 90.28 per cent; trace of sulphate present.

Conn. Agr. Expt. Sta., Bull. 242, 160 (1922).

Nico Dust.

See "Nicotine Dusts."

Nico-Dust for Walnut Worm and Aphis.

(WALNUT GROWERS' SPRAY MFG. CO., LOS ANGELES, CAL.)

Guaranteed: Nicotine 0.40 per cent; basic lead arsenate 10.00 per cent; total arsenic 1.50 per cent; water soluble arsenic trace, inert matter (lime) 89.60 per cent.

Found: Nicotine 0.62 per cent; lead oxide 11.95 per cent; arsenic oxide 2.89 per cent; total arsenic 2.19 per cent; water-soluble arsenic 0.08 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 50 (1925).

Nico Dust No. 75.

(NICO-DUST MFG. CO.)

	Guaranteed.	Found.
Total arsenic, metal	....	5.65
Water-soluble arsenic, metal	....	0.18
Calcium arsenate	22.00	15.05

Cal. Dept. Agr., Spec. Pub. 75, 27 (1927).

Nico Fume (Liquid).

See "Nicotine Sulphate Solutions."

"Nico-Fume" Paper.

(TOBACCO BY-PRODUCTS & CHEM. CORP., LOUISVILLE, KY.)

	Guaranteed.	Found.
Nicotine	20.00	21.10

Ore. Agr. Expt. Sta., Cir. 84, 10 (1927).

Nico Fume Tobacco Powder.

See "Nicotine Dusts."

Nico Garden Dust.

Nico Soap.

See "Nicotine Soaps."

Nico-Sulphur Dust No. 5.

Nico-Sulphur Dust No. 6.

Nico-Sulphur Dust No. 8.

See "Nicotine-Sulphur Dusts."

Nicota.

Nicoticide.

See "Nicotine Sulphate Solutions."

Nicotine Capsules.

(LANGLEY & MICHAELS).

	Guaranteed.	Found.
Nicotine	13.00	13.48

Cal. Dept. Agr., Spec. Pub. 75, 35 (1927).

Nicotine Contact Mixture.

See "Nicotine Dusts".

Nicotine Dusts.

See Table XVII.

Nicotine, Floral.

See "Nicotine Sulphate Solutions."

Nicotine-Lime Dust.

See "Nicotine Dusts."

Nicotine Miscible Oil.

(MICHEL & PELTON CO.)

Guaranteed: Water 10.00 per cent.

Found: Nicotine 1.00 per cent; soap 5.40 per cent; phenols 5.70 per cent; tar oil 21.10 per cent; mineral oil 61.60 per cent; water 4.00 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 39 (1927).

Nicotine, Rose.

See "Nicotine Sulphate Solution."

Nicotine Soaps.

See Table XVIII.

Nicotine Spray.

See "Nicotine Soaps."

Nicotine-Sulfur-Lead Arsenate Dust.

(WALNUT GROWERS' SPRAY MFG. CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Sulphur	60.00	44.19
Nicotine	1.90	1.55
Lead arsenate	10.00	0.27
Arsenic, metal	2.00	0.06
Inert matter	28.00	...

Cal. Dept. Agr., Spec., Pub. 34, 49 (1923).

TABLE XVII. NICOTINE DUSTS

Manufacturer, Distributor or Brand	Nicotine		Inert matter,	Fineness, finer than		Publication
	Guaranteed	Found	Guaranteed	100 mesh	200 mesh	
	%	%	%	%	%	
Anaheim Feed & Fuel Co., Anaheim, Cal. Double Nico-Dust	. . .	2.71	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 44 (1922).
Bomberger Seed Co., Modesto, Cal. Double Nico-Dust	....	1.29	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 44 (1922).
Bomberger Seed Co., Modesto, Cal. Nico Dust[1]	....	1.04	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 42 (1922).
California Associated Raisin Co., Fresno, Cal. Double Nico-Dust[1]	....	1.40	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 44 (1922).
California Associated Raisin Co., Fresno, Cal. Nico-Dust[1]	. . .	1.62	. .	....	....	Cal. Dept. Agr., Spec. Pub. 34, 42 (1922).
California Pest Control Co. Calpest Garden Dust	3.00	3.74	....	....	. .	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
California Spray Chemical Co., Watsonville, Cal.[1]	2.00	1.84	95.00	....	....	Cal. Dept. Agr., Spec. Pub. 34, 42 (1922).
California Spray Chemical Co., Watsonville, Cal.	2.00	1.90	98.00	....	....	Cal. Dept. Agr., Spec. Pub. 34, 43 (1922).
California Spray Chemical Co., Watsonville, Cal. Ortho. Double	3.50	3.60	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
California Spray Chemical Co., Watsonville, Cal. Ortho. Double	4.00	3.91	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
California Spray Chemical Co., Watsonville, Cal. Ortho Double	3.60	3.45	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
California Sprayer Co., Calispray Dust No. 12	1.70	1.70	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
California Sprayer Co. Calispray Insecticide Dust No. 11	0.50	1.22	....	90.00	66.00	Cal. Dept. Agr., Spec. Pub. 66, 25 (1926).
California Sprayer Co. Calispray Insecticide Dust No. 15	2.40	2.32	....	85.50	72.50	Cal. Dept. Agr., Spec. Pub. 66, 25 (1926).
Dosch Chemical Co., Louisville, Ky. Dosch No. 6[1]	2.20	2.60	97.80	....	....	Cal. Dept. Agr., Spec. Pub. 34, 43 (1922).
Dosch Chemical Co., Louisville, Ky. Dosch No. 10 Nico-Dust[1]	3.80	3.27	96.20	....	....	Cal. Dept. Agr., Spec. Pub. 34, 42 (1922).
Hall Tobacco Chemical Co., New York, N. Y. Fumigator	12.50	9.80	....	....	....	Ore. Agr. Expt. Sta., Cir. 64, 11 (1925).
Heightstown Hardware Co., Heightown, N. J. Axfixo[2]	1.25	1.47	98.75	....	....	Conn. Agr. Expt. Sta., Bull. 258, 371 (1924).
Insecticide Supply Co., Los Angeles, Cal. Dustall No. 3	0.90	1.33	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Insecticide Supply Co., Los Angeles, Cal. Dustall No. 6	2.00	2.30	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Insecticide Supply Co., Los Angeles, Cal. Dustall No. 8	2.75	3.48	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Insecticide Supply Co., Los Angeles, Cal. Dustall No. 10	3.50	3.58	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
International Milling Co., Impco Extra Strong Insecticide Dust	2.50	1.89	....	79.00	59.00	Cal. Dept. Agr., Spec. Pub. 58, 36 (1925).
International Milling Co., Impco Insecticide Dust	2.00	1.95	....	86.00	64.00	Cal. Dept. Agr., Spec. Pub. 58, 36 (1925).
International Milling Co., Impco Strong Insecticide Dust	1.20	1.06	....	86.00	58.00	Cal. Dept. Agr., Spec. Pub. 58, 36 (1925).
Manufacturer unknown	....	2.81	....	...	....	Conn. Agr. Expt. Sta., Sample 9663.
Manufacturer unknown. Nicotine Sulphate Dust	....	3.25	....	....	....	Conn. Agr. Expt. Sta., Sample 4170.
Chas. C. Navlet Co., San Jose, Cal.	2.00	3.91	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Niagara Sprayer Co., Middleport, N. Y. Niagara A-1 Dust Mixture	....	3.01	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Niagara Sprayer Co., Middleport, N. Y. Niagara Dust Mixture No. 3 with Nicotine	1.00	1.13	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Niagara Sprayer Co., Middleport, N. Y. Niagara Mixture S 303	1.00	1.35	....	93.00	82.00	Cal. Dept. Agr., Spec. Pub. 66, 25 (1926).

[1] Lime carrier.
[2] Total ash 96.50 per cent; insoluble ash 1.28 per cent; calcium oxide 31.85 per cent; magnesium oxide 23.57 per cent.

TABLE XVII. NICOTINE DUSTS—*Concluded.*

Manufacturer, Distributor or Brand	Nicotine		Inert Matter, Guaranteed	Fineness, finer than		Publication
	Guaranteed	Found		100 mesh	200 mesh	
	%	%	%	%	%	
Niagara Sprayer Co., Middleport, N. Y. Niagara New Nicotine Contact Mixture D-1	1.25	1.43	98.75	....	....	Conn. Agr. Expt. Sta., Bull. 258, 371(1924)
Niagara Sprayer Co., Middleport, N. Y. Niagara New Nicotine Contact Mixture D 11	1.25	1.49	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 36 (1925).
Niagara Sprayer Co., Middleport, N. Y. Niagara Nicotine Contact Mixture	2.20	2.38	....	....	....	Conn. Agr. Expt. Sta., Bull. 242, 155(1922).
Niagara Sprayer Co., Middleport, N. Y. Niagara No. 4 Nicotine-Lime Dust	1.90	1.95	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 43 (1922).
Niagara Sprayer Co., Middleport, N. Y. Niagara No. 6 Dust Mixture with Nicotine	2.00	2.38	....	90.00	80.00	Cal. Dept. Agr., Spec. Pub. 58, 36 (1925).
Niagara Sprayer Co., Middleport, N. Y. Niagara No. 10 Dust Mixture with Nicotine	3.25	3.89	....	89.00	72.00	Cal. Dept. Agr., Spec. Pub. 58, 36 (1925).
Niagara Sprayer Co., Middleport, N. Y. Nicotine-Lime Dust[1]	2.20	2.44	97.80	....	....	Cal. Dept. Agr., Spec. Pub. 34, 43 (1922).
Niagara Sprayer Co., Middleport, N. Y. Nicotine-Lime Dust	1.10	1.23	98.90	....	....	Cal. Dept. Agr., Spec. Pub. 34, 43 (1922).
Niagara Sprayer Co., Middleport, N. Y. Nicotine-Lime Dust	1.90	1.81	98.10	....	....	Cal. Dept. Agr., Spec. Pub. 34, 43 (1922).
Niagara Sprayer Co., Middleport, N. Y. Nicotine-Lime Dust	0.70	0.52	99.30	....	....	Cal. Dept. Agr., Spec. Pub. 34, 43 (1922).
Niagara Sprayer Co., Middleport, N. Y. No. 2 Niagara A-1 Dust	2.70	2.92	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).

Niagara Sprayer Co., Middleport, N. Y. No. 5[1]	1.75	1.76	98.25	....	....	Cal. Dept. Agr., Spec. Pub. 51, 48 (1925).
Nico-Dust Mfg. Co., Los Angeles, Cal. Nico-Dust No. 3	.095	0.99	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Nico-Dust Mfg. Co., Los Angeles, Cal. Nico-Dust No. 6	2.00	2.21	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Nico-Dust Mfg. Co., Los Angeles, Cal. Nico-Dust No. 8	2.75	3.84	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Nico-Dust Mfg. Co., Los Angeles, Cal. Nico-Dust No. 10	3.50	4.62	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
San Jose Spray Mfg. Co., San Jose, Cal. S. J.	1.75	1.82	....	99.00	86.00	Cal. Dept. Agr., Spec. Pub. 58, 36 (1925).
Tobacco By-Products & Chem. Corp., Louisville, Ky. Black Leaf F 2	2.00	0.84	....	....	....	N. J. Agr. Expt. Sta., Bull. 441, 9 (1926).
Tobacco By-Products & Chem. Corp., Louisville, Ky. Nico Fume Tobacco Powder	12.50	12.71	....	....	....	Conn. Agr. Expt. Sta., Bull. 272, 147(1925).
L. D. Waller Seed Co., Guadalupe, Cal. Nico-Dust[1]	....	3.20	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 42 (1922).
Walnut Growers Association. Double Nico-Dust	2.36	2.41	94.00	....	....	Cal. Dept. Agr., Spec. Pub. 34, 44 (1922).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal. Nico-Dust No. 2[1]	0.75	0.96	99.25	....	....	Cal. Dept. Agr., Spec. Pub. 51, 48 (1925).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal. Nico-Dust No. 5	1.50	1.60	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 36 (1927).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal.[1]	0.56	0.45	98.50	....	....	Cal. Dept. Agr., Spec. Pub. 34, 42 (1922).

[1] Lime carrier.

[2] Total ash 96.50 per cent; insoluble ash 1.28 per cent; calcium oxide 31.85 per cent; magnesium oxide 23.57 per cent.

TABLE XVIII. NICOTINE SOAPS

Manufacturer or Distributor and Brand	Nicotine		Soap			Publication
	Guaranteed	Found	Guaranteed	Found	Water Found	
	%	%	%	%	%	
Alhambra Spray Co., Alhambra, Cal. Alhambra Nico-Soap	....	1.68	....	16.90	....	Cal. Dept. Agr., Spec. Pub. 51, 49 (1925).
An-Fo Mfg. Co., Los Angeles, Cal. An-Fo Nicotine Spray[1]	0.80	0.95	12.50	9.80	83.40	Cal. Dept. Agr., Spec. Pub. 75, 39 (1927).
An-Fo Mfg. Co., Los Angeles, Cal. An-Fo Nicotine Spray[1]	1.00	1.10	12.50	16.40	77.80	Cal. Dept. Agr., Spec. Pub. 75, 39 (1927).
Benj. Hammond, Fishkill, N. Y. Thrip Juice[2]	0.12	0.47	37.70	41.89	53.06	N. Y Agr. Expt. Sta., Bull. 384, 298(1914).
Hammond Slug & Shot Works, Fishkill, N. Y. Thrip Juice[3]	1.00	2.11	37.70[4]	38.05[4]	....	Mich. Agr. Coll. Expt Sta., Spec. Bull. 74, 10 (1915).
The Charles H. Lilly Co., Seattle, Wash. Tobacco Soap	2.00	2.10	6.00	6.30	....	Ore. Agr. Expt. Sta., Cir. 84, 10 (1927).
Manufacturer Unknown. Sulfo-Tobacco Plant and Animal Soap	....	0.40	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 47 (1923).
Chas. C. Navlet Co., San Jose, Cal. Nico Whale Oil Soap	....	None	....	20.60	....	Cal. Dept. Agr., Spec. Pub. 34, 47 (1923).

[1] Pine oil guaranteed 1.50 per cent.
[2] Fatty acids and resin, found 32.46 per cent; combined alkali, guaranteed 7.80 per cent; found 9.43 per cent; unsaponified, found 5.05 per cent.
[3] Potash guaranteed 7.80 per cent; found 8.04 per cent.
[4] Includes resin.

TABLE XIX. NICOTINE SULPHATE SOLUTION

Manufacturer or Distributor and Brand	Nicotine		Inert matter, Guaranteed	Publication
	Guaranteed	Found		
	%	%	%	
Detroit Nicotine Co., Detroit, Mich. "To-Bak-ine" Liquid	45.00	46.02	.....	Mich. Agr. Coll. Expt. Sta., Spec. Bull. 74, 9, (1915).
Germain Seed & Plant Co., Los Angeles, Cal. Floral Nicotine	10.00	11.14	90.00	Cal. Dept. Agr., Spec. Pub. 34, 52 (1922).
Hall Tobacco Chemical Co., St. Louis, Mo. Hall's	40.00	40.61	.....	Conn. Agr. Expt. Sta., Bull. 272, 147 (1925).
Kentucky Tobacco Products Co., Louisville, Ky. Black Leaf 40	40.00	41.95	60.00	Cal. Dept. Agr., Spec. Pub. 34, 52 (1922).
Montgomery, Ward & Co., Portland, Ore. Nicotine Sulfate	40.00	40.30	.....	Ore. Agr. Expt. Sta., Cir. 84, 10 (1927).
Nicotine Mfg. Co., St. Louis, Mo. Nikoteen	30.00	31.56	70.00	Cal. Dept. Agr., Spec. Pub. 34, 52 (1922).
Nicoteen Mfg. Co., St. Louis, Mo. 30% Nikoteen	30.00	30.77	.....	N. J. Agr. Expt. Sta., Bull. 441, 9 (1926).
Nicotine Production Corporation. N. P. C. Nicotine Sulphate	40.00	40.64	.....	Cal. Dept. Agr., Spec. Pub. 75, 34 (1927).
P. L. Palethorp Co., Owensboro, Ky. Nicoticide.	25.00	45.30	.....	N. Y. Agr. Expt. Sta., Bull. 348, 94 (1912).
Parke Davis & Co , Detroit, Mich. Rose Nicotine	10.00	11.19	.....	N. Y. Agr. Expt. Sta., Bull. 384, 297 (1914).
Purity Chemical Products Co. Santa Rosa Ca. Nicota[1]	2.00	2.33	.....	Cal. Dept. Agr., Spec. Pub. 75, 34 1927).
Scabcura Dip Co., Chicago Ill. Nikoteen	.....	26.01	.....	U. S. D. A Bur. Chem., Bull. 68, 47 (1902).
F. A. Thompson Co., Detroit, Mich. Rose Nicotine	10.00	9.92	.....	N. Y. Agr. Expt Sta., Bull. 384, 297 (1914).
Tobacco By-Products & Chemical Corp., Inc., Louisville, Ky. Black Leaf 40	40.00	40.54	.....	Conn. Agr Expt. Sta., Bull. 242, 154 (1922) and Bull. 272, 147 (1925).
Tobacco By-Products & Chemical Corp., Inc., Louisville, Ky. 40% Nicotine Sulphate	40.00	40.42	.....	N. J. Agr. Expt. Sta., Bull. 459, 7 (1927).
Tobacco By-Products & Chemical Corp., Inc., Louisville, Ky. Nico Fume (Liquid)	40.00	42.90	.....	Conn. Agr. Expt. Sta. Bull. 272, 147, (1925).

[1] Water guaranteed 85.00%; found 96.10%.

TABLE XX. NICOTINE-SULPHUR DUSTS

Manufacturer or Distributor and Brand	Nicotine		Free Sulphur		Combined sulphur, Found	Inert matter, Guaranteed	Fineness, finer than		Publication
	Guaranteed	Found	Guaranteed	Found			100 mesh	200 mesh	
	%	%	%	%	%	%	%	%	
American Milling & Warehouse Co. (defunct) Impco	....	0.29	....	49.98	....	....	78.00	52.00	Cal. Dept. Agr., Spec. Pub. 66, 24 (1926).
Bomberger Seed Co., Modesto, Cal.[1]	....	0.96	....	39.39	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).
California Associated Raisin Co., Fresno, Cal[1]	....	0.88	....	52.44	0.31	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).
The California Sprayer Co., Calispray Dust No. 1	1.70	1.30	72.00	73.85	..	....	....	....	Cal. Dept., Agr., Spec. Pub. 75, 37 (1927).
The California Sprayer Co. Calispray Dust No. 2	2.70	2.43	70.00	67.10	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 37 (1927).
The California Sprayer Co. Calispray Combined Insecticide and Fungicide Dust No. 3	3.30	3.50	68.00	64.60	....	....	....	...	Cal. Dept. Agr., Spec. Pub. 75, 37 (1927).
The Calispray Sprayer Co.[2]	1.60	1.87	71.00	66.55	....	3.40	....	....	Cal. Dept. Agr., Spec. Pub. 34, 46 (1922).
Dosch Chemical Co., Louisville, Ky. Dosch	1.80	1.81	58.00	60.16	....	40.20	....	....	Cal. Dept. Agr., Spec. Pub. 34, 46 (1922).
Dosch Chemical Co., Louisville, Ky. Dosch	2.00	4.03	....	54.58	....	....	..	....	Cal. Dept. Agr., Spec. Pub. 34, 46 (1922).
Dosch Chemical Co., Louisville, Ky. Dosch	2.00	1.55	59.00	58.00	....	39.00	....	....	Cal. Dept. Agr., Spec. Pub. 34, 46 (1922).
F. A. Frazier Co. Frazier's 5X[3]	1.50	1.52	40.00	35.70	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 37 (1927).

L. O. Haupt, Hanford, Cal.[1]	....	0.97	....	68.10	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).
Hood River Spray Co., Hood River, Ore. N. S. P. Dust	....	1.89	....	64.00	....	....	....	....	Ore. Agr. Expt. Sta., Cir. 84, 11 (1927).
C. C. Morse & Co., San Francisco, Cal...	....	1.31	....	65.65	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 46 (1922).
Niagara Sprayer Co., Middleport, N. Y. Niagara Dust Mixture with Sulphur and Nicotine No. 5	1.75	2.46	48.00	49.42	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 37 (1927).
Niagara Sprayer Co., Middleport, N. Y. Niagara No. 7	2.25	2.61	58.00	58.15	4.16	39.75	....	....	Cal. Dept. Agr., Spec. Pub. 51, 49 (1925).
Niagara Sprayer Co., Middleport, N. Y. Niagara Special Mixture 154A	1.75	2.32	58.00	62.02	....	....	95.00	73.00	Cal. Dept. Agr., Spec. Pub. 66, 24 (1926).
Niagara Sprayer Co., Middleport, N. Y. Niagara Special Mixture S155A	2.25	3.25	38.00	41.03	....	....	92.00	72.00	Cal. Dept. Agr., Spec. Pub. 66,24 (1926)
Niagara Sprayer Co., Middleport, N. Y. Niagara Sulphur with 7% Nicotine Solution [1]	2.55	2.59	66.00	68.57	1.40	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 49 (1925).
Niagara Sprayer Co., Middleport, N. Y. Niagara Sulphur with 10% Nicotine Solution[1]	3.75	3.27	63.00	64.13	2.14	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 49 (1925).
Niagara Sprayer Co., Middleport, N. Y. No. 10[1]	3.25	4.22	58.00	56.29	5.74	39.75	....	....	Cal. Dept. Agr., Spec. Pub. 51, 49 (1925).
San Francisco Sulfur Co., San Francisco, Cal	....	0.26	....	46.17	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).
San Jose Spray Mfg. Co., San Jose, Cal...	3.50	2.51	50.00	45.15	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 37 (1927).
Standard Chemical Co., Oakland, Cal. Sulfur-Nicotine Compound[4]	1.20	1.24	43.00	47.00	....	49.80	....	....	Cal. Dept. Agr., Spec. Pub. 34, 48 (1922).
L. D. Waller Seed Co., Guadalupe, Cal...	2.84	1.45	13.10	66.09	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 46 (1922).

[1] Lime carrier.
[2] Calcium hydroxide guaranteed 24.00 per cent.
[3] Sulphur classed as inert matter on label.
[4] Soap guaranteed 6.00 per cent; found 4.60 per cent.

TABLE XX. NICOTINE-SULPHUR DUSTS—*Concluded.*

Manufacturer or Distributor and Brand.	Nicotine: Guaranteed	Nicotine: Found	Free Sulphur: Guaranteed	Free Sulphur: Found	Combined sulphur, Found	Inert matter, Guaranteed	Fineness, finer than: 100 mesh	Fineness, finer than: 200 mesh	Publication
	%	%	%	%	%	%	%	%	
Walnut Growers' Association[1]	0.96	1.01	50.00	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal. Nico Garden Dust	2.00	1.86	45.00	30.16	....	....	95.00	75.00	Cal. Dept. Agr., Spec. Pub. 66, 24 (1926).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal. Nico-Sulphur Dust No. 5	1.75	1.83	45.00	46.36	....	....	90.00	72.00	Cal. Dept. Agr., Spec. Pub. 58, 35 (1295).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal. Nico-Sulphur Dust No. 6	2.00	2.20	40.00	32.78	....	....	90.50	60.50	Cal. Dept. Agr., Spec. Pub. 66, 24 (1926).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal. Nico-Sulphur Dust No. 8	2.75	2.99	40.00	37.18	....	....	86.00	45.00	Cal. Dept. Agr., Spec. Pub. 66, 24 (1926).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal[1]	3.70	2.78	48.10	49.99	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal[1]	1.50	1.16	60.00	50.33	....	38.50	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal[1]	1.96	1.80	50.00	50.26	....	44.00	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal[1]	0.96	1.03	50.00	44.92	....	47.00	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).
Walnut Growers' Spray Mfg. Co., Los Angeles, Cal[1]	2.36	1.01	25.00	28.71	0.52	69.00	....	....	Cal. Dept. Agr., Spec. Pub. 34, 45 (1922).

[1] Lime carrier.

Nicotine-Sulfur Paste.

(STANDARD CHEMICAL CO., OAKLAND, CAL.)

	Guaranteed.	Found.
Nicotine	1.20	1.56
Free sulphur	43.00	45.25
Combined sulphur	....	0.25
Soap	6.00	7.07
Inert matter (lime)	49.80	....

Cal. Dept. Agr., Spec. Pub. 34, 48 (1923).

Nicotine Sulphate Dust.

See "Nicotine Dusts."

Nicotine Sulphate Solution.

See Table XIX.

Nicotine-Sulphur Dusts.

See Table XX.

Nico-Tone.

(THE KIL-TONE CO., VINELAND, N. J.)

See also "Green Cross Nico-Tone."

	Guaranteed.	Found.
Nicotine	1.25	0.67

N. J. Agr. Expt. Sta., Bull. 407, 10 (1924).

Nico-Tone B.

(THE KIL-TONE CO., VINELAND, N. J.

	Guaranteed.	Found.
Nicotine	3.00	2.17

N. J. Agr. Expt. Sta., Bull. 407, 10 (1924).

Nico Whale Oil Soap.

See "Nicotine Soaps."

Nictone.

(PARKE, DAVIS & CO., DETROIT, MICH.)

Found: Nicotine 9.87 per cent.

N. Y. Agr. Expt. Sta., Bull. 384, 297 (1914).

Nikoteen.

See "Nicotine Sulphate Solution."

Nikoteen Aphis-Punk.

(NICOTINE MFG. CO., ST. LOUIS, MO.)

Guaranteed: Nicotine 700 grains per package.
Found: Nicotine 7.96 per cent; 239.5 grains per package.

N. Y. Agr. Expt. Sta., Bull. 348, 94 (1912).

90-10 Dusting Mixture.

See "Niagara 90-10 Dusting Mixture."

No-Mor-Fly

(NO-MOR PRODUCTS CO., LOS ANGELES, CAL.)

Found: Oil 100.00 per cent; wate: trace, ash none to 0.003 per cent. Wintergreen and cassia present.

Cal. Dept. Agr. Spec. Pub. 51, 56 (1925).

North State Insecticide.

(NORTH STATE INSECTICIDE CO., RICHMOND, VA.)

Found: Insoluble in hydrochloric acid, 24.91 per cent; cupric oxide 12.43 per cent; iron and aluminum oxides 13.98 per cent; calcium oxide 9.07 per cent; arsenious oxide 20.32 per cent; sulphur trioxide 12.95 per cent; acetic acid and water by difference, 6.34 per cent.

U. S. D. A., Bur. Chem. Bull. 68, 27 (1902).

Nox-A-Vermin.

(COAST CHEMICAL CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Phenols	20.00	22.40

Cal. Dept. Agr., Spec. Pub. 34, 36 (1923).

Noxem Squirrel and Gopher Poison.

See "Strychnine Preparations."

Noxicide.

See "Phenol Soap Solutions."

Nox-Weed.

(C. W. MORRELL, LOS ANGELES, CAL.)

Found: Arsenious oxide 16.74 per cent; sodium hydroxide 26.80 per cent; sodium carbonate 42.00 per cent; sodium chloride small amount, chromic oxide 1.93 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 20 (1923).

Nox Worm Dry Powdered.

(A. F. DINGLEY, SOUTH PORTLAND, ME.)

	Guaranteed.	Found.
Total arsenic, metal	16.00	19.82
Water-soluble arsenic, metal	5.00	0.25
Copper	4.00	5.30

Maine Agr. Expt. Sta., Official Inspections 122, 87 (1926).

N. S. P. Dust.

See "Nicotine-Sulphur Dusts."

No. 1 Niagara Entodust.

See "Arsenate of Lead."

No. 3 Dust.

(LEGGETT & BRO., INC., NEW YORK, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	16.00	16.30
Water-soluble arsenic, metal	0.50	0.04
Copper	....	4.85

N. J. Agr. Expt. Sta., Bull. 441, 12 (1926).

No. 3 Dust Mixture.

See "Nicotine Dusts."

No. 4 Nicotine-Lime Dust.

No. 5 Nicotine Dust.

No. 6 Dust Mixture with Nicotine.

No. 10 Dust Mixture with Nicotine.

See "Nicotine Dusts."

No. 6 All-in-One Dust.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Nicotine	1.00	1.14
Total arsenic, metal	1.76	2.10
Water-soluble arsenic, metal	0.50	0.26
Lead oxide	....	6.45
Sulphur	75.00	76.16

Cal. Dept. Agr. Spec. Pub. 75, 38 (1927).

No. 6 Disinfectant.

See "Phenol Soap Solutions."

Nu Rex O.

(CALIFORNIA REX SPRAY CO., SACRAMENTO, CAL.)

	Guaranteed.	Found.
Arsenic oxide	5.55	6.62
Copper	12.70	11.50

Ore. Agr. Expt. Sta., Cir. 84, 13 (1927).

Nyal Roach Powder.

(NYAL CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Talc	55.00	46.32

Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).

O

Oakland Ant Co.

(OAKLAND ANT EXTERMINATING CO., OAKLAND, CAL.)

Found: Arsenious oxide 0.29 per cent; arsenic, metal 0.22 per cent.

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Oil, Fish.

The U. S. Department of Agriculture recommends the following specifications for fish oil for spraying purposes:

The oil should be light pressed and unadulterated, and have the following specifications:

Saponification value	190 to 193
Iodine value	139 to 193
Specific gravity at 15° C	0.927 to 0.933
Free fatty acid	Less than 5 per cent.

U. S. D. A., Dept. Bull. 1439 (1926).

Oil, Menhaden, Light Pressed

(MANUFACTURER UNKNOWN)

Found: Specific gravity, 15° C., 0.932; saponification number 187; iodine number 173; free fatty acids 3.46 per cent.

Conn. Agr. Expt. Sta., Sample 421.

Oils, Mineral.

See Table XXI.

Oil Emulsions, Mineral.

See Table XXII.

TABLE XXI. OILS, MINERAL

Manufacturer or Distributor and Brand	Oil	Baumé gravity, degrees	Specific gravity, 20° C.	Saybolt Viscosity, 100° C., seconds	Unsulphonated	Evaporation, 60-65° C.[1]	Cold Test	Publication
	%				%			
Associated Oil Co., San Jose, Cal. Avon Brown Neutral	100.00	21.80	....	....	63.20	....	....	Cal. Dept. Agr., Spec. Pub. 75, 65 (1927).
Associated Oil Co., San Jose, Cal. Crude Oil[2]	100.00	18.40	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 39 (1922).
J. R. Chase, San Jose, Cal. Crude Oil[3]	....	19.50	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 57 (1925).
G. F. Doleshal Products Co., Pasadena, Cal. Sure-Shot[4]	99.80[5]	39.60	....	....	75.90	....	....	Cal. Dept. Agr., Spec. Pub. 51, 57 (1925).
Hackney Chemical Co., Parlier, Cal. Di-Fli Home Spray	100.00	39.30	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).
Hockwald Chemical Co., San Francisco, Cal. Fli-Mo-Cide	100.00[6]	44.10	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).
Lacko Specialty Co., Inc., San Francisco, Cal. Fly Croke	100.00	43.50	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).
Lacko Specialty Co., Inc., San Francisco, Cal. Lilacko Spray	99.80	43.10	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).
Mailliard & Schmiedell, San Francisco, Cal. Chemco Insect and Germ Destroyer[7]	100.00	50.50	....	....	52.10[8]	....	....	Cal Dept. Agr., Spec. Pub. 51, 56 (1925).
Manufacturer unknown. Alcopol Oil	....	....	0.9201	222	56.20	3.22	+7°F.	Conn. Agr. Expt. Sta., Sample 6729.
Manufacturer unknown. No. 14 Mineral Oil	....	....	....	246	97.80	1.71	....	Conn. Agr. Expt. Sta., Sample 8213.
Manufacturer unknown. No. 15 Mineral Oil	....	....	....	90	92.80	1.38	....	Conn. Agr. Expt. Sta., Sample 8214.
Manufacturer unknown. No. 16 Mineral Oil	....	....	....	331	96.40	1.68	....	Conn. Agr. Expt. Sta., Sample 8215.
Manufacturer unknown. No. 14 Spray Oil	....	....	0.9306	604	56.00	1.77	+27°F.	Conn. Agr. Expt. Sta., Sample 6727.
Manufacturer unknown. No. 910 Spray Oil	....	....	0.9280	473	56.40	1.69	+16°F.	Conn. Agr. Expt. Sta., Sample 6728.
Mystic Mfg. Co., Glendale, Cal. XX Mystic XX Spray[9]	100.00	37.60	....	....	77.40	....	....	Cal. Dept. Agr., Spec. Pub. 58, 43 (1925).
Standard Oil Co. of New York. Socony Motor Oil—heavy	....	....	0.9148	915	39.60	0.73	+18°F.	Conn. Agr. Expt. Sta., Sample 6725.
Standard Oil Co. of New York. Socony Motor Oil—light	....	....	0.9073	291	62.40	1.26	+10°F.	Conn. Agr. Expt. Sta., Sample 6726.
Standard Oil Co. of New York. Socony Motor Oil—medium	....	....	0.9129	443	52.40	0.85	+16°F.	Conn. Agr. Expt. Sta., Sample 6724.
Standard Oil Co. of New Jersey. Acto	....	....	....	173	96.00	....	....	Conn. Agr. Expt. Sta., Sample 9369.
Standard Oil Co. of New Jersey. Marcol	....	....	....	96	96.00	....	....	Conn. Agr. Expt. Sta., Sample 9371.
Standard Oil Co. of New Jersey. Wyrol	....	....	....	140	96.00	....	....	Conn. Agr. Expt. Sta., Sample 9370.
Sun Oil Co., Philadelphia, Pa. XXX Pale Spindle Oil	....	....	0.9257	169	55.20	3.88	−27°F.	Conn. Agr. Expt. Sta., Sample 6723.
Sun Oil Co., Philadelphia, Pa. LIV Newport Pale	....	....	0.9307	224	54.80	3.04	+16°F.	Conn. Agr. Expt. Sta., Sample 6720.
Sun Oil Co., Philadelphia, Pa. LIX New York Red	....	....	0.9360	449	53.20	1.77	+28°F.	Conn. Agr. Expt. Sta., Sample 6722.

[1]See Scott, "Standard Methods of Chemical Analysis" 1st ed. p. 575.
[2]Light oils 4.00 per cent; medium oils 31.25 per cent; heavy oils 64.75 per cent.
[3]Distillation test: initial boiling-point 105° C.; distilling 105-200° C., 5.19 per cent; 200-250° C., 9.86 percent; 250-305° C., 15.30 per cent; residue 69.44 per cent. Trace of water. Asphalt.
[4]Guaranteed active ingredients 100.00 per cent.
[5]Water 0.2 per cent.
[6]Ash 0.002 per cent.
[7]Sample is a mixture of kerosene and gasoline with a little oil of wintergreen.
[8]Fraction boiling above 150° C.
[9]Precipitated chalk, guaranteed 0.34 per cent; none found. Water, trace.

TABLE XXI. OILS, MINERAL—*Concluded*

Manufacturer or Distributor and Brand	Oil	Baumé gravity, degrees	Specific gravity, 100° C., seconds	Saybolt Viscosity, 100° C., seconds	Unsulphonated	Evaporation 60–65° C.[1]	Cold Test	Publication
	%				%			
Sun Oil Co., Philadelphia, Pa. LXII Toledo Red	....	....	0.9347	332	53.40	2.22	+27°F.	Conn. Agr. Expt. Sta., Sample 6721.
Sun Oil Co., Philadelphia, Pa. XCI Sunoco Golden	....	....	0.9254	103	58.00	5.08	−27°F.	Conn. Agr. Expt. Sta., Sample 6714.
Sun Oil Co., Philadelphia, Pa. XCII Sunoco Golden	....	....	0.9395	196	76.60	2.44	−18°F.	Conn. Agr. Expt. Sta., Sample 6713.
Sun Oil Co., Philadelphia, Pa. XCV Sunoco Golden	....	....	0.9450	434	77.80	1.69	+14°F.	Conn. Agr. Expt. Sta., Sample 6710.
Sun Oil Co., Philadelphia, Pa. XCV Sunoco Golden	....	....	0.9518	652	75.00	1.58	+43°F.	Conn. Agr. Expt. Sta., Sample 6711.
Sun Oil Co., Philadelphia, Pa. XCVII Sunoco Golden	....	....	0.9705	907,219	54.20	0.71	+85°F.	Conn. Agr. Expt. Sta., Sample 6712.
The Texas Co. Aleph Oil	....	....	0.9313	291[10]	53.40	2.88	+21°F.	Conn. Agr. Expt. Sta., Sample 6715.
The Texas Co. Altair Oil	....	....	0.9342	463[11]	54.40	2.05	+18°F.	Conn. Agr. Expt. Sta., Sample 6717.
The Texas Co. Nabob Oil	....	....	0.9281	214[12]	54.00	3.57	+19°F.	Conn. Agr. Expt. Sta., Sample 6718.
The Texas Co. No. 776 Oil	....	....	0.9230	704[13]	55.40	1.93	+41°F.	Conn. Agr. Expt. Sta., Sample 6716.
Tidewater Oil Co. Tycol 122	....	....	0.9070	213	58.80	0.00	+21°F.	Conn. Agr. Expt. Sta., Sample 6719.
Van Winkle Coffee Co., San Francisco, Cal. Old Rip Van Winkle Fly Spray	100.00[14]	42.20	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).

[1]See Scott "Standard Methods of of Chemical Analysis" 1st ed. p. 575.
[10]Guaranteed 300.
[11]Guaranteed 500.
[12]Guaranteed 200.
[13]Guaranteed 780.
[14]Ash 0.011 per cent; water, trace.

O. K. Ant Paste.

(WESTERN WHOLESALE DRUG CO.)

Guaranteed: Arsenic 8.39 per cent.
Found: Arsenious oxide 11.33 per cent; arsenic, metal 8.58 per cent; invert sugar 21.45 per cent; sucrose 17.27 per cent; water 33.02 per cent.
Cal. Dept. Agr., Spec. Pub. 58, 17 (1925).

O-Kay Gopher Poison.

Okay Poisoned Wheat.

O.K. Squirrel Poison.

See "Strychnine Preparations."

Old Rip Van Winkle Fly Spray.

See "Oils, Mineral."

Ongman's Dip and Disinfectant.

See "Phenol Soap Solutions".

Orange Oil Emulsion.

Orchard Dormant Soluble Oil.

Ortho Apricot Oil.

Ortho Crude Oil Emulsion.

See "Oil Emulsions, Mineral."

Ortho Double Nicotine Dust.

See "Nicotine Dusts."

Ortho Garden Dust.

(CALIFORNIA SPRAY CHEMICAL CO., WATSONVILLE, CAL.)

	Guaranteed.	Found.
Nicotine	2.00	2.11
Arsenic oxide	4.00	3.82
Copper	2.50	2.54

Cal. Dept. Agr., Spec. Pub. 75, 38 (1927).

Ortho Gopher Poison.

See "Strychnine Preparations."

Ortho Kleenup.

Orthol.

See "Oil Emulsions, Mineral."

Ortho Liquid Soap.

See "Soaps."

Ortho Miscible Oil.

Ortho Orange Oil Emulsion.

See "Oil Emulsions, Mineral."

Ortho Paradichlorobenzene.

See "Paradichlorbenzene."

TABLE. XXII. OIL EMULSIONS, MINERAL

Manufacturer or Distributor or Brand	Oil		Phenols—Found	Soap—Found	Water		Ash other than Soap Ash—Found	Constants of Separated Oil			Publications
	Guaranteed	Found			Guaranteed	Found		Baumé Gravity, degrees	Saybolt Viscosity, 100° F., seconds	Unsulphonated	
	%	%	%	%	%	%	%			%	
J. Willis Adriance, Stockton, Cal. Germo	....	94.00	5.90	....	....	....	....	..	...	....	Cal. Dept. Agr., Spec. Pub. 34, 39 (1923).
Alhambra Spray Co. Alhambra Spray[1]	....	60.40	10.20	4.90	....	....	1.31	....	...	....	Cal. Dept. Agr., Spec. Pub. 34, 36 (1923).
American Soap Co., Oakland, Cal. American Jazz Spray[2]	70.00	66.00	....	4.05	....	....	....	28.00	...	....	Cal. Dept. Agr., Spec. Pub. 34, 37 (1923).
Anaheim Spray Chemical Co., Anaheim, Cal. Blue Ribbon Orchard Spray	....	79.50[3]	....	4.00	20.00	16.20	....	33.05	53	86.00	Cal. Dept. Agr., Spec. Pub. 75, 51 (1927).
Anaheim Spray Chemical Co., Anaheim, Cal. E. M. F. Orchard Spray	....	68.15	....	6.20	....	24.70	....	37.10	...	66.75	Cal. Dept. Agr., Spec. Pub. 66, 32 (1926).
Associated Oil Co., San Jose, Cal. Petrotine	83.00	86.30	....	....	....	12.60	....	29.80	...	87.60	Cal. Dept. Agr., Spec. Pub. 75, 48 (1927).
Balfour, Guthrie & Co., San Francisco, Cal. Orchard Dormant Soluble Oil	....	81.95	3.68[4]	5.28	13.00	8.00	0.81	20.80	...	52.00	Cal. Dept. Agr., Spec. Pub. 51, 37 (1925).
Balfour, Guthrie & Co., San Francisco, Cal. Soluble Oil Spray[5]	87.00	86.37	2.80	4.03	....	....	1.57	....	...	....	Cal. Dept. Agr., Spec. Pub. 34, 36 (1923).
Balfour, Guthrie & Co., Los Angeles, Cal. Universal Brand Neutral Emulsion	70.00	71.20	....	....	....	26.60	....	22.50	...	58.80	Cal. Dept. Agr., Spec. Pub. 75, 48 (1927).
Balfour, Guthrie & Co., Los Angeles, Cal. Universal Brand Triona	70.00	75.40	....	....	....	23.30	....	31.95	58	86.80	Cal. Dept. Agr., Spec. Pub. 75, 48 (1927).
Balfour, Guthrie & Co., Los Angeles, Cal. Universal Brand Triumph	.....	86.60[3]	4.40	3.90	13.00[3]	5.00[3]	....	28.40	...	....	Cal. Dept. Agr., Spec. Pub. 75, 53 (1927).
Balfour, Guthrie & Co., Los Angeles, Cal. Universal Brand Triumph	87.00[3]	88.40[3]	4.80	3.50	....	3.90[3]	....	29.10	...	....	Cal. Dept. Agr., Spec. Pub. 75, 53 (1927).
Balfour, Guthrie & Co., Los Angeles, Cal. Universal Dormant Soluble Oil	....	85.70[3]	1.80	7.10	13.00[3]	3.80[3]	....	19.90	...	....	Cal. Dept. Agr., Spec. Pub. 75, 53 (1927).
Balfour, Guthrie & Co., San Francisco, Cal. Universal Mealy Bug Spray Oil	....	75.40	7.80	9.40	13.00	7.00	....	23.20	...	44.20	Cal. Dept. Agr., Spec. Pub. 66, 32 (1926).
Balfour, Guthrie & Co., Lindsay, Cal. Universal Medol Emulsion	70.00	66.40	....	....	....	30.20	....	28.20	...	52.70	Cal. Dept. Agr., Spec. Pub. 66, 30 (1926).
Bean Spray Pump Co., San Jose, Cal. Bean's Bug-Go, Crude	75.00[3]	77.05[3]	....	1.39	....	21.60	....	22.55	...	....	Cal. Dept. Agr., Spec. Pub. 66, 32 (1926).
David Burke & Co. Bejo Orchard Spray	....	89.40	....	2.00	30.00	6.80	....	40.10	...	76.90	Cal. Dept. Agr., Spec. Pub. 66, 32 (1926).
David Burke & Co. Pacific Orchard Spray	....	77.40	5.80	4.90	25.00	11.40	....	39.10	...	70.60	Cal. Dept. Agr., Spec. Pub. 66, 32 (1926).
California Pest Control Co. Calpest Summer Spray	80.00[3]	85.85[3]	....	....	....	13.15	....	31.10	...	....	Cal. Dept. Agr., Spec. Pub. 75, 48 (1927).
California Rex Spray Co., Benicia, Cal. Rex Emulso	75.00[3]	75.70[3]	....	1.40	....	22.40	....	24.20	...	19.40	Cal. Dept. Agr., Spec. Pub. 66, 33 (1926).
California Rex Spray Co., Benicia, Cal. Rex Miscible Oil, Heavy	....	80.40[3]	4.40	6.50	8.00[3]	8.30[3]	....	27.90	...	....	Cal. Dept. Agr., Spec. Pub. 75, 53 (1927).
California Rex Spray Co., Benicia, Cal. Rex Miscible Oil, Light	....	80.30[3]	3.70	6.20	8.00[3]	9.40[3]	....	29.20	...	....	Cal. Dept. Agr., Spec. Pub. 75, 53 (1927).
California Rex Spray Co., Benicia, Cal. Vulture Oil	75.00[3]	74.70[3]	....	1.60[6]	....	22.95[3]	....	30.15	...	63.00	Cal. Dept. Agr., Spec. Pub. 75, 51 (1927).

[1]Inert matter 24.60 per cent.

[2]Soap guaranteed 4.00 per cent; inert matter guaranteed 26.00 per cent; found 30.00 per cent; Baumé gravity of oil, guaranteed 30.00. Rosin present.

[3]Per cent by volume.

[4]Phenols guaranteed 87.00 per cent. This emulsion contains rosin.

[5]Inert matter guaranteed 13.00 per cent; found 6.00 per cent. Rosin present.

[6]Guaranteed 1.00 per cent.

TABLE XXII. OIL EMULSIONS, MINERAL—*Continued*

Manufacturer or Distributor or Brand	Oil		Phenols—Found	Soap—Found	Water		Ash other than Soap Ash—Found	Constants of Separated Oil			Publications
	Guaranteed	Found			Guaranteed	Found		Baumé Gravity, degrees	Saybolt Viscosity, 100°F., seconds	Unsulphonated	
	%	%	%	%	%	%	%			%	
California Spray Chemical Co., Watsonville, Cal. Kleenup Oil	....	77.10	....	....	....	21.80	0.07	22.70	...	45.50	Cal. Dept. Agr., Spec. Pub. 66, 30 (1926).
California Spray Chemical Co., Watsonville, Cal. Ortho-Apricot Oil	75.00	74.00	....	....	....	26.00	....	29.10	...	59.80	Cal. Dept. Agr., Spec. Pub. 66, 30 (1926).
California Spray Chemical Co., Watsonville, Cal. Ortho-Crude Oil Emulsion	75.00[3]	75.60[3]	....	....	....	22.70	....	22.10	...	38.80	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
California Spray Chemical Co., Watsonville, Cal. Ortho-Kleenup Grade A[7]	....	....	....	....	....	....	0.29	....	102	53.20	Conn. Agr. Expt. Sta., Sample 8861.
California Spray Chemical Co., Watsonville, Cal. Ortho Kleenup Oil	....	....	....	....	....	....	....	....	102	55.60	Conn. Agr. Expt. Sta., Sample 8045.
California Spray Chemical Co., Watsonville, Cal. Ortho-Kleenup Oil, Grade B	75.00[3]	78.20[3]	....	....	....	21.65	....	21.85	...	58.40	Cal. Dept. Agr., Spec. Pub. 75, 48 (1927).
California Spray Chemical Co., Watsonville, Cal. Orthol	75.00[3]	77.50[3]	none	....	....	21.80[3]	0.13	40.60	...	94.50	Cal. Dept. Agr., Spec. Pub. 58, 42 (1925).
California Spray Chemical Co., Watsonville, Cal. Orthol Concentrate	80.00[3]	79.60[3]	....	....	....	18.70	....	30.70	...	86.80	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
California Spray Chemical Co., Watsonville, Cal. Orthol-K (Heavy)	.....	....	....	....	....	....	....	....	111	80.80	Conn. Agr. Expt. Sta., Sample 9743.
California Spray Chemical Co., Watsonville, Cal. Ortho Miscible Oil	85.00[3]	87.25[3]	2.72	6.14	....	3.65	....	21.55	...	50.90	Cal. Dept. Agr., Spec. Pub. 66, 33 (1926).

California Spray Chemical Co., Watsonville, Cal. Ortho Orange Oil Emulsion[8]	....	....	....	....	25.00	24.70	0.48	40.30	...	96.70	Cal. Dept. Agr., Spec. Pub. 51, 32 (1925).
California Spray Chemical Co., Watsonville, Cal. Ortho Orange Oil Emulsion[8]	75.00	80.30	....	....	25.00	18.20	0.51	40.80	...	95.90	Cal. Dept. Agr., Spec. Pub. 51, 32 (1925).
California Spray Chemical Co., Watsonville, Cal. Ortho Penetrating Oil Spray	75.00[3]	72.50[3]	1.90	none	....	25.10	....	25.40	...	53.80	Cal. Dept. Agr., Spec. Pub. 58, 44 (1925).
California Spray Chemical Co., Watsonville, Cal. Volck Concentrate	....	83.55	....	....	....	16.28	0.02	....	...	....	Conn. Agr. Expt. Sta., Sample 2504.
California Spray Chemical Co., Watsonville, Cal. Volck[9]	83.00	79.19	....	....	....	....	....	....	...	94.40	Conn. Agr. Expt. Sta., Sample 8934.
California Spray Chemical Co., Watsonville, Cal. Volck Emulsion	....	....	....	....	....	....	....	....	108	93.60	Conn. Agr. Expt. Sta., Sample 8047.
California Spray Chemical Co., Watsonville, Cal. Volck Light	83.00[3]	81.80[3]	....	....	....	17.95	....	34.00	50	95.60	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
Carco Spray Co., Tacoma, Wash. Oil Emulsion	....	86.60	....	....	....	....	....	....	...	....	Ore. Agr. Expt. Sta., Cir. 84, 13 (1927).
Classen, Murfit & Co., Philadelphia, Pa. Keresol	....	80.00[10]	4.15	12.00	....	....	1.30	....	...	....	Conn. Agr. Expt. Sta., Bull. 258, 373 (1924).
Clarkson & Ford, New York, N. Y. Soluble Spray Oil[11]	....	85.10	....	....	....	....	....	....	...	....	Conn. Agr. Expt. Sta., Bull. 272, 148 (1925).
Coulson Poultry & Stock Food. Coulson's Poultry Spray	....	88.60	9.60[12]	....	....	0.10	0.04	26.20	...	38.40	Cal. Dept. Agr., Spec. Pub. 51, 45 (1925).
Eastbay Chemical Co., Emeryville, Cal. Zeno Miscible Oil Spray[13]	....	84.22	4.00	4.78	....	....	0.94	....	...	....	Cal. Dept. Agr., Spec. Pub. 34, 36 (1923).

[3]Per cent by volume.
[7]Total nitrogen, 0.15 per cent; ammonia (NH_3) 0.12 per cent; casein 0.19 per cent. This is an ammonium caseinate emulsion.
[8]Ash contains copper and calcium.
[9]Ammonia (NH_3), found 0.06 per cent.
[10]Kerosene.
[11]Specific gravity, 25° C., 0.9333; unsaponifiable matter 85.10 per cent. Rosin present. A light petroleum oil containing a sodium soap.
[12]Guaranteed 15.00 per cent. Sample does not contain rosin.
[13]Inert matter guaranteed 16.00 per cent, found 6.00 per cent.

TABLE XXII. OIL EMULSIONS, MINERAL—*Continued*

Manufacturer or Distributor or Brand	Oil		Phenols—Found	Soap—Found	Water		Ash other than Soap Ash—Found	Constants of Separated Oil			Publications
	Guaranteed	Found			Guaranteed	Found		Baumé Gravity, degrees	Saybolt Viscosity, 100° F., seconds	Unsulphonated	
	%	%	%	%	%	%	%			%	
Eastbay Chemical Co., Emeryville, Cal. Zeno Miscible Oil Spray[14]	....	83.00	4.20	....	....	....	....	....	...	....	Cal. Dept. Agr., Spec. Pub. 34, 36 (1923).
Herbicide Chemical Laboratories. Fumispray	54.57	53.99	....	3.13[15]	45.29	42.20	0.01	....	...	65.30	Cal. Dept. Agr., Spec. Pub. 51, 35 (1925).
Herbicide Chemical Laboratories. Fumispray	....	55.76	....	3.54	40.00	39.00	0.08	....	...	....	Cal. Dept. Agr., Spec. Pub. 51, 35 (1925).
Hood River Spray Co., Hood River, Ore. Oil Emulsion	84.00	90.70	....	....	....	....	....	....	...	....	Ore. Agr. Expt., Sta. Cir. 84, 13 (1927).
Hood River Spray Co., Hood River, Ore. Oil Emulsion	75.00	73.80	....	....	....	....	....	....	...	....	Ore. Agr. Expt. Sta., Cir. 84, 13 (1927).
Leffingwell Rancho Co., Whittier, Cal. XXX Heavy Emulsion	85.00[3]	87.80[3]	....	....	....	12.50	....	38.10	69	98.40	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
Leffingwell Rancho Co., Whittier, Cal. XXX Medium Emulsion	85.00[3]	87.70[3]	....	....	....	12.40	....	33.50	63	88.80	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
Los Angeles Chemical C., Los Angeles, Cal. Mission Brand Insecto No. 1	90.00[3]	91.10[3]	....	....	....	8.42	....	26.40	75	70.00	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
Manufacturer unknown. Sulco-V. B.	....	....	3.97	....	....	....	....	....	...	....	Conn. Agr. Expt. Sta., Bull. 242, 162 (1922).
McClure Chemical Laboratories. Calox	....	89.20	3.33	4.00	16.00	2.87	....	29.00	...	56.50	Cal. Dept. Agr., Spec. Pub. 58, 44 (1925).
McClure Chemical Laboratories. Renol (Miscible Oil)	....	84.60	3.50	8.50	6.00	2.40	....	38.60	...	69.60	Cal. Dept. Agr., Spec. Pub. 58, 44 (1925).

G. P. McNear Co., Petaluma, Cal. Four and One Spray	....	92.70	7.20[16]	....	....	0.10	0.01	....	...	74.20	Cal. Dept. Agr., Spec. Pub. 51, 45 (1925).
G. P. McNear Co., Petaluma, Cal. McNear's Poultry House Spray	94.00	94.24	5.76[17]	....	....	trace	....	....	...	....	Cal. Dept. Agr., Spec. Pub. 75, 56 (1927).
Michel & Pelton Co., Mapco Miscible Oil	....	83.60	5.20	7.05	10.00	2.50	....	21.05	...	....	Cal. Dept. Agr., Spec. Pub. 75, 53 (1927).
Chas. C. Navlet Co., Inc., San Francisco, Cal. Navco Crude Oil Emulsion[18]	....	66.12	....	....	30.00[3]	31.60[3]	0.64	22.60	...	31.70	Cal. Dept. Agr., Spec. Pub. 51, 33 (1925).
Chas. C. Navlet Co., Inc., San Francisco, Cal. Navco Miscible Oil	....	85.40[3]	5.20	6.30	12.00[3]	2.80[3]	....	22.30	...	....	Cal. Dept. Agr., Spec. Pub. 75, 53 (1927).
Peerless Spray Chemical Co., Covina, Cal. Peerless Spray Emulsion	85.00[3]	85.27[3]	....	....	....	14.13	....	27.77	85	86.40	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
Perfecto Spray Mfg. Co., Los Angeles, Cal. Perfecto Spray Oil	83.00[3]	85.73[3]	....	....	....	13.98	....	31.33	45	74.30	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
B. G. Pratt, New York, N. Y. Pratt's Carboleine[19]	86.00	88.70	present	....	....	11.17	1.22	....	...	....	Conn. Agr. Expt. Sta., Bull. 272, 148 (1925).
Rochester Rex Co., Rochester, N. Y. Emulso	....	....	....	....	....	....	....	....	157	61.00	Conn. Agr. Expt. Sta., Sample 8235.
R. R. Rogers Chemical Co., "Cee-Pee-Dee" Carbolized Petroleum Distillate	....	79.78	19.32[20]	....	2.00	0.80	0.06	24.90	...	47.50	Cal. Dept. Agr., Spec. Pub. 51, 45 (1925).
San Jose Spray Mfg. Co., San Jose, Cal. Cot Oil	....	79.90[3]	0.10	....	30.00	18.50	0.21	30.60	...	62.20	Cal. Dept. Agr., Spec. Pub. 66, 31 (1926).
San Jose Spray Mfg. Co., San Jose, Cal. Crude Oil Emulsion	....	81.19[3]	0.20	....	....	19.01	0.44	19.30	...	....	Cal. Dept. Agr., Spec. Pub. 66, 31 (1926).

[3]Per cent by volume.
[14]Inert matter guaranteed 16.50 per cent; found 12.50 per cent.
[15]Guaranteed 0.14 per cent.
[16]Guaranteed 2.00 per cent.
[17]Guaranteed 4.80 per cent.
[18]Ether-insoluble matter (glue) 1.65 per cent. Rosin present.
[19]Guaranteed mineral oil 83.00 per cent; saponifiable oil 3.00 per cent; potassium oxide 1.00 per cent.
[20]Guaranteed 20.00 per cent.

TABLE XXII. OIL EMULSIONS, MINERAL—*Concluded.*

Manufacturer or Distributor or Brand	Oil		Phenols—Found	Soap—Found	Water		Ash other than Soap Ash—Found	Constants of Separated Oil			Publications
	Guaranteed	Found			Guaranteed	Found		Baumé Gravity, degrees	Saybolt Viscosity, 100° F., seconds	Unsulphonated	
	%	%	%	%	%	%	%			%	
San Jose Spray Mfg. Co., San Jose, Cal. Exelol	....	83.14[3]	....	....	25.00	15.62	....	22.53	...	68.80	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
San Jose Spray Mfg. Co., San Jose, Cal. San Jose Summer Oil	80.00[3]	86.01[3]	....	....	....	13.58	....	30.60	106	100.00	Cal. Dept. Agr., Spec. Pub. 75, 49 (1927).
San Jose Spray Mfg. Co., San Jose, Cal. Skalene	....	78.54[3]	5.60	4.20	10.00	11.75	....	27.30	...	64.40	Cal. Dept. Agr., Spec. Pub. 66, 33 (1926).
San Jose Spray Mfg. Co., San Jose, Cal. Skalol	....	82.70[3]	4.60	5.30	10.00	6.20	....	21.20	...	....	Cal. Dept. Agr., Spec. Pub. 75, 53 (1927).
Santa Rosa Poultry Association, Santa Rosa, Cal. Sarpa Poultry Spray[21]	....	98.10	1.60	....	....	0.30	none	....	...	42.00	Cal. Dept. Agr., Spec. Pub. 51, 57 (1925).
Santa Rosa Poultry Association, Santa Rosa, Cal. Sarpa Poultry Spray	....	76.11	21.88	....	....	2.00	0.01	....	...	....	Cal. Dept. Agr., Spec Pub. 51, 57 (1925).
Sherwin-Williams Co., Cleveland, Ohio. Citro-Mulsion[22]	69.00	72.90	0.56	....	31.00	23.20	0.05	....	...	67.10	Cal. Dept. Agr., Spec. Pub. 51, 33 (1925).
Sherwin-Williams Co., Cleveland, Ohio. Citro-Mulsion[23]	73.00	72.87	0.38	....	....	23.80	0.08	....	...	63.40	Cal. Dept. Agr., Spec. Pub. 51, 33 (1925).
Sherwin-Williams Co., Cleveland, Ohio. Free Mulsion	....	85.70[24]	....	....	....	....	....	....	162	59.40	Conn. Agr. Expt. Sta., Sample 7776.
Sherwin-Williams Co., Cleveland, Ohio. Spray Mulsion	....	83.60	2.90	8.10	5.00	4.00	....	24.70	...	....	Cal. Dept. Agr., Spec. Pub. 75, 53 (1927).
Sherwin-Williams Co., Cleveland, Ohio. Summer Mulsion	75.00	74.90	....	....	....	24.40	....	36.50	...	95.20	Cal. Dept. Agr., Spec. Pub. 75, 50 (1927).
Sherwin-Williams Co., Cleveland, Ohio. Winter Mulsion	75.00	75.34	0.23	....	....	23.80	0.11	27.20	...	58.90	Cal. Dept. Agr., Spec. Pub. 66, 31 (1926).
Standard Oil Co. of Indiana. Dendrol[25]	....	....	....	....	....	....	....	....	142	62.80	Conn. Agr. Expt. Sta., Sample 7777.
Standard Oil Co. of Indiana. L 21 Oil[26]	....	....	....	....	....	....	0.06	....	193	60.80	Conn. Agr. Expt. Sta., Sample 8862.
Sterling Spray Co. S. O. S. Sterling Oil Spray	....	92.48	....	1.90	....	4.55	....	36.65	37	76.10	Cal. Dept. Agr., Spec. Pub. 75, 51 (1927).
Sun Co., Boston & New York. Sun Miscible Oil[27]	....	79.00	....	....	....	....	2.85	....	...	....	Conn. Agr. Expt. Sta., Bull. 258, 373 (1924).
Sun Oil Co., Philadelphia, Pa. Sunoco Spray Oil	....	....	....	....	....	....	....	....	374	46.00	Conn. Agr. Expt. Sta., Sample 8046.
Van Antwerp Drug Corp., Mobile, Ala. Schnarr's Insecticide[28]	....	49.13	....	....	....	33.68	1.44	....	...	....	Conn. Agr. Expt. Sta., Bull. 258, 373 (1924).

[3]Per cent by volume.
[21]Specific gravity, 0.89002.
[22]Ether-insoluble (gums) 2.05 per cent.
[23]Ether-insoluble (gums) 2.18 per cent.
[24]Cc per 100 gm.
[25]Alcohol 0.23 per cent.
[26]Total nitrogen 0.03 per cent, ammonia nitrogen 0.01 per cent.
[27]Unsaponifiable matter 79.00 per cent; saponified matter 16.00 per cent.
[28]Total fatty acids 8.25 per cent; free fatty acids 0.77 per cent.

Ortho Penetrating Oil Spray.

See "Oil Emulsions, Mineral."

Ortho Penetrating Poisoned Barley.

See "Strychnine Preparations."

Ortho Poison Brand.

(CALIFORNIA SPRAY CHEMICAL CO., WATSONVILLE, CAL.)

	Guaranteed.	Found.
Arsenious oxide	7.10	6.90
Arsenic, metal	1.75	5.22

Cal. Dept. Agr., Spec. Pub. 51, 18 (1925).

Ortho Walnut Worm and Aphis Dust.

(CALIFORNIA SPRAY CHEMICAL CO., WATSONVILLE, CAL.)

	Guaranteed.	Found.
Nicotine	0.90	1.17
Total arsenious oxide	3.00	3.22
Total arsenic, metal	1.96	2.10
Water-soluble arsenic, metal	....	0.06
Lead oxide	....	10.00

Cal. Dept. Agr., Spec. Pub. 75, 38 (1927).

Ortho Walnut Worm Dust.

(CALIFORNIA SPRAY CHEMICAL CO., WATSONVILLE, CAL.)

	Guaranteed.	Found.
Arsenic	1.96	1.72

Cal. Dept. Agr., Spec. Pub. 75, 26 (1927).

Ortho Weed Killer.

(CALIFORNIA SPRAY CHEMICAL CO., WATSONVILLE, CAL.)

	Guaranteed.	Found.
Arsenious oxide	29.00	29.73

Cal. Dept. Agr., Spec. Pub. 75, 25 (1927).

Ortho Whale Oil Soap.

See "Soaps."

Otaylite.

(MANUFACTURER NOT STATED)

Found: Water 8.20 per cent; soap 14.38 per cent; free sulphur 8.13 per cent; sodium carbonate 22.50 per cent; silica 28.46 per cent; iron and aluminum oxides 1.40 per cent; calcium carbonate 13.05 per cent; magnesium carbonate 3.48 per cent. No arsenic or lead present.

Cal. Dept. Agr., Spec. Pub. 34, 59 (1923).

The Owl Argentine Ant Poison.

(THE OWL DRUG CO., SACRAMENTO, CAL.)

	Guaranteed.	Found.
Arsenic	0.20	0.18

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

Owl Prussic Acid.

See "Hydrocyanic Acid".

The Owl Sheep Dip.

See "Phenol Soap Solutions."

"Oxygenic" Powder.

(OXYGENIC INDUSTRIAL CO., LOS ANGELES, CAL.)

Found: Water 7.48 per cent; copper sulphate ($CuSO_4.5H_2O$) 28.45 per cent; calcium oxide 32.12 per cent; gypsum 11.29 per cent; ammonium chloride 4.59 per cent; potassium chloride 3.42 per cent; sodium chloride 0.50 per cent; magnesium chloride 2.85 per cent; magnesium sulphate 3.10 per cent; silica 2.40 per cent; iron and aluminum oxides 0.58 per cent; carbon dioxide 3.22 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 60 (1923).

P.

Pacific R & H Hydrocyanic Acid.

See "Hydrocyanic Acid."

Panama Spray Compound.

(CENTER PHARMACY, OAKLAND, CAL.)

No statement of active or inert ingredients. Not analyzed.

Cal. Dept. Agr., Spec. Pub. 66, 36 (1926).

Paracide.

See "Paradichlorbenzene."

Paradichlorbenzene.

See Table XXIII.

Paragrene.

(FRED L. LAVANBURG, NEW YORK, N. Y.)

Found: Cupric oxide 23.46 per cent; combined arsenious oxide 17.52 per cent; free arsenious oxide 23.08 per cent; acetic acid 6.72 per cent; gypsum 19.31 per cent, sodium sulphate 2.26 per cent; sodium chloride 0.25 per cent; ferric oxide 0.20 per cent; moisture 6.20 per cent. The substance is a mixture of Paris green, gypsum and white arsenic.

Univ. of Cal. Coll. of Agr., Expt. Sta., Bull. 151, 23 (1903).

Paris Green.

See Table XXIV.

Parker's Magic Discovery.

See "Lime-Sulphur Solution."

Par'Oidium.

(F. C. BOUCHER & CO., ST. PAUL, MINN., IMPORTERS).

Found: Ash insoluble in hydrochloric acid 7.10 per cent; carbon dioxide 2.88 per cent; sulphur trioxide 17.12 per cent; ferric oxide 10.63 per cent; calcium oxide 15.58 per cent; magnesium oxide 0.73 per cent; free sulphur 19.12 per cent; tobacco and water (by difference) 26.84 per cent. Substance is a mixture of gypsum, sulphur, ferric oxide, small amounts of sand, and tobacco.

U. S. D. A., Bur. Chem., Bull. 68, 54 (1902).

TABLE XXIII. PARADICHLORBENZENE

Manufacturer or Distributor and Brand	Paradichlorbenzene		Melting Point °C.	Publication
	Guaranteed	Found		
	%	%		
Braun-Knecht-Heimann, San Francisco, Cal.	99.00	98.80	.....	Ore. Agr. Expt. Sta., Cir. 84, 14 (1927).
California Spray Chemical Co., Watsonville, Cal. Ortho	99.00	98.50	.....	Cal. Dept. Agr., Spec. Pub. 75, 65 (1927).
Hooker Electrochemical Co., Paracide	100.00	99.70	.....	Cal. Dept. Agr., Spec. Pub. 75, 66 (1927),
Mechling Bros. Mfg. Co. Camden, N. J. Mechling's P. T. B.	.....	.....	56	Conn. Agr. Expt Sta., Bull. 242, 160 (1922).
Niagara Alkali Co. Niagara P. D. B.[1]	.....	99.17	53.2	Cal. Dept. Ag . Spec. Pub. 51 56 (1925).
Southern California Disinfecting Co., Los Angeles Cal. Cedar Blocks	100.00	93.60	.....	Cal. Dept. Agr., Spec. Pub. 75, 66 (1927).

[1] No ash.

TABLE XXIV. PARIS GREEN

Manufacturer or Distributor and Brand	Arsenious Oxide				Cupric Oxide Found	Publication
	Total		Water-Soluble			
	Guaranteed	Found	Guaranteed	Found		
	%	%	%	%	%	
Acme White Lead & Color Works, Detroit, Mich.	50.00	57.50	....	1.00	24.60	Ore. Agr. Expt. Sta., Cir. 84, 9 (1927).
Bowker Chemical Co., New York, N. Y.	50.00	55.23	3.50	1.15	29.55	N. J. Agr. Expt. Sta., Bull. 459, 5 (1927).
Brunswig Drug Co. Pfeiffer's	50.00	57.01	3.50	5.30	....	Cal. Dept. Agr., Spec. Pub. 75, 23 (1927).
Chipman Chemical Engineering Co., Inc., Bound Brook, N. J. Chipman	50.00	55.17	3.50	0.64	31.28	N. J. Agr. Expt. Sta., Bull. 459, 5 (1927).
Le Comptoir Co-Opératif Fédéré de Québec, Montreal, Can	....	55.48	....	1.15	30.42	Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).
Dupuy & Ferguson, Montreal, Can	....	56.99	....	1.17	30.07	Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).
The Glidden Co., Cleveland, Ohio. Glidden	50.00	55.32	3.50	2.47	....	Cal. Dept. Agr., Spec. Pub. 75, 23 (1927).
Interstate Chemical Co., Jersey City, N. J. Key	50.00	55.04	3.50	1.15	31.60	N. J. Agr. Expt. Sta., Bull. 459, 5 (1927).
Fred. J. Lavanburg Co., New York, N. Y. Star	50.00	55.68	3.50	3.26	....	Cal. Dept. Agr., Spec. Pub. 75, 23 (1927).
John Lucas & Co., Inc., Philadelphia, Pa. John Lucas	50.00	55.58	3.50	3.07	....	Cal. Dept. Agr., Spec. Pub. 75, 23 (1927).
Lucas-Kil-Tone Co., Vineland, N. J. Green Cross	50.00	54.53	3.60	2.43	31.68	N. J. Agr. Expt. Sta., Bull. 459, 5 (1927).
Martin-Senour Co., Chicago, Ill.	50.00	54.33	3.50	1.65	30.19	N. J. Agr. Expt Sta., Bull. 424, 7 (1925).
Montgomery, Wa d & Co., Oakland, Cal.	50.00	56.72	3.50	2.06	....	Cal. Dept. Agr., Spec., Pub. 75, 23 (1927).
Nitrate Agencies Co., Bayonne, N. J. Naco	50.00	54.34	3.50	1.50	30.01	N. J. Agr. Expt. Sta., Bull. 407, 7 (1924).
Pfeiffer Insecticide Co., Inc., New York, N. Y. Bug	50.00	53.15	3.50	1.65	29.80	N. J. Agr. Expt. Sta., Bull. 424, 7 (1925)
Sherwin-Williams Co., Cleveland, Ohio. Sherwin-Williams	50.00	55.83	3.50	2.74	....	Cal. Dept. Agr., Spec. Pub. 75, 23 (1927).
Sherwin-Williams Co., Cleveland, Ohio. Hemmingway's	50.00	55.42	3.50	1.10	....	Cal. Dept. Agr., Spec. Pub. 75, 23 (1927).
Snow & Nealley, Bangor, Me	....	57.20	....	3.02	....	Maine Agr. Expt Sta., Official Inspections 126; 84 (1927).
Walnut Growers' Spray Mfg. Co. Golden State	50.00	55.73	3.50	2.37	....	Cal. Dept. Agr., Spec. Pub. 75, 23 (1927).
Western Wholesale Drug Co. Devoe	50.00	56.69	3.50	2.24	....	Cal. Dept. Agr., Spec. Pub. 75, 23 (1927).
Western Wholesale Drug Co. Star	50.00	57.81	3.50	1.98	....	Cal. Dept. Agr., Spec. Pub. 75, 23 (1927).

P. B. K.

(JOHN LUCAS & CO., INC., PHILADELPHIA, PA.)

(See also "Green Cross P. B. K.")

	Guaranteed.	Found.
Total arsenic, metal	21.30	21.24
Water-soluble arsenic, metal	1.00	1.64
Copper	6.00	9.00

N. J. Agr. Expt. Sta., Bull. 407, 14 (1924).

P. D. Q. Argentine Ant Solution.

See "Hirschey."

P. D. Q. Insect Powder.

(WORCESTER COMPOUND CO., WORCESTER, MASS.)

Found: Moisture 2.62 per cent; free sulphur 15.59 per cent; ash insoluble in hydrochloric acid 64.51 per cent; ash soluble in hydrochloric acid 15.23 per cent; coal-tar products (by difference) 2.05 per cent; calcium, magnesium, potassium, sodium, sulphate and phosphate present. A mixture of sulphur, coal-tar products and earth.

U. S. D. A., Bur. Chem., Bull. 68, 49 (1902).

Peerless Spray Emulsion.

Penetrating Oil Spray.

See "Oil Emulsions, Mineral."

Perfecto Rosin Paste.

See "Soaps."

Perfecto Spray Oil.

See "Oil Emulsions, Mineral."

Pest-Go.

(PEST-GO, INC., PORTLAND, ORE.)

	Guaranteed.	Found.
Active salts	70.00	68.80

Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).

Pestroy.

See "Bordeaux Mixture-Lead Arsenate."

Peterman's Roach Food.

(WM. PETERMAN, NEW YORK, N. Y.)

Found: Borax 20.60 per cent; balance potato or pea meal and red coloring matter.

U. S. D. A., Bur. Chem., Bull. 68, 43 (1902).

Petrotine.

See "Oil Emulsions, Mineral."

Pheno-Dip.

See "Phenol Soap Solutions."

Phenol.

See Table XXV.

Phenolene.

See "Phenol Soap Solutions."

TABLE XXV. PHENOL

Manufacturer or Distributor and Brand	Phenols		Water	Non-Soap Ash	Oils	Constants of Separated Oil		Publication
	Guaranteed	Found				Baumé Gravity, Degrees	Unsulphonated	
	%	%	%	%	%		%	
Braun-Knecht-Heimann Co., San Francisco, Cal. Acid Carbolic, Crude	....	24.60	0.50	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 58, 46 (1925).
Braun-Knecht-Heimann Co., San Francisco, Cal. Hercules Carbolic Acid	....	33.60	1.00	....	65.40	....	....	Cal. Dept. Agr., Spec. Pub. 75, 56 (1927).
Germain Seed & Plant Co. Germain Crude Carbolic Acid[1]	15.00	14.70	0.40	....	82.80	23.50	22.50	Cal. Dept. Agr., Spec. Pub. 58, 46 (1925).
Hayward Drug Co., Hayward, Cal. Crude Carbolic Acid	....	22.00	0.60	0.13	75.66	0.80	39.03	Cal. Dept. Agr., Spec. Pub. 51, 44 (1925).
A. R. Maas Laboratories. Crude Carbolic Acid	....	14.92	trace	0.05	84.48	0.70	trace	Cal. Dept. Agr., Spec. Pub. 51, 44 (1925).
Mefford Chemical Co., Los Angeles, Cal. Crude Carbolic Acid	....	37.70	1.60[2]	trace	59.60	12.30	7.20	Cal. Dept. Agr., Spec. Pub. 51, 44 (1925).
Peterson Bros., Hayward, Cal. Waters Bros. Crude Carbolic Acid[1]	.....	17.00	0.20	....	80.50	20.80	36.10	Cal. Dept. Agr., Spec. Pub. 58, 46 (1925).
R. R. Rogers Chemical Co., San Francisco, Cal. Crude Carbolic Acid	40.00	42.00	14.00	....	44.00	....	....	Cal. Dept. Agr., Spec. Pub. 75, 56 (1927).
R. R. Rogers Chemical Co., San Francisco, Cal. Crude Carbolic Acid 25 per cent.	25.00	26.92	1.60	0.03	70.98	1.60	3.60	Cal. Dept. Agr., Spec. Pub. 51, 44 (1925).
Rogers Pharmacy, Hayward, Cal. Crude Sol. Carbolic Acid	....	12.60	trace	0.07	86.50	25.50	49.80	Cal. Dept. Agr., Spec. Pub. 51, 44 (1925).

[1] Adulterated with mineral oil.
[2] Guaranteed none.

TABLE XXVI. PHENOL SOAP SOLUTIONS

Manufacturer or Distributor and Brand	Phenols		Soap		Water		Non-Soap Ash	Oils			Publication
	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found		Total	Tar	Mineral	
	%	%	%	%	%	%	%	%	%	%	
Acme White Lead & Color Works, Detroit, Mich. Acme Sheep & Cattle Dip	....	10.70	....	24.30	10.00	10.40	0.60	....	52.00	....	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).
An-Fo Mfg. Co., Los Angeles, Cal. An-Fo Disinfectant	....	16.10	....	21.81	10.00	9.60	2.09	....	49.25	....	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).
An-Fo Mfg. Co., Los Angeles, Cal. An-Fo Sheep Dip	....	17.30	....	20.90	10.00	8.20	1.05	....	50.40	....	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).
H. L. Atkinson, San Francisco, Cal. At-Ko Sheep Dip	....	22.20	....	5.86	10.00	2.00	0.35	....	68.29	....	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).
Buker's Bird Store, San Francisco, Cal. Buker's Sheep Dip	....	25.10	....	14.40	10.00	6.40	....	....	22.70	29.40	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).
Coffin-Redington Co., San Francisco, Cal. Creo Fenol Sheep Dip	....	14.00	....	16.00	10.00	8.00	0.50	....	59.70	....	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).
The G. E. Conkey Co., Cleveland, Ohio. Conkey's Noxicide[1,2]	....	16.80	....	23.30	9.00	8.60	0.60	49.20	....	....	Cal. Dept. Agr., Spec. Pub. 51, 45 (1925).
Economy Hog & Cattle Powder Co. Economy Germicide Dip	....	15.90	....	14.20	10.00	6.60	1.20	....	60.90	....	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).
W. P. Fuller & Co. Fuller's Carbolic Insecticide Sheep Dip	9.10	13.00	6.00	7.90	....	29.80	4.80	....	45.00[3]	....	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).
W. P. Fuller & Co. Fuller's Sheep Dip and Cattle Wash	9.15	11.00	24.94	7.60	....	15.30	2.40	....	63.20[4]	....	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).
Furst-McNess Co., Oakland, Cal. F. W. McNess Krenol Dip & Disinfectant	....	19.40	....	26.20	8.00	8.00	0.50	....	43.60	....	Cal. Dept. Agr., Spec. Pub. 75, 57 (1927).

Germain Seed & Plant Co., Los Angeles, Cal. Cann's Canco	....	10.25	....	20.57	10.00	14.10	1.06	....	52.68	....	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Germo Mfg. Co. Germo Carboline..	....	9.50	....	13.60	12.00	12.00	0.70	....	62.60	....	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Germo Mfg. Co. Germo Cresosote Dip	....	12.40	....	14.70	12.00	7.40	....	....	63.00	....	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Germo Mfg. Co. Germo Sheep Dip..	....	11.30	....	19.60	12.00	10.40	0.60	....	55.70	....	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Heinrich Chemical Co., Oakland, Cal. Ongman's Dip & Disinfectant	....	12.50	....	10.30	8.00	5.80	1.70	....	25.80	44.00	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Dr. Hess & Clark. Dr. Hess Dip and Disinfectant	14.00	14.93	20.00	19.07	9.50	8.87	1.25	....	54.03[5]	....	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Hockwald Chemical Co. Hockwald's Sheep Dip	....	14.50	....	17.80	12.00	7.80	0.50	....	56.80	....	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Kirk, Geary & Co. Kirk Geary Dipsol Sheep Dip	16.00	25.30	....	14.10	7.00	4.60	0.10	....	28.70[6]	26.70	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Langley & Michaels Co. Cresolite Sheep Dip	...	16.60	. .	22.70	10.00	10.80	. .	. .	48.30	. .	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Langley & Michaels Co., Germosol Special Disinfectant	....	58.80	....	20.10	20.00	17.00	3.70	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Dr. LeGear Medicine Co., St. Louis, Mo. Dr. LeGear's Dip and Disinfectant[1,7]	....	12.51	....	18.90	12.00	10.80	0.20	55.97	....	....	Cal. Dept. Agr., Spec, Pub. 51, 45 (1925).
Arthur R. Maas Chemical Co. Cresylol	....	14.76	....	15.60	15.00	10.60	0.43	....	. .	57.95	Cal. Dept. Agr., Spec. Pub. 75, 58 (1927).
Mefford Chemical Co. Sheep Dip...	....	3.50	....	....	10.00	9.20	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 45 (1925).

[1]Contains rosin.
[2]Sp. Gr. of oil, Baumé, 3.10. Unsulphonated, trace.
[3]Guaranteed 54.40 per cent.
[4]Guaranteed 36.60 per cent.
[5]Guaranteed 53.00 per cent.
[6]Guaranteed 65.00 per cent.
[7]Sp. Gr. of oil, Baumé, 2.95. Unsulphonated, 1.80 per cent.

TABLE XXVI. PHENOL SOAP SOLUTIONS—*Continued*

Manufacturer or Distributor and Brand	Phenols		Soap		Water		Non-Soap Ash	Oils			Publication
	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found		Total	Tar	Mineral	
	%	%	%	%	%	%	%	%	%	%	
Michel & Pelton Co., San Francisco, Cal. Liquor Cresolis Compound...	50.00	52.43	....	....	21.00	21.18	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 43 (1925).
Michel & Pelton Co., San Francisco, Cal. Liquor Cresolis Compound .	....	47.75	....	....	15.00	16.00	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 43 (1925).
Michel & Pelton Co., San Francisco, Cal. Liquor Cresolis Compound...	....	53.03	....	....	21.00	19.85	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 43 (1925).
Michel & Pelton Co., San Francisco, Cal. Mapco Sheep Dip.....	....	18.70	....	8.60	10.00	2.20	0.30	....	28.30	40.00	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
Moorman Mfg. Co. Moor Mans Stock & Poultry Dip & Disinfectant[1,8]	....	23.12	....	30.20	8.00	8.20	0.16	36.99	....	....	Cal. Dept. Agr., Spec. Pub. 51, 44 (1925).
H. K. Mulford Co. Krelos.....	....	28.70	....	13.70	10.00	9.00	1.80	....	45.60	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
Ness & Co., Darlington, England. Thymo-Cresol[9].....	....	....	....	....	....	....	....	....	....	....	U. S. D. A., Bur. Chem. Bull. 68, 57 (1902).
No-Vermo Mfg. Co. Sol-o-cree[1, 10]..	....	6.00	....	18.80	10.00	9.80	0.40	63.20	....	....	Cal. Dept. Agr., Spec. Pub. 51, 45 (1925).
The Owl Drug Co. The Owl Sheep Dip.....	....	20.00	....	14.20	10.00	8.00	1.50	....	55.70	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
Pacific Chemical Co., Los Angeles, Cal. Licresol.....	50.00	50.75	....	....	....	21.20	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 43 (1925).
Parke, Davis & Co., Detroit, Mich. Kreso Dip No. 1.....	....	22.55	....	20.80	8.00	8.60	2.65	....	44.60	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
Polk Miller Products Corp. Sergeant's Disinfectant.....	....	22.10	....	23.00	10.00	9.00	0.70	....	42.60	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
Pratt Food Co. Pratt's Dip and Disinfectant.....	9.50	9.20	....	15.50	10.00	8.00	0.30	....	64.90[11]	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
W. T. Rawleigh Co., Oakland, Cal. Rawleigh's Stock Dip and Disfectant.....	....	16.40	....	17.90	8.00	8.40	1.20	....	54.30	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
Ansel W. Robinson, San Francisco, Cal. Robinson's Red Label Sheep Dip.....	....	20.12	....	9.41	10.00	2.00	0.07	....	65.40	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
R. R. Rogers Chemical Co., San Francisco, Cal. Arcol.....	50.00	51.85	20.00	19.78	25.00	22.25	0.09	....	5.34	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
R. R. Rogers Chemical Co., San Francisco, Cal. Ravol.....	50.00	43.50	20.00	21.50	27.00	24.01	0.63	....	8.40	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
R. R. Rogers Chemical Co., San Francisco, Cal. Vermol.....	50.00	50.50	20.00	22.80	25.00	19.90	0.68	....	4.79	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
Scott & Gilbert Co. Scott & Gilbert Sheep Dip.....	....	19.20	....	18.45	10.00	9.10	0.80	....	51.45	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
The Shaw-Batcher Co. Capital Sheep Dip and Cattle Wash[12]....	....	....	....	....	....	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 59 (1927).
The Sherwin-Williams Co., Cleveland, Ohio. Pheno Dip.....	....	26.50	....	23.90	8.00	8.20	0.30	....	38.80	....	Cal. Dept. Agr., Spec. Pub. 75, 60 (1927).
The Sherwin-Williams Co., Cleveland, Ohio. Phenolene[1].....	....	15.20	....	21.10	10.00	8.40	0.23	54.31	....	....	Cal. Dept. Agr., Spec. Pub. 51, 45 (1925).
The Sherwin-Williams Co., Cleveland, Ohio. S. W. Sheep Dip....	....	10.40	....	22.10	10.00	10.00	0.10	....	55.30	....	Cal. Dept. Agr., Spec. Pub. 75, 60 (1927).
Spratt's Patent, Ltd., San Francisco, Cal. Spratt's Dip.....	....	23.70	....	20.80	10.00	8.00	2.90	....	43.80	....	Cal. Dept. Agr., Spec. Pub. 75, 60 (1927).
United Drug Co. No. 6 Disinfectant	....	29.40	....	14.70	10.00	7.80	2.20	....	45.40	....	Cal. Dept. Agr., Spec. Pub. 75, 60 (1927).

[1]Contains rosin.
[8]Sp. Gr. of oil, Baumé, 3.70. Unsulphonated, trace.
[9]Substance is a creosote soap emulsion.
[10]Sp. Gr. of oil, Baumé, 22.40. Unsulphonated, 39.90 per cent.
[11]Guaranteed 55.00 per cent.
[12]Emulsion broken. Not analyzed.

TABLE XXVI. PHENOL SOAP SOLUTIONS—*Concluded.*

Manufacturer or Distributor and Brand	Phenols		Soap		Water		Non-Soap Ash	Oils		Publication
	Guaranteed	Found	Guaranteed	Found	Guaranteed	Found		Total	Tar	Mineral	
	%	%	%	%	%	%	%	%	%	%	
Geo. Z. Wait Co. Dr. G. Z. Wait's Sheep Dip	15.00	13.70	....	21.40	....	10.20	....	0.10	52.20[11]	....	Cal. Dept. Agr., Spec. Pub. 75, 60 (1927).
G. Z. Waite, Sacramento, Cal. Sheep Dip	15.00	14.20	....	21.20	....	9.60	....	51.10[7]	....	....	Cal. Dept. Agr., Spec. Pub. 58, 46 (1925).
Water Bros., Inc., Oakland, Cal. Liquor Cresolis Compound	40.00	45.50	....	34.10[13]	28.00	17.00	0.50	....	1.80	....	Cal. Dept. Agr., Spec. Pub. 75, 60 (1927).
Water Bros., Inc., Oakland, Cal. Sheep Dip	....	21.40	....	6.90	10.00	3.20	0.20	....	28.10	....	Cal. Dept. Agr., Spec. Pub. 75, 60 (1927).
J. R. Watkins Co., Oakland, Cal. Watkin's Germicide Dip and Disinfectant	18.00	17.40	24.40	22.70	....	8.40	1.40	....	49.00[14]	....	Cal. Dept. Agr., Spec. Pub. 75, 60 (1927).
West Disinfecting Co., San Francisco, Cal. Carco Natholeum Dip	....	12.50	....	21.80	10.00	10.40	1.80	....	51.60	....	Cal. Dept. Agr., Spec. Pub. 75, 60 (1927).
West Disinfecting Co. Karspray	....	47.00	....	21.40	25.00	21.40	....	3.65	....	....	Cal. Dept. Agr., Spec. Pub. 66, 33 (1926).
West Disinfecting Co. Licresolis	....	55.63	....	....	15.00	13.20	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 43 (1925).
Western Wholesale Drug Co., Los Angeles, Cal. Solution of Cresol	50.00	48.30	....	....	....	19.20	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 43 (1925).
Williams & Moore. W. & M. Antiseptic Sheep Dip	....	18.10	....	....	15.00	8.00	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 51, 44 (1925).

[7]Sp. Gr. of oil, Baumé, 2.95. Unsulphonated, 1.80 per cent.
[11]Guaranteed 55.00 per cent.
[13]Includes 32.00 per cent. olive and other oils.
[14]Guaranteed 49.30 per cent.

TABLE XXVII. PHOSPHORUS PREPARATIONS

Manufacturer or Distributor and Brand	Free Phosphorus		Publication
	Guaranteed	Found	
	%	%	
Allan-Pfeiffer Chemical Co., St. Louis, Mo. Allan's Lightning Roach Paste[1]	....	1.94	U. S. D. A. Bur. Chem., Bull. 68, 45 (1902).
American Druggists Syndicate. A.D. S. Rat and Roach Paste	2.00	1.90	Cal. Dept. Agr., Spec. Pub. 75, 47 (1927).
Barnard & Co., Boston, Mass. Roach and Water Bug Exterminator[2]	....	1.37	U. S. D. A. Bur. Chem., Bull. 68, 45 (1902).
C. S. Brown & Co., Chicago, Ill. Fidelity Cockroach Paste[3]	....	0.77	U. S. D. A. Bur. Chem., Bull. 68, 45 (1902).
Buffalo Specialty Co. Rat Nip	2.50	1.20	Cal. Dept. Agr., Spec. Pub. 75, 47 (1927).
B. E. Cole, Hollister, Cal. Squirrel Poison-Phosphorus[4]	0.90	0.026	Cal. Dept. Agr., Spec. Pub. 51, 52 (1925).
Common Sense Mfg. Co. Common Sense Rat Exterminator	2.00	1.59	Cal. Dept. Agr., Spec. Pub. 58, 41 (1925).
The DePree Co., San Francisco, Cal. Pied Piper Rat and Roach Paste	2.00	1.30	Cal. Dept. Agr., Spec. Pub. 75, 47 (1927).
C. W. Hill Chemical Co., Los Angeles, Cal. Rat Poison (Mission)[5]	....	0.60	Cal. Dept. Agr., Spec. Pub. 51, 52,(1925).
Hudelson & Damrell, Modesto, Cal. Gold Crown Poison	5.00	8.53	Cal. Dept. Agr., Spec. Pub. 75, 47 (1927).
Hudelson & Damrell, Modesto, Cal. Gold Crown Poison Barley[6]	....	0.07	Cal. Dept. Agr., Spec. Pub. 66, 35 (1926).
Jacob's Pharmacy, Atlanta, Ga. Tiger Paste[2]	....	1.93	U. S. D. A. Bur. Chem., Bull. 68, 45 (1902).
H. K. Mulford Co. Mulford Phosphorus Paste	2.00	2.34	Cal. Dept. Agr., Spec. Pub. 75, 47 (1927).
Nyal Co., San Francisco, Cal. Sure Kill Rat and Roach Paste	1.50	1.58	Cal. Dept. Agr., Spec. Pub. 75, 47 (1927).
The Rat Biscuit Co. Rat Bis-Kit Paste	2.00	2.28	Cal. Dept. Agr., Spec. Pub. 75, 47 (1927).
The Rat-Mum Co. Rat-Mum	0.20	0.11	Cal. Dept. Agr., Spec. Pub. 58, 41 (1925).
Stearns' Electric Paste Co. Stearns' Electric Rat and Roach Paste	1.50	2.16	Cal. Dept. Agr., Spec. Pub. 75, 47 (1927).
United Drug Co. Elkay's Rat and Roach Paste	2.00	1.73	Cal. Dept. Agr., Spec. Pub. 75, 47 (1927).
Youell's Exterminating Co., Westfield, N. J. Youell's Rat Snap[7]	3–1 2/16	0.63	Cal. Dept. Agr., Spec. Pub. 51, 52 (1925).
Zeno Products, Inc., New York, N. Y. Zeno	2.00	0.11	Cal. Dept. Agr., Spec. Pub. 51, 52 (1925).

[1]Contains corn starch and glucose.
[2]Contains wheat starch and molasses.
[3]Contains wheat starch, molasses and glucose.
[4]Manufacture discontinued.
[5]Guaranteed 97.00 per cent. inert matter (honey). Manufacture discontinued.
[6]No potassium cyanide found present.
[7]Guaranteed hydrocyanic acid 5/16 per cent; hydrochloric acid 5/16 per cent; hydrofluoric acid 5/16 per cent; "vertigrese," blue stone and water 1 4/16 per cent; lard, molasses, flour and corn meal 94 1/16 per cent. No hydrocyanic, hydrochloric or hydrofluoric acids or copper found.

Phenol Soap Solutions.

See Table XXVI.

Phosphorus Preparations.

See Table XXVII.

Pied Piper Rat and Roach Paste.

See "Phosphorus Preparations."

Pink Arsenoid (Lead Arsenite.)

(ADLER COLOR & CHEMICAL WORKS, NEW YORK, N. Y.)

Found: Lead oxide 49.58 per cent; combined arsenious oxide 40.02 per cent; free arsenious oxide 3.24 per cent; moisture 0.31 per cent; organic matter, lead sulphate, etc., 6.85 per cent. The substance is colored with a pink aniline residue.

Univ. of Cal. Coll. of Agr. Expt. Sta., Bull. 151, 26 (1903).

P. K. B.

(JOHN LUCAS & CO., INC., PHILADELPHIA, PA.)

	Guaranteed.	Found.
Total arsenic, metal	21.00	21.64
Water-soluble arsenic, metal	1.00	0.87
Copper	....	15.50

N. J. Agr. Expt. Sta., Bull. 441, 13 (1926).

Plant Oil.

(B. G. PRATT CO., NEW YORK, N. Y.)

Found: Largely vegetable oils.

N. Y. Agr. Expt. Sta,. Bull. 384, 302 (1914).

Plant Tonic and Insecticide.

(BYRNE MFG. CO., OAKLAND, CAL.)

Declared composition: Tobacco stems, lime, sulfur, borax, oil of sassafras (synthetic), geranium oil and water.

Found: Nicotine 0.22 per cent; free sulphur 0.39 per cent; faint test for borax; very small amount of calcium oxide; sassafras and geranium oils present.

Cal. Dept. Agr., Spec. Pub. 34, 60 (1923).

Poison Bait Compound.

(CHIPMAN CHEMICAL ENGINEERING CO., INC., NEW YORK, N. Y.)

Guaranteed: Sodium arsenite 2.50 per cent; inert matter 97.50 per cent; total arsenic 1.60 per cent; water-soluble arsenic 1.60 per cent.

Found: Total arsenic (metal), 0.98 per cent.

Conn. Agr. Expt. Sta., Sample 1825.

Poison Barley.

See "Strychnine Preparations."

Poisoned Ant Syrup.

(SAN DIEGO HORTICULTURAL COMMISSIONER, SAN DIEGO, CAL.)

	Guaranteed.	Found.
Sodium arsenite	0.15	0.23

Cal. Dept. Agr., Spec. Pub. 66, 19 (1926).

Poisoned Barley.

Poisoned Grain.

Poisoned Grain Squirrel Poison.

See "Strychnine Preparations".

Poison Green.

(BANNENMAN CHEMICAL CO., SYRACUSE, N. Y.)

Found: Substance is artifically colored calcium arsenite. Arsenious oxide, 38.4 per cent.

N. Y. Agr. Expt. Sta., Bull. 348, 98 (1912).

Poison Spray Tabs—Bordeaux Arsenate.

(EARL THOMAS CULTURE CORP, NEW YORK, N.Y.)

	Guaranteed.	Found.
Total arsenic, metal	5.00	5.51
Water-soluble arsenic, metal	0.05	0.07
Copper	....	12.40

Maine Agr. Expt. Sta., Official Inspections 110, 56 (1923).

Poison Wheat.

See "Strychnine Preparations."

Pomodust.

See "Niagara 90-10 Dusting Mixture."

Potassium Cyanide.

(MANUFACTURER NOT STATED).

Found: Moisture 0.22 per cent; potassium cyanide 93.80 per cent sodium cyanide 0.87 per cent; sodium chloride 1.15 per cent; potassium ferrocyanide 0.75 per cent; fine dust 3.22 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 25 (1923).

Potato Dust Mixture.

See "Nicotine Dusts."

Potato Dust Poison.

(DELORO CHEMICAL CO., DELORO, ONT., CANADA).

Found: Total arsenic oxide 9.62 per cent; water-soluble arsenic oxide 0.10 per cent; cupric oxide 8.07 per cent.

Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).

Potato Scab Destroyer.

(AM. HORT. DISTRIBUTING CO., MARTINSBURG, W. VA.)

Found: Substance is an artifically colored solution of formaldehyde.

N. Y. Agr. Expt. Sta., Bull. 384, 301 (1914).

Poultry House Spray.

(PURITY CHEMICAL PRODUCTS CO., SANTA ROSA, CAL.)

Guaranteed: Phenols 25.00 per cent; base, sediment and moisture 2.00 per cent.

Found: Phenols 25.00 per cent; mineral oils 53.90 per cent; water 0.40 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 56 (1927).

Pratt's Carboleine.

See "Oil Emulsions, Mineral."

Pratt's Dip & Disinfectant.

See "Phenol Soap Solutions."

Pratt's Lice Killer.

(PRATT FOOD CO.)

	Guaranteed.	Found.
Nicotine	0.34	0.72
Naphthalene	5.60	5.88
Pyrethrum	4.00	....

Cal. Dept. Agr. Spec. Pub. 75, 40 (1927).

Premium Intestinal Cleaner.

(GERMAIN SEED & PLANT CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Sodium bicarbonate	15.00	15.84

Cal. Dept. Agr., Spec. Pub. 75, 65 (1927).

Preparation B.

(THE INSECTICIDE CO., SAN FRANCISCO, CAL.)

Guaranteed: Inert matter, trace of butter color.
Found: Mineral oils 10.00 per cent; yellow color present; no ash.
Cal. Dept Agr., Spec. Pub. 51, 60 (1925).

Preparation No. 3

(THE INSECTICIDE CO., SAN FRANCISCO, CAL.)

See "Sodium Fluoride."

Preparation No. 5.[1]

(THE INSECTICIDE CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.	Guaranteed.	Found.
Calcium arsenate	7.00	3.48	3.25	3.80
Calcium arsenite	1.00	2.83	2.50	2.71

Cal. Dept. Agr., Spec. Pub. 75, 26 (1927).

Prussic Acid.

See "Hydrocyanic Acid."

P. S. C. Condensed Rosin Spray.

P. S. C. Fish Oil Soap.

See "Soap."

Puritol.

See "Albatross Puritol."

Purity.

(PURITY CHEMICAL PRODUCTS CO.)

	Guaranteed.	Found.
Sodium hypochlorite	4.00	4.24
Available chlorine	....	4.04

Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).

Pyrethro Fly Fluid.

(W. T. RAWLEIGH CO., FREEPORT, ILL.)

Not analyzed.
Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).

[1] Two grades.

Pyrethrum

See Table XXVIII.

Pyrox.

See "Bordeaux Mixture-Lead Arsenate."

Q.

Qua-Sul.[1]

(A. R. GREGORY, SAN FRANCISO, CAL.)

	Guar.	Found.	Guar.	Found.	Guar.	Found.
Sodium polysulphide	.....	7.04	....	8.00	4.45	7.24
Sodium thiosulphate	.....	3.04	....	3.17	7.16	3.60
Active sulphur	.....	....	6.00	....	....	....
Baumé gravity	.....	19.00	....	20.50	....	19.00

Cal. Dept. Agr. Spec. Pub. 66, 23 (1926).

Quick Action Fly Killer.

(QUICK ACTION PRODUCTS CO., BELL, CAL.)

	Guaranteed.	Found.
Baumé gravity, 15.5°C	....	39.90
Mineral oil	....	96.74
Methyl salicylate	3.00	2.49

Cal. Dept. Agr., Spec. Pub. 51, 55 (1925).

Quick Action Lice Powder.

(QUICK ACTION PRODUCTS CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Cresol oil (Phenols)	1.00	0.05
Hydrocarbons	10.00	....
Naphthalene	....	5.92
Sodium fluoride	10.00	8.20
Inert matter	79.00	....

Cal. Dept. Agr., Spec. Pub. 51, 59 (1925).

Qykade.

(THE CHLORINE PRODUCTS CO., NEW YORK, N. Y.)

Found: Grams per 100 cc. total solids 1.26; available chlorine 0.40; total chlorine, 0.71; calcium oxide, 0.64 per cent. Substance is a mixture of calcium hypochlorite and calcium chloride in solution.
Conn. Agr. Expt. Sta., Bull. 258, 376 (1924).

R.

Rajah Argentine Ant Poison.

(THE OWL DRUG CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Total arsenic, metal	0.20	0.16
Water-soluble arsenic, metal	0.20	0.16

Cal. Dept. Agr., Spec. Pub. 34, 18 (1923).

Rat Bis-Kit Paste.

See "Phosphorus Preparations."

[1] Three Samples.

TABLE XXVIII. PYRETHRUM

Manufacturer or Distributor and Brand	Ether Extract %	Ash %	Water %	Publication
Buhack Producing & Mfg. Co. Buhack Insect Powder........................	6.80	6.43	....	Cal Dept. Agr., Spe . Pub. 75, 63 (1927).
W. T Rawleigh Co., Oakland, Ca'. Rawleigh's Insect Powder........................	9.00	6.80	....	Cal. Dept. Ag ., Spec. Pub. 75 63 (1927).
Winkelmann & Brown Drug Co., Baltimore, Md. Death Dust for Insects........................	10.68	7.74	6.75	U. S. D. A , Bur. Chem., Bull. 68 39 (1902).

Rat-Ex.

(CHEMICAL SPECIALTIES CO., LOS ANGELES. CAL.)

	Guaranteed.	Found.
Barium carbonate........................	20.00	26.21
Inert matter........................	80.00	....

Cal. Dept. Agr., Spec. Pub. 66, 34 (1926).

Rat-Go.

See "Leinen."

Rat-Mum.

Rat-Nip.

Rat Poison (Mission).

See "Phosphorus Preparations".

Rat Scent.

See "Strychnine Preparations".

Rat Tex.

(CALIFORNIA REX SPRAY CO., WATSONVILLE, CAL.)

	Guaranteed.	Found.
Arsenious oxide........................	30.00	31.66

Cal. Dept. Agr., Spec. Pub. 75, 26 (1927).

Ravol.

See "Phenol Soap Solutions."

Rawleigh's Insect Powder.

See "Pyrethrum."

Rawleigh's Louse Powder.

(W. T. RAWLEIGH CO., FREEPORT, ILL.)

Not analyzed.

Cal. Dept. Agr., Spec. Pub. 58, 48 (1925).

Rawleigh's Stock Dip & Disinfectant.

See "Phenol Soap Solutions."

Red Cross Ant Destroyer.

(RED CROSS CHEMICAL CO., CINCINNATI, OHIO.)

Found: Borax 11.07 per cent; calcium oxide 13.12 per cent; sulphur trioxide 18.56 per cent; gypsum and sassafras root present.

U. S. D. A., Bur. Chem., Bull. 68, 43 (1902).

Red Label Sheep Dip.

See "Phenol Soap Solutions."

Reliance Argentine Ant Poison.

(LANGLEY & MICHAELS CO., SAN FRANCISCO, CAL.)

Guaranteed: Arsenic, metal 0.11 per cent; sodium arsenite 0.20 per cent.
Found: Arsenic, metal 0.13 per cent; sodium arsenite 0.22 per cent; invert sugar 7.88 per cent; cane sugar 40.29 per cent; dextrin, etc., 1.82 per cent; water 47.67 per cent.

Cal. Dept. Agr., Spec. Pub. 58, 16 (1925).

Renol.

See "Oil Emulsions, Mineral."

Revenge Lice Destroyer.

(I. D. RUSSELL CO.)

	Guaranteed.	Found.
Naphthalene	2.00	3.57
Sulphur	5.00	5.35
Phenols	....	0.80
Phenol and creosote	5.00	5.92

Cal. Dept. Agr. Spec. Pub. 75, 41 (1927).

Rex Emulso.

See "Oil Emulsions, Mineral.":

Rex Fly Tox.

(CALIFORNIA REX SPRAY CO., BENICIA, CAL.)

Guaranteed: Active ingredients 100.00 per cent.

Found: Specific gravity, 0.8147; oil 100.00 per cent; no water or ash; kerosene 92.50 per cent; safrole present.

Cal. Dept. Agr., Spec. Pub. 51, 56 (1925).

Rex Miscible Oil.

Rex Vulture Oil.

See "Oil Emulsions, Mineral."

Rid-O-Germ.

(WESTERN CHEMICAL CO., INC.)

	Guaranteed.	Found.
Available chlorine	....	2.68
Water	87.28	87.45

Cal. Dept. Agr., Spec. Pub. 75, 61 (1927).

Rip Van Winkle Fly Spray.

See "Oils, Mineral."

Roach and Croton Bug Exterminator.

(PERFECTION MFG. CO., JERSEY CITY, N. J.)

Found: Borax 47.61 per cent; balance pyrethrum, corn meal and pink coloring matter.

U. S. D. A., Bur. Chem., Bull. 68, 43 (1902).

Roach and Water Bug Exterminator.

See "Phosphorus Preparations."

Roach Doom.

See "Murray."

Roachine.

(BROWN & ALLEN, ATLANTA, GA.)

Found: Borax 90.00 per cent; balance pyrethrum and blue coloring matter.

U. S. D. A., Bur. Chem., Bull. 68, 43 (1902).

Roach Liquid.

(THE PIED PIPER SERVICE, PROVIDENCE, R. I.)

Found: Substance is a mixture of kerosene and methyl salicylate.

Conn. Agr. Expt. Sta., Bull. 258, 376 (1924).

Roach Powder.

(THE PIED PIPER SERVICE, PROVIDENCE, R. I.)

Found: Water 14.57 per cent; nitrogen 0.50 per cent; protein 3.13 per cent; starch 13.73 per cent; ash 40.60 per cent; sodium oxide 18.89 per cent; boric oxide 18.32 per cent; chloride 5.12 per cent; traces of silica, iron, sulphate and phosphate. The substance is a mixture of a cereal, borax and salt.

Conn. Agr. Expt. Sta., Bull. 258, 376 (1924).

Roachsault.

(BARRETT CHEMICAL CO., NEW YORK, N. Y.)

Found: Sodium fluoride 85.00 per cent; water 2.53 per cent; aluminum and iron oxides 0.27 per cent; fine sand 9.60 per cent; sodium sulphate (by difference), 2.60 per cent.

U. S. D. A., Bur. Chem., Bull. 68, 53 (1902).

Rosin Spray.

See "Soaps."

Rough on Rats.

(E. S. WELLS ESTATE.)

	Guaranteed.	Found.
Arsenious oxide	....	98.19
Arsenic, metal	56.00	74.37
Barium carbonate	20.00	0.00

Cal. Dept. Agr., Spec. Pub. 75, 27 (1927).

Royal Roach Powder.

(H. C. DUBRING & CO., CHICAGO, ILL.)

Found: Borax 30.94 per cent; arsenious oxide 0.73 per cent; arsenic oxide 4.69 per cent; some calcium and dye stuff. Substance is probably a mixture of borax, London Purple and pyrethrum.

U. S. D. A., Bur. Chem., Bull. 68, 30 (1902).

S.

Salairacine.

(J. D. MCGREGOR, STAMFORD, CONN.)

Two Samples:

Sample 17745.

Found: Moisture 0.90 per cent; acid-insoluble matter, 0.56 per cent; nitrate nitrogen none; lead oxide 24.21 per cent; arsenic oxide 11.73 per cent; iron and aluminum oxides 0.50 per cent; calcium oxide 25.64 per per cent; magnesium oxide 17.33 per cent; carbon dioxide (by difference) 19.13 per cent.

Sample 19740.

Found: Nitrate nitrogen 1.95 per cent; arsenic oxide 10.54 per cent; calcium oxide 17.67 per cen .

Conn. Agr. Expt. Sta., Bull. 242, 161 (1922).

Sanders Blue Dust 5-11.

(NEW YORK INSECTICIDE CO., MEDINA, N. Y.)

	Guaranteed.	Found.
Copper	9.00	11.10

Maine Agr. Expt. Sta., Official Inspections 122, 86 (1926).

Sander's Dust.

(MANUFACTURER UNKNOWN).

Found: Copper 6.10 per cent; arsenic 2.93 per cent: Arsenic is present as calcium arsenate.

Conn. Agr. Expt. Sta., Bull. 258, 370 (1925).

San Jose Summer Oil.

See "Oil Emulsions, Mineral."

San-U-Zay Scale Oil.

(THE GARDINER-JOHNS CO., ROCHESTER, N. Y.)

Found: The substance is largely a mixture of mineral and animal oils.

N. Y. Agr. Expt. Sta., Bull. 384, 301 (1914).

Sapho "Fly X."

(THE KENNEDY MFG. CO., MONTREAL, CANADA.)

Found: Specific gravity, 19° C., 0.844; flash point 67° C.; fire point 77° C.; residue at 100° C., 0.15 per cent; methyl salicylate 2.08 per cent. Base is kerosene.

Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).

Sapho Liquid.

(THE KENNEDY MFG. CO., MONTREAL, CANADA).

Found: Specific gravity, 19° C., 0.844; flash point 67° C.; fire point 78° C.; residue at 100° C., 0.81 per cent; phenol 1.68 per cent. Base is kerosene.

Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).

Sarpa Poultry Spray.

See "Oil Emulsions, Mineral."

Scalecide.

(B. G. PRATT CO., NEW YORK, N. Y.)

Found: Substance is a mixture of mineral and vegetable oils and naphthalene.

N. Y. Agr. Expt. Sta., Bull. 384, 302 (1914).

Scalybark Insecticide.

(DR. MESSIG, SANTA ANA, CAL.)

Found: Water 82.92 per cent; solids 17.08 per cent; lime-sulphur 3.00 per cent; sodium chloride 3.50 per cent; soap 3.00 per cent; free sulphur and vegetable matter, etc. 4.30 per cent; no lead; a minute quantity of arsenic. The substance is partly a yellow liquid and partly a black solid containing some small leaves; it has an ammoniacal odor.

Cal. Dept. Agr., Spec. Pub. 34, 57 (1923).

Schnarr's Insecticide.

See "Oil Emulsions, Mineral."

Schrader Argentine Ant Powder.

(SCHRADER CHEMICAL CO., SAN FRANCISCO, CAL.)

Guaranteed: Sodium fluoride 68.00 per cent; sodium acid fluoride 8.00 per cent; all closed dalmatian flowers 7.20 per cent.

Found: Total fluorine 38.33 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).

Schrader's Argentine Ant Syrup.

(SCHRADER CHEMICAL CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Arsenious oxide	0.20	0.20

Cal. Dept. Agr., Spec. Pub. 75, 24 (1927).

Schrader's Red Ant Powder.

(SCHRADER INSECT POWDERS CO., SAN FRANCISCO, CAL.)

Guaranteed: Sodium fluoride 55.00 per cent; sodium acid fluoride 10.00 per cent; all closed dalmatian flowers 20.00 per cent; inert matter 15.00 per cent.

Found: Total fluorine 30.14 per cent; organic matter 21.13 per cent.

Cal. Dept. Agr., Spec. Pub. 66, 37 (1926).

Scott & Gilbert Sheep Dip.

See "Phenol Soap Solutions."

Scrofularia.

(BENJ. HAMMOND, FISHKILL-ON-HUDSON, N. Y.)

Found: Moisture 4.91 per cent; ash 19.52 per cent; ether extract 7.35 per cent. Substance is a mixture of tobacco and pyrethrum colored with lead chromate.

U. S. D. A., Bur. Chem., Bull. 68, 49 (1902).

Selenine.

(CHARLES DICKENS, OAKLAND, CAL.)

Found: Barium polysulphide 4.33 per cent; barium thiosulphate 0.39 per cent; selenium 0.23 per cent; tellurium trace.

Cal. Dept. Agr., Spec. Pub. 58, 50 (1925).

Semesan.

(E. I. DUPONT DE NEMOURS & CO., INC., WILMINGTON, DEL.).

Guaranteed: Hydroxymercurichlorphenol 35 per cent.; inert matter 65.00 per cent.

Found: Mercury 21.32 per cent; hydroxymercurichlorphenol 36.68 per cent; ash 66.30 per cent; calcium oxide 16.72 per cent; silica 0.68 per cent; iron and aluminum oxides 0.35 per cent; magnesium oxide 0.35 per cent; carbon dioxide 16.79 per cent. The mercury compound is para-hydroxymercuri-orthochlorphenol, probably present as the sodium salt. The inert matter is probably a mixture of calcium hydroxide and sodium carbonate.

Conn. Agr. Expt. Sta., Sa nple 8932.

Semesan Bel.

(E. I. DUPONT DE NEMOURS & CO., INC., WILMINGTON, DEL.).

Guaranteed: Hydroxymercurichlorphenol 10.00 per cent.

Found: Mercury 6.52 per cent.

Cal. Dept. Agr. Spec. Pub. 75, 62 (1927).

Sergeant's Disinfectant.

See "Phenol Soap Solutions."

70-10-20.

(J. R. GILLAM & BRO., BURLINGTON, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	1.80	1.80
Water-soluble arsenic, metal	....	0.30
Sulphur	68.00	69.69

N. J. Agr. Expt. Sta., Bull. 441, 11 (1926).

70-10-20 Mixture.

See "Niagara Mixture No. 150."

70-10-20 Sulfur Lead-Lime Dust.

(LUCAS-KIL-TONE CO., VINELAND, N. J.)

Guaranteed: Sulphur 70.00 per cent.

Found: Sulphur 66.48 per cent; total arsenic 1.93 per cent; water-soluble arsenic 0.26 per cent.

N. J. Agr. Expt. Sta., Bull. 459, 11 (1927).

70-20-10 Dusting Mixture.

(MECHLING BROS. CHEMICAL CO., CAMDEN, N. J.)

	Guaranteed.	Found.
Total arsenic, metal	2.00	2.65
Water-soluble arsenic, metal	0.50	0.12
Sulphur	69.00	65.47

N. J. Agr. Expt. Sta., Bull. 459, 12 (1927).

75-5-20

(J. R. GILLAM & BRO., BURLINGTON, N. J.)

Found: Total arsenic 1.28 per cent; water-soluble arsenic 0.26 per cent; sulphur 72.00 per cent.

N. J. Agr. Expt. Sta., Bull. 441, 11 (1926).

S & G Poultry Lice Powder.

See "Sodium fluoride."

Sheep Dip.

See "Phenol Soap Solutions."

Simplex.

(H. G. SMITH CO., UTICA, N. Y.)

	Guaranteed.	Found.
Sulphur	20.00	21.07
Arsenic	....	2.61
Lead oxide	....	9.75

Mich. Agr. Coll. Expt. Sta., Spec. Bull. 74, 11 (1915).

Sin-O-lor.

(HUGH KNIGHT, RIVERSIDE, CAL.)

Found: Substance is a purple liquid containing nearly 1 per cent potassium permanganate and 0.62 per cent sodium sulphate.

Cal. Dept. Agr., Spec. Pub. 34, 58 (1923).

S. J. Nicotine Dust.

See "Nicotine Dusts."

Skalene.

Skalol.

See "Oil Emulsions, Mineral."

Skinner's Arsenate Bordeaux.

See "Bordeaux Mixture-Lead Arsenate."

Skinner's Special 30-70 Copper Lime Dust.

(SKINNER MACHINERY CO., DUNEDIN, FLA.)

	Guaranteed.	Found.
Copper	10.00	12.11

N. J. Agr. Expt. Sta., Bull. 407, 16 (1924).

Slugall.

(GERMAIN SEED & PLANT CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Nicotine	0.10	0.12
Total arsenious oxide	1.00	0.37
Water-soluble arsenious oxide	0.63	0.25
Naphthalene	5.00	1.10

Cal. Dept. Agr., Spec. Pub. 75, 38 (1927).

Slug Shot.

(HAMMOND'S SLUG SHOT WORKS, BEACON, N. Y.)

	Guaranteed.	Found.
Free sulphur	6.00	....
Total arsenic, metal	0.79	0.89
Water-soluble arsenic, metal	trace	0.12
Copper	0.91	1.01
Nicotine	trace	0.04
Crude carbolic acid	0.40	present

Copper sulphate and copper arsenate declared present.

Conn. Agr. Expt. Sta., Bull. 242, 159 (1922).

Slug Slugger.

(MICHEL & PELTON CO.)

	Guaranteed.	Found.
Calcium arsenate	3.00	4.76

Cal. Dept. Agr., Spec. Pub. 75, 27 (1927).

Small's Snail Poison.

(SMALL'S SEED CO., RIVERSIDE, CAL.)

	Guaranteed.	Found.
Calcium arsenate	2.80	3.80

Cal. Dept. Agr., Spec. Pub. 75, 27 (1927).

Snailex.

(THE FERTILSPRAY CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Ferrous sulphate	20.00	20.06
Ferric sulphate	20.00	32.39
Copper sulphate	0.45	1.25

Cal. Dept. Agr., Spec. Pub. 75, 45 (1927).

Snail Foil.

(AN-FO MFG. CO.)

	Guaranteed.	Found.
Free sulphur	3.00	2.88
Phenols	2.00	2.28
Sodium fluoride	1.00	1.36
Mineral oil	8.00	8.77

Cal. Dept. Agr., Spec. Pub. 75, 40 (1927).

Snail Poison.

See "Small's Snail Poison."

Snarol.

(THE ANTROL LABORATORIES, INC., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Calcium arsenate	3.50	5.17
Total arsenic, metal	1.32	1.95
Inert matter	96.50	....

Conn. Agr. Expt. Sta., Sample 8935.

Soap.

See Table XXIX.

Soap, Sulfo-Tobacco Plant & Animal.

See "Nicotine Soaps."

Soap, Sulpho-Tobacco.

See "Sulpho-Tobacco Soap."

Soap, Tobacco.

See "Nicotine Soaps."

Soda-Sulfur Compound.

(W. C. COLLINS, SAN FRANCISCO, CAL.)

Found: Water-soluble matter, 68.44 per cent; sodium polysulphide 0.80 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 32 (1923).

Sodium Fluoride.

See Table XXX.

Sodium Fluosilicate.

(VIRGINIA-CAROLINA CHEMICAL CORP., RICHMOND, VA.)

Found: Sodium fluosilicate 79.39 per cent; sodium fluoride 16.45 per cent; sodium carbonate 0.75 per cent; undetermined 3.41 per cent.

Conn. Agr. Expt. Sta., Sample 7505.

Solbar.

See "Barium Tetrasulphide."

Sol-o-cree.

See "Phenol Soap Solutions."

Soluble Arsenoid.

See "Watson."

Soluble Oil.

Soluble Oil Spray.

See "Oil Emulsions, Mineral."

Soluble Sulphur Compound.

See "Nicotine Dusts."

Soluble Sulphur Solution.[1]

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.	Guaranteed.	Found.
Soluble sulphur	58.00	58.21	57.00	58.16

N. Y. Agr. Expt., Sta., Bull. 384, 296 (1924).

Solution of Cresol.

See "Phenol Soap Solutions."

S. O. S. Sterling Oil Spray.

See "Oil Emulsions, Mineral."

Sow-Bug Destroyer.

(CHAS. C. NAVLET CO., SAN FRANCISCO, CAL.).

Guaranteed: Copper aceto-arsenite 8.00 per cent.
Found: Arsenious oxide 10.94 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 27 (1927).

Sow-Bug-Go.

See "Leinen."

Sow-Bug-Killer.

(SAN JOSE SPRAY MFG. CO., SAN JOSE, CAL.)

Guaranteed: Copper aceto-arsenite 8.00 per cent.
Found: Arsenious oxide 10.76 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 27 (1927).

Special Dry Mix.

(THE KIL-TONE CO., VINELAND, N. J.)

Found: Sulphur 54.64 per cent.

N. J. Agr. Expt. Sta., Bull. 441, 7 (1926).

Special Filled Capsules No. 173935.

(ELI LILLY & CO., INDIANAPOLIS, IND.)

Found: Nicotine 15.82 per cent.

Cal. Dept. Agr., Spec. Pub. 66, 26 (1926).

Special Mixture 154A.

See "Nicotine-Sulphur Dusts."

Special Mixture No. 161 Potato Dust.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	7.40	8.65
Water-soluble arsenic, metal	0.50	0.22
Copper	6.00	7.31

N. J. Agr. Expt. Sta., Bull. 407, 14 (1914).

Special Mixture M 163.

Special Mixture No. 221.

Special Mixture No. 274.

[1] Two Samples.

TABLE XXIX. SOAP

Manufacturer or Distributor and Brand	Soap				Water—Found	Total Alkali Found	Sodium Carbonate	Non-soap Ash	Inert Matter—Found	Publication
	Total		Rosin Soap	Fish Oil Soap						
	Guaranteed	Found								
	%	%	%	%	%	%	%	%	%	
California Pest Control Co. Calpest Whale Oil	....	24.86	....	....	69.38	2.53	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 54 (1927).
California Spray Chemical Co., Watsonville, Cal. Ortho Liquid	....	13.70	....	....	78.40[1]	....	....	1.10	....	Cal. Dept. Agr., Spec. Pub. 58, 46 (1925).
California Spray Chemical Co., Watsonville, Cal. Ortho Whale Oil	30.00	30.80	....	....	61.60	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 54 (1927).
Roy E. Campbell, Alhambra, Cal. Citrus Washing Powder[2]	....	20.80	....	....	35.25	....	42.40	....	....	Cal. Dept. Agr., Spec. Pub. 34, 59 (1922).
General Chemical Co., New York, N. Y. Fish Oil[3]	....	....	....	....	....	....	....	....	....	Conn Agr. Expt. Sta., Bull. 242, 160 (1922).
Germain Seed & Plant Co., Los Angeles, Cal. Germain Fish Oil[4]	....	71.20	none	71.20	....	....	....	....	23.58[5]	Cal. Dept. Agr., Spec. Pub. 51, 40 (1925).
Germain Seed & Plant Co., Los Angeles, Cal. Germain's Rosin Wash	....	34.70	6.10	28.60	....	....	....	....	63.90	Cal. Dept. Agr., Spec. Pub. 51, 40 (1925).
Johnson & Musser Seed Co., Los Angeles, Cal. J & M Reliable Insecticide[6]	....	64.71	....	....	34.30	....	....	....	....	U. S. D. A. Bur. Chem., Bull. 68, 35 (1902).
Langley & Michaels Co. Hard Fish Oil[7]	64.40	39.60	....	....	29.60[8]	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 54 (1927).
Manufacturer unknown. Lennox Tobacco[9]	....	....	....	....	....	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 47 (1922).

Michel & Pelton Co., San Francisco, Cal. Mapco Rosin Soap for Spray	....	....	43.30	18.30	....	....	7.70	....	29.10[10]	Cal. Dept. Agr., Spec. Pub. 51, 40 (1925).
Michel & Pelton Co., San Francisco, Cal. Mapco Whale Oil	....	53.30	....	....	43.40[11]	0.53	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 54 (1927).
Miller Products Co., Portland, Ore., Whale Oil	60.00	57.90	....	....	....	....	....	....	....	Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).
Mt. Hood Soap Co., Portland, Ore. Felbro Whale Oil	58.50	76.10	....	....	....	....	....	....	....	Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).
Chas. C. Navlet Co. Navco Whale Oil	....	25.90	....	....	69.40	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 54 (1927).
Pacific Soap Co. P. S. C. Condensed Rosin Spray	55.00	53.36	....	....	33.70	11.08[12]	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 54 (1927).
Pacific Soap Co. P. S. C. Condensed Rosin Spray	65.00	46.10	....	....	35.75	14.20	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 54 (1927).
Pacific Soap Co. P. S. C. Condensed Rosin Spray	....	52.00	....	....	31.74[11]	12.51	....	....	....	Cal. Dept. Agr., Spec. Pub. 75,54 (1927).
Pacific Soap Co. P. S. C. Fish Oil	75.00	76.35	....	....	16.67	4.37	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 55 (1927).
Perfecto Spray Mfg. Co., Los Angeles, Cal. Perfecto Rosin Paste	....	58.25	....	....	35.10[13]	....	....	3.99	....	Cal. Dept. Agr., Spec. Pub. 58, 46 (1925).

[1]Water guaranteed 67.00%.
[2]Trace of phosphate present.
[3]Two samples of this soap were examined only to see whether they were potassium or sodium soaps. One was a sodium soap, the other chiefly potassium soap.
[4]Glycerine 4.21 per cent.
[5]Inert matter guaranteed 30.00%.
[6]Fatty anhydrides 25.30 per cent; resin anhydrides 34.67 per cent; sodium oxide 2.92 per cent; potassium oxide 1.82 per cent.
[7]Oils 24.90 per cent.
[8]Water guaranteed 35.60%.
[9]No nicotine found.
[10]Inert matter guaranteed 30.00%.
[11]Water guaranteed 40.00%.
[12]Alkali guaranteed 10.00%.
[13]Water guaranteed 36.00%.

TABLE XXIX. SOAP—*Concluded.*

Manufacturer or Distributor and Brand	Soap				Water—Found	Total Alkali Found	Sodium Carbonate	Non-soap Ash	Inert Matter—Found	Publication
	Total		Rosin Soap	Fish Oil Soap						
	Guaranteed.	Found.								
	%	%	%	%	%	%	%	%	%	
J. C. Pierson, Albany, N. Y. Fir-Tree Oil[14]	....	66.25	....	....	28.74	7.28[15]	....	....	....	N. Y. Agr. Expt. Sta., Bull. 384, 298 (1914).
George A. Price, Albany, N. Y. Stott's Fir-Tree Oil[16]	....	71.12	....	....	23.73	5.91	....	....	....	N. Y. Agr. Expt. Sta., Bull. 348, 95 (1912).
San Jose Soap Works, San Jose, Cal. Whale Oil	....	25.90	....	....	74.10	....	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 59 (1922).
Sun-Ban Laboratories, Portland, Ore. Clensel	32.10	30.40	....	....	....	....	....	....	....	Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).
J. B. Williams Co., Glastonbury, Conn. No. 30[17]	....	67.57	....	....	30.97	6.56	0.15	0.95	....	Conn. Agr. Expt. Sta., Sample 3778.
Williams & Moore, Stockton, Cal. Williams & Moore Spray	....	79.10	....	....	18.50	....	....	1.10	....	Cal. Dept. Agr., Spec. Pub. 66, 36 (1926).

[14] Fatty acids and resin 59.15 per cent; unsaponified matter (mostly phenol) 5.01 per cent.
[15] Combined alkali 7.10 per cent; free caustic 0.18 per cent.
[16] Phenol 5.15 per cent.
[17] Free oleic acid 0.63 per cent; sodium chloride 0.46 per cent.

Special 210 Dust Mixture.

See "Nicotine Dusts."

Special Mixture S 155 A.

See "Nicotine-Sulphur Dusts."

Spratt's Dip.

See "Phenol Soap Solutions."

TABLE XXX. SODIUM FLUORIDE

Manufacturer or Distributor and Brand	Sodium Fluoride		Publication
	Guaranteed	Found	
	%	%	
Brunswig Drug Co.	.....	93.70	Cal. Dept. Agr., Spec. Pub. 51, 59 (1925).
Burrell-Dugger Co. Talcimized	65.00	70.17	Cal. Dept. Agr., Spec. Pub. 75, 62 (1927).
The Insecticide Co., San Francisco, Cal. Preparation No. 3[1]	.....	93.27	Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).
C. U. McClellan & Co. McClellan's	95.50	95.31	Cal. Dept. Agr., Spec. Pub. 75, 62 (1927).
Mefford Chemical Co.	90.00	97.56	Cal. Dept. Agr., Spec. Pub. 75, 62 (1927).
Montgomery, Ward & Co., Portland, Ore.	65.00	98.60	Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).
Scott & Gilbert Co. S&G Poultry Lice Powder.	90.00	96.58	Cal. Dept. Agr., Spec. Pub. 75, 62 (1927).

[1] Ash found 5.40 per cent.; "inert fossil flour", guaranteed 7.60 per cent.

Spratt's Lice Powder.

(SPRATT'S PATENT, LTD.)

	Guaranteed.	Found.
Ash (talc)	40.00	37.06

Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).

Spray Moore Weed Killer.

(KIRK, GEARY & CO.)

	Guaranteed.	Found.
Arsenious oxide	30.00	26.74

Cal. Dept. Agr., Spec. Pub. 75, 25 (1927).

Spray Mulsion.

See "Oil Emulsions, Mineral."

Squirrel Poison.

See "Strychnine Preparations."

Squirrel Poison-Phosphorus.

See "Phosphorus Preparations."

Stallard's New Lice Exterminator.

(MANUFACTURER NOT STATED.)

Found: Moisture 0.16 per cent; free sulphur 73.51 per cent; ferric oxide 23.73 per cent; silica 1.53 per cent.

Cal. Dept. Agr., Spec. Pub. 51, 11 (1925).

Star Water.

(MANUFACTURER UNKNOWN.)

Found: Available chlorine 2.64 per cent.

Conn. Agr. Expt. Sta., Bull. 258, 377 (1924).

Stearns' Electric Rat and Roach Paste.

See "Phosphorus Preparations."

Steraklene.

(CONNECTICUT CHEMICAL & DISINFECTANT CO., NEW HAVEN, CONN.)

	Guaranteed.	Found.
Sodium hypochlorite	8.00	6.13
Available chlorine	....	5.86
Inert matter	92.00	....

Conn. Agr. Expt. Sta., Sample 9466.

Sterilac

(THE STERILAC CO., NORTH CHICAGO, ILL.)

Guaranteed: Active ingredient 94.00 per cent; inactive (mono-hydrated sodium carbonate), 6.00 per cent. "An alkaline chloramine mixture readily soluble in water."

Found: Chloramine T, 94.24 per cent.

Conn. Agr. Expt. Sta., Sample 9658.

Sterling Argentine Ant Poison.

(WESTERN WHOLESALE DRUG CO., LOS ANGELES, CAL.)

	Guaranteed.	Found
Arsenic, metal	0.18	0.12

Cal. Dept. Agr., Spec. Pub. 58, 17 (1925).

Sterling Oil Spray.

See "Oil Emulsions, Mineral."

Sterlingworth Cut Worm Killer.

(STERLING CHEMICAL CO., CAMBRIDGE, MASS.)

	Guaranteed.	Found.
Total arsenious oxide	1.00	1.99
Water-soluble arsenic, metal	0.07	1.40

Conn. Agr. Expt. Sta., Bull. 242, 159 (1924).

Sterlingworth Weed Killer.

(STERLING CHEMICAL CO., CAMBRIDGE, MASS.)

	Guaranteed.	Found.
Arsenic oxide	30.00	30.10

Cal. Dept. Agr., Spec. Pub. 34, 20 (1923).

Stott's Fir-Tree Oil Soap.

See "Soap."

Strawberry Weevil Bait.

(M. R. FORSELL, SEATTLE, WASH.)

Found: Total arsenic oxide 1.54 per cent; water-soluble arsenic oxide 0.61 per cent; calcium oxide 0.42 per cent; magnesium oxide 1.42 per cent; moisture 7.24 per cent. Substance is dried apple waste plus magnesium arsenate.

Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).

Strychnine Preparations.

See Table XXXI.

Success Special Insecticide.

(VICTORY TREE SPRAY CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Sulphur	6.00	7.20
Sodium nitrate	23.00	22.44
Sodium carbonate	39.90	32.99
Soap	10.00	9.27
Water	....	27.41
Inert matter	22.00	....

Cal. Dept. Agr., Spec. Pub. 58, 49 (1925).

Success Tree Spray.

(H. D. BLANCHARD, PORTERVILLE, CAL.)

	Guaranteed.	Found.
Water	....	8.72
Sulphur	20.00	15.63
Sodium nitrate	20.00	19.62
Sodium carbonate	35.00	38.70
Soap	12.00	12.04
Insert matter	11.00	....

Cal. Dept. Agr., Spec. Pub. 51, 55 (1925).

Sulco-V. B.

See "Oil Emulsions, Mineral."

Sulfene.

(F. A. FRAZIER CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Sodium polysulphide	64.00	65.76
Sodium thiosulphate	22.00	25.60
Free sulphur	2.00	0.45
Sodium sulphate	4.00	....
Water	8.00	....

Cal. Dept. Agr., Spec. Pub. 66, 23 (1926).

TABLE XXXI. STRYCHNINE PREPARATIONS

Manufacturer or Distributor and Brand	Strychnine		Publication
	Guaranteed	Found	
	%	%	
G. H. Benedict and Co. O. K. Squirrel Poison[1]	0.40	0.17	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
Brunswig Drug Co., Los Angeles, Cal. Brunswig Squirrel Annihilator	....	0.28	Cal. Dept. Agr., Spec. Pub. 66, 28 (1926).
California Spray Chemical Co., Watsonville, Cal. Ortho Gopher Poison	90.00	89.60	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
California Spray Chemical Co., Watsonville, Cal. Ortho Penetrating Poisoned Barley	0.3125	0.443	Cal. Dept. Agr., Spec. Pub. 66, 27 (1926).
California Spray Chemical Co., Watsonville, Cal. Ortho Penetrating Poisoned Barley	0.3129	0.38	Cal. Dept. Agr., Spec. Pub. 66, 27 (1926).
Coffin-Redington Co., Noxem Squirrel and Gopher Poison	0.30	0.29	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
B. E. Cole, Hollister, Cal. County Farm Bureau Mixture[2]	....	0.55	Cal. Dept. Agr., Spec. Pub. 51, 51 (1925).
Diamond Milling Co., Livermore, Cal. Poisoned Barley	0.41	0.33	Cal. Dept. Agr., Spec. Pub. 58, 38 (1925).
Herbert F. Dugan. Poisoned Barley.	0.25	0.26	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
Herbert F. Dugan. Strychnine Alkaloid	....	99.66	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
Dupins Chemical Co., Fort Dodge, Ia. Gopher-Get-'er[3]	....	0.310	Cal. Dept. Agr., Spec. Pub. 34, 53 (1923).
Dupuis Chemical Co. Gopher-Go	0.25	0.37	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
Fort Dodge Chemical Co., Fort Dodge, Ia. Gopher Death[4]	....	0.35	Cal. Dept. Agr., Spec. Pub. 34, 53 (1923).
Germain Seed & Plant Co., Los Angeles, Cal. Go-For-Gopher[5]	0.31	0.05	Cal. Dept. Agr., Spec. Pub. 51, 51 (1925).
Germain Seed & Plant Co., Los Angeles, Cal. Go-For-Gopher[5]	31.00	0.15	Cal. Dept. Agr., Spec. Pub. 51, 51 (1925)..
Kirk-Geary Co., Sacramento, Cal. Capital Squirrel Poison	0.24	0.23	Cal. Dept. Agr., Spec. Pub. 58, 38 (1925).
Kirk-Geary Co., Sacramento, Cal. Dead Shot Squirrel & Gopher Killer	0.25	0.25	Cal. Dept. Agr., Spec. Pub. 58, 38 (1925).
Kirk-Geary Co., Sacramento, Cal. Dead Shot Squirrel & Gopher Killer	0.24	0.21	Cal. Dept. Agr., Spec. Pub. 58, 38 (1925).
Langley & Michaels Co., San Francisco, Cal. Hall's Lightning Squirrel and Gopher Poison	0.347[6]	0.32[6]	Cal. Dept. Agr., Spec. Pub. 66, 28 (1926).

[1]Cyanide, guaranteed 0.10 per cent; found trace.
[2]Sample is poisoned wheat sweetened with saccharin.
[3]Sample is a poisoned mixture of raisins and figs.
[4]Tablets sweetened with sugar and having an odor of anice.
[5]Sample is poisoned raisins.
[6]Strychnine sulphate.

TABLE XXXI. STRYCHNINE PREPARATIONS—*Concluded.*

Manufacturer or Distributor and Brand	Strychnine		Publication
	Guaranteed	Found	
	%	%	
Langley & Michaels Co., San Francisco, Cal. Hall's Lightning Squirrel and Gopher Poison	0.32[6]	0.30[6]	Cal. Dept. Agr., Spec. Pub. 66, 28 (1926).
John F. Leinen Chemical Co., San Francisco, Cal. Leinen's Poisoned Barley	0.3125	0.449	Cal. Dept. Agr., Spec. Pub. 66, 28 (1926).
John F. Leinen Chemical Co., San Francisco, Cal. Leinen's Poisoned Barley	0.40625	0.36	Cal. Dept. Agr., Spec. Pub. 66, 28 (1926).
John F. Leinen Chemical Co., San Francisco, Cal. Morse's Gopher Poison	0.3125	0.27	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
John F. Leinen Chemical Co., San Francisco, Cal. O-Kay Gopher Poison	0.25	0.23	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
John F. Leinen Chemical Co., San Francisco, Cal. O-Kay Poisoned Wheat	0.25	0.24	Cal. Dept. Agr., Spec. Pub. 58, 39 (1925).
Long & Gretter, Monterey, Cal. Long and Gretter's Squirrel Poison	0.20	0.324	Cal. Dept. Agr., Spec. Pub. 66, 28 (1926).
Roy Specialty Co. El Roy Gopher Poison[7]	....	0.25	Cal. Dept. Agr., Spec. Pub. 51, 51 (1925).
Scott & Gilbert Co., San Francisco, Cal. Cespi Poisoned Barley	0.30	0.288	Cal. Dept. Agr., Spec. Pub. 66, 28 (1926).
Scott & Gilbert Co., San Francisco, Cal. Cespi Poisoned Wheat	0.30	0.33	Cal. Dept. Agr., Spec. Pub. Cal.75, 46 (1927).
Geo. Z. Wait Co. Wait's Squirrel and Gopher Poison[8]	0.20	0.21	Cal. Dept. Agr., Spec. Pub. 58, 40 (1925).
Western Wholesale Drug Co. Western Poisoned Barley	0.27	0.26	Cal. Dept. Agr., Spec. Pub. 66, 28 (1926).
W. M. Willett, San Francisco, Cal. Wakelee's Squirrel & Gopher Poison	0.25	0.61	Cal. Dept. Agr., Spec. Pub. 58, 40 (1925).
Williams & Moore. Moore's Prepared Squirrel Poison	0.32	0.33	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
C. G. Woods Chemical Co. Gopher Scent	0.20	0.30	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).
C. G. Woods Chemical Co. Rat Scent	0.20	0.29	Cal. Dept. Agr., Spec. Pub. 75, 46 (1927).

[6]Strychnine sulphate
[7]Sample is a mixture of poisoned raisins, wheat, etc.
[8]Arsenic guaranteed 0.75 per cent; found 0.57 per cent.

Sulfo.

(MILLER PRODUCTS CO., PORTLAND, ORE.)

	Guaranteed.	Found.
Sulphur	90.00	85.50

Ore. Agr. Expt. Sta., Cir. 84, 11 (1927).

Sulfocide.

(B. S. PRATT CO., NEW YORK, N. Y.)

Two samples:

Sample 18457.

Guaranteed: 30 per cent sulphur as sodium polysulphide and thiosulphate.

Found: Total sulphur 29.25 per cent; thiosulphate sulphur 1.84 per cent; sulphate sulphur 0.10 per cent; sulphide sulphur 27.31 per cent.

Conn. Agr. Expt. Sta., Bull. 242, 160 (1922).

Sample 2506.

Guaranteed: Sodium polysulphide 39-40 per cent; sodium thiosulphate 1-2 per cent; inert matter 58-60 per cent.

Found: Total sulphur 33.78 per cent; monosulphide sulphur 7.79 per cent; thiosulphate sulphur 2.56 per cent; sulphate sulphur 0.25 per cent; polysulphide sulphur 23.18 per cent; sodium polysulphide (calculated as the pentasulphide), 38.48 per cent.

Conn. Agr. Expt. Sta., Bull. 272, 146 (1926).

Sulfodust.

See "Sulphur."

Sulfo-Tobacco Plant and Animal Soap.

See "Nicotine Soaps."

Sulfur.

See "Sulphur."

Sulfur Dusting Mixture Formula No. 5.

See "Naco."

Sulfur-Lime.

See the following:

Dry Mix Sulfur-Lime.

80-20.

Kasulime.

Leinen's Mildew-Go.

Mechling's Dry Mix.

New Jersey Dry Mix Sulfur-Lime.

Niagara Dry Mix.

Sulfur-Nicotine Compound.

See "Nicotine-Sulphur Dusts."

Sulpho-Arsenate Mixture.

(THE KIL-TONE CO., VINELAND, N. J.)

	Guaranteed.	Found.
Sulphur	68.00	68.57
Total arsenic, metal	....	2.47
Water-soluble arsenic, metal	....	0.19

N. J. Agr. Expt., Sta., Bull. 407, 13 (1924).

Sulpho-Arsenate Powder.

(THE KIL-TONE CO., VINELAND, N. J.)

(See also "Green Cross")

	Guaranteed.	Found.
Total arsenic, metal	9.48	9.69
Water-soluble arsenic, metal	0.66	0.19
Sulphur	48.50	49.73

N. J. Agr. Expt. Sta., Bull. 441, 12 (1926).

Sulphur Carbolate of Lime.

See "Whitney."

"Sulpho-Tobacco" Soap.

(R. W. HUNT, SAN JOSE, CAL.)

	Guaranteed.	Found.
Nicotine	0.18	0.03
Sulphur	3.88	0.78

Cal. Dept. Agr., Spec. Pub. 34, 47 (1923).

Sulpho-Tone.

(LUCAS-KIL-TONE CO., VINELAND, N. J.)

Guaranteed: Sulphur 60.00 per cent.

Found: Sulphur 62.48 per cent; coarser than 100 mesh, 0.86 per cent; passes 100 mesh, 99.14 per cent; 200 mesh, 57.37 per cent; 300 mesh, 14.75 per cent.

N. J. Agr., Expt. Sta., Bull. 459, 8 (1927).

Sulphur.

See Table XXXII.

Sulphur-Arsenate Dust 83-15.

(JOHN BACON, GASPORT, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	2.80	2.44
Water-soluble arsenic, metal	0.15	0.14
Sulphur	83.00	84.75

Conn. Agr. Expt. Sta., Bull. 272, 147 (1925).

Sulphur-Arsenate Dust 90-10.

(JOHN BACON, GASPORT. N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	1.90	1.86
Water-soluble arsenic, metal	0.10	0.11
Sulphur	88.50	88.27

Conn. Agr. Expt. Sta., Bull. 272, 147 (1925).

TABLE XXXII. SULPHUR

Manufacturer or Distributor and Brand	Sulphur		Water	Ash	Type	Publication
	Guaranteed	Found				
	%	%	%	%		
Batelle & Rennick, New York, N. Y.[1]						
99½% Pure Superfine Commercial	99.50	99.70	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 8 (1927).
Cabco Supply Stores. Cabco Flour..	90.00	91.40[2]	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Cabco Supply Stores. Cabco.....	92.00	93.50	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
California Associated Buyers Co., Fresno-Selma, Cal. "Lilly".....	100.00	99.86	0.12	0.02	Sublimed	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
California Rex Spray Co. Rex Sulfur Paste.....	46.00	48.92	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 57 (1922).
California Spray Chemical Co., Watsonville, Cal. Ortho Dusting.....	99.00	99.32	0.09	0.12	Milled	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
California Spray Chemical Co., Watsonville, Cal. Ortho-Milled[3].....	85.00	87.29	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 26 (1922).
California Spray Chemical Co., Watsonville, Cal. Ortho Soil.....	....	99.50	0.33	0.10	Milled	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
California Spray Chemical Co., Watsonville, Cal. Ortho.....	99.00	99.48	0.45	0.08	Milled	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
California Spray Chemical Co., Watsonville, Cal. Ortho Wettable.....	90.00	92.65	1.83	3.52	....	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
R. L. Cody. Ventilated[4].....	....	99.69	0.21	0.10	....	Cal. Dept. Agr., Spec. Pub. 34, 26 (1922).
D. F. DeBernardi & Co. L. Chambon Fils.....	100.00	99.88	0.12	none	Sublimed	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
F. A. Frazier Co. Frazier's B-7 Dusting[5].....	100.00	99.67	0.21	0.12	Milled	Cal. Dept. Agr., Spec. Pub. 51, 21 (1925).

F. A. Frazier Co. Frazier's Dusting Sulphur B-6.....	90.00	91.62	0.22	8.16	Milled	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
General Chemical Co., San Francisco, Cal. Orchard Brand Atomic.....	45.00	46.10	52.15	....	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
General Chemical Co., San Francisco, Cal. Orchard Brand Dritomic....	90.00	91.20	0.80	....	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Granucci Bros., San Francisco, Cal. Columbus Brand.....	....	97.15[6]	....	....	Milled	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
Granucci Bros., San Francisco, Cal. Columbus Sublimed.....	....	99.40	0.33	0.28	Sublimed	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
Granucci Bros., San Francisco, Cal. Columbus Ventilated.....	....	99.70	0.14	0.16	Milled	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
Herbert & Herbert, Inc., Perth Amboy, N. J. Square Brand H.&H. Colloidal	45.00	55.22	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 9 (1927).
Holland & Holland XXXXX Brand Resublimed Flowers.....	100.00	99.50	0.30	0.20	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Kutner-Goldstein Co. Fleur de Lis Soufre Sublimed Flowers.....	100.00	99.60	0.40	....	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
D. Lima Bros. Co. Marca Fioristilla Ground.....	....	98.00	0.23	0.61	Milled	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
Manufacturer unknown. Colloidal...	....	36.30	....	....	....	Conn. Agr. Expt. Sta., Bull. 258, 371 (1924).
Manufacturer unknown. Superfine[7]..	....	....	....	....	....	Conn. Agr. Expt. Sta., Sample 6914.
Mechling Bros. Chemical Co., Camden, N. J. Sulfur Dust[8].....	....	99.50	....	....	....	N. J. Agr. Expt. Sta., Bull. 459, 8 (1927).

[1]Passes 100 mesh 97.2 per cent; 200 mesh 43.5 per cent; 300 mesh 14.5 per cent.
[2]Calcium hydroxide, guaranteed 10.00 per cent; found 7.14 per cent.
[3]Inert matter guaranteed 15.0 per cent.
[4]Passes 200 mesh 97.0 per cent.
[5]Passes 200 mesh 95.0 per cent.
[6]Copper sulphate 2.73 per cent.
[7]Passes 300 mesh 100 per cent.
[8]Passes 100 mesh 99.0 per cent; 200 mesh 24.6 per cent; 300 mesh 9.2 per cent.

TABLE XXXII. SULPHUR—*Continued*

Manufacturer or Distributor and Brand	Sulphur		Water	Ash	Type	Publication
	Guaranteed	Found				
	%	%	%	%		
Meyer, Wilson & Co., San Francisco, Cal. Flowers of Sulphur K. R....	99.00	99.10	0.90	....	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Murphy Oil Co., East Whittier, Cal..	....	99.73	0.27	none	....	Cal. Dept. Agr., Spec. Pub. 34, 26 (1922).
Chas. C. Navlet Co., Berkeley, Cal. Neutral Brand Dusting.....	99.00	98.20	0.30	1.10	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Chas. C. Navelt Co., Berkeley, Cal. Neutral Sulphur, Superfine Flour..	99.50	99.13	0.24	0.63	Milled	Cal. Dept. Agr., Spec. Pub. 58, 23 (1925).
Niagara Sprayer Co., Middleport, N. Y. Niagara Dusting Sulphur. Sulfodust[9].....	93.00	92.40	....	....	....	Conn. Agr. Expt. Sta., Bull. 258, 371 (1924).
Niagara Sprayer Co., Middleport, N. Y. Niagara Kolodust.....	90.00	90.10	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Niagara Sprayer Co., Middleport, N. Y. Niagara Superfine Dusting.....	99.50	99.70	0.20	0.10	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Niagara Sprayer Co., Middleport, N. Y. Vesuvius Sublimed Flowers....	100.00	99.85	0.09	0.06	....	Cal. Dept. Agr., Spec. Pub. 66, 21 (1926).
Dr. O'Toole, Sacramento, Cal.....	....	99.46	0.10	0.44	....	Cal. Dept. Agr., Spec. Pub. 34, 26 (1922).
Pacific Guano & Fertilizer Co., Berkeley, Cal. Cropmaker Flowers.....	100.00	99.50	0.40	0.10	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Pacific Guano & Fertilizer Co., Berkeley, Cal. Producer Flowers.....	100.00	99.64	0.25	0.11	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Pacific Guano & Fertilizer Co., Berkeley, Cal. Sunkist Dusting.....	99.00	97.45	0.35	1.60	....	Cal. Dept. Agr., Spec. Pub. 75, 28 (1927).
Pascal, Dubedat & Co., P. D. C. Rooster Flowers.....	....	99.44	0.39	0.17	....	Cal. Dept. Agr., Spec. Pub. 66, 21 (1926).
Richards Import & Export Co. Union	99.62	99.57	0.38	0.05	Sublimed	Cal. Dept. Agr., Spec. Pub. 58, 24 (1925).
D. Rubino. Angelo Pontillo.....	90.00	99.71	0.08	0.21	....	Cal. Dept. Agr., Spec. Pub. 66, 21 (1926).
San Francisco Sulphur Co., San Francisco, Cal. Alfa Brand Dry Wettable Flowers.....	90.00	92.50	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
San Francisco Sulphur Co., San Francisco, Cal. Anchor Sublimed Velvet Flowers.....	100.00	99.80	0.20	....	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
San Francisco Sulphur Co., San Francisco, Cal. Asti Sublimed Sulphur, 100% Pure.....	100.00	100.00	....	....	Sublimed	Cal. Dept. Agr., Spec. Pub. 58, 24 (1925).
San Francisco Sulphur Co., San Francisco, Cal. Diamond S Flour.....	100.00	99.65	0.23	0.12	Milled	Cal. Dept. Agr., Spec. Pub. 58, 24 (1925).
San Francisco Sulphur Co., San Francisco, Cal. Eagle Sublimed Flowers	100.00	99.38	0.22	0.40	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
San Francisco Sulphur Co., San Francisco, Cal. Electric.....	99.80	99.85	0.02	0.11	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
San Francisco Sulphur Co., San Francisco, Cal. Owl Superfine Flour...	99.50	98.69	0.18	0.56	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
San Francisco Sulphur Co., San Francisco, Cal. Red Flag Velvet Flowers	100.00	99.64	0.28	0.09	Sublimed	Cal. Dept. Agr., Spec. Pub. 58, 24 (1925).
San Francisco Sulphur Co., San Francisco, Cal. Swan Brand Superfine Ventilated Dusting.....	98.50	98.13	0.30	1.57	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
San Francisco Sulphur Co., San Francisco, Cal. Ventilated[10].....	....	99.59	0.25	0.16	....	Cal. Dept. Agr., Spec. Pub. 34, 26 (1923.)
San Francisco Sulphur Co., San Francisco, Cal. XL Sublimed.....	99.80	99.83	0.07	0.10	Milled	Cal. Dept. Agr., Spec. Pub. 66, 21 (1926).
The Sherwin-Williams Co., Cleveland, Ohio. Sherwin-Williams Dusting..	100.00	99.80	0.07	0.13	Milled	Cal. Dept. Agr., Spec. Pub. 58, 24 (1927).

[9]Inert matter guaranteed 7.00 per cent.
[10]Passes 200 mesh 97.00 per cent.

TABLE XXXII. SULPHUR—*Concluded.*

Manufacturer or Distributor and Brand	Sulphur Guaranteed	Sulphur Found	Water	Ash	Type	Publication
	%	%	%	%		
The Sherwin-Williams Co., Cleveland, Ohio. Sherwin-Williams Ultra Brand Flowers	100.00	99.59	0.22	....	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
The Sherwin-Williams Co., Cleveland, Ohio. Sherwin-Williams Zephyr Brand Flowers	100.00	99.43	0.38	0.20	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
Stauffer Chemical Co., Anchor Velvet Flowers	100.00	99.60	0.10	0.30	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
T. D. Urbahns, Sacramento, Cal. Ortho Sprays—Milled[11, 12]	85.00	90.24	2.02	....	....	Cal. Dept. Agr., Spec. Pub. 34, 26 (1922).
T. D. Urbahns, Sacramento, Cal. Wet-O-Dry XX Wettable Dosch[12]	70.00	71.84	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 26 (1922).
Western Sulphur Co., Oakland, Cal. Bear Brand Bleaching	100.00	99.50	0.50	....	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
Western Sulphur Co., Oakland, Cal. Cream of Sulphur	90.00	90.13	0.51	7.83	Milled	Cal. Dept. Agr., Spec. Pub. 58, 25 (1925).
Western Sulphur Co., Oakland, Cal. Poppy Dusting	98.00	99.08	0.15	0.78	....	Cal. Dept. Agr., Spec. Pub. 75, 29 (1927).
T. & S. C. White Co., New York, N. Y. Sulphur Dust 100%–300 Mesh[14]	....	....	....	....	....	Conn. Agr. Expt. Sta., Sample 3620.
Yolo County Purchasing & Selling Corp., Woodland, Cal. Ortho[15]	99.00	99.46	0.32	0.23	....	Cal. Dept. Agr., Spec. Pub. 34, 26 (1923).

[10]Passes 200 mesh 97.0 per cent.
[11]Guaranteed: calcium thiosulphate 4.58 per cent; gypsum 1.63 per cent; casein, 0.46 per cent.
[12]Inert matter guaranteed 15.0 per cent.
[14]Passes 200 mesh 100 per cent.
[15]Passes 200 mesh 83.16 per cent.

Sulphur Compound.

(BOGART CHEMICAL CO., NEW YORK, N. Y.)

(See also "Agricultural Sulphur Compound" and "Niagara Soluble Sulphur Compound").
Found: Soluble sulphur 9.35 per cent.
N. Y. Agr. Expt. Sta., Bull. 348, 93 (1912).

Sulphur Dust.

(NIAGARA DUST CO., KENTVILLE, N. S., CANADA.)

Found: Sulphur 78.60 per cent; total arsenic oxide 4.74 per cent; water-soluble arsenic oxide 0.06 per cent; lead oxide 9.75 per cent; colloidal clay (Bentonite) present.
Canada Dept. Agr., Div. Chem., Rept. Dominion Chemist (1928).

Sulphur Smoke Dusting Mixture

See "Naco."

Sulphur with 7 Percent Nicotine Solution.

Sulphur with 10 per cent Nicotine Solution.

See "Nicotine-Sulphur Dusts."

Summer Mulsion.

Summer Oil.

See "Oil Emulsions, Mineral."

"Sun" Argentine Ant Poison.

(SUN DRUG CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Total arsenic, metal	0.20	0.30
Water-soluble arsenic, metal	0.20	0.30

Cal. Dept. Agr., Spec. Pub. 34, 18 (1923).

Sun Miscible Oil.

Sunoco Spray Oil.

See "Oil Emulsions, Mineral."

Sure Death Rat Killer.

(PFEIFFER CHEMICAL CO.)

Found: Arsenious oxide 97.22 per cent.
Cal. Dept. Agr., Spec. Pub. 75, 27 (1927).

Sure Death to Insects.

(H. C. DUSENBERRY, NEW YORK, N. Y.)

Found: Substance is gasoline possibly containing oil of citronella.
U. S. D. A., Bur. Chem., Bull. 68, 56 (1902).

Sure Destruction for Cockroaches and Ants.

(INSECT EXTERMINATOR MFG. CO., COUNCIL BLUFFS, IOWA).

Found: Borax 99.50 per cent; balance pink coloring matter.
U. S. D. A., Bur. Chem., Bull. 68, 43 (1902).

Sure Kill Rat and Roach Paste.

See "Phosphorus Preparations".

Sure-Noxem.

(DEVOE & RAYNOLDS, CHICACO, ILL.)

	Guaranteed.	Found.
Arsenious oxide	2.00	2.10
Sulphur	6.00	16.60

Ore. Agr. Expt. Sta., Cir. 64, 11 (1925).

Sure-Shot.

See "Oils, Mineral."

S. W. Sheep Dip.

See "Phenol Soap Solutions."

T.

Talbot's Bed Bug Powder.

(TALBOT MFG. CO.)

Guaranteed: Sodium acid fluoride 8.00 per cent.
Found: Sodium fluoride 58.46 per cent; ash 4.67 per cent.
Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).

Talcimized Sodium Fluoride.

See "Sodium Fluoride."

Tar Acids and Petroleum Oils.

(R. R. ROGERS CHEMICAL CO.)

Guaranteed: Phenols 20.00 per cent.
Found: Phenols 21.60 per cent; oils 77.35 per cent; non-soap ash 0.02 per cent; moisture 0.40 per cent. Constants of separated oil: Baumé gravity 23.3; unsulphonated oil, 44.40 per cent.
Cal. Dept. Agr. Spec. Pub. 51, 44 (1925).

Thrip Juice.

See "Nicotine Soaps."

Thymo-Cresol.

See "Phenol Soap Solutions."

Tiger Paste.

See "Phosphorus Preparations."

Tizit Tree Spray.

(TIZIT SPRAY MFG. CO., LOS ANGELES, CAL.

	Guaranteed.	Found.
Total arsenic, metal	4.00	3.41
Water-soluble arsenic, metal	0.20	2.25
Lead oxide	16.00	15.55
Sulphur	22.00	23.00
Sodium carbonate	16.00	17.08
Sodium oleate	25.00	24.98
Inert matter	17.00	....

Cal. Dept. Agr., Spec. Pub. 51, 54 (1925).

Tobacco Dusts.

See Table XXXIII.

Tobacco, Ground.

See "Tobacco Dusts."

Tobacco Naphtholene Mixture.

(H. A. STOOTHOFF CO., MT. VERNON, N. Y.)

	Guaranteed.	Found.
Nicotine	0.50	1.02

N. Y. Agr. Expt. Sta., Bull. 384, 297 (1914).

Tobacco Soap.

See "Nicotine Soaps."

Tobacco Tea.

(INDIGO BLUING CO)

Found: Nicotine 0.28 per cent.
Cal. Dept. Agr., Spec. Pub. 34, 52 (1923).

"To-Bak-ine" Liquid.

See "Nicotine Sulphate Solutions."

Todco, Argentine Ant Poison.

(OWL DRUG CO., SAN FRANCISCO, LOS ANGELES, CAL.)

Guaranteed: Arsenic 0.20 per cent.
Found: Arsenic, 0.15 per cent; cane sugar 59.24 per cent.
Cal. Dept. Agr., Spec. Pub. 58, 17 (1925).

Tonicide.

See "Blue Label."

Tree Paint.

(HOOD RIVER SPRAY CO., HOOD RIVER, ORE.)

	Guaranteed.	Found.
Copper	1.00	0.70

Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).

Tree Spray.

See "Tizit" and "Victory."

Treevax.

(TREEVAX CHEMICAL CO., HICKSVILLE, OHIO).

Found: Sulphur 62.00 per cent; potassium nitrate 27.00 per cent; ferric oxide 11.00 per cent.
Mich. Agr. Coll. Expt. Sta., Spec. Bull. 74, 11 (1915).

Trelife.

(THE FERTILSPRAY CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Ferrous sulphate	20.00	20.98
Ferric sulphate	20.00	36.85
Copper sulphate	0.45	1.27

Cal. Dept. Agr., Spec. Pub. 75, 45 (1927).

TABLE XXXIII. TOBACCO DUST

Manufacturer or Distributor and Brand	Nicotine		Nicotine-sulphate, Guaranteed	Inert Matter, Guaranteed	Passing 200 mesh	Publication
	Guaranteed	Found				
	%	%	%	%	%	
Z. N. Beach, Wallingford, Conn	....	1.66	....	....	....	Conn. Agr. Expt. Sta., Sample 4715.
Melvin W. Buster, Santa Rosa, Cal	....	2.03	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
C. D. Carpenter, Berkeley, Cal	....	2.36	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
Lewis Cheeseman, Hatfield, Mass.[1]	....	1.72	....	....	....	Conn. Agr. Expt. Sta., Bull. 242, 155 (1922).
Corona Chemical Co., Newark, N. J.	0.50	0.82	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
H. P. Cox, San Francisco, Cal.	....	1.50	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
Dosch Chemical Co., Louisville, Ky. Dosch	1.20	0.40	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
F. & I. Tobacco Products Co., Lancaster, Pa	1.00	0.93	....	....	....	N. J. Agr. Expt. Sta., Bull. 407, 11 (1924).
Golden Gate Mills, San Francisco, Cal. Impco Poultry Tobacco Dust Worm Cure	0.50	0.73	....	98.50	....	Cal. Dept. Agr., Spec. Pub. 51, 49 (1925).
Hall Tobacco Chemical Co., St. Louis, Mo	....	1.30	....	....	60.00	Conn. Agr. Expt. Sta., Bull. 242, 155 (1922).
International Milling Co., San Francisco, Cal	....	1.16	2.00	98.00	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
International Milling Co., San Francisco, Cal	....	2.78	5.00	95.50	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
International Milling Co., San Francisco, Cal	0.50	1.30	....	99.50	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
R. J. Irwin, Inc., New York, N. Y. No. 2	0.50	0.98	....	....	....	N. J. Agr. Expt. Sta., Bull. 441, 9 (1926).
E. M. Ives, Meriden, Conn	....	0.71	....	....	96.00	Conn. Agr. Expt. Sta., Bull. 272, 148 (1925).
M. E. Jaffa, University of California, Berkeley, Cal.	....	1.09	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
Kentucky Tobacco Produce Co	....	0.16	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).
Montgomery, Ward & Co., Portland, Ore	1.50	1.32	....	....	....	Ore. Agr. Expt. Sta., Cir. 84, 11 (1927).
Chas. W. Muller. Muller's Ground Tobacco	1.00	1.08	....	....	....	Cal. Dept. Agr., Spec. Pub. 75, 34 (1927).
E. J. Reilly, San Francisco, Cal	....	0.60	....	....	....	Cal. Dept. Agr., Spec. Pub. 34, 50 (1923).

[1] Total ash 39.60 per cent; acid-insoluble ash 15.30 per cent; total nitrogen 1.99 per cent.

Trepep.

(PERFECTO SPRAY MFG. CO., LOS ANGELES, CAL.)

Guaranteed: Water 80.00 per cent.

Found: Water 83.60 per cent; soap 3.69 per cent; nicotine 0.26 per cent; copper 0.23 per cent; protein 5.13 per cent; phenols 0.90 per cent; calcium oxide 4.70 per cent; sulphur 0.79 per cent; free ammonia 0.36 per cent.

Cal. Dept. Agr., Spec. Pub. 66, 37 (1926).

Triona.

Triumph.

See "Oil Emulsions, Mineral."

Tuber Tonic.

(SHERWIN-WILLIAMS CO., CLEVELAND, OHIO.)

Found: Total arsenic 23.40 per cent; water-soluble arsenic 0.86 per cent; copper 19.70 per cent.

N. J. Agr. Expt. Sta., Bull. 459, 16 (1927).

Tux-E-Do Mixture.

(SCHOONMAKER & SON, CEDAR HILL, N. Y.)

Found: Total arsenious oxide 2.69 per cent; water-soluble arsenious oxide 1.77 per cent; cupric oxide 5.90 per cent.

N. Y. Agr. Expt. Sta., Bull. 348, 90 (1912).

Twenty Plus Disinfectant.

(MICHEL & PELTON CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Sodium hypochlorite	12.00	11.91
Available chlorine	....	5.67

Cal. Dept. Agr., Spec. Pub. 51, 53 (1925).

210 Dust Mixture Special.

See "Nicotine Dusts."

Tydol 122.

See "Oils, Mineral."

U.

U. C. Worm Capsules.

(JONES DRUG STORE, PETALUMA, CAL.)

Found: Nicotine 15.59 per cent.

Cal. Dept. Agr., Spec. Pub. 66, 26 (1926).

Universal Brand Neutral Emulsion.

Universal Brand Triona.

Universal Brand Triumph.

Universal Dormant Soluble Oil.

Universal Mealy Bug Spray Oil.

Universal Medol Emulsion.

See "Oil Emulsions, Mineral."

University Capsules.

(THE UNIVERSITY CAPSULE CO., SAN FRANCISCO, CAL.)

	Guaranteed.	Found.
Nicotine	13.00	14.20

Cal. Dept. Agr., Spec. Pub. 66, 26 (1926).

University Poultry Worm Capsules.

(NOVATO PHARMACY, NOVATO, CAL.)

Found: Nicotine 14.81 per cent.

Cal. Dept. Agr., Spec. Pub. 66, 26 (1926).

University Worm Capsules.

(CHICKEN PHARMACY, PETALUMA, CAL.)

	Guaranteed.	Found.
Nicotine	13.00	13.39

Cal. Dept. Agr., Spec. Pub. 75, 35 (1927).

University Worm Capsules No. 1.

(PETALUMA AVIAN PATHOLOGY LABORATORY, PETALUMA, CAL.

	Guaranteed.	Found.
Nicotine	15.00	14.83

Cal. Dept. Agr., Spec. Pub. 66, 26 (1926.)

Urania Green.

(IMPORTED FROM GERMANY).

Found: Total arsenious oxide 57.05 per cent; water-soluble arsenious oxide 4.18 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 16 (1923).

Uspulun.

(THE BAYER CO., INC., NEW YORK, N. Y.)

Guaranteed: Hydroxymercurichlorphenol sulphate 30.00 per cent.
Found: Mercury 19.57 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 62 (1927).

V.

Vaporizing and Fumigating Insecticide.

(EASTERN CHEMICAL CO., BOSTON, MASS.)

	Guaranteed.	Found.
Nicotine	37.00	30.87
Camphor	23.00	13.64
Alcohol	32.00	53.49

U. S. D. A., Bur. Chem., Bull. 68, 47 (1902).

Veltha.

(WM. WOOD & SON, WOODGREEN, LONDON, ENG.).

Found: Sand 32.73 per cent; water 27.00 per cent; carbon 2.31 per cent; sulphur trioxide 19.90 per cent; ferrous oxide 17.90 per cent. Substance is partially dehydrated ferrous sulphate with 35.00 per cent sand and carbon.

U. S. D. A., Bur. Chem., Bull. 68, 48 (1902).

Vermol.

See "Phenol Soap Solutions."

Verm-O-Spray.

(VERM-O-SPRAY PRODUCTS CO., WEST HAVEN, CONN.)

Found: Specific gravity, 15.6° C., 0.8825; trace of ash; flash point 61.0°C.; fire point 64° C.; salicylate present. Substance is a mixture of kerosene and methyl salicylate.

Conn. Agr. Expt. Sta., Bull. 258, 376 (1924).

Victory Tree Spray.

(VICTORY TREE SPRAY CO., LOS ANGELES, CAL.)

	Guaranteed.	Found.
Total arsenic oxide	4.50	5.74
Water-soluble arsenic, oxide	0.50	1.37
Lead oxide	15.00	14.83
Sulphur	25.00	24.85
Sodium oxide	10.00	13.02
Soap	....	3.80

Cal. Dept. Agr., Spec. Pub. 66, 18 (1926).

Vigorol.

(TREE CHEMICAL CO., SAN JUAN BAUTISTA, CAL.).

Guaranteed: Potassium cyanide 5.47 per cent.

Found: Potassium cyanide, 1.66 per cent; nitrate nitrogen 0.31 per cent; ammonia nitrogen 2.24 per cent; organic nitrogen 0.65 per cent; total nitrogen 3.20 per cent; phosphorous pentoxide 3.15 per cent. This is a preparation intended to be injected into the sap of trees. It was found to injure trees, and renewal of license to sell was refused in California.

Cal. Dept. Agr., Spec. Pub. 51, 12, 58 (1925).

Vitedust.

(NIAGARA SPRAYER CO., MIDDLEPORT, N. Y.)

	Guaranteed.	Found.
Copper sulphate	11.00	9.40
Lead arsenate	14.00	12.80

Ore. Agr. Expt. Sta., Cir. 64, 11 (1925).

Volck.

Vulture Oil.

See "Oil Emulsions, Mineral."

W.

Dr. G. Z. Wait's Sheep Dip.

See "Phenol Soap Solutions."

Wait's Squirrel and Gopher Poison.
Wakelee's Squirrel and Gopher Poison.

See "Strychnine Preparations."

Walnut Worm Dust.

See "Ortho Walnut Worm Dust."

War on Ants.

(CANNON CHEMICAL CO.)

Guaranteed: Sugar 20.00 per cent.

Found: Sodium fluoride 45.27 per cent; organic matter 25.05 per cent; sugar 19.72 per cent.

Cal. Dept. Agr., Spec. Pub. 75, 63 (1927).

Waters Bros. Crude Carbolic Acid.

See "Phenol."

Watkin's Germicide Dip and Disinfectant.

See "Phenol Soap Solutions."

Watkin's Louse Killer.

(J. R. WATKINS CO.)

	Guaranteed.	Found.
Nicotine	0.10	0.23
Naphthalene	10.00	10.07

Cal. Dept. Agr., Spec. Pub. 75, 41 (1927).

Watson's Soluble Arsenoid.

(JOHN WATSON CO., INC., HOULTON, ME.)

Guaranteed: Sodium arsenate 80.00 per cent; arsenic, metal 32.20 per cent.

Found: Arsenic, metal 40.09 per cent.

Maine Agr. Expt. Sta., Official Inspections 118, 70 (1925).

Weedicator.

(WEEDICATOR WEED CO.)

	Guaranteed.	Found.
Arsenious oxide	....	7.84
Water	70.00	70.00

Cal. Dept. Agr., Spec. Pub. 75, 25 (1927).

Weed Killer.

(CHIPMAN CHEMICAL ENGINEERING CO., BOUND BROOK, N. J.)

	Guaranteed.	Found.
Salts	45.00	44.10

Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).

Weed Killer.

(HOOD RIVER SPRAY CO., HOOD RIVER, ORE.)

Found: Arsenious oxide 30.00 per cent.

Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).

Weed Killer.

(U. S. SMELTING, REFINING & MINING CO., SALT LAKE CITY, UTAH).

	Guaranteed.	Found.
Sodium arsenite	43.00	44.50

Ore. Agr. Expt. Sta., Cir. 84, 15 (1927).

Weed-Killer No. 1 Thin Liquor.

(F. W. WAITE, EL CENTRO, CAL.)

Found: Arsenious oxide 1.13 lb. per gal.; sodium chloride, 1.94 lb. per gallon.

Cal. Dept. Agr., Spec. Pub. 34, 20 (1923).

Weed Killer, No. 2, Thick Liquor.

(F. W. WAITE, EL CENTRO, CAL.)

Found: Arsenious oxide 8.10 lb. per gal.; sodium chloride 0.14 lb. per gallon.

Cal. Dept. Agr., Spec. Pub. 34, 20 (1923).

Weed Killer, Solid.

(F. W. WAITE, EL CENTRO, CAL.)

Found: Arsenious oxide 1.56 per cent; sodium hydroxide 57.60 per cent; sodium carbonate 38.16 per cent; sodium chloride 1.42 per cent.

Cal. Dept. Agr., Spec. Pub. 34, 20 (1923).

Weevil Bait.

See "Strawberry Weevil Bait."

Wescco Bleaching Water.

Found: Available chlorine 2.89 grams per 100 cc.

Conn. Agr. Expt. Sta., Bull. 258, 377 (1924).

Western Poisoned Barley.

See "Strychnine Preparations."

Whale Oil Soap.

See "Soap."

White Arsenoid (Barium Arsenite).

(ADLER COLD & CHEMICAL WORKS, NEW YORK, N. Y.)

Found: Barium carbonate 44.05 per cent; barium chloride 13.05 per cent; barium oxide 8.18 per cent; free arsenious oxide 27.64 per cent; lead carbonate 1.86 per cent; silica 0.20 per cent; water 4.00 per cent.

Univ. of Calif. Coll. of Agr. Expt. Sta., Bull. 151, 25 (1903).

Whitewash.

See "Wyandotte Detergent."

Whitney's Sulphon Carbolate of Lime.

(WHITNEY CO., NATICK, MASS.)

Found: Sand, 1.14 per cent; carbon dioxide 8.60 per cent; sulphur trioxide 0.16 per cent; calcium oxide 57.42 per cent; magnesium oxide 7.37 per cent; phenol anhydride 1.68 per cent; water and pink dye by difference, 23.63 per cent.

U. S. D. A., Bur. Chem., Bull. 68, 51 (1902).

Williams and Moore Spray Soap.

See "Soap."

Winter Mulsion.

See "Oil Emulsions, Mineral."

W. & M. Antiseptic Sheep Dip.

See "Phenol Soap Solutions".

Wyandotte Detergent (Whitewash).

(MANUFACTURER NOT STATED).

Found: Moisture 4.50 per cent; sand 69.22 per cent; sodium carbonate 10.60 per cent; calcium oxide 1.20 per cent; magnesium oxide 0.35 per cent; soap 10.40 per cent; nicotine none. This substance was sold as a wash to prevent sunburn of trees, but was found of no value for this purpose.

Cal. Dept. Agr., Spec. Pub. 34, 59 (1923).

Wyrol.

See "Oils, Mineral."

X.

XL all.

(G. H. RICHARDS, LONDON, ENG.)

Found: Nicotine 3.41 per cent.
N. Y. Agr. Expt. Sta., Bull. 348, 94 (1912).

XX Mystic XX Spray.

See "Oils, Mineral."

X X X Heavy Emulsion.

X X X Medium Emulsion.

See "Oil Emulsions, Mineral."

Y.

Yellow Label Hydroxide Paste.

See "Mechling."

Youell's Rat Snap.

See "Phosphorus Preparations."

Z.

Zeno.

See "Phosphorus Preparations."

Zenoleum Lice Killer.

(ZENNER DISINFECTANT CO., DETROIT, MICH.)

Found: Nicotine 0.51 per cent.
Mich. Agr. Coll. Expt. Sta., Spec. Bull. 74, 11 (1915).

Zeno Miscible Oil Spray.

See "Oil Emulsions, Mineral."

Zinc Arsenite.

See "Arsenite of Zinc."

Zinc Bordeaux.

(GENERAL CHEMICAL CO., NEW YORK, N. Y.)

	Guaranteed.	Found.
Total arsenic, metal	10.16	10.22
Water-soluble arsenic, metal	1.00	0.25
Copper	15.70	16.07
Zinc	13.31	14.41

Conn. Agr. Expt. Sta., Bull. 242, 154 (1922).

BULLETIN 301 FEBRUARY, 1929

Connecticut Agricultural Experiment Station
New Haven, Connecticut

CONTROL STUDIES ON THE PLUM CURCULIO IN CONNECTICUT APPLE ORCHARDS

PHILIP GARMAN AND M. P. ZAPPE

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Press of The Wilson H. Lee Co., New Haven, Conn.

Recommendations for Control of Curculios on Apple Trees in Connecticut

(1) Arsenate of lead[1] used at 1½ pounds per 50 gallons of spray mixture—applied four times, two applications being subsequent to the calyx period preferably in a pink, calyx, 7-day and 2-weeks or 17-day schedule. Continue until curculios are well under control or if the infestation is small in the beginning, then omit the 7-day application on all except outside rows around the orchard. Apply sprays after calyx at the rates indicated on page 409

(2) Treat interplanted peaches, or peaches in orchards nearby, using lead arsenate as per spray calendar recommendations and cultivate thoroughly up to the trunks during July.

(3) Take care of wild apples or unsprayed trees in immediate neighborhood if possible, either by removal of trees, spraying them at calyx period with lead arsenate and fish oil sticker, or by collection and destruction of early dropped fruits.

(4) Destroy fence rows bordering orchard and remove stone walls if possible.

(5) For trees in the home garden, additional measures such as collection of dropped fruits, may be practised, keeping them picked up and destroyed from the middle of June on—and the destruction of beetles caught by jarring them from the trees onto a sheet.

[1] $PbHAsO_4$—Acid lead arsenate. Commercial arsenate of lead is commonly sold in Connecticut in this form.

CONTENTS

Control Studies on the Plum Curculio[1] in Connecticut Apple Orchards

PHILIP GARMAN AND M. P. ZAPPE

The plum curculio has been recognized as a major enemy of fruits in New England since Colonial days. Records of its occurrence in this country may be found in literature appearing between 1735 and 1750[2], and judging from the amount written since that time it has continued its depredations undiminished in severity, ranking today as one of the most important fruit pests. It is probably a native American insect, which became destructive on the introduction of fruit culture by the colonists.

The studies described in this paper were commenced in 1923, and therefore cover a period of six seasons. Though most of the observations were made at the Station farm at Mount Carmel, the orchard of Mr. C. E. Shepard of the West Woods section of Mount Carmel was placed at our disposal for experimental work. The systematic spraying tests recorded on pages 407-434 represent five seasons' work at the Station farm and four seasons at Mr. Shepard's orchard.

NATURE AND EXTENT OF THE DAMAGE

As the name implies, plums are the favorite food of the curculio and damage to these fruits is always severe. Peaches are likewise attacked and although not seriously in Connecticut, much loss results in some regions. Apricots are about equally preferred to to plums while cherries, nectarines, quinces and pears are sometimes injured. Haws are also said to be infested. Perhaps the most serious damage by the curculio in Connecticut occurs on apples, not necessarily because of the amount of feeding or egg-laying, but because of the importance of the apple crop in the State and the difficulty of controlling it under ordinary conditions.

INJURY TO APPLES

Curculios puncture the fruit of the apple both to feed and to lay eggs. Egg punctures are made during the spring and early summer, whereas feeding punctures may be made at any time. Egg punctures are characteristic for the insect, consisting of small crescentic excavations (Plate IV, a) which may enlarge as the apple grows, often resulting in large arrow-shaped scars (Plate V, a)

[1] *Conotrachelus nenuphar* Herbst.
Order Coleoptera—Family Curculionidae.

[2] See Quaintance and Jenne, 1912, p. 15.

a quarter of an inch or more across. The crescentic excavation usually prevents the destruction of the egg by growth of the fruit, the egg being placed in the flap at the center of the excavation. Feeding punctures consist of small circular holes often excavated around the edges by the feeding of the beetle, the fall punctures being largely of this type (Plate VI, a, b).

The number of punctures per apple varies with the density of the infestation. On trees sprayed with lead arsenate according to the usual schedule, the number varies from one to five, though occasionally more are encountered. On unsprayed fruit, the number frequently reaches 20 or more per single fruit. Where one or two punctures are present, the value of the fruit is not seriously affected except that it should be removed[1] from the highest grade (Fancy). Where 10 to 20 punctures occur, the value is naturally much less. A few external punctures do not, however, impair the keeping qualities and there is no danger of wormy fruit even where more than this occur, since no larvae develop in fruit remaining on the tree. Expanded curculio marks from punctures made early in the season frequently cover a considerable area and may hurt the sale if put on the market in competition with perfect fruit. The greatest damage, however, results from early feeding punctures which deform the fruit and from larvae which partly develop but are later crushed by the growth of the apple (Plate V, b). Such fruit is much reduced in value.

As to the amount of the injury occasioned, it may be said that a large per cent of the fruit is often affected on unsprayed trees, varying with the abundance of the beetles and the size of the crop. Our experience indicates that they may injure as much as 90 per cent of the entire crop, rendering a large part of it unsalable or fit only for cider. On large trees (12 years or more), a medium crop usually shows greater injury than either a very light or heavy one. Ordinarily 50 to 60 per cent of the fruit is damaged in infested orchards where no spraying is done. The following table shows the degree of injury which is found on untreated trees in sprayed orchards, the percentages representing curculio marked fruit:

TABLE 1

	Orchard	1921	1922	1923	1924	1925	1926	1927
				Per Cent				
Milford.....	A	57	67	60	48	..	23–60	..
Expt. Sta., Mt. Carmel	B	..	..	..	64	61	50	55
Shepard's, Mt. Carmel.	C	..	..	..	..	79	26	40

The above figures would not be especially significant unless a comparison were given with fruit from average commercial orchards. Counts were therefore made in a few orchards in order

[1]Public Acts, State of Conn. 1919, Chapter 295, Section 2.

to obtain figures bearing on the amount of damage to fruit as handled by the average Connecticut orchardist.

TABLE 2—RESULT OF SCORES IN COMMERCIAL ORCHARDS—1928

Variety	Location of Orchard	Total Apples	Number Marked by Curculio	Per Cent Marked	Treatment
Baldwin	Cheshire	749	128	17.2	Dormant and pink sprays dusted 7, 14, 30 days after.
Baldwin	Cheshire	661	36	5.4	Same as above plus prepink spray.
Baldwin	Wallingford	1,333	40	3.3	Dormant oil, pink, calyx, dust 10 days later, July 30.
Wagener	Wallingford	749	49	6.5	
Baldwin	Wallingford	1,179	166	14.2	
McIntosh	Cheshire	535	68	12.7	Pink spray, calyx dust (90-10) 7, 14, 30 days later.
Baldwin	Cheshire	749	128	17.4	Same as above.
Baldwin	Cheshire	659	36	5.5	Same as above plus prepink spray.
Baldwin	Cheshire	1,376	228	16.5	Dormant, pink, delayed calyx sprays; dusted afterwards.
Baldwin	Cheshire	554	123	22.2	
Baldwin	Branford	1,421	42	2.95	Dormant, pink calyx and 4 others last on August 1; all sprays.
Baldwin	Branford	945	102	10.7	Dormant, pink, calyx and 3 others; all sprays.

LIFE HISTORY

The life history of the plum curculio is very well known and has been worked out carefully by many investigators. Therefore, it will be unnecessary to extend this phase of the report unduly, but it will be desirable to give a general outline of the life cycle in Connecticut, developing such points as affect control measures.

Eggs are laid in the crescent-shaped punctures already mentioned. On apples, these punctures begin to be noticed shortly after the petals fall when the apples have reached one-fourth to one-half inch in size. After this, there is a period of three to five weeks (Fig. 28) in the field when egg-laying is continued but the peak of oviposition occurs about June 15, dropping off rapidly and being similar to the abundance curve (Fig. 26, b). In insectary cages, egg-laying has been observed to continue until the second week in July or even the last of July while newly made egg-punctures may be observed on apples in the field as late as July 25.

Length of Life Periods 1924–1925

The eggs hatched in an average of seven days according to our observations, varying from five to 16 days. The egg and larval period in the fruit averaged for this locality 22.9 days, varying from 17 to 39 days; while the average time from the entrance of the larvae into the soil to the formation of the adult was 21.2 days varying from 10 to 31 days. Our total period then from deposition of eggs to emergence of adults averaged 53.4, and varied from 31-67 days. The adult was observed to spend some time in the soil after transforming and there seemed to be considerable lack of uniformity in the maturity reached before they came from the soil. This probably accounts for the rather large variation encountered in the total length of the life cycle. There is, however, considerable difference in the length of the life periods in different years and the summer emergence of the adult has varied accordingly. The following records give a general picture of the periods in 1924–1925.

Table 3

	Average Days	Range
Eggs in fruit	7.0	5–16
Larvae in fruit	15.9	12–23
Larvae in soil	11.6	6–16
Pupae in soil	11.0	8–25
Adult in soil	9.8	....
Total	55.4	31–80

Length of Periods under Different Conditions and Cause of the Variations

It seems probable that the total life period given in the preceding table is shorter than actually occurs in the field in some seasons and the following figures bear on this point. Larvae emerging from dropped fruit collected under experimental trees were placed in field cages in 1924–1925, and the time to the emergence of the beetles observed. It will be seen that the average time spent in the ground is 42.2 days which if added to the periods spent in the fruit as egg and larva: namely, 22.9 days, would equal 65.1 days. This, it would seem, more nearly approaches conditions in the orchard. We know, for instance, that the greatest number of eggs laid about June 15 (1923–1924) in Connecticut and the total period of 65 days would bring the period of adult emergence (second brood) to the maximum for August 19. In 1924 and 1925, the curve (see chart on page 389) came to the maximum on September 1, although since that time it has fallen more nearly on the theoretical date, August 15–20 in 1927, and 10–15 in 1928. Another fact

which supports the late summer emergence idea is the percentage of fall feeding punctures found on the fruit.

Table 4

Number Observed		Average Time Spent in Soil, Days
38		37.8
5		36.0
1		32.0
28		42.6
22		50.1
13		34.3
1		49.0
12		52.0
Total...120	Av. of all observations	...42.2 days
	Av. of Averages	.....41.7 days

Thus, from the variety Dutchess (unsprayed) examined on August 26, 1927, .09 per cent were marked with this type of feeding punctures; whereas, Russets picked and scored during October ran as high as 2.0 per cent; Greenings scored September 11 averaged 1.4 per cent while Baldwins scored October 27 but picked about one week earlier averaged 6.5 per cent on some unsprayed trees. The greatest amount of fall feeding is thus seen to occur after the first of September and since the adults will begin to feed within a few days after emergence, they could not well have emerged much earlier than this date. On the other hand, during 1928 when there was a very early emergence of adults, few or no feeding punctures were found on early fruit which would tend to contradict the last statement.

Life History in 1928

Results of rearing curculios in 1928 indicated that there was a much shorter total life period than occurred in 1924 and 1925 and as a direct result an earlier emergence of adults during August, than was experienced during these years. One hundred individuals reared from eggs during 1928 gave an average cycle of 47.9 days and 28 days from emergence from the fruit until appearance above the soil as adults. Larvae placed in the soil on the same dates presumably under identical conditions (placed together in small jars) varied as much as three weeks in their period of emergence. In all cases, a normal emergence curve was produced, the peak of the lots obtained early in the season being approximately 27 days, and those obtained later, about 30 days. The following table shows the results obtained for 1928 in rearing curculios from egg to adult and from larva to adult, the latter being obtained from dropped fruits collected in the orchard at Mt. Carmel.

TABLE 5—LENGTH OF TIME SPENT IN SOIL—1928

Date Entered Soil	Date Emerged	Number Observed	Average	Range Days
June 28	July 25–27	4	28	27–30
July 1	July 25–Aug. 6	107	27	24–36
July 7	July 29–Aug. 21	43	27	22–45
July 8	July 31–Aug. 15	44	28	23–28
July 8	Aug. 4–Aug. 21	119	36	27–44
July 8	July 29–Aug. 10	32	26	21–31
July 9	Aug. 1–Aug. 11	32	27	22–32
July 10	July 21–Aug. 11	95	26	21–31
July 10	Aug. 1–Aug. 24	125	27	21–45
July 11	Aug. 6–Aug. 21	65	31	27–41
July 12	Aug. 4–Aug. 11	91	27	23–30
July 15	Aug. 7–Aug. 19	51	28	23–35
July 16	Aug. 11–Aug. 23	114	32	26–39
July 18	Aug. 10–Aug. 21	64	27	23–34
July 23	Aug. 19–Aug. 26	7	29	27–35
July 24	Aug. 17–Aug. 26	4	29	24–33
July 26	Aug. 19–Aug. 27	10	28	24–36
July 27	Aug. 23–Sept. 3	11	30	27–36
July 29	Aug. 23–Sept. 5	16	30	25–38
July 30	Aug. 21–Sept. 3	6	29	22–33
July 31	Aug. 30–Aug. 31	4	31	30–31
Aug. 3	Aug. 26–Sept. 3	4	26	23–29
	July 21–Sept. 5	1,048	28	21–45

TABLE 6—LENGTH OF LIFE CYCLE FROM EGG TO ADULT—1928

No.	Date Eggs Laid	Date Adult Emerged	Number Beetles	Period Days
1	May 30	July 26	1	57
2	June 12–13	July 26	2	43
3	June 12–13	July 28	2	45
4	June 10–11	Aug. 4	1	54
5	June 15–16	Aug. 4	1	49
6	June 24	Aug. 1	1	38
7	June 24	Aug. 3	1	40
8	June 24–5	Aug. 6	1	42
9	June 24–5	Aug. 7	1	43
10	June 21	Aug. 8	1	47
11	June 26	Aug. 9	1	44
12	June 26	Aug. 15	3	50
13	June 26–7	Aug. 9	7	43
14	June 29	Aug. 15	2	47
15	June 29	Aug. 17	3	49
16	June 29	Aug. 19	2	52
17	June 27	Aug. 14	3	48
18	June 27	Aug. 15	1	49
19	June 30	Aug. 15	2	47
20	June 30	Aug. 19	1	51
21	July 1	Aug. 11	1	41
22	July 1	Aug. 15	1	45
23	July 11	Aug. 24	1	55
24	June 28	Aug. 10	3	43
25	June 28	Aug. 11	1	44
26	June 28	Aug. 13	1	46
27	June 28	Aug. 30	1	63
28	July 5	Aug. 26	2	52

TABLE 6—LENGTH OF LIFE CYCLE FROM EGG TO ADULT—1928—*Concluded*

No.	Date Eggs Laid	Date Adult Emerged	Number Beetles	Period Days	
29	July 5	Aug. 29	1	55	
30	July 2	Aug. 17	1	46	
31	July 3	Aug. 13	1	41	
32	July 3	Aug. 19	5	47	
33	July 6	Aug. 15	2	40	
34	July 6	Aug. 19	2	44	
35	July 4	Aug. 6	1	31	
36	July 4	Aug. 14	1	39	
37	July 4	Aug. 17	1	42	
38	July 4	Aug. 19	4	47	
39	July 7	Aug. 31	1	55	
40	July 11	Aug. 30	1	50	
41	July 11	Aug. 31	1	51	
42	July 11	Sept. 5	1	56	
43	July 8	Aug. 19	1	42	
44	July 18	Aug. 22	1	45	
45	July 18	Aug. 25	1	48	
46	July 8	Aug. 26	4	49	
47	July 9	Aug. 24	1	46	
48	July 9	Aug. 26	3	48	
49	July 12	Aug. 30	1	49	
50	July 12	Sept. 5	2	55	
51	July 10	Aug. 30	1	51	
52	July 10	Aug. 31	3	52	
53	July 14	Aug. 31	3	48	
54	July 14	Sept. 9	1	57	
55	July 22	Sept. 14	2	54	
56	July 22	Sept. 17	1	57	
57	July 19	Sept. 17	1	60	
58	July 22–24	Sept. 17	2	56	
59	July 22–24	Sept. 25	1	64	
Total, average and range			100	47.1	31–64

A chart of the various activities of the curculio during the summer is shown in Figure 23. The first phase showing beetles coming from hibernation often begins in April but is not shown on the chart for lack of space. The peaks and relative abundance at different periods are shown together with the dates when the activity began, when it came to the maximum and finally ceased.

As a rule, the curculio lives longer in the adult stage than in any other. Adults of the second generation emerging from the soil during August and September hibernate and appear during May or June of the following year. Mating occurs in August or September but more often in Spring after coming from hibernation. Beetles sometimes live in captivity until October of the second year, making their total life 13 or 14 months. In most instances, however, beetles hibernating successfully, die before the middle of July and the total period for this stage may be said to vary from a few months (for those that fail to survive the winter) to nine to 13 months. The following chart (Fig. 23) indicates the general course of the life history.

Description

No extended scientific description will be attempted here, since the various stages have been frequently described and are shown in Plates I and II. The larva is sometimes confused with that of the Oriental fruit moth, and it may be said that the main gross

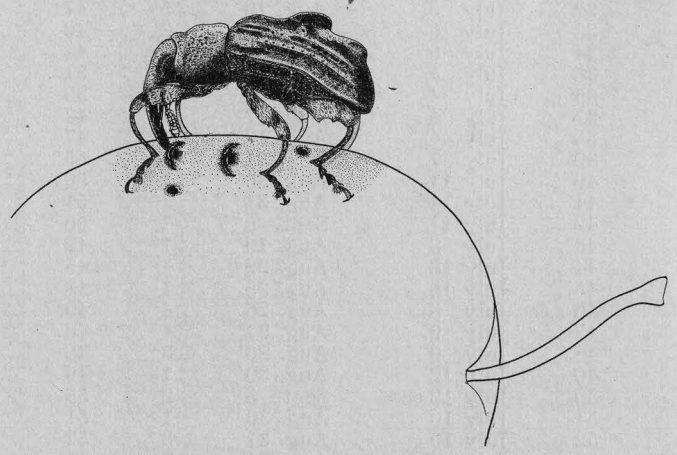


Fig. 21. The curculio beetle, its egg and feeding punctures. Enlarged 5 times.

points of difference lie in the curvature of the body and the color. The curculio almost invariably rests in a curved position while the fruit moth is straighter and more active and when mature is

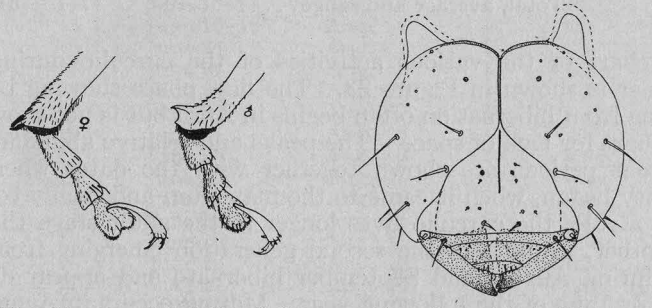


Fig. 22. Structural details of the curculio. Left, hind tibiae and tarsi of adult female and male. Right, head of larva, front view showing punctures and setae.

pink in color. The curculio larva is always white or slightly yellow and possesses no abdominal legs.

There has been some doubt in the authors' minds regarding the number of larval instars, but we have been able to check the

statement of Quaintance and Jenne (1912) on p. 56 and find that there are four instars as stated there. The average width of the head capsule of 10-14 individuals of each instar are as follows: first, .28 mm.; second, .45 mm.; third, .69 mm.; and fourth, .96 mm. The larva is shown in Plate I, b and c, the head capsule in Fig. 22.

The pupa, shown in Plate I, d, is without protection except that it transforms in an earthen cell.

Adults, Plate II, a to d, are small brownish gray snout beetles with elevations of different heights on the wing covers, the beetle itself varying in length from tip of snout to end of abdomen from 5 to 7 mm.

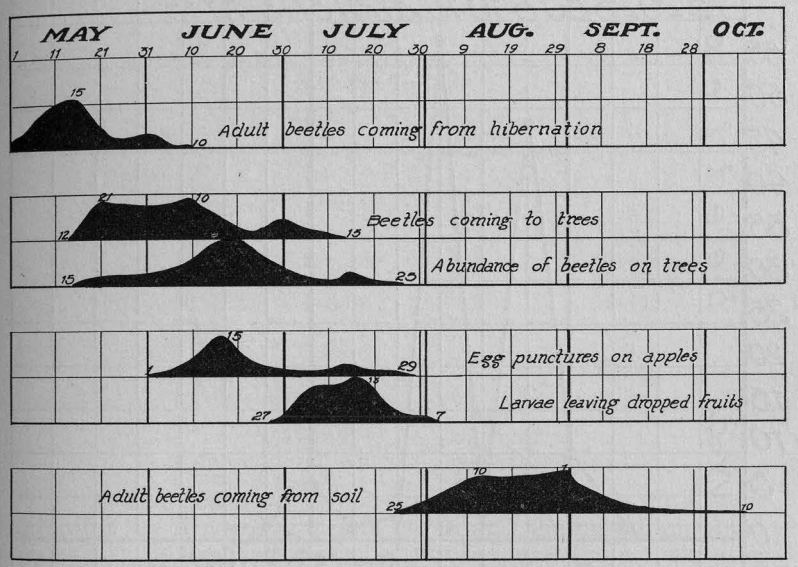


Fig. 23. Chart showing various activities of the curculio. Earliest emergence of hibernating beetles during our experiments occurred April 24. Adult beetles enter hibernation in August and September shortly after emerging from the soil.

When at rest, the adult folds its legs close to the body and if disturbed falls to the ground where it resembles closely a piece of bark or small cinder. The sexes are distinguished by the shape of the hind tibia as shown in Fig. 22.

Abundance of the Curculio in Its Various Stages and at Different Periods of Activity

Spring emergence of the adult

Emergence from hibernation begins on the approach of warm weather in the spring. The appearance of beetles depends upon temperature, and apparently upon rainfall in certain seasons. It

has been noted by different authorities and observed during these investigations, that there may be an almost complete absence of beetles in the orchard until a given period dependent upon the temperature or other climatic conditions, when they come suddenly in considerable numbers. During the present investigation, records have been kept of emergence of the adults confined in field cages, from which data it appears that they begin to come from hibernation as a rule when the blossom buds of most varieties

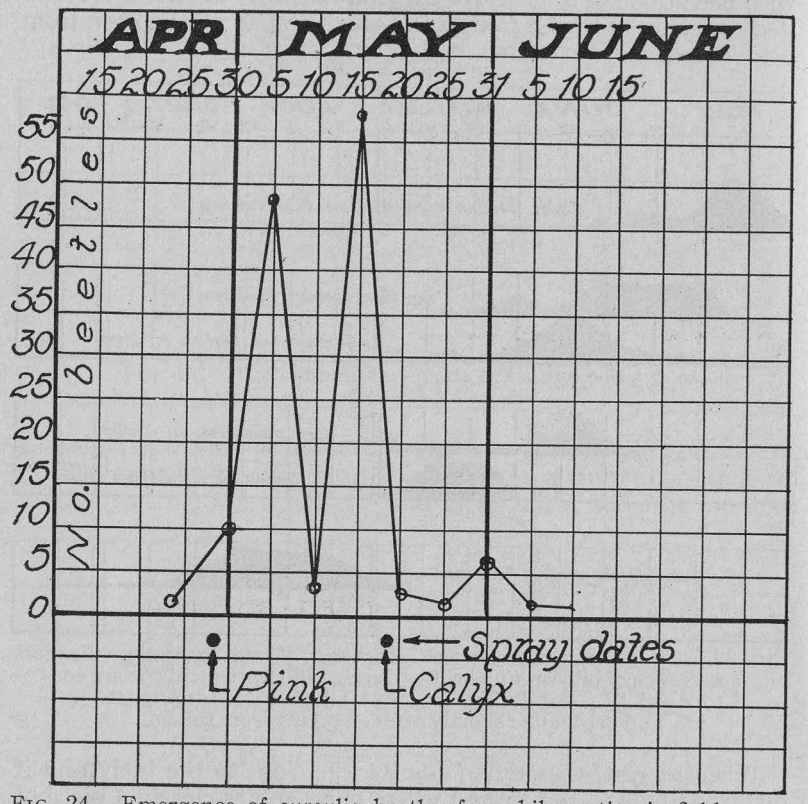


FIG. 24. Emergence of curculio beetles from hibernation in field cages 1925. Varying emergence is probably due to variations in temperature.

are turning pink. The earliest record of emergence thus far obtained is on April 24, 1925, and adults continued to come from the soil until June 12. The best records were obtained in 1925 and 1927 when three distinct waves of emergence were noted probably due to varying temperatures. In 1925, '26, '27 and '28, however, they appeared well on schedule, beginning to appear in numbers when the apple trees had reached the pink blossom bud stage. The data are shown graphically in Figures 23 and 24.

Temperature is, of course, an important factor affecting the time of emergence in spring, and especially the appearance of the beetles on the trees. According to various records (Quaintance and Jenne, 1912, pp. 118-119) the beetles begin usually to be found on the trees after a few days when the thermometer registers 60° F. (mean daily) or above. If the season is dry, the amount of rainfall decidedly affects their emergence from the soil. This is especially true of our observations in field cages where in 1926 the numbers emerging were decidedly increased after heavy rains. In 1927 this condition was not as marked but the following table will show that the greatest emergence occurred after the heaviest rainfall of that period.

TABLE 7—EMERGENCE OF HIBERNATING BEETLES AS AFFECTED BY RAINFALL—1927

Date	Rainfall in Inches	Beetles Emerging in Cages	Temperature, Deg. F.
May 2	tr.	..	.....
3	.05	..	.....
4	....	2	52–62
5	.2	..	.....
7	tr.	1	50–62
10	.2	3	56–62
11	1.05	12	57–71
13	...	..	.....
14	.55	..	.....
15	...	2	53–64
17	.1	..	.....
20	tr.	2	50–64

ABUNDANCE OF BEETLES ON THE TREES

The beetles, however, do not appear on the trees until some time after the first emergence in cages, and the maximum abundance on apple trees is not reached until at least three weeks after the calyx or petal fall spray would normally be applied. On plums, however, their appearance on the trees is somewhat earlier corresponding with the blooming period of some varieties, and the maximum abundance and egg-laying activities do not correspond altogether with the maximum abundance on apples according to our figures. The following charts (Figures 26 and 27) have been prepared to show this phase of the beetles' activities. On apples they begin to appear sometime between the pink and calyx periods, but do not become abundant until later. From the calyx period on, they increase rapidly until about three weeks afterwards when they decrease and gradually disappear, a few stragglers remaining until the middle or even the latter part of July.

EGG LAYING ACTIVITY AT DIFFERENT PERIODS

Extensive observations on the egg laying activities of the curculio in the field were made in 1928, results of fruit examinations being kept during the egg laying period. On apple trees it appears that

the danger period in 1928 lay between June 1 and June 22 (calyx spray applied May 28 in our orchard) during which period sprays should be repeated at least twice for trees that are heavily infested. After June 22, there was a long-drawn-out period continuing until August when a few egg scars were made, which suggests the advisability of infrequent applications after the greatest feeding period is past in order to prevent the small amount of damage which occurs at the later time. Ordinarily, however, this has not been found necessary from the control standpoint, but sprays in July recommended for maggot control should play an important part in preventing damage from the late injury described. Figure 28 shows the injury to apples and other fruits resulting from egg punctures, and Plate IV shows typical egg scars.

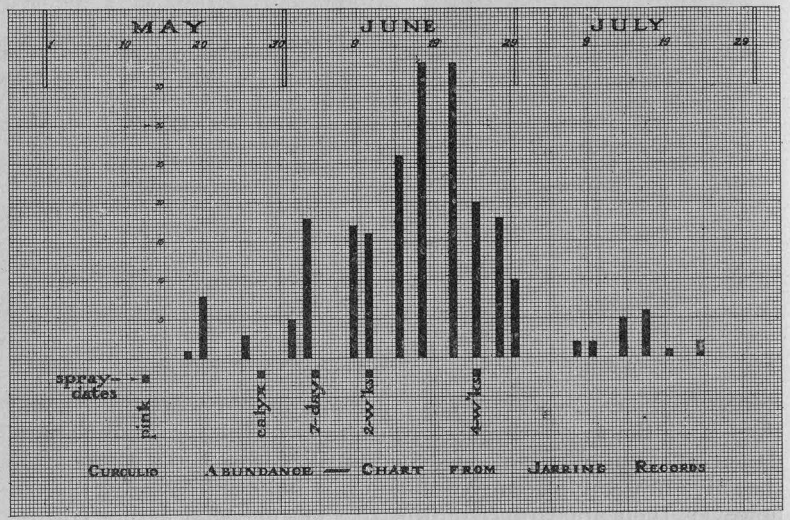


FIG. 25. Curculio abundance on fruit trees constructed from 1926 jarring records, together with spray dates for that year.

It has been thought that some differences might occur in different parts of the State in relation to the earliest egg laying activities. Thus, in 1928, according to the observations of Professor Manter, the calyx spray for apples was begun May 29 at Storrs and on the same date at Mt. Carmel. According to the bioclimatic law[1], there should be a variation of seven days between New Haven and Storrs, Conn., or 11 days between New Haven and Salisbury, while between Mount Carmel and Greenwich there should be no important difference. Such differences must vary from season to season, however, but evidently egg laying at Mount Carmel and Storrs commenced almost simultaneously in 1928.

[1]Hopkins, A. D. The Bioclimatic law and its application to research and practice in Entomology, Jour. Wash. Acad. Sci., 1921; 11: p. 141. According to this law there should be a difference in periodic activity of four days for each one degree of latitude, 5 degrees of longitude and 400 feet of altitude.

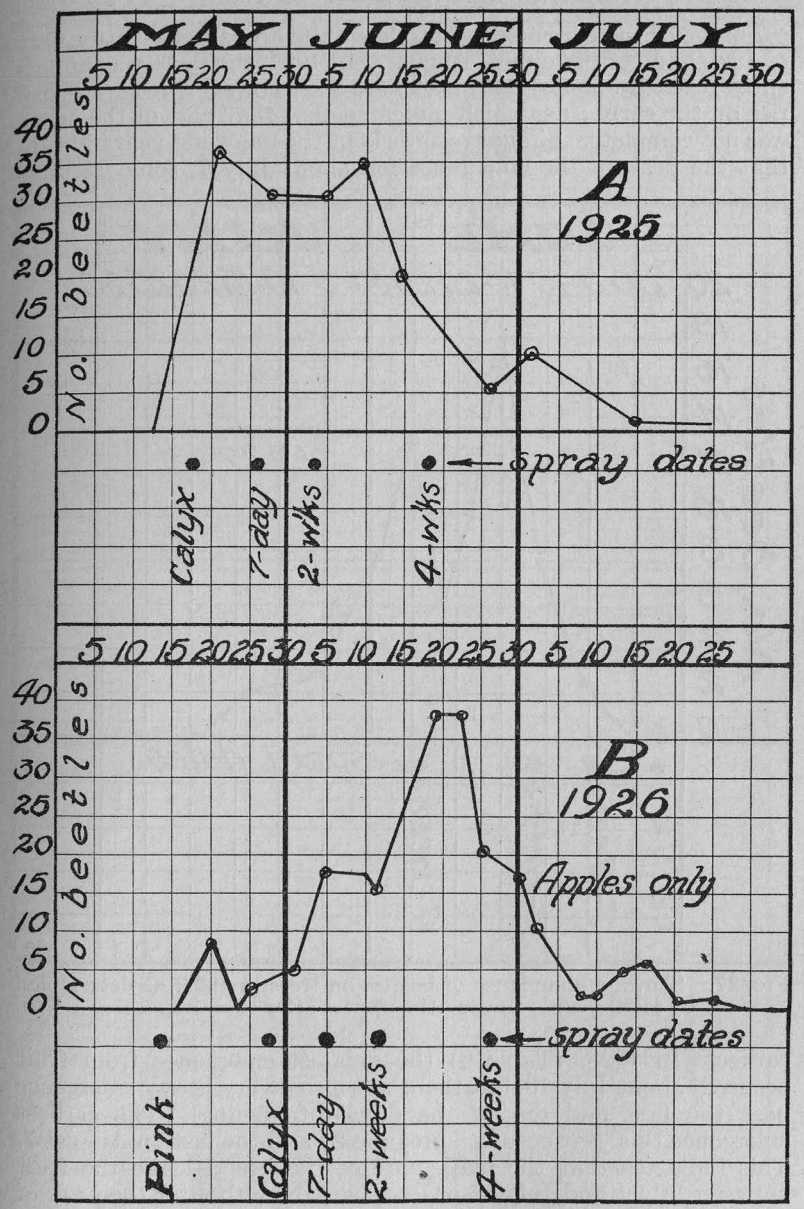


FIG. 26. Chart for comparison of (A) beetles coming to trees from hibernation as determined by removing beetles jarred at frequent intervals and (B) abundance on trees determined by jarring and releasing the beetles after counting.

Larvae Leaving Dropped Fruit

Larvae of the curculio begin to leave the drops in the latter part of June and continue until August. In 1924, the peak was apparently reached about July 15. There was, however, a very sharp rise on the early side, which indicated that that part of the curve was not complete. Similar records kept the following year indicate that the peak of the emergence fell about July 1, some 15 days

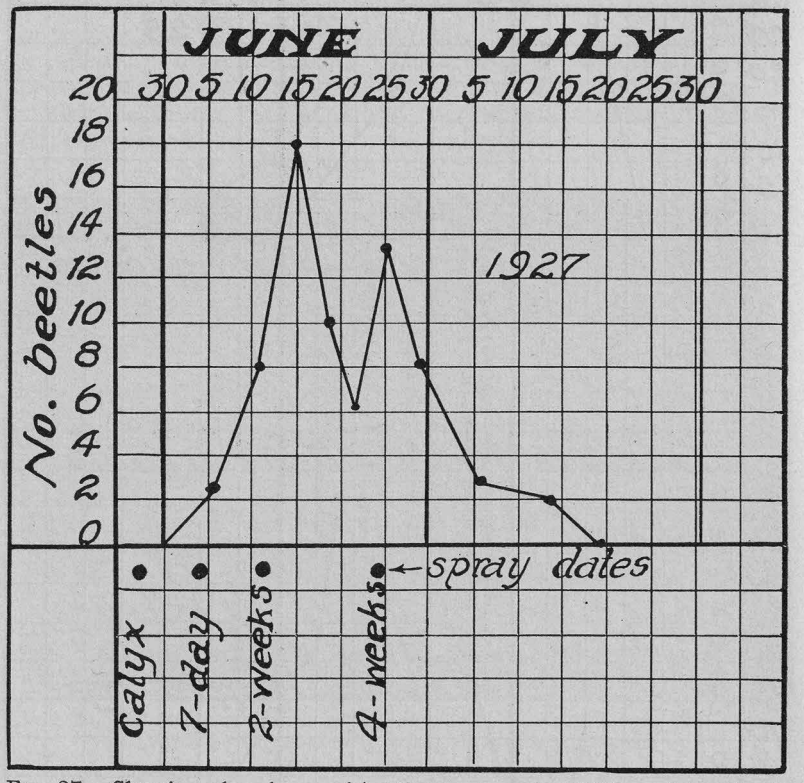


Fig. 27. Showing abundance of beetles on trees in 1927, as determined by jarring and releasing the beetles after counting.

earlier. In 1928, (Table 9) the greatest emergence from fruit occurred about July 10, but there was also a very heavy emergence near the first and during the days intervening. The earliest emergence this year occurred on June 27 and the last on August 7. This indicates that the main part of the brood leave the fruit between July 1 and July 15 or less than a month after the peak of egg laying on apples (Fig. 29). There is some variation from season to season in this phase of the curculios' activity though not so much as might be expected.

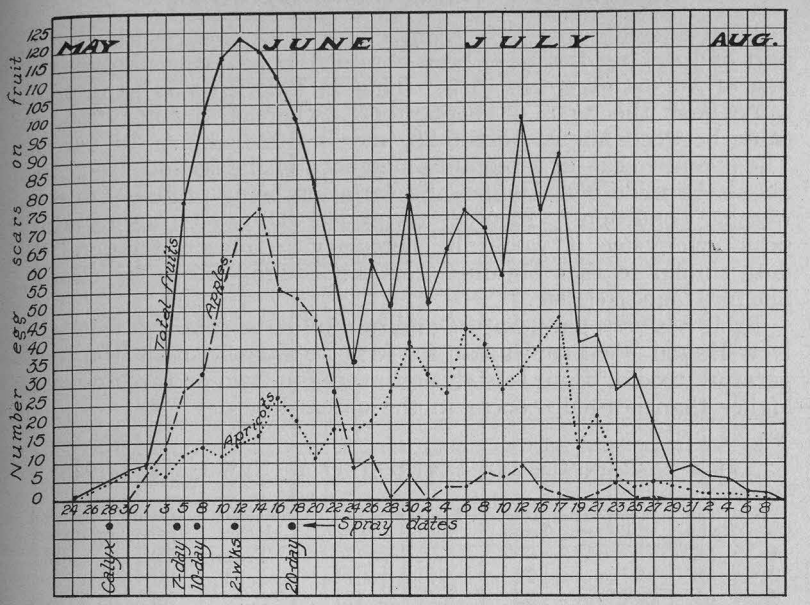


Fig. 28. Abundance of egg scars on fruit of apples, plums and apricots, shown under "total fruits" and apples and apricots separately. The curve for plums was essentially the same as that for apricots. Curves obtained from examination of marked branches every other day.

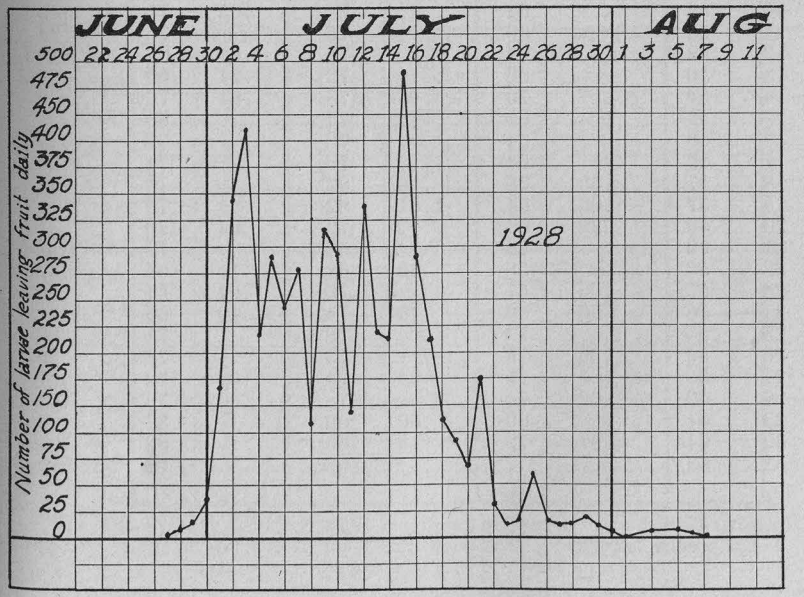


Fig. 29. Chart showing number of larvae leaving dropped fruit daily in 1928.

Emergence of the Second Brood Adults

Adults begin to emerge in insectary cages towards the latter part of July, but few have been obtained in field cages before the first of August except in 1928. Thus in 1924 (Fig. 30), the peak came near the first of September; whereas, during 1926, it came between August 15 and 20, and in 1928, about August 10. The average peak of the adult emergence of the second brood lies about the middle of August, the variation being probably due to weather conditions. In order to predict the exact time of adult peak emergence it would be necessary to obtain temperature data similar to that obtained for the codling moth by Glenn, Shelford and Headlee.

Table 8 shows temperature and rainfall data obtained from the New Haven Weather Bureau for May to August, 1928, the temperature records from this station averaging two or three degrees higher than normally occur in the orchard.

Table 8—Rainfall and Temperature in New Haven—1928

	May		June		July		August	
	Mean Temp.	Rainfall Inches	Mean Temp.	Rainfall Inches	Mean Temp.	Rainfall Inches	Mean Temp.	Rainfall Inches
1	58	.04	66	....	72	Trace	72	.02
2	58	....	72	.34	74	.12	80	....
3	61	....	62		77	....	82	Trace
4	60	....	62	.42	78	.88	85	....
5	58	....	58	1.04	76	1.13	82	.08
6	60	Trace	62	.58	68	1.29	67	.79
7	55	.03	66	Trace	71	....	64	.21
8	51	....	66	....	78	....	71	.05
9	50	.11	64	.49	80	....	78	....
10	56	....	61	....	74	.05	76	.46
11	60	Trace	60	....	75	Trace	75	.24
12	52	....	64	....	78	.01	68	Trace
13	50	....	66	....	72	.24	69	....
14	54	....	70	.45	73	.84	76	....
15	54	....	68	....	74	....	80	....
16	60	....	64	....	76	....	78	....
17	62	....	64	....	78	....	74	.15
18	57	.66	68	.18	82	....	76	.21
19	57	.06	64	1.51	82	....	75	....
20	56	.28	63	....	72	.04	70	....
21	60	....	63	Trace	68	....	72	Trace
22	58	....	58	.20	68	.11	64	.32
23	55	.06	57	Trace	76	.04	64	.56
24	56	.50	66	.19	74	2.40	69	....
25	56	....	72	....	78	....	71	.02
26	59	.36	73	....	73	....	72	.29
27	58	.07	75	.04	74	.02	72	.07
28	60	.02	74	Trace	78	.69	76	.04
29	64	....	69	.50	69	....	82	....
30	64	.07	72	.15	66	....	82	Trace
31	63	....	..	....	68	....	68	Trace
Monthly mean	57.4		65.6		74.3		73.9	
Total precip.		2.26		6.09		7.86		3.51

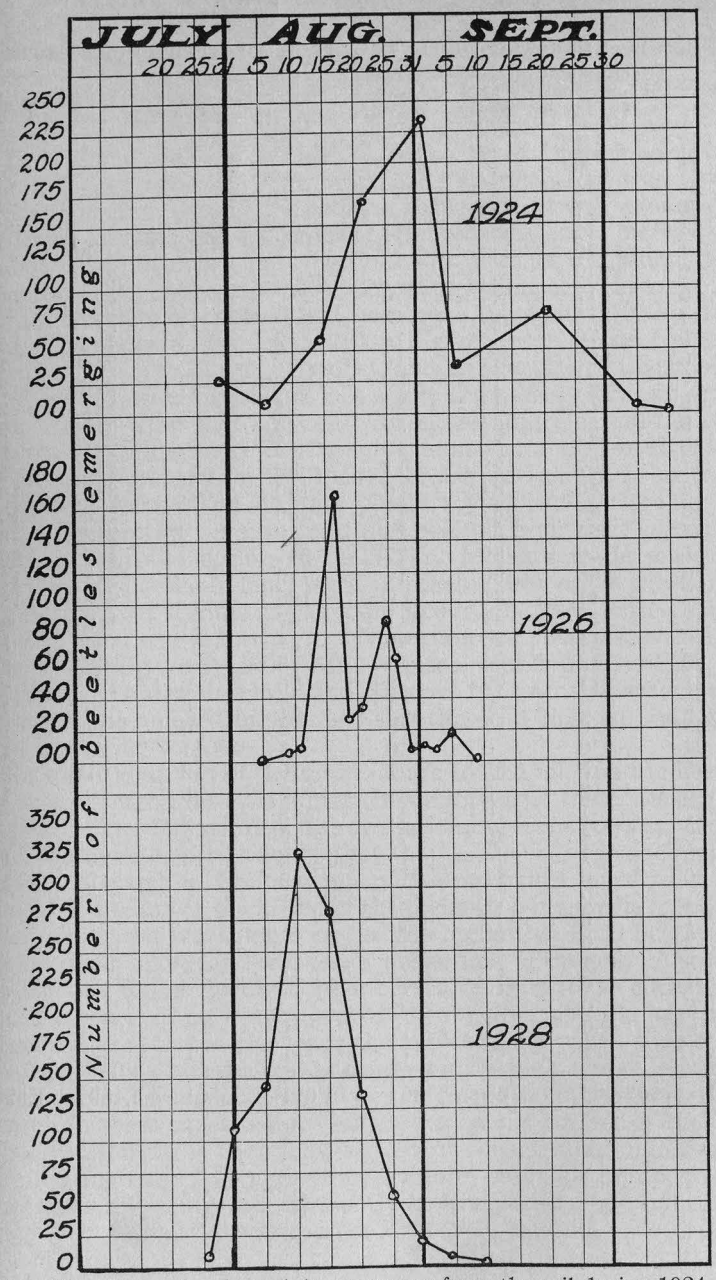


Fig. 30. Chart showing adult emergence from the soil during 1924, 1926 and 1928. Curve for 1928 represents number of emerging adults summed at the end of 5-day intervals.

TABLE 9—EMERGENCE OF LARVAE FROM DROPPED FRUITS—1928

Date	6622 Mixed Plums, Apples and Peach Drops	2779 Peach Drops	1423 Early Apple Drops	3028 Medium Apple Drops	707 Late Drops From Apple	Totals	Apples Only
May 27	1	..	..	..	..	1	..
May 28	6	..	..	..	..	16	..
May 29	14	..	..	..	..	14	..
May 30	..	..	..	..	..	36	..
May 31	..	..	..	..	..	..	..
July 1	170	..	..	..	..	170	..
July 2	349	..	..	..	..	349	..
July 3	417	..	6	..	..	423	6
July 4	214	..	3	..	..	217	3
July 5	170	..	14	2	..	186	16
July 6	227	..	16	2	..	245	18
July 7	224	14	30	8	..	276	38
July 8	73	11	23	4	..	111	27
July 9	156	64	56	43	..	319	99
July 10	135	58	49	49	..	291	98
July 11	67	28	11	39	..	145	50
July 12	146	84	0	100	..	330	100
July 13	80	34	73	36	..	223	109
July 14	84	53	22	59	..	212	81
July 15	130	89	27	241	..	487	268
July 16	88	90	14	119	..	311	133
July 17	41	39	6	126	..	212	132
July 18	20	31	1	67	..	119	68
July 19	14	26	0	54	..	94	54
July 20	12	34	1	13	8	68	22
July 21	11	29	2	70	9	121	81
July 22	3	9	1	7	6	26	14
July 23	0	7	0	4	6	17	10
July 24	0	6	0	3	11	20	14
July 25	3	35	1	10	12	61	23
July 26	2	5	4	3	5	19	12
July 27	1	6	..	3	3	13	6
July 28	4	6	..	2	2	14	4
July 29	1	4	..	2	13	20	15
July 30	0	1	..	2	9	12	11
July 31	2	..	1	1	1	5	3
Aug. 1	0	..	..	..	..	..	..
Aug. 2	0	..	..	..	..	..	..
Aug. 3	1	..	..	..	3	4	3
Aug. 4	0	..	..	..	..	..	..
Aug. 5	0	..	..	..	..	..	..
Aug. 6	0	..	..	1	2	3	3
Aug. 7	1	..	..	1	1	3	2
Total larvae	2,903	763	361	1,071	91	5,189	1,523

HABITS OF THE CURCULIO

HIBERNATION AND SPRING EMERGENCE

It is fairly well established that the adult beetles winter in woods, hedge rows or stone walls near the orchard or even in the orchard itself. During the winter, the beetle is very difficult to find and an extended search in peach orchards, apple orchards or woods adjoining may fail absolutely to disclose the hibernating quarters. Probably the most successful attempt to discover the winter quarters is reported by Quaintance and Jenne (1912 p. 130) "At Youngstown, N. Y., in 1905 Mr. Johnson made frequent searches in the fall during October, and on the 14th of that month nine beetles were discovered in a slight depression under an apple tree. They were well covered with closely matted well decayed leaves.....Nine more beetles were found in a similar situation in an apple orchard on the 16th.....On November 7, six more specimens were taken beneath partly rotted leaves close to the soil. The beetles were wet and dull colored from their surroundings.....In the spring of 1905 Mr. Johnson made extended searches for beetles in fence rows, in peach, plum, apple and quince orchards in old stumps in adjoining woods, cracks in fences, under piles of wood and so forth.....None, however, was discovered... The following year, 1906, Mr. Johnson found on April 24, 10 beetles covered with leaves and decayed fruit on the surface of a young apple orchard in sod. At this time the blossom buds were just beginning to open."

In spite, however, of the usual failure to find hibernating beetles in or near orchards, it is almost invariably true that beetles first appear in greater numbers on rows adjoining fence rows or woods, and there can be little doubt that they seek shelter in such situations. A search in Connecticut in 1923 and 1924 failed to reveal the whereabouts of the beetle in the orchard, but a single specimen was found in a woods near one of the orchards. This beetle was found under leaves and trash near the surface of the soil. A second beetle was found during September, 1928 in a dried curled leaf on the edge of a nearby woods. In field cages it has been observed that the beetles leave the apples under which they crawl to feed before hibernation and apparently hide under leaves or trash in the immediate vicinity. In spring before emergence, a search in these cages will reveal beetles on the surface of the soil. Shortly afterwards they may appear in considerable numbers on the netting over the cage. Furthermore, curculios bumped from the trees in spring are frequently covered with clay, indicating that they passed the winter in contact with the soil.

Food of the Beetles

Unlike some other insects the adults of the curculio require food. They will feed upon the leaves of peach and apple, and even upon the petals of the flowers (Plate III, b). Confined in cages with fruit blossoms, they often eat through the calyx cup, evidently in search of sweets. In confinement they have been observed to feed also on sugars of various kinds and seem very fond of honey. Much feeding is of course done on young fruits, of all species which the curculio infests. As to varieties of apples preferred either for food or oviposition there seems to be little choice since feeding and egg punctures have been observed on practically all varieties grown in this state. If there is any choice of variety on the part of the beetle, it is the Dutchess variety which seems to be severely injured in most Connecticut localities. The following table shows that the curculio will develop in many varieties. We have attempted to feed them on other fruits besides those in which the larvae develop but without much success except in the case of

Table 10

Variety	No. of Apples	No of Adults Obtained
Baldwin	100	35
Fall Pippin	60	20
Gravenstein	100	90
Hurlburt	100	39
King	100	29
McIntosh	100	18
Russet	70	9
Stark	70	14

oranges, on the peel of which they will feed to some extent. They will also feed on such mixtures as casein and honey, with just enough water added so that it can be rolled into a ball, and they have been observed to feed on a sponge containing sugar with enough citric acid to make it quite sour. Saccharin was not observed to be attractive to the beetles for food.

Moisture Requirements

Adult curculios require considerable moisture during their lives. Not only does moisture or humidity influence their distribution in the United States, but a certain amount seems to be needed for proper functioning of the life activities. Trees with thick, heavy and abundant foliage, providing abundant dampness in the interior are often heavily infested. In cages, they may be frequently seen taking water from any convenient source or they may be trapped in bottles containing only moist blotting paper placed alongside of equally large bottles containing a natural food supply. Such an experiment was performed, using small glass bottles provided

with wire funnel traps. Apricots were used as the attracting food. The following results were obtained:

Table 11

Date	No. Beetles Used	Beetles in Moisture Bottle	Beetles in Food Bottle	Notes
May 31–June 1	7	5	2	
June 1–2	7	5	2	bottles reversed.
June 2–3	6	1	5	pair of beetles put in food bottle before starting.
May 28–9	6	0	6	check—nothing in moisture bottle.

It is not certain when the beetles take moisture in the field, but it is evident that they are much more active on warm, damp cloudy days than on dry clear ones. One must naturally conclude that moisture or water supply plays a very important role in the biology of the curculio.

Another meteorological factor that affects the curculio is high winds. It is well known that a slight jar is sufficient to make the insect feign death and drop to the ground. It is but natural, therefore, to find them much less abundant on trees, after or during a high wind when the branches are moving about.

Number of Feeding and Egg Punctures

As already noted, the beetles will feed readily upon the fruit. The number of feeding and egg punctures varies in confinement but the following figures will indicate the number usually produced. Quaintance and Jenne give records of individuals making as many as 616 egg punctures although the average for all localities is much lower—101 for Myrtle, Georgia, and 31 for Siloam Springs, Arkansas. The average feeding punctures for these localities is much higher than the number of egg punctures—287 for Arkansas and 161 for Georgia. These figures, however, represent the combined feeding of one pair and indicate that the average feeding punctures per beetle is usually not over 150. Our figures vary from 35-105 egg punctures per female with an average of 79. Feeding punctures per female, however, averaged less than the total number of egg punctures, 46 in number although some individuals fed much more than this.

Egg Laying and Feeding of Adults Emerging During Summer

As already mentioned, no eggs are laid in this locality by beetles emerging during the summer. The greatest damage to the fruit lies in the fall feeding punctures (Plates VI and VII, a) which,

however, have never appeared to be especially abundant in orchards where our experiments were conducted. The following table shows the relative abundance of this type of feeding punctures on sprayed fruit:

TABLE 12—AMOUNT OF FALL FEEDING OF THE ADULT CURCULIO

Date Scored	Total Fruits	Number with Fall Feeding Punctures	Per Cent with Fall Feeding Punctures	Treatment
August and Sept., 1928....	21,362	44	0.2	Sprayed
August and Sept., 1928....	16,181	51	0.3	Sprayed
Sept. and Oct., 1928.....	32,186	112	0.3	Sprayed
Sept. and Oct., 1928.....	18,075	151	0.8	Check—no treatment

The actual percentage of fall feeding punctures on sprayed fruit thus seems to be small and may be disregarded as far as preventive measures are concerned. There is often a considerably greater number on dropped mature fruits than on fruit picked from the trees which is thought to be due to beetles seeking hibernating quarters beneath the trees. The greatest amount of damage due to fall feeding of curculios is recorded in our data for 1926, when it averaged 6.5 per cent on unsprayed Baldwins.

TOTAL NUMBER OF BEETLES DEVELOPING IN APPLES AND POSSIBLE MENACE TO FRUIT OF THE FOLLOWING SEASON

In 1924, all dropped fruits were collected from a sprayed orchard containing two rows of unsprayed trees. All picked fruits were counted in scoring so that the relative number developing in the orchard is apparent. By making certain deductions for mortality, and allowing a conservative number of punctures per beetle (below the average in this case) the percentage of the crop which could be injured during the following year may be roughly estimated. While such figures can never be made to represent the actual condition in the field due to many undeterminable and variable factors, they do show that curculios developing in an apple orchard may offer a considerable menace to the crop during the succeeding year. The estimate is a very conservative one and it seems probable that the amount of damage is often considerably greater.

Total number of fruits in 1925.....	144,435
Total larvae from drops in 1924.....	2,601
Total adults allowing 85% mortality (50% larval mortality, 70% for adults).....	390
Total punctures allowing 100 per beetle..	39,000
Total apples which could be injured allowing 1.5 punctures per apple.....	26,000
Per cent of total crop which could be injured.....	18.0

REACTION OF ADULT BEETLES TO INSECTICIDES

In confinement the curculio is more or less easily poisoned with various arsenicals. In the field, however, a tree sprayed with the usual strength of lead arsenate will contain no curculios within 24 hours after spraying; whereas, on unsprayed trees in the immediate vicinity they may be very numerous. Experiments along this line were carried out in 1924 with always the same results; namely, the rapid disappearance of beetles after the poison was applied. This was determined by jarring the trees within 24 hours and placing sheets under the trees to catch fallen beetles. None were taken on the sheets. In cages the most rapid kill that we have yet obtained was 100 per cent in four days, which would indicate that some of the beetles at least should be obtained by jarring in 24 hours. No doubt a fatal dose is obtained shortly after the material is applied and the beetles go elsewhere to die. A report published in Bulletin 32 of the Georgia State Board of of Entomology is interesting in this connection. The authors here confined 372 beetles in an enclosed tree sprayed twice with 3-50 lead arsenate. The following day no beetles could be found feeding on the tree but they all died in 10 days. It seems probable that conditions obtaining here are very similar to field conditions although it does not necessarily prove that arsenate of lead as generally applied (where the dosage is smaller) is a repellant. Probably the substance is repellant in action only after the killing dose is obtained. Our tests, however, indicate a rapid disappearance from trees sprayed with 1½ pounds per 50 gallons.

Various other insecticides have been employed in cage tests, including basic lead arsenate, sodium fluosilicate and ferrous arsenate (scorodite) but none have equaled the lead arsenate in killing power. Sodium fluosilicate mixed with four parts of lime showed considerable value but did not quite equal acid lead arsenate. Basic lead arsenate was only partially effective, a fact made further evident by field tests in 1928. To increase the killing power of certain poisons of low toxicity, various compounds such as lead and zinc stearate were added but without success. These are mentioned on page 406.

REACTION OF BEETLES TO VARIOUS SUPPOSED ATTRACTIVE AND REPELLENT SUBSTANCES

Curculios are very sensitive to odors. It has been shown by Power and Chestnut[1] that the odorous constituents of apples consist of such compounds as acetaldehyde, amyl esters of formic acid and caproic acid and malic, caproic and capryllic acid. A subsequent research[2] indicated the presence of geraniol. Much

[1]Journ. Amer. Chem. Soc. 42: No. 7: pp. 1509–1526: 1920.
[2]Journ. Amer. Chem. Soc. 44: p. 1498: 1922.

time has been given to a consideration of these compounds from the standpoint of attractives and the only ones which could be detected to have much influence on the beetle are acetaldehyde and malic acid. Both the pure acetaldehyde and the acetaldehyde producing acetaldehyde-sodium bisulphite have been used with similar results. However, when used in the field the beetles have not been successfully trapped by any substance. Probably the scarcity of beetles is one factor influencing results, but another important factor is the high volatility, the odor disappearing within a short time after being placed in the open. This is also true of the repellents tried. Laboratory tests were conducted by placing small specimen bottles (capacity 23 cc.) in one end of a box three

TABLE 13—RESULTS OF TESTS WITH VARIOUS ATTRACTIVE MATERIALS USING LONG BOX PLUS TRAP BOTTLES AT END; COMPARED IN EACH CASE WITH NATURAL FOOD

Substance	Kind of Fruit Compared	Number in Fruit Bottle	Number in Test Bottle	Number Beetles Used
Geraniol	apricots[1]	8	0	10[2]
Granulated sugar and and water	apricots	8	0	10
Malic acid plus sugar	apples and apricots	7 6	2 1	9 7
Cal. malate Acet. sod. bisulphite	apples and peaches	6 1 6	2 6 2	8 7 8
Acetal., water, cal. malate, sugar	apricots	3	2	5
Acetal.-cal. malate (dry)	apricots	6	0	6
Moist blotting paper	apricots	2{1 1	5{2 3	7
Moist blotting paper	apricots plus geraniol	2	5	7
Moist blotting paper	apricots plus pair beetles	5	1	6
Empty bottle	apricots	6	0	6

feet long by four inches wide by three inches high with openings at both ends. At one end was connected a short upright tube in which was placed a small electric light. This provided enough heat so that there was a gentle current of air through the box, from one end to the other. Each bottle was provided with a wire cone so that beetles could enter but would remain in the bottle. The tests were begun by placing the beetles in the far end of the box and allowing them to remain over night, the number found in each bottle being recorded the following day. The top of the box was provided with heavy red celluloid made for photographic work. It will be seen here that although the light factor is excluded by use of the red screen and the maze construction of the box, there is

[1]Small green fruits.
[2]Two beetles failed to enter trap bottles.

still a disturbing element in the moisture which accompanies the attractive substances. It is also important as noted by others to use beetles at a time when naturally attracted to their native food plants, for if older beetles are supplied especially after most of the feeding and egg-laying are over, conflicting results may be expected. The Y tubes such as have been devised by McIndoo[1] have also been used with air currents from a suction pump. The unevenness of the air current through the tubes precluded consistent results in the few tests that were made with this type of apparatus.

In view of the fact that moisture apparently played such an important part in the above experiments another series was devised comparing equally large squares of blotting paper, one soaked in pure water, the other soaked in the solution of odorous substances to be tested. The paper did not take up such insoluble substances as lime, but some, of course, was deposited on them.

TABLE 14—COMPARISON OF EQUAL SIZE SQUARES OF BLOTTING PAPER CONTAINING WATER WITH VARIOUS SOLUTIONS OF ODORIFEROUS MATERIALS

Substances Compared	Number in Test Bottle	Number in Moisture Bottle	Number Beetles Used
Calcium malate and acetaldehyde	8	1	9
Iso-amyl n-capryllate acetaldehyde, malic acid and lime	4	2	8
Same	5	2	8

From these results it may be seen that the substances tried had considerable greater attractiveness, yet when we refer to the preceding table it is evident that they do not have nearly as great attractiveness as the natural foods.

The action of repellents was tested in a similar manner except that air was blown through the cage with considerable force with an electric fan. The various substances were placed in the base of the funnel and the fumes blown into the cage with the air. In some of the tests, beetles were first collected on a peach shoot before introduction of the test odor, with the result that they were promptly driven from their natural food to the far end of the box. About 32 substances were tried in this manner with the following results:

TABLE 15

Repellents and Activators	Repellents	Substances Without Apparent Action
Capryl alcohol	Benzaldehyde	Amyl alcohol (Iso)
Iso amyl-n-caproate	Capryl alcohol	Amyl Formate
Iso amyl alcohol	Allyl isothiocyanate	Amyl n-capryllate
Acetaldehyde	Iso-amyl-n-caproate	N.-butyl alcohol
Carbolic acid	Xylene	Anise oil

[1]Journal of Economic Entomology 19: 549–571: 1926.

TABLE 15—*Concluded*

Repellents and Activators	Repellents	Substances Without Apparent Action
Gasoline	Allyl alcohol	Calcium cyanide
Benzaldehyde		Carbon disulphide
Xylene		Chloroform
Allyl iso-thiocyanate		Cider
Allyl alcohol		Clove oil
		Dichloroethane
		Dinitrotoluene
		Ether
		Ethyl alcohol
		Lime sulphur
		Lysol
		Nicotine sulphate
		Octyl alcohol
		Paradichlorobenzene
		Propyl alcohol
		Vinegar

It is worthy of note that such substances as calcium cyanide have little effect, while capryl alcohol and benzaldehyde are strongly repellent. The almost immediate activation of the beetles on the introduction of strong capryl alcohol odor is surprising, the insects running about the cage as if mad.

Application of these apparently repellent substances in the field, however, resulted only in the rapid disappearance of the odor through volatilization, and they consequently had little effect in keeping the beetles from the trees. It is very difficult to select the various repellents in order of their potency and the foregoing list is not intended to convey the impression that one is necessarily more active than another. They have been divided into three lots for convenience. Some of the activator substances were apparently not repellent in the tests conducted and they have therefore been omitted from the repellent list.

There remains the discussion of the protective action of such materials as lime or other non-poisonous material. If we protect a portion of an apple, for instance, with a thick coat of lime, the beetles will feed on the unprotected side. Under natural conditions it is almost impossible to cover completely all sides of an apple unless extremely careful work is done and it is as nearly impossible to maintain this covering over any period of time. It is furthermore difficult to maintain a coat of any thickness so their ultimate value in this regard is doubtful. Lime is sometimes desirable in the spray mixtures, however, for other reasons.

REACTION OF BEETLES TO LIGHT

Confined in cages, the adult curculio beetles are decidedly positive to light, but Quaintance and Jenne have shown that the activities of the female are about equally distributed during the day and the night. The adult beetles have been observed

frequently in the field during the day at rest with legs folded, although when disturbed by jarring they may become active and take flight.

HABITS OF THE LARVAE

On emergence from the egg, the curculio larva burrows into the center of the fruit where it continues to feed until a cavity of considerable size is excavated. After the apple drops and the larva becomes full grown, it enters the soil, penetrating to a depth of two inches or less. They rarely go more than three inches below the surface and 90 to 100 per cent will be found within the first two inches. Frequent disturbance of the soil by any means destroys the larvae and the value of cultivation in curculio control is therefore apparent. Undersized larvae often desert fruit and burrow in the ground, but it seems probable that these are stunted mature larvae, forced to abandon the fruit before full size is reached.

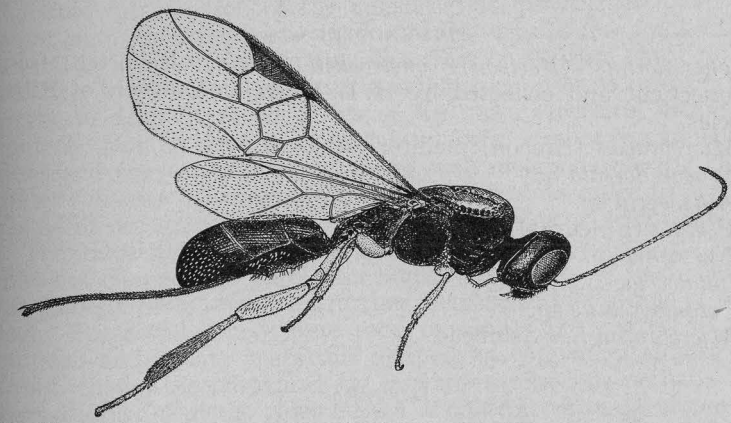


FIG. 31. Adult parasite *Triaspis curculionis* Fitch enlarged about 12 times. Left legs, wing and antenna removed.

PARASITES

Parasites of the plum curculio have not been numerous at any time during this investigation. The most abundant, *Triaspis curculionis* Fitch, (Fig. 31) was observed in 1928 and it parasitized about 18 to 33 per cent of the larvae leaving the fruit July 1. The following table shows the relative numbers of this parasite obtained from a large number of larvae, the average parasitism being 5.0 per cent. The species emerged July 15 to August 21.

The only other parasite observed was the egg parasite *Anaphoidea conotracheli* Girault, found during the summer of 1928. This parasite is reported to kill as much as 85 per cent of the eggs of the plum curculio. Quaintance and Jenne mention nine other

TABLE 16—PERCENTAGE OF PARASITISM BY *Triaspis curculionis* FITCH

Date Larvae Entered Soil	Number Curculio Larvae	Number Parasites Emerging	Per Cent Curculio Larvae Parasitized
June 28	6	2	33.3
July 1	170	31	18.2
July 2	22	7	31.8
July 12	50	1	2.0
July 7	96	1	1.0
July 12	32	0	0.0
July 13	128	0	0.0
July 12	91	1	1.0
July 8	118	1	.9
July 16	125	5	4.0
July 17	114	1	.8
	953	48	5.0

parasites, a number of predaceous insects and other enemies. It will suffice here to list these additional enemies together with a few notes on their Connecticut status.

HYMENOPTERA

Thersilochus (Porizon) conotracheli Riley. Reported from Connecticut and collected by H. L. Viereck on flowers of Ribes species.

Microbracon (Bracon) mellitor Say.

Bracon dorsata Say.

Anisocyrta sp.

Pimpla (Epieurus) sp.

Eurytoma sp.

Cataloccus sp.

Cerambycobius sp.

Microbracon lixi Ashmead.

DIPTERA

Miophasia aenea Wiedemann. Generally distributed over North and South America and probably occurring in Connecticut.

Cholomyia inaequipes Bigot.

PREDACEOUS ENEMIES

Ants, *Dorymyrmex pyramicus* Roger. We do not have this species in Connecticut although other species no doubt play an important part in destruction of curculio larvae.

Lacewings *Chrysopa oculata* Say and other species present in Connecticut orchards.

Thrips. Reported to destroy eggs of the curculio. Observed frequently in or near egg scars and they had apparently destroyed the eggs present in them.

Carabid or ground beetles. Frequently present in Connecticut orchards.

Chauliognathus pennsylvanicus DeGeer. A small brown beetle frequently present. The larvae of this species is said to attack curculio larvae.

Birds of various species are known to feed on curculios.

Moles destroyed a great many larvae in ground cages in 1924. It was found necessary to protect the bottom of these cages against their entrance.

DISEASES

Larvae have been observed frequently to die of disease where the soil becomes very damp, and are frequently covered with a white fungus, probably Isaria or Sporotrichum species. The adult beetles have also been found diseased under similar conditions one of the causes being the green muscardine fungus *Isaria anisopliae* (Metch.) commonly attacking grubs in the soil. (See Pl. II, b.)

CONTROL

Before introduction of the arsenicals as insecticides about 60 years ago, horticulturists used various means for combatting curculios. Cultivation, jarring the trees to capture the beetles, allowing live stock to run in the orchard in order to destroy the larvae in drop fruits are a few of the more successful means of control. Besides these there have been forty or more recommendations and suggestions varying from such means as placing chips under the trees to hanging dead mice therein in order to attract the adult beetles which were thought to lay eggs on such material.

The development of arsenicals as insecticides resulted in a material change in control procedures. Arsenate of lead, developed about 1893, brought a further increase in this means of control. Successful sprays were soon developed for control of the curculio and in late years this method has prevailed almost entirely, though accompanied by orchard sanitation, perhaps the most successful of the older means of control. The development of spray controls during the last 25 years and the trend of present day recommendations is well illustrated in the following summary of literature:

RECOMMENDATIONS OF OTHER INVESTIGATORS

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 thorough shallow cultivation from time larvae begin to leave fruit until

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." Over-wintering 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 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 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. 274-278, 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 states: "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 32-79 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 states: "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 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 thorough 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 one pound of powder or two 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. Slingerland, 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. Describes methods used for controlling curculio in the Georgia fruit belt on peaches. 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 states, "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.

1928. Sanders, P. D., Trans. Peninsula Hort. Society, pp. 18-23 (Abstr. in Review of Applied Entomology Vol. X. VI: p. 451: 1928.) "Recommendations for control include destruction of overwintering adults by burning woodlands and hedge rows around orchards. Application to peaches of lead arsenate 1-50 or 5 per cent lead arsenate dust, once when petals have fallen and again as shucks are pushing off and cultivation under spread of the tree during second and third weeks after dropping of windfalls.

Besides the literature just quoted, there is considerable published data on the effect of dusts in curculio control with some difference of opinion regarding the merits of the method compared with sprays. Thus Quaintance (1921) p. 224 says "In the case of the plum curculio on apples, dusting compares favorably with spraying where the insect is not especially abundant"...."Under conditions of curculio abundance....dusting is not an effective control and spraying may not furnish the protection desired". The Indiana State report on Horticultural investigations (1919) states that "dusting controlled curculio and codling moth as well as spraying, whereas Cullinan and Baker, Bulletin 283 (1924) of the

Indiana Station state that dusting was inferior to sprays for curculio control in three out of five years work. The work of Stoddard and Zappe at Milford conducted during the years 1920–1924 showed consistent results[1] in favor of spraying although the percentage gain from this method was never great. In addition there are the New Jersey reports comparing dust and spray indicating an advantage for sprays, and in general, opinions favor sprays as better controls.

It is important before discussing any control program to know what conditions surround orchards where most damage is done. A number of typical fruit farms near New Haven were therefore studied. Nearly all Connecticut apple orchards are either cultivated in part or allowed to remain in sod, the orchards in one or the other being about equally divided. Few or no orchardists use clean cultivation. This is due in part to the nature of the land used for this purpose which is often hilly or rolling, and the danger of washing is considerable. There is also much waste or uncultivated land in many localities so that it is almost impossible to locate an orchard without placing it near a wood or within a few rods of numbers of wild apples. Such conditions are primarily responsible for severe infestations commonly found, and it must be recognized that under such conditions heavy infestations of curculio are the rule rather than the exception. Plate VII, b shows a typical wild apple tree.

Conditions Surrounding Ten Representative Orchards

Orchard No. 1. Wallingford. South side of one section near woods reported to be worst; inspection revealed much damage; no wild apples, however, in the vicinity although not far away was an unsprayed orchard; section protected on west by woods. In addition to the woods, a number of peach trees probably supplying many beetles were interplanted with the apples. In another section of the same orchard near a woods on the east side little damage could be seen. This, however, was some distance from the peach trees and the apple orchard mentioned.

Orchard No. 2. Durham. Orchard well in the open though with a fence row on the south. On the north side from a quarter to one-half a mile distant were peach orchards of considerable size.

Orchard No. 3. Middlefield. Large extensive plantings, some of the apples interplanted with peaches. Worst infestations seem to be in these interplanted orchards.

Orchard No. 4. Wallingford. Interplanted orchard, worst conditions in section protected on west by woods, other parts of interplanted orchard said by owner to be less severely injured.

Orchard No. 5. Wallingford. Large plantings some near peach orchards apparently free or with few curculios. No fence rows or woods to protect the orchards although peaches are planted near

[1]Conn. Agr. Expt. Station, Bull. 265; p. 293; 1924.

some of them. The peaches are cleanly cultivated and dusted yearly with arsenate-sulphur-lime dust. Strip cultivations practiced in apple orchards. Plums in bearing near orchard.

Orchard No. 6. Milford. Damage worse on west side adjoining woodland. Orchard in sod or strip cultivation. Fence rows or stone walls around entire orchard, but the worst damage is next the woods as mentioned. Wild apples not far distant.

Orchard No. 7. Branford. Worst damage on outside rows next the woods. Wild apple trees not far distant, but no peaches. Orchard under strip cultivation.

Orchard No. 8. Mount Carmel. Strip cultivation practiced. Worst infestation on west side near fence row, although the latter is low. Young peach orchard also on west side. Other apple trees nearby, but sprayed.

Orchard No. 9. Mount Carmel. Protected on west by fence row and on southwest by wood lot. Wild apples numerous near the orchard. Peach orchards and plum trees to east.

Orchard No. 10. Mount Carmel. About one-fourth mile from No. 9. Not protected on west by fence row, but with bearing peach orchard on south and a few plums on north and west. Damage in this orchard, however, has never been severe for some unknown reason. Orchard in sod. Possibly the plums are sufficiently attractive to draw the beetles away from the apples. Plenty of hibernating quarters nearby.

About the only conclusions which can be drawn from this survey is that the worst damage is done in orchards protected by woods or fence rows on one side (which strange to say seems to be the west side in many of the orchards examined), while those not so protected are not as severely damaged. The presence of peaches in the vicinity seems to have some influence especially if accompanied by woods or fence rows and the presence of wild apples probably has something to do with total number of curculios in an orchard although the survey does not show anything striking in this regard. There is little doubt that beetles develop on these wild fruits since the fruits are abundantly marked and the adults have been jarred from the trees on several occasions. The occurrence of plums or apricots does not seem to influence the severity of infestation as much as peaches.

Preliminary Tests with Various Insecticides

We have already shown that curculios leave the trees shortly after applications of arsenic and it has been well demonstrated that they may be easily killed in confinement when fed on leaves sprayed with the usual dosages. Laboratory tests indicate that the Connecticut curculio is no different in these respects from others, Tables 17-19. It will be noted, however, that death is not immediate and sometimes does not occur until 10 to 12 days after introduction of poisoned food.

TABLE 17—FIVE-DAY TESTS WITH ARSENICALS, FOLIAGE TESTS

Substance Used	Number of Beetles	Date Begun	Number Dead in the Following Days 1	2	3	4	5	% Dead	Notes
Acid lead arsenate 1.2 gm. per 250 cc.	11	June 25	2	8	10		11	100	
Calcium arsenate 1.2 gm. per 250 cc.	8	25	0	5	5		8	100	Beetles excluded from water supply.
Ortho-zinc arsenite 1.2 gm. per 250 cc.	11	25	0	3	4		11	100	
Acid lead arsenate 1,2 gm. per 250 cc. molasses 10 cc....	10	25	1	4	8		9	90	
Ball of casein molasses and lead arsenate.....	8	25	2	5	8		8	100	
Check.....	10	26	0	0	0		0	00	

These tests were made in jars in the insectary, the twigs being sprayed with the solutions indicated and allowed to dry before placing in the jars with curculios.

TABLE 18—TWELVE-DAY TESTS WITH VARIOUS ARSENICALS

Substance Used	Number Beetles	Date	Dead in the Following Days 1	2	3	4	5	6	7	8	9	10	11	12	Per Cent Dead
Acid lead arsenate 1.2 gm. per 250 cc.	10	Aug. 20	1	1	3	0	3	0	5	0	0	7	0	10	100
Ball of casein with 50 gm. casein, 1 gm. lead arsenate, 10 gm. honey; water to make 125 gm..	9	20	0	0	2	0	0	0	5	0	0	9	0	0	100
Check—no treatment	7	20	0	0	0	0	0	0	0	0	0	0	0	0	00

TABLE 19—LABORATORY TESTS WITH POISON DUSTS TO KILL THE PLUM CURCULIO
(20 beetles used in each jar)

Material	Date Begun	Dead in the following days 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Scorodite 2 gms. Lead stearate 10 gms.....	Aug. 23	1	0	1	0	0	1	0	2	0	0	3	0	3	0	4	
Scorodite 10 gms. Zinc stearate 5 gms.....	23	0	0	0	0	0	2	0	4	0	0	4	0	4	0	4	
Copper fluoride 2 gms. lime 20 gms.	23	1	0	1	0	0	2	0	2	0	0	2	0	3	0	3	
Lead stearate pure.	23	0	0	0	0	0	2	0	4	0	0	5	0	5	0	6	
Zinc stearate pure.	23	1	0	1	0	0	1	0	0	0	0	1	0	1	0	1	2 lost
Magnesium fluoride 20 gms. lead stearate 4 gms..	23	1	0	1	0	0	0	0	1	0	0	3	0	3	0	4	3 lost
Lead peroxide 1 lb. As_2O_5 ¼ oz.....	23	0	0	2	0	0	2	0	2	0	0	2	0	3	0	3	1 lost
Lead arsenate (basic) pure....	23	0	0	2	0	0	6	0	8	0	0	9	0	13	0	14	4 sick
Check.....	23	2	0	2	0	0	2	0	2	0	0	2	0	3	0	4	
Sodium fluosilicate 1 lb. Lime 4 lbs.	10	0	0	6	0	10	0	0	0	11	0	0	11	0	12	0	2 escaped
Check.....	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Arsenate sulfur dust 10% lead arsenate	15	0	0	13	0	0	15	0	0	15	0	0	15	0	0	0	2 escaped
Check.....	15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	

NOTE: Insecticides dusted on fruit and placed in jars containing curculio beetles.

VALUE OF EXPOSING DROPS TO DIRECT SUNLIGHT AND COLLECTING THEM FROM BENEATH THE TREES

Several ground cages were supplied in 1928 with dropped apples and plums containing egg punctures of the curculio and presumably infested by the larvae. Some of these cages were exposed to direct sunlight; others were protected by cotton sheeting; still others by thick building paper excluding all direct sunlight. The following results were obtained.

TABLE 20

		Number Beetles Emerging	Number Beetles per 100 Fruits
Protected with cotton sheeting...	(1) 200 apples	75	
	(2) 75 apples	25	36
Exposed to direct sunlight.....	(1) 200 apples	25	
	(2) 75 apples	6	11
Protected with building paper...	(1) 75 plums	11	14
Exposed to direct sunlight.....	(1) 75 plums	9	12

There is undoubtedly some advantage from exposure of dropped fruits to direct sunlight but control by this means is far from complete in Connecticut. Raking drops into the open is a comparatively simple operation in completely cultivated orchards, but a difficult one in orchards kept in sod. The time required for collecting drops by hand from a 17-year old tree is at least 30 minutes for one man (tree in sod or partly cultivated) and probably one hour for large trees. To obtain the greatest benefit, this operation requires repetition at least twice during the summer and the cost may be figured at 50 cents to $1.00 per tree for $4.00 a day labor. At best, the operation is expensive, although it is fully recognized that the use of such labor often depends upon the value of the crop. At present the feeling among the growers in this section is that the plan is not practical. There is no reason, however, why such a method cannot be employed to advantage where a few trees are involved, though it should be recognized that complete control will not be obtained where there are other infested fruits in the vicinity; neither will the result of this work be evident until the following year.

SPRAYING EXPERIMENTS FOR CURCULIO CONTROL—1924–1928

In view of the rather wide variation in recommendations for spray control of the curculio on apple and the failure in several instances to obtain satisfactory results in Connecticut with the schedules in use, a program of control experiments was devised and carried out with a view to finding more satisfactory measures than were available at the beginning. It became apparent at once that the 7-day spray advocated by the New Jersey Station

offered one solution although a difficult one from the standpoint of many growers with large orchards and limited equipment. If some means could be devised whereby this additional spray might be avoided it would be of considerable advantage. It became desirable to find out, therefore, which sprays, if any, could be omitted and it seemed also worth while to distribute the sprays more evenly throughout the life activities of the adult which as shown by the diagram, Figure 25, do not correspond fully with the pink-calyx-7-day-2-weeks schedule. However, the data obtained in 1928 on the egg-punctures of the beetle seem to indicate that a pink, calyx, 2 weeks, or 17-day schedule, piles up the poison on the trees before the peak of this activity is reached, and the amount of damage occasioned by late feeders, being relatively small, can probably be disregarded in commercial orchards of Connecticut. It also seemed desirable to try addition of such substances as molasses as an attractive food for the beetle or any new arsenical substitute which might come into use, because of the danger of foliage injury from the usual mixtures and the growing belief that the arsenical residue on sprayed fruit at harvest is too large. A comparison of dusts and sprays used in a pink, calyx, 7-day and two weeks schedule was tried out in 1928. Nicotine dust was also tried in 1924 and shown to be worthless for control.

Spray Apparatus and Methods Used

All trees were sprayed at first with 12-foot rods, provided with angle disc nozzles. Sprays were applied in 1924 and 1925 with an Arlington XL sprayer furnishing 150-200 pounds pressure and in 1926, 1927 and 1928 with a Bean sprayer furnishing about 250 pounds. Spiral nozzles of the type shown in Plate VIII, a and b, were used in 1926, 1927 and 1928 and were very effective in furnishing a thorough even coating on fruit and foliage. In 1928 an extension of about four feet was used on one of the rods allowing the operator to reach the tops of the trees more easily. With age, the spiral nozzles became worn through the center and allowed a solid stream to issue at the end. One of our nozzles, however, was used for three years before developing this defect, but it would no doubt last a much shorter time in large orchards where kept in continual use. When operating to best advantage, we were able with this apparatus, using two lines of hose, to apply about 1,000 gallons in the course of an eight-hour day.

The method of spraying consisted of passing completely around each tree, coating as thoroughly as possible all parts thereof. The amount applied to each tree varied with the size of the tree, but from calculations made at Shepard's orchard and that of the Experiment farm at Mount Carmel, the amount applied was approximately one gallon at 7-day and two week periods for

every 24 cubic yards.[1] This will mean approximately one gallon or more for every 10 feet of circumference measured around the outer branches of such varieties as Baldwin, McIntosh and Greening, where these varieties are normal in shape and 15-20 years old. The exact amounts as figured would be as follows for the three varieties:

Table 21

Circumference, Feet	Gallons Spray		
	Baldwin	Greening	McIntosh
100	16.6	14.1	17.0
80	9.3	6.6	10.4
60	4.7	....	4.8

The volume increases rapidly with circumference, one large Greening tree 125 feet around containing about 760 cu. yards. At the rate mentioned this tree should require about 30 gallons at the 7-day period.

Trees will naturally vary in the number of branches according to the method and amount of pruning and consequently the amount of foliage, but it is believed that the trees experimented upon in two different orchards represent fairly typical conditions for the average Connecticut orchard. The amount applied at the calyx period was about two-thirds the amount of the 7-day because of the smaller amount of foliage, while the pink spray required only one-third of the amount of the 7-day.

The main reason for using the circumference instead of the height in calculating volume lies in the fact that volume seems to be more closely correlated with circumference in our orchards when figured on the formula

$$v \text{ (cu. yds.)} = \frac{C}{4\pi x 27}\left(\frac{0}{2} - .144C\right) = \frac{C}{339.1}\left(\frac{0}{2} - .144C\right)$$

The three varieties mentioned assume a fairly typical shape in middle-aged trees and in older trees if there is plenty of room around each tree. There are cases, however, where the shape of the tree is irregular, due to manner of growth or from being crowded. In the latter cases probably the best method of obtaining the amount of spray would be to rely on careful measurements as suggested by Smith (l. c.) but it is very doubtful whether the orchardist would consider such an operation as practical or even advisable. A certain amount of judgment should always be exercised by the operator, with the aim in view of covering the leaf and fruit surface as completely as possible. A rough estimate of the amounts needed on regular shaped trees can be obtained by

[1]See Smith, Jour. Ec. Ent. 1927. Formula used $v(\text{cu. ft.}) = \frac{C_2}{4\pi}\left(\frac{0}{2} - .144C\right)$.

circumference measurements, as a basis for control operations. It should also be stated that the experimental trees were headed low, the outer branches being quite near to or touching the ground.

Dusting was done with a power Niagara duster, covering both sides of the tree as completely as possible at each application.

In the course of these experiments a total of more that 700,000 individual apples were examined, representing 1,400 barrels of fruit.

Materials Used

Materials used throughout these experiments were standard materials sold on the market and consisted of lead arsenate, dry lime sulphur, casein lime and 40 per cent nicotine sulphate. Nicotine sulphate was omitted wherever possible and the experiments at the Station farm were conducted wholly without this material. At Shepard's Orchard it was used in the early sprays (pink and calyx) in 1925 and 1928, but not in 1926 and 1927.

The casein lime was a standard brand consisting of two parts of lime and one part casein analyzed by the Department of Chemistry and reported in 1925, Bulletin 272, p. 149, under analytical number 2475.

Two brands of lead arsenate were used which have also been analyzed by the Department of Chemistry and reported in Bulletin 272, p. 145, under analytical numbers 2474 and 2464. Both products contained approximately 30 per cent arsenic oxide and .18 per cent water soluble arsenic.

The fish oil used in 1926 and 1927 was purchased on the local market as light pressed menhaden oil, but differed considerably from that obtained from Mr. Ashworth in 1928, in being much thicker and heavier. The analysis of our 1928 material follows:

Specific gravity	.9324
Saponification number	187.4
Iodine number	173.3
Free fatty acids as oleic acid	3.46%

The two dusts used were three per cent nicotine dust, and 90-10 sulphur arsenate dust consisting of 90 per cent finely ground sulphur and 10 per cent lead arsenate.

Experiment Station Orchard

Spraying experiments were begun in 1924, using the Experiment Station orchard at Mount Carmel. This orchard consists of a number of varieties arranged in rows running the length of the orchard or part way through. There are 96 trees in all, arranged in six rows. As far as could be determined, the varieties appeared to show about equal infestations, but with a systematic decrease

in amount of injured fruit from the outside rows towards the center, and being greater in the lower parts of the orchard to the west. Work during this summer was more or less preliminary and consisted of small tests on 7-14 trees each, taking in entire rows or parts thereof, and scoring all fruit from the orchard. Owing to the variation in degree of infestation in the orchard it was recognized that these results could not be fully relied upon, although giving a general indication of the amount of control. Consequently, the tests were continued in 1925 in different locations which procedure gave a considerably better idea of their value. In 1924, it will be seen that there were fully twice as many punctures on the early drop fruits as on the picked fruit and windfalls harvested later, except on the unsprayed trees where the number was about equal. Tree shaving all sprays had slightly more unmarked fruit than any others. The plot having no 7-day spray, however, averaged 85.5 per cent clean as compared with 86.6 per cent for the complete schedule. None of the remaining treatments averaged as high as these.

It should be mentioned here that several factors influence the abundance of curculios on the trees and have been taken into consideration in evaluating results. They are:

(1) Location of the tree in the orchard—outside trees or trees near fence rows are always more heavily infested.

(2) Number of apples per tree. Very few apples on a large sprayed tree are not usually injured. A medium or light crop, one barrel or less, on a tree normally producing six or seven, is usually injured severely while a maximum crop, well sprayed, usually shows a relatively small percentage of punctures.

(3) Size or volume of the tree itself has influenced results.

Table 22—Results of Spraying Experiments for Control of Plum Curculio on Apple—1924.—Detailed Record

Tree Nos.	Total No. Apples	No. Good Apples	No. Marked Apples	Total No. Punctures	Per Cent Marked Apples	No. Punctures per Apple	Kind of Fruit Scored	Treatment
A 1–3, 5–12, 14–16	664	165	499	1,354	75.0	2.04	Drops	Molasses plus lead arsenate Calyx and 2 weeks
	480	96	384	1,124	80.0	2.34	Drops	
	669	410	259	654	38.7	0.98	Windfalls	
	3,409	2,051	1,358	3,238	39.8	0.95	Picked	
	5,222	2,722	2,500	6,370	47.8	1.22	Total	
A 4 and A 13	275	36	239	622	86.9	2.26	Drops	None
	89	2	87	280	97.7	3.15	Drops	
	154	24	130	432	84.4	2.80	Windfalls	
	265	60	205	583	77.3	2.20	Picked	
	783	122	661	1,917	84.4	2.45	Total	

TABLE 22—RESULTS OF SPRAYING EXPERIMENTS FOR CONTROL OF PLUM CURCULIO ON APPLE—1924—Detailed Record

Tree Nos.	Total No. Apples	No. Good Apples	No. Marked Apples	Total No. Punctures	Per Cent Marked Apples	No. Punctures per Apple	Kind of Fruit Scored	Treatment
B	621	406	215	450	34.6	0.72	Drops	
1– 3,	515	305	210	467	40.7	0.91	Drops	Calyx, 7-day
5–12,	482	404	78	114	16.2	0.24	Windfalls	and 2 weeks;
14–16	4,428	3,756	672	1,199	15.2	0.27	Picked	*No pink*
	6,046	4,871	1,175	2,230	19.4	0.37	Total	
B 4	322	89	233	515	72.3	1.60	Drops	
and	93	10	83	273	89.2	2.93	Drops	
B 13	292	210	82	166	28.1	0.57	Windfalls	None
	315	220	95	208	30.2	0.66	Picked	
	1,022	529	493	1,162	48.2	1.13	Total	
C	2,386	1,471	915	2,017	38.3	0.84	Drops	
1– 3,	1,429	870	559	1,044	39.2	0.73	Drops	Pink, 7-day
5– 8	764	616	148	232	19.3	0.30	Windfalls	and 2 weeks;
	3,301	2,739	562	952	17.0	0.29	Picked	*No calyx*
	7,880	5,696	2,184	4,245	27.7	0.54	Total	
C 4	34	7	27	75	79.4	2.20	Drops	
	133	178	55	84	41.3	0.63	Windfalls	None
	363	135	128	263	35.2	0.72	Picked	
	530	320	210	422	39.6	0.79	Total	
C	2,477	786	1,691	4,135	68.2	1.67	Drops	
9–12,	1,638	307	1,331	4,531	81.2	2.77	Drops	Commercial
14–16	1,336	339	997	3,306	74.6	2.47	Windfalls	nicotine
	4,302	1,270	3,032	9,546	70.5	2.22	Picked	dust
	9,753	2,702	7,051	21,518	72.29	2.20	Total	
C 13	1,766	728	1,038	1,910	58.7	1.08	Drops	
	576	105	471	945	81.7	1.64	Drops	
	521	265	256	488	49.13	.93	Windfalls	None
	2,258	805	1,453	3,114	64.35	1.38	Picked	
	5,121	1,903	3,218	6,457	62.83	1.26	Total	
D	803	669	134	251	16.69	0.31	Drops	
1– 3,	1,030	893	137	230	13.30	0.22	Drops	Pink, calyx
5– 8	990	853	137	210	13.84	0.21	Windfalls	and 2 weeks;
	4,430	3,781	643	672	14.51	0.15	Picked	*No 7-day*
	7,253	6,202	1,051	1,363	14.49	0.19	Total	
D 4	317	107	210	458	66.24	1.44	Drops	
	228	63	165	375	72.37	1.64	Drops	
	294	99	195	448	66.33	1.52	Windfalls	None
	1,129	326	803	2,360	71.12	2.09	Picked	
	1,968	595	1,373	3,641	69.77	1.85	Total	

TABLE 22—RESULTS OF SPRAYING EXPERIMENTS FOR CONTROL OF PLUM CURCULIO ON APPLE—1924—Detailed Record

Tree Nos.	Total No. Apples	No. Good Apples	No. Marked Apples	Total No. Punctures	Per Cent Marked Apples	No. Punctures per Apple	Kind of Fruit Scored	Treatment
D	359	87	272	262	75.76	.72	Drops	
9–12,	221	63	158	627	71.5	2.83	Drops	Commercial
14–16	843	286	557	1,957	66.07	2.32	Windfalls	nicotine
	2,160	407	1,753	3,688	81.16	1.70	Picked	dust
	3,583	843	2,740	6,534	76.47	1.87	Total	
D 13	26	9	17	36	65.38	1.38	Drops	
	66	11	55	217	83.33	3.28	Drops	
	145	51	94	207	64.83	1.42	Windfalls	None
	176	37	139	377	78.98	2.14	Picked	
	413	108	305	837	73.85	2.02	Total	
E	207	120	87	205	42.1	0.99	Drops	
1– 3,	238	147	191	256	38.27	1.07	Drops	Pink, calyx
5–12,	328	279	49	93	14.94	0.28	Windfalls	and 7-day;
14–16	2,921	2,607	314	673	10.3	0.2	Picked	*No 2 weeks*
	3,694	3,053	541	1,227	14.66	0.33	Total	
E 4	97	12	85	50	87.5	0.5	Drops	
and	106	34	72	266	67.94	2.5	Drops	
E 13	106	47	59	154	55.6	1.4	Windfalls	None
	1,168	430	738	2,129	63.0	1.8	Picked	
	1,477	523	954	2,599	64.58	1.76	Total	
F	6,320	5,096	1,224	2,266	19.37	0.35	Drops	
1– 3,	2,915	2,302	613	1,514	21.03	0.52	Drops	Pink, calyx,
5–12,	4,561	4,220	341	703	7.45	0.15	Windfalls	7-day and
14–16	10,487	9,433	1,054	1,728	10.05	0.16	Picked	2 weeks
	24,283	21,051	3,232	6,211	13.31	.25	Total	
F 4	1,070	315	655	1,411	61.2	1.32	Drops	
and	319	39	280	798	87.8	2.50	Drops	
F 13	194	91	103	194	52.5	1.0	Windfalls	None
	211	69	142	350	67.3	1.66	Picked	
	1,794	514	1,180	2,753	65.7	1.53	Total	
A, B, C,	3,907	1,404	2,504	5,077	64.1	1.29	Drops	
D, E &	1,610	342	1,268	3,238	78.8	2.01	Drops	Summary of
F,	1,706	787	919	2,089	53.9	1.22	Windfalls	all check
4 & 13	5,885	2,182	3,703	9,384	62.9	1.59	Picked	trees
	13,108	4,714	8,394	19,788	64.04	1.51	Total	
Special	290	148	142	321	48.96	1.10	Drops	Two sprays of lead arsenate with baits.
	831	563	268	519	32.3	.625	Picked	

TABLE 23—SHOWING COMPARISON OF DIFFERENT SPRAY TREATMENTS EXPERIMENT STATION FARM—1924

Treatment	Per Cent Unmarked Fruit	Kind of Fruit	Total Per Cent of Unmarked Fruit
No Pink Spray	62.5	Drops	
Calyx, 7-day	———	———	80.57
and 2 weeks	83.9	Picked	
No Calyx Spray	61.6	Drops	
Pink, 7-day and	———	———	72.22
2 weeks	82.5	Picked	
No 7-day Spray	85.2	Drops	
Pink, calyx and	———	———	85.5
2 weeks	85.6	Picked	
No 2 weeks Spray	60.0	Drops	
Pink, calyx and	———	———	82.67
7-day	88.8	Picked	
All Sprays	80.1	Drops	
Pink, calyx, 7-day and	———	———	86.69
2 weeks	90.7	Picked	
	31.6	Drops	
Check—no spray	———	———	35.96
	39.1	Picked	

EXPERIMENT STATION FARM, 1924

Notes:

Trees planted 1911.

Percentage based on counts varying from 3,583 to 24,283 for each treatment.

Peach orchard alongside removed in winter of 1923-24; early drops collected and larvae trapped in cages 1924.

Spray formula used

Lead arsenate	3 pounds
Lime sulphur (liquid)	3 gallons
Casein lime	1 pound
Nicotine sulphate	1 pint
Water	100 gallons

Dates of Spray Applications

Pink	May 13
Calyx	June 2
7-day	June 10
2-weeks	June 16

RESULTS IN 1925

The work was continued in 1925, shifting blocks, and also introducing several new treatments. First a schedule comprising pink, four days after calyx, five days later and two weeks after the five-day spray. (2) use of coated lead arsenate (home made). (3) double the usual strength of lead arsenate and (4) fish oil sticker in calyx spray without lime sulphur. This year the spray containing fish oil plus lead arsenate applied at the calyx period without lime sulphur was slightly better than any other treatment, although the difference between it and the complete schedule was only 0.2 per cent. The "no calyx" treatment stood high in clean fruit indicating that beetles did not get started in the orchard this year until some time after this period. The trees from which the 7-day spray was omitted were low in percentage of clean fruit. In these tests, the complete schedule again stood practically as high as any other, being only .16 per cent less than the highest score.

TABLE 24—RESULTS OF SPRAYING EXPERIMENTS FOR CONTROL OF PLUM CURCULIO ON APPLE—1925

EXPERIMENT STATION FARM: DETAILED RECORD

Tree Nos.	Kind of Fruit	Total No. of Apples	No. Marked by Curculio	Per Cent Marked Fruit	Total No. of Punctures	Average No. Punctures Per Apple	Treatment Received
A 1-3	Drops	1,656	808	48.79	1,366	.82	Pink: 6 days after calyx
5-8	Picked	6,509	1,156	17.76	1,814	.28	8 days after 6-day;
	Total	8,165	1,964	24.05	3,180	.39	2 wks. after 8-day; No lime-sulphur at 6-day
A 4	Drops	56	45	80.35	76	1.35	
	Picked	621	488	78.58	1,069	1.72	Check—no treatment
	Total	677	533	78.72	1,145	1.69	
A 9-12	Drops	2,086	1,506	72.20	2,817	1.35	Pink; 6 days after calyx
14-16	Picked	6,879	1,940	28.20	2,834	.41	with coated lead arsenate; 2-weeks
	Total	8,965	3,446	38.43	5,651	.63	
A 13	Drops	267	264	98.87	650	2.43	
	Picked	416	289	69.47	671	1.61	Check—no treatment
	Total	683	553	80.96	1,321	1.93	
B 1-3	Drops	677	395	58.34	745	1.10	Pink; heavy dose lead
	Picked	7,456	636	8.53	1,080	.14	arsenate at calyx and 2-weeks
	Total	8,133	1,031	12.67	1,825	.22	
B 4	Drops	2,104	1,562	74.23	2,950	1.40	
	Picked	3,579	1,514	42.30	2,616	.73	Check—no treatment
	Total	5,683	3,076	54.12	5,566	.98	
B 9-12	Drops	1,887	83	4.40	122	.06	Pink; calyx with fish
14-16	Picked	1,933	149	7.71	233	.12	oil sticker, no lime-sulphur; 2 weeks.
	Total	3,820	232	6.07	355	.09	
B 13	Drops	309	178	57.60	433	1.40	
	Picked	479	273	56.99	704	1.47	Check—no treatment
		788	451	57.23	1,137	1.44	
C 1-3	Drops	5,596	1,052	18.80	1,591	.28	No 2-weeks;
5-12	Picked	17,708	1,358	7.67	2,228	.12	Pink; calyx; 7-day
14-16	Total	23,304	2,410	10.34	3,819	.16	
C 4 and	Drops	71	41	57.74	97	1.36	
13	Picked	699	365	52.21	784	1.12	Check—no treatment
	Total	770	406	52.72	881	1.14	
D 1-3	Drops	6,545	518	7.91	886	.13	All sprays
5-12	Picked	13,318	720	5.40	1,362	.10	Pink; calyx; 7-day and 2-weeks
14-16	Total	19,863	1,238	6.23	2,248	.11	

TABLE 24—RESULTS OF SPRAYING EXPERIMENTS FOR CONTROL OF PLUM CURCULIO ON APPLE—1925—*Concluded*

EXPERIMENT STATION FARM: DETAILED RECORD—*Concluded*

Tree Nos.	Kind of Fruit	Total No. of Apples	No. Marked by Curculio	Per Cent Marked Fruit	Total No. of Punctures	Average No. Punctures Per Apple	Treatment Received
D 4 and 13	Drops	627	365	58.21	816	1.30	
	Picked	1,818	1,369	75.30	4,559	2.50	Check—no treatment
	Total	2,445	1,734	70.92	5,375	2.19	
E 1–3	Drops	3,556	201	5.65	300	.08	No calyx
5–12	Picked	18,030	1,734	9.61	2,819	.15	Pink; 7-day and 2-wks
14–16	Total	21,586	1,935	8.96	3,119	.14	
E 4 and 13	Drops	1,015	425	41.87	1,112	1.09	
	Picked	2,672	2,039	76.30	6,139	2.29	Check—no treatment
	Total	3,687	2,464	66.82	7,251	1.96	
F 1–3	Drops	9,620	1,629	16.93	2,929	.30	No 7-day
5–12	Picked	22,592	3,268	14.46	6,075	.27	Pink, calyx and 2-wks
14–16	Total	32,212	4,897	15.20	9,004	.27	
F 4 and 13	Drops	2,709	1,130	41.71	2,337	.86	
	Picked	1,635	1,332	81.46	3,640	2.22	Check—no treatment
	Total	4,344	2,462	56.67	5,977	1.37	
A, B, C, D, E, F,	Drops	7,158	4,010	56.02	8,471	1.18	
	Picked	11,919	7,669	64.34	20,182	1.69	Summary of all checks
4 & 13	Total	19,077	11,679	61.22	28,653	1.50	

Total number apples scored 144,435

Note—"Drops" include early drops collected until about the middle of July.
"Picked" includes fruit taken from tree and also windfalls at time of harvesting crop.

TABLE 25—SHOWING COMPARISON OF DIFFERENT SPRAY TREATMENTS

EXPERIMENT STATION FARM—1925

	Treatment	Per Cent. Unmarked Fruit	Kind of Fruit	Total Per Cent of Unmarked Fruit
	No calyx	94.35	Drops	
1	Pink, 7-day and 2 weeks	90.39	Picked	91.04
	No calyx: Pink; 6 days	61.21	Drops	
2	after calyx; 8 days later; 2 weeks after 8 day	82.24	Picked	75.95
	No 7-day	83.07	Drops	
3	Pink, calyx and 2 weeks	85.54	Picked	84.80
	No 7-day	95.60	Drops	
4	Pink, calyx with fish oil; 2 weeks	93.30	Picked	93.93
	No 7-day: Pink—heavy	41.66	Drops	
5	dose lead arsenate at calyx; also at 2 weeks	91.47	Picked	88.33

TABLE 25—SHOWING COMPARISON OF DIFFERENT SPRAY TREATMENTS —*Concluded*

EXPERIMENT STATION FARM—1925—*Concluded*

	Treatment	Per Cent Unmarked Fruit	Kind of Fruit	Total Per Cent of Unmarked Fruit
	No 2 weeks	81.20	Drops	
6	Pink, calyx and 7-day	92.33	Picked	89.66
	All sprays	92.08	Drops	
7	Pink, calyx, 7-day and 2 weeks	94.60	Picked	93.77
		43.98	Drops	
8	Check-no spray	35.66	Picked	38.78

Notes:

Percentages based on counts varying from 3,820 to 32,212 apples for each plot.
Early drops collected 1925.
Amount of spray used 8–14 gallons per tree.
All apples scored by individual examinaion.
Orchard cultivated until 1925 when middle section was left in sod.

Spray Formulas Used

Lead arsenate	3 pounds
Nicotine sulphate	1 pint
Casein lime	1 pound
Lime sulphur (dry)	6 pounds
Water	100 gallons
Fish oil (light pressed menhaden)	1 quart
Lead arsenate	3 pounds (No. 4 only at calyx)
Water	100 gallons
Lead arsenate	6 pounds (No. 5 only at calyx and 2 weeks)
Water	100 gallons

Dates of Spray Applications

Pink,—April 29. Calyx,—May 19. 6-day,—May 25. 7-day,—May 26. 2-weeks,—June 1 and 2. 4-weeks,—June 16.

RESULTS IN 1926.

Coated lead arsenate was tried with a view to eliminating some of the sprays but without success. It should be said, however, that the material used was not the same as the product manufactured later and probably failed for this reason. Colloidal arsenate of lead was used as a substitute for acid lead arsenate with good results. During 1926, the plots treated with lead arsenate and fish oil at the calyx period fell below the complete schedule by 1.3 per cent. The total score of all trees receiving the treatment, however, fell somewhat below this due to the

high score of one outside tree. This tree seemed to be so much out of line with the results obtained from the rest that it seems justifiable to omit it from the final figures:

TABLE 26—RESULTS OF FISH OIL—LEAD ARSENATE TEST

Tree No.	Total number apples	Number marked by curculio	Size of tree cubic yards	Per cent marked fruit
B1	2,840	705	330	24.8
B2	3,707	231	318	6.2
B3	1,976	78	286	3.9
B5	4,607	227	345	4.9
B6	2,550	90	400	3.5
B7	1,502	52	343	3.5
B8	735	18	278	2.4
Average marked fruit omitting B1.				4.6

TABLE 27—RESULTS OF SPRAYING EXPERIMENTS FOR CONTROL OF PLUM CURCULIO ON APPLE—1927

EXPERIMENT STATION FARM: DETAILED RECORD

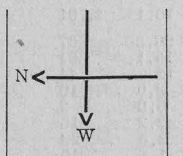
Tree Nos.	Total No. of Apples	No. Marked by Curculio	Per Cent Marked Fruit	Total No. of Punctures	Average No. Punctures Per Apple	Treatment Received
A 1–3 5–8	6,670	1,333	19.9	2,474	.37	No 7-day; pink, calyx with regular lead arsenate (no lime sulphur), 2-weeks
A 9-12 14–16	10,988	1,807	16.4	3,797	.34	No 7-day; pink, calyx with coated lead arsenate (no lime sulphur), 2-weeks
A 4 and 13	1,552	1,207	77.1	4,104	2.64	Check—no treatment
B 1–3 5–8	18,267	1,751	9.6	2,872	.16	No 7-day; pink; calyx with fish oil and lead arsenate no lime sulphur; 2-weeks
C 1–3 5–8	23,169	1,672	7.2	3,213	.14	No 7-day; pink; calyx with fish oil and lead arsenate, no lime sulphur
B 4 and C 4	3,221	871	27.0	1,649	.51	Check—no treatment
B 9–12 14–16	4,816	522	10.8	634	.13	No calyx; pink; 4 days after calyx; 5 days later;
C 9–12 14–16	3,093	232	7.5	363	.12	12 days after 5-day (complete mixture)
B 13 C 13	3,181	1,667	52.4	3,575	1.12	Check—no treatment
D 1–3 5–8	5,965	87	1.46	153	.025	Complete schedule; pink (ferrous ars.); 7-day, calyx Colloidal lead ars.; 2-weeks
D 4	1,820	702	38.86	1,333	.73	Check—no treatment
D 9–12 14–16	4,061	136	3.34	286	.07	All sprays; pink; calyx; 7-day; 2-weeks; complete mixture
D 13	398	113	28.4	264	.66	Check—no treatment
E 1–3 4–12 14–16	2,889	143	4.9	389	.13	No pink; calyx; 7-day and 2-weeks; complete mixture
E 4, 13 F 9–12 14–16	853 10,664	421 578	49.3 5.4	1,235 1,159	1.45 .10	Check—no treatment No 7-day; pink; calyx and 2-weeks; complete mixture
F 13	66	59	89.4	342	5.18	Check—no treatment
Checks	11,091	5,040	45.44	12,502	1.12	

Notes—Drop fruits were not collected in this orchard in 1926.
Spray dates: Pink, May 4.
Calyx, May 28
7-day, June 4
2-weeks, June 11
4-weeks, June 24
Formula: Complete mixture and fish oil same as in 1925.
Colloidal and ferrous arsenates at 3 pounds per 100 gallons.
Coated lead arsenate at 8 lbs. paste per 100 gallons.

RESULTS IN 1927

During this year the orchard was divided into three blocks of 24-30 trees each, the plots being sprayed with (1) pink, calyx, 7-day and 2-weeks schedule, (2) pink, calyx, with fish oil and lead arsenate, and 2-weeks sprays, (3) pink, calyx, 2-weeks and 4-weeks sprays. Casein lime was added to plot (2) at the calyx period causing much of the spray to run off the foliage and was thought to be responsible for the poor showing of this plot. The results again showed that the complete schedule (1) was better and on the end row, some 8-15 per cent better than other schedules. The total percentage, however, showed little difference (2-5 per cent), but the considerably improved control of this schedule since 1924 began to be apparent, indicating that the most consistently good results are to be expected from it. A diagram of the orchard with percentages of marked fruit on the count trees is shown below and indicates the variation in percentage of marked fruit in various locations. This year outlying wild apples were sprayed within a fourth of a mile of the orchard.

PLAN AND RESULTS OF EXPERIMENTS AT STATION FARM, MOUNT CARMEL IN 1927



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
F	X	X	11	—	X	34	X	5	—	X	—	X	4	—	X	X
E	X	X	5	7	X	74	X	3	5	X	19	X	3	0	X	X
D	X	X	13	3	X	73	X	2	2	X	44	X	1	6	X	X
C	X	X	—	—	X	—	X	—	2	X	15	X	—	3	X	X
B	X	X	—	8	X	—	X	5	2	X	21	X	0	1	X	X
A	19	15	17	23	—	94	20	15	13	4	24	7	5	5	5	9
Treatments:	pink, calyx, 2 weeks, 4 weeks.					check	pink, calyx with fish oil, 2 weeks.				check	pink, calyx, 7-day, 2 weeks.				

Notes:
All percentages referred to nearest whole number; represent fruit marked by curculios.
Trees left blank bore no fruit or so little that the count was worthless.
All picked fruit from count trees scored.
Outlying wild apple trees sprayed with lead arsenate at calyx period.
Drop fruits not collected in 1927.
Row A next a fence row.

Spray dates: Pink—May 6
Calyx—May 26–7
7 day—June 4
2 weeks—June 9
4 weeks—June 23

Formula:
Lead arsenate..... 3 pounds.
Lime sulphur (dry)..... 6 pounds.
Casein lime..... 1 pound.
Water.....100 gallons

TABLE 28—RESULTS OF SPRAYING EXPERIMENTS FOR CONTROL OF PLUM CURCULIO ON APPLE—1927

EXPERIMENT STATION FARM: DETAILED RECORD

Tree Nos.	Total No. of Apples	Number Marked by Curculio	Per Cent Marked Fruit	Total No. Punctures	Average No. Punctures Per Apple	Treatment
A 1	962	182	18.9	686	.71	Pink, calyx, 2-weeks, 4-weeks
A 2	1,166	176	15.1	296	.25	
A 3	586	99	16.9	208	.35	
A 4	260	60	23.0	139	.534	
A 5	7	0	0.00	0	.0	
B 3	9	0	0.0	0	.0	
B 4	1,424	112	7.8	169	.12	
D 3	171	22	12.9	55	.32	
D 4	1,014	36	3.5	69	.068	
E 3	2,098	102	4.8	163	.077	
E 4	1,261	86	6.8	198	.15	
F 3, 4	4,512	486	10.8	808	.18	
Total	13,470	1,361	10.1	2,791	.20	
A 7	1,586	321	20.2	667	.42	Pink, calyx (with fish oil), 2-weeks
A 8	2,366	357	15.1	601	.25	
A 9	260	33	12.7	44	.16	
A 10	178	7	3.9	10	.056	
B 8	19	1	5.2	2	.105	
B 9	450	10	2.2	16	.035	
C 9	626	16	2.5	29	.046	
D 8	667	12	1.8	16	.024	
D 9	1,452	35	2.4	52	.035	
E 8	2,792	93	3.3	180	.064	
E 9	2,496	118	4.7	205	.082	
F 8	4,543	238	5.2	382	.084	
Total	17,435	1,241	7.11	2,204	.126	
A 12	2,139	156	7.3	288	.13	Pink, calyx, 7-day, 2-weeks
A 13	218	1	.45	1	.04	
A 14	466	22	4.7	36	.077	
A 15	2,004	97	4.8	114	.056	
A 16	3,855	359	9.3	547	.14	
B 14	167	2	1.2	5	.029	
B 13	50	0	0	0	.0	
C 14	5,890	168	2.8	248	.042	
D 13	626	74	1.2	23	.036	
D 14	2,089	118	5.6	197	.094	
E 13	396	14	3.5	36	.091	
E 14	39	0	0	0	.0	
F 13	3,185	139	4.3	159	.049	
Total	21,124	1,150	5.44	1,654	.078	
A 6	292	274	93.8	1,259	4.30	Check—no treatment
A 11	152	36	23.7	69	.45	
B 11	179	37	20.6	51	.28	
C 11	1,491	221	14.8	343	.23	
D 6	1,056	772	73.1	2,031	1.92	
D 11	809	358	44.2	781	.96	
E 6	916	682	74.4	1,869	2.04	
E 11	1,461	276	18.9	412	.28	
F 6	1,860	641	34.4	1,200	.64	
Total	8,216	3,297	40.13	8,015	.97	

RESULTS IN 1928

The same plots were used in 1928 as in 1927, but with one different treatment; namely, a pink, calyx, 10-day, and 20-day schedule. There appeared to be little difference in any of the plots, indicating that they were about equal in curculio control. The pink, calyx, 7-day and two-weeks spray and the pink, calyx, 10-day and 20-day sprays, gave more uniform control. A comparison of several trees of the same variety and the same relative location in the orchard on the other hand, indicates a slight but not significant advantage for the schedule containing fish oil over that omitting it, Table 29. Wild apples in the vicinity of the orchard were sprayed again.

TABLE 29

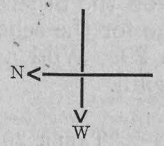
Variety	Tree No.	Total Apples	Height in Feet	Size cu. yds.	Per cent marked	Treatment
Baldwin	A2	2,179	20	277	13.3	Pink, calyx, 7-day, 2 weeks.
"	A13	2,811	19	274	5.1	pink, calyx with fish oil, 2 weeks.
"	A4	2,294	20	318	8.3	pink, calyx, 7-day 2 weeks.
"	A12	2,125	21	309	7.1	pink, calyx with fish oil, 2 weeks.
Greening	D4	1,318	20	310	7.7	pink, calyx, 7 day, 2 weeks.
"	D13	1,419	19	310	2.1	pink, calyx with fish oil, 2 weeks.
"	D3	1,417	18	233	4.3	pink, calyx 7-day, 2 weeks.
"	D14	1,325	18	312	5.0	pink, calyx with fish oil, 2 weeks.

The total percentage of marked fruit is almost identical on the outside row in the different plots and further indicates that the amount of control was almost the same in all three while mathematical computations indicate no significant advantage of any schedule. This year was a bad year for russeted fruit and scab. No McIntosh trees received the fish oil-lead arsenate spray in 1928, but it is reasonable to expect decreased control of scab when such schedules are used. On trees not scabbing badly results were good, the foliage being better and with less spray burn, due no doubt to decreased amount of spray. Advantages of this schedule lie in its greater economy since one application is omitted, and its greater safety—probable disadvantages in lessened fungous control.

A comparison was also made in 1928 of 90-10 sulphur arsenate dust and spray, both dust and spray being applied on the same schedules—pink, calyx, 7-day and 2-weeks. Results indicate a slightly better control of curculio by spraying although the differ-

ence is not great. Thus the per cent of unmarked fruit in the sprayed plot for this year totaled 96.6 per cent while the unmarked fruit on the dusted plot totaled 92.7 per cent. This corresponds in general with results obtained in the Milford experiments of Zappe and Stoddard.

Plan and Results of Experiments to Control Curculios at Experiment Station Farm in 1928



	1	2	3	4	5	6	6	8	8	10	11	12	13	14	15	16
F	X	X	2.8	1.7	45	X	X	4.3	3.2	X	X	28	25	2.2	X	X
E	X	X	3.1	4.9	X	20	X	3.5	—	X	9.5	3.1	1.4	1.0	X	X
D	X	X	4.3	7.7	X	33	X	6.0	2.7	X	27	X	2.1	5.0	X	X
C	X	X	3.2	2.2	X	11	X	1.4	3.0	X	22	X	3.5	—	X	X
B	X	X	4.6	5.2	X	9	X	2.3	3.8	X	12	X	4.8	7.4	X	X
A	6.4	13.3	11.7	8.3	9.2	30	8.0	10.7	7.1	10.2	33	7.1	5.1	6.3	17.0	—
	Treatments: pink, calyx, 7 day, 2 weeks.					check	pink, calyx, 10 day, 20-day.				check		pink, calyx with fish oil, 2 weeks.			

Notes:

Outlying wild apple trees sprayed with lead arsenate and fish oil sticker at calyx period. No drop fruits collected.

Spray dates: pink—May 8
Calyx—May 28
7-day—June 4
10-day—June 7
2-weeks—June 11
20 day—June 18

Formula—
Lead arsenate..... 3 pounds
Lime sulphur (dry)..... 6 pounds
Casein lime..... 1 pound
Water.....100 gallons
Fish oil, 1 pint to 100 gallons. (Used in combination with lead arsenate only.)

Table 30—Results of Spraying Experiments for Control of Plum Curculio on Apples

Experiment Station Farm—1928

	Total No. of Apples	Number Marked by Curculio	Per Cent Marked Fruit	Total[1] Number Punctures	Average No. Punctures Per Apple	Treatment
A 1	235	15	6.4	36	.15	Pink, calyx, 7-day, 2-weeks
A 2	2,179	290	13.3	450	.21	
A 3	844	99	11.7	136	.16	
A 4	2,294	191	8.3	288	.12	
A 5	3,971	366	9.2	521	.13	
B 3	3,083	143	4.6	186	.06	
B 4	2,308	120	5.2	177	.08	
C 3	3,175	103	3.2	132	.04	
C 4	2,811	61	2.2	73	.02	
D 3	1,417	61	4.3	69	.05	
D 4	1,318	101	7.7	177	.13	
E 3	1,001	31	3.1	52	.05	
E 4	896	44	4.9	66	.07	
F 3	3,914	109	2.8	111	.03	
F 4	2,740	47	1.7	57	.02	
Totals	32,186	1,781	5.53±1.95	2,531	.079	
A 7	4,075	327	8.0	448	.11	Pink, calyx, 10-day, 20-day
A 8	2,747	293	10.7	341	.12	
A 9	3,952	281	7.1	356	.09	
A 10	1,859	189	10.2	275	.15	
B 8	1,699	40	2.3	96	.06	
B 9	2,360	91	3.8	138	.06	
C 8	944	13	1.4	21	.02	
C 9	708	21	3.0	28	.04	
D 8	1,171	70	6.0	112	.09	
D 9	1,498	41	2.7	51	.03	
E 8	676	24	3.5	24	.03	
F 8	234	10	4.3	3	.01	
F 9	3,676	120	3.2	137	.04	
Totals	25,599	1,520	5.93±2.29	2,030	.079	
A 12	2,125	153	7.1	237	.11	Pink, calyx with fish oil, 2-weeks
A 13	2,811	144	5.1	209	.07	
A 14	3,613	228	6.3	295	.08	
A 15	2,233	379	17.0	617	.27	
B 13	2,218	106	4.8	146	.06	
B 14	1,055	78	7.4	128	.12	
C 13	3,204	112	3.5	138	.04	
D 13	1,419	30	2.1	40	.03	
D 14	1,325	67	5.0	100	.07	
E 12	3,185	98	3.1	133	.04	
E 13	1,258	18	1.4	12	.009	
E 14	695	7	1.0	6	.009	
F 13	479	120	25.0	167	.35	
F 14	1,400	31	2.2	47	.03	
Totals	27,020	1,571	5.81±1.87	2,275	.084	
A 6	1,003	302	30.1	602	.60	Check—no treatment
B 6	1,447	130	9.0	170	.12	
C 6	1,690	183	10.8	222	.13	
D 6	1,580	515	32.6	864	.55	
E 6	840	168	20.0	294	.35	
F 5	352	158	44.9	279	.79	
A 11	2,450	818	33.4	1,326	.54	
B 11	2,291	285	12.4	429	.19	
C 11	1,126	242	21.5	393	.35	
D 11	995	255	25.6	495	.50	
E 11	1,149	109	9.5	124	.11	
F 12	3,152	873	27.7	1,235	.39	
Totals	18,075	4,038	22.26±2.28	6,433	.356	

[1] Does not include fall feeding punctures.

TABLE 31—EXPERIMENTS TO CONTROL THE PLUM CURCULIO ON APPLE: SPRAY VERSUS DUST

Tree	Total Apples	Number Marked by Curculio	Per Cent Marked Fruit	Total Number of Punctures	Average Number Punctures Per Apple	Treatment
N 3	380	119	31.3	179	.47	Spray: pink, calyx, 7-day, 2-weeks
N 4	432	60	13.9	87	.20	
N 6	4,042	121	3.0	156	.4	
N 7	2,236	9	.4	8	.003	
N 8	2,034	30	1.4	45	.02	
N 9	1,118	0	0	0	.0	
Totals	10,242	339	3.3±3.3	475	.046	
R 5	1,983	181	9.1	272	.14	Dust: pink, calyx, 7-day, 2-weeks
R 6	896	57	6.4	82	.09	
R 7	1,993	90	4.5	91	.04	
R 8	891	70	7.8	101	.11	
R 9	2,469	127	5.1	143	.06	
S 7	513	6	1.2	6	.01	
S 8	1,242	40	3.2	62	.05	
S 9	3,994	259	6.5	323	.08	
Totals	13,981	830	5.9±1.6	1,070	.076	
N 2	1,068	525	49.2	1,302	.122	Check—no treatment
O 1	202	96	47.5	216	.107	
Totals	1,270	621	48.89	1,518	.119	

EXPERIMENTS AT SHEPARD'S ORCHARD, MOUNT CARMEL; RESULTS IN 1925

This orchard consists of 52 trees of three varieties arranged in six rows. It was divided into two plots with check row through the center. The orchard is provided with abundant sources of infestation, with sprayed and unsprayed apple trees on three sides and a bearing peach orchard on the fourth. In 1925, it received (1) a pink, calyx, 7-day and 2-weeks schedule and (2) a pink, calyx, 2-weeks and five weeks spray. Results favored the condensed schedule (1) by nearly seven per cent.

TABLE 32—RESULTS OF SPRAYING EXPERIMENTS TO CONTROL CURCULIOS: SHEPARD'S ORCHARD—1925

Total Apples	Total Injured	Per Cent Injured	Total Punctures	Average No. Punctures Per Apple	Kind of Fruit Scored	Treatment
						7-day
421	113	26.84	266	.63	Drops	April 29, May 19
11,071	2,295	20.73	4,718	.43	Picked	May 27, June 2
11,492	2,408	20.95	4,984	.43	Total	
						5-weeks
421	113	26.84	266	.63	Drops	April 29, May 19
12,352	3,389	27.43	7,616	.62	Picked	June 2, June 22
12,773	3,502	27.41	7,882	.62	Total	
625	534	85.44	1,574	2.52	Drops	Check—no treatment
3,040	2,369	77.92	8,121	2.67	Picked	
3,665	2,903	79.20	9,695	2.64	Total	

TABLE 33—COMPARISON OF SPRAYS FOR CURCULIO CONTROL: SHEPARD'S ORCHARD—1925

Treatment	Per Cent Unmarked Fruit	Kind of Fruit	Total Per Cent of Unmarked Fruit
7-day	73.26	Drops	
April 29, May 19			79.05
May 27, June 2	79.27	Picked	
5-weeks	73.16	Drops	
April 29, May 19,			72.59
June 2, June 22	72.57	Picked	
Check	14.56	Drops	
No Treatment			20.80
	23.08	Picked	

Notes:

Trees planted in 1911.

Amount of spray used 5–7 gallons per tree. (Trees bearing most fruit smaller than trees at Experiment Station farm.)

Percentages based on counts varying from 3,665 to 12,773 apples for each plot.

This orchard is very heavily infested; has been in sod, but was sprayed regularly by owner in previous years. Cultivated in part during 1925.

Spray Formula Used.

Lead arsenate	3 pounds
Nicotine sulphate	1 pint
Casein lime	1 pound
Lime sulphur (dry)	6 pounds
Water	100 gallons

RESULTS IN 1926

The two plots were reversed during 1926 and were the same except that schedule Number 2 received a 4-weeks after calyx application instead of a 5-weeks. This year the condensed schedule averaged .5 per cent less than the expanded pink-calyx-2-weeks-4-weeks schedule.

RESULTS IN 1927

Thinking that our 1926 results might have been influenced unduly by some unseen factor the same sprays were repeated on the same plots with the result that the expanded schedule averaged .1 per cent better. The amount of fruit on the two plots was slightly larger both years on the plot receiving the condensed schedule and if influenced by this factor alone the count should have been much better. The systematic increase in injury occurs on the orchard fringe but is greater towards the west side and should influence both plots alike. This infestation is apparently

TABLE 34—RESULTS OF SPRAYING EXPERIMENTS FOR CONTROL OF PLUM CURCULIO: SHEPARD'S ORCHARD—1926

Row	Kind of Fruit	Total No. of Apples	Number Marked by Curculio	Per Cent Marked Fruit	Total No. of Punctures	Average No. Punctures Per Apple	Treatment
C 1–4	Drops	2,243	100	4.4	147	.065	Pink, calyx, 7-day and 2-weeks
	Picked	9,325	339	3.6	540	.058	
D 1–4	Drops	5,321	373	7.01	626	.117	
	Picked	10,752	306	2.8	504	.0468	
E 1–4	Drops	3,110	151	4.8	286	.0919	
	Picked	5,681	91	1.6	196	.034	
F 1–4	Drops	2,403	85	3.5	121	.050	
	Picked	8,553	196	2.26	295	.034	
G 1–4	Drops	583	26	4.4	37	.063	
	Picked	3,792	75	1.97	105	.027	
H 1–4	Drops	925	95	10.2	155	.167	
	Picked	2,223	93	4.2	303	.136	
Total	Drops	14,585	830	5.69	1,372	.094	
	Picked	40,326	1,100	2.73	1,943	.048	
Total all fruits		54,911	1,930	3.51	3,315	.060	
C 6–7	Drops	1,261	84	6.6	122	.09	Pink, calyx, 2-weeks and 4-weeks
	Picked	4,546	200	4.4	292	.06	
D 6–8	Drops	2,193	96	4.4	263	.12	
	Picked	6,731	86	1.2	115	.02	
E 6–9	Drops	1,383	190	13.9	360	.26	
	Picked	6,266	148	2.3	254	.04	
F 6–9	Drops	310	9	2.9	14	.04	
	Picked	1,624	33	2.0	66	.04	
G 6–8	Drops	262	13	4.9	18	.07	
	Picked	2,719	129	4.7	231	.08	
H 6–10	Drops	1,127	158	14.0	240	.21	
	Picked	2,239	183	8.2	406	.18	
Total	Drops	6,536	550	8.41	1,017	.15	
	Picked	24,125	779	3.22	1,364	.05	
Total all fruits		30,661	1,329	4.334	2,381	077	
Total CDEFG 5	Drops	3,177	1,398	44.0	2,781	.87.	Check—no treatment
	Picked	8,036	2,144	26.7	4,444	.55	
Total all fruits		11,213	3 542	31.58	7 225	.644	

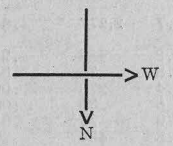
somewhat worse, however, on the northwest corner which falls within the plot receiving the condensed schedule. The only other factor entering the question is the size of the trees. These were measured and it was found that those receiving the condensed schedule are larger. From these facts it becomes apparent that although the count is almost identical, that plot receiving the condensed schedule is in reality better because it controlled equally well with a greater handicap.

TABLE 35—RESULTS OF SPRAYING EXPERIMENTS FOR CONTROL OF PLUM CURCULIO ON APPLE; SHEPARD'S ORCHARD—1927

Tree Nos.	Total No. of Apples	Number Marked by Curculio	Per Cent Marked Fruit	Total No. of Punctures	Average No. Punctures Per Apple	Treatment
D 3	703	23	3.27	36	.051	Pink, calyx, 7-day, 2-weeks
E 3	19	0	0.0	0	.0	
F 3	1,236	38	3.0	56	.045	
G 3	836	38	4.5	66	.079	
H 2	746	160	21.45	361	.484	
D 4	223	7	3.1	9	.040	
E 4	95	1	1.05	2	.021	
F 4	1,645	46	2.8	59	.036	
G 4	868	4	.46	11	.012	
H 4	782	49	6.26	207	.264	
Totals	7,153	366	5.1	807	.112	
D 6	210	3	1.4	3	.014	Pink, calyx, 2-weeks, 4-weeks
E 6	121	2	1.65	2	.016	
F 6	964	55	5.7	117	.121	
G 6	157	99	6.3	94	.598	
H 6	1,704	100	5.86	161	.094	
E 7	346	9	2.6	9	.026	
F 7	1,441	16	1.1	24	.016	
G 7	1,924	42	2.2	64	.033	
H 7	1,308	81	6.2	106	.081	
Totals	8,175	407	4.98	580	.071	
D 5, E 5 F 5, G 5, H 5	1,566	628	40.1	1,073	.68	Check—no treatment

Note—Drop fruits were not collected in this orchard in 1927.

PLAN AND RESULTS OF EXPERIMENTAL WORK IN SHEPARD'S ORCHARD —1927



	A	B	C	D	E	F	G	H	
1	X	X	X	X	X	X	X	X	Pink, calyx, 7-day, 2 weeks.
2			X	X	X	X	X	21	
3			..	3	0	3	4	..	
4			..	3	1	3	.4	6	
5			..	11	26	39	51	55	Check—no treatment.
6			..	1	2	5	8	6	
7			..	..	3	1	2	6	Pink, calyx, 2-weeks, 4-weeks.
8			X	X	X	X	X	X	
9					X	X	X	X	
10								X	

Notes:

Figures represent percentages of curculio marked fruit. All percentages are referred to the nearest whole number.

All picked fruit from count trees scored.

Trees left blank bore no fruit in 1927.

Spray dates—pink May 6–7
calyx—May 27
7-day—June 4
2-weeks—June 9
4-weeks—June 23

Formula—
Lead arsenate..... 3 pounds
Lime sulphur (dry)..... 6 pounds
Casein lime..... 1 pound
Water.....100 gallons

RESULTS IN 1928

This year the complete condensed schedule (pink, calyx, 7-day and 2-weeks) was retained on the same plot and compared with the same schedule on the remaining plot, varying only in the substitution of basic lead arsenate for the acid form commonly employed. The basic arsenate apparently reduced the amount of russet on Gravensteins by seven per cent, but did not so affect the McIntosh. On the other hand, canker worms did much more damage in this plot and the total percentage of fruit unmarked by curculio was considerably less—90.9 per cent compared with 94.3 per cent for the acid lead arsenate.

TABLE 36—EXPERIMENTS IN CURCULIO CONTROL; SHEPARD'S ORCHARD—1928

Tree Nos.	Total No. of Apples	Number Marked by Curculio	Per Cent Marked Fruit	Total No. of Punctures	Average No. Punctures Per Apple	Treatment
C 3	2,749	211	7.67	286	.10	Pink, calyx, 7-day, 2 weeks (acid lead arsenate)
D 3	3,148	37	9.8	37	.01	
E 3	4,211	118	2.8	141	.03	
F 3	1,795	20	1.1	24	.01	
G 3	1,182	87	7.36	133	.11	
H 2	1,203	254	21.1	470	.39	
C 4	2,154	216	10.0	328	.15	
D 4	2,528	53	2.1	62	.02	
E 4	2,789	93	3.3	131	.05	
F 4	1,978	88	4.4	129	.06	
G 4	1,421	89	6.3	127	.09	
H 4	800	220	27.5	409	.51	
Totals	25,958	1,480	5.7	2,277	.8	
C 6	1,741	351	20.2	488	.28	Pink, calyx, 7-day and 2-weeks (basic lead arsenate)
D 6	2,140	60	2.8	75	.03	
E 6	2,792	178	6.4	270	.09	
F 6	565	27	4.8	35	.06	
G 6	649	51	7.9	73	.01	
H 6	1,210	289	23.88	434	.36	
C 7	1,894	385	20.32	212	.11	
D 7	3,983	82	2.1	111	.03	
E 7	2,617	109	4.2	147	.05	
F 7	164	13	7.9	18	.11	
G 7	825	31	3.8	42	.05	
H 7	780	183	23.5	294	.37	
Totals	19,360	1,759	9.18	2,199	.11	
$C_5D_5E_5F_5$	4,848	1,435	29.6	2,211	.45	Check, no treatment

PLAN OF EXPERIMENTS AT SHEPARDS ORCHARD, 1928; AND RESULTS OF FRUIT COUNTS FROM DIFFERENT TREES

A	B	C	D	E	F	G	H		
X	X	X	X	X	X	X	X	1	Pink, calyx, 7 day, 2 weeks.
		X	X	X	X	X	21.1	2	Acid lead arsenate.
		7.6	9.8	2.8	1.1	7.3	..	3	
		10.0	2.1	3.3	4.4	6.3	27.15	4	
		4.15	2.21	2.22	56.1	..	..	5	Check—no treatment.
		20.2	2.8	6.4	4.8	7.9	23.9	6	
		20.3	2.1	4.2	7.9	3.8	23.5	7	Pink, calyx, 7-day, 2 weeks.
		X	X	X	X	X	X	8	Basic lead arsenate.
			X	X	X	X	X	9	
							X	10	

Spray dates—Pink—May 10
Calyx—May 24
7-day—May 31
2-weeks—June 7

Formula same as used in Experiment Station Orchard, except for addition of nicotine sulphate at pink and calyx periods.

ASSEMBLED RESULTS OF DIFFERENT SPRAYS FOR CURCULIO CONTROL—1924–1928

The following table gives a general summary of the work with sprays conducted between 1924 and 1928 with percentages of fruit unmarked by curculios obtained in the different experiments. Treatments 1-8 were conducted in the orchard of the Experiment Station at Mount Carmel, 9-11 in the orchard of Mr. C. E. Shepard near Mount Carmel. The assembled results show the importance of the 7-day treatment, and the close similarity of the schedule containing fish oil sticker. The unusual uniformity of results obtained in 1928 is probably accidental, but shows that the various schedules employed are about equal in effectiveness; and we believe all of them have considerable merit for control of curculios under Connecticut conditions.

TABLE 37—RESULTS OF DIFFERENT SPRAYS FOR CURCULIO CONTROL 1924–1928—PICKED FRUIT ONLY

	Treatment	Per Cent Clean Fruit 1924	1925	1926	1927	1928
1	*No pink* Calyx, 7-day, 2-weeks...	83.9	....	95.04	....	....
2	*No calyx* Pink, 7-day, 2-weeks....	82.5	90.4	....	....	....
3	*No 7-day* Pink, calyx, 2-weeks....	85.6	85.54	94.6	....	....
4	*No 7-day* Pink, calyx, 2-weeks, 4-weeks.....	....	....	....	89.9	....
5	*No 2-weeks spray* Pink, calyx and 7-day...	88.8	92.3	....	....	....
6	Pink, calyx, 10-day, 20-day	....	....	....	....	94.07
7	*All sprays* Pink, calyx, 7-day, 2-weeks	90.7	94.6	96.65	94.6	94.4
8	*No 7-day* Fish oil plus lead arsenate at calyx; pink, calyx and 2-weeks.....	....	93.30	95.3	92.9	94.19
9	*5-weeks spray* Pink, calyx, 2-weeks, 5-weeks.....	....	72.5	....	....	....
10	*4-weeks spray* Pink, calyx, 2-weeks, 4-weeks.....	....	....	96.78	95.02	....
11	*All sprays* Pink, calyx, 7-day, 2-weeks	....	79.2	97.26	94.9	94.4

Miscellaneous Results

During the experiments conducted at the Experiment Station Farm, it was noted that a gradual reduction in curculio injury took place over that five-year period when the tests were conducted. The following figures are the average of marked fruit obtained from the check trees:

Table 38

Date	Per Cent Marked by Curculio	Notes
1924	64	Drops collected
1925	61	" "
1926	45	" "
1927	40	Wild apples sprayed
1928	22	" "

It seems that continued sprays of the kind employed, together with supplementary controls such as removal of drop fruits (1924-6) and spraying of outlying trees (1927-8) has considerable effect in reducing the total infestation. Also that several years of intensive work results in a steady decline in the total number of curculios in the orchard. It seems reasonable that after a point is reached, similar to 1928, in our spray experiments, that some of the sprays could be safely omitted without seriously influencing the amount of unmarked fruit. The orchardist should then be concerned chiefly with the outside trees of his orchard or the rows nearest the protecting woods if such woods are present.

Cost of Materials

The question will naturally arise as to whether the gain from one extra spray, in decreased amount of curculio damage will pay the cost of the treatment.

Figuring on a cost of materials plus labor employed, and on the basis of our 1928 results it would require at least a five per cent gain in unmarked fruit to pay the cost of the treatment where fruit sells for 12 dollars a barrel, the general market quotation for the highest grade in 1928 (Nov. 25 quotation $2-$12). Where the value of the crop drops to $6 a barrel or $2, a much higher per cent of gain from curculio must be obtained if the cost of the operation is successfully met from this gain. The greatest differences between a three and a four spray schedule, except on outside rows, has not been over 10 per cent in any year, so that the increased value of the crop does not meet the cost of the application in uninjured fruit except for apples bringing the highest price.

The gain in value of clean fruit may be further offset by the practise of including apples marked by curculios (one to three external marks per fruit) in the higher grades (Grade A)—so that

although marked by such punctures the fruit still has considerable value on the market. We have allowed for this condition and assumed for convenience that this fruit will bring 75 per cent of the value of the highest grades although it may and often does bring a much higher per cent.

Regarding the schedule including fish oil sticker it may be stated that although more economical than the other schedules, because of (1) omission of lime sulphur at calyx period, (2) omission of the 7-day application altogether, it cannot be said to control scab except on varieties not especially susceptible. It has, however, been used successfully on Baldwins, Spys, Gravensteins, Wealthys, Suttons, Hurlburts, Greenings and Starks. It may also be added that the European red mite did not become abundant on any of the varieties mentioned during the years when this schedule was used.

Spray Burn

Spray burn being of considerable popular interest at this time, the basic form of lead arsenate was used as noted above in Shepard's orchard. Little or no difference could be seen in the foliage of Gravensteins, Astrachans, or McIntosh, although Gravensteins showed seven per cent less russeted fruit than was present in the plot where acid lead arsenate was used. It is not altogether certain, however, that this difference was due to the spray employed. In our Mount Carmel orchard, the plot where fish oil and lead arsenate were used at the calyx period showed much better foliage than either of the other two spray tests. There was considerable russeted fruit throughout the orchard, most of which was probably due to factors not associated with the spray program.

Arsenical Residue

Analyses of apples sprayed with various combinations were made in 1928, from plots receiving the four-spray schedule, and the three-spray schedule including fish oil sticker at calyx. The latter block contained one Astrachan tree which was picked about August 10. Analysis by Mr. Fisher of the Department of Chemistry, showed .004 grains As_2O_3 per pound of fruit taken from the side of this tree and .006 grains per pound from the top. The tolerance for export fruit is .01 grain arsenic trioxide per pound which is much above that found by Mr. Fisher. Rainfall during July and August averages about four inches per year for each of these months in this locality, but in 1928 the precipitation in July was more than seven inches. Analyses of fruit picked later in the season and also from trees receiving an arsenical spray the tenth of July in addition to the usual schedule (pink, calyx, 7-day and 2-weeks) showed similarly small quantities of arsenical residue, all of them much below the export tolerance. From this it seems that

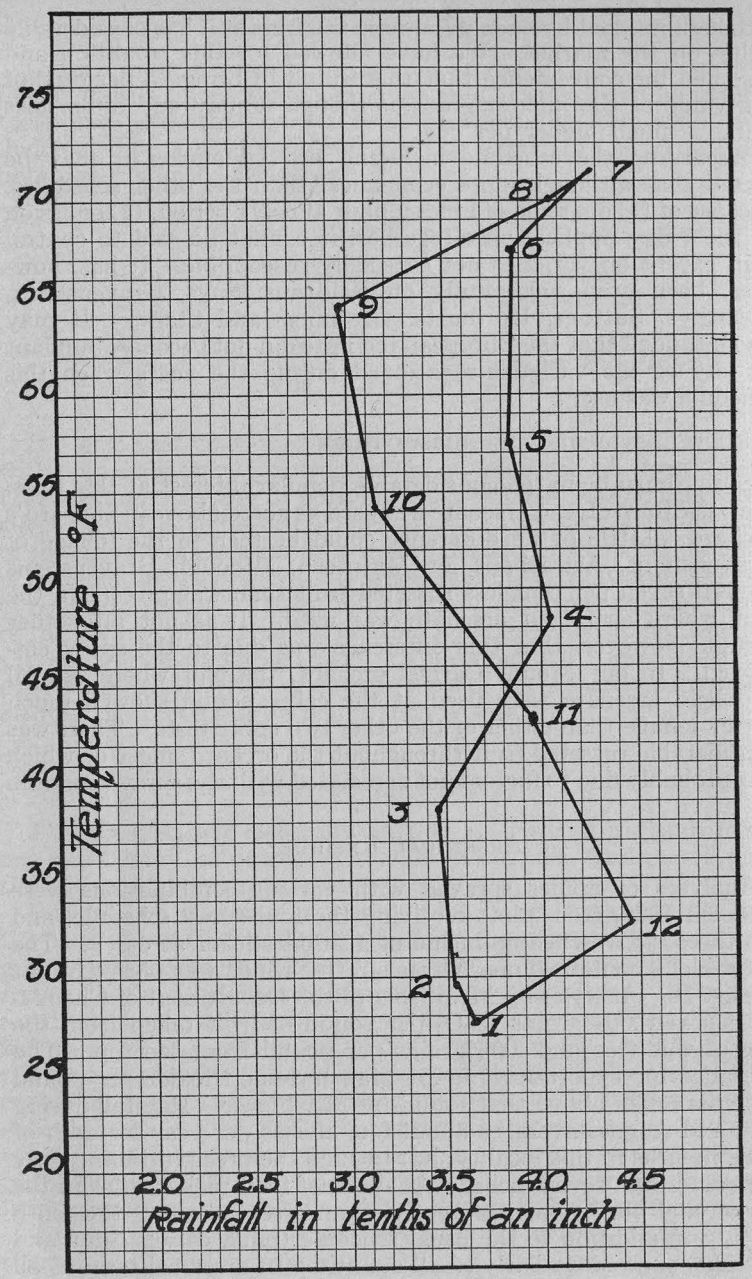


FIG. 32. Climatograph of New Haven district, compiled from U. S. weather bureau records covering the period between 1920 and 1927. The numbers 1, 2, 3, etc., represent the months January, February, March, etc.

there is little danger of harmful residues in Connecticut, especially on those apples picked after September 1, when normally eight or more inches of rain will have fallen. This is also illustrated in Fig. 32 which is a climatograph of the period between 1920 and 1927.

GENERAL CONCLUSIONS

(1) The plum curculio is responsible for much damage to apples in Connecticut.

(2) It is single-brooded and all attempts to produce eggs from beetles emerging during the summer, failed.

(3) The beetles emerge from hibernation near the first of May but do not appear in numbers on the trees till after the blossoms fall.

(4) Beetles come to the trees from outside sources in greatest numbers for a period of about 20 days in Connecticut.

(5) The peak of abundance and egglaying is reached near the middle of June, frequently the 15th, sometimes nearer the 20th.

(6) Beetles developing in dropped apples may offer a serious menace to the succeeding crop.

(7) Sprays applied according to successful schedules outlined in this paper pile up the poison until the June peak of abundance is reached after which there is considerably less danger.

(8) Beetles continue on the trees (apples) in small numbers until the last of July.

(9) All attracting and repelling substances thus far have failed to exert any influence on the curculio in the field. Capryl alcohol is a powerful repellent when confined in cages.

(10) Laboratory tests indicate that the beetles are fond of sweets and may be poisoned in captivity by mixtures containing them.

(11) Effective poisons used in cage tests include, (1) acid lead arsenate, (2) basic lead arsenate, (3) sulphur arsenate dust 90-10, (4) calcium arsenate (5) ortho-zinc arsenite, and (6) sodium fluosilicate lime dust, 1-4.

(12) Parasites are not abundant in Connecticut, the most numerous being apparently *Triaspis curculionis*, which, however, did not kill over 33 per cent of the larvae obtained at any one time.

(13) Spray tests in three different orchards indicate:

(1) That a fair degree of control may be secured with three sprays in Connecticut, but better control with four using a pink, calyx, 7-day and 2-weeks schedule as outlined.

(2) That occasionally a pink, calyx, 2-weeks, and 4-weeks schedule will give good control, while the omission of the 7-day and using fish oil and lead arsenate at the calyx period without lime sulphur closely approximates the results obtained with the four spray schedule but is on the whole less uniform. Such a

schedule should be valuable on trees that burn easily and are not subject to scab infection, besides being more economical than a 4-spray schedule.

(3) That the most consistently good results have been obtained with the 4-spray schedule consisting of pink, 7-day and 2-weeks applications. This resulted in an average of 94.2 per cent unmarked fruit for all tests.

(4) There has been a gradual reduction in injured fruit since 1924, in the orchard where dropped fruits were collected and wild apples in the vicinity sprayed.

(5) Basic lead arsenate compared with acid lead arsenate and used at the same rate per gallon gave less control of curculio than the acid form. It also allowed too much damage from canker worms to be practical at the rate used.

(6) Sprays and dusts used in one field test in 1928 on a full schedule (pink, calyx, 7-day, and 2-weeks) showed the spray slightly superior in control but that dust has merit. This conforms in general with the Milford experiments of Stoddard and Zappe.

(7) Spray residues remaining on the fruit at harvest have been small enough in all cases to conform with the export tolerance.

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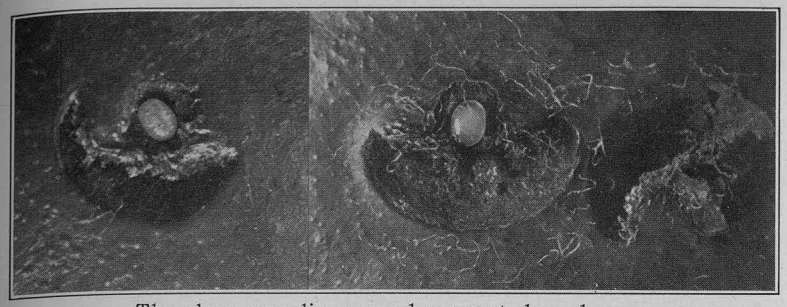
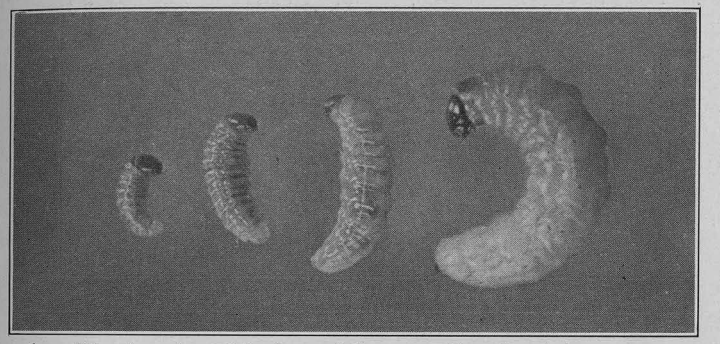
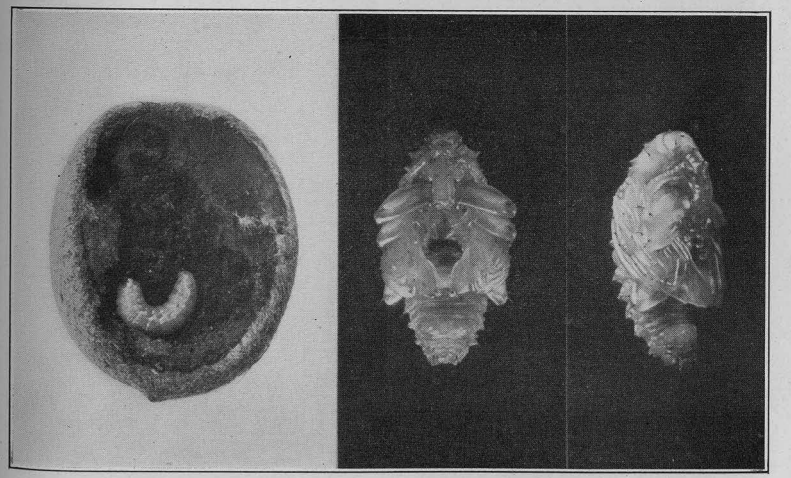


a. The plum curculio egg and crescent shaped egg scars, enlarged nine times.

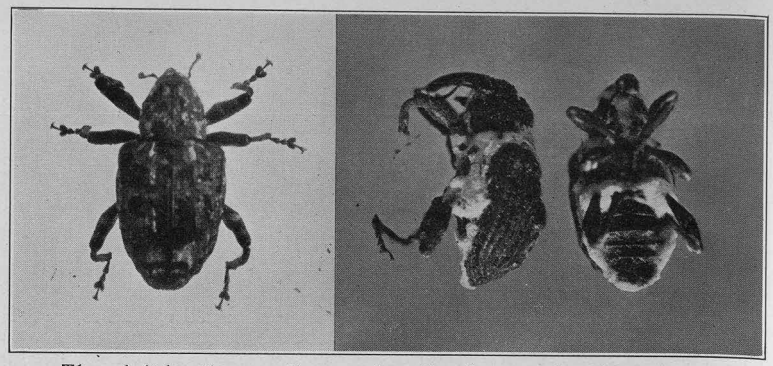


b. The four larval instars of the curculio, about three times natural size.



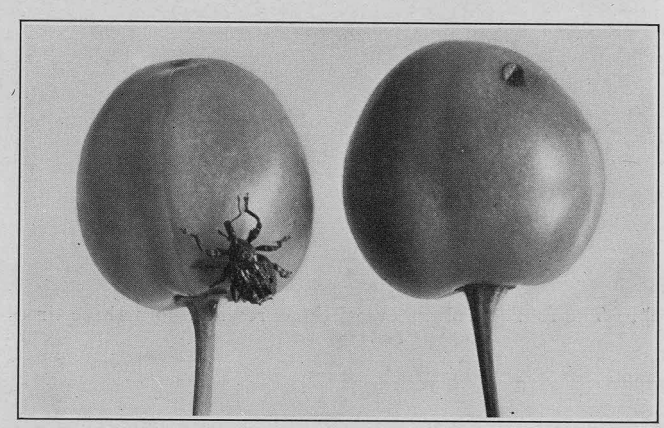
c. Full grown larva in peach, natural size.

d. The pupa, enlarged about five times.

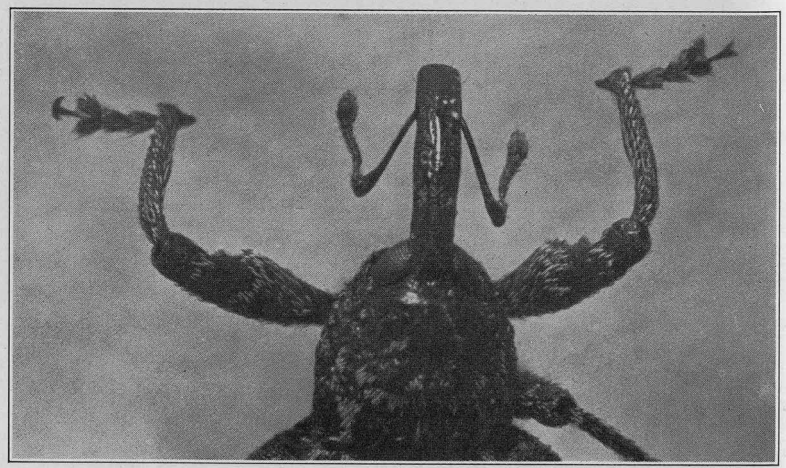


a. The adult beetle curculio, enlarged six times.

b. Beetles attacked by a fungus, *Isaria* sp.



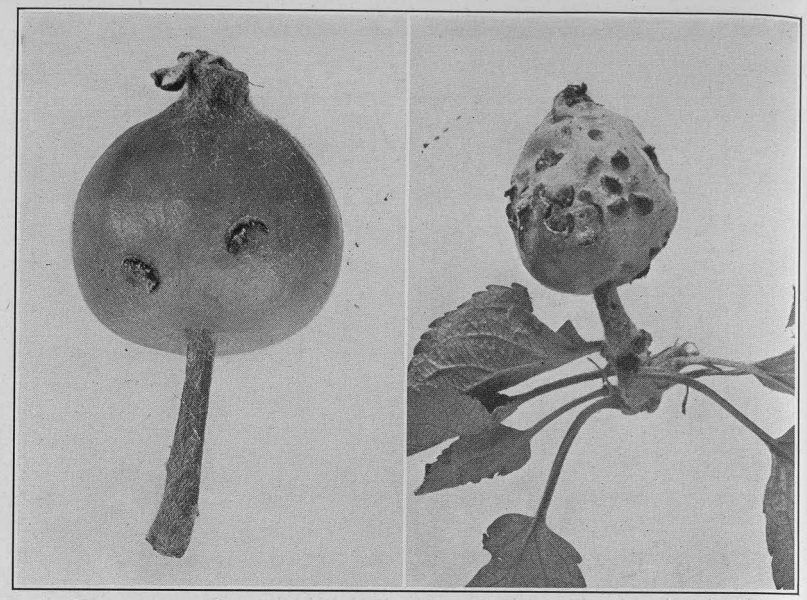
c. The adult beetle and its work on cherries, twice enlarged.



d. The head and beak of the adult curculio, enlarged about 20 times.

a. Jarring beetles from cherry trees in full bloom. Few or no beetles were found at this period.

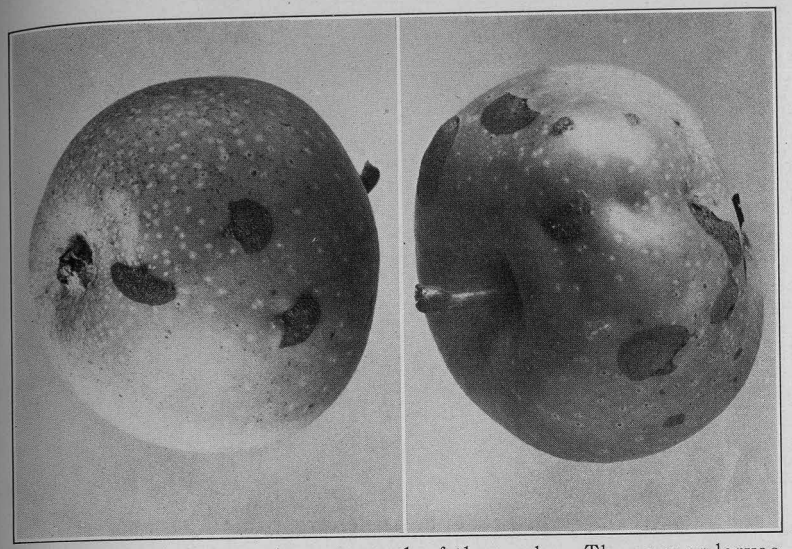
b. Feeding of adult beetles on apple blossoms.



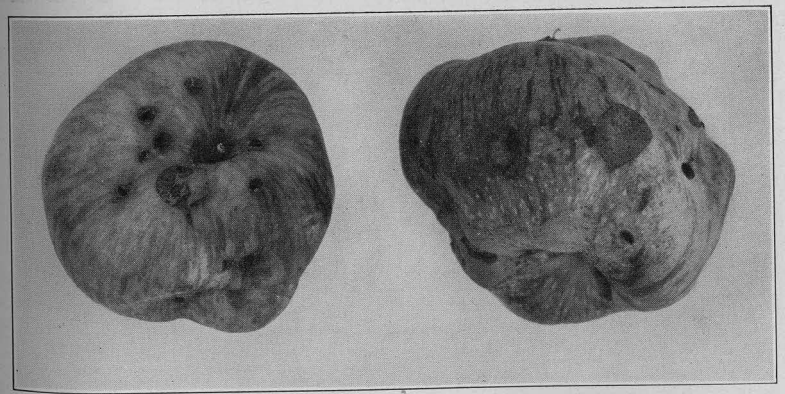
a. Egg scar on apple, enlarged twice.

b. Result of numerous feeding punctures.

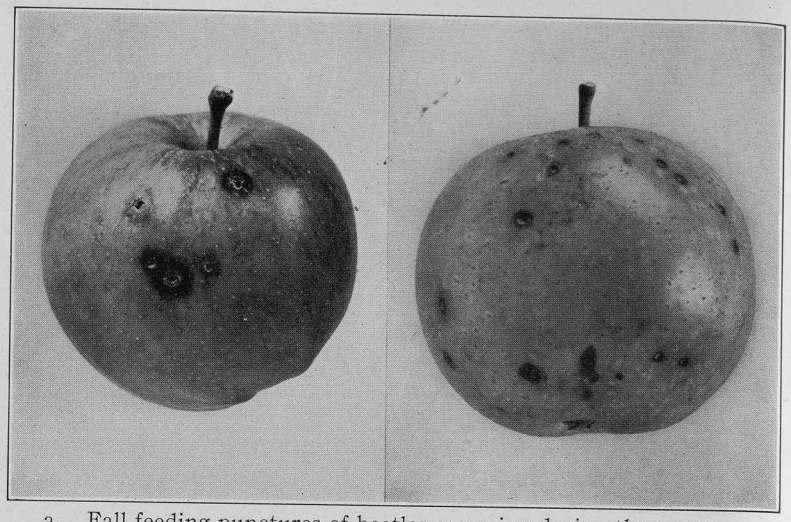
c. Size of dropped apples in which curculio larvae frequently develop. Slightly reduced.



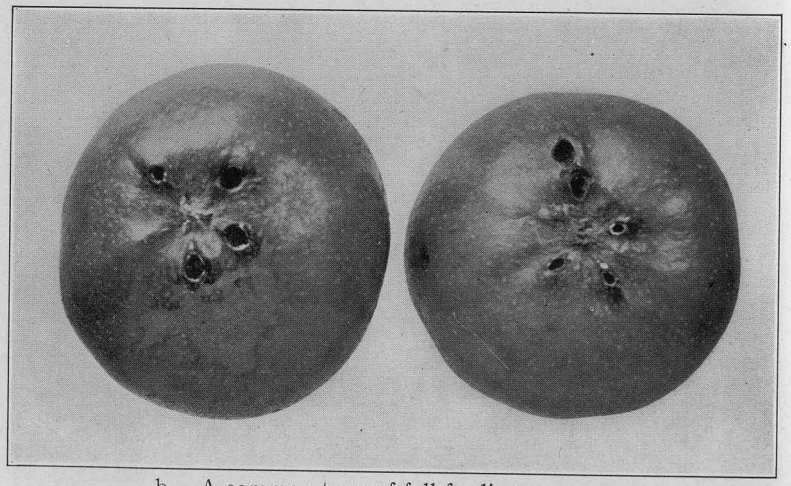
a. Expanded egg scars due to growth of the apple. The eggs or larvae were probably crushed by the growth of the fruit.



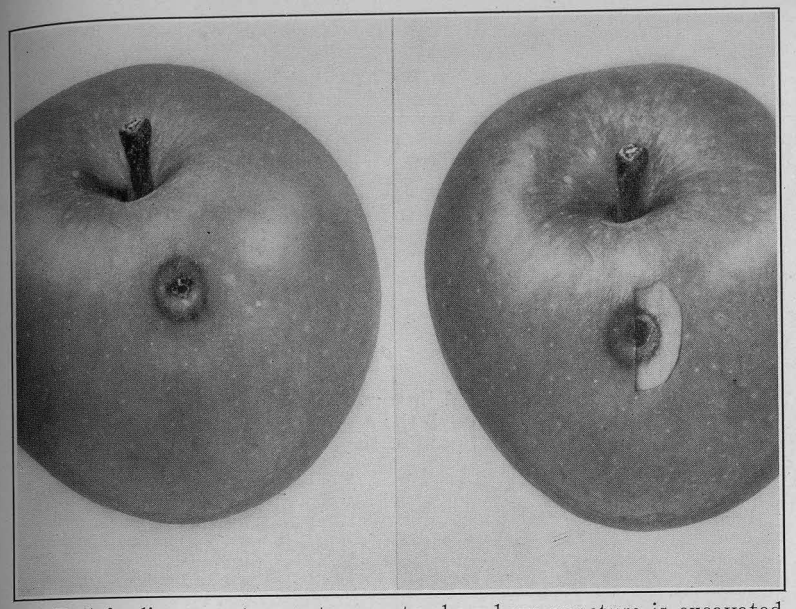
b. Deformed fruit resulting from numerous curculio egg scars and feeding punctures.



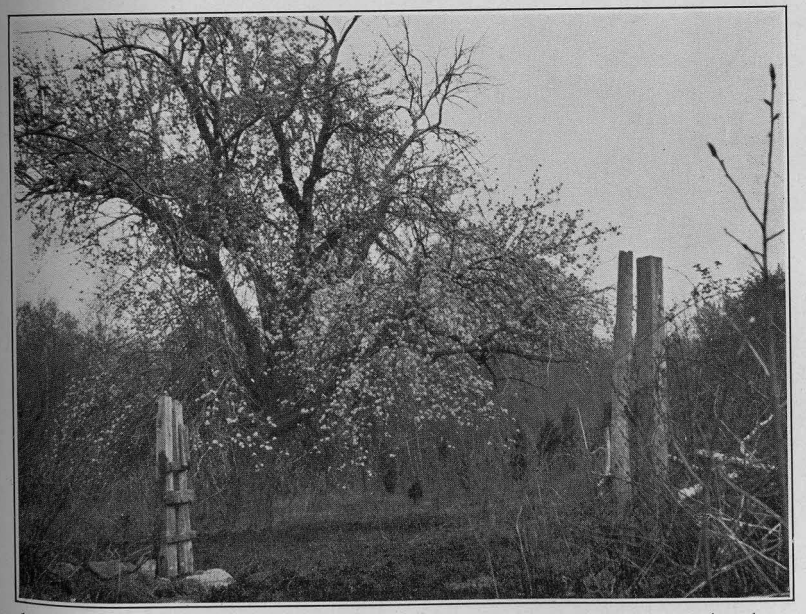
a. Fall feeding punctures of beetles emerging during the summer.



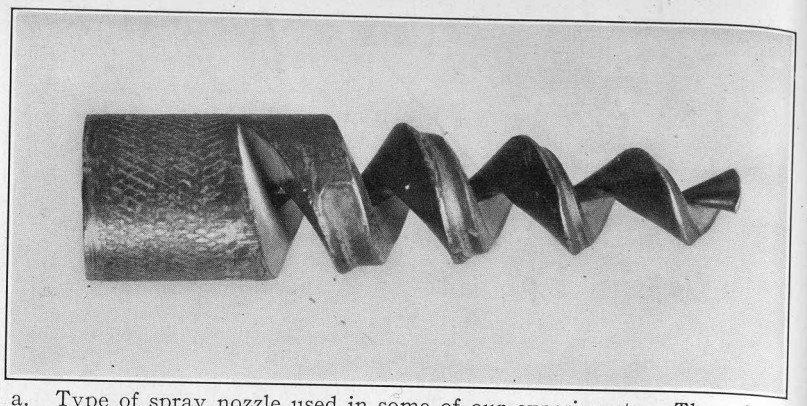
b. A common type of fall feeding puncture.



a. Fall feeding puncture cut away to show how puncture is excavated around the edges.



b. Wild apple tree growing under ideal conditions to promote development of curculios in large numbers. A decided menace if near a commercial orchard.



a. Type of spray nozzle used in some of our experiments. There is a graduated hole through the center of the nozzle which furnishes liquid to the spiral surface.

b. Delivery of spray from the nozzle shown in a. Note the solid cone-shaped whirling spray which covers the tree with great rapidity. Absence of projections on the end of the spray rod to catch on branches is a decided advantage. It can be thrust into the center of a tree covering parts not ordinarily reached with the usual spray outfit.

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Connecticut Agricultural Experiment Station
New Haven, Connecticut

THE WILLOW SCAB FUNGUS

Fusicladium saliciperdum

G. P. CLINTON
AND
FLORENCE A. MCCORMICK

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.

Press of The Wilson H. Lee Co., New Haven, Conn.

The Willow Scab Fungus

*Fusicladium saliciperdum**

G. P. Clinton and Florence A. McCormick

Introduction

The scab fungus of willows has been known in Europe for many years. In its parasitic stage it was found in North America for the first time in 1927 by the senior author (20). Years before, however, it had been reported, in what is claimed to be its saprophytic stage, from Greenland and Ellesmere Island by Rostrup (48). It is a relative of the common apple and pear scabs and has been called willow scab in Europe but its action on its most susceptible hosts has been so different from that of these scabs that the name willow leaf rot is more descriptive of its injury. It is the imperfect or conidial stage *Fusicladium saliciperdum* that, as a parasite, causes the injury to the willows while the asco or perfect stage occurs on the old dead leaves as a saprophyte only.

We have no fixed opinion whether this disease is native or has been introduced. The fact that it is very closely related to the poplar scab, which is native and has been known for years but which in 1928 assumed unusual vigor, might indicate it is also a native disease that, because of very favorable conditions, has suddenly sprung into unusual prominence from which it may subside, as it does in Europe.

On the other hand, while found here on wild willows, it seems to be confined, so far as seen by us, to the general vicinity where serious outbreaks have occurred on willows planted as shade trees. This might indicate its introduction on foreign stock planted in some of these infected regions, as has been claimed by some.

The willow disease must not be confused with the injury of willow-leaf beetles whose larvæ cause serious damage to the leaves by eating out holes, often skeletonizing them completely.

*We are indebted for aid in obtaining data of various kinds for this paper to Messrs. E. M. Stoddard, A. D. McDonnell, A. A. Dunlap and Mrs. Lillian D. Kelsey, of the Botanical Department. Specimens of diseased willows, collected both within and outside the state, have been sent by a number of interested people. Permission was granted by Luther M. Keith of the State Highway Department to spray street trees and by Mr. and Mrs. Henry F. Parmelee, to spray trees on their estate; both at Norfolk, Conn. Alfred Rehder, of the Arnold Arboretum, has verified many of our willow determinations. Dr. C. W. Dodge, of the Farlow Cryptogamic Herbarium of Harvard, has helped us with the literature and exsiccati references. C. O. Erlanson, of the University of Michigan, sent us specimens of willow leaves recently collected in Greenland, upon which we found *Venturia chlorospora* in its asco stage. Written December, 1928.

Injury of this nature has also been very conspicuous in certain sections of New England in the past season. Seen from the distance it is difficult to tell which one is causing the trouble.

Cesati (17) discoverer of the saprophytic stage, Allescher and Tubeuf (7) first describers of the parasitic stage, Karsten (30, 31), Rostrup (47-52) and Aderhold (2--3) were some of the earlier European botanists who made notes on this fungus. Aderhold, of Germany, was the first to definitely associate the two stages as now understood. In an article (2, pp. 80—3) published in 1897 on the scabs of birch, pear, poplar, apple, willow and ash he described both stages of the scabs on these hosts, placing the imperfect stage of each under the form genus Fusicladium and the perfect stage under the genus Venturia. The names applied to the two stages of the willow scab were designated as *Fusicladium ramulosum*, now known as *F. saliciperdum*, and *Venturia chlorospora*.

Recent investigations have been carried on by two European botanists concerning the parasitic nature of this fungus and its action on the willow. Dr. Marie Schwarz (60), of Holland in 1922, published a paper dealing with this and other parasitic fungi found on a species of weeping willow, *Salix alba* var. *vitellina pendula*, in the parks at Utrecht in 1920. Mrs. N. L. Alcock(4,5), of Edinburgh, Scotland, has more recently published two short papers dealing with its action on willow rods, *Salix alba* var. *vitellina*. Like Dr. Schwarz, she found a variety of other fungi associated with the death of the leaves and twigs some of which, besides the scab, were apparently parasitic. However, there has been some doubt even after these investigations as to how important the scab was in such outbreaks. We have attempted in our investigations to clear up some of the doubtful points in its life history and to determine methods of control by spraying.

PART I. AMERICAN INVESTIGATIONS

Distribution

The willow scab in its conidial stage was first definitely recognized in Connecticut, at Norfolk, in late June, 1927. Mrs. Parmelee who wrote to the Experiment Station of injury to her willows had, however, noticed the trouble the year before, but the cause had not been determined. Our visit to Norfolk was made some time after the leaves had been killed (Plate X, a) and many had fallen, so that at first we were not sure of the cause, thinking possibly a late frost, which was said to have occurred, might have been responsible. Identification was made more difficult by the fact that many of the leaves showed no fruiting stage of this fungus while other fungi had become more or less prominent on the dead tissues. The responsible fungus was soon located,

compared and found identical with European specimens of the willow scab. Now that its characteristic appearances are known it is easily recognized by us if present on the dead leaves or twigs.

Soon after its location at Norfolk, information was received from various sources of its presence in restricted localities in eastern New York, western Massachusetts and in near by locations in Connecticut, on both willow trees and shrubs. On a visit during August of 1927, the senior author also found the disease causing great damage to large willow trees at Weymouth and Digby in Nova Scotia (Plate XI, a, c,) and to a less extent at Greenwich in New Brunswick, Canada, and although the auto trip also included all the New England states except Vermont, it was not observed further in any of these.

To date, in Connecticut, the disease has been surely located in sixteen towns in the northwestern part of the state. These towns are Bridgewater, Canaan, Cornwall, Goshen, Kent, Litchfield, Norfolk, North Canaan, Salisbury, Sharon, Southbury, Torrington, Warren, Waterbury, Winchester, Woodbury. However, in three or four other towns removed from that region, occasional dead twigs of certain species of willows have been found that superficially resembled those seen on the willows in the infected district but, as the fruiting stage of the fungus was not found on any of them, we have left their identification as extremely doubtful. It is quite possible that in these cases the injury, resembling fireblight, was caused by bacteria, since they were sometimes found in the dead tissues. Bacterial diseases of this nature have been described elsewhere but as yet we have made no special study of such a trouble in Connecticut.

A camping trip, in late June, 1928, made by the senior author with students at Keene, New Hampshire, disclosed the fungus abundant on some highway trees in the town of Dublin. It has also been reported to us as occurring prominently in the Bridgewater valley in Vermont, although we have received no specimens from that state. In August it was found by the junior author in New York state on the Hudson-Hillsdale highway. Specimens have also been sent to us from the Lebanon mountain region in New York, found on the road from Pittsfield to Albany.

In July of this year a short auto trip from Canaan, Conn., north into the Berkshires through Sheffield, Great Barrington, Southbridge, Lenox and Pittsfield, Massachusetts, revealed the disease as common along the highway on the trees and shrub willows at these places. This is a region where large willows are very common and form a conspicuous part of the landscape. Specimens from this part of Massachusetts have also been sent to us for determination. The disease was seen by Mr. McDonnell of the botanical department in the vicinity of Easthampton and Northampton, but we have no record of its presence further eastward in Massachusetts, though it has been looked for as far east as Boston and from there north to the Maine line.

Early in the summer of 1928, Maine specimens were sent us from Salisbury Cove, on Mt. Desert Island, and from Brooklin, both in Hancock county. Later, in August, the senior author made an auto trip along Route 1 of the National Highway and saw diseased trees common from the state line at Calais all the way south to Bath, but few below the latter city. These infected trees were at or near the following cities: Calais, Pembroke, Dennysville, East Machias, Machias, Whitneyville, Harrington (Plate XII, c), Cherryville, Ellsworth, Salisbury Cove (Plate XII, d), Bar Harbor, Blue Hill, Brooklin, Bucksport, Lincolnville, Camden, Wiscasset, Wells, Kittery Point. The disease was reported by other observers from Belfast, Waldoboro and Goulds-boro.

Previous to the Maine trip the senior author also visited Nova Scotia (including Cape Breton Island), Prince Edward Island and New Brunswick and saw the disease on the susceptible species *Salix alba* var. *vitellina* practically everywhere it occurred over the 1200 miles traveled by auto. This species is a common street and shade tree in this region. The towns, or vicinities near them, where the disease was seen were as follows: In Nova Scotia proper at Yarmouth, Argyle, Shelburne, Liverpool, Bridgewater, Lunenburg, Mahone Bay, Hubbards, Black Point, St. Margarets Bay, Halifax, Waverly, Oakfield, Enfield, Stubenacadia, Stewiacke (Plate XI, b), Brookfield, Truro, New Glasgow, James River, Antigonish, Heatherton, Afton, Monastery; in Cape Breton Island at Margaree Forks, Margaree Harbor (Plate XI, d), Cheticamp, Badeek, Sydney, Big Pond, Big Pond Center, Cleveland; in Prince Edward Island at Charlottetown, North River, New Haven (Plate XII, a); in New Brunswick, at Cape Tormentine, Sackville, Moncton, (Plate XII, b), Salisbury, Sussex, Hampton, St. George, St. Andrews and at various places between those last mentioned. We also understand that the disease has been found in Quebec though we have seen no specimens from there.

Hosts

Fusicladium Stage:

More attention has been paid by us to determine the species of willows attacked in Connecticut than elsewhere, so most of the species reported here are from this state. Those on which we have found the fungus are as follows:

1. *Salix alba*: Conn., Me.
2. *S. alba* var *vitellina*: Conn., Mass., Me., N. H. (this may be *S. alba* x *fragilis* = *S. rubens*, according to Rehder), N. Y., Vt.; N. Scotia proper, C. Breton Isl., P. Edw. Isl., N. Brunsw.
3. *S. cordata*: Conn., Mass.; P. Edw. Isl.
4. *S. discolor*: Conn.

5. *S. lucida*: Conn.
6. *S. nigra*: Conn., Mass., N. Y.
7. *S. pentandra*: Conn., Me.; N. Scotia proper.
8. *S. sericea*: Conn.
9. *Salix* sps. undet.: Conn., Me.; N. Scotia.

Venturia Stage:

From literature we have learned of the North American distribution of the asco stage as follows:

1. *Salix arctica:* Ellesmere Isl. (Rostrup), Greenland (Lind).
2. *S. arctica* var. *Brownei*: Greenland (Lind).
3. *S. glauca*: Greenland (Rostrup).
4. *S. grænlandica:* Greenland (Rostrup).
5. *S. herbacea:* Greenland (Rostrup).
6. *S. reticulata:* Greenland (Lind).

Besides the above we have recently received specimens of dead willow leaves collected June 1, 1928, at Englishman's Harbor, Disko Island, Greenland, by C. O. Erlanson of the University of Michigan. The leaves were collected for *Rhytisma salicinum* (Pers.) Fr., but also had other minute ascomycetes on them. On one of the leaves of these we found the asco stage of *Venturia chlorospora*, (spores more nearly var. *canescens* as they varied from 5.5-8*u* x 16-21*u*, chiefly 16-18*u*, and the asci from 14.5-16.5*u* x 48-54*u*, bristles on perithecia infrequent, perithecia commonly 90-100*u* in diameter), on this additional following host:

7. *S. chloroclados* x *glauca:* Greenland (Erlanson).

Susceptibility and Resistance

There seems to be at least some difference in the susceptibility of different species of willows to this fungus (Plate IX, a-b, free). There has also been quite a difference in its attack on susceptible individual trees and shrubs of the same kind even when growing close together. This latter difference we explain on the supposition that the disease had previously become well established on the badly infected plants, through overwintering on the branches, but not as yet on the less infected individuals and that the spores are washed or carried over the former much more readily than to adjacent plants. In time, however, if conditions prove favorable, the latter should become badly infected. For example, along the highway from Norfolk to Canaan there are numerous large willows, some apparently of the same variety as those in the village yet the disease gradually decreases outside of Norfolk to become inconspicuous at Canaan several miles distant. Some of these trees, however, may be crosses with *Salix alba* (Plate IX, c). At Calais, Maine, there is a row of *Salix alba* var.

vitellina of about a dozen trees reaching from the water to the highway. Those next the road were badly diseased in August, 1928, while those near the water (Plate IX, d) showed very little injury.

On the other hand *Salix alba* (Plate IX, a, shows catalpa and willow), although reported infected in Europe, seems to be resistant here, since we have rarely found it on that species even where the disease exists nearby on its variety *vitellina* which is the most susceptible of all the willows yet observed.

On two of the estates at Norfolk are several trees determined by us as the Bay-leaf willow, *Salix pentandra*, but although these are very near badly diseased trees no disease was found on them in 1927 and only occasional infected leaves in 1928. This species, however, seems to be one of those infected in Maine, although not as seriously as var. *vitellina*. *Salix nigra* is another large shade tree that has been rather badly injured though the fungus does not seem to fruit so abundantly on it. *Salix cordata* (Plate X, c) is apparently the most susceptible of the native willow shrubs. So far we have not seen the disease on the weeping willow, *Salix babylonica*, although it occurs occasionally in the infected regions and is reported from Europe as a host.

Injury to Trees

The worst injury to large trees, mostly *Salix alba* var. *vitellina*, was seen at Norfolk, Conn. (Plate X, b), Hancock county, Maine, and general in Nova Scotia. In the last region, according to a farmer interviewed, the disease, as in Connecticut, appeared conspicuously in 1926 but much more so in 1927. When first seen by the senior author in August of the latter year (Plate XI, a, c), some of the large trees had no, or very few, leaves on them and could easily be mistaken for dead trees. In 1928 in different parts of Nova Scotia hundreds of dead trees were seen and many more so badly injured that another season's attack was likely to finish them (Plate XI, b, d). The situation in Maine, in Hancock county along the coast (Plate XII, c, d), was not much better.

At Norfolk, by the end of June, 1927, the very large trees of *Salix alba* var. *vitellina*, which are conspicuous shade trees in the village, were partly to largely defoliated although later some new leaves were put out. In 1928, with an unusually wet spring and summer, by the first of August there was not a single untreated tree of this variety (Plate X, b) that was not completely or very nearly completely defoliated and very few if any new leaves were put out. It looks as if many of these trees were doomed, as they have gone through at least three seasons of more or less complete defoliation, and early this season most of the smaller twigs and many of the large branches were dead. Already several fairly young trees have been killed or so severely injured that only the

main trunks are alive. These trees were so weakened by the general attack on the leaves and young twigs very early in the several seasons that starvation and winter injury killed the large branches which were not directly attacked.

Bad as healthy willows are in littering the ground with dead twigs, after passing through last winter, the litter of twigs on the ground under the infected trees was unusually conspicuous, although only a comparatively few had yet broken off. We have seen no fungous disease of trees where the injury has been so sudden and severe as from this fungus, though the chestnut blight and the white pine blister rust in the long run cause more serious financial loss and eventually just as serious injury to the trees.

The fungus carries over the winter on the young twigs infected the previous year. In the spring the Fusicladium stage appears on these and the spores are washed down on the very young leaves in the opening buds, so that their death may occur before they have reached any size, much as occurs with the leaves of the sycamore from the anthracnose fungus. Some young leaves, however, escape infection only to succumb later. If the moist favorable weather continues, nearly full grown, or even full grown, leaves may suddenly rot on the trees and adhere there for some time, presenting a very mournful sight. They then dry up and gradually fall off leaving the trees more or less completely defoliated. Bad defoliation two or three years in succession seems to be fatal since after the first year, little adventitious foliage is put out and gradual starvation results.

If the tissues of the leaves are fairly mature when first infected, the infection may stop after killing spots of varying size in the otherwise healthy green tissues (Plate XIII, b). Often where the large, but still young, leaves are attacked the rot spreads down the midrib to the base killing the tissues as it advances. Quite frequently in these cases it reaches through the petiole into the tissues of the young twigs and causes a more or less conspicuous canker there (Plate XIII, a). If girdling occurs the twig, with its attached leaves above, soon dies. These dead twigs and leaves assume a reddish-brown or blackish color according to the species of willow. The fruiting stage may or may not be found on the dead twigs and leaves, apparently developing much more on some willow species than on others and, of course, not developing on tissues that have been indirectly killed by the action of the fungus.

The Fungus

The spring and summer of 1928 were unusually favorable not only for this scab but for all related scabs. Apple scab obtained an early start and its injury was much greater than in ordinary years; Pear scab, too, was more prominent than usual. Although known in New England for some time, we had not previously

listed the Poplar scab, *Fusicladium radiosum* (Lib.) Lind (*F. ramulosum, F. Tremulae*) from Connecticut. This year it has been found common not only in this state but in New Hampshire, Vermont and Massachusetts.

The chief aid in identifying the presence of the willow scab is the characteristic appearance of its fruiting stage. This develops usually on the under side of the leaves but is rather infrequent on the cankered areas of the young twigs. It may appear on these latter next year in early spring and produce the first infection of the leaves. It shows on the leaves as small dense olive-brown pustules which more or less cover the surface, but which particularly follow the downward course of the larger veins and especially the midrib (Plate XV, a).

The spores are olive to reddish-brown in color. They are truncate at the base, generally rounded at the apex, and have one, rarely two, or very rarely three septa. They vary from 12*u* to 25*u* long and from 6*u* to 10*u* wide. When two-celled, the basal cell is usually considerably longer and is somewhat broader (Plate XV, d). They are borne singly at the tips of the conidiophores. Apparently only one spore is formed on each conidiophore.

In cultures there is formed a dense velvety olive-brown growth on which the spores are usually abundantly developed in two to three weeks (Plate XV, b). The spores are somewhat larger than in nature, varying from 9-12*u* x 18-36*u*, and largely disappear through germination in old cultures. With age the mycelium is of similar color to the spores, moderately septate and branched and varies from 2.5*u* to 7.5*u*, chiefly 4-6*u*, in diameter. Not infrequently rounded, larger cells (9-15*u*) occur in the mycelium but are not thickened like chlamydospores. In old cultures imperfect perithecia appear somewhat sparingly. We have not yet been able by crossing with other species of Fusicladium or by stimulation to bring them to maturity. They appear similar to the immature perithecia we have found on sections of leaves, mentioned later.

The conidiophores on the leaves are closly compacted together to form the fruiting pustule. They arise from a more or less extended sclerotial mass of rounded cells (Plate XV, c) from which they are not always very clearly marked off. In general their erect habit, their brownish color, about the same as that of the spores, and their separation from each other above serve to distinguish them. They have one to several septa and at their base they gradually merge into the cells of the sclerotial mass. As a rule they are as long or longer than the spores and slightly narrower. Occasionally sections through the old leaves show more elongated, fewer and laxly clustered conidiophores that have borne spores both at and near their tips. We believe that these are always the conidiophores of the saprophytic Cladosporium.

Although the writers have made attempts to locate the Venturia stage of this fungus as described by Aderhold on the old leaves, have searched the twigs and leaves during the growing season and examined them especially at the time in the spring when infections from this stage would naturally take place, we have as yet failed to find it. Occasionally, however, in the sections made of infected leaves taken from the trees, we have found immature perithecia closely associated with the Fusicladium that may be the asco stage. Apparently, no one has yet made cultures from the Venturia stage and by this means, or by inoculations, proved its relationship to the Fusicladium. We have little doubt that the Venturia fungus eventually will be found here. We do doubt, however, if it is the asco stage, that it is as important in primary infection (unless occurring on the twigs on which it has not yet been reported) as the Fusicladium stage produced in early spring on the twigs from the overwintered cankers. This condition has also been found to be true with certain hosts of the pear and apple scabs in Connecticut and in England.

Associated Fungi

As stated earlier in the paper, certain of the workers with the Fusicladium stage of this fungus have found other fungi associated with it, some of which they have considered parasites and so apparently responsible for part of the trouble in the outbreak. Dr. Schwarz (60), for example, mentions three parasitic fungi, one of which, *Phoma intricans*, is described as new. The second is an ascomycete belonging to the genus Physalospora, determined by her as *P. Salicis* (Fckl.) Rab. She also notes that two other species of Physalospora, *P. gregaria* Sacc. and *P. Miyabeana* Fuk., have been mentioned as parasites of the willow. Lastly she gives *Discella carbonacea* (Fr.) Berk. & Br. as the third parasite.

Mrs. Alcock (5) in her article mentions the following fungi occurring on willow rods as parasites of greater or less intensity: *Physalospora gregaria* Sacc., *Cryptomyces maximus* (Fr.) Rhem, *Scleroderris fuliginosa* (Pers.) Karst. and *Myxosporium scutellatum* (Otth) Petrak.

Very recently Nattrass (42, 43), of England, has published articles on the parasitism of *Physalospora Miyabeana* Fuk., in relation to *Fusicladium saliciperdum*, as a cause of the disease of willows. Contrary to other investigators he is inclined to believe that the willow scab, at least in England, plays a secondary part to the Physalospora. He makes the following statement at the conclusion of his second article (43): "From these preliminary observations and experiments it appears that on the basket willow in Somerset *F. saliciperdum* cannot be regarded other than as a follower of *P. Miyabeana* and that it is in no way responsible for the symptoms of the disease on the leaves."