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Forty-fifth Annual Report

OF

The Connecticut Agricultural Experiment Station

Being the annual report for the year ending October 31

1921

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THE BOARD OF CONTROL.

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NEW HAVEN, CONN.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

February, 1922.

BOARD OF CONTROL.

His Excellency, Everett J. Lake, *ex-officio, President.*

James H. Webb, *Vice President*.....Hamden
George A. Hopson, *Secretary*.....Mt. Carmel
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Joseph W. Alsop.....Avon
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STAFF.

Administration.

E. H. JENKINS, PH.D., *Director and Treasurer.*
MISS V. E. COLE, *Librarian and Stenographer.*
MISS L. M. BRAUTLECHT, *Bookkeeper and Stenographer.*
MISS J. V. BERGER, *Stenographer.*
WILLIAM VEITCH, *In charge of Buildings and Grounds.*

Chemistry, Analytical Laboratory.

E. M. BAILEY, PH.D., *Chemist in Charge.*
R. E. ANDREW, M.A., C. E. SHEPARD, H. D. EDMOND, B.S., OWEN L. NOLAN, R. T. MERWIN, H. J. FISHER, B.A. — *Assistant Chemists.*
FRANK SHELDON, *Laboratory Assistant.*
V. L. CHURCHILL, *Sampling Agent.*
MISS ALTA H. MOSS, *Clerk.*

Biochemical Laboratory.

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

Botany.

G. P. CLINTON, SC.D., *Botanist in Charge.*
E. M. STODDARD, B.S. *Pomologist.*
MISS FLORENCE A. MCCORMICK, PH.D., *Pathologist.*
G. E. GRAHAM, *General Assistant.*
MRS. W. W. KELSEY, *Stenographer.*

Entomology.

W. E. BRITTON, PH.D., *Entomologist in charge; State Entomologist.*
B. H. WALDEN, B.AGR., M. P. ZAPPE, B.S., PHILIP GARMAN, PH.D., — *Assistant Entomologists.*
JOHN T. ASHWORTH, *Deputy in Charge of Gipsy Moth Work.*
SAMUEL T. SEALY, *Deputy in Charge of Mosquito Control.*
MISS GLADYS M. FINLEY, *Stenographer.*

Forestry.

WALTER O. FILLEY, *Forester in charge.*
A. E. Moss, M.F., H. W. HICOCK, M.F., — *Assistant Foresters.*
MISS PAULINE A. MERCHANT, *Stenographer.*

Plant Breeding.

DONALD F. JONES, *Plant Breeder in charge.*
P. C. MANGELSDORF, B.S., *Assistant.*

Tobacco Station.

G. H. CHAPMAN, PH.D., Windsor, Conn.

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ERRATA

Report for 1921:

In the Report for 1920, page 346, eighth line from bottom, for not renewed, read June 16, 1921.

On same page, fifth line from bottom, for not renewed, read April 4, 1921.

Report for 1922:

Page 78. First line of table, for potash read potato.

Page 100. Strike out the first and second lines in the table and insert in their place the last three lines of the same table.

Page 106. 20th line, near middle of page, for 16008, read 16608.

Bulletin 233, page 37. 23d line from top, after 1614 insert arcadian sulphate of ammonia, made by Barrett Co., N. Y. City; and in same line for New York read Bridgeport.

Report of the Board of Control

OF

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

To His Excellency, Everett J. Lake, Governor of Connecticut:

As required by Statute, the Board of Control of the Connecticut Agricultural Experiment Station herewith submits its annual report for the year ending Oct. 31, 1921.

The General Assembly (Chapter 193, Public Acts, January Session, 1921), provided for the appointment of a State Forester by the State Park and Forest Commission, repealing the Statute which made him an appointee of this Station. This relieves the Station Forester of much administrative work and gives greater opportunity for experimental work in forestry.

The General Assembly made the following biennial appropriations for the maintenance of this Station and for the work required of the Station staff by Statute.

Current expenses	$82,000	
Food and drug inspection	15,000	
Suppression of gipsy and browntail moths and inspection of imported nursery stock	60,000	
Bee diseases	4,000	
Control of white-pine blister-rust	10,000	
Mosquito elimination	12,000	
State Entomologist	25,000	
Total		$208,000

The Assembly also appropriated to this board, for the biennial period, $10,000 for research and experiment on the causes and prevention of diseases and injuries to the Connecticut tobacco crop and for the improvement of the crop by selection and breeding and by coöperative experiments with growers.

The Station has secured a tract of land of thirteen and one-half acres, well suited for the work, without any expenditure of State funds, and has begun experimental work on it.

The Connecticut Valley Tobacco Improvement Association has been organized by growers and packers of tobacco in Connecticut and Massachusetts, and funds have been raised for the same object as that for which the State appropriation was made. Dr. G. H. Chapman, formerly of the Massachusetts Agricultural Station, has been appointed as research director, an arrangement has been made by which Dr. Chapman is added to the Staff of this Station, and the two agencies propose to work in the closest coöperation.

The changes in the Station staff have been few. Mr. C. D. Hubbell, assistant to the plant breeder, resigned on April first, and Mr. P. C. Mangelsdorf was appointed in his place July first. Mr. H. D. Edmond, chemist, was given leave of absence in November, 1920, on account of serious illness, and Mr. R. N. Copeland served temporarily as chemist from March first to September first. Mr. H. J. Fisher was appointed as chemist in October, 1921.

In view of the fact that the salaries paid here have been considerably lower than for service of the same character in many other institutions, the fact that so few changes have occurred here within recent years is a tribute to the loyalty of the members of the Staff of this institution for which we wish to record our grateful appreciation.

The report of the Director now in the printer's hands gives in brief outline the character and results of this Station's work during the year just closed, and will be submitted to you as soon as it appears.

Respectfully submitted,

GEORGE A. HOPSON,
Secretary.

REPORT OF THE TREASURER

July 1, 1920 - June 30, 1921

E. H. JENKINS, in account with THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION for the fiscal year ending June 30, 1921.

RECEIPTS.

Balance on hand, July 1, 1920 (Analysis Fees) ...		$13.45
State Appropriation (General)	$22,500.00	
State Appropriation (Transfer from Blister-Rust Appropriation)	500.00	
State Appropriation (Food)	2,500.00	
State Appropriation (Food Deficiency)	5,200.00	
State Appropriation (Insect Pest)	7,500.00	
United States Appropriation (Hatch)	7,500.00	
United States Appropriation (Adams)	7,500.00	
Fertilizer Analysis Fees	17,000.00	
Lockwood Trust Income (including sale of tree seedlings and Mt. Carmel Farm Produce)	10,500.00	
Interest on Bank Deposits	85.03	
Connecticut State Department of Health (rent) ..	200.00	
Connecticut Agricultural College (for A. E. Moss)	1,500.00	
Sales of Gasoline and Oil	378.92	
Sale of Station Produce	1.00	
Miscellaneous	56.69	
Court Fees (E. H. Jenkins)	1.00	
Court Fees (E. M. Bailey)	70.23	
		82,992.87
		$83,006.32

DISBURSEMENTS.

E. H. Jenkins, director (salary)	$2,800.00
E. H. Jenkins, treasurer "	400.00
V. E. Cole (salary)	1,375.00
L. M. Brautlecht "	975.00
T. B. Osborne "	3,150.00
E. M. Bailey "	3,100.00
C. E. Shepard "	2,100.00
W. E. Britton "	3,100.00
G. P. Clinton "	3,100.00
E. M. Stoddard "	2,225.00
W. O. Filley "	3,100.00
A. E. Moss "	2,500.00
F. A. McCormick "	1,058.33
D. F. Jones "	3,075.00
R. E. Andrew "	2,625.00
R. N. Copeland "	566.66

H. D. Edmond	(salary)	$1,100.00
V. L. Churchill	"	1,275.00
Wm. Veitch	"	987.50
P. A. Merchant	"	480.00
G. E. Graham	"	1,375.00
C. D. Hubbell	"	695.00
H. W. Hicock	"	300.00
Alta H. Moss	"	897.00
Mrs. L. D. Kelsey	"	663.33
Owen Nolan	"	1,635.00
D. Paguirigan	"	116.67
Frank Sheldon	"	975.00
G. A. Hopson	"	353.15
Marion Pickett		24.20
Clara L. Weed		253.86
Jane V. Berger		553.33
Henry Kiley		1,394.00
Herbert W. Edwards		1,394.00
Oliver J. Welch		1,295.00
Thomas F. Barrows		756.00
Thomas O'Donnell		80.67
Richard Merwin		934.00
Ervin Applegate		72.00
Labor		4,781.41
Publications		527.15
Postage		231.54
Stationery		532.12
Telephone and Telegraph		240.01
Freight and Express		181.31
Gas, Electricity and Kerosene		1,327.97
Coal		3,759.62
Water		123.30
Chemicals		1,000.76
Laboratory Supplies		687.07
Seeds, Plants, etc.		176.63
Agricultural and Horticultural Supplies		113.60
Food Samples		20.57
Ice		118.75
Photographic Supplies		113.26
Automobile Oil		69.68
Miscellaneous Supplies		515.99
Fertilizers		392.70
Feeding Stuffs		433.35
Library (Books and Periodicals)		495.03
Library (Binding)		135.65
Tools, Machinery and Appliances		552.66
Tools, Machinery and Appliances (Repairs)		1,006.19
Furniture and Fixtures		437.79
Furniture and Fixtures (Repairs)		114.74
Scientific Apparatus		154.15
Scientific Apparatus (Repairs)		6.65
Live Stock		57.50
Traveling by the Board		142.09
Traveling by the Staff		1,220.38
Gasoline for Automobiles		804.17
Traveling in connection with Adams Fund Investigations		69.54
Insurance		882.27
Insect Pest Appropriation to State Entomologist		7,500.00

Contingent	$426.64	
Buildings (New)	30.00	
Buildings and Land (Betterments)	107.03	
Buildings and Land (Repairs)	617.13	
Total Disbursements		$82,966.10
Balance on hand, June 30, 1921 (Analysis Fees)		40.22
		$83,006.32

NEW HAVEN, CONN., Aug. 5, 1921.

THIS IS TO CERTIFY that we have examined the accounts of E. H. Jenkins, Treasurer of the Agricultural Experiment Station, for the fiscal year ending June 30, 1921, and have found them correct.

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

REPORT OF
E. H. JENKINS, DIRECTOR,
in Account with
MOSQUITO ELIMINATION APPROPRIATION
for the two years ended June 30, 1921.

Receipts

		July 1, 1919, to June 30, 1921
Petty Cash Fund from B. H. Walden, May 1, 1920		$500.00
From State Comptroller for vouchers sent by		
B. H. Walden	$2,006.49	
E. H. Jenkins	11,549.38	
		$13,555.87
Total		$14,055.87

Expenditures

	July 1, 1919, to June 30, 1920	July 1, 1920, to June 30, 1921	
B. H. Walden (salary)	$499.98	.....	$499.98
S. T. Sealy (salary)	424.04	$2,100.00	2,524.04
Nicholas Matiuck (labor)	440.00	700.00	1,140.00
Prokofee Mickevich (labor)	237.00	.....	237.00
J. W. Draper (labor)	269.50	.....	269.50
A. Davidiuk (labor)	182.97	.....	182.97
Russell Bartlett (labor)	217.88	281.25	499.13
L. E. Rice and others (labor)	85.50	729.50	815.00
Town of Guilford for Frank Blatchley (labor)	90.00	687.65	777.65
John Lubeck (labor)	102.50	.....	102.50
Yakop Faidash (labor)	61.00	17.50	78.50
Henry Pawlikowski (labor)	72.90	42.30	115.20
Jake Hauser (labor)	23.75	.....	23.75
Jos. Hauser (labor)	11.03	.....	11.03
John Faidash (labor)	4.50	.....	4.50
Stephen Osmolek (labor)	4.50	38.50	43.00
Jos. Krivenski (labor)	.....	235.00	235.00
J. D. O'Shea (labor)	.....	314.84	314.84
F. D. Luddington (labor)	.....	274.00	274.00
R. E. Fitch (labor)	.....	248.66	248.66
E. Barton (labor)	.....	98.38	98.38
F. Williams (labor)	.....	32.00	32.00
John Kosch (labor)	.....	82.00	82.00
A. Antczak (labor)	.....	198.03	198.03
Frank Kudlicki (labor)	.....	196.08	196.08
George Davis (labor)	.....	187.93	187.93
Roy Clinton (labor)	.....	238.68	238.68
Elon Bragg (labor)	.....	171.50	171.50
John Gilbert (labor)	.....	234.13	234.13

Frank Toth (labor)	.....	$ 45.50	$ 45.50
Eaton, Brown & Simpson (ditching)	.....	250.00	250.00
Labor (extra)	$ 1.35	.....	1.35
Stationery	.....	92.03	92.03
Postage	.....	4.65	4.65
Telephone and Telegraph	3.08	3.85	6.93
Team and Horse Hire and Carting	48.25	101.15	149.40
Freight and Express	.59	1.51	2.10
Oil for Mosquitoes	81.94	8.82	90.76
Miscellaneous Supplies	26.15	57.95	84.10
Automobile Supplies	.....	2.50	2.50
Automobile Oil	4.25	4.35	8.60
Automobile (new purchase)	650.00	.....	650.00
Automobile (repairs)	76.82	826.84	903.66
Tools, Machinery and Appliances	24.45	36.90	61.35
Tile, Lumber, Cement, etc.	174.42	.....	174.42
Tide-Water Gates	.....	520.00	520.00
Furniture and Fixtures	.....	27.38	27.38
Scientific Apparatus	.....	38.48	38.48
Automobile Insurance	73.60	56.90	130.50
Contingent	4.00	.....	4.00
Travel	110.24	144.90	255.14
Travel (gasoline for automobile)	17.90	200.14	218.04
Total	$4,024.09	$9,531.78	$13,555.87

Balance on hand, June 30, 1921 (Petty Cash Fund)	$500.00

Of the total amount expended in two years as above ($13,555.87), there was spent for

Supervision: Maintenance of old work	$5,351.77	
Supervision: New work	43.12	
		$5,394.89
New Work (Groton)		250.00
*Maintenance:		
Madison	$531.13	
Guilford	798.64	
Branford	1,561.40	
East Haven	75.42	
New Haven	1,314.20	
Orange	643.16	
Fairfield	2,830.88	
Groton	72.00	
Stamford	84.15	
		$7,910.98
		$13,555.87

*Of the expense of maintenance in the towns, three-quarters is to be paid by the towns, as follows: Madison, $398.34; Guilford, $598.98; Branford, $1,171.06; East Haven, $56.57; New Haven, $985.65; Orange, $482.36; Fairfield, $2,123.16; Groton, $54.00; Stamford, $63.11.—Total, $5,933.23.

CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

NEW HAVEN, CONN.

BULLETIN 232 OCTOBER, 1921

Report of the Director

For the Year ending October 31, 1921

By E. H. Jenkins

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

OCTOBER, 1921

BOARD OF CONTROL.

His Excellency, Everett J. Lake, *ex-officio, President.*

James H. Webb, *Vice President* ..... Hamden
George A. Hopson, *Secretary* ..... Mt. Carmel
E. H. Jenkins, *Director and Treasurer* ..... New Haven
Joseph W. Alsop ..... Avon
Charles R. Treat ..... Orange
Elijah Rogers ..... Southington
William H. Hall ..... South Willington

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MISS J. V. BERGER, *Stenographer.*
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Chemistry:

Analytical Laboratory.
E. MONROE BAILEY, PH.D., *Chemist in Charge.*
R. E. ANDREW, M.A.
C. E. SHEPARD, H. D. EDMOND, B.S., OWEN L. NOLAN, RICHARD MERWIN, HARRY J. FISHER, B.A. — *Assistant Chemists.*
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MISS FLORENCE A. MCCORMICK, PH.D., *Pathologist.*
G. E. GRAHAM, *Assistant.*
MRS. W W. KELSEY, *Secretary.*

Entomology.
W. E. BRITTON, PH.D., *Entomologist in Charge; State Entomologist.*
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H. W. HICOCK, M.F., *Assistant.*
MISS PAULINE A. MERCHANT, *Stenographer.*

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

In charge of the Tobacco Station.
G. H. CHAPMAN, PH.D., Windsor, Conn.

Report of the Director

FOR THE YEAR ENDING OCTOBER 31ST, 1921.

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

A formal report of your Board to the Governor of the State is made annually. This, however, is not distributed with the bulletins and is therefore not generally seen by the public.

It seems wise, therefore, to give some brief summary of this Station's work in a form which can be read by all who are interested.

While much of the Station's work is fundamental and essential to the teaching of the Agricultural College and of the Extension Service, it is done without advertising and does not attract public notice, so that the needs of the Station and the importance of its work are quite generally overlooked. In addition to doing this agricultural research work this Station has become during the forty-six years of its life an agency of public service, primarily agricultural, but serving in large measure all the citizens of the State.

BIOCHEMICAL DEPARTMENT.

Dr. T. B. Osborne in charge.

Two projects are being studied in this department.

One of them, in charge of Dr. Osborne, is a study of the chemistry of the different proteins.

Another problem, closely related, in which Dr. Osborne and Dr. L. B. Mendel of Yale University are collaborating, is a study of the relative values of these proteins in nutrition. This has necessarily involved a study of all other factors of nutrition. Thus it has led to the discovery of the fat-soluble vitamine (coincidentally with its discovery by another investigator) and to further knowledge of the rôle of the other ingredients of the diet as well as to the perfection of artificial rations which have opened a wider field for study of fundamental problems. The first project was undertaken about thirty years ago by Dr. Osborne, long before the Adams fund was provided by Congress. The published results of these two researches have contributed largely to a new conception of the nature and composition of the proteins and their different values in nutrition, and have finally demonstrated the falsity of the assumption that the proteins of food are about alike in nutritive value, having shown that some are incapable of supporting the growth and even the life of animals, and that the others differ very considerably in their effectiveness.

The work of the present year may be briefly noticed as follows:

A method has been devised by which a ration for experimental animals can be prepared in which fat is at most a minimal contamination. On such rations young rats quadrupled their weight in the usual time and appeared as well nourished as rats which had liberal amounts of fat in their diets. Unless, therefore, a minute amount of fat plays as important a part in assimilation as do the vitamines, it is reasonable to assume that pure fats are not an essential part of the mammalian diet.

The same kind of experiment was then carried on with carbohydrates. A ration was prepared in which the amount of carbohydrates was at most exceedingly small. In some of these trials the rats grew from early age to adult size at a rate rarely exceeded on normal rations. A chemical analysis of the entire bodies of some of them showed that they contained practically as much glycogen as is found in rats fed on diets in which carbohydrates are abundant, indicating that the rat can manufacture the necessary supply of tissue carbohydrates from non-carbohydrate material, and can also supply its energy from other sources than carbohydrates.

Next an experiment was tried of excluding *both* carbohydrates and fat from the diet, which then contained more than 90 percent of protein, 5 percent of inorganic salts along with small daily doses of vitamines in dried alfalfa and brewery yeast, thus forcing the animal to meet its energy requirement from protein alone. In these trials, which are still in progress, the rats have grown at more than normal rate to about 225 grams, but subsequent growth has been much slower so that the final outcome is uncertain.

Trials with variable quantities of vitamine B, in rations which were otherwise identical, show a quantitative relation between the amount of vitamines fed and the gain in weight.

The record of 1,000 rats which have been under experiment here show that ophthalmia has appeared only in rats deprived of the fat-soluble vitamine, but never in those weakened by any other disease or defect of diet, and never has it "spread," though the ophthalmic rats have been close to those which did not have the disease. This strongly indicates that xerophthalmia is purely a food-deficiency disease and is not infectious.

In view of the question frequently asked whether dried milk is deficient in vitamines, it is worth while noting that in this laboratory rats have grown from early age to full adult size, for more than a year, on dried milk powder, corn starch and lard.

Dr. Osborne has undertaken the study of the proteins of green or growing plants; a study of extreme difficulty, but in which the experience of many years in the study of reserve proteins of seeds is of great value. This is a very important field of study which

apparently has received no attention because of its great difficulties.

The work above described is of fundamental importance. Its results may not be immediately applied to feeding practice, but it provides the basis on which most rational experimental work on feeding problems can be securely placed.

The co-operative exhibits for the meeting of the American Medical Association and of the National Child Welfare Association have been noticed in the report of the Chemical Department.

The results of the work of the biochemical laboratory are published in scientific journals. Following is a list of those which have appeared during the present year:

Skimmed Milk as a Supplement to Corn in Feeding. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLIV, 1-4.

Growth on Diets Poor in True Fats. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1920) XLV, 145-152.

A Critique of Experiments with Diets Free from Fat-Soluble Vitamine. Thomas B. Osborne and Lafayette B. Mendel. Jour. Biol. Chem. (1921) XLV, 277-288.

The Effect of Alkali on the Efficiency of the Water-Soluble Vitamine B. Thomas B. Osborne and Charles S. Leavenworth. Jour. Biol. Chem. (1921) XLV, 423-426.

Does Growth Require Preformed Carbohydrate in the Diet? Thomas B. Osborne and Lafayette B. Mendel. Proc. Soc. Exper. Biol. and Med. (1921) XVIII, 136-137.

Growth on Diets Containing More than Ninety Per Cent of Protein. Thomas B. Osborne and Lafayette B. Mendel. Proc. Soc. Exper. Biol. and Med. (1921) XVIII, 167-168.

Ophthalmia and Diet. Thomas B. Osborne and Lafayette B. Mendel. Jour. Am. Med. Assn. (1921) LXXVI, 905-908.

La oftalmia y el regimen. Thomas B. Osborne and Lafayette B. Mendel. Jour. Am. Med. Assn. Edicion Espanol. (1921) V, 503-506.

Anaphylaxis Reactions with Purified Proteins from Milk. H. Gideon Wells and Thomas B. Osborne. Jour. Infect. Dis. (1921), XXIX, 200-216.

The Botanical Department.

Dr. G. P. Clinton in charge.

This department, in co-operation with the Entomological Department and with Mr. B. A. Porter of the U. S. Bureau of Entomology, has conducted rather elaborate experiments on the comparative efficiency of dusting *versus* spraying apples and peaches to combat insect and fungous pests. Mr. Stoddard was the co-operating member from this department. This is a continuance of similar tests made last year on apples.

For this work the apple orchards of Messrs. W. F. Platt and F. N. Platt at Milford were used and the Station's orchard at Mt. Carmel. The experiments with peaches were carried on at Mr. M. L. Coleman's orchard at Cheshire and the Station's orchard at Mt. Carmel. The number of trees involved was 1,017, and the fruit individually examined and scored amounted to about 334 barrels of apples and 1,715 baskets of peaches.

The work on the improvement of sweet-corn seed, now in its second year, has been done by Mr. Stoddard at the farms of Mr. C. R. Treat of Orange, and the E. B. Clark Seed Co. of Milford, with gratifying results and will be continued for another year at least.

Data have been gathered on the condition and yield of the individual trees in the fertilizer tests at the Barnes experimental peach orchard, now in the tenth bearing year.

Studies of the white-pine blister-rust have been continued and the results partially prepared for publication by Dr. Clinton and Dr. McCormick. These include work on some other rusts.

A tobacco disease survey has been carried on, chiefly by Dr. Clinton, the results to be published as soon as other work will permit.

A study of the wild-fire of tobacco has taken most of the time of Dr. Clinton, Dr. McCormick and Mr. Graham during the past summer. It is hoped to prepare the results shortly for publication.

Dr. McCormick has made life-history studies of the *Thielavia basicola* (root rot of tobacco) and has brought to light the ascospores of this fungus in artificial cultures.

Cultures of miscellaneous fungi, especially of *Pythium*, have been obtained and are being studied by Dr. Clinton and Dr. McCormick.

Eight hundred and sixty-two samples of agricultural seeds have been tested for various growers, besides about 2,000 ears of sweet corn for the seed-corn selection work of the Station, and also the ears of twenty-five barrels of sweet corn for the E. B. Clark Seed Co., for selection of their seed stock planting.

Three hundred and eighty-two specimens have been added to the herbarium, which now numbers nearly 48,500 specimens.

The Chemical Department.

Dr. E. M. Bailey in charge.

The time of this department is largely occupied with the chemical examination of fertilizers, feeding stuffs, human foods and drugs, as required by statute and with analyses required by experimental field work at this Station and at Storrs. Six hundred and three samples of commercial and other fodder materials, more than one thousand samples of commercial and other fertilizers, and about twenty-two hundred samples of foods, drugs and miscellaneous materials have been examined and the results have been published or are being prepared for publication. Ten hundred and sixty-nine pieces of Babcock glassware have been tested and certified for creameries and individuals in this state. Of the number tested, about one percent were found inaccurate and so marked.

In collaboration with the Biochemical Department an educational exhibit was prepared and exhibited at the annual meeting of the American Medical Association held in Boston. It consisted of stuffed experimental animals, photographs and charts showing the results of various lines of investigations. A descriptive leaflet was also distributed. A similar exhibit was prepared for the meeting of the American Child Hygiene Association in New Haven.

The chemist in charge has continued to collaborate with the Council of the American Medical Association in matters pertaining to diabetic and other special foods; and, as Associate Referee on the cryoscopy of milk for the Association of Agricultural Chemists, has prepared a report of data obtained in this and other laboratories upon the freezing point range of authentic milk from normal and abnormal cows for the purpose of establishing a basis for the judgment of market milk with reference to the detection of added water.

Mr. Andrew, as Referee on Tea for the same Association, has prepared a report of studies on the determination of caffeine, which includes a new method for this determination devised in this laboratory; and he has further collaborated in the study of methods for the analysis of drugs.

Mr. Shepard has continued to participate in the co-operative analytical program of the American Oil Chemists' Society, which involves analyses of check cottonseed meals and fertilizers every month, with the aim of securing greater uniformity of procedure in the examination of these products.

Expert testimony in court has been furnished to the Dairy and Food Commissioner when required.

The department has issued Bulletin 223 on Fertilizers, Bulletin 227 on Food Products and Drugs, and Bulletin 229 on Feeding Stuffs.

Mr. R. N. Copeland, Ph.B., filled a temporary appointment as chemist from March 1st to September 1st, 1921. Mr. Harry J. Fisher, A.B., was appointed as a chemist on October 17th, 1921.

Entomological Department.

Dr. W. E. Britton in charge.

The control operations against the gypsy moth in the eastern portion of the state have been continued vigorously under the supervision of Mr. John T. Ashworth, in co-operation with the Federal Bureau of Entomology. The federal men have scouted the margin of the infested area, while the state men have worked in the more thickly infested territory. The federal scouts found three new towns infested (Stafford, Somers and Suffield), all bordering upon Massachusetts. While this pest has done great

damage in the neighboring states of Massachusetts and Rhode Island, any serious damage in this state has been prevented. The imported nursery stock inspected consisted of twenty-one shipments, containing 126 cases. Ten shipments, or 47.6 per cent, were found to contain insects or other animals or plant diseases, some of which are known to be pests, and the infested material was destroyed.

The ninety-four nurseries in the State have all been inspected, one of them twice, but a few of them have not yet cleaned up their nurseries so as to receive certificates. In addition, sixty-five orchards and gardens have been examined with reference to insect pests.

The elaborate experiments on the comparative efficiency of dusting *versus* spraying on apples and peaches, in which this department co-operated with the Botanical Department and Mr. B. A. Porter of the Bureau of Entomology, has already been noted above.

Mr. Walden has studied the life history of the raspberry fruit worm, *Byturus unicolor,* and will continue his observations next year and also test measures of control.

Mr. Walden has made further collections of leafhoppers which, together with the material collected in 1920, form an exceedingly valuable series from Connecticut.

Mr. Zappe has carried out a number of minor projects, mostly along control lines. Some of these are as follows:—spraying to control the arbor-vitae leaf miner; wire-worm experiments on tobacco; controlling the rhododendron lace bug; relation between flea-beetles and tobacco wild-fire; paradichlorobenzene as a remedy for the peach borer. Mr. Zappe has made important collections of beetles and has spent much time rearranging the Coleoptera in the Station collection to conform with the new Check List.

Dr. Garman has given considerable attention to a study of the European red mite, *Paratetranychus pilosus,* and is experimenting with various materials to destroy the eggs. He has studied the violet midge, *Contarinia violicola,* which caused much damage in the large greenhouses of the W. W. Thomson Company of West Hartford. Dr. Garman has made studies of the grass-feeding spittle-bug, and his paper has been published as Bulletin 230 of this Station. He will continue to study the other species of this group of insects (family *Cercopidae*), as their life histories are not at all well known.

Dr. Garman has nearly finished a paper on the Odonata or dragon-flies of Connecticut, to be published by the State Geological and Natural History Survey, and will prepare a paper on the mites of Connecticut, to be published also by the Survey.

Dr. Garman has made important collections of Odonata from the different sections of the state, and has made many drawings to be used to illustrate the Hemiptera of Connecticut.

Mr. Sealy has supervised the maintenance of the mosquito ditching work during the season. There has been very little new work. The appropriation was increased $2,000 by the General Assembly.

The insect collection now contains more than 5,500 named species. The number of specimens is as follows:—

Systematic collection	20,800 specimens
Duplicates	30,000 specimens
Undetermined	5,000 specimens
Total	55,800 specimens

The department library now contains about 1,000 bound volumes and 3,000 separate pamphlets. There are 2,300 photographic negatives, 720 lantern slides, and 1,400 microscopic mounts of insects.

The entomologist has aided in a number of the projects, has investigated an injury to tobacco plants by the seed corn maggot, has attended to the correspondence and issued the necessary certificates, and has spent much time editing and revising the manuscript of the Hemiptera of Connecticut soon to be published by the Geological and Natural History Survey. His Check-List of the Insects of Connecticut was published early in the year.

Some time has also been devoted to the work of the Tree-Protection Examining Board.

Publications of Entomological Department 1921.

By W. E. Britton:

Twentieth Report State Entomologist of Connecticut (Bulletin 226); 84 pages, 13 figures, 12 plates; 10,500 copies distributed in April 1921.

Spray Now to Kill the European Red Mite; Bulletin of Immediate Information No. 13 (mimeographed), 3 pages; 600 copies distributed March 10, 1921.

Check List of the Insects of Connecticut; Bulletin 31, State Geological and Natural History Survey; 397 pages; distributed in spring by State Librarian at Hartford.

The European Corn Borer; Report Connecticut Board of Agriculture for 1919-1920, page 92; 4 pages; 1921.

Report of Committee on Injurious Insects; Proceedings 30th Annual Meeting Connecticut Pomological Society; page 36.

Report of Committee on Insects and Diseases, Insects; Report Connecticut Vegetable Growers' Association, page 21; 1921.

First Report of the Tree-Protection Examining Board; Bulletin 231; 12 pages; 11,500 copies distributed in November 1921; 1000 copies in the form of a separate to be used by the Board.

The House Fly as a Carrier of Disease Germs and How Controlled; 12 pages, 2 figures; published as an unnumbered bulletin of the State Department of Health (Revised Edition).

By W. E. Britton and G. P. Clinton:

Spray Calendar (Bulletin 224), 44 pages, 95 figures: 11,500 copies distributed in March 1921.

By W. E. Britton and L. O. Howard:

William Hampton Patton, Entomological News, Vol. XXXII, page 33 February 1921, 8 pages, 1 plate.

By B. H. Walden:

Progress of Anti-Mosquito Work in Connecticut, Proceedings 7th Annual Meeting New Jersey Mosquito Extermination Association, page 92, 1920.

By M. P. Zappe:

Aphis Control, Report Connecticut Board of Agriculture for 1919-20, page 96, 1921.

By Philip Garman:

A Study of the Bulb Mite (Bulletin 225) 20 pages, 3 figures, 3 plates; 10,500 copies distributed in March 1921.

The Grass-Feeding Frog-Hopper or Spittle-Bug (Bulletin 230) 12 pages, 3 figures, 2 plates: 10,500 copies distributed in November 1921.

The Relation of Certain Greenhouse Pests to a Geranium Leaf Spot (Bulletin 239, Maryland Agr. Exp. Station), 30 pages, 7 figures, October 1920.

The European Red Mite, *Paratetranychus pilosus,* Can. & Fanz., in Journal of Economic Entomology, Vol. 14, page 355, 1921.

By Philip Garman and F. L. Stevens:

The Genus Septoria Presented in Tabulation with Discussion, Trans. Ill. State Acad. Science, Vol. XIII, page 176, 44 pages, 1920.

Forestry Department.

W. O. Filley in charge.

Since 1901 the Station Forester has, as State Forester, purchased and administered land for state forests and since 1905 has, as State Forest Fire Warden, organized and supervised the local fire warden service. Hereafter the State Forester will be appointed by the State Park and Forest Commission with an office in Hartford. The first incumbent of the new position is Austin F. Hawes, who served as forester of this Experiment Station from 1904 until 1909.

The new arrangement relieves the Experiment Station of responsibility for the state forests and the fire warden service, both of which require an increasing amount of administrative routine. This change will give the Station Forester more time for experimental work. He is by statute made an ex-officio member of the State Park and Forest Commission, and will continue to co-operate with the State Forester in his work.

Forest Planting.—The nursery work at Mt. Carmel was confined to lifting and shipping over 50,000 transplants set out as

two-year seedlings in 1919, and transplanting a few thousand two-year seedlings from seed beds on the Station grounds. The fifty thousand transplants were shipped to the Portland, Simsbury and Eastford State Forests.

An arrangement was made with a commercial nursery to fill small orders for forest planting stock at prices based on the total amount of orders placed by the Experiment Station. In this way wholesale rates were secured for thirty land owners whose orders totalled 122,500 red and white pine transplants. Ten thousand trees for use on state forests and parks were purchased in the same way. The total shipments for forest planting by the Experiment Station and by the commercial nursery on Experiment Station orders, amounted to 175,000 trees.

The plantations at Rainbow have required but little attention. Mr. F. M. Snow continues to act as caretaker. He has harrowed the fire lines and attended to sales of wood as well as guarded against fires and trespassers.

White Pine Survey.—The white pine survey undertaken in 1919 was completed in the winter of 1921 in co-operation with the Bureau of Plant Industry.

The fifty-four towns covered by the survey give the following results:

County	Forest Area Acres	Hardwood and Pine Areas Acres	Pure Pine Stands Acres	Pine Reproduction Acres	Standing Pine Timber Acres
Litchfield, (15 towns)	220,050	56,450	6,700	6,725	52,970,000
Hartford, (16 towns)	117,150	3,625	5,600	5,850	33,940,000
Tolland, (8 towns)	109,100	15,700	2,600	1,550	21,325,000
Windham, (11 towns)	147,950	56,550	3,725	1,725	22,770,000
New London, (2 towns)	31,950	9,550	450	275	4,950,000
	626,200	141,875	19,075	16,125	135,955,000

Throughout the rest of the State there are a few scattering stands of pine which would doubtless bring the total to 140,000,000 Ft. B.M. There is also a sufficient acreage planted to pine in the other towns to make the total area of young growth at least 20,000 acres. The value of standing pine is approximately $1,120,000 and the present value of young pine growth is not less than $500,000.

White Pine Blister Rust.—Control work has been carried on under the supervision of Mr. Hicock.

(1). The Branford area was carefully scouted for pine infections but, as in previous years, none were found.

(2). Inspection of plantations. Twelve plantations and one nursery in which pine infections had previously been found and eradication work done were again inspected. Infected pines were found in seven of these but the infections were so localized as to indicate that the disease is being effectually controlled there.

(3). The eradication of wild Ribes (currants and gooseberries) from infected areas in Norfolk, Canaan and Colebrook between May 1st and September 15th, covered about 8,000 acres, one half of which had been previously worked in 1916-1917, and 1919. In the area worked for the first time considerable pine infection was found, but mostly concentrated near small infection centers. In the areas reworked few Ribes were found, and almost no pine infections of a date subsequent to the eradication. About 39,000 Ribes bushes were pulled and destroyed during the summer.

(4). The Pomfret area, of which a survey was made in 1919, was carefully scouted again and five infected pines found. Only one of these was outside the original infected area. The disease seems to be under control here, although the area must be watched for several seasons.

(5). Cornwall. As new pine infections had been located in Cornwall last winter, that town was thoroughly scouted during the summer and infected pines were found very widely distributed. They were mostly 1918 and 1919 infections which had not yet fruited. The situation is so serious that it seems necessary to begin eradication work in this town next season, and it will be necessary to ask land owners to bear a share of the cost, as the state appropriation alone will not be sufficient for all the work to be done next year.

(6). Further scouting. After September 15th, scouting was done in Canaan, North Canaan, Salisbury, and the towns along the Rhode Island line. In these latter no suspicious infections were discovered, but the towns northwest of Cornwall show almost as bad conditions as were found in that town.

It seems evident that the blister rust had become established in Cornwall, Canaan, North Canaan and Salisbury before control work was effective in Norfolk. Until this year, however, most of these infections could not be detected and only a small percentage has as yet fruited. The northern half of Litchfield County will require radical measures in the near future if the spread of the disease is to be checked. It may be necessary to establish a quarantine and prohibit the growing of currant and gooseberry bushes in that region. Financial co-operation with the towns, or with the land owners, must also supplement the state appropriation, which is entirely inadequate to relieve the situation promptly and effectively.

State Forests.—The State Forests were under the charge of the Station Forester for eight months of the year. Only two purchases of land were made during that time. The addition of

154 acres at Eastford and twenty acres at Portland made the total area of State Forests 4,441 acres as turned over to the new State Forester. Additional purchases have been completed since July 1st from the appropriation of $10,000 granted by the Legislature of 1921. Sales of wood, ties, poles, etc., amounted to $2,375.

In the spring, plantings were made as follows:

Portland	12,000 red pine	500 arborvitae	
Simsbury.....	17,000 red pine	4,000 arborvitae	
Eastford	15,000 red pine	4,000 Douglas fir	4,000 white spruce

The total number of trees planted on state forests was 56,500.

In the fall of 1920 Mr. Moss and Mr. Hicock started the field work for a topographic and type map of the Eastford State Forest, but were unable to complete it that season. Mr. Moss therefore continued the work during the summer and fall of 1921, as a co-operative project with the State Forester. Since this survey was initiated and carried out by the Experiment Station, it will probably be published as a Station bulletin, as was the working plan for the Portland State Forest made in 1913.

State Forest Fire Warden.—The calendar year 1920 showed the smallest total number of forest fires in any year since records have been kept. Only 408 fires were reported, of which 208 were in the month of April, and 112 in May, leaving only eighty-eight for the balance of the year. The area burned over was 11,348 acres, and the estimated damage was $40,000, both these totals also establishing new low records. Although due credit should be given to the fire wardens for increased vigilance and efficiency, it is probably true that the decrease in the number of fires is largely due to weather conditions. During the first six months of 1921, 530 fires were reported with an area burned of 17,465 acres, and an estimated damage of $70,000. This increase over the previous year is readily accounted for by a comparatively light snow fall during the winter, especially in March, so that the ground was bare over most of the state by the first of April. The precipitation was below normal in most parts of the State for every month except April.

Tree Protection Examining Board.—The work of this Board, of which Mr. Filley is Secretary, has already been reported in Bulletin 231.

Plant Breeding Department.

Dr. Jones in charge.

Ten years' work in careful selection from a cross between Sumatra and Broadleaf tobacco has resulted in fixing a type called Connecticut Round Tip, which combines the higher number and better shape of leaves of the Sumatra with the larger size of the Broadleaf.

This is briefly described in Bulletin 228.

While its actual value and the best method of growing and fermenting this type is not yet fully established, it is meeting with favor among growers. About 200 acres have been grown this year, and a larger acreage next year seems assured.

The method of corn-breeding based on selection in self-fertilized lines is now in its third year. Following our initiative, sixteen Stations in this country, two in Canada, and one each in Spain and Italy are taking up this method and applying it to the improvement of corn.

The number of generations of self-fertilization necessary to attain complete uniformity and stability in a naturally cross-pollinated plant, such as corn, is being studied, using material which has been inbred for sixteen years.

The breeding work on tobacco will be greatly facilitated by the establishment of the tobacco station which is noticed elsewhere. It includes:

(1). The study of inheritance of yield, quality, shape and number of leaves after crossing established varieties. Particular attention is now being given to several selections of a cross of Broadleaf and Cuban varieties.

(2). A strain test to determine whether inherited differences have arisen in established varieties of tobacco which are normally self-fertilized, and if so the most desirable will be propagated and tested.

(3). Selection of plants on the basis of resistance to root-rot disease to determine whether such differences permanently exist, and if so, whether sufficient resistance exists as to be commercially practicable and what is its relation to yield and quality.

In co-operation with the Storrs Station this department has made a careful corn survey of the State and after collecting the varieties which appeared most productive and otherwise desirable, comparative field tests have been made with them during six years at Storrs and Mt. Carmel. The results have been tabulated and sent to those specially interested with a map of the state showing the sections in which different varieties may be expected to give the most satisfactory yields and also giving the names of growers from whom the seed may be obtained.

In addition to the bulletin cited above there has been published:

Genetic Studies on the Protein Content of Maize. E. M. East and D. F. Jones. Genetics, 5: 543-610, Nov. 1920.

The Tobacco Experiment Station.

The last General Assembly appropriated to the Board of Control of the Connecticut Agricultural Station $10,000 for the biennial period for research and experiment on the causes and

prevention of diseases and injuries to the Connecticut tobacco crop which occur in the field or in the preparation for market and for improving the crop by selection and breeding and by co-operative experiments with growers.

The Board is authorized to accept gifts or loans of land or equipment, or gifts of money to be used exclusively for the purposes named above, such gifts of land to be accepted in the name of the state.

The Station is required to make an annual report to the Governor to be printed with the Station report and is authorized to issue bulletins of information of value to tobacco growers.

The Act was approved May 5, 1921.

Anticipating this action, Messrs. F. W. Morgan, J. E. Ransom and J. B. Stewart of Windsor, because of their interest in the project, generously bought a tract of 13½ acres of excellent tobacco land with three tobacco barns in Windsor and offered it to the Station at its cost to them, refusing a better offer from another source. The Station obtained funds from private sources to buy this land as no state appropriation could be used for the purpose.

This secures for the work what is absolutely necessary for its success, perpetual control of the land and the crops.

It was imperative to start work at once, or to lose a year's use of the land; but on May 5th, the earliest date on which we could undertake it, there were no seed beds, no tools, no fertilizers ready, and no one engaged to manage the field work.

In spite of these embarrassments it was determined to make a beginning, however unfavorable the outlook. Mr. Louis Evans, who had much experience in growing tobacco, was engaged to handle the field work. About seven acres of turf land were broken up, fertilized and fitted for the crop. Dr. Jones had a small supply of six tobacco selections from crosses of two types which were to be tested in the field for further selection and fermented for judgment of their quality. By gift and purchase plants were secured for setting about three and one-half acres of Round Tip tobacco, and a portion of the field was set off for study of tobacco diseases under Dr. Clinton's supervision, infected plants being supplied from beds made by him at the Station in New Haven and by donation from growers.

The plants were set during the first week in June.

About $800 had to be spent in repairing and fitting the barns, and over $500 for tools and miscellaneous supplies. In common with the experience of many other growers, the crop suffered from wild-fire, which gave opportunity for valuable study of this bacterial disease.

The crop cured successfully. The Round Tip is to be sold in the bundle and the selections are now being fermented under Dr. Chapman's supervision.

Immediately after the passage of this Act, leading growers and

packers in Connecticut and Massachusetts, appreciating the suggestion of the Legislative Committee on Appropriations that, if the state made an appropriation, the growers and packers should also co-operate with the state in financing, and realizing that the funds appropriated by the state were insufficient to adequately equip and maintain the tobacco experiment station to the extent deemed necessary, organized and incorporated the Connecticut Valley Tobacco Improvement Association, the objects of which are to "carry on any kind of work calculated to improve the quality of, or to protect from disease, New England tobacco, and to co-operate in this work with any individuals or organizations interested in such tobacco work."

This Association secured the services of Dr. George H. Chapman, of the Massachusetts Agricultural Experiment Station, to act in the capacity of Research Director, and also equipped an office and laboratory with sufficient endowment for maintenance and experiment at Windsor, in which pathological and chemical work necessary to the solution of the various problems can be carried on.

It was evident to both the Station and to the managers of this Association that the common aim of both could best be secured by the closest co-operation between them. The Station had suitable land for experimental work which, so far as can be seen, is secure for the long-continued work which is absolutely necessary, but the funds appropriated by the State are not sufficient to support the work which should be done. After full discussion, therefore, the following arrangement was concluded between the two organizations:

"It is the intention of the Board of Control of the Connecticut Agricultural Experiment Station to devote exclusively the land and buildings in Windsor held by it under the Lockwood Trust, to experiments on the growing of tobacco and on processes for its preparation for manufacture, so long as there are sufficient funds provided by the state or by a co-operating company for the suitable conduct of such work.

To this work the Station will devote the use of its land and the buildings already there and whatever money the state has appropriated or may appropriate for study of the tobacco crop.

The Station wishes the fullest co-operation possible with all agencies in the same kind of work.

In particular it desires close relations with the Connecticut Valley Tobacco Improvement Association as at present organized and administered; it being understood that while this Association is supported entirely by the contributions of its members, yet its work and findings are in the interest of all growers and handlers of tobacco in the New England district, and will be freely communicated to them in suitable ways.

To that end the following agreement has been made:

(1). Plans for the different kinds of experimental work to be carried out at the Tobacco Station may be proposed both by the Director of the Station and the Research Director of the said Association, and shall be adopted by mutual agreement and consent.

(2). The Research Director of the Association shall have general direction of the work in the field and of the curing, fermenting and further handling of the leaf and of its sale and it is understood that all income from sales shall be devoted to the furtherance of the experimental work.

(3). The Plant Breeder of the Station shall have the management of work in breeding and selection.

(4). Both the Research Director of the Association and the staff of the station shall be fully informed of the progress and results of the work done under the supervision of either.

(5). There shall be opportunity for work by the Station botanist on tobacco diseases on land especially set apart by mutual agreement for that purpose.

(6). If desired, a building or buildings for the purpose of experiment may be built on the land at the expense of either party. If it should be necessary for the Station at any time to dispose of the property, the Connecticut Valley Tobacco Improvement Association shall have opportunity to buy the property at its fair valuation as determined by competent judges selected by buyer and seller; but from the purchase price shall be deducted the value of any buildings erected by the said Association at their value as determined at the time of sale and by the said method of valuation.

(7). It is the present understanding of the Station that the fund appropriated by the state may be spent in any way for the furtherance of the work, either in salaries, labor, or supplies, and probably in building, though the opinion of the Attorney General on the last item is desirable.

(8). It seems desirable, if not necessary, that all publications should appear as co-operative between the Tobacco Improvement Association and the Station. For example—

Cause and Prevention of Canker in Tobacco, by G. H. Chapman, Research Expert. The Connecticut Valley Tobacco Improvement Association and the Connecticut Agricultural Experiment Station Co-operating.

Round Tip Tobacco, by D. F. Jones, Plant Breeder of the Conn. Agric. Expt. Sta. The Conn. Agric. Sta. and the Conn. Valley Tobacco Improvement Assn. Co-operating.

(9). For the publication of bulletins on the progress of results of the work the Station will provide, subject to limitations of space imposed by State authority.

(10). The Station laboratories and apparatus will be used in the work to the extent consistent with the other demands on it.

(11). Any further arrangements regarding the detail of the work shall be exclusively settled by the Research Director of the Connecticut Valley Tobacco Improvement Association, the Director of the Station, and Mr. J. W. Alsop, representing both agencies.

(12). In order that the Research Director may receive publications of other Stations and to facilitate the use of the franking privilege, he is made a member of the Station staff as "In charge of the Tobacco Station."

Farmers' Week.

Beginning on January 24th, 1921, conferences of the various agricultural societies were held in Hartford, and an Exhibit was staged in the State Armory.

The Station occupied a floor space of about 64 by 18 ft., and made an educational exhibit of the work done in the six separate departments of its work. The success of the Exhibit was due to the very cordial co-operation of every one in the Station employ, for all of whom unusual work became necessary.

The Field Day.

On August 31st the annual Station Field Day was held at Mt. Carmel. As this year marks the three hundredth anniversary of the first planting of corn in New England by white men it was fitting that the breeding, selection and growing of corn should have been the subject of the talks after lunch. Between 250 and 300 were present.

Physical Equipment.

The equipment of the Station includes a working library of about 6,500 volumes and about 500 volumes not owned by the Station but deposited here as a loan, an herbarium of 48,500 specimens, an insect collection of 55,800 specimens, 1,500 lantern slides, 3,700 negatives, and 3,745 microscope slides.

The valuation of the Station land and buildings is.....	$295,275
The valuation of the contents of the buildings.....	97,360
	$392,635

Respectfully submitted,

E. H. Jenkins,
Director.

Connecticut
Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 233 **NOVEMBER, 1921**

Fertilizer Report for 1921

By E. H. JENKINS, *Director, and*
E. M. BAILEY, *Chemist in Charge of the Analytical Laboratory.*

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

October, 1921.

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Donald F. Jones, S.D., *Plant Breeder.*
P. C. Mangelsdorf, B.S., *Assistant.*

In charge of the Tobacco Station.
G. H. Chapman, Ph.D., Windsor, Conn.

Report on Commercial Fertilizers, 1921

By E. H. Jenkins, *Director, and* E. M. Bailey,
Chemist in Charge of the Analytical Laboratory.

We desire here to emphasize certain points regarding the law and the gratuitous analysis of fertilizers, which do not seem to be fully understood by those concerned. Complete understanding of these points will greatly increase the effectiveness of our work and its value, both to sellers and users of fertilizers.

What is required of all who sell commercial fertilizers in this state?

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

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

On request, copies of the law and blanks for registration and for tonnage reports 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.*

What is required of persons drawing samples for analysis?

The Station every year analyzes a large number of samples sent by individuals, representing fertilizers bought by them for their own use. The object of the sender is to learn whether the fertilizer contains all that is guaranteed, and, if it does not, to provide evidence for a claim against the seller. *It is absolutely necessary that the sample should be taken essentially in the way prescribed by the law and in the presence of a witness.* If this is not done, it will be difficult to prove the fairness of the sample, the Station will have been put to useless expense and the analysis of the sample will not be of any value to the sender. Therefore, the Station will supply to any applicant a form which describes the method of sampling and on which the sample should be fully described. This description should be sent to the Station with

(not in) the sample. It thus makes the analysis of public interest and value, which is the only justification for doing the work at state expense, and it is the only way by which it is possible for the sender to learn the true composition of the stock sampled and to prove its composition if a claim for rebate is made.

The Station desires to know the retail cash ton price of each fertilizer but, if so requested, will not publish the information.

In 1921, 76 individuals and firms registered for sale in this state 544 brands of commercial fertilizers, classified as follows:

Nitrogenous superphosphates	330
Cotton seed meal and castor pomace	61
Other chemicals and unmixed materials	153
Total	544

To meet the legal requirements, the following list of registered brands has been prepared:

American Agricultural Chemical Co., 2 Rector St., New York, N. Y.
Basic Lime Phosphate
Bone-Phosphate and Potash
Castor Pomace
Complete Potato Mixture
Cotton Seed Meal
Double A Tobacco Fertilizer
Dry Ground Fish
Fine Ground Bone
Fish and Potash
Grass and Lawn Top Dressing
Grass and Oats Fertilizer
Ground Tankage
High Grade Acid Phosphate
High Grade Ground Bone
High Grade Sulphate of Potash
Kainit
Monarch Potato Manure
Muriate of Potash
Nitrate of Soda
Pulverized Sheep Manure
16% Acid Phosphate
Special Ground Bone
Sulphate of Ammonia
Tobacco Mixer
Tobacco Special
Universal Phosphate
Bradley's Complete Manure for Top Dressing Grass and Grain
Bradley's Corn Phosphate
Bradley's New Method Fertilizer
Bradley's Northland Potato Grower
Bradley's Potato Fertilizer
Bradley's Potato Manure
Bradley's Reliable 6% Potash Fertilizer

Bradley's Valley Tobacco Fertilizer
Bradley's XL Superphosphate of Lime
Great Eastern General 1921
Great Eastern Northern Corn Special 1920
Great Eastern Potato Manure 1920
Packers' Union Animal Corn Fertilizer
Packers' Union Potato Manure 1921
Packers' Universal Fertilizer 1920
Quinnipiac Climax Phosphate
Quinnipiac Corn Manure
Quinnipiac Phosphate
Quinnipiac Potato Phosphate
Quinnipiac Potato Manure
Quinnipiac Wrapper Leaf Brand Tobacco Manure Revised
Wheeler's Corn Fertilizer
Wheeler's Cuban Tobacco Grower
Wheeler's Potato Manure 1920
Williams & Clark's Americus Ammoniated Bone Superphosphate
Williams & Clark's Americus Corn Phosphate
Williams & Clark's Americus Potato Manure
Williams & Clark's Potato Phosphate
Williams & Clark's Prolific Fertilizer
Williams & Clark's Seed Leaf Tobacco Manure

American Agricultural Chemical Co. of New Jersey, Newark, N. J.
Listers Balancer for Cotton Seed Meal
Listers Bone Meal 1916
Listers Celebrated Ground Bone and Tankage Acidulated
Listers Celebrated Tobacco Fertilizer
Listers Complete Tobacco Fertilizer without Potash
Listers Complete Tobacco Manure
Listers Corn and Potato Fertilizer
Listers Eastern Pride Fertilizer
Listers Fish and Potash Fertilizer
Listers 4-8-4 Fertilizer
Listers High Grade Acid Phosphate
Listers Standard Pure Superphosphate of Lime
Listers Success Fertilizer
Listers Tobacco Fertilizer
Nitrate of Soda

American Cotton Oil Co., 65 Broadway, New York, N. Y.
"Acco" Brand Cotton Seed Meal
"Surety" Brand Cotton Seed Meal

American Milling Co., Peoria, Ill.
43% Amco Cottonseed Meal

Apothecaries Hall Co., Waterbury, Conn.
Acid Phosphate
Bone and Meat Tankage
Bone Meal
Castor Pomace
Fish
Ground Animal Tankage
Liberty Corn, Fruit and All Crops
Liberty Market Gardeners' Special
Liberty Market Gardeners' Special (potash)
Liberty Potato and Vegetable Special
Liberty 3-8-4
Liberty Tobacco Special
Liberty Tobacco Special (potash)

Muriate of Potash
Nitrate of Soda
Sheep Manure
Sulphate of Ammonia
Sulphate of Potash

Armour Fertilizer Works, 305 Broadway, New York, N. Y.
Armour's Big Crop Acid Phosphate
Armour's Big Crop Fertilizer 0-10-5
Armour's Big Crop Fertilizer 3-8-4
Armour's Big Crop Fertilizer 4-10-0
Armour's Big Crop Fertilizer 5-8-5
Armour's Big Crop Potato & Onion 4-8-4
Armour's Big Crop Tobacco Special 5-4-5
Armour's Corn Grower 2-8-2
Armour's Fertilizer 5-4-3
Armour's General Crop 1-7-1
Armour's Nitrate of Soda
Armour's Sheep Manure

Ashcraft-Wilkinson Co., 1309 Candler Building, Atlanta, Ga.
Helmet Brand Prime Cotton Seed Meal
Monarch Brand
Paramount Brand Good Cotton Seed Meal

Atlantic Packing Co., New Haven, Conn.
Atlantic Acid Phosphate
Atlantic Cotton Seed Meal
Atlantic Dry Ground Fish
Atlantic 5-8
Atlantic 4-8-6
Atlantic Grain Fertilizer
Atlantic Potato Phosphate
Atlantic Special Vegetable
Atlantic Superphosphate
Atlantic Tankage
Atlantic Tobacco
Atlantic Tobacco Grower
Atlantic Tobacco Manure
Atlantic Tobacco Special

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

Barrett Company, 17 Battery Place, New York, N. Y.
Arcadian Sulphate of Ammonia

Berkshire Fertilizer Co., Bridgeport, Conn.
Acid Phosphate
Berkshire Ammoniated Bone Phosphate
Berkshire Complete Fertilizer
Berkshire Complete Tobacco
Berkshire Grass Special
Berkshire Long Island Special
Berkshire Market Garden Fertilizer
Berkshire Potato and Vegetable Phosphate
Berkshire Tobacco Grower
Berkshire Tobacco Starter
Castor Pomace
Dry Ground Fish
Fine Ground Bone
43% Protein Cotton Seed Meal
Ground Sheep Manure

Muriate of Potash
Nitrate of Soda
Precipitated Bone Phosphate
Sulphate of Potash
Tankage 7.5-10
Tankage 5-18
Vegetable Potash

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

Bowker Fertilizer Co., 60 Trinity Place, New York, N. Y.
Bowker's 16% Acid Phosphate
Bowker's All Round Fertilizer
Bowker's Conn. Valley Tobacco Fertilizer
Bowker's Corn, Grain and Grass Phosphate
Bowker's Fisherman's Brand Fish and Potash
Bowker's Fresh Ground Bone
Bowker's Hill and Drill Phosphate
Bowker's Lawn and Garden Dressing Revised
Bowker's Nitrate of Soda
Bowker's Potato and Vegetable Phosphate
Bowker's Square Brand Farm and Garden Phosphate
Bowker's Superphosphate with Ammonia 4%
Bowker's Sure Crop Phosphate Revised
Bowker's Tobacco Elements
Bowker's Tobacco Grower
Maryland Corn Phosphate
Maryland Standard Fertilizer
Maryland Truck Garden Fertilizer
Stockbridge "B" General Crop Manure
Stockbridge Early Crop Manure
Stockbridge Market Garden Manure
Stockbridge Tobacco Manure
Stockbridge Top Dressing and Forcing Manure

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

Brodé, F. W., Corporation, 119 Madison Ave., Memphis, Tenn.
Owl Brand 43 Cotton Seed Meal
Owl Brand 41 Cotton Seed Meal

Buckeye Cotton Oil Co., Gwynn Building, 6th and Main Sts., Cincinnati, Ohio.
"Buckeye" Good Cotton Seed Meal
"Buco" Cotton Seed Feed

Chittenden, E. D., Co., Bridgeport, Conn.
Chittenden's Complete Tobacco and Onion Grower with 4% Potash
Chittenden's Complete Tobacco and Onion Grower with 6% Potash
Chittenden's Complete Tobacco and Onion Grower without Potash
Chittenden's Dry Ground Fish
Chittenden's High Grade Potato with 4% Potash
Chittenden's Tobacco Special with 5% Potash
Chittenden's Tobacco Special without Potash
Chittenden's Vegetable and Onion Grower with 3% Potash
Chittenden's Vegetable and Onion Grower without Potash
Ground Castor Pomace

Clark, Everett B., Seed Co., Milford, Conn.
Clark's Special Mixture for General Use

Clark's Special Mixture with Potash (4-10-4)
Clark's Special Mixture with Potash (4-8-6)
16% Acid Phosphate

Coe-Mortimer Co., Inc., 51 Chambers St., New York, N. Y.
E. Frank Coe's Basic Fruit and Legume Phosphate (Basic Lime Phosphate) (Key-Plow Brand)
E. Frank Coe's Celebrated Special Potato Fertilizer Revised
E. Frank Coe's Columbian Corn and Potato Fertilizer
E. Frank Coe's Connecticut Wrapper Grower
E. Frank Coe's Cotton Seed Supplement
E. Frank Coe's Gold Brand Excelsior Guano Revised
E. Frank Coe's New Englander Special
E. Frank Coe's 16% Superphosphate
E. Frank Coe's Special Grass Top Dressing
E. Frank Coe's Tobacco Leaf Fertilizer
Fine Ground Bone
Nitrate of Soda

Connecticut Fat Rendering & Fertilizing Corporation, New Haven, Conn.
Tankage

Cornwall, H. B., Meriden, Conn.
Cornwall's Potato and General Use
Cornwall's Tobacco Grower

Davis, S. P., Little Rock, Ark.
Beauty Brand Cotton Seed Meal
Good Luck 41% Protein Cotton Seed Meal and Cracked Screened Cake
Steerboy 43% Protein Cotton Seed Meal and Cracked Screened Cake

Dold, Jacob, Packing Co., Buffalo, N. Y.
Dold Quality Bone Meal

Eastern States Farmers' Exchange, 292 Worthington St., Springfield, Mass.
Bone Meal
Castor Pomace
Dried Ground Fish
Eastern States 16% Acid Phosphate
Eastern States 2-8-2
Eastern States 3-8-4
Eastern States 4-8-4
Eastern States 4-10
Eastern States 4-8-7
Eastern States 5-4-3
Eastern States 5-4-5
Eastern States 5-8-5
Ground Bone
Ground Tankage
Muriate of Potash
Nitrate of Soda
Precipitated Bone
Sulphate of Ammonia
Sulphate of Potash

Essex Fertilizer Co., 39 North Market St., Boston, Mass.
Essex 1-10-1 for Grain and Grass
Essex 2-8-2 for Farm and Garden
Essex 2-8-3 for All Crops
Essex 4-8-4 for Potatoes, Roots and Vegetables
Essex Fish Fertilizer 3-8-3 for All Crops
Essex 5-8-6

Essex Ground Bone
Essex Market Garden 3-8-4 for Vegetables and Grass
Essex Special Tobacco 5-5-4
Essex Tobacco Manure 5-7-2

Frisbie, L. T., Co., New Haven, Conn.
Castor Pomace
Cotton Seed Meal
Frisbie's Acid Phosphate
Frisbie's Bone Meal
Frisbie's Corn and Grain Fertilizer
Frisbie's Dry Ground Fish
Frisbie's 2-10
Frisbie's 4-10
Frisbie's 5-8
Frisbie's 5-8-7
Frisbie's High Grade Sulphate of Potash
Frisbie's Market Garden
Frisbie's Special 4-10-6
Frisbie's Special (3-8-4)
Frisbie's Special (5-8.5-5)
Frisbie's Special Vegetable and Potato Grower
Frisbie's Sulphate of Ammonia
Frisbie's Superphosphate
Frisbie's Tankage (5-14)
Frisbie's Tankage (9-6.40)
Frisbie's 3-8-6
Frisbie's Tobacco
Frisbie's Tobacco Grower
Frisbie's Tobacco Special
Muriate of Potash
Nitrate of Soda
Tobacco Manure 5-8-6

Hailey, John H., Co., Houston, Texas.
Texas Brand (Cotton Seed Cake or Meal)

Hall, W. D., Co., Atlanta, Ga.
Hall Brand Good Cotton Seed Meal

Hayes Grain & Commission Co., Little Rock, Ark.
Hayes Brand Cotton Seed Meal and Cake
Nutrine Brand Cotton Seed Meal and Cake

Head & Co., Dallas, Texas.
Rabbitfoot Brand Cotton Seed (Cake and) Meal

Humphreys-Godwin Co., (Not Inc.), Memphis, Tenn.
Bull Brand Cotton Seed Meal
Danish Brand Cotton Seed Meal
Dixie Brand Cotton Seed Meal
Unit—1
Unit—2
Unit—3

Industrial Cotton Oil Properties, 65 Broadway, New York, N. Y.
Longhorn Brand Prime Cotton Seed Meal

International Agricultural Corporation, Buffalo Fertilizer Works, 126 State St., Boston, Mass.
Bone Meal
Buffalo Economy
Buffalo Farmers' Choice
Buffalo General Favorite
Buffalo High Grade Manure

Buffalo New England Special
Buffalo Onion Special
Buffalo Phosphate and Potash
Buffalo 16%
Buffalo 10-8
Buffalo Tobacco Grower
Buffalo Tobacco Producer
Buffalo Tobacco Special
Buffalo Top Dresser and Starter
Buffalo Vegetable and Potato
Dry Ground Fish
I. A. C. Complete
I. A. C. Complete Tobacco
I. A. C. Early Harvest
Nitrate of Soda

Jennings-Brown Co., Inc., Shreveport, La.
Robin Brand Good Cotton Seed Meal

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

Lovitt, L. B., & Co., Memphis, Tenn.
"Lovit"
"Memphis"
"Neal's Choice"
"Thirty Six"

Lowell Fertilizer Co., 40 North Market St., Boston, Mass.
Dry Ground Fish
Lowell Acid Phosphate 16%
Lowell Animal Brand 3-8-4 for All Crops
Lowell Bone Fertilizer 2-8-2 for Corn, Grain, Grass and Vegetables
Lowell Empress 1-10-1 for Grain and Vegetables
Lowell 2-8-3 for Vegetables and Grain
Lowell 3-8-3 for Corn, Grain and Vegetables
Lowell 4-8-4 for Potatoes, Corn and Vegetables
Lowell 5-8-0 for Grass, Grain and Vegetables
Lowell 5-8-4 for Vegetables and Grass
Lowell Ground Bone
Lowell 4-10
Lowell Lawn and Garden Dressing 4-7-2
Lowell 5-8-6
Lowell Tobacco 5-5-4 for Tobacco, Fruits and Vines
Lowell Tobacco 5-6-0 for Tobacco, Fruit and Vines
Lowell Tobacco 5-7-2
Nitrate of Soda

Lyle & Lyle, Huntsville, Ala.
Economy Cotton Seed Feed
Lyle's Best Cotton Seed Meal

Mapes Formula & Peruvian Guano Co., 143 Liberty St., New York, N. Y.
Mapes Connecticut Valley Special
Mapes Corn Manure
Mapes Cotton Seed Tobacco Manure
Mapes General Tobacco Manure
Mapes General Truck Manure
Mapes General Use Manure
Mapes Grain Brand
Mapes Potato Manure
Mapes Pure Ground Bone

Mapes Tobacco Ash Constituents
Mapes Tobacco Starter Improved
Mapes Top Dresser

Meech & Stoddard, Inc., Middletown, Conn.
Connecticut Cotton Seed Meal
Pure Raw Bone Meal

Middlesex Fertilizer Co., Middletown, Conn.
White Star Fertilizer

Miller Fertilizer Co., Maryland Life Bldg., 10 South St., Baltimore, Md.
Acid Phosphate
Miller's Clermont
Miller's 5-8-7
No. 1 Potato and Vegetable Grower
Standard Phosphate

Mitchell, W. L., 699 Forest St., New Haven, Conn.
Mitchell's Raw Phosphate Float

National Fertilizer Ct., 60 Trinity Place, New York, N. Y.
National Complete Grass Fertilizer
National Complete Tobacco Fertilizer
National Eureka Potato Fertilizer
National 5-4 Tobacco Manure
National Market Garden Fertilizer Revised
National Nitrogen Phosphate Mixture No. 2
National Nitrogen Phosphate Mixture No. 4
National Potato Phosphate
National 16% Plain Superphosphate
National Special Tobacco Revised
National Tobacco Foundation
National Universal Phosphate
National XXX Fish and Potash

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

New England Fertilizer Co., 40A North Market St., Boston, Mass.
N. E. Corn Phosphate 2-8-2 for Grain and Vegetables
N. E. 2-8-3 for Vegetables and Grain
N. E. 3-8-3 for Corn, Grain and Vegetables
N. E. Superphosphate 3-8-4 for All Crops
N. E. 4-8-6 for Potatoes and Vegetables
N. E. 5-8-7 for Potatoes and Market Gardens
N. E. Tobacco 5-6-0
N. E. Tobacco Manure 5-5-4
N. E. 5-8-6

Nitrate Agencies Co., 85 Water St., New York, N. Y.
Naco Brand Acid Phosphate
Naco Brand Fish
Naco Brand Muriate of Potash
Naco Brand NitraPo
Naco Brand Nitrate Soda
Naco Brand Sulphate of Ammonia
Naco Brand Sulphate of Potash
Naco Brand Tankage
Naco Brand 2-8-2 Formula
Naco Brand 3-8-4 Formula
Naco Brand 4-8-4 Formula
Naco Brand 4-8-7 Formula
Naco Brand 5-8-5 Formula

Nothern, W. C., Box 414, Memphis, Tenn.
Bee Brand Cotton Seed Meal
Queen Bee Brand Cotton Seed Meal
Standard Cotton Seed Meal

Olds & Whipple, Hartford, Conn.
Acid Phosphate
Cotton Hull Ashes
High Grade Sulphate of Potash
Nitrate of Soda
O & W Bone Phosphate and Potash Compound
O & W Castor Pomace
O & W Complete Corn, Onion and Potato Fertilizer
O & W Complete Tobacco Fertilizer
O & W Dry Ground Fish
O & W H. G. Starter and Potash Compound
O & W H. G. Tobacco Starter
O & W Special Complete Corn, Onion and Potato Fertilizer
O & W Special Grass Fertilizer
O & W Tobacco Special Fertilizer
Precipitated Bone Phosphate

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

Park & Pollard Co., 131 State St., Boston, Mass.
Cloverland Cotton Seed Meal
Highland Cotton Seed Meal
Upland Cotton Seed Meal

Parmenter & Polsey Fertilizer Co., 41 North Market St., Boston, Mass.
P & P 1-10-1 for Grain and Grass
P & P Plymouth Rock Brand 3-8-4 for All Crops
P & P 4-8-4 for Potatoes, Corn and Vegetables
P & P 2-8-2 for Farm and Garden
P & P 2-8-3 for Corn, Fruits and Vegetables

Pentecost & Martin, Inc., 15 East 40th St., New York, N. Y.
Potash Marl

Piedmont-Mt. Airy Guano Co., 707 Keyser Bldg., Baltimore, Md.
Brown's Corn and Grain Fertilizer
Brown's Fish, Bone and Potash
Brown's 5-8-7 Fertilizer
Brown's Market Garden Fertilizer
Brown's Potato Phosphate
Brown's Special for Tobacco
Brown's Top Dresser
Home Mixture
Muriate of Potash
Nitrate of Soda
8% Tankage
Sulphate of Ammonia
Piedmont 16% Acid Phosphate
10% Fish (Dry Ground)
3 50 Bone Meal

Proto-Feed & Guano Co., 4121 South La Salle St., Chicago, Ill.
Master Brand Pulverized Sheep Manure

Providence Farmers' Exchange, Inc., 16 South Water St., Providence, R. I.
Exchange Brand 2-8-2 Fertilizer
Exchange 3-8-4 Fertilizer

Exchange 4-8-4 Fertilizer
Exchange 4-10-0 Fertilizer
Exchange 5-8-5 Fertilizer
16% Acid Phosphate
Muriate of Potash
Nitrate of Soda
9-15 Tankage

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

Quality Seed & Fertilizer Co., Stamford, Conn.
All Crop Fertilizer
Bartlett Brand Special Tree Fertilizer
Grain Fertilizer
Potato Fertilizer
Sheep Manure Tankage

Robinson, Geo. B., Jr., 18 Broadway, New York, N. Y.
"Robin" Cotton Seed Meal

Rogers & Hubbard Co., Middletown, Conn.
Ground Fish (Dried)
Hubbard's "Bone Base" Fertilizer for Seeding Down
Hubbard's "Bone Base" Oats and Top Dressing Borax .40
Hubbard's "Bone Base" Soluble Corn and General Crops Manure
Hubbard's "Bone Base" Soluble Potato Manure
Hubbard's Pure Raw Knuckle Bone Flour
Hubbard's Strictly Pure Fine Bone
Nebraska Potash
Nitrate of Soda
Rogers & Hubbard's All Soils-All Crops Phosphate
Rogers & Hubbard's Climax Tobacco Brand
Rogers & Hubbard's Complete Phosphate
Rogers & Hubbard's Soluble Tobacco Manure
Rogers & Hubbard's Tobacco Grower, Vegetable Formula
The R & H Brand Cotton Seed Meal

Royster, F. S., Guano Co., 1603 Munsey Bldg., Baltimore, Md.
Castor Pomace
Dry Ground Fish
Nitrate of Soda
Royster's Arrowhead Tobacco Formula
Royster's Bully Guano
Royster's Fine Ground Bone Meal
Royster's Fish and Potash
Royster's Fish, Flesh and Fowl
Royster's Landmark Brand
Royster's Perfecto Tobacco Formula
Royster's Prime Fish Brand
Royster's Quality Trucker
Royster's 16% Acid Phosphate
Royster's Trucker's Delight
Royster's Valley Tobacco Formula

Sanderson Fertilizer & Chemical Co., New Haven, Conn.
Sanderson's Acid Phosphate
Sanderson's Atlantic Coast Bone, Fish and Potash
Sanderson's Complete Tobacco Grower
Sanderson's Corn Superphosphate
Sanderson's Fine Ground Bone
Sanderson's Formula A

Sanderson's Formula B
Sanderson's High Grade Ammoniated Phosphate
Sanderson's Kelsey's Bone, Fish and Potash
Sanderson's Nitrate of Soda
Sanderson's Phosphate without Potash
Sanderson's Potato Manure
Sanderson's South American Sheep and Goat Manure
Sanderson's Tobacco Grower
Sanderson's Top Dressing for Grass and Grain

Shoemaker, M. L., & Co., Venango St. and Delaware Ave., Philadelphia, Pa.
Swift-Sure Bone Meal
Swift-Sure Superphosphate Tobacco and General Use
Swift-Sure Superphosphate Tobacco Starter

Soper, J. E., Co., 206 Chamber of Commerce, Boston, Mass.
Pioneer Cotton Seed Meal
Priscilla Cotton Seed Meal
Puritan Cotton Seed Meal

Southland Cotton Oil Co., Paris, Texas.
Climax Brand Cotton Seed Meal

Springfield Rendering Co., Springfield, Mass.
Springfield Animal Brand
Springfield Ground Bone
Springfield Special Potato, Onion and Vegetable
Springfield 2-8-2 Fertilizer

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

Texas Cake & Linter Co., Dallas, Texas.
"Texoma Brand" Prime Cotton Seed Meal

Van Iderstine Co., Long Island City, N. Y.
Van Iderstine's Pure Ground Bone

Virginia-Carolina Chemical Co. (of Delaware), Equitable Bldg., 120 Broadway, New York, N. Y.
Bone Meal
V-C Beaver Brand
V-C Callenge Brand
V-C Champion Brand
V-C Cherokee Brand
V-C Comet Brand
V-C Fish Phosphate and Potash Brand
V-C Indian Chief Brand
V-C Marvel Brand
V-C Nitrate of Soda
V-C Owl Brand
V-C Pawnee Brand
V-C Perfection Brand
V-C Plant Bed Brand
V-C Plow Brand
V-C Star Brand
V-C Universal Brand

Westervelt, A. C., & Co., Memphis, Tenn.
Planet Brand Cotton Seed Meal
Star Brand Cotton Seed Meal
Sun Brand Cotton Seed Meal

What Cheer Chemical Co., Inc., 188 Grotto Ave., Pawtucket, R. I.
Shay's Corn
Shay's Potato

Shay's Special
Superior Brand
What Cheer Brand
What Cheer Special

Wilcox Fertilizer Co., Mystic, Conn.
Acid Phosphate
Eldredge High Grade Fish and Potash
Nitrate of Soda
Precipitated Bone
Wilcox Corn Special
Wilcox Dry Ground Fish
Wilcox Fish and Potash
Wilcox Grass Fertilizer
Wilcox Potato and Vegetable Phosphate
Wilcox Potato Fertilizer
Wilcox Tobacco Special

Witherbee, Sherman & Co., 2 Rector St., New York, N. Y.
Barium-Phosphate Grade A
Ground Phosphate Rock
Nitrate of Potash

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

Worcester Rendering Co., Auburn, Mass.
Royal Worcester Corn and Grain 2-8-2
Royal Worcester Ground Steam Bone
Royal Worcester Potato and Vegetable 4-8-4

During the year, V. L. Churchill, the station sampling agent, has visited 95 towns and villages and drawn 636 samples for analysis. These include all of the registered brands which could be found on sale.

Classification of Fertilizers Analyzed.

1. *Containing nitrogen as the chief active ingredient:*

Nitrate of soda	30
Sulphate of ammonia	9
Cotton seed meal	318
Castor pomace	19

2. *Containing phosphoric acid as the chief active ingredient:*

Barium-Phosphate	1
Ground rock phosphate	3
Precipitated bone phosphate	20
Dissolved rock phosphate or acid phosphate	28

3. *Containing potash as the chief active ingredient:*

Muriate of potash	9
Sulphate of potash	28
Nebraska potash	2
Cotton hull ashes	1
Vegetable potash	1
Kainit	1

4. *Raw materials containing nitrogen and potash:*	
NitraPo	2
Nitrate of potash	2
5. *Raw materials containing nitrogen and phosphoric acid:*	
Fish manures	48
Slaughterhouse tankage	20
Garbage tankage	1
Bone manures	33
Bone and tankage	3
6. *Mixed fertilizers:*	
Phosphate and potash compounds	9
Nitrogenous superphosphates without potash	38
Nitrogenous superphosphates with potash:	
Sampled by station	286
Sampled by purchasers	22
Home mixtures:	
Sampled by station	16
Sampled by purchasers	15
7. *Miscellaneous fertilizers, amendments and waste products:*	
Tobacco stems	2
Tobacco ashes	1
Sheep manure	13
Wood ashes	15
Lime	4
Peat or muck	6
Dried sludge	4
Miscellaneous wastes	16
	1,026
Fungicides and insecticides	13
Total	1,039

A review of the analyses which follow shows these facts regarding the cost to consumers of the plant food bought in fertilizer chemicals and raw materials.

Ammonium sulphate has been the cheapest source of fertilizer nitrogen this year; the cost of nitrogen per pound ranging from 22.3 to 17.2 cents per pound, the average cost being 19 cents.

Nitrate of soda has come next, its nitrogen in the samples examined ranging in price from 28.1 to 19.1 cents per pound, the average being 23.4 cents.

In cotton seed meal nitrogen has cost about 36 cents per pound but the cost has varied very greatly.

In castor pomace nitrogen has cost 45.1 cents per pound.

In fish scrap, if 10 cents per unit is allowed for bone phosphate, nitrogen has cost 38.6 cents per pound as the average, the cost ranging from 46.3 to 24 cents.

Phosphoric acid in ground raw rock has cost 3 cents per pound.

In precipitated bone, available phosphoric acid has cost 8.5 cents per pound as an average, prices ranging from 9.5 to 7.5 cents.

In acid phosphate available phosphoric acid has cost 9.5 cents per pound as an average, prices ranging from 11.7 cents to 6.9 cents.

Water-soluble potash in both muriate and sulphate has cost about 11 cents per pound.

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA.

Thirty samples were analyzed as follows:

16508. Sold by Apothecaries Hall Co., Waterbury. Stock of Connecticut Sumatra Tobacco Co., Hartford.

16658. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Sampled at the factory.

17876. Sold by L. T. Frisbie Co., New Haven. Sent by H. F. Johnson, County Agent, Norwich.

17338. Sold by Coe-Mortimer Co., New York. Stock of W. R. Holcomb, Somerville.

17409. Sold by Eastern States Farmers' Exchange, Springfield, Mass. Stock of A. R. Carpenter, Bloomfield.

17245. Sold by The Rogers & Hubbard Co., Middletown.

Sampled at the factory:

16901. Sold by Olds & Whipple, Hartford. Stock of The Haviland Tobacco Co., East Windsor Hill.

17308. Sold by Armour Fertilizer Works, New York. Stock of Rockville Grain & Coal Co., Rockville.

16769. Sold by American Agricultural Chemical Co., New York. Stock of J. A. Glasnapp, West Cheshire.

16655. Sold by Olds & Whipple, Hartford. Sampled at the factory.

16937. Sold by Piedmont-Mt. Airy Guano Co., Baltimore, Md. Stock of Windsor Clark, Putnam.

17230. Sold by Providence Farmers' Exchange, Inc., Providence, R. I. Stock of Walter Scott, Niantic.

16881. Sold by Eastern States Farmers' Exchange, Springfield, Mass. Stock of John M. Herr, Burnside.

17374. Sold by International Agricultural Corp., Boston, Mass. Stock of P. Schwartz Co., New London.

16764. Sold by Lowell Fertilizer Co., Boston, Mass. Stock of Geo. S. Jennings, Southport.

16772. Sold by Piedmont-Mt. Airy Guano Co., Baltimore, Md. Stock of Joseph Adams, Green's Farms.

16849. Sold by Apothecaries Hall Co., Waterbury. Stock of Connecticut State School for Boys, Meriden.

16776. Sold by Wilcox Fertilizer Co., Mystic. Stock of Geo. R. Stannard, Branford.

16413. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of J. E. Shepard, South Windsor.

16768. Sold by Bowker Fertilizer Co., New York. Stock of Goodsell Bros., Bristol.

17387. Sold by Virginia-Carolina Chemical Co., New York. Stock of J. R. Reinhard, West Cheshire.

17244. Sold by Nitrate Agencies Co., New York. Stock of E. N. Austin, Suffield.

17390. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of Silliman Hardware Co., New Canaan.

15796, 15797 and **15798.** Sold by Wesel-Duval Co., New York. Stock of Griffin-Neuberger Tobacco Co., North Bloomfield.

16647. Sold by L. T. Frisbie Co., New Haven. Sampled at the factory.

16732. Sold by L. T. Frisbie Co., New Haven. Stock of H. Dudek, Talcottville.

17368. Manufacturer unknown. Sent by County Agent, F. L. Davis, Putnam.

17115. Manufacturer unknown. Sent by Hackett Bros., Buckland.

TABLE I. ANALYSES OF NITRATE OF SODA.

Station No.	Per cent. of Nitrogen Guaranteed.	Per cent. of Nitrogen Found.	Cost per ton.	Nitrogen costs cents per pound.
16508	15.00	15.72	$60.00	19.1
16658	15.00	15.79	63.00	19.9
17873	.....	15.54	66.00	21.2
17338	15.00	15.12	65.00	21.5
17409	14.80	15.54	68.00	21.9
17245	15.80	14.84	65.00	21.9
16901	15.00	15.86	70.00	22.1
17308	14.81	15.28	68.00	22.3
16769	15.00	15.60	70.00	22.4
16655	15.00	15.56	70.00	22.5
16937	15.23	15.42	70.00	22.7
17230	14.81	15.20	70.00	23.0
16881	14.80	14.76	68.75	23.3
17374	15.00	15.04	70.00	23.3
16764	15.00	14.83	70.00	23.6
16772	15.23	13.88	66.00	23.8
16849	15.00	15.04	72.00	23.9
16776	15.00	15.77	80.00	25.4
16413	13.98	15.08	77.00	25.5
16768	15.00	15.20	78.00	25.7
17387	14.80	15.12	80.00	26.5
17244	15.00	15.00	80.00	26.7
17390	15.00	15.12	85.00	28.1
15796	.....	15.10	.....	....
15797	.....	15.16	.....	....
17598	.....	15.52	.....	....
16647	14.80	15.56	.....	....
16732	14.80	15.84	.....	....
17368	.....	15.40	.....	....
17115	.....	15.70	.....	....

The costs of nitrate of soda here reported have ranged from $85.00 to $60.00 per ton, but it has been bought in the late spring at considerably lower prices. Since the beginning of the year the wholesale New York price fell from $65.00 to $40.00 per ton. With the exception of sulphate of ammonia, nitrate of soda has been the cheapest and most profitable form of nitrogen in our market.

The average cost of nitrogen in the samples here reported has been 23.4 cents per pound, ranging from 19.1 to 28.1 cents.

One sample, **16772,** sold by the Piedmont-Mt. Airy Guano Co., failed to meet the guaranty of 15.23 per cent. of nitrogen. It contained only 13.88 per cent.

SULPHATE OF AMMONIA.

Nine samples were analyzed as follows:

17872. Sold by L. T. Frisbie Co., New Haven. Sampled by H. F. Johnson, County Agent, Norwich.

17419. Sold by Eastern States Farmers' Exchange, Springfield, Mass. Stock of H. H. McKnight, Ellington.

16773. Sold by Piedmont-Mt. Airy Guano Co., Baltimore, Md. Stock of Joseph Adams, Green's Farms.

16770. Sold by American Agricultural Chemical Co., New York. Stock of J. A. Glasnapp, West Cheshire.

16842. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

16414. Sold by Berkshire Fertilizer Co., New York. Stock of J. E. Shepard, South Windsor.

16736. Sold by L. T. Frisbie Co., New Haven. Stock of H. Dudek, Talcottville.

17264. Sold by Nitrate Agencies Co., New York. Stock of J. McAllister, Farmers' Exchange, Cromwell.

17463. Sold by L. T. Frisbie Co., New Haven. Sampled at the factory.

TABLE II. ANALYSES OF SULPHATE OF AMMONIA.

Station No.	Per cent. of Nitrogen Guaranteed.	Per cent. of Nitrogen Found.	Cost per ton.	Nitrogen costs cents per pound.
17872	.....	20.66	$62.00	15.0
17419	20.56	20.66	71.00	17.2
16773	20.51	20.20	70.75	17.5
16770	20.16	20.20	75.00	18.6
16842	20.56	20.76	80.00	19.3
16414	20.75	20.94	93.30	22.3
16736	20.56	20.98	.....	....
17264	20.56	20.56	.....	....
17463	20.56	20.42	.....	....

This has been the cheapest form of nitrogen in our market this year, the average cost of nitrogen being about 19 cents per pound.

From January to August the wholesale price fell about 33 per cent.

Here again the only sample below guaranty, **16773,** was sold by the Piedmont-Mt. Airy Guano Co. and had 0.3 per cent. less nitrogen than was guaranteed.

COTTON SEED MEAL.

In a following table are analyses of 318 samples, the larger part of which represented car lots. The amount of cotton seed meal bought and used as a fertilizer in this state during the year cannot be far from fifteen thousand tons.

Guaranties.

Of 267 samples in which the guaranty is known, 32 failed to meet their guaranties, but 14 of these were deficient by less than 0.2 per cent. Those samples which had a larger deficiency are the following:

No.	Seller.	Nitrogen deficiency.
17277	Ashcraft-Wilkinson Co.	0.71
16091	F. W. Brodé & Co.	0.35
16564	J. H. Hailey Co.	0.30
16565	J. H. Hailey Co.	0.39
16028	Humphreys-Godwin Co.	0.38
16459	Humphreys-Godwin Co.	0.23
16784	Humphreys-Godwin Co.	0.20
16287	Humphreys-Godwin Co.	0.25
16561	Humphreys-Godwin Co.	0.43
16280	Humphreys-Godwin Co.	0.27
17127	Humphreys-Godwin Co.	0.28
17248	Humphreys-Godwin Co.	0.32
16707	Humphreys-Godwin Co.	0.25
16462	L. B. Lovitt & Co.	0.37
16559	L. B. Lovitt & Co.	0.67
15896	McGregor Cotton Oil Co.	0.21
17455	W. C. Nothern	0.24
16490	G. B. Robinson, Jr.	0.34

In considering the larger number of deficiencies in meal sold by Humphreys-Godwin Co., it must be noted that the number of samples of their goods is very much larger than that of others and that the *percentage* of deficiencies is a little less than the average.

Composition.

The percentage of nitrogen has ranged from 5.5 to 8.11 and the average of 193 samples, in which the nitrogen found, nitrogen guaranteed and cost are all given, is 6.3, which is slightly lower than the average last year.

Cost.

The price of cotton seed meal, in common with that of all fertilizers, has fluctuated wildly since the summer of 1920. It was quoted in car lots f.o.b. *factory* at $30.00 in January, 1921, at $26.00 in May and $35.00 in September. The wholesale prices prior to January were much higher. In the late spring, cut-prices prevailed. The car-lot prices to Connecticut buyers have ranged from $70.00 to $36.00.

The average cost per ton of 193 lots in this state was $44.32 and the average cost per pound of nitrogen was 36 cents.

TABLE III. ANALYSES OF COTTON SEED MEAL.

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	American Cotton Oil Co., New York City.				
16040	Longhorn, 84265	Griffin-Neuberger Tobacco Co., North Bloomfield	7.14	6.88	.....
17164	Surety, 160194 Southern	The Coles Co., Middletown	5.90	5.76	$46.00
	American Milling Co., Peoria, Ill.				
16398	Amco Brand	B. M. Rosenberg, Ellington	7.38	6.88	50.00
16486	Amco, 42562 Pa	The Coles Co., Middletown	6.91	6.88	41.50
17498	Amco	Station Agent, from J. W. McAllister, Farmers' Exchange, Cromwell	6.80	6.88	.....
16375	C. S. M. 14681 Pa	Broad Brook Lumber and Coal Co., Broad Brook	7.13	6.88	55.00
16377	C. S. M., T. P. W., 2353	Broad Brook Lumber and Coal Co., Broad Brook	6.83	6.88	45.00
16399	C. S. M., 20456	Broad Brook Lumber and Coal Co., Broad Brook	7.00	6.88	45.00
	Apothecaries Hall Co., Waterbury, Conn.				
16471	C. S. M	Huntington Bros., Windsor	7.16	....	.....
	Ashcraft-Wilkinson Co., Atlanta, Ga.				
17277	Helmet	Jeremiah McGrath, Broad Brook	5.85	6.56	41.00
16588	Monarch	Station Agent, from A. D. Bridge Sons Co., Hazardville	7.07	6.88	44.00
16721	Monarch, 192371	The Coles Co., Middletown	6.80	6.88	47.00
16853	Monarch	Station Agent, from Arthur Manning, South Manchester	7.04	6.88	38.00
16882	Monarch	Manning & Kahn, Manchester	7.08	6.88	38.00
16774	Paramount	Station Agent, from F. C. Morse, Guilford	5.98	5.76	39.00
	F. W. Brodé Co., Memphis, Tenn.				
15975	Jay, J. E., 47778	Geo. E. Phelps & Co., Thomsonville	5.85	5.75	38.00
16528	Owl, J. L	Garber-Northam Grain Co., Hartford	6.99	6.88	44.00
16631	Owl, M. & St. P	E. H. Rollins, Granby	7.00	6.56	66.50
16634	Owl, C. B. & Q., 99150	E. H. Rollins, Granby	7.00	6.56	66.50
16957	Owl	Station Agent, from A. W. Shepard & Son, Hartford	6.96	6.88	42.75
16091	C. S. M., N. Y. C., 240346	Broad Brook Lumber & Coal Co., Broad Brook	6.53	6.88	45.50
16283	C. S. M., C. B. & Q., 107108	Broad Brook Lumber & Coal Co., Broad Brook	7.12	6.88	55.50
16295	C. S. M., 1312103	Broad Brook Lumber & Coal Co., Broad Brook	6.90	6.88	.....

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen Found.	Per cent. Nitrogen Guaranteed.	Cost per ton.
	Buckeye Cotton Oil Co., Cincinnati, Ohio.				
16236	Buckeye	J. B. Cannon, Granby	5.84	5.76	$40.00
	Cotton Seed Products Co., Louisville, Ky.				
16156	Prime, M. K. & T. 81653	Broad Brook Lumber & Coal Co., Broad Brook	7.16	6.88	.....
	E. Crosby & Co., Brattleboro, Vt.				
16220	C. S. M., N. Y. C., 258423	Spencer Bros., Inc., Suffield	5.83	5.75	50.00
	Dallas Peanut Feed Mfrs., Dallas, Texas.				
15914	Besfeed, 47735	Griffin-Neuberger Tobacco Co., North Bloomfield	7.41	6.88	.....
16021	Besfeed, 89549	Griffin-Neuberger Tobacco Co., North Bloomfield	7.03	6.88	.....
	S. P. Davis, Little Rock, Ark.				
16406	Beauty	Station Agent, from A. D. Bridge Sons Co., Hazardville	5.69	5.75	52.00
16628	Good Luck, 45225	E. H. Rollins, Granby	6.98	6.56	65.00
16632	Good Luck, M. P., 8492	E. H. Rollins, Granby	6.98	6.56	64.50
17499	Good Luck	Station Agent, from Geo. Ackley, New Milford	6.48	6.50	42.50
16635	Good Luck, Wab., 78139	E. H. Rollins, Granby	7.24	6.56	65.00
16418	Steerboy	Herbert Cotton, East Granby	6.81	6.88	47.50
16630	Steerboy, N. Y. C., 218987	E. H. Rollins, Granby	6.71	6.88	45.00
16780	Steerboy	Station Agent, from C. F. Allen, Warehouse Pt	7.08	6.88	43.50
16786	Steerboy, S. S. W., 14062	Geo. T. Soule, New Milford	7.04	6.88	43.00
	Dixie Cotton Oil Co., Little Rock, Ark.				
16453	C. S. M., 170589	Griffin-Neuberger Tobacco Co., North Bloomfield	7.01	....	.....
	Eastern States Farmers' Exch. Springfield, Mass.				
16898	C. S. M	Station Agent, from C. B. Sikes, Ellington	7.10	6.87	43.00
	Ennis Cotton Oil & Mfg. Co., Ennis, Texas.				
15884	C. S. M., N. H., 71436	Geo. T. Soule, New Milford	7.43	6.88	.....

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Fidelity Products Co., Houston, Texas.				
16331	C. S. M., L. E. & W., 11906.	Broad Brook Lumber & Coal Co., Broad Brook	6.86	6.56	$48.00
16378	C. S. M., Southern, 26935.	Broad Brook Lumber & Coal Co., Broad Brook	6.57	6.56	50.00
16494	C. S. M.	Fred Lyman, Manchester	6.72	6.88	48.00
16629	C. S. M., S. S. W., 29178.	E. H. Rollins, Granby	7.16	6.88	41.25
	L. T. Frisbie Co., New Haven, Conn.				
16648	C. S. M.	Station Agent, from factory	7.28	6.58	.....
16734	C. S. M.	H. Dudek, Talcottville	6.89	6.88	.....
	John H. Hailey Co., Houston, Texas.				
16566	Texas	F. R. & R. M. Goodrich, Portland.	7.06	6.88	....[1]
16609	Texas	The Allied Tobacco Co., Hartford.	7.28	6.88	42.50
17500	Texas	Station Agent, from W. J. Norton, Broad Brook	7.04	6.87	46.00
16564	C. S. M., P. R. R., 44433.	F. R. & R. M. Goodrich, Portland	6.76	7.06	....[1]
16565	C. S. M., N. P., 39582	F. R. & R. M. Goodrich, Portland	7.04	7.43	....[1]
	W. D. Hall Co., Atlanta, Ga.				
15977	Good, 21727	Olin H. Osborn, Warehouse Point	5.94	5.76	51.50
17574	Good	Station Agent, from Leonard Grain Co., Winsted	6.21	5.76	45.00
	Hayes Grain & Comm. Co., Little Rock, Ark.				
16897	Hayes	Station Agent, from Patrick Colbert, South Windsor	6.92	6.87	45.00
	Hill County Cotton Oil Co., Hillsboro, Texas.				
15903	C. S. M., 51344	Griffin-Neubergar Tobacco Co., North Bloomfield	7.43	6.88	.....
	Honey Grove Cotton Oil Co., Honey Grove, Texas.				
16407	C. S. M.	Station Agent, from John Klaus, Scitico	7.00	6.88	59.00

[1] $4.90 per unit ammonia.

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn.				
15902	Bull, 8188	Griffin-Neuberger Tobacco Co., North Bloomfield	7.00	6.88	.....
15912	Bull, 29846	Griffin-Neuberger Tobacco Co., North Bloomfield	7.43	6.88	.....
15919	Bull, 79034	Griffin-Neuberger Tobacco Co., North Bloomfield	6.99	6.88	.....
15925	Bull, 44808	Griffin-Neuberger Tobacco Co., North Bloomfield	6.92	6.88	.....
16007	Bull, 124146	Griffin-Neuberger Tobacco Co., North Bloomfield	7.40	6.88	.....
16008	Bull, 22196	Griffin-Neuberger Tobacco Co., North Bloomfield	6.79	6.88	.....
16009	Bull, 48876	Griffin-Neuberger Tobacco Co., North Bloomfield	7.00	6.88	.....
16011	Bull, 120688	Griffin-Neuberger Tobacco Co., North Bloomfield	6.71	6.88	.....
16012	Bull, 121600	Griffin-Neuberger Tobacco Co., North Bloomfield	6.90	6.88	.....
16013	Bull, 18122	Griffin-Neuberger Tobacco Co., North Bloomfield	7.17	6.88	.....
16018	Bull, 36929	Griffin-Neuberger Tobacco Co., North Bloomfield	6.88	6.88	.....
16019	Bull, 104154	Griffin-Neuberger Tobacco Co., North Bloomfield	6.90	6.88	.....
16022	Bull, 49245	Griffin-Neuberger Tobacco Co., North Bloomfield	6.83	6.88	.....
16028	Bull, 41425	Griffin-Neuberger Tobacco Co., North Bloomfield	6.50	6.88	.....
16036	Bull, 16803	Griffin-Neuberger Tobacco Co., North Bloomfield	6.82	6.88	.....
16038	Bull, 122422	Griffin-Neuberger Tobacco Co., North Bloomfield	7.46	6.88	.....
16042	Bull, 34384	Griffin-Neuberger Tobacco Co., North Bloomfield	6.94	6.88	.....
16043	Bull, 76636	Griffin-Neuberger Tobacco Co., North Bloomfield	7.10	6.88	.....
16047	Bull, 29907	Griffin-Neuberger Tobacco Co., North Bloomfield	6.84	6.88	.....
16048	Bull, 28372	Griffin-Neuberger Tobacco Co., North Bloomfield	7.30	6.88	.....
16292	Bull, 24207 G. N.	G. S. Phelps & Co., Thompsonville	7.24	6.88	$48.50
16332	Bull, N. C., 62601	G. S. Phelps & Co., Thompsonville	7.29	6.88	48.50
16365	Bull, W. A. B., 67886	G. S. Phelps & Co., Thompsonville	6.94	6.88	42.75
16366	Bull, Southern, 131666	G. S. Phelps & Co., Thompsonville	6.70	6.88	44.00
16383	Bull, 10127, C. B.	E. F. Miller, Ellington	7.30	6.88	42.50
16405	Bull, M. K. & T., 81176	G. S. Phelps & Co., Thompsonville	6.82	6.88	44.00
16446	Bull, 5156	American Sumatra Tobacco Co., East Hartford	6.89	6.88	.....

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn. (*Continued*).				
16448	Bull, 34316	American Sumatra Tobacco Co., East Hartford	7.11	6.88	.....
16449	Bull, 130389	American Sumatra Tobacco Co., East Hartford	6.99	6.88	.....
16450	Bull, 36563	American Sumatra Tobacco Co., East Hartford	7.04	6.88	.....
16452	Bull, 37771	American Sumatra Tobacco Co., East Hartford	7.23	6.88	.....
16459	Bull, 14442	American Sumatra Tobacco Co., East Hartford	6.65	6.88	.....
16460	Bull, 29328	American Sumatra Tobacco Co., East Hartford	6.88	6.88	.....
16461	Bull, 26576	American Sumatra Tobacco Co., East Hartford	6.84	6.88	.....
16586	Bull	Station Agent, from J. E. Shepard, South Windsor	7.14	6.88	$41.65
16595	Bull, I. C., 49448	G. S. Phelps & Co., Thompsonville	6.98	6.88	43.00
16596	Bull, C. & E., 60806	G. S. Phelps & Co., Thompsonville	7.49	6.88	43.00
16598	Bull, M. O. P., 32542	E. F. Miller, Ellington	7.14	6.88	42.50
16662	Bull	Station Agent from Fassler & Silberman, Hartford	6.84	6.88	49.50
16669	Bull, N.Y.,N.H.& H.,74070	G. S. Phelps & Co., Thompsonville	7.20	6.88	44.75
16737	Bull, C. of G., 51046	G. S. Phelps & Co., Thompsonville	7.06	6.88	42.50
16738	Bull, A. C. L., 31464	G. S. Phelps & Co., Thompsonville	6.92	6.88	42.00
16760	Bull, M. P., 6298	G. S. Phelps & Co., Thompsonville	6.92	6.88	42.50
16761	Bull, 35548	G. S. Phelps & Co., Thompsonville	6.78	6.88	41.00
16762	Bull, 130617, Southern	G. S. Phelps & Co., Thompsonville	6.76	6.88	40.00
16763	Bull, S. A. L., 27205	G. S. Phelps & Co., Thompsonville	7.00	6.88	41.00
16784	Bull	C. R. Dubia, Brookfield	6.68	6.88	.....
16880	Bull	John M. Herr, Burnside	7.30	6.88	49.50
16906	Bull	Station Agent, from Haviland Tobacco Co., East Windsor Hill	7.30	6.88	42.25
16912	Bull, 37492	G. S. Phelps & Co., Thompsonville	6.94	6.88	40.00
16913	Bull, 7304	G. S. Phelps & Co., Thompsonville	7.22	6.88	40.00
16914	Bull, 8514	G. S. Phelps & Co., Thompsonville	6.86	6.88	40.00
16944	Bull, 7129	G. S. Phelps & Co., Thompsonville	6.98	6.88	40.00
17007	Bull, 30683	Steane, Hartman & Co., Hartford	7.13	6.88	.....
17008	Bull, 140962	Steane, Hartman & Co., Hartford	7.18	6.88	.....
17009	Bull, 107113	Steane, Hartman & Co., Hartford	7.08	6.88	.....
17010	Bull, 22127	Steane, Hartman & Co., Hartford	7.16	6.88	.....
17011	Bull, 33001	Steane, Hartman & Co., Hartford	7.28	6.88	.....
17122	Bull, B. & O., 195707	Spencer Bros., Inc., Suffield	7.18	6.88	43.00
16284	Danish, D. & R. S., 67092	Spencer Bros., Inc., Suffield	5.83	5.75	50.00
16285	Danish, C. N. W., 27414	Spencer Bros., Inc., Suffield	5.75	5.75	50.00
16286	Danish, A. C. L., 41711	Spencer Bros., Inc., Suffield	5.85	5.75	.....
16287	Danish, Southern, 121499	Spencer Bros., Inc., Suffield	5.50	5.75	50.00
16288	Danish, N. Y. C., 225933	Spencer Bros., Inc., Suffield	6.07	5.75	50.00

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen Found.	Per cent. Nitrogen Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn. (*Continued*)				
16289	Danish, N. S., 21467	Spencer Bros., Inc., Suffield	6.27	5.75	$50.00
16290	Danish, T. O. C., 14176	Spencer Bros., Inc., Suffield	5.76	5.75	50.00
16297	Danish, Penn., 517571	Spencer Bros., Inc., Suffield	5.85	5.75	50.00
16298	Danish, Penn., 501717	Spencer Bros., Inc., Suffield	6.14	5.75	50.00
16463	Danish, N. & W., 62319	G. S. Phelps & Co., Thompsonville	5.90	5.75	41.00
16464	Danish, R. I., 45718	Spencer Bros., Inc., Suffield	5.80	5.75	42.00
16465	Danish, N. Y. C., 260294	Spencer Bros., Inc., Suffield	5.67	5.75	46.00
16487	Danish	S. J. Orr, West Suffield	5.81	5.75	61.50
16488	Danish	S. J. Orr, West Suffield	5.82	5.75	61.60
16560	Danish, R. I., 54548	Spencer Bros., Inc., Suffield	5.74	5.75	40.00
16561	Danish, G. N., 24206	Spencer Bros., Inc., Suffield	5.32	5.75	50.00
16562	Danish, S.S.W., 19460	G. S. Phelps & Co., Thompsonville	5.58	5.75	41.00
16654	Danish, C. B. & Q., 107422	G. S. Phelps & Co., Thompsonville	5.98	5.75	41.00
17004	Danish	E. S. Lovell, Newtown	6.18	5.75	44.00
17057	Danish, C. V., 62735	Spencer Bros., Inc., Suffield	6.30	5.75	38.50
17058	Danish, Southern, 335756	Spencer Bros., Inc., Suffield	6.00	5.75	38.50
17059	Danish, Southern, 151673	Spencer Bros., Inc., Suffield	6.08	5.75	38.50
17060	Danish, N. Y. C., 161229	Spencer Bros., Inc., Suffield	5.94	5.75	38.50
17061	Danish, B. & O., 171756	Spencer Bros., Inc., Suffield	5.98	5.75	38.50
17062	Danish, 302510	Spencer Bros., Inc., Suffield	5.76	5.75	36.00
17063	Danish, L. & N., 103046	Spencer Bros., Inc., Suffield	6.90	5.75	38.50
17064	Danish, Southern, 134287	Spencer Bros., Inc., Suffield	6.24	5.75	38.50
17120	Danish, S. S. W., 13750	Spencer Bros., Inc., Suffield	6.02	5.75	48.50
17121	Danish, C. B. & Q., 133067	Spencer Bros., Inc., Suffield	6.18	5.75	38.50
17525	Danish, St.L.& S.F., 124872	The Coles Co., Middletown	5.78	5.75	50.00
17573	Danish, 8152	The Coles Co., Middletown	5.66	5.75	52.00
17599	Danish	Station Agent, from Geo. S. Phelps & Co., Thompsonville	5.68	5.75	38.00
16030	Dixie, 107142	Griffin-Neuberger Tobacco Co., North Bloomfield	6.90	6.56	.....
16045	Dixie, 12158	Griffin-Neuberger Tobacco Co., North Bloomfield	7.11	6.56	.....
16280	Dixie	L. B. Haas & Co., Hartford	6.29	6.56	56.00
16281	Dixie	L. B. Haas & Co., Hartford	6.41	6.56	56.00
16282	Dixie	L. B. Haas & Co., Hartford	6.37	6.56	56.00
16367	Dixie, G. N., 24780	H. C. Nelson, West Suffield	6.46	6.56	47.00
16382	Dixie, P. & R., 4578	G. S. Phelps & Co., Thompsonville	6.56	6.56	42.75
16504	Dixie, D., 130621–71673	Garber-Northam Co., Hartford	6.58	6.56	50.50
16512	Dixie, 45619	Olds & Whipple, Hartford	6.64	6.56	40.00
16531	Dixie	G. S. Phelps & Co., Thompsonville	6.68	6.56	54.00
16580	Dixie	Station Agent, from Chas. Ott, Burnside	7.08	6.56	43.50
16590	Dixie	John Ewald, Cromwell	6.74	6.56	42.50
16620	Dixie, C. M. & St.P., 503721	G. S. Phelps & Co., Thompsonville	6.63	6.56	43.00
16829	Dixie, 66622	E. S. Seymour, Suffield	6.72	6.56	39.75
16828	Dixie, 22148	E. S. Seymour, Suffield	6.76	6.56	39.75

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn. (*Continued*)				
17127	Dixie	Station Agent, from A. Manning, Manchester	6.28	6.56	$42.00
17248	Dixie	G. A. Peckham, Suffield	6.24	6.56	....
15777	C. S. M., 102781	The Coles Co., Middletown	6.02	5.76	69.08
15894	C. S. M., 99958	Griffin-Neuberger Tobacco Co., North Bloomfield	6.80	....	.....
15895	C. S. M., 13932	Griffin-Neuberger Tobacco Co., North Bloomfield	6.94	....	.....
15897	C. S. M., 30695	Griffin-Neuberger Tobacco Co., North Bloomfield	7.31	....	.....
15898	C. S. M., 17005	Griffin-Neuberger Tobacco Co., North Bloomfield	6.82	....	.....
15899	C. S. M., 35613	Griffin-Neuberger Tobacco Co., North Bloomfield	7.05	....	.....
15900	C. S. M., 241740	Griffin-Neuberger Tobacco Co., North Bloomfield	7.30	....	.....
15901	C. S. M., 132692	Griffin-Neuberger Tobacco Co., North Bloomfield	6.96	....	.....
15906	C. S. M., 11741	Griffin-Neuberger Tobacco Co., North Bloomfield	6.74	....	.....
15907	C. S. M., 44729	Griffin-Neuberger Tobacco Co., North Bloomfield	6.63	....	.....
15908	C. S. M., 55878	Griffin-Neuberger Tobacco Co., North Bloomfield	6.64	....	.....
15909	C. S. M., 57284	Griffin-Neuberger Tobacco Co., North Bloomfield	7.27	....	.....
15910	C. S. M., 87500	Griffin-Neuberger Tobacco Co., North Bloomfield	6.71	....	.....
15913	C. S. M., 90104	Griffin-Neuberger Tobacco Co., North Bloomfield	7.25	....	.....
15915	C. S. M., 101182	Griffin-Neuberger Tobacco Co., North Bloomfield	6.68	....	.....
15916	C. S. M., 208711	Griffin-Neuberger Tobacco Co., North Bloomfield	6.39	....	.....
15917	C. S. M., 4378	Griffin-Neuberger Tobacco Co., North Bloomfield	6.69	....	.....
15918	C. S. M., 20196	Griffin-Neuberger Tobacco Co., North Bloomfield	6.33	....	.....
15920	C. S. M., 13752	Griffin-Neuberger Tobacco Co., North Bloomfield	6.68	....	.....
15921	C. S. M., 45886	Griffin-Neuberger Tobacco Co., North Bloomfield	6.86	....	.....
15922	C. S. M., 2530	Griffin-Neuberger Tobacco Co., North Bloomfield	6.89	....	.....
15923	C. S. M., 17239	Griffin-Neuberger Tobacco Co., North Bloomfield	7.01	....	.....

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen Found.	Per cent. Nitrogen Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn. (*Continued.*)				
15924	C. S. M., 15598	Griffin-Neuberger Tobacco Co., North Bloomfield	6.55	....	.....
15926	C. S. M., 46131	Griffin-Neuberger Tobacco Co., North Bloomfield	7.04	....	.....
16006	C S. M., 30406	Griffin-Neuberger Tobacco Co., North Bloomfield	7.22	....	.....
16010	C. S. M., 90489	Griffin-Neuberger Tobacco Co., North Bloomfield	7.16	....	.....
16020	C. S. M., 234420	Griffin-Neuberger Tobacco Co., North Bloomfield	7.13	....	.....
16023	C. S. M., 25507	Griffin-Neuberger Tobacco Co., North Bloomfield	6.96	....	.....
16024	C. S. M., 54644	Griffin-Neuberger Tobacco Co., North Bloomfield	6.92	....	.....
16025	C. S. M., 126125	Griffin-Neuberger Tobacco Co., North Bloomfield	7.05	....	.....
16029	C. S. M., 63348	Griffin-Neuberger Tobacco Co., North Bloomfield	7.10	....	.....
16031	C. S. M., 241750	Griffin-Neuberger Tobacco Co., North Bloomfield	7.13	....	.....
16033	C. S. M., 93742	Griffin-Neuberger Tobacco Co., North Bloomfield	6.88	....	.....
16034	C. S. M., 61573	Griffin-Neuberger Tobacco Co., North Bloomfield	6.90	....	.....
16035	C. S. M., 102829	Griffin-Neuberger Tobacco Co., North Bloomfield	7.00	....	.....
16039	C. S. M., 21763	Griffin-Neuberger Tobacco Co., North Bloomfield	6.98	....	.....
16046	C. S. M., 14891	Griffin-Neuberger Tobacco Co., North Bloomfield	6.97	....	.....
16215	C. S. M., S. F., 27712	Spencer Bros., Inc., Suffield	5.88	5.75	$50.00
16216	C. S. M., N. Y. C., 115279	Spencer Bros., Inc., Suffield	5.60	5.75	50.00
16217	C. S. M., C. G. R., 84555.	Spencer Bros., Inc., Suffield	6.02	5.75	50.00
16218	C. S. M., Southern, 152676	Spencer Bros., Inc., Suffield	5.62	5.75	50.00
16219	C. S. M., C. H. D., 40299.	Spencer Bros., Inc., Suffield	6.04	5.75	50.00
16409	C. S. M	Station Agent, from J. E. Shepard, South Windsor	6.92	6.91	.....
16411	C. S. M	Station Agent, from J. E. Shepard, South Windsor	7.19	7.29	43.41
16416	C. S. M., 11359	Station Agent, from J. E. Shepard, South Windsor	7.88	7.96	46.95
16417	C. S. M., 84487	Station Agent, from J. E. Shepard, South Windsor	8.11	8.15	48.06
16455	C. S. M., 88678	American Sumatra Tobacco Co., East Hartford	7.14	....	.....

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Humphreys-Godwin Co., Memphis, Tenn. (*Continued*).				
16470	C. S. M., N. Y. C., 238827	Huntington Bros., Windsor	7.24	....	.....
16524	C. S. M.	Huntington Bros., Windsor	7.06	....	....[1]
16582	C. S. M., 34105	Station Agent, from J. E. Shepard, South Windsor	7.19	7.20	$42.49
16583	C. S. M., 36005	Station Agent, from J. E. Shepard, South Windsor	7.08	7.07	42.14
16589	C. S. M.	Station Agent, from J. E. Shepard, South Windsor	7.19	....	42.43
16702	C. S. M., G. A., 8658	Spencer Bros., Inc., Suffield	6.10	5.75	40.00
16703	C. S. M., S. A. L., 24838	Spencer Bros., Inc., Suffield	7.30	7.00	43.00
16704	C. S. M., A.T.& S.F.,27477	Spencer Bros., Inc., Suffield	5.70	5.75	39.00
16705	C. S. M., Southern, 133553	Spencer Bros., Inc., Suffield	7.08	7.00	45.00
16706	C. S. M., G. A., 5106	Spencer Bros., Inc., Suffield	6.09	5.75	38.00
16707	C. S. M., A. C. L., 39760	Spencer Bros., Inc., Suffield	5.50	5.75	40.00
16708	C. S. M., Penn., 22004	Spencer Bros., Inc., Suffield	6.20	5.75	41.00
16709	C. S. M., P. R. R., 14879	Spencer Bros., Inc., Suffield	5.95	5.75	41.00
16710	C. S. M., Penn., 52944	Spencer Bros., Inc., Suffield	5.58	5.75	40.00
16711	C. S. M., M. K. T., 88132	Spencer Bros., Inc., Suffield	6.15	5.75	40.00
16712	C. S. M., Frisco, 32235	Spencer Bros., Inc., Suffield	6.12	5.75	40.00
16713	C. S. M., G. A., 1005	Spencer Bros., Inc., Suffield	6.03	5.75	40.00
16886	C. S. M., G. T., 12821	Spencer Bros., Inc., Suffield	6.02	5.75	40.00
16887	C. S. M., U. P., 10455	Spencer Bros., Inc., Suffield	5.82	5.75	39.00
16888	C. S. M., A. C. L., 35742	Spencer Bros., Inc., Suffield	6.06	5.75	38.60
16889	C. S. M., St.L.&B.&M.,1646	Spencer Bros., Inc., Suffield	5.73	5.76	40.00
16890	C. S. M., St.L.&S.F.,125280	Spencer Bros., Inc., Suffield	5.74	5.75	38.50
16891	C. S. M., A. C. L., 32300	Spencer Bros., Inc., Suffield	5.56	5.75	40.00
16892	C. S. M., N. S., 4023	Spencer Bros., Inc., Suffield	6.08	5.75	38.50
16893	C. S. M., A. C. L., 39956	Spencer Bros., Inc., Suffield	5.90	5.75	50.00
16894	C. S. M., N.C.&St.L.24516	Spencer Bros., Inc., Suffield	5.88	5.75	40.00
16972	C. S. M., N. Y. C., 255668	Spencer Bros., Inc., Suffield	5.97	....	36.00
16973	C. S. M., 4067	Spencer Bros., Inc., Suffield	5.74	....	36.00
16974	C. S. M., 14707	Spencer Bros., Inc., Suffield	5.78	....	36.00
16975	C. S. M., R. I., 155248	Spencer Bros., Inc., Suffield	6.01	....	36.00
	Industrial Cotton Oil Prop't's, Houston, Texas.				
16665	Longhorn	Fassler & Silberman, Hartford	7.12	6.88	46.75
	Jayton Cotton Oil Co., Jayton, Texas.				
15892	Ordinary, 16803	Griffin-Neuberger Tobacco Co., North Bloomfield	6.99	6.88	.....
15905	Ordinary, 180965	Griffin-Neuberger Tobacco Co., North Bloomfield	6.97	6.88	.....
16004	Ordinary, 52844	Griffin-Neuberger Tobacco Co., North Bloomfield	6.90	6.88	.....
16016	Ordinary, 2400	Griffin-Neuberger Tobacco Co., North Bloomfield	7.07	6.88	.....

[1] $4.90 per unit ammonia.

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	Jefferson Oil Co., Jefferson, Texas				
16037	Ordinary, 248755	Griffin-Neuberger Tobacco Co., North Bloomfield	6.70	6.88	.....
16451	Jefferson, 130396	American Sumatra Tobacco Co., East Hartford	6.79	6.88	.....
	Kasco Mills, Waverly, N. Y.				
16621	C. S. M., 30916, D. W. P.	The Coles Co., Middletown	7.26	6.88	$50.00
16623	C. S. M., Erie 72823	The Coles Co., Middletown	6.91	6.16	47.50
	L. B. Lovitt & Co., Memphis, Tenn.				
17540	Lovit	Station Agent, from T. J. Colemen, Warehouse Point	6.82	6.56	50.00
16783	Memphis	Station Agent, from W. C. Everett, Bloomfield	6.16	6.16	44.00
16960	Neal's Choice	Station Agent, from A. N. Shepard & Son, Hartford	7.12	6.88	47.50
16782	36 Brand	Station Agent, from A. R. Carpenter, Bloomfield	5.68	5.75	46.00
16237	C. S. M.	Thomas Connor, Poquonock	6.30	....	....[1]
16291	C. S. M.	John B. Parker, Poquonock	6.79	....	....[2]
16376	C. S. M.	John B. Parker, Poquonock	6.55	7.38	....[2]
16462	C. S. M., G. T., 23273	A. R. Fairbanks, Windsor	6.32	6.69	69.19
16558	C. S. M.	I. Meyer & Co., Windsor Locks	6.00	5.76	41.00
16559	C. S. M.	I. Meyer & Co., Windsor Locks	5.09	5.76	41.00
	Lyle & Lyle Huntsville, Ala.				
16778	Economy	Station Agent, from Meech & Stoddard, Middletown	6.04	5.76	39.00
16779	Lyle's Best	Station Agent, from H. C. Vibert, South Windsor	6.94	6.88	40.50
16899	Lyle's Best	Station Agent, from R. E. Hyde, Ellington	6.96	6.88	43.00
17874	Lyle's Best	H. F. Johnson, Co. Agent, Norwich	6.88	6.88	45.00
15785	C. S. M., 15698	The Coles Co., Middletown	5.87	5.76	70.00
16622	C. S. M., 36464	The Coles Co., Middletown	5.90	5.76	45.00
16962	C. S. M., 133187, Southern	Station Agent, from A. N. Shepard & Son, Hartford	7.04	6.88	42.75
	Mart Cotton Oil Co., Mart, Texas.				
16032	C. S. M., 8207	Griffin-Neuberger Tobacco Co., North Bloomfield	7.32	6.88	.....

[1] $8.50 per unit ammonia.
[2] $8.85 per unit ammonia.

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen		Cost per ton.
			Found.	Guaranteed.	
	McGregor Cotton Oil Co., McGregor, Texas.				
15896	C. S. M., 24044	Griffin-Neuberger Tobacco Co., North Bloomfield	6.67	6.88	.....
	Meech & Stoddard, Inc., Middletown.				
16777	Connecticut	Station Agent, from manufacturer	6.20	5.76	$39.00
	Morrilton Cotton Oil Co., Morrilton, Ark.				
16447	Big Four, 31055	American Sumatra Tobacco Co., East Hartford	7.29	6.88	.....
	Munger Oil & Cotton Co., Teague, Texas.				
15904	C. S. M., 24480	Griffin-Neuberger Tobacco Co., North Bloomfield	7.23	6.88	.....
16005	C. S. M., 59617	Griffin-Neuberger Tobacco Co., North Bloomfield	7.50	6.88	.....
16015	C. S. M., 84008	Griffin-Neuberger Tobacco Co., North Bloomfield	7.40	6.88	.....
	W. C. Nothern, Memphis, Tenn.				
17496	Bee	Station Agent, from Wm. Reeves, Windsorville	6.68	6.56	45.00
16852	Queen Bee, P. R. R., 32149	Station Agent, from D. E. and R. C. Neelans, Hazardville	6.98	6.88	48.00
17455	Queen Bee	Station Agent, from E. N. Austin, Suffield	6.64	6.88	43.00
16408	Standard	Station Agent, from Jos. Klaus, Scitico	6.10	5.75	57.00
	Osage Cotton Oil Co., Kansas City, Mo.				
16456	Special Quality, 3427	American Sumatra Tobacco Co., East Hartford	6.92	6.88	.....
16458	Special Quality, 17678	American Sumatra Tobacco Co., East Hartford	7.07	6.88	.....
16041	C. S. M., 78632	Griffin-Neuberger Tobacco Co., North Bloomfield	7.27	6.88	.....
16044	C. S. M., 102643	Griffin-Neuberger Tobacco Co., North Bloomfield	7.28	6.88	.....
16454	C. S. M., 18926	American Sumatra Tobacco Co., East Hartford	7.28	6.88	.....

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Continued*).

Station No.	Manufacturer or Jobber, Car No. or Mark.	Purchased, Sampled or Sent by	Per cent. Nitrogen.		Cost per ton.
			Found.	Guaranteed.	
	Park & Pollard Co., Boston, Mass.				
16767	Upland	Station Agent, from F. B. Newton Estate, Plainville	5.66	5.75	$56.00
17005	Upland, 49459	Broad Brook Lumber and Coal Co., Broad Brook	6.88	5.75	40.00
16474	C. S. M., Southern, 40217.	Broad Brook Lumber and Coal Co., Broad Brook	6.73	6.56	52.00
16633	C. S. M., R. I., 36847	E. H. Rollins, Granby	7.05	6.88	59.00
	Planters Cotton Oil Co., Bonham, Texas.				
16027	C. S. M., 38766	Griffin-Neuberger Tobacco Co., North Bloomfield	6.83	6.88	.....
	Riverside Cotton Oil Co., Fort Worth, Texas.				
15893	C. S. M., 552825	Griffin-Neuberger Tobacco Co., North Bloomfield	7.12	6.88	.....
15911	C. S. M., 98181	Griffin-Neuberger Tobacco Co., North Bloomfield	6.89	6.88	.....
16017	C. S. M., 33252	Griffin-Neuberger Tobacco Co., North Bloomfield	6.74	6.88	.....
16026	C. S. M., 42455	Griffin-Neuberger Tobacco Co., North Bloomfield	6.90	6.88	.....
	G. B. Robinson, Jr., New York City.				
16489	Robin, P. R. R., 49566	A. E. Potwine, East Windsor	6.60	6.50	39.80
16490	Robin, P. R. R., 40419	A. E. Potwine, East Windsor	6.16	6.50	39.80
16827	C. S. M., 125145	Griffin-Neuberger Tobacco Co., North Bloomfield	7.13	6.88	40.75
	The Rogers & Hubbard Co., Middletown, Conn.				
16602	C. S. M., N. Y., N. H. & H., 89549	Fred. E. Lord, Warehouse Point	6.61	6.58	43.50
16907	C. S. M	Station Agent, from Arthur Manning, South Manchester	6.44	6.17	42.00
17092	C. S. M	W. E. Harvey, Windsor	6.44	6.08	.....
17126	C. S. M	Station Agent, from Arthur Manning, South Manchester	6.58	6.58	42.00
17128	C. S. M	Station Agent, from Arthur Manning, South Manchester	6.64	6.58	42.00
17211	C. S. M	F. A. Hamilton, Warehouse Point	6.96	6.58	42.50

TABLE III. ANALYSES OF COTTON SEED MEAL—(*Concluded*).

Station No.	Manufacturer or Jobber, Car No. or Mark	Purchased, Sampled or Sent by	Per cent. Nitrogen. Found.	Per cent. Nitrogen. Guaranteed.	Cost per ton.
	J. E. Soper Co., Boston, Mass.				
16182	Priscilla	E. N. Austin, Suffield	7.23	6.75	$49.00
16484	Priscilla	Arthur E. Pascoe, Warehouse Point	7.08	6.75	52.50
16781	Puritan	Station Agent, from R. F. Harvey, Burnside	6.12	5.75	48.50
	Southland Cotton Oil Co., Paris, Texas.				
16457	Climax, 172063	American Sumatra Tobacco Co., East Hartford	6.82	6.88	.....
16584	Climax, 84562	Station Agent, from J. E. Shepard, South Windsor	7.18	6.88	42.53
16585	Climax, 19481	Station Agent, from J. E. Shepard, South Windsor	7.20	6.88	42.53
	A. C. Westervelt & Co. Memphis, Tenn.				
16689	Planet, Southern, 150019	Martin E. Noone, Suffield	7.10	6.88	41.00
16963	Planet	Station Agent, from A. N. Shepard & Son, Hartford	7.14	6.88	55.50
16965	Planet	Station Agent, from A. N. Shepard & Son, Hartford	7.08	6.88	55.50
16860	Sun	Fred D. Weed, Danbury	5.93	5.75	47.00
	West Cotton Oil Mill, West, Texas.				
16610	C. S. M	Richard & Cooley, East Hartford.	7.08	6.88	46.00
	E. H. Young Co., Inc., Fort Worth, Texas.				
16014	Young's 43, 50109	Griffin-Neuberger Tobacco Co., North Bloomfield	7.15	6.88	.....
	Unknown.				
16299	C. S. M	A. N. Farnham, Westville	5.60	....	.....
16510	C. S. M., 36285	Conn. Sumatra Tobacco Co., Buckland	6.66	6.58	40.00
16805	C. S. M	Geo. C. Eno, Simsbury	6.90	....	42.50
17111	C. S. M	Hackett Brothers, Buckland	7.08	....	.....
17114	C. S. M	Hackett Brothers, Buckland	6.88	....	.....

CASTOR POMACE.

Nineteen samples were analyzed as follows:

17288. Sold by Eastern States Farmers' Exchange, Springfield, Mass. Stock of Robert Gregg, West Suffield.

16516. Sold by Apothecaries Hall Co., Waterbury. Stock of Conn. Sumatra Tobacco Co., Buckland.

16604. Sold by Independent Trading Co., Inc., New York. Stock of J. H. Lynch, Ellington.

16976. Sold by Eastern States Farmers' Exchange, Springfield, Mass. Stock of Spencer Bros., Inc., Suffield.

16443. Sold by Baker Castor Oil Co., New York. Stock of American Sumatra Tobacco Co., East Hartford.

17329. Sold by E. D. Chittenden Co., Bridgeport. Stock of W. J. Norton, Broad Brook.

16445. Sold by Baker Castor Oil Co., New York. Stock of American Sumatra Tobacco Co., East Hartford.

16660. Sold by Olds & Whipple, Hartford. Sampled at factory.

16843. Sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

16444. Sold by Baker Castor Oil Co., New York. Stock of American Sumatra Tobacco Co., East Hartford.

16744. Sold by Baker Castor Oil Co., New York. Stock of Olds & Whipple, Hartford.

16904. Sold by Baker Castor Oil Co., New York. Stock of Haviland Tobacco Co., East Windsor.

16680. Sold by Berkshire Fertilizer Co., Bridgeport. Sampled at factory.

16806. Sold by Olds & Whipple, Hartford. Stock of Geo. Eno, Simsbury.

17497. Sold by Apothecaries Hall Co., Waterbury. Stock of O. S. Olmsted, Hazardville.

15928. Sold by Baker Castor Oil Co., New York. Stock of Griffin-Neuberger Tobacco Co., North Bloomfield.

15929. Sold by Baker Castor Oil Co., New York. Stock of Griffin-Neuberger Tobacco Co., North Bloomfield.

16472. Sold by Olds & Whipple, Hartford. Stock of Huntington Bros., Windsor.

16651. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

TABLE IV. ANALYSES OF CASTOR POMACE.

Station No.	Per cent. of Nitrogen Found	Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
17288	6.18	5.76	$51.50	41.7
16516	6.00	4.52	50.00	41.7
16604	5.96	....	50.00	41.9
16976	6.02	5.76	51.50	42.8
16443[1]	5.19	4.50	45.00	43.4
17329	5.70	4.52	50.00	43.9
16445[1]	5.10	4.50	45.00	44.1
16660	6.60	5.00	58.90	44.6
16843	5.58	4.52	50.00	44.8
16444[1]	4.99	4.50	45.00	45.1
16744[1]	5.58	4.50	52.00	46.6
16904[1]	5.36	4.50	51.00	47.6
16680	5.18	4.52	50.00	48.3
16806	6.30	....	62.00	49.2
17497	5.40	4.53	55.00	50.9
15928	5.36	....	.....	....
15929	6.39	....	.....	....
16472	5.53	....	.....	....
16651	5.87	5.35	.....	....

[1] Guaranty of 1 to 3 per cent. potash and 1-3 per cent. phosphoric acid.

In ten of the samples about 5 per cent. nitrogen is guaranteed. 5.76 is the highest guaranty.

The average cost of nitrogen in castor pomace has been 45.1 cents per pound.

The usual amounts of phosphoric acid and potash found in castor pomace are shown in the following five analyses:

TABLE V. NITROGEN, PHOSPHORIC ACID AND POTASH IN CASTOR POMACE.

Station No.	16443	16445	16444	16744	16904	Average
Percentage of						
Nitrogen	5.19	5.10	4.99	5.58	5.36	5.24
Water-and citrate-soluble phosphoric acid	1.78	1.78	1.76	1.79	1.72	1.77
Total phosphoric acid	1.79	1.82	1.79	1.87	1.80	1.81
Total potash	1.12	1.17	1.09	1.00	1.06	1.09

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

BARIUM-PHOSPHATE.

17391. Grade A. Sold by Witherbee, Sherman & Co., New York, N. Y. Stock of Chas. Q. Eldredge, Mystic. Guaranteed 28 per cent. phosphoric acid.

ANALYSIS OF BARIUM-PHOSPHATE.

Station No.	17391
Percentage of	
Water-soluble phosphoric acid	0.04
Citrate-soluble phosphoric acid	5.17
Insoluble phosphoric acid	25.34
Total phosphoric acid	30.55

RAW ROCK PHOSPHATE.

Three samples were analyzed as follows:

16883. Mitchell's Raw Phosphate Float. Sold by Walter Mitchell, New Haven. Sent by F. E. Prentice, North Haven.

17414. Mitchell's Raw Phosphate Float. Sold by Walter Mitchell, New Haven. Stock of Louis Schwartz, Mt. Carmel.

16577. Tetraphosphate, submitted by Herbert Myrick, Springfield, Mass.

TABLE VI. ANALYSES OF RAW ROCK PHOSPHATE.

Station No.	16883	17414	16577
Percentage of			
Water-soluble phosphoric acid	.....	.....	.....
Citrate-soluble phosphoric acid	4.33	.....	1.75
Citrate-insoluble	26.35	.....	22.90
Total phosphoric acid	30.68	30.47	24.65
"Available" phosphoric acid	4.33	.....	1.75
Cost per ton	$19.00	$20.00	.....

PRECIPITATED BONE PHOSPHATE.

This is a manufacturing by-product, in fine mechanical condition, containing from 30 to 40 per cent. of phosphoric acid, most of it in "available" form.

The analyses of twenty samples are given in the table. There appear to be three distinct grades; four samples contained 38 per cent. or more of available phosphoric acid, ten contained from 33 to 38 per cent., four from 30 to 32, and two under 30 per cent.

Most of this phosphate was sold at a stated price "per unit" of available phosphoric acid, as shown by analysis, a "unit" being 20 pounds or one per cent.

In these samples the price has ranged from 7½ to 9½ cents per pound for available phosphoric acid.

15784 is of inferior quality selling at a high price, unless the quotation is at retail for small amounts.

17446 was found by a trade chemist to contain 39.92 per cent. of available phosphoric acid and a somewhat larger percentage of total phosphoric acid than this Station found. The difference probably is explained by a difference in the method of extraction, the method used here being prescribed by the fertilizer law.

TABLE VII. ANALYSES OF PRECIPITATED BONE PHOSPHATE.

Station No.	Manufacturer or Wholesale Dealer	Dealer or Purchaser.	Phosphoric Acid.					Cost per ton.
			Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.	"Available."	
	Sampled by Station:		%	%	%	%	%	
17584	Berkshire Fertilizer Co., B'dgeport	Sampled at factory	0.90	38.21	0.73	39.84	39.11[1]	.....
16659	Olds & Whipple, Hartford	Sampled at factory	0.85	38.06	0.63	39.54	38.91[2]	.....
16905	Olds & Whipple, Hartford	Haviland Tob. Co., East Windsor Hill	0.73	38.50	0.23	39.46	39.23[3]	$66.66
17446	Wilcox Fertilizer Co., Mystic	M. E. Thompson, Ellington	0.77	37.09	0.36	38.22	37.86[3]	70.00
	Sampled by Purchaser:							
15930	American Glue Co., Boston, Mass.	Griffin-Neuberger Tobacco Co., North Bloomfield	2.12	30.96	1.56	34.64	33.08	.....
15931	American Glue Co., Boston, Mass.	Griffin-Neuberger Tobacco Co., North Bloomfield	1.80	33.32	2.32	37.44	35.12	.....
16434	American Glue Co., Boston, Mass.	American Sumatra Tobacco Co., East Hartford	0.98	33.83	0.73	35.54	34.81	.....
16435	American Glue Co., Boston, Mass.	American Sumatra Tobacco Co., East Hartford	0.76	35.57	0.79	37.12	36.33	.....
16436	American Glue Co., Boston, Mass.	American Sumatra Tobacco Co., East Hartford	0.68	35.59	0.99	37.26	36.27	.....
16437	American Glue Co., Boston, Mass.	American Sumatra Tobacco Co., East Hartford	0.73	35.34	0.95	37.02	36.07	.....
16438	American Glue Co., Boston, Mass.	American Sumatra Tobacco Co., East Hartford	0.71	37.00	0.93	38.64	37.71	.....
16439	American Glue Co., Boston, Mass.	American Sumatra Tobacco Co., East Hartford	0.84	36.23	0.93	38.00	37.07	.....
16878	East. St. Farm. Exch., Springfield.	John Herr, Burnside	0.61	36.54	0.87	38.02	37.15	57.00
15789	A. W. Higgins, Westfield, Mass.	Griffin-Neuberger Tobacco Co., North Bloomfield	1.80	30.41	1.33	33.54	32.21	.....
15790	A. W. Higgins, Westfield, Mass.	Griffin-Neuberger Tobacco Co., North Bloomfield	1.75	28.89	1.87	32.51	30.64	.....
15791	A. W. Higgins, Westfield, Mass.	Griffin-Neuberger Tobacco Co., North Bloomfield	1.58	29.46	3.45	34.49	31.04	.....
15792	A. W. Higgins, Westfield, Mass.	Griffin-Neuberger Tobacco Co., North Bloomfield	1.03	29.72	1.70	32.45	30.75	.....
16518	Olds & Whipple, Hartford	Conn. Sumatra Tobacco Co., Buckland	1.63	26.52	5.39	33.54	28.15	.....
16523	Olds & Whipple, Hartford	Huntington Bros., Windsor	0.68	37.57	0.13	38.38	38.25[4]	52.32
15784	Unknown	Quality Shop, Stamford	2.02	25.28	1.97	29.27	27.30	60.00

[1] Guaranty 38% "available." [2] Guaranty 30% "available." [3] Guaranty 39.50% "available." [4] Guaranty 36.08% phosphoric acid.

DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

The analyses of 28 samples are given in table VIII.

The guaranty is the same in all cases, except **17186**, sold by the Virginia-Carolina Chemical Co., in which 20 per cent. "available" was guaranteed and 18.87 per cent. was found.

Two other samples, **17051**, from the American Agricultural Chemical Co., and **17019**, from the Coe-Mortimer Co., did not meet their guaranties.

The cost of available phosphoric acid to the farmer in 21 samples ranged from 6.9 to 11.7 cents per pound and averaged 9.4 cents.

During the last year the price of acid phosphate has been very high and almost prohibitive until the market broke and forced sales reduced the price from $30.00 or more to less than $20.00.

The wholesale price of acid phosphate in bulk, f.o.b. N. Y., was $16.00 in January and $12.50 in the following September.

Sampled by Station:

17240. Sold by Nitrate Agencies Co., New York. Stock of J. McAllister, Farmers' Exchange, Cromwell.

17101. Sold by Eastern States Farmers' Exchange, Springfield, Mass. Stock of A. R. Carpenter, Bloomfield.

16765. Sold by Everett B. Clark Seed Co., Milford. Sampled at factory.

16771. Sold by Piedmont-Mt. Airy Guano Co., Baltimore, Md. Stock of Joseph Adams, Green's Farms.

16656. Sold by Olds & Whipple, Hartford. Sampled at factory.

16775. Sold by Wilcox Fertilizer Co., Mystic. Stock of G. R. Stannard, Branford.

17134. Sold by Providence Farmers' Exchange, Providence, R. I. Stock of Walter Scott, Niantic.

17451. Sold by Nitrate Agencies Co., New York. Stock of E. N. Austin, Suffield.

17146. Sold by Virginia-Carolina Chemical Co., New York. Stock of J. R. Reinhard, West Cheshire.

16678. Sold by Berkshire Fertilizer Co., Bridgeport. Stock of D. L. Clark & Sons, Milford.

17186. Sold by Virginia-Carolina Chemical Co., New York. Stock of J. D. Kelsey, Madison.

17373. Sold by International Agricultural Corp., Woburn, Mass. Stock of P. Schwartz Co., New London.

16845. Sold by Armour Fertilizer Works, New York. Stock of Rockville Grain & Coal Co., Rockville.

16766. Sold by Bowker Fertilizer Co., New York. Stock of W. T. McKenzie, Yalesville.

17198. Sold by F. S. Royster Guano Co., Baltimore, Md. Stock of Silliman Hardware Co., New Canaan.

TABLE VIII. ANALYSES OF ACID PHOSPHATE.

Station No.	Phosphoric Acid. Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.	"Available" found.	Cost per ton.	"Available" phosphoric acid costs cents per pound.
	%	%	%	%	%		
17240	14.59	2.78	0.04	17.41	17.37	$24.00	6.9
17101	12.31	3.74	0.63	16.68	16.05	33.00	7.5
16765	14.12	1.79	0.29	16.20	15.91	24.50	7.7
16771	13.30	2.59	0.61	16.50	15.89	25.75	8.1
16656	14.50	2.64	0.22	17.36	17.14	29.45	8.6
16775	15.21	3.04	0.15	18.40	18.25	31.50	8.6
17134	13.57	2.70	0.90	17.17	16.27	28.00	8.6
17451	14.69	2.10	0.05	16.84	16.79	30.00	8.9
17146	14.09	2.21	1.11	17.41	16.30	30.00	9.2
16678	14.99	1.64	1.61	18.24	16.63	31.00	9.3
17186	15.81	3.06	1.19	20.06	18.87	33.00	9.3
17373	11.11	4.94	1.23	17.28	16.05	30.00	9.3
16845	14.11	2.70	0.93	17.74	16.81	33.00	9.8
16657	13.57	3.23	1.01	17.81	16.80	34.75	10.3
17198	13.26	4.01	0.36	17.63	17.27	36.00	10.4
16683	11.97	4.84	0.75	17.56	16.81	36.00	10.7
17576	10.18	4.71	0.67	15.56	14.89	32.00	10.7
17023	12.24	4.40	0.63	17.27	16.64	36.00	10.8
17051	10.00	4.83	0.84	15.67	14.83	33.00	11.1
17019	10.73	4.46	0.87	16.06	15.19	35.50	11.7
16766	11.15	5.04	1.14	17.33	16.19	38.00	11.7
16649	13.18	3.76	0.28	17.22	16.94	.....	....
16650	13.54	3.88	0.31	17.73	17.42	.....	....
16851	14.28	2.39	0.70	17.37	16.67	.....	....
16900	10.14	5.96	1.00	17.10	16.10	.....	....
17332[1]	15.44	0.96	0.12	16.52	16.40	.....	....
17117	.....	....	....	17.33	.....	.....	....
17875	14.27	3.27	0.52	18.06	17.54	24.00	6.9

[1] Old Stock.

16683. Sold by Miller Fertilizer Co., Baltimore, Md. Stock of Ansonia Flour & Grain Co., Ansonia.

17576. Sold by Miller Fertilizer Co., Baltimore, Md. Stock of Laden Bros., Inc., Wallingford.

17023. Sold by American Agricultural Chemical Co., New York. Stock of Frank Upham, Stafford.

17051. Sold by American Agricultural Chemical Co., New York. Stock of Fred Appel, Riverton.

17019. Sold by Coe-Mortimer Co., New York. Stock of Gunther Bros., Rockville.

16657. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled at factory.

16649. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

16650. Sold by Atlantic Packing Co., New Haven. Sampled at factory.

16851. Sold by Apothecaries Hall Co., Waterbury. Stock of Connecticut School for Boys, Meriden.

16900. Sold by National Fertilizer Co., New York. Stock of F. O. Williams, Silver Lane.

17332.[1] Stock of J. F. Brown, North Stonington.

Sampled by Purchaser:

17117. Stock of Hackett Bros., Buckland.

17875. Sold by L. T. Frisbie Co., New Haven. Stock of Norwich Coöp. Exchange, Norwich.

III. RAW MATERIALS CONTAINING POTASH.

In table IX are given analyses of 9 samples of muriate, 28 of high grade sulphate, 2 of Nebraska potash, and one each of kainit, "vegetable potash" and cotton hull ashes. Six of these failed to meet their guaranties. These were—

		Deficiency per cent.
17410	Eastern States Farmers' Exchange.....	4.75
17231	Providence Farmers' Exchange.....	3.30
16733	L. T. Frisbie Co.	0.40
17210	The Rogers & Hubbard Co.	0.25
16473	Olds & Whipple.....	0.80
16509	.....	3.00

Every sample of potash salts analyzed was tested for borax with negative result.

The average cost per pound of potash as muriate in 5 samples drawn by the Station was 11.3 cents.

The average cost per pound of potash as sulphate in 7 samples drawn in the same way was 11.1 cents.

Muriate of Potash. Sampled by Station Agent.

16848. Sold by Apothecaries Hall Co., Waterbury. Stock of Connecticut School for Boys, Meriden.

16934. Sold by Piedmont-Mt. Airy Guano Co., Baltimore, Md. Stock of Farmers' Exchange, Putnam.

16681. Sold by Berkshire Fertilizer Co., Bridgeport. Sampled at factory.

17410. Sold by Eastern States Farmers' Exchange, Springfield, Mass. Stock of A. R. Carpenter, Bloomfield.

[1] Old stock.

17231. Sold by Providence Farmers' Exchange, Providence, R. I. Stock of Walter Scott, Niantic.

16401. Sold by Apothecaries Hall Co., Waterbury. Stock of Highwood Fruit Growers' Association, Highwood.

16646. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

17479. Sold by American Agricultural Chemical Co., New York. Stock of J. E. Stoddard, Abington.

Muriate of Potash. Sampled by Purchaser.

15960. Dealer unknown. Sent by S. G. McLean, South Glastonbury.

Sulphate of Potash. Sampled by Station Agent.

17871. Sold by L. T. Frisbie Co., New Haven. Stock of Norwich Cooperative Association.

16061. Sold by L. T. Frisbie Co., New Haven. Stock of A. N. Shepard & Son, Hartford.

16679. Sold by Berkshire Fertilizer Co., Bridgeport. Sampled at factory.

16661. Sold by Olds & Whipple, Hartford. Sampled at factory.

17412. Sold by Eastern States Farmers' Exchange, Springfield, Mass. Stock of C. B. Sikes, Ellington.

17449. Sold by Nitrate Agencies Co., New York. Stock of E. N. Austin, Suffield.

16902. Sold by Olds & Whipple, Hartford. Stock of Haviland Tobacco Co., East Windsor Hill.

16932. Sold by Nitrate Agencies Co., New York. Stock of W. R. Holcomb, Somerville.

16850. Sold by Apothecaries Hall Co., Waterbury. Stock of Connecticut School for Boys, Meriden.

Sulphate of Potash. Sampled by Purchaser.

16555. Sold by Grace & Co., Montreal, Canada. Stock of I. Meyer & Co., Windsor Locks.

16879. Sold by Eastern States Farmers' Exchange, Springfield, Mass. Stock of John M. Herr, Burnside.

16509. Seller unknown. Stock of Conn. Sumatra Tobacco Co., Broad Brook.

15799 to **15811** were sold by G. F. Taylor, New York, and sampled by the Griffin-Neuberger Tobacco Co., North Bloomfield.

16473. Sold by Olds & Whipple, Hartford. Stock of Huntington Bros., Windsor.

16733. Sold by L. T. Frisbie Co., New Haven. Stock of H. Dudek, Talcottville.

16858. Seller unknown. Sent by Department of Agronomy, Connecticut Agricultural College.

TABLE IX. ANALYSES OF POTASH SALTS.

Station No.	Potash. Found.	Potash. Guaranteed.	Cost per ton.	Potash costs cents per pound.
	%	%		
16848	57.04	48.00	$110.00	9.6
16934	49.96	50.00	97.00	9.7
16681	49.96	50.00	100.00	10.0
17410	43.28	48.00	96.00	11.1
17231	44.36	48.00	100.00	11.3
16401	56.60	.....	.....	....
16646	50.24	48.00	.....	....
17479	50.32	48.00	.....	....
15960	56.76	.....	92.00	9.2
17871	50.24	.....	.....	...
16061	49.32	48.00	85.00	8.6
16679	52.36	48.00	110.00	10.5
17449	51.16	47.00	120.00	11.7
16661	53.08	48.00	120.00	11.3
17412	48.16	48.00	110.00	11.4
17449	51.16	47.00	120.00	11.7
16902	49.40	48.65	118.00	11.9
16932	48.80	47.00	125.00	12.8
16850	50.60	48.00	.....	....
16555	50.64	50.32	110.00	10.9
16879	48.68	48.00	110.00	11.3
16509	46.32	49.37	115.00	12.4
15799	49.40	.....	.....	....
15800	49.92	.....	.....	....
15801	49.32	.....	.....	....
15802	49.04	.....	.....	....
15803	50.00	.....	.....	....
15804	50.36	.....	.....	....
15805	50.44	.....	.....	....
15806	49.16	.....	.....	....
15807	49.16	.....	.....	....
15808	50.12	.....	.....	....
15809	49.20	.....	.....	....
15810	50.68	.....	.....	....
15811	50.12	.....	.....	....
16473	49.92	50.73	.....	....
16733	49.56	50.00	.....	....
16858	50.00	.....	.....	....
17332	27.74	27.50	49.00	8.8
16682	37.00	37.00	90.00	12.2
17210	27.24	27.50	42.50	7.8
15479	20.42	.....	.....	...
17572	14.82	15.00	16.30	5.5

Miscellaneous Potash Materials. Sampled by Station Agent.

17332. Nebraska Potash. Sold by Rogers & Hubbard Co., Middletown. Sampled at factory.

16682. Vegetable Potash. Sold by Berkshire Fertilizer Co., Bridgeport. Sampled at factory.

Miscellaneous Potash Materials. Sampled by Purchaser.

17210. Nebraska Potash. Sold by Rogers & Hubbard Co. Stock of F. A. Hamilton, Warehouse Point.

15479. Cotton Hull Ashes. Sold by Olds & Whipple, Hartford. Stock of Windsor Tobacco Growers' Corporation.

17572. Kainit. Sold by Rogers & Hubbard Co., Middletown. Stock of the Lyman Farm, Middlefield.

IV. MATERIALS CONTAINING NITROGEN AND POTASH.

NITRAPO.

16475. Sold by Nitrate Agencies Co., New York. Sent by S. R. MacDonald, Atlantic City, N. J. Found to contain 14.88 per cent. nitrogen and 16.01 per cent. potash.

17270. Sold by Nitrate Agencies Co., New York. Stock of E. N. Austin, Suffield. Found to contain 9.96 per cent. nitrogen and 18.24 per cent. potash; guaranteed 14.80 nitrogen, 15 potash. Sold for $107.00 per ton.

One sample of NitraPo meets its guaranty, the other is far below it in nitrogen.

One sample contained 0.18 per cent. of borax, the other 0.39 per cent.

NitraPo is said to be a by-product in the refining of nitrate of soda and should be an excellent source of both nitrogen and potash, if the amount of borax present is inconsiderable.

NITRATE OF POTASH.

16884. Sent by J. L. Watrous, Middlefield. Found to contain 12.56 per cent. of nitrogen and 42.92 per cent. of potash.

17386. Sold by Witherbee, Sherman & Co., New York. Sampled from stock of M. L. Coleman, Cheshire. Found to contain 12.47 per cent. of nitrogen and 43.40 per cent. of potash.

V. MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

FISH MANURES.

In table X are analyses of 48 samples, 18 of them taken by the Station agent and 30 by other individuals.

GUARANTIES.

Six samples contained considerably less nitrogen than was guaranteed. They are—

		Per cent. deficiency.
17411	Eastern States Farmers' Exchange	0.58
17581	John Meehan & Son	0.49
16729	John Meehan & Son	0.96
16335	Apothecaries Hall Co.	0.34
17265	Nitrate Agencies Co.	0.42
17448	Nitrate Agencies Co.	0.34

COST.

As with other fertilizer chemicals, the price of fish to the farmer has varied widely. In the samples received here the highest price was $91.00 and the lowest $48.33. The usual fluctuations in the regular market have been increased by "resales," "forced sales," etc.

Allowing 10 cents per unit of bone phosphate, the cost of nitrogen has ranged from 46.3 cents to 24 cents per pound. The average is 38.6 cents.

The fish scrap has been of higher grade than it was last year, the average percentages of nitrogen and phosphoric acid being 9.11 and 7.78 respectively, as against 8.33 and 6.01 last year.

TABLE X. ANALYSES OF

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.
	Sampled by Station Agent:	
16864	American Agricultural Chemical Co....	F. S. Bidwell & Co., Windsor Locks....
17015	Apothecaries Hall Co.....	Sampled at factory.....
16587	Atlantic Packing Co.....	Ellsworth Sperry, East Windsor Hill...
16415	Berkshire Fertilizer Co.....	J. E. Shepard, South Windsor.....
17330	E. D. Chittenden Co.....	Frank Dowd, Ellington.....
17411	Eastern States Farmers' Exchange.....	C. B. Sikes, Ellington.....
16410	L. T. Frisbie Co.....	J. E. Shepard, South Windsor.....
16959	L. T. Frisbie Co.....	A. N. Shepard & Son, Hartford.....
17359	International Agric. Corp.....	Fred Bogli, Glastonbury.....
16844	Lowell Fertilizer Co.....	T. J. Coleman, Warehouse Point.....
17581	John Meehan & Son.....	W. J. Norton, Broad Brook.....
17265	Nitrate Agencies Co.....	J. McAllister, Farmers' Exchange, Cromwell.....
17448	Nitrate Agencies Co.....	E. N. Austin, Suffield.....
16903	Olds & Whipple.....	Haviland Tobacco Co., East Windsor Hill.....
16804	Piedmont-Mt. Airy Guano Co.....	Joseph Adams, Green's Farms.....
17246	Rogers & Hubbard Co.....	Sampled at factory.....
16838	Wilcox Fertilizer Co.....	Spencer Bros., Suffield.....
16809	F. S. Royster Guano Co.....	Geo. S. Phelps & Co., Thompsonville...
	Sampled by Purchaser:	
16049	American Glue Co.....	Griffin-Neuberger Tobacco Co., North Bloomfield.....
16050	American Glue Co.....	Griffin-Neuberger Tobacco Co., North Bloomfield.....
16051	American Glue Co.....	Griffin-Neuberger Tobacco Co., North Bloomfield.....
16052	American Glue Co.....	Griffin-Neuberger Tobacco Co., North Bloomfield.....
16053	American Glue Co.....	Griffin-Neuberger Tobacco Co., North Bloomfield.....
16335	Apothecaries Hall Co.....	C. A. Huntington, Windsor.....
16511	Apothecaries Hall Co.....	Conn. Sumatra Tobacco Co., Buckland
17175	Atlantic Packing Co.....	F. Howard Ensign, East Hartford.....
16227	Atlantic Packing Co.....	Ellsworth Sperry, East Windsor Hill..
16527	Atlantic Packing Co.....	John Leonard, Burnside.....
16877	Eastern States Farmers' Exchange.....	John M. Herr, Burnside.....
16735	L. T. Frisbie Co.....	H. Dudek, Talcottville.....
16729	John Meehan & Son.....	Aaron Dobkin, Ellington.....
16603	John Meehan & Son	J. H. Lynch, Ellington.....
17125	New England Fertilizer Co.....	J. McGrath, East Windsor Hill.....

FISH MANURES.

Nitrogen.				Phosphoric Acid.						
As ammonia.	As organic.	Total found.	Total guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total found.	Total guaranteed.	Cost per ton.	Nitrogen costs cents per pound.[1]
%	%	%	%	%	%	%	%	%		
0.18	8.74	8.92	8.23	0.69	6.03	1.34	8.06	6.00	$81.00	44.4
0.40	8.40	8.80	8.20	1.03	6.04	1.65	8.72	5.50	.....	....
0.24	9.42	9.66	8.22	....	....	....	7.96	6.40	78.00	39.5
0.10	8.04	8.14	8.23	0.54	5.31	1.19	7.04	6.00	77.00	46.3
0.20	9.18	9.38	8.22	....	....	....	7.52	6.00	80.00	41.8
0.13	....	7.64	8.22	....	....	....	5.25	4.58	52.00	33.3
0.17	9.00	9.17	8.24	0.58	6.11	1.61	8.30	6.40	77.00	40.9
0.24	9.28	9.52	8.22	0.57	5.65	1.24	7.46	6.40	87.90	45.3
0.16	7.96	8.12	8.00	....	....	....	3.57	3.70	75.00	45.7
0.20	9.40	9.60	8.22	0.59	5.62	1.24	7.45	6.40	75.00	38.2
....	....	8.61	9.10	....	....	....	7.54	....	63.50	35.9
0.12	7.18	7.80	8.22	0.50	4.10	0.84	5.44	4.57	.....	....
0.12	7.76	7.88	8.22	0.61	4.77	0.68	6.06	4.58	62.00	38.5
0.30	8.66	8.96	8.23	0.79	5.98	0.87	7.64	5.50	70.00	38.1
0.08	8.54	8.62	8.23	0.81	5.39	1.85	8.05	....	51.40	28.8
0.18	8.60	8.78	8.25	0.38	12.09	1.06	13.53	12.50	65.00	35.3
0.16	9.36	9.52	8.24	0.53	6.37	1.27	8.17	5.00	80.00	41.0
0.20	9.04	9.24	8.24	0.62	6.08	1.91	8.61	5.00	87.00	46.0
0.15	8.88	9.03	....	0.57	7.62	1.28	9.47	....	.....	....
0.09	9.86	9.95	....	0.50	6.64	1.05	8.19	....	.....	....
0.89	8.55	9.44	....	1.12	5.92	0.88	7.92	....	.....	....
0.11	10.01	10.12	....	0.51	6.21	1.01	7.73	....	.....	....
0.16	9.42	9.58	....	0.37	6.60	1.22	8.19	....	.....	....
0.10	9.43	9.53	9.87	0.62	4.80	1.54	6.96	5.50	56.55[2]	28.8
....	....	....	9.16	0.70	4.90	2.81	8.41	7.51	52.00	27.7
....	....	9.82	8.22	....	....	....	7.64	6.86	90.99	45.5
0.17	9.18	9.35	9.50	0.50	7.03	0.90	8.43	7.87	78.00	40.7
....	....	9.66	8.22	0.56	5.49	1.38	7.43	6.40	70.00	35.4
....	....	8.40	8.22	....	....	....	5.62	4.58	52.00	....
0.18	9.46	9.64	8.22	0.54	5.18	1.89	7.61	6.40	.....	....
0.48	8.84	9.32	10.28	0.88	5.24	1.39	7.51	....	83.00	43.6
0.42	8.28	8.70	....	0.83	4.54	1.87	7.24	....	82.00	46.2
0.14	8.62	8.76	....	0.54	7.40	0.64	8.58	....	70.00	38.8

[1] Allowing 10c. per unit of bone phosphate.
[2] Cost $4.75 per unit ammonia + $.10 per unit bone phosphate.

TABLE X. ANALYSES OF

Station No.	Manufacturer or Wholesale Dealer.	Dealer or Purchaser.
	Sampled by Purchaser—(Continued):	
16431	Piedmont-Mt. Airy Guano Co.	American Sumatra Tobacco Co., East Hartford
16557	Piedmont-Mt. Airy Guano Co.	I. Meyer & Co., Windsor Locks
17209	Rogers & Hubbard Co.	F. A. Hamilton, Warehouse Point
15793	Wilcox Fertilizer Co.	Griffin-Neuberger Tobacco Co., North Bloomfield
15794	Wilcox Fertilizer Co.	Griffin-Neuberger Tobacco Co., North Bloomfield
15795	Wilcox Fertilizer Co.	Griffin-Neuberger Tobacco Co., North Bloomfield
15927	Wilcox Fertilizer Co.	Griffin-Neuberger Tobacco Co., North Bloomfield
16432	Wilcox Fertilizer Co.	American Sumatra Tobacco Co., East Hartford
16433	Wilcox Fertilizer Co.	American Sumatra Tobacco Co., East Hartford
16400	Unknown	L. Wetstone, Hartford
16501	Unknown	Farnham Tobacco Corp., Hartford
16502	Unknown	Farnham Tobacco Corp., Hartford
16513	Unknown	Conn. Sumatra Tobacco Co., Buckland
16520	Unknown	Conn. Sumatra Tobacco Co., Buckland
17116	Unknown	Hackett Bros., Buckland

SLAUGHTER HOUSE TANKAGE.

Analyses of 20 samples appear in table XI.

The mechanical analyses show that some of these tankages are very coarse and, therefore, not so readily available to crops as they would be if more finely ground.

FISH MANURES—(*Concluded*).

Nitrogen.				Phosphoric Acid.						
As ammonia.	As organic.	Total found.	Total guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total found.	Total guaranteed.	Cost per ton.	Nitrogen costs cents per pound.[1]
%	%	%	%	%	%	%	%	%		
0.12	9.32	9.44	....	0.31	6.86	1.41	8.58	....	.....	....
0.14	9.34	9.48	9.60	0.58	6.52	1.61	8.71	7.56	$48.33	24.0
....	....	8.66	8.00	....	....	....	12.49	11.00	60.00	33.0
0.82	8.06	8.88	....	1.34	4.71	0.79	6.84	....	.....	....
0.72	7.66	8.38	....	0.82	5.32	0.86	7.00	....	.....	....
1.23	7.85	9.08	....	1.54	4.83	0.51	6.88	....	.....	....
0.11	9.52	9.63	....	0.55	6.41	0.74	7.70	....	.....	....
0.82	8.52	9.34	....	1.10	4.87	0.67	6.64	....	.....	....
0.94	8.34	9.28	....	1.04	4.85	0.92	6.81	....	.....	....
0.20	9.66	9.86	....	0.58	6.05	1.78	8.41	....	.....	....
0.16	9.40	9.56	8.22	0.32	6.72	1.60	8.64	6.86	.....	....
0.18	9.40	9.58	8.22	0.44	6.46	1.56	8.46	6.86	.....	....
0.36	8.80	9.16	9.16	0.58	6.38	1.68	8.64	7.54	.....	....
0.12	9.30	9.42	9.16	0.51	4.81	1.36	6.68	7.54	.....	....
0.10	9.28	9.38	....	0.59	7.15	0.97	8.71	....	.....	....

[1] Allowing 10c. per unit of bone phosphate.

Tankage is a general name used for any dried animal refuse and it varies greatly in composition and fertilizing value, which depend on the kind of refuse used and the process of rendering it. Thus, in these samples nitrogen ranges from 3½ to 8 per cent. and phosphoric acid from 5 to 23¼ per cent. It is, therefore, not possible, as in the case of most other raw materials, to make a statement of average composition.

Garbage Tankage **17719**, sent by J. A. Martin, Wallingford, contained 2.31 per cent. of nitrogen and 3.26 per cent. of phosphoric acid. Its commerical value was requested by the sender. The nitrogen of such material is not very available, though its solubility varies a good deal with the variations in the quality of the garbage. Neither the nitrogen nor the phosphoric acid of garbage can be worth more than half as much as they are in nitrate

TABLE XI. ANALYSES OF

Station No.	Manufacturer.	Dealer or Purchaser.
	Sampled by Station Agent:	
17458	American Agricultural Chemical Co.	L. F. Burr, Branford
16847	Apothecaries Hall Co	Conn. School for Boys, Meriden
17468	Atlantic Packing Co	Sampled at factory
17585	Berkshire Fertilizer Co	Sampled at factory
16643	Conn. Fat Rendering & Fertilizer Co.	Sampled at factory
17413	Eastern States Farmers' Exchange	West Woods Farmers' Cooperative Assn., Mt. Carmel
16644	L. T. Frisbie Co	Sampled at factory
16645	L. T. Frisbie Co	Sampled at factory
16966	L. T. Frisbie Co	C. E. Lyman, Middlefield
17478	Lowell Fertilizer Co	M. E. Cook, Wallingford
17226	Piedmont-Mt. Airy Guano Co	Minor Ives, South Meriden
17579	P. J. O'Donnell & Son	Burr Nurseries, Manchester
	Sampled by Purchaser:	
16742	Apothecaries Hall Co	H. S. Coe, Waterbury
17305	Conn. Fat Rendering Co	C. Lewis Alling, West Haven
16908	L. T. Frisbie Co	A. E. Plant's Sons Co., Branford
16909	L. T. Frisbie Co	A. E. Plant's Sons Co., Branford
16403	Middlesex Fertilizer Co	A. N. Pierson, Inc., Cromwell
16717	Middlesex Fertilizer Co	A. N. Pierson, Inc., Cromwell
16718	Middlesex Fertilizer Co	A. N. Pierson, Inc., Cromwell
16296	Wilson Co	S. D. Woodruff & Sons, Orange

of soda and acid phosphate. We consider that twelve cents for nitrogen and five for phosphoric acid per pound would be the upper limit for their valuation in this material.

BONE MANURES.

Thirty-three samples of these manures have been analyzed this year.

Six samples failed to meet their nitrogen guaranty and two failed in phosphoric acid, but in every case the deficiency in one ingredient was more than met in money value by the overrun in the other.

SLAUGHTER HOUSE TANKAGE.

Nitrogen.				Phosphoric Acid.		Mechanical Analysis.		
As ammonia.	As organic.	Total found.	Total guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Cost per ton.
%	%	%	%	%	%	%	%	
0.41	5.35	5.76	4.94	17.33	13.73	58.00	42.00	$45.00
0.50	5.50	6.00	5.82	13.13	15.00	40.00	60.00	.....
0.18	5.06	5.24	4.10	15.98	14.00	18.00	82.00	.....
0.09	6.37	6.46	6.17	11.45	10.00	55.00	45.00	.....
0.10	3.34	3.44	3.20	23.24	22.00	64.00	36.00	50.00
0.23	6.15	6.38	5.75	5.18	6.86	34.00	66.00	.....
0.20	7.28	7.48	7.40	12.19	6.40	26.00	74.00	.....
0.10	5.04	5.14	4.10	16.23	14.00	16.00	84.00	.....
0.18	4.94	5.12	4.10	16.30	14.00	20.00	80.00	30.00
0.28	....	5.14	4.82	14.10	14.00	35.00	65.00	53.00
0.44	6.17	6.61	6.58	5.86	.....	30.00	70.00	45.00
....	....	5.04	4.94	18.15	18.00	62.00	38.00	40.00
0.16	7.90	8.06	5.76	8.42	15.00	60.00	40.00	50.00
0.02	3.76	3.78	....	21.93	.....	60.00	40.00	.....
0.18	4.06	4.24	4.10	16.41	14.00	20.00	80.00	45.00
0.24	7.32	7.56	7.41	11.88	6.40	30.00	70.00	55.00
0.03	6.03	6.06	....	13.16	.....	.....	.....	40.00
....	....	8.10	6.06	9.33	13.16	.....	.....	40.00
....	....	5.96	6.06	15.61	13.16	.....	.....	40.00
0.26	....	7.95	7.58	7.29	8.81	56.00	44.00	.....

As a rule the bone manures are in finer mechanical state than are tankages, only 9 of the 32 having less than half their weight coarser than 1/50 inch. Specially fine is Rogers & Hubbard's Pure Raw Knuckle Bone Flour, in which 97 per cent. is finer than 1/50 inch.

In the samples examined the average percentages of nitrogen and phosphoric acid are 2.95 and 24.35 respectively and the average cost of 26 samples is $56.44.

TABLE XII. ANALYSES OF

BONE MANURES.

Station No.	Manufacturer and Brand.	Dealer or Purchaser	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric Acid. Found.	Phosphoric Acid. Guaranteed.	Mechanical analysis. Finer than 1-50 inch.	Mechanical analysis. Coarser than 1-50 inch.	Cost per ton.
	Sampled by Station Agent:		%	%	%	%	%	%	
17000	Am. Agr. Chem. Co., Special Ground Bone	J. E. Stoddard, Abington	2.17	2.06	29.55	28.00	62.00	38.00	$57.00
17430	Am. Agr. Chem. Co., Fine Ground Bone	F. S. Bidwell & Co., Windsor Locks	2.60	2.47	26.38	22.88	53.00	47.00	56.00
17439	Am. Agr. Chem. Co. of N. J., Listers Bone Meal	S. J. Orr, West Suffield	3.22	2.47	23.28	22.88	66.00	34.00	50.00
17440	Apothecaries Hall Co., Pure Bone Meal	Sampled at factory	3.84	3.29	24.56	20.00	40.00	60.00	50.00
16412	Berkshire Fertz. Co., Fine Ground Bone	J. E. Shepard, South Windsor	2.70	2.50	27.07	20.00	54.00	46.00	46.00
17433	Bowker Fertz. Co., Fresh Ground Bone	Goodsell Bros., Bristol	2.72	2.47	23.62	22.88	64.00	36.00	60.00
17437	Coe-Mortimer Co., Inc., Fine Ground Bone	Morrison & Dunham, Bethel	2.54	2.47	24.36	22.88	57.00	43.00	58.00
17445	East' States Farmers' Exch., Ground Bone	C. B. Sikes, Ellington	3.46	2.47	21.57	22.88	56.00	44.00	51.00
17434	Essex Fertz. Co., Ground Bone	A. R. Brewer & Co., Hartford	2.34	2.05	28.32	26.00	64.00	36.00	50.75
17431	L. T. Frisbie Co., Bone Meal	Stamford Mason Supply Co., Stamford	3.28	2.46	25.46	20.00	52.00	48.00	56.00
17436	International Agr. Corp., Bone Meal	Newcomb & Barber, Litchfield	2.62	2.50	22.44	22.00	53.00	47.00	58.00
17147	Lowell Fertz. Co., Ground Bone	John O. Fox & Co., Putnam	2.08	2.05	28.18	20.00	62.00	38.00	60.00
17438	Mapes Formula & Peruvian Guano Co., Pure Ground Bone	R. E. Morgan & Co., Windsor	3.90	2.47	25.00	20.00	33.00	67.00	45.00
16958	Meech & Stoddard, Inc., Fine Ground Bone	A. N. Shepard & Son. Hartford	4.12	3.70	22.64	12.00	42.00	58.00	50.00
16940	Piedmont-Mt. Airy Guano Co., Bone Meal	F. L. Davis, Farmers' Exch., Putnam	3.56	2.47	21.31	22.90	42.00	58.00	48.00
17429	Rogers & Hubbard Co., Pure Raw Knuckle Bone Flour	Cadwell & Jones, Hartford	3.88	3.82	26.28	24.70	97.00	3.00	88.00
17435	Rogers & Hubbard Co., "Bone Base" Strictly Pure Fine Bone	Tuttle Brick Co., Newfield	3.10	3.29	24.74	20.59	55.00	45.00	60.00
17432	F. S. Royster Guano Co., Fine Ground Bone Meal	Plumb Bros. Co., Waterbury	3.12	2.47	26.56	22.88	45.00	55.00	.....
17444	Sanderson Fertz. & Chem. Co., Fine Ground Bone	G. R. Stannard, Branford	3.24	2.47	24.69	22.88	48.00	52.00	59.00
17442	M. L. Shoemaker & Co., Swift-Sure Bone Meal	Olds & Whipple, Hartford	4.62	4.53	24.69	20.00	73.00	27.00	71.25
17450	Springfield Rendering Co., Ground Bone	E. N. Austin, Suffield	1.80	2.47	29.81	23.00	75.00	25.00	55.00
17583	Springfield Rendering Co., Ground Bone.	Henry Adams, Suffield	1.56	2.47	30.44	23.00	69.00	31.00	50.00
17453	Van Iderstine Co., Pure Ground Bone	McArdle Seed Store, Greenwich	1.62	2.00	30.32	27.00	65.00	35.00	60.00
17443	Virginia-Carolina Chem. Co., Bone Meal.	F. T. Blish Hardware Co., South Manchester	2.64	2.47	25.87	22.00	53.00	47.00	53.50
	Sampled by Purchaser:								
16731	L. T. Frisbie Co., Steam Ground Bone	H. Dudek, Talcottville	2.30	2.47	28.55	22.88	40.00	60.00	.....
15886	Godfrey Fertilizer & Chemical Co., Pure Bone Meal	A. N. Pierson, Inc., Cromwell	2.68	.....	24.33	.....	63.00	37.00	65.60
16556	Products Mfg. Co., Ground Bone	I. Meyer & Co., Windsor Locks	3.29	3.73	22.20	19.12	70.00	30.00	35.00
15818	Unknown	Frank J. Beach, Woodmont	3.67	.....	25.94	.....	.....	.....	.....
16503	Unknown	Farnham Tobacco Corp., Hartford	2.63	2.47	27.38	22.88	45.00	55.00	77.00
16521	Unknown	Conn. Sumatra Tob. Co., Buckland	3.52	3.29	20.88	18.30	32.00	68.00	.....
17091	Unknown	S. B. Hoyt, Inc., New Canaan	2.24	.....	12.59	.....	50.00	50.00	.....
15412	M. L. Shoemaker & Co., Unground Bone	Sent by Manufacturer	3.28	.....	.....	.....	.....	.....	.....
17112	Unknown	Hackett Bros., Buckland	3.86	.....	23.21	.....	.....	.....	.....

MIXED BONE AND TANKAGE.

17466. Listers Celebrated Ground Bone and Tankage Acidulated, made by American Agricultural Chemical Co. of New Jersey. Stock of J. F. Brown, North Stonington; cost $64.00 per ton.

17014. Bone and Meat Tankage sold by Apothecaries Hall Co., Waterbury. Sampled at factory.

17441. Made by the Connecticut Fat Rendering Co., New Haven. Sold by Apothecaries Hall Co., Waterbury. Sent by Louis Warncke & Son, Cannondale; cost $58.00.

ANALYSES OF MIXED BONE AND TANKAGE.

Station No.	17466	17014	17441
Percentage of			
Nitrogen in ammonia	0.38	0.22	....
Total nitrogen found	3.04	2.92	3.00
Total nitrogen guaranteed	2.67	3.29	3.29
Total phosphoric acid found	12.92	23.26	26.43
Total phosphoric acid guaranteed	12.00	20.00	20.00

VI. MIXED FERTILIZERS.

MIXED FERTILIZERS CONTAINING PHOSPHATES AND POTASH.

17002. American Agl. Chem. Co.'s Bone Phosphate and Potash. Stock of Frank Upham, Stafford.

17049. American Agl. Chem. Co.'s Grass and Oats Fertilizer. Stock of N. A. Johnson, Forestville.

16794. Armour's Big Crop Fertilizer. Stock of Lightbourn & Pond, New Haven.

17192. Armour's Big Crop Fertilizer. Stock of Lightbourn & Pond, New Haven.

17355. International Agricultural Corporation's Buffalo Phosphate and Potash. Stock of J. S. Dewey, Tariffville.

17378. International Agricultural Corporation's Buffalo Ten-Eight. Stock of Edward Bidwell, Glastonbury.

17237. Olds & Whipple's Bone Phosphate and Potash Compound. Stock of Fred Gerber, Ellington.

17145. Va.-Carolina Chemical Co.'s V. C. Comet Brand. Stock of E. O. Chapman, North Haven.

ANALYSES

Station No.	17002	17049	16794	17192	17355	17378	17237	17145
	%	%	%	%	%	%	%	%
Water-soluble phosphoric acid	6.64	7.76	7.95	7.82	4.32	4.66	1.13	8.83
Citrate-soluble phosphoric acid	5.54	4.46	1.69	1.89	7.11	5.82	3.61	1.80
Citrate-insoluble phosphoric acid	0.40	0.65	0.27	0.27	0.86	0.83	0.19	0.58

Total phosphoric acid found	12.58	12.87	9.91	9.98	12.29	11.31	4.93	11.21
Total phosphoric acid guaranteed	13.00	13.00	10.50	10.50	11.00	11.00	4.00	11.00
"Available" phosphoric acid found	12.18	12.22	9.64	9.71	11.43	10.48	4.74	10.63
"Available" phosphoric acid guaranteed	12.00	12.00	10.00	10.00	10.00	10.00	4.00	10.00
Potash as muriate	2.92	2.08	5.47	5.18	1.52	7.62	....	7.38
Total potash found	2.92	2.08	5.47	5.18	5.07	8.60	16.16	7.38
Total potash guaranteed	2.00	2.00	5.00	5.00	4.00	8.00	15.00	8.00
Price per ton	$46.00	$45.00	$55.00	$55.00	$48.00	$59.75	$73.00	$54.50

A sample labeled "Potash," **16968**, sent by E. S. Seymour, Suffield, and stated to have been bought of Olds & Whipple, Hartford, for $66.30 per ton, contained 5.94 per cent. of phosphoric acid and 14.60 per cent. of potash. This has the composition of O. & W's Phosphate and Potash Compound.

NITROGENOUS SUPERPHOSPHATES WITHOUT POTASH.

Thirty-eight samples of this class have been analyzed with the results given in Table XIII.

Of these **17251** was sent by G. A. Peckham, Suffield, stated to be Rogers & Hubbard's Soluble Corn & General Crop. This is not representative of any brand as we have been advised that it was bought several years ago and probably its composition has changed during storage.

DIFFERENCES IN GRADE AND COST OF NITROGEN.

Of the samples examined, 6 we class as low grade containing less than 2.5 per cent. of nitrogen, 13 we class as of medium grade having from 2.5 to 4.11 per cent., and 10 we class as high grade containing more than 4.11 per cent. of nitrogen.

From the quoted cash prices it appears that allowing ten cents per pound for available phosphoric acid the average cost of nitrogen in the low grade goods here reported was sixty-eight cents per pound, in the medium grade fifty cents and in the high grade fifty-six and six tenths cents per pound. It will be noted that all of these high grade goods were tobacco manures, probably most of them compounded with cotton seed meal.

This emphasizes the fact which we always urge that the buyer cannot afford to use low grade goods. Manufacturers are reducing the number of low grade fertilizers which they offer, and buyers should always give the preference to medium or high grade goods.

GUARANTIES.

Six of the brands failed to meet their nitrogen guaranties by more than one-tenth per cent., but in all but one case the money value of the nitrogen deficiency was more than made good by an overrun in the amount of phosphoric acid.

TABLE XIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen.	
				In nitrates.	In ammonia.
	Sampled by Station Agent:				
	American Agricultural Chem. Co., New York City.			%	%
17452	Tobacco Special	Portland	$63.00	0.92	0.12
	Apothecaries Hall Co., Waterbury.				
17301	Liberty Market Gardeners' Special.	Wapping	35.00	0.16	2.08
17315	Liberty Tobacco Special	Wapping	67.00	0.46	0.68
	Atlantic Packing Co., New Haven.				
17295	Atlantic 5–8	Prospect	54.00	1.52	1.06
	Berkshire Fertilizer Co., Bridgeport.				
16695	Long Island Special	Milford	48.35	1.80	0.28
17307	Tobacco Grower	Suffield	.....	1.42	0.14
16869	Tobacco Starter	Suffield	70.00	2.02	0.82
	Bowker Fertilizer Co., New York.				
17328	Superphosphate with Ammonia 4%	Avon	58.00	0.58	1.37
17312	Tobacco Grower	Avon	68.00	0.92	0.14
	E. D. Chittenden Co., Bridgeport.				
17020	Complete Tobacco & Onion Grower without Potash	Ellington	53.50	1.82	0.92
17331	Tobacco Special without Potash	Suffield	62.00	0.78	0.48
16802	Vegetable & Onion Grower without Potash	Green's Farms	48.00	0.54	1.38
	Everett B. Clark Seed Co., Milford.				
16810	Special Mixture for General Use	Milford	45.00	0.20	2.00
	L. T. Frisbie Co., New Haven.				
17348	2–10	New Britain	49.00	0.70	0.04
17352	4–10	Clintonville	48.00	1.74	0.06
17351	5–8	Buckland	48.00	1.39	1.16
	International Agricultural Corp., Boston, Mass.				
17356	Buffalo Onion Special	Tariffville	55.00	1.10	0.25
16928	Buffalo Tobacco Grower	Glastonbury	66.75	0.75	1.21
17357	Buffalo Tobacco Special	West Suffield	60.00	0.78	0.63
17286	Buffalo Top Dresser and Starter	Tariffville	74.00	2.93	0.24
	Lowell Fertilizer Co., Boston, Mass.				
17485	4–10	New Haven	.....	0.18	1.64
16922	5–8 for Grass, Grain and Vegetables	Warehouse Point.	60.00	0.96	1.00

WITHOUT POTASH.

Nitrogen.				Phosphoric Acid.							Station No.
Organic, water-soluble.	Organic, water-insoluble.	Total.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		
		Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	
%	%	%	%	%	%	%	%	%	%	%	
0.13	3.35	4.52	4.11	2.02	3.95	0.20	6.17	5.00	5.97	4.00	17452
0.06	0.94	3.24	3.29	8.08	2.26	0.78	11.12	11.00	10.34	10.00	17301
none	3.30	4.44	4.11	0.88	3.17	0.26	4.31	5.00	4.05	4.00	17315
0.41	1.25	4.24	4.10	3.78	5.46	1.07	10.31	9.00	9.24	8.00	17295
0.32	1.26	3.66	3.30	3.29	4.83	0.90	9.02	9.00	8.12	8.00	16695
0.18	2.58	4.32	4.11	0.81	4.97	0.22	6.00	4.00	5.78	4.00	17307
0.11	1.95	4.90	5.00	2.06	2.87	0.28	5.21	5.00	4.93	4.00	16869
0.47	0.75	3.17	3.29	7.44	3.40	0.79	11.63	11.00	10.84	10.00	17328
0.31	3.57	4.94	4.11	2.22	3.36	0.20	5.78	5.00	5.58	4.00	17312
none	0.62	3.36	3.29	7.40	2.81	1.10	11.31	11.00	10.21	10.00	17020
0.06	2.82	4.14	4.12	2.00	2.76	0.75	5.51	5.00	4.76	4.00	17331
0.08	0.47	2.47	2.47	8.41	2.10	0.47	10.98	11.00	10.51	10.00	16802
0.02	1.34	3.56	3.29	8.70	2.62	1.92	13.24	10.50	11.32	10.00	16810
0.30	0.86	1.90	1.64	7.03	4.18	0.51	11.72	11.00	11.21	10.00	17348
0.32	1.18	3.30	3.28	7.02	4.57	0.46	12.05	11.00	11.59	10.00	17352
0.39	1.30	4.24	4.10	2.92	5.95	0.90	9.77	9.00	8.87	8.00	17351
0.55	0.54	2.44	2.50	5.32	5.57	2.03	12.92	11.00	10.89	10.00	17356
0.08	2.10	4.14	4.10	2.04	2.54	0.35	4.93	5.00	4.58	4.00	16928
0.06	1.87	3.34	3.30	1.69	2.35	0.26	4.30	4.00	4.04	3.00	17357
0.16	2.65	5.98	5.80	3.42	3.44	0.87	7.73	7.00	6.86	6.00	17286
0.48	1.44	3.74	3.28	7.97	3.92	0.52	12.41	11.00	11.89	10.00	17485
0.70	1.00	3.66	4.10	3.91	4.05	0.51	8.47	9.00	7.96	8.00	16922

TABLE XIII. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Nitrogen. In nitrates.	Nitrogen. In ammonia.
	National Fertilizer Co., New York.			%	%
17268	5-4 Tobacco Manure	Windsorville	.....	0.22	0.84
17267	Nitrogen Phosphate Mixture No. 2	Melrose	44.00	0.60	0.48
16923	Nitrogen Phosphate Mixture No. 4	Silver Lane	.....	0.56	1.12
	New England Fertilizer Co., Boston, Mass.				
17271	5-6	East Granby	.....	1.06	0.12
	Olds & Whipple, Hartford.				
17242	High Grade Tobacco Starter	Pine Meadow	.....	3.40	0.22
17238	Special Grass Fertilizer	Ellington	.....	2.88	0.08
17233	Tobacco Special Fertilizer	Glastonbury	$66.00	1.00	0.10
	Providence Farmers' Exchange, Inc., Providence, R. I.				
17132	Exchange Brand 4-10	Waterbury	.....	0.36	2.00
	F. S. Royster Guano Co., Baltimore, Md.				
17194	Landmark	Waterbury	57.00	0.10	1.74
17110	Prime Fish Brand	Shelton	44.00	0.10	0.92
	Sanderson Fertilizer & Chem. Co., New Haven.				
16836	High Grade Ammoniated Phosphate	Wethersfield	54.25	0.94	1.18
17227	Phosphate without Potash	New Canaan	50.00	0.36	0.62
17395	Tobacco Grower	Warehouse Point.	63.00	0.80	0.09
	M. L. Shoemaker & Co., Philadelphia, Pa.				
16743	Swift-Sure Superphosphate Tobacco Starter	Hartford	58.90	0.90	0.10
17190	Swift-Sure Superphosphate Tobacco Starter	Suffield	62.00	1.08	0.10
	Sampled by Purchaser:				
17251*	Rogers & Hubbard's Soluble Corn & General Crop	Suffield: G. A. Peckham	.....	....	....
17161	Shoemaker's Swift-Sure Phosphate	Hartford	58.90	....	....
17177	Shoemaker's Swift-Sure	Granby	57.00	....	....

See note on page 73.

In **16922** Lowell Fertilizer Company's 5-8 for Grass, Grain and Vegetables, there was a nitrogen deficiency of 0.44%, which valued at thirty cents a pound would make a deficiency of $2.64 per ton.

WITHOUT POTASH—(*Concluded*).

Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-insoluble.	Nitrogen. Total. Found.	Nitrogen. Total. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Station No.
%	%	%	%	%	%	%	%	%	%	%	
0.05	3.21	4.32	4.11	1.50	4.11	0.17	5.78	5.00	5.61	4.00	17268
0.01	0.61	1.70	1.65	6.17	4.88	1.15	12.20	11.00	11.05	10.00	17267
0.10	1.66	3.44	3.29	7.54	2.79	1.29	11.62	11.00	10.33	10.00	16923
0.31	2.29	3.78	4.10	4.29	2.76	0.28	7.33	7.00	7.05	6.00	17271
0.30	4.70	8.62	8.23	2.63	1.80	0.29	4.72	3.00	4.43	3.00	17242
0.16	1.72	4.84	4.95	6.36	3.14	0.20	9.70	8.00	9.50	8.00	17238
none	3.19	4.29	4.11	2.16	3.17	0.17	5.50	4.00	5.33	4.00	17233
0.20	0.78	3.34	3.29	8.22	2.24	0.68	11.14	10.50	10.46	10.00	17132
0.06	1.28	3.18	3.29	7.82	2.43	0.56	10.81	10.50	10.25	10.00	17194
none	0.68	1.70	1.65	5.86	2.20	0.17	8.23	8.50	8.06	8.00	17110
0.13	0.85	3.10	3.29	7.68	3.77	1.24	12.69	11.00	11.45	10.00	16836
0.14	0.68	1.80	1.65	6.17	4.81	1.37	12.35	11.00	10.98	10.00	17227
0.04	3.13	4.06	4.11	1.80	3.93	0.33	6.06	5.00	5.73	4.00	17395
0.81	2.01	3.82	3.30	5.54	4.39	2.16	12.09	12.00	9.93	10.00	16743
0.83	1.83	3.84	3.30	8.04	3.65	1.92	13.61	12.00	11.69	10.00	17190
....	....	1.16	2.50	....	....	....	5.16	12.00	.....	.....	17251
....	....	3.76	3.30	....	....	0.90	11.91	12.00	11.01	10.00	17161
....	....	3.22	3.30	....	....	....	13.29	12.00	.....	.....	17177

QUALITY OF THE NITROGEN.

In none of the samples was the availability of the organic nitrogen found to be decidedly poor.

NITROGENOUS SUPERPHOSPHATES CONTAINING POTASH.

In Table XIV are given analyses of 286 samples of this class of fertilizers with the cash ton prices quoted by the firms from whose stock the samples were drawn. There are also given 22 analyses of samples sent by purchasers.

Guaranties.

One hundred and thirty-one of the brands (45 per cent. of the whole number) did not fully meet their guaranty in all respects. Ninety-eight were deficient in one ingredient, thirty-one in two, and two in three ingredients.

In all but twenty-eight cases however the deficiency in one was more than made up in money value by an overrun in the other ingredients.

The following did not make up the money deficiency, if, as seems fair, nitrogen is reckoned at forty cents, available phosphoric acid at ten cents and potash at eleven cents per pound respectively.

Number.	Name.	Deficiency.
17084	Bradley's Northland Potash Grower	$ 1.07
16992	A. A. C. Co.'s Quinnipiac Potato	1.64
17326	Bowker's Maryland Truck Garden Fertilizer	1.48
17417	Eastern States 4-8-7	3.37
17335	Essex Fertilizer Co.'s Fish Fertilizer 3-8-3	1.98
17082	Frisbie's Market Garden Fertilizer	1.60
17260	Frisbie's Market Garden Fertilizer	1.14
17371	Lowell's 5-8-0 Vegetable	4.40
16920	Lowell's Animal Brand	2.41
17537	Lowell's Animal Brand	3.36
17369	Lowell's Bone Fertilizer 2-8-2	2.87
16813	Lowell's Empress Brand	2.51
17149	Miller Fertilizer Co. 5-8-7	2.48
16752	Miller Fertilizer Co. No. 1 Potato and Vegetable	2.62
16685	Miller Fertilizer Co. Standard Phosphate	1.93
17266	New England Fertilizer Co.'s 3-8-3	3.22
17071	New England Fertilizer Co.'s 4-8-6	2.25
16939	Piedmont-Mt. Airy Co.'s Brown's 5-8-7	13.50
16967	Piedmont-Mt. Airy Co.'s Brown's Fish, Bone and Potash	3.74
16933	Piedmont-Mt. Airy Co.'s Brown's Market Garden	3.92
19635	Piedmont-Mt. Airy Co.'s Brown's Top Dresser	10.43
16803	Piedmont-Mt. Airy Co.'s Brown's Potato Phosphate	3.15
17185	Piedmont-Mt. Airy Co.'s Brown's Potato Phosphate	5.10
16936	Piedmont-Mt. Airy Co.'s Brown's Home Mixture	4.80
17197	F. S. Royster Co.'s Trucker's Delight	1.43
17087	F. S. Royster Co.'s Quality Trucker	2.75
17106	Shay's Special Fertilizer 3-8-3	2.54
17148	Worcester Rendering Co.'s Corn and Grain Fertilizer	2.04

Of thirteen brands of the Lowell Fertilizer Co. five were deficient in money value. All of the three Miller Fertilizer Co.'s brands were thus deficient, and seven out of the "Brown" brands made by the Piedmont-Mt. Airy Co. were likewise deficient.

Composition and Nitrogen Cost.

Of two hundred and eighty brands

28 have a guarantee of 0.82 per cent. nitrogen
57 " " " " 1.65 " " "
65 " " " " 2.47 " " "
57 " " " " 3.29 " " "
60 " " " " 4.11 " " "
13 have a still higher nitrogen guaranty.

It is gratifying to note the relatively small number of brands in the State which have a low nitrogen content.

As nitrogen in organic forms costs at present about four times as much as available phosphoric acid or potash its cost is of special importance to purchasers.

The relative cost in brands of different grades is shown in the following statement.

Phosphoric acid is reckoned at ten cents and potash at eleven cents per pound respectively (which has been about their average price in raw materials) and the sum of these values is subtracted from the average cost of the fertilizer. This remainder divided by the number of pounds of nitrogen gives the cost per pound of nitrogen—plus the costs of manufacture and sale. As these are not very different for the different grades of goods, the nitrogen cost per pound shows fairly its relative difference in these different grades.

Such a comparison is as follows:

Formulas.	Number of brands.	Average Cost per ton.	Nitrogen costs per lb.	Average.
.82-8-2	11	$46.11	$0.96	$1.18
.82-10-2	5	47.80	1.41	
1.65-8-2	30	50.08	0.90	.79
1.65-8-3	17	52.18	0.68	
2.47-8-3	13	53.70	0.63	.71
2.47-8-4	20	58.83	0.69	
2.47-8-6	5	69.95	0.82	
3.29-8-4	24	61.55	0.56	.55
3.29-8-6	10	64.03	0.54	
4.11-4-3	10	73.23	0.71	.70
4.11-4-4	4	74.38	0.70	
4.11-4-5	10	74.25	0.68	

It appears that the average cost of nitrogen has been lowest in the 3.29 grade and about half of what it has been in the low (0.82 per cent.) grade. The 4.11 grade consists chiefly of special tobacco fertilizers with cotton seed meal as the chief nitrogen base.

Superphosphates costing about $65 were more economical than the low grade costing about $47.

The National Fertilizer Association, composed of manufacturers of fertilizers, has urged its members to make and offer for sale fertilizers with high analysis. The Association points out that this is in the interest of both buyer and seller, since the costs of manufacture and sale are the same in both high-analysis and low-analysis goods and therefore the overhead expense per unit of plant food is less in the former than in the latter.

Quality of the Water-Insoluble Nitrogen.

The distribution of water-insoluble organic nitrogen into so-called active and inactive fractions is effected by means of two methods, both of which are based upon the action of permanganate of potash on the insoluble organic nitrogen, the one in alkaline solution, the other in neutral solution. The results obtained are taken as an index of the quality of the insoluble organic nitrogenous material. Thus if less than 50 per cent. is found to be "active" when the alkaline method is applied, or less than 80 per cent. when the neutral method is used, the substance and quality of the organic nitrogen present is regarded as inferior. That the so-called "active" insoluble nitrogen is available as plant food is substantiated by vegetation tests. The operation of these methods in inspection and commercial laboratories is reasonably uniform but the construction placed upon the results obtained varies considerably in practice. Thus, in some cases, quality is judged in connection with the proportion which the insoluble organic nitrogen bears to the total nitrogen present, and again, it has been suggested that the water-soluble organic nitrogen and the active insoluble portion should be reckoned together after the manner of expressing so-called available phosphoric acid. It has been our practice to judge the insoluble organic nitrogen on the basis of quality as contemplated by the authors of the methods, recognizing, however, that the distribution of small amounts (.3 per cent. or less) of insoluble nitrogen may lead to conclusions that are without practical significance, and further, that no criticism should attach to goods in which the total nitrogen found exceeds that guaranteed by an amount which equals or closely approximates the inactive insoluble organic nitrogen. It is clearly desirable, however, that some uniform method of expressing conclusions be arrived at to the advantage alike of the purchaser, the analyst and the manufacturer.

The following brands contained insoluble organic nitrogen, less than 50 per cent. of which was found to be "active" by the alkaline method and substantially less than 80 per cent. by the neutral method.

Solubility of Nitrogen.

		Total Nitrogen		Water-insol. organic nitrogen.	"Active" by alkaline method.	"Active" by neutral method.
		Guaranteed.	Found.			
16701	Quinnipiac Potato Phosphate	1.65	1.54	0.48	49	69
16752	Miller No. 1 Potato and Vegetable Grower	3.30	2.96	0.70	38	67
17578	Miller Standard Phosphate	2.47	2.24	0.42	44	63
17149	Miller 5-8-7	4.12	3.82	0.64	37	66
17323	Chittenden Vegetable and Onion Grower, 3% Potash	2.47	2.34	0.75	43	46
16802	Chittenden Vegetable and Onion Grower without Potash	2.47	2.47	0.47	47	48
17281	Listers Tobacco Fertilizer	1.65	1.59	0.40	39	57
17416	Eastern States 3-8-4	2.46	2.48	0.62	45	63

HOME MIXTURES.

These include mixtures made by individuals from raw materials delivered to them or mixtures made for them by manufacturers from materials and formulas prescribed by the purchaser.

In Table XV are given analyses of 15 samples with the statements of the amounts of the several raw materials used in the mixture.

Table XVI includes 16 samples of which the formulas were not reported to the Station.

In general these home mixtures contain a higher average percentage of nitrogen than the average of factory-mixed goods. They are distinctly higher grade and indicate possibly a conviction that on our light soils, low in humus, and with the scarcity of stable manure, lack of available nitrogen is the fertilizer factor most likely to limit crop production.

16441. Formula B.1; **16440,** Formula B.2; **16442,** Formula S.L., were sent by the American Sumatra Tobacco Co., Hartford.

16402. Mixed by Olds & Whipple, Hartford. Sampled and sent by Brewer Bros., Hockanum.

16840. Stated to be a mixture of acid phosphate, cotton seed meal and wood ashes. Sampled and sent by W. H. Carrier, Glastonbury.

16863. Mixed by L. T. Frisbie Co. Sampled and sent by Frank J. Beach, Woodmont.

16984. Mixed by L. T. Frisbie Co. Sampled and sent by E. E. Tucker, Rockville.

16861. Sampled and sent by D. E. Golden, Hazardville.

16601. Mixed by Rogers & Hubbard Co., Middletown. Sampled and sent by F. E. Lord, Warehouse Point.

16563. Sampled and sent by Meyer & Mendelsohn, Inc., Hartford.

16607. Special mixture made by Olds & Whipple. Sampled and sent by the Allied Tobacco Co., Hartford.

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	American Agricultural Chemical Co.		
17447	Complete Potato Mixture	Riverton	$58.00
17480	Double A Tobacco Fertilizer	Windsor	80.00
16796	Fish & Potash	Southport	63.00
16793	Grass and Lawn Top-Dressing	Hazardville	73.00
16994	Monarch Potato Manure	New Haven	.....
17139	Special Mixture	South Manchester	7.00
16870	Tobacco Mixer	Suffield	76.00
16999	Universal Phosphate	Putnam	48.00
17293	Bradley's Complete Manure for Top Dressing Grass and Grain	Stafford Springs	70.00
17001	Bradley's Corn Phosphate	Stafford Springs	46.00
16797	Bradley's New Method Fertilizer	Norwalk	50.00
17084	Bradley's Northland Potato Grower	Putnam	65.00
16750	Bradley's Potato Manure	Hazardville	59.75
16991	Bradley's Potato Fertilizer	Thompsonville	54.00
17465	Bradley's 6% Potash Fertilizer	North Franklin	64.00
17297	Bradley's Valley Tobacco Fertilizer	New Milford	84.00
16690	Bradley's XL Superphosphate of Lime	Windsor Locks	55.00
17086	Great Eastern Northern Corn Special, 1920	Forestville	49.00
17054	Great Eastern General, 1921	Riverton	44.00
17294	Great Eastern Potato Manure, 1920	Forestville	51.00
17052	Packers' Union Animal Corn Fertilizer	Riverton	54.00
17298	Packers' Union Potato Manure, 1921	Waterford	54.00
17303	Packers' Union Universal Fertilizer, 1920	Westville	42.00
16694	Quinnipiac Climax	Milford	47.50
17193	Quinnipiac Climax Phosphate	North Haven	48.00
16795	Quinnipiac Corn Manure	Milford	53.50
17304	Quinnipiac Phosphate	North Haven	55.00
16992	Quinnipiac Potato Manure	Milford	56.00
16701	Quinnipiac Potato Phosphate	Southport	55.00
17135	Quinnipiac Potato Phosphate	Plainfield	50.00
17300	Quinnipiac Wrapper Leaf Tobacco Manure	Windsor	80.00
17296	Wheeler's Corn Fertilizer	Riverton	48.00
17482	Wheeler's Cuban Tobacco Grower	Granby	77.00
17053	Wheeler's Potato Manure, 1920	Riverton	51.00
16997	Williams & Clark's Americus Ammoniated Bone Superphosphate	Hazardville	53.00
16993	Williams & Clark's Americus Potato Manure	New Britain	55.00
17154	Williams & Clark's Americus Corn Phosphate	New London	55.00
16867	Williams & Clark's Prolific Fertilizer	New Britain	54.00
16998	Williams & Clark's Potato Phosphate	Clark's Corner	.....
17302	Williams & Clark's Seed Leaf Tobacco Manure	Granby	75.50

WITH POTASH.

Station No.	Nitrogen. In nitrates.	Nitrogen. In ammonia.	Nitrogen. Organic, water-soluble.	Nitrogen. Organic, water-insoluble	Nitrogen. Total. Found.	Nitrogen. Total. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. As muriate.	Potash. Total.	Potash. Guaranteed.	Station No.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
17447	0.27	1.00	0.47	0.76	2.50	2.47	4.19	3.91	1.24	9.34	9.00	8.10	8.00	4.00	4.00	4.00	17447
17480	1.04	0.08	0.38	2.74	4.24	4.11	0.89	5.30	0.31	6.50	5.00	6.19	4.00	0.92	4.52	5.00	17480
16796	0.10	0.74	0.39	1.05	2.28	2.47	8.17	2.86	1.01	12.04	11.00	11.03	10.00	2.94	2.94	3.00	16796
16793	1.96	2.02	0.26	1.06	5.30	4.94	4.91	1.25	0.22	6.38	7.00	6.16	6.00	4.64	4.64	4.00	16793
16994	0.60	1.32	0.18	1.26	3.36	3.29	5.15	3.25	1.43	9.83	9.00	8.40	8.00	1.41	3.74	4.00	16994
17139	....	....	....	....	6.09	....	....	....	0.40	5.50	.....	5.10	.....	8.05	9.50	....	17139
16870	1.76	0.01	none	0.63	2.40	2.47	1.04	8.04	0.55	9.63	9.00	9.08	8.00	0.88	5.80	6.00	16870
16999	0.34	0.02	0.25	0.19	0.80	0.82	2.41	5.29	0.19	7.89	9.00	7.70	8.00	2.09	2.09	2.00	16999
17293	2.82	1.48	0.27	0.43	5.00	4.94	3.29	3.37	0.40	7.06	7.00	6.66	6.00	4.14	4.14	4.00	17293
17001	0.52	0.76	0.42	0.04	1.74	1.65	4.66	3.70	0.54	8.90	9.00	8.36	8.00	2.09	2.09	2.00	17001
16797	0.10	0.12	0.23	0.55	1.00	0.82	3.27	4.96	1.56	9.79	9.00	8.23	8.00	0.35	1.90	2.00	16797
17084	1.04	1.02	none	1.00	3.06	3.29	5.37	3.17	0.77	9.31	9.00	8.54	8.00	3.86	3.86	4.00	17084
16750	0.74	0.98	0.07	0.67	2.46	2.47	5.85	2.48	0.92	9.25	9.00	8.33	8.00	4.06	4.06	4.00	16750
16991	0.70	0.16	0.09	0.73	1.68	1.65	5.19	3.07	0.95	9.21	9.00	8.26	8.00	0.36	2.81	3.00	16991
17465	1.08	1.54	0.23	0.55	3.40	3.29	4.65	3.36	0.77	8.78	9.00	8.01	8.00	5.49	5.49	6.00	17465
17297	0.40	0.10	0.73	2.65	3.88	4.11	1.17	5.35	0.29	6.81	5.00	6.52	4.00	0.57	2.78	3.00	17297
16690	0.26	0.80	0.10	1.36	2.52	2.47	5.95	3.08	1.05	10.08	10.00	9.03	9.00	2.49	2.49	2.00	16690
17086	0.52	0.62	none	0.48	1.62	1.65	4.63	3.79	1.02	9.44	9.00	8.42	8.00	2.02	2.02	2.00	17086
17054	none	0.14	0.41	0.39	0.94	0.82	2.52	5.33	1.27	9.12	9.00	7.85	8.00	1.95	1.95	2.00	17054
17294	0.44	0.22	0.47	0.67	1.80	1.65	5.09	3.05	0.97	9.11	9.00	8.14	8.00	2.47	2.79	3.00	17294
17052	0.58	0.96	0.50	0.58	2.62	2.47	5.40	3.75	1.30	10.45	10.00	9.15	9.00	1.75	2.00	2.00	17052
17298	0.10	0.68	0.61	0.27	1.66	1.65	4.15	3.99	0.27	8.41	9.00	8.14	8.00	2.72	2.72	3.00	17298
17303	none	0.24	0.28	0.36	0.88	0.82	3.72	4.22	1.05	8.99	9.00	7.94	8.00	1.87	1.87	2.00	17303
16694	0.08	0.16	0.21	0.45	0.90	0.82	2.31	5.58	1.59	9.48	9.00	7.89	8.00	1.13	1.84	2.00	16694
17193	0.10	0.18	0.39	0.35	1.02	0.82	1.88	6.14	1.28	9.30	9.00	8.02	8.00	0.84	1.83	2.00	17193
16795	0.42	0.74	0.24	0.34	1.74	1.65	4.20	3.84	1.00	9.04	9.00	8.04	8.00	1.24	1.97	2.00	16795
17304	0.24	0.94	0.48	0.82	2.48	2.47	5.47	3.09	1.39	9.95	10.00	8.56	9.00	2.30	2.30	2.00	17304
16992	0.74	0.82	none	0.76	2.32	2.47	3.85	4.17	1.33	9.35	9.00	8.02	8.00	3.78	3.78	4.00	16992
16701	0.28	0.48	0.30	0.48	1.54	1.65	5.06	3.33	0.83	9.22	9.00	8.39	8.00	2.76	2.76	3.00	16701
17135	....	....	....	....	1.52	1.65	....	....	0.27	8.33	9.00	8.06	8.00	2.81	2.81	3.00	17135
17300	0.97	0.08	0.35	2.61	4.01	4.11	1.18	4.54	0.28	6.00	5.00	5.72	4.00	0.70	3.16	3.00	17300
17296	0.47	0.70	0.19	0.34	1.70	1.65	3.76	4.51	0.79	9.06	9.00	8.27	8.00	0.68	2.02	2.00	17296
17482	1.00	0.08	0.76	2.72	4.56	4.11	0.76	4.71	0.31	5.78	5.00	5.47	4.00	0.94	4.73	5.00	17482
17053	0.52	0.64	0.15	0.41	1.72	1.65	2.86	5.18	1.25	9.29	9.00	8.04	8.00	1.00	2.91	3.00	17053
16997	0.54	0.78	0.31	0.77	2.40	2.47	5.86	3.98	1.37	11.21	10.00	9.84	9.00	2.09	2.09	2.00	16997
16993	0.40	0.68	0.07	0.49	1.64	1.65	2.99	5.16	1.27	9.42	9.00	8.15	8.00	1.00	2.93	3.00	16993
17154	0.58	0.76	0.12	0.36	1.82	1.65	3.60	4.76	0.54	8.81	9.00	8.27	8.00	2.13	2.13	2.00	17154
16867	0.10	0.18	0.06	0.48	0.82	0.82	5.25	2.89	1.05	9.19	9.00	8.14	8.00	1.97	1.97	2.00	16867
16998	1.66	0.14	0.19	0.53	2.52	2.47	5.04	3.66	0.64	9.34	9.00	8.70	8.00	3.65	3.65	4.00	16998
17302	0.50	0.14	0.69	2.81	4.14	4.11	1.05	4.75	0.32	6.12	5.00	5.80	4.00	0.62	2.86	3.00	17302

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	American Agricultural Chemical Co., of New Jersey, Newark, N. J.		
17317	Listers 4–8–4 Fertilizer	Rockville	.....
17376	Listers Balancer for C.S.M.	Glastonbury	$73.00
17283	Listers Celebrated Tobacco Fertilizer	Warehouse Point	.....
17278	Listers Corn & Potato Fertilizer	Norfolk	53.00
17379	Listers Fish & Potash Fertilizer	Warehouse Point	58.00
17467	Listers Standard Pure Superphosphate of Lime	North Stonington	53.00
17088	Listers Success Fertilizer	Norfolk	50.00
17281	Listers Tobacco Fertilizer	Brookfield	51.00
	Apothecaries Hall Co., Waterbury, Conn.		
16754	Liberty 3–8–4	Meriden	46.25
17311	Liberty Corn, Fruit and All Crops	Windsorville	45.75
16753	Liberty Market Gardeners' Special	Meriden	50.25
17313	Liberty Potato and Vegetable Special	Windsorville	56.00
17021	Liberty Tobacco Special	Windsorville	71.00
	Armour Fertilizer Works, New York, N. Y.		
16798	Big Crop Fertilizer, 3–8–4	Norwalk	68.00
17131	Big Crop Fertilizer 3–8–4	New Canaan	60.00
16874	Big Crop Fertilizer 5–8–5	Rockville	70.00
16875	Big Crop Potato and Onion 4–8–4	Rockville	63.00
17017	Big Crop Tobacco Special 5–4–5	Rockville	83.00
17314	Big Crop Tobacco Special 5–4–5	Poquonock	78.50
16865	Corn Grower	New Haven	56.00
17137	Corn Grower	Poquonock	44.00
17044	Fertilizer 5–4–3	Rockville	75.00
16692	General Crop 1–7–1	New Haven	45.00
	Atlantic Packing Co., New Haven, Conn.		
17108	4–8–6	New Haven	68.25
17487	4–8–6	New Haven	68.25
16996	Grain Fertilizer	New Britain	51.75
17484	Grain Fertilizer	New Haven	.....
17047	Potato Phosphate	New Haven	57.75
16995	Superphosphate	New Britain	60.35
17459	Special Vegetable	New Britain	68.85
17299	Tobacco Grower	South Windsor	.....
17469	Tobacco Manure	Silver Lane	70.00

WITH POTASH—(*Continued*).

	Nitrogen.						Phosphoric Acid.							Potash.			
					Total.					Total.		So-called "Available."					
Station No.	In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
17317	1.64	0.28	0.61	0.77	3.30	3.29	4.36	4.28	1.25	9.89	9.00	8.64	8.00	3.28	3.28	4.00	17317
17376	1.72	0.07	0.03	0.66	2.48	2.47	4.02	4.61	0.67	9.30	9.00	8.63	8.00	0.70	6.50	6.00	17376
17283	1.01	0.10	none	3.39	4.50	4.11	3.50	2.14	0.42	6.06	5.00	5.64	4.00	0.28	3.43	3.00	17283
17278	0.10	0.30	0.52	0.80	1.72	1.65	4.20	4.01	1.92	10.13	9.00	8.21	8.00	3.28	3.28	3.00	17278
17379	0.73	0.25	0.55	0.84	2.37	2.47	6.75	3.78	1.16	11.69	11.00	10.53	10.00	2.85	2.85	3.00	17379
17467	1.12	0.32	0.54	0.60	2.58	2.47	3.90	4.74	1.80	10.44	10.00	8.64	9.00	1.97	1.97	2.00	17467
17088	0.20	0.18	0.48	0.69	1.55	1.65	4.57	3.76	1.70	10.03	9.00	8.33	8.00	1.97	1.97	2.00	17088
17281	0.54	0.20	0.45	0.40	1.59	1.65	4.81	3.08	1.05	8.94	9.00	7.89	8.00	3.04	3.04	3.00	17281
16754	0.12	1.90	0.02	0.38	2.42	2.47	6.77	1.52	0.35	8.64	8.00	8.29	8.00	4.01	4.01	4.00	16754
17311	0.18	0.82	0.11	0.81	1.92	1.65	5.05	2.88	0.68	8.61	9.00	7.93	8.00	2.34	2.34	2.00	17311
16753	0.10	2.46	0.08	0.50	3.14	3.29	7.36	0.93	0.26	8.55	9.00	8.29	8.00	3.86	3.86	4.00	16753
17313	0.14	1.82	0.12	0.52	2.60	2.47	6.21	2.31	0.52	9.04	10.00	8.52	9.00	5.26	5.26	5.00	17313
17021	0.66	0.66	none	3.10	4.42	4.11	1.53	2.73	0.40	4.66	5.00	4.26	4.00	0.57	5.29	5.00	17021
16798	0.74	0.78	0.12	0.64	2.28	2.47	6.37	1.95	0.56	8.88	8.50	8.32	8.00	4.00	4.00	4.00	16798
17131	....	....	....	....	2.34	2.47	....	....	0.45	8.67	8.50	8.22	8.00	....	4.04	4.00	17131
16874	1.00	1.84	none	1.13	3.97	4.11	4.74	3.32	0.92	8.98	8.50	8.06	8.00	5.40	5.40	5.00	16874
16875	1.12	1.16	0.04	0.82	3.14	3.29	6.26	2.18	0.77	9.21	8.50	8.44	8.00	3.80	3.80	4.00	16875
17017	0.88	0.12	none	2.94	3.94	4.11	3.72	2.54	0.37	6.63	4.50	6.26	4.00	0.21	5.35	5.00	17017
17314	0.80	0.24	0.07	2.93	4.04	4.11	2.50	2.16	0.27	4.93	4.50	4.66	4.00	0.39	4.88	5.00	17314
16865	0.54	0.36	none	0.70	1.60	1.65	5.06	3.19	0.55	8.80	8.50	8.25	8.00	1.77	1.77	2.00	16865
17137	....	....	....	....	1.76	1.65	....	....	0.42	8.51	8.50	8.09	8.00	....	2.00	2.00	17137
17044	0.96	0.08	0.21	3.25	4.50	4.11	2.38	2.73	0.42	5.53	4.50	5.11	4.00	0.21	3.88	3.00	17044
16692	0.12	0.44	none	0.38	0.94	0.82	1.76	5.39	0.91	8.06	7.50	7.15	7.00	1.10	1.10	1.00	16692
17108	1.42	0.06	0.46	0.84	2.78	3.28	5.02	4.14	0.45	9.61	9.00	9.16	8.00	6.33	6.33	6.00	17108
17487	1.62	0.09	0.95	0.86	3.52	3.28	4.93	4.10	0.64	9.67	9.00	9.03	8.00	5.48	5.48	6.00	17487
16996	0.58	0.06	0.25	0.63	1.52	1.64	4.94	3.44	1.36	9.74	9.00	8.38	8.00	2.06	2.06	2.00	16996
17484	0.05	0.67	0.43	0.57	1.72	1.64	4.97	4.35	0.97	10.29	9.00	9.32	8.00	2.33	2.33	2.00	17484
17047	1.12	0.32	0.41	0.61	2.46	2.46	5.19	3.95	0.35	9.49	9.00	9.14	8.00	3.97	3.97	4.00	17047
16995	0.76	0.44	0.35	0.81	2.36	2.46	4.34	4.13	1.06	9.53	9.00	8.47	8.00	3.17	3.17	3.00	16995
17459	0.05	0.81	1.46	0.82	3.14	3.28	4.60	3.60	0.88	9.08	9.00	8.20	8.00	3.95	3.95	4.00	17459
17299	1.51	0.12	0.33	2.22	4.18	4.10	1.78	4.94	0.38	7.10	6.00	6.72	5.00	0.68	4.02	4.00	17299
17469	1.86	0.11	1.00	1.21	4.18	4.10	5.42	4.11	0.50	10.03	9.00	9.53	8.00	0.69	6.16	6.00	17469

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Berkshire Fertilizer Co., Bridgeport, Conn.		
16700	Ammoniated Bone Phosphate	Southport	$45.00
17050	Ammoniated Bone Phosphate	Waterbury	52.00
17310	Grass Special	Ellington	.....
17013	Complete Fertilizer	Waterbury	63.00
17309	Complete Tobacco	Ellington	.....
16696	Market Garden Fertilizer	Milford	61.50
17012	Potato and Vegetable Phosphate	Milford	46.00
16943	Special Mixture	Brooklyn	48.00
	F. E. Boardman, Middletown, Conn.		
17460	Complete Fertilizer for Potatoes & General Crops	Middletown	54.00
17461	Complete Fertilizer for Tobacco	Middletown	55.00
	Bowker Fertilizer Co., New York City.		.....
17043	All Round Fertilizer	Yalesville	67.00
17321	Connecticut Valley Tobacco Fertilizer	Thompsonville	76.00
16873	Corn, Grain and Grass Phosphate	Rockville	47.00
17306	Fisherman's Brand Fish and Potash	Yalesville	66.00
17046	Hill and Drill Phosphate	Mansfield Depot	60.00
16800	Potato and Vegetable Phosphate	Plainville	56.00
16799	Square Brand Farm and Garden Phosphate	Yalesville	54.00
17022	Sure Crop Phosphate revised	Willimantic	40.00
16747	Tobacco Elements	Thompsonville	74.00
17085	Maryland Corn Phosphate	Willimantic	36.00
17326	Maryland Truck Garden Fertilizer	Willimantic	.....
17327	Stockbridge Early Crop Manure	Mansfield Depot	80.00
16814	Stockbridge Market Garden Manure	Plainville	68.00
16871	Stockbridge Tobacco Manure	Suffield	.....
	A. D. Bridge's Sons, Inc., Hazardville, Conn.		
16667	Corn, Potato and General Purpose Fertilizer	Hazardville	60.00
16666	Special Tobacco Fertilizer	Hazardville	69.00
	E. D. Chittenden Co., Bridgeport, Conn.		
17016	Complete Tobacco and Onion Grower with 4% Potash	Suffield	.....
17324	Complete Tobacco and Onion Grower with 6% Potash	Enfield	68.50
16941	High Grade Potato with 4% Potash	Brooklyn	52.50
16872	Tobacco Special 5% Potash	Suffield	.....
17323	Vegetable and Onion Grower, 3% Potash	Green's Farms	56.50

WITH POTASH—(*Continued*).

Nitrogen.						Phosphoric Acid.							Potash.			
				Total					Total.		So-called "Available."					
In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
0.64	0.14	none	0.24	1.02	0.80	9.51	1.81	0.24	11.56	11.00	11.32	10.00	1.84	1.84	2.00	16700
0.84	0.08	0.03	0.25	1.20	0.80	8.41	2.06	0.15	10.62	11.00	10.47	10.00	1.92	1.92	2.00	17050
4.04	0.28	0.10	1.38	5.80	5.75	0.72	4.23	0.18	5.13	5.00	4.95	4.00	3.95	3.95	4.00	17310
1.74	0.22	none	0.62	2.58	2.50	6.77	1.73	0.58	9.08	9.00	8.50	8.00	2.66	2.66	3.00	17013
1.46	0.14	0.19	2.51	4.30	4.11	1.19	4.85	0.37	6.41	4.00	6.04	4.00	0.56	4.70	4.00	17309
1.78	0.28	0.29	1.17	3.52	3.30	2.39	5.84	0.84	9.07	9.00	8.23	8.00	3.95	3.95	4.00	16696
1.18	0.16	none	0.48	1.82	1.70	6.77	1.77	0.35	8.89	9.00	8.54	8.00	2.64	2.64	2.00	17012
2.00	0.12	0.28	1.70	4.10	4.11	0.36	8.34	1.43	10.13	9.00	8.70	.....	4.84	4.84	5.00	16943
0.74	0.74	0.12	1.84	3.44	3.30	4.37	2.97	0.18	7.52	7.50	7.34	7.00	4.80	4.80	4.00	17460
0.91	0.84	0.18	1.71	3.64	3.30	4.81	3.56	0.23	8.60	7.50	8.37	7.00	0.23	4.06	4.00	17461
0.72	0.86	0.33	0.57	2.48	2.47	5.90	2.83	0.83	9.56	9.00	8.73	8.00	4.11	4.11	4.00	17043
1.02	0.13	0.03	2.94	4.12	4.11	1.19	4.49	0.41	6.09	5.00	5.68	4.00	0.78	3.36	3.00	17321
0.62	0.22	0.18	0.74	1.76	1.65	5.09	3.62	1.05	9.76	9.00	8.71	8.00	2.29	2.29	2.00	16873
0.16	0.76	0.38	1.07	2.37	2.47	7.92	3.14	0.88	11.94	11.00	11.06	10.00	2.71	2.71	3.00	17306
0.94	1.08	0.08	0.48	2.58	2.47	5.79	3.60	0.28	9.67	10.00	9.39	9.00	2.19	2.19	2.00	17046
0.32	0.62	0.33	0.47	1.74	1.65	3.12	4.92	1.41	9.45	9.00	8.04	8.00	1.16	3.08	3.00	16800
0.24	0.58	0.35	0.41	1.58	1.65	4.93	3.64	1.05	9.62	9.00	8.57	8.00	2.07	2.07	2.00	16799
0.38	0.10	0.15	0.19	0.82	0.82	2.59	5.45	0.75	8.79	9.00	8.04	8.00	2.11	2.11	2.00	17022
1.74	0.08	none	0.94	2.76	2.47	1.56	6.53	0.72	8.81	9.00	8.09	8.00	0.88	5.63	6.00	16747
0.64	0.74	none	0.28	1.66	1.65	4.41	3.83	0.42	8.66	9.00	8.24	8.00	2.06	2.06	2.00	17085
1.40	1.02	0.52	0.20	3.14	3.29	4.92	3.37	0.31	8.60	9.00	8.29	8.00	3.61	3.61	4.00	17326
1.24	1.82	0.34	0.66	4.06	4.11	5.11	2.96	0.41	8.48	9.00	8.07	8.00	7.43	7.43	7.00	17327
0.52	1.30	0.28	1.38	3.48	3.29	5.74	2.41	1.01	9.16	9.00	8.15	8.00	3.95	3.95	4.00	16814
1.28	0.06	0.30	2.58	4.22	4.11	1.26	4.09	0.29	5.64	5.00	5.35	4.00	0.64	4.77	5.00	16871
0.66	1.06	.....	.....	3.76	3.30	2.81	6.14	1.04	9.99	8.00	8.95	8.00	0.19	4.55	4.00	16667
0.54	0.06	.....	.....	4.26	4.11	1.14	4.36	0.49	5.99	4.00	5.50	4.00	0.28	4.89	4.00	16666
1.46	1.02	0.08	0.76	3.32	3.29	5.86	3.09	0.54	9.49	9.00	8.95	8.00	0.76	4.31	4.00	17016
1.62	0.90	none	0.68	3.20	3.29	5.21	3.54	0.54	9.29	9.00	8.75	8.00	5.86	5.86	6.00	17324
0.12	2.72	0.03	1.43	4.30	4.12	6.82	2.49	0.86	10.17	9.00	9.31	8.00	4.46	4.46	4.00	16941
1.65	0.02	none	2.79	4.46	4.12	2.46	2.31	0.26	5.03	5.00	4.77	4.00	0.35	6.24	5.00	16872
0.96	0.58	0.05	0.75	2.34	2.47	5.55	3.00	0.51	9.06	9.00	8.55	8.00	2.94	2.94	3.00	17323

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Everett B. Clark Seed Co., Milford, Conn.		
16868	Special Mixture with Potash (4–8–6)	Milford	$53.00
17322	Special Mixture with Potash (4–10–4)	Southport	50.00
17481	Special Mixture with Potash (4–8–6)	Woodmont	53.00
	The Coe-Mortimer Co., New York City		
17339	Celebrated Special Potato Fertilizer Revised	Plantsville	.....
16697	Columbian Corn and Potato Fertilizer	Milford	50.00
17341	Connecticut Wrapper Grower	Poquonock	82.00
17099	Cotton Seed Supplement	Glastonbury	73.00
16698	Gold Brand Excelsior Guano Revised	Milford	60.00
17325	New Englander Special	Abington	45.00
17342	Special Grass Top Dressing	Glastonbury	73.00
17343	Tobacco Leaf Fertilizer	Glastonbury	70.00
	H. B. Cornwall, Meriden, Conn.		
17615	Potato and General Use	Southington	64.00
17616	Tobacco Grower	Glastonbury	70.00
	Eastern States Farmers' Exchange, Springfield, Mass.		
17109	2–8–2	Bristol	52.00
17416	3–8–4	Madison	44.25
17415	4–8–4	Bristol	68.50
17417	4–8–7	Madison	65.00
17420	5–4–5	South Manchester	57.60
	Essex Fertilizer Co., Boston, Mass.		
17081	1–10–1 for Grain and Grass	Hartford	49.25
17103	2–8–2 for Farm and Garden	South Manchester	56.00
17336	4–8–4 for Potatoes, Roots and Vegetables	Hartford	70.00
17340	Special Tobacco 5–5–4	Wapping	77.50
17464	5–8–6	Wapping	70.00
17335	Fish Fertilizer, 3–8–3 for All Crops	Hartford	62.25
17337	Market Garden 3–8–4 for Vegetables and Grass	South Manchester	66.00
17083	Tobacco Manure 5–7–2	Rockville	70.00
	L. T. Frisbie Co., New Haven, Conn.		
17462	3–8–6	New Hartford	57.00
17350	5–8–7	Putnam	.....
17078	Corn and Grain Fertilizer	Stamford	60.00
17488	Corn and Grain Fertilizer	New Haven	56.00
17082	Market Garden	Hartford	.....

WITH POTASH—(*Continued*).

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available."					
In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
0.20	1.82	0.11	1.45	3.58	3.29	6.91	2.33	1.01	10.25	8.50	9.24	8.00	6.48	6.48	6.00	16868
0.08	2.10	0.14	1.00	3.32	3.29	8.13	2.09	0.77	10.99	10.50	10.22	10.00	4.04	4.04	4.00	17322
0.09	2.13	0.15	1.19	3.56	3.29	5.78	2.96	0.73	9.47	8.50	8.74	8.00	6.01	6.01	6.00	17481
0.38	1.04	0.24	1.52	3.18	3.29	6.18	2.19	0.84	9.21	9.00	8.37	8.00	3.75	3.75	4.00	17339
0.58	0.70	none	0.40	1.68	1.65	2.94	5.39	1.06	9.39	9.00	8.33	8.00	1.20	3.13	3.00	16697
0.83	0.10	0.54	2.70	4.17	4.11	0.81	4.89	0.31	6.01	5.00	5.70	4.00	0.85	4.60	5.00	17341
1.72	0.02	0.07	0.71	2.52	2.47	1.28	7.65	0.45	9.38	9.00	8.93	8.00	0.93	6.28	6.00	17099
0.42	1.04	0.14	0.90	2.50	2.47	4.89	2.99	1.45	9.33	9.00	7.88	8.00	3.95	3.95	4.00	16698
0.29	0.07	0.32	0.14	0.82	0.82	2.98	5.00	0.68	8.66	9.00	7.98	8.00	1.93	1.93	2.00	17325
1.43	2.13	0.64	0.84	5.04	4.94	4.78	2.89	0.45	8.12	7.00	7.67	6.00	3.45	3.45	4.00	17342
1.15	0.11	0.29	2.79	4.34	4.11	1.16	4.44	0.26	5.86	5.00	5.60	4.00	0.66	2.99	3.00	17343
0.91	0.15	0.22	2.14	3.42	3.70	6.37	3.44	1.04	10.85	.....	9.81	9.00	8.26	8.26	7.50	17615
2.75	0.17	0.41	1.91	5.24	5.76	2.59	4.92	1.11	8.62	.....	7.51	5.00	0.89	5.91	5.00	17616
0.20	0.58	0.07	0.85	1.70	1.65	6.64	2.22	0.41	9.27	9.00	8.86	8.00	1.52	2.00	2.00	17109
1.16	0.07	0.61	0.64	2.48	2.46	3.86	4.35	0.63	8.84	9.00	8.21	8.00	4.52	4.52	4.00	17416
1.52	0.23	0.72	0.93	3.40	3.29	6.53	2.33	0.82	9.68	9.00	8.86	8.00	0.51	4.39	4.00	17415
0.27	1.03	1.24	0.50	3.04	3.29	5.54	2.63	0.90	9.07	9.00	8.17	8.00	6.22	6.22	7.00	17417
0.15	1.04	0.16	2.87	4.22	4.11	3.84	1.62	0.26	5.72	5.00	5.46	4.00	0.53	6.70	5.00	17420
none	0.34	0.17	0.41	0.92	0.82	6.75	3.41	1.15	11.31	11.00	10.16	10.00	1.17	1.17	1.00	17081
0.14	0.20	0.60	0.80	1.74	1.64	5.30	2.88	0.99	9.17	9.00	8.18	8.00	1.99	1.99	2.00	17103
0.61	1.00	0.89	0.86	3.36	3.28	6.07	2.57	0.61	9.25	9.00	8.64	8.00	4.57	4.57	4.00	17336
1.58	0.09	0.37	2.34	4.38	4.10	2.04	4.24	0.51	6.79	6.00	6.28	5.00	0.68	4.31	4.00	17340
1.88	0.11	0.53	2.94	5.46	4.11	1.11	5.02	0.54	6.67	9.00	6.13	8.00	0.80	4.22	6.00	17464
0.18	0.89	0.58	0.57	2.22	2.46	5.70	2.23	0.68	8.61	9.00	7.93	8.00	3.04	3.04	3.00	17335
0.02	1.14	0.65	0.71	2.52	2.46	6.49	1.96	0.59	9.04	9.00	8.45	8.00	3.79	3.79	4.00	17337
1.62	0.10	0.06	2.38	4.16	4.10	4.68	3.62	0.50	8.80	8.00	8.30	7.00	0.44	2.10	2.00	17083
1.00	0.07	0.60	1.05	2.72	2.46	1.14	6.91	2.20	10.25	9.00	8.05	8.00	0.69	6.69	6.00	17462
1.60	1.07	0.33	1.22	4.22	4.10	5.56	4.04	0.43	10.03	9.00	9.60	8.00	6.62	6.62	7.00	17350
0.72	0.10	0.09	0.58	1.49	1.64	4.29	4.77	0.96	10.02	9.00	9.06	8.00	2.11	2.11	2.00	17078
0.27	0.57	0.30	0.58	1.72	1.64	5.12	4.07	0.87	10.06	9.00	9.19	8.00	2.33	2.33	2.00	17488
1.36	0.16	0.50	0.75	2.77	3.28	5.11	4.12	0.38	9.61	9.00	9.23	8.00	6.01	6.01	6.00	17082

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	L. T. Frisbie Co., New Haven, Conn.—(*Continued*).		
17260	Market Garden	North Haven	$64.00
17155	Special Mixture	East Hartford	.....
17334	Special	New Britain	65.00
17333	Special Vegetable and Potato Grower	Stamford	70.00
17586	Special Vegetable and Potato Grower, 4–8–4	Wilson	45.00
17358	Special 4–10–6	Woodmont	58.00
17344	Superphosphate	Stamford	68.00
17353	Tobacco Grower	South Windsor	.....
17102	Tobacco Manure, 5–8–6	Hartford	.....
	International Agricultural Corporation (Buffalo Fertilizer Works), Boston, Mass.		
17349	Complete	East Granby	.....
16925	Complete Tobacco	East Granby	.....
17285	Buffalo Economy	West Suffield	52.00
17279	Buffalo Farmers' Choice	Litchfield	48.00
17284	Buffalo General Favorite	West Suffield	44.00
17282	Buffalo High Grade Manure	Glastonbury	68.25
17280	Buffalo New Englander Special	Litchfield	58.00
17354	Buffalo Tobacco Producer	Glastonbury	78.50
17287	Buffalo Vegetable & Potato	Tariffville	63.00
	Lowell Fertilizer Co., Boston, Mass.		
16924	2–8–3 for Vegetables and Grain	Rockville	50.00
17375	3–8–3 for Corn, Grain and Vegetables	Yantic	46.00
16820	4–8–4 for Potatoes, Corn and Vegetables	Wethersfield	62.75
17100	5–5–4 for Tobacco, Fruits and Vines	Rockville	83.00
17371	5–8–4 for Vegetables and Grain	Warehouse Point	77.00
16920	Animal Brand 3–8–4 for All Crops	Wallingford	60.00
17537	Animal Brand 3–8–4 for All Crops	Southington	68.00
17369	Bone Fertilizer 2–8–2 for Corn, Grain, Grass and Vegetables	New Britain	53.00
16813	Empress Brand 1–10–1 for Grain and Vegetables	New Britain	48.00
16926	Lawn and Garden Dressing 4–7–2	Hartford	.....
17380	Tobacco 5–7–2	Rockville	.....
	Mapes Formula and Peruvian Guano Co., New York City.		
17377	Connecticut Valley Special	South Glastonbury	90.00
17370	Corn Manure	Forestville	57.50
17393	Cotton Seed Tobacco Manure	Windsor	71.00
17079	General Truck Manure	Forestville	72.00

WITH POTASH—(*Continued*)

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available."					
In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
....	....	....	....	2.92	3.28	....	....	0.47	9.47	9.00	9.00	8.00	....	5.88	6.00	17260
0.82	none	0.40	3.72	1.47	....	1.29	5.22	0.60	7.11	.....	6.51	.....	0.53	6.89	....	17155
0.43	0.45	0.74	0.70	2.32	2.47	5.02	3.96	0.50	9.48	9.00	8.98	8.00	3.88	3.88	4.00	17334
0.74	1.02	0.52	0.82	3.10	3.29	4.55	4.12	0.74	9.42	9.00	8.68	8.00	4.01	4.01	4.00	17333
0.78	0.92	....	....	3.46	3.28	....	....	0.64	9.77	9.00	9.13	8.00	....	4.22	4.00	17586
0.55	1.48	0.36	1.15	3.54	3.28	8.08	3.69	0.46	12.23	11.00	11.77	10.00	6.21	6.21	6.00	17358
0.64	0.50	0.56	0.66	2.36	2.46	4.41	4.26	0.96	9.63	9.00	8.67	8.00	3.02	3.02	3.00	17344
0.86	1.06	0.59	1.83	4.34	4.10	1.01	5.56	0.47	7.04	6.00	6.57	5.00	1.58	4.01	4.00	17353
1.76	0.14	0.93	1.23	4.06	4.10	5.78	4.06	0.46	10.30	9.00	9.84	8.00	1.02	6.31	6.00	17102
0.48	0.36	0.52	0.64	2.00	1.60	5.07	3.66	1.16	9.89	9.00	8.73	8.00	2.00	2.00	2.00	17349
0.82	0.46	0.21	1.85	3.34	3.30	1.47	3.34	0.37	5.18	5.00	4.81	4.00	0.64	3.76	4.00	16925
0.28	0.18	0.52	0.68	1.66	1.60	5.77	4.17	1.09	11.03	9.00	9.94	8.00	2.32	2.32	2.00	17285
0.11	0.14	0.37	0.34	0.96	0.80	5.77	3.99	1.18	10.94	11.00	9.76	10.00	2.23	2.23	2.00	17279
0.04	0.18	0.26	0.50	0.98	0.80	5.07	3.38	0.79	9.24	9.00	8.45	8.00	1.22	1.22	1.00	17284
1.00	0.52	0.37	1.38	3.27	3.30	4.70	3.91	1.29	9.90	9.00	8.61	8.00	5.87	5.87	6.00	17282
0.39	0.38	0.18	0.91	1.86	1.60	2.03	6.86	2.65	11.54	11.00	8.89	10.00	4.08	4.08	4.00	17280
0.78	1.26	0.20	2.04	4.28	4.10	0.55	3.68	0.35	4.58	5.00	4.23	4.00	0.62	3.36	4.00	17354
0.52	0.56	0.32	1.14	2.54	2.50	2.75	6.80	2.56	12.11	9.00	9.55	8.00	3.80	3.80	4.00	17287
0.04	0.16	0.69	0.79	1.68	1.64	5.51	2.27	1.18	8.96	9.00	7.78	8.00	3.09	3.09	3.00	16924
0.43	0.57	0.59	0.63	2.22	2.46	5.81	3.36	0.22	9.39	9.00	9.17	8.00	3.04	3.04	3.00	17375
0.72	1.00	0.81	0.87	3.40	3.29	5.68	2.90	0.63	9.21	9.00	8.58	8.00	4.36	4.36	4.00	16820
1.24	0.04	0.54	2.22	4.04	4.10	1.61	4.10	0.42	6.13	6.00	5.71	5.00	0.76	4.00	4.00	17100
1.28	0.16	0.99	1.17	3.60	4.10	5.52	2.62	0.93	9.07	9.00	8.14	8.00	2.14	3.69	4.00	17371
0.18	0.82	0.50	0.68	2.18	2.46	6.13	2.00	0.68	8.81	9.00	8.13	8.00	3.81	3.81	4.00	16920
....	....	....	....	2.02	2.46	....	....	0.58	8.64	9.00	8.06	8.00	....	4.02	4.00	17537
0.09	0.09	0.60	0.62	1.40	1.64	5.13	2.58	0.84	8.55	9.00	7.71	8.00	1.83	1.83	2.00	17369
none	0.14	0.30	0.30	0.74	0.82	5.96	3.17	1.71	10.84	11.00	9.13	10.00	0.94	0.94	1.00	16813
1.96	1.22	none	0.10	3.28	3.28	7.57	0.75	1.34	9.66	8.00	8.32	7.00	1.97	1.97	2.00	16926
1.16	0.04	0.43	2.27	3.90	4.10	4.48	3.73	0.46	8.67	8.00	8.21	7.00	0.54	2.19	2.00	17380
2.32	0.06	0.29	2.33	5.00	4.95	0.04	5.21	0.33	5.58	.....	5.25	4.00	1.40	6.25	7.00	17377
1.30	0.06	0.61	0.81	2.78	2.47	1.90	6.87	1.27	10.04	10.00	8.77	8.00	3.86	3.86	3.00	17370
1.79	0.06	0.07	2.32	4.24	4.12	0.49	3.55	0.51	4.55	.....	4.04	4.00	0.53	1.63	1.00	17393
3.70	0.04	0.26	0.72	4.72	4.12	1.12	5.43	1.57	8.12	8.00	6.55	6.00	2.43	5.39	5.00	17079

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Mapes Formula and Peruvian Guano Co., New York City—(*Continued*).		
17080	General Use Manure	Windsor Locks	.....
17392	General Tobacco Manure	South Windsor	.....
17372	Grain Grower	Suffield	$49.00
16816	Potato Manure	Forestville	67.00
16578	Tobacco Ash Constituents	Burnside	77.50
16837	Tobacco Ash Constituents	Warehouse Point	74.50
16579	Tobacco Starter Improved	Burnside	63.00
16815	Top Dresser	Forestville	87.50
17136	Top Dresser	Hartford	.....
	Miller Fertilizer Co., Baltimore, Md.		
17149	5–8–7	Newington	57.00
16684	Clermont	Ansonia	45.00
17577	Clermont	Wallingford	42.00
16752	No. 1 Potato and Vegetable Grower	Wallingford	57.00
16685	Standard Phosphate	Ansonia	54.00
17578	Standard Phosphate	Wallingford	52.00
	National Fertilizer Co., New York City.		
16929	Complete Tobacco Fertilizer	South Manchester	74.00
17262	Complete Tobacco Fertilizer	Somerville	77.43
16818	Eureka Potato Fertilizer	West Cheshire	65.00
16817	Market Garden Fertilizer Revised	Southington	59.00
17065	Potato Phosphate	Wallingford	.....
17388	Special Tobacco Revised	Somerville	75.50
17394	Tobacco Foundation	Warehouse Point	71.75
16812	Universal Phosphate	Wallingford	.....
17261	XXX Fish and Potash	Wallingford	.....
	New England Fertilizer Co., Boston, Mass.		
17048	2–8–3 for Vegetables and Grain	Meriden	54.00
17266	3–8–3 for Corn, Grain and Vegetables	Meriden	58.00
17071	4–8–6 for Potatoes and Vegetables	Putnam	65.00
17486	5–8–6	Glastonbury	70.00
17263	5–8–7 for Potatoes and Market Gardens	Putman	76.25
16930	Corn Phosphate for Grain and Vegetables	Rockville	54.00
17536	Potato, Vegetable and Grass, 4–8–4	Putnam	.....
17045	Superphosphate, 3–8–4, for all Crops	Rockville	64.00
17272	Tobacco Manure, 5–5–4	Ellington	.....

WITH POTASH—(*Continued*).

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available."					
In ammonia.	In nitrates.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
1.52	0.04	0.27	0.71	2.54	2.47	0.12	6.61	2.06	8.79	8.00	6.73	6.00	0.93	4.02	4.00	17080
1.69	0.05	0.13	2.13	4.00	4.12	0.12	4.45	0.19	4.76	.....	4.57	4.00	0.39	5.59	5.00	17392
0.38	0.08	0.72	0.55	1.73	1.65	2.19	6.24	1.50	9.93	10.00	8.43	8.00	2.00	2.00	2.00	17372
2.58	0.08	0.30	0.64	3.60	3.29	1.76	5.61	2.02	9.39	8.00	7.37	7.00	3.15	4.98	5.00	16816
0.07	0.06	....	....	0.83	0.82	0.50	2.23	3.40	6.13	6.00	2.73	4.00	3.04	[1]2.47	15.00	16578
0.08	0.10	....	....	1.02	0.82	0.33	3.16	3.02	6.51	6.00	3.49	4.00	....	14.34	15.00	16837
2.42	0.30	....	....	4.30	4.12	3.21	3.83	1.61	8.65	8.00	7.04	6.00	0.44	1.72	1.00	16579
6.90	0.18	0.78	0.48	8.34	8.22	1.04	3.50	1.20	5.74	6.00	4.54	4.00	0.48	3.75	2.00	16815
....	....	....	....	8.46	8.22	....	....	0.63	6.20	6.00	5.57	4.00	....	3.41	2.00	17136
0.98	1.32	0.88	0.64	3.82	4.12	4.36	4.43	0.92	9.71	8.50	8.79	8.00	6.24	6.24	7.00	17149
0.14	0.14	....	....	1.18	0.82	5.30	4.19	1.05	10.54	10.50	9.49	10.00	2.01	2.01	2.00	16684
none	0.08	0.49	0.37	0.94	0.82	....	....	0.96	10.52	10.50	9.56	10.00	....	2.21	2.00	17577
0.80	0.68	0.78	0.70	2.96	3.30	3.18	4.97	1.27	9.42	8.50	8.15	8.00	3.90	3.90	4.00	16752
0.76	0.62	....	....	2.11	2.47	3.98	4.12	0.88	8.98	8.50	8.10	8.00	3.34	3.34	3.00	16685
0.62	0.27	0.93	0.42	2.24	2.47	....	....	0.84	9.27	8.50	8.43	8.00	....	3.07	3.00	17578
1.06	0.16	0.26	2.46	3.94	4.11	1.14	4.72	0.36	6.22	5.00	5.86	4.00	1.04	4.14	5.00	16929
0.84	0.10	0.09	3.07	4.10	4.11	2.28	2.23	0.26	4.77	5.00	4.51	4.00	0.37	5.55	5.00	17262
1.32	1.50	none	0.72	3.54	3.29	6.41	2.18	0.93	9.52	9.00	8.59	8.00	4.37	4.37	4.00	16818
0.88	1.32	0.16	0.40	2.76	2.47	5.68	2.56	0.97	9.21	9.00	8.24	8.00	4.02	4.02	4.00	16817
0.44	0.48	0.25	0.51	1.68	1.65	4.44	3.68	0.92	9.04	9.00	8.12	8.00	3.01	3.01	3.00	17065
0.15	1.07	0.58	2.62	4.42	4.11	0.68	4.73	0.40	5.81	5.00	5.41	4.00	0.74	3.59	3.00	17388
0.09	1.33	0.06	1.36	2.84	2.47	0.63	8.02	0.42	9.07	9.00	8.65	8.00	1.48	5.73	6.00	17394
0.02	0.24	0.38	0.42	1.06	0.82	3.59	4.62	0.95	9.16	9.00	8.21	8.00	2.39	2.39	2.00	16812
0.58	0.78	0.10	1.02	2.48	2.47	7.60	3.86	0.82	12.28	11.00	11.46	10.00	3.55	3.55	3.00	17261
0.02	0.12	0.76	0.72	1.62	1.64	5.43	2.75	0.99	9.17	9.00	8.18	8.00	3.07	3.07	3.00	17048
0.12	0.90	0.50	0.55	2.07	2.46	5.61	2.46	0.65	8.72	9.00	8.07	8.00	2.89	2.89	3.00	17266
0.86	0.94	0.45	0.68	2.93	3.28	5.33	2.90	0.70	8.93	9.00	8.23	8.00	6.04	6.04	6.00	17071
1.57	0.22	1.07	1.24	4.10	4.10	5.89	3.84	0.50	10.23	9.00	9.73	8.00	1.24	6.62	6.00	17486
1.04	1.14	0.78	1.02	3.98	4.10	5.16	3.49	0.73	9.38	9.00	8.65	8.00	7.63	7.63	7.00	17263
0.06	0.08	0.60	0.73	1.47	1.64	5.52	2.52	0.90	8.94	9.00	8.04	8.00	1.75	1.75	2.00	16930
....	....	....	....	3.21	3.29	....	....	0.75	8.80	.....	8.05	8.00	....	4.70	4.00	17536
0.20	0.92	0.72	0.74	2.58	2.46	6.64	2.14	0.74	9.52	9.00	8.78	8.00	3.73	3.73	4.00	17045
2.16	0.10	0.01	1.69	3.96	4.10	1.75	4.16	0.29	6.20	6.00	5.91	5.00	0.77	4.35	4.00	17272

[1] 7.36 as sulphate, 2.07 as carbonate.

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Nitrate Agencies Co., New York City.		
17074	Naco Brand, 2–8–2 Formula	Bristol	$50.00
17269	Naco Brand, 3–8–4 Formula	South Manchester	44.25
17073	Naco Brand, 4–8–4 Formula	Bristol	58.50
	Olds & Whipple, Hartford, Conn.		
17236	Complete Corn, Onion and Potato Fertilizer	South Windsor	61.00
16921	Complete Tobacco Fertilizer	South Windsor	70.00
17243	High Grade Starter & Potash Compound	Hartford	.....
16931	Special Complete Corn, Onion and Potato Fertz...	Ellington	.....
	Parmenter & Polsey Fertilizer Co., Boston, Mass.		
17072	1–10–1 for Grain and Grass	Plantsville	45.00
17241	2–8–2, for Farm and Garden	Plantsville	50.00
17247	4–8–4, for Potatoes, Corn and Vegetables	Wallingford	65.00
17239	Plymouth Rock, 3–8–4	Rocky Hill	.....
	Piedmont-Mt. Airy Guano Co., Baltimore, Md.		
16939	Brown's 5–8–7 Fertilizer	Putnam	60.00
16938	Brown's Corn and Grain Fertilizer	Putnam	38.00
16801	Brown's Fish, Bone and Potash	Green's Farms	48.35
16967	Brown's Fish, Bone and Potash	Putnam	49.00
16933	Brown's Market Garden Fertilizer	Putnam	52.00
16935	Brown's Top Dresser	Putnam	57.00
16803	Brown's Potato Phosphate	Green's Farms	43.00
17185	Brown's Potato Phosphate	Putnam	44.00
16936	Home Mixture	Putnam	45.12
	Providence Farmers' Exchange, Providence, R. I.		
17229	Exchange Brand, 2–8–2 Fertilizer	Waterbury	.....
17133	Exchange Brand, 3–8–4 Fertilizer	Waterbury	.....
17228	Exchange Brand, 4–8–4 Fertilizer	Waterbury	.....
16942	Exchange Brand, 5–8–5 Fertilizer	Brooklyn	58.00
	Quality Seed and Fertilizer Co., Stamford, Conn.		
17201	All Crop Fertilizer	Stamford	50.00
17200	Bartlett Special Tree Fertilizer	Stamford	60.00
17199	Potato Fertilizer	Stamford	65.00
	Rogers & Hubbard Co., Middletown, Conn.		
17191	Hubbard's Bone Base Fertilizer for Seeding Down	Middletown	.....
17070	Hubbard's Bone Base Oats and Top Dressing	Somers	.....

WITH POTASH—(*Continued*).

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available."					
In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
0.10	0.54	0.27	0.81	1.72	1.64	6.87	2.33	0.45	9.65	9.00	9.20	8.00	1.63	2.04	2.00	17074
0.36	0.88	0.22	2.12	3.58	2.46	5.95	2.44	0.64	9.03	9.00	8.39	8.00	0.44	3.28	4.00	17269
0.98	1.14	0.25	0.89	3.26	3.20	6.60	2.39	0.81	9.80	9.00	8.99	8.00	0.49	4.29	4.00	17073
1.52	0.10	none	1.68	3.30	3.30	5.67	3.50	0.27	9.44	8.00	9.17	8.00	4.81	4.81	4.00	17236
0.82	0.08	0.47	2.95	4.32	4.11	0.96	4.05	0.17	5.18	4.00	5.01	4.00	0.94	4.42	4.00	16921
1.50	0.08	0.44	2.16	4.18	4.11	0.03	5.42	0.04	5.49	4.00	5.45	4.00	1.37	15 81	15 00	17243
1.66	0.14	none	1.02	2.82	2.45	5.33	3.56	0.63	9.52	8.00	8.89	8.00	2.42	2.42	2.00	16931
0.08	0.04	0.45	0.41	0.98	0.82	6.44	3.36	1.15	10.95	11.00	9.80	10.00	1.35	1.35	1.00	17072
0.14	0.06	0.67	0.79	1.66	1.64	5.38	3.00	0.97	9.35	9.00	8.38	8.00	2.12	2.12	2.00	17241
0.62	1.02	0.76	0.83	3.23	3.28	5.68	2.93	0.65	9.26	9.00	8.61	8.00	4.02	4.02	4.00	17247
0.28	0.80	0.57	0.63	2.28	2.46	6.71	2.56	0.61	9.88	9.00	9.27	8.00	3.82	3.82	4.00	17239
1.08	1.02	0.14	0.50	2.74	4.11	6.74	3.20	0.77	10.71	9.00	9.94	8.00	4.08	4.08	7.00	16939
0.20	0.52	0.09	0.63	1.44	1.65	5.11	3.26	0.88	9.25	.....	8.37	8.00	2.05	2.05	2.00	16938
0.10	1.36	....	....	3.30	3.29	6.84	1.76	0.79	9.39	.....	8.60	8.00	3.83	3.83	4.00	16801
....	....	....	....	2.86	3.29	....	....	0.74	9.01	.....	8.27	8.00	....	3.62	4.00	16967
1.42	0.62	0.16	0.54	2.74	2.88	3.33	4.36	0.77	8.46	.....	7.69	8.00	5.01	5.01	6.00	16933
1.50	0.86	0.32	0.54	3.22	4.94	5.84	4.32	0.91	11.07	.....	10.16	8.00	2.55	2.55	3.00	16935
0.16	0.70	0.25	0.67	1.78	2.47	5.07	3.36	0.82	9.25	.....	8.43	8.00	3.69	3.69	3.00	16803
1.04	0.20	0.15	0.44	1.83	2.47	3.92	4.24	0.73	8.89	.....	8.16	8.00	2.86	2.86	3.00	17185
1.80	0.54	0.30	0.98	3.62	4.12	6.24	3.70	0.95	10.89	.....	9.94	10.00	3.69	3.69	4.00	16936
0.28	1.08	none	0.59	1.95	1.65	5.27	2.40	0.63	8.30	8.50	7.67	8.00	2.48	2.48	2.00	17229
none	1.68	0.27	0.65	2.60	2.47	6.72	1.78	0.54	9.04	8.50	8.50	8.00	3.71	3.71	4.00	17133
0.10	2.08	0.28	0.75	3.21	3.29	6.63	2.07	0.69	9.39	8.50	8.70	8.00	3.52	3.52	4.00	17228
0.60	2.12	0.27	1.27	4.26	4.11	6.99	1.73	0.64	9.36	8.50	8.72	8.00	4.80	4.80	5.00	16942
0.82	0.06	none	1.12	2.00	1.65	2.34	7.29	1.04	10.67	8.50	9.63	8.00	2.68	2.68	2.00	17201
2.32	0.06	1.26	0.62	4.26	4.00	4.49	3.44	0.91	8.84	8.50	7.93	8.00	4.74	4.74	4.00	17200
2.76	0.08	0.12	0.75	3.71	3.29	3.01	5.81	1.02	9.84	8.50	8.82	8.00	2.47	4.29	4.00	17199
0.40	0.26	0.21	2.07	2.94	2.46	0.03	12 20	3.39	15.62	15.00	12.23	6.00	3.96	3.96	4.00	17191
6.64	0.06	0.50	1.02	8.22	8.22	none	5.99	2.43	8.42	8.00	5.99	3.00	3.27	4.00	4.00	17070

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Rogers & Hubbard Co., Middletown, Conn.—(*Con.*)		
16927	Hubbard's Bone Base Soluble Corn and General Crops Manure	Glastonbury	$56.00
17067	Hubbard's Bone Base Soluble Potato Manure	Milldale	81.00
17138	R. and H. 3–8–6 Brand	South Manchester	74.00
17184	R. and H. All Soils-All Crops Phosphate	Milldale	62.25
17189	R. and H. Climax Tobacco Brand	Glastonbury	71.25
17066	R. and H. Complete Phosphate	Middletown	45.50
17182	R. and H. Potato Phosphate	Glastonbury	50.00
17105	R. and H. Soluble Tobacco Manure	Somers	82.50
17140	Special Tobacco Mixture	South Manchester	67.00
17068	R. and H. Tobacco Grower Vegetable Formula	Glastonbury	82.00
	F. S. Royster Guano Co., Baltimore, Md.		
17203	Arrow Head Tobacco Formula	Glastonbury	60.00
16811	Bully Guano	Waterbury	57.00
17489	Bully Guano	Waterbury	57.00
17222	Fish, Flesh and Fowl	Thompsonville	54.00
16748	Fish and Potash	Thompsonville	51.00
17197	Trucker's Delight	New Canaan	70.00
17087	Quality Trucker	Watertown	80.00
17385	Valley Tobacco Formula	Glastonbury	70.00
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.		
17223	Atlantic Coast Bone, Fish and Potash	Guilford	53.00
17069	Complete Tobacco Grower	Glastonbury	76.00
17225	Corn Superphosphate	West Cheshire	53.00
16819	Formula A	Guilford	63.00
17076	Formula B	Highwood	68.00
16832	Potato Manure	Stratford	59.25
17389	Top Dressing for Grass and Grain	New Haven	.....
17075	Kelsey's Bone, Fish and Potash	Highwood	.....
	M. L. Shoemaker and Co., Philadelphia, Pa.		
16751	Swift-Sure Superphosphate Tobacco and General Use	Hazardville	63.00
	Springfield Rendering Co., Springfield, Mass.		
17204	2–8–2 Fertilizer	Granby	40.00
17077	Animal Brand	Thompsonville	58.00

WITH POTASH—(*Continued*)

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available."					
In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
0.98	0.74	0.05	0.75	2.52	2.46	1.36	7.43	0.59	9.38	10.00	8.79	8.00	4.08	4.08	4.00	16927
2.10	0.68	0.51	0.81	4.10	4.11	0.21	8.39	0.74	9.34	10.00	8.60	8.00	1.20	5.89	6.00	17067
1.28	0.50	0.08	0.43	2.29	2.46	none	8.50	1.13	9.63	9.50	8.50	8.00	0.90	5.72	6.00	17138
2.36	0.12	0.52	0.30	3.30	3.29	3.13	4.90	1.91	9.94	9.00	8.03	8.00	3.86	3.86	4.00	17184
1.08	0.22	0.39	2.61	4.30	4.11	0.09	6.43	1.37	7.89	5.00	6.52	4.00	0.53	3.04	3.00	17189
0.16	0.16	0.36	0.28	0.96	0.82	3.89	4.31	2.02	10.22	9.00	8.20	8.00	1.95	1.95	2.00	17066
0.92	0.18	0.25	0.37	1.72	1.64	4.47	4.88	1.74	11.09	9.00	9.35	8.00	3.60	3.60	4.00	17182
2.16	1.36	0.46	0.64	4.62	4.93	1.77	7.28	0.70	9.75	10.00	9.05	8.00	0.66	3.60	4.00	17105
....	....	....	....	4.13	....	....	....	1.19	7.73	.....	6.54	.....	0.51	3.18	....	17140
1.12	0.14	0.39	3.07	4.72	4.93	0.33	5.01	0.49	5.83	5.00	5.34	4.00	1.09	4.05	4.00	17068
0.48	0.82	none	2.74	4.04	4.11	2.73	1.74	0.14	4.61	4.50	4.47	4.00	0.15	2.79	3.00	17203
0.08	0.98	0.02	0.54	1.62	1.65	2.73	5.76	1.34	9.83	8.50	8.49	8.00	4.64	4.64	5.00	16811
0.13	1.00	none	0.53	1.66	1.65	2.41	5.77	1.52	9.70	8.50	8.18	8.00	4.64	4.64	5.00	17489
0.14	0.84	none	0.62	1.60	1.65	3.73	4.41	1.01	9.15	8.50	8.14	8.00	3.12	3.12	3.00	17222
0.16	0.92	none	0.57	1.65	1.65	5.62	2.71	0.69	9.02	8.50	8.33	8.00	1.11	1.11	1.00	16748
0.10	1.68	none	1.26	3.04	3.29	5.58	2.76	0.47	8.81	8.50	8.34	8.00	3.95	3.95	4.00	17197
0.10	1.68	none	1.16	2.94	3.29	5.83	2.15	0.40	8.38	8.50	7.98	8.00	7.04	7.04	7.00	17087
0.53	0.82	0.05	2.63	4.03	4.11	2.48	1.73	0.14	4.35	4.50	4.21	4.00	0.31	5.08	5.00	17385
0.12	0.52	0.28	0.88	1.80	1.65	3.75	5.59	1.25	10.59	9.00	9.34	8.00	3.54	3.54	3.00	17223
0.82	0.08	none	2.94	3.84	4.11	1.10	4.73	0.20	6.03	5.00	5.83	4.00	1.40	5.06	5.00	17069
0.56	0.20	0.41	0.67	1.84	1.65	3.56	5.71	0.99	10.26	9.00	9.27	8.00	1.16	2.35	2.00	17225
0.86	1.04	0.32	1.16	3.38	3.29	6.34	2.38	0.73	9.45	9.00	8.72	8.00	3.92	3.92	4.00	16819
0.82	1.62	0.26	0.84	3.54	3.29	0.73	8.23	2.16	11.12	9.00	8.96	8.00	1.79	5.60	6.00	17076
0.62	1.28	0.17	0.43	2.50	2.47	5.50	3.13	0.88	9.51	9.00	8.63	8.00	3.92	3.92	4.00	16832
2.72	0.86	0.66	0.88	5.12	4.94	4.37	2.92	0.45	7.74	7.00	7.29	6.00	3.91	3.91	4.00	17389
0.16	0.96	0.44	0.79	2.35	2.47	6.83	4.30	1.91	12.14	11.00	11.13	10.00	3.07	3.07	3.00	17075
1.40	0.10	0.50	1.64	3.64	2.46	6.37	4.12	1.78	12.27	12.00	10.49	10.00	0.48	1.88	3.00	16751
0.44	0.10	0.51	0.57	1.62	1.64	4.97	3.71	0.33	9.01	9.00	8.65	8.00	2.06	2.06	2.00	17204
0.48	0.58	0.74	0.70	2.50	2.46	4.96	4.55	0.49	10.00	9.00	9.51	8.00	4.22	4.22	4.00	17077

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Springfield Rendering Co., Springfield, Mass. (*Cont.*)		
17195	Special Potato, Onion and Vegetable	Suffield	$63.00
17600	Special Potato, Onion and Vegetable	Somers	.....
	Talfa Co., Boston, Mass.		
17418	Nature's Plant Food	New London	.....
	Virginia-Carolina Chemical Co., New York City.		
17150	Beaver Brand	Torrington	44.00
16745	Challenge Brand	Hartford	56.00
17580	Challenge Brand	Torrington	48.50
16830	Champion Brand	Hartford	68.00
16839	Cherokee Brand	Glastonbury	65.00
16831	Fish Phosphate and Potash Brand	South Manchester	.....
17196	Indian Chief Brand	Hazardville	73.00
17144	Plow Brand	South Manchester	42.00
17151	Marvel Brand	New Canaan	48.00
17384	Owl Brand	North Haven	50.00
16834	Perfection Brand	North Haven	61.50
17205	Plant Bed Brand	Granby	45.50
	What Cheer Chemical Co., Pawtucket, R. I.		
17153	Special Brand, 3–8–3	New London	42.00
17129	Shay's Potato Fertilizer	Middlefield	60.00
17130	Shay's Corn Fertilizer	Middlefield	52.00
17106	Shay's Special Fertilizer, 3–8–3	Middletown	48.00
	Wilcox Fertilizer Co., Mystic, Conn.		
17104	Corn Special	Ellington	53.00
17188	Fish and Potash	Mystic	46.00
16835	Grass Fertilizer	Branford	70.00
17224	Potato Fertilizer	Branford	51.50
17183	Potato and Vegetable Phosphate	Ellington	58.50
17187	Tobacco Special	Mystic	.....
	S. D. Woodruff & Sons, Orange.		
16833	Home Mixture	Orange	55.00
	Worcester Rendering Co., Auburn, Mass.		
17148	Corn and Grain Fertilizer	Putnam	50.00
17107	Royal Worcester Potato and Vegetable, 4–8–4	Putnam	55.00

WITH POTASH—(*Continued*).

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available."					
In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
0.74	0.38	1.16	0.76	3.04	3.28	4.38	4.78	0.43	9.59	9.00	9.16	8.00	3.98	3.98	4.00	17195
0.60	0.58	....	....	3.47	3.28	....	....	0.63	9.61	9.00	8.98	8.00	....	3.95	4.00	17600
0.73	0.02	0.54	0.07	1.36	1.00	0.01	1.15	4.25	5.41	3.00	1.16	.....	5.80	5.80	2.00	17418
0.16	0.10	0.26	0.36	0.88	0.82	2.65	5.78	0.99	9.42	9.00	8.43	8.00	2.43	2.43	2.00	17150
0.06	0.38	0.11	0.29	0.84	0.82	6.15	3.26	0.79	10.20	10.00	9.41	9.00	2.72	2.72	3.00	16745
.....	.....	.....	....	1.03	0.82	.....	....	1.16	10.23	10.00	9.07	9.00	....	3.46	3.00	17580
0.22	2.08	0.22	0.94	3.46	3.29	6.50	1.90	0.58	8.98	9.00	8.40	8.00	4.90	4.90	4.00	16830
0.52	0.46	none	2.97	3.95	4.11	1.68	2.87	0.35	4.90	5.00	4.55	4.00	0.64	3.11	3.00	16839
0.10	0.60	0.15	0.93	1.78	1.65	3.23	5.33	1.51	10.07	.....	8.56	8.00	1.95	1.95	2.00	16831
0.48	0.62	0.10	2.82	4.02	4.11	1.50	2.88	0.37	4.75	.....	4.38	4.00	0.72	5.22	5.00	17196
0.04	0.06	0.26	0.60	0.96	0.82	3.45	4.71	0.56	8.72	.....	8.16	8.00	1.04	1.04	1.00	17144
0.06	0.20	0.17	0.54	0.97	0.82	3.56	4.92	0.87	9.35	.....	8.48	8.00	3.99	3.99	4.00	17151
0.18	0.65	0.25	0.96	2.04	1.65	6.12	2.00	0.41	8.53	.....	8.12	8.00	3.03	3.03	3.00	17384
0.09	1.58	0.11	0.80	2.58	2.47	7.88	1.12	0.45	9.45	.....	9.00	9.00	5.62	5.62	5.00	16834
0.70	0.88	0.25	1.40	3.23	2.47	6.36	2.36	0.67	9.39	10.00	8.72	9.00	0.23	3.44	1.00	17205
0.40	0.10	0.91	1.29	2.70	2.47	3.21	4.75	0.37	8.33	9.00	7.96	8.00	2.67	2.67	3.00	17153
0.76	0.06	0.55	1.78	3.15	3.28	2.61	5.27	0.63	8.51	9.00	7.88	8.00	4.29	4.29	4.00	17129
0.56	0.24	0.12	0.76	1.68	1.64	5.26	2.94	0.29	8.49	9.00	8.20	8.00	2.45	2.45	2.00	17130
0.54	0.08	0.37	1.29	2.28	2.47	2.67	4.60	0.33	7.60	9.00	7.27	8.00	3.20	3.20	3.00	17106
1.24	0.22	0.15	0.93	2.54	2.46	7.05	2.06	0.13	9.24	9.00	9.11	8.00	3.52	3.52	4.00	17104
0.70	0.24	0.06	1.72	2.72	2.46	4.31	2.39	1.37	8.07	7.00	6.70	6.00	3.00	3.00	3.00	17188
1.58	0.28	0.68	1.76	4.30	4.12	4.73	2.40	1.75	8.88	7.00	7.13	6.00	5.04	5.04	4.00	16835
0.12	0.36	0.40	1.26	2.14	1.65	5.53	3.98	2.90	12.41	9.00	9.51	8.00	0.29	2.10	2.00	17224
0.90	1.10	0.03	1.09	3.12	3.29	6.52	1.84	**0.26**	8.62	9.00	8.36	8.00	4.16	4.16	4.00	17183
1.28	0.04	0.04	3.28	4.64	4.11	0.54	4.78	2.62	7.94	5.00	5.32	4.00	1.36	4.97	5.00	17187
1.70	none	0.46	2.18	4.34	3.29	2.53	2.93	0.82	6.28	9.00	5.46	.....	5.64	5.64	3.00	16833
0.62	0.02	0.40	0.44	1.48	1.64	4.65	2.97	0.26	7.88	9.00	7.62	8.00	2.00	2.00	2.00	17148
1.38	0.14	0.14	0.90	3.16	3.28	4.39	3.60	0.33	8.32	9.00	7.99	8.00	4.33	4.33	4.00	17107

TABLE XIV. NITROGENOUS SUPERPHOSPHATES

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.
	Sampled by Station:		
	Worcester Rendering Co., Auburn, Mass.—(*Cont.*)		
16986	Frisbie's 2–8–2	Rockville	$37.50
16985	Frisbie's 4–8–4	Rockville	50.00
17213	International Products Co., 4–8–4	New Haven	60.00
17006	Olds & Whipple's High Grade Starter and Potash Compound	Broad Brook	93.00
16981	Piedmont-Mt. Airy Guano Co., Brown's Top Dresser	Rockville	66.00
16983	Piedmont-Mt. Airy Guano Co., 4–8–4	Rockville	54.00
16334	Quality Seed Store's Bartlett Spec. Tree Fertz	Stamford	60.00
16808	Royster's 5–4–5	Suffield	89.00
17250	Rogers & Hubbard's Oats and Top Dressing	Suffield	.....
17249	Rogers & Hubbard's Potato Manure	Suffield	81.00
16483	[1]Royster's 5–4–5	Suffield	.....
16885	[1]Rogers & Hubbard's All Soils-1 All Crops	Middlefield	.....
17665	Virginia-Carolina Chem. Co.'s Indian Chief Brand	Suffield	81.50
17538	Virginia-Carolina Chem. Co's Indian Chief Brand	Suffield	81.50
17517	Virginia-Carolina Chem. Co's 5–4–5	Suffield	66.50
17118	H. B. Tobacco Special (Hackett Bros.)	Buckland	.....
17206	Woodruff's Home Mixture	Whitneyville	45.00
16982	Piedmont Special for Tobacco	Rockville	63.00
	Sampled by Purchaser:		
17235	Cornwall's Potato and General Use	Yalesville	60.00
17207	Eastern States Farmers' Exch., 5–4–5	Glastonbury	57.60

[1] 1920 stock.

17040. Sampled and sent by W. N. Peck, Mt. Carmel.

16987. Special mixture made by L. T. Frisbie Co. Sampled and sent by L. C. Skinner, Rockville.

16859. Sent by Prof. W. L. Slate, Jr., Storrs.

16404. Sampled and sent by C. E. Thresher, Buckland.

16862. Special mixture made by L. T. Frisbie Co. Sampled and sent by S. B. Wakeman, Fairfield.

VII. MISCELLANEOUS FERTILIZERS, AMENDMENTS AND WASTE PRODUCTS.

TOBACCO STEMS.

16235. Canadian Stems. Sold by J. J. Cahill; sampled and sent by Gordon Scholes; both of Warehouse Point. Cost per ton in car lot, $24.00, delivered.

TABLE XIV. NITROGENOUS SUPERPHOSPHATES WITH POTASH—(*Concluded*).

Nitrogen.						Phosphoric Acid.							Potash.			
				Total.					Total.		So-called "Available."					
In nitrates.	In ammonia.	Organic, water-soluble.	Organic, water-insoluble.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As muriate.	Total.	Guaranteed.	Station No.
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
....	....	....	....	1.48	1.64	....	....	0.91	9.34	9.00	8.43	8.00	....	2.06	2.00	16985
....	....	....	....	3.06	3.28	....	....	0.82	9.22	9.00	8.40	8.00	....	3.89	4.00	16958
1.18	1.02	....	....	2.08	4.00	2.01	6.52	0.68	9.21	.....	8.53	8.00	....	4.05	4.00	17213
....	....	....	....	4.22	4.11	....	....	0.26	5.03	4.00	4.77	4.00	....	16.02	15.00	17006
....	....	....	....	3.54	4.94	....	....	0.93	9.44	.....	8.51	8.00	....	3.33	3.00	16981
....	....	....	....	3.02	3.28	....	....	0.69	9.12	.....	8.43	8.00	....	3.52	4.00	16983
....	....	....	....	2.76	4.00	0.30	4.40	0.75	5.45	8.51	4.70	8.00	2.50	2.88	4.00	16334
....	....	....	....	5.30	4.11	1.92	....	0.32	4.22	4.50	3.90	4.00	....	5.42	5.00	16808
....	....	....	....	7.60	8.22	....	....	....	8.48	8.00	.....	.....	....	3.50	4.00	17250
....	....	....	....	4.01	4.11	....	....	....	9.16	10.00	.....	.....	....	5.82	6.00	17249
....	....	....	....	2.78	4.11	4.20	1.21	0.47	5.88	.....	5.41	4.00	....	3.74	5.00	16483
....	....	....	....	2.48	3.29	....	....	....	9.54	9.00	.....	.....	....	5.67	6.00	16885
....	....	....	....	4.18	4.11	....	....	....	4.75	.....	.....	.....	....	5.02	5.00	17665
....	....	....	....	4.24	4.11	....	....	0.41	5.01	.....	4.60	4.00	....	5.22	5.00	17538
....	....	....	....	4.44	4.11	....	....	....	4.64	.....	.....	.....	....	4.60	5.00	17517
....	....	....	....	7.06	....	0.29	5.84	0.88	7.01	.....	6.13	.....	....	1.19	....	17118
....	....	....	....	3.06	3.29	....	....	....	7.84	.....	9.00	.....	....	2.83	3.00	17206
....	....	....	....	3.80	4.12	....	....	....	4.75	.....	4.05	4.00	....	6.38	5.00	16982
....	....	....	....	3.28	4.50	7.46	3.11	1.11	11.68	9.00	10.57	.....	....	6.79	7.50	17235
....	....	....	....	4.00	4.11	....	....	....	5.81	5.00	.....	.....	....	5.90	5.00	17207

15885. Broken Tobacco Stems. Sold by Morgan & Dickinson, Windsor. Sampled and sent by B. A. Krick, East Granby.

ANALYSES OF TOBACCO STEMS.

	16235	15885
Station No.		
Percent of		
Nitrogen	1.04	1.48
Phosphoric acid	0.73	0.72
Potash	4.56	5.18

TOBACCO ASHES.

16977. Sent by Spencer Bros., Suffield, and stated to represent the residue from burned cased tobacco. They contain 2.30 per cent. of phosphoric acid and 20.16 per cent. of water-soluble potash.

TABLE XV. ANALYSES OF

Station No.	Maker or Sender.	Formula.							
		Nitrate of soda.	Cotton seed meal.	Acid phosphate.	Muriate of potash.	High grade tankage.	Low grade tankage.	Bone.	Fish.
16515	Conn. Sumatra Tobacco Co., Buckland	...	800	....	....	....	....	....	1200
16517	Conn. Sumatra Tobacco Co., Buckland	...	1200	....	....	....	....	....	....
16519	Conn. Sumatra Tobacco Co., Buckland	...	1200	....	....	....	....	....	....
16522	Conn. Sumatra Tobacco Co., Buckland	400	....	....	....	....	....	800	800
16841	Conn. School for Boys, Meriden	100	....	750	200	750	...	....	....
16663	Fassler & Silberman, Hartford	100	900	....	....	....	....	400	300
16664	Fassler & Silberman, Hartford	100	900	....	....	....	....	400	300
17289	H. C. Vibert, So. Windsor	...	....	....	....	....	....	1400	400
16507	C. L. Hevenor, Wapping	250	900	....	....	....	....	600	....
17041	W. N. Peck, Mt. Carmel	...	666	1334	....	....	....	....	....
17042	W. N. Peck, Mt. Carmel	...	666	1334	....	....	....	....	....
16910	A. E. Plant's Sons, Branford	200	....	1000	200	300	300	....	....
16911	A. E. Plant's Sons, Branford	100	....	1000	200	700	....	....	....
16821	Emil W. Woike, Little River	300	200	1000	160	340	....	....	....
16249	J. P. Graham, Suffield[1]	...	800	480	....	....	....	....	275

[1] Sold as a 5-4-5 formula made by Royster Guano Co., also contains 80 lbs. sulphate of ammonia.

DRIED AND PULVERIZED SHEEP MANURE.

Analyses of thirteen samples of this material are given in table XVII.

16749. Sold by American Agricultural Chemical Co. Sampled from stock of G. S. Phelps & Co., Thompsonville.

16866. Sould by the Apothecaries Hall Co., Waterbury. Sampled from stock of Stanley-Svea Coal Co., New Britain.

17018. Sold by Armour Fertilizer Works, New York, N. Y. Sampled from stock of Rockville Grain and Coal Co.

16699. Sold by Berkshire Fertilizer Co., Bridgeport.

16746. Sold by Natural Guano Co., Aurora, Ill. Sampled from stock of Cadwell & Jones, Hartford.

16581. Sold by Pacific Manure and Fertilizer Co., San Francisco, Cal. Sampled from stock of Cadwell & Jones, Hartford.

15883. A small sample received from the Proto-Feed and Guano Co., Chicago, Ill., by the F. T. Blish Hardware Co., South Manchester.

HOME MIXTURES.

Formula.			Percentage Composition.											
			Nitrogen.				Phosphoric Acid.				Potash.			
Precipitated bone.	Castor pomace.	Sulphate of potash.	In nitrates.	In ammonia.	Organic.	Total.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.	As sulphate.	As muriate.	Total.	Station No.
%	%	%	%	%	%	%	%	%	%	%	%	%	%	
....	....	....	.....	0.22	7.84	8.06	0.36	5.72	0.61	6.69	.....	.....	1.25	16515
300	300	200	.....	.....	.....	4.88	0.24	5.80	1.05	7.09	5.65	0.36	6.01	16517
300	300	200	.....	.....	.....	5.10	0.39	6.47	0.14	7.00	5.55	0.23	5.78	16519
....	....	....	2.50	0.17	5.18	7.85	0.29	7.78	4.20	12.27	.....	.....	.....	16522
....	....	200	0.50	0.26	1.67	2.70	5.28	4.41	1.80	11.49	5.66	5.13	10.79	16841
....	....	300	0.82	0.10	4.74	5.66	1.01	7.14	0.37	8.52	7.09	1.04	8.13	16663
....	....	300	0.80	0.10	4.65	5.55	0.98	6.84	0.29	8.11	7.73	0.86	8.59	16664
....	....	200	0.09	0.12	2.50	3.92	0.33	15.06	2.96	18.35	5.23	1.04	6.27	17289
....	....	250	1.96	0.04	3.82	5.82	0.12	8.81	0.09	9.02	6.68	0.39	7.07	16507
....	....	....	.....	.....	.....	2.00	11.26		1.06	12.32	.....	.....	.....	17041
....	....	....	.....	.....	.....	2.78	10.77		1.04	11.81	.....	.....	.....	17042
....	....	....	.....	.....	.....	3.46	11.55		1.32	12.87	.....	.....	5.04	16910
....	....	....	.....	.....	.....	2.85	11.45		1.65	13.10	.....	.....	5.67	16911
....	....	....	.....	.....	.....	3.98	7.97	1.98	0.26	10.21	.....	.....	5.67	16821
....	....	365	.....	1.00	2.22	3.22	2.96	3.07	0.52	6.55	4.22	0.90	5.12	16249

16693. Sold by Proto-Feed and Guano Co. Sampled from stock of the F. T. Blish Hardware Co., South Manchester.

17152. Master Brand Sheep Manure. Sold by the Proto-Feed and Guano Co. Sampled from stock of Quality Seed and Fertilizer Co., Stamford.

16739. Sold by the Proto-Feed and Guano Co. Sampled and sent by the Elm City Nursery Co., New Haven.

17483. Wizard Brand. Sold by the Pulverized Manure Co., Chicago. Sampled from stock of D. K. Allen, Greenwich.

17202. "Sheep Manure Tankage." Sampled from stock of Quality Seed and Fertilizer Co., Stamford.

16691. South American Sheep and Goat Manure. Sampled from stock of Sanderson Fertilizer and Chemical Co., New Haven.

As the analyses show and as is inevitable with any kind of manure, the composition is very variable. Five out of the thirteen fail in one respect or another to meet their guaranties.

On the average these samples contain 1.82 per cent. of nitrogen,

TABLE XVI. ANALYSES OF HOME-MIXED NITROGENOUS SUPERPHOSPHATES.

Station No.	Nitrogen.				Phosphoric Acid.					Potash.	
	In nitrates.	In ammonia.	Organic.	Total found.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total found.	So-called "Available" found.	As muriate.	Total found.
	%	%	%	%	%	%	%	%	%	%	%
16441	0.61	0.15	5.18	5.94	0.55	5.60	0.17	6.32	6.15	0.41	6.54
16440	0.10	0.12	5.74	5.96	0.53	5.20	0.14	5.87	5.73	0.50	6.08
16442	0.73	0.15	5.42	6.30	0.59	5.55	0.15	6.29	6.14	0.44	4.10
16402	....	0.13	6.53	6.66	0.60	6.36	0.22	7.18	6.96	0.54	5.79
16840	....	....	....	2.03	5.51	5.02	0.31	10.84	10.53	0.31	1.11
16863	....	....	....	3.34	6.86	4.54	0.59	11.99	11.40	....	6.33
16984	....	....	....	2.50	....	....	1.75	10.30	8.55	....	6.64
16861	....	....	....	4.80	5.94	3.68	1.32	10.94	9.62	0.62	0.62
16601	1.22	0.60	0.97	2.79	0.09	7.79	1.84	9.72	7.88	1.63	8.13
16563	0.58	0.10	5.58	6.26	0.68	5.01	0.23	5.92	5.69	0.54	6.29
16607	0.90	0.14	3.19	4.23	0.93	3.95	0.33	5.21	4.88	0.74	4.13
17040	....	....	....	2.38	....	....	0.82	10.26	9.44	....	7.59
16987	....	....	....	6.24	....	....	0.31	5.28	4.97	....	3.42
16859	....	....	....	8.66	....	....	....	9.90	....	....	0.72
16404	....	....	....	5.84	0.13	7.33	1.84	9.30	7.46	0.43	7.20
16862	....	....	....	3.40	7.64	3.20	0.38	11.22	10.84	....	6.39

1.11 of phosphoric acid and 2.65 of potash soluble in water. The average cost is $51.25. The composition of horse manure and of sheep manure is about as follows:

TABLE XVII. ANALYSES OF

Station Numbers	16749	16866	17018
Percentage Amount of			
Nitrogen as nitrates	0.14	....	....
" as ammonia	0.32	....	....
" organic	1.08	....	....
" Total	1.54	1.55	1.40
Phosphoric acid, water-soluble	0.12	....	0.12
" " citrate-soluble	0.72	....	0.61
" " citrate-insoluble	0.18	....	0.17
" " Total	1.02	0.92	0.90
Potash, water-soluble	3.21	3.18	3.24
Cost per ton	$57.00	$49.00	$50.00

	Sheep Manure.	Horse Manure.
Water	10.2	73.4
Organic and volatile matter	71.3	18.3
Mineral matter	18.5	8.3
	100.0	100.0
Nitrogen	1.82	0.69
Phosphoric acid	1.11	0.67
Potash	2.65	0.63

Sheep manure carries, per ton, less than twice as much phosphoric acid, three times as much nitrogen and four times as much potash and organic matter as horse manure contains.

When the price of sheep manure is more than four times that of horse manure there can be no advantage in using it as far as fertilizing value alone is concerned. Its dryness, fine mechanical condition, less offensive smell and ease of handling are items which must be considered in determining the economy of its use in individual cases.

WOOD ASHES.

Analyses of 15 samples are given in the following table. The origin of the samples, as far as known, is as follows:

From American Wood Rim Co., Onaway, Mich.:

15445. Sampled and sent by P. M. Barrows, Stamford.

From John Joynt, Lucknow, Canada:

16530. Car M. C. 99709. Sampled and sent by The Shaker Farms, Somers.

16567. Car S. B. 26490. Sampled and sent by The Shaker Farms. Bought of G. S. Phelps & Co., Thompsonville.

16597. Car G. T. 23355. Sampled and sent by G. S. Phelps & Co., Thompsonville.

SHEEP MANURE.

16699	16746	16581	15883	16693	17152	16739	17483	17202	16691
none	....	....	....	0.08	....	....	....	....	0.06
0.52	0.22	0.06	0.09	0.08	0.04	....	0.12	0.04	0.40
1.86	2.13	1.35	1.93	1.80	1.91	....	1.90	1.74	1.08
2.38	2.35	1.41	2.02	1.96	1.95	1.80	2.02	1.78	1.54
0.09	0.70	0.23	0.51	0.11	0.13	....	0.34	....	0.24
0.48	0.55	0.57	1.30	0.46	0.72	....	0.83	....	1.55
0.12	0.17	0.17	0.20	0.22	0.10	....	0.12	....	0.19
0.69	1.42	0.97	2.01	0.79	0.95	0.77	1.29	0.72	1.98
1.84	1.84	3.16	3.09	1.90	2.91	2.28	2.19	2.35	3.30
$45.00	$57.00	$57.00	.....	$45.00	$60.00	$50.00	$60.00	$40.00	$45.00

16608. Car G. T. 12676. Sampled and sent by American Sumatra Co., East Hartford.

16668. Sampled and sent by American Sumatra Tobacco Co., from Southwick Plantation.

16677. Sampled and sent by J. B. Rose, West Suffield.

16846. Sampled by Station from American Sumatra Tobacco Co., Hazelwood Plantation.

16964. Sampled by Station from stock of A. N. Shepard & Son, Hartford.

17176. Sampled and sent by A. N. Shepard & Son, Hartford.

From Sperry & Barnes, New Haven:

16915. Sampled and sent by George Augur, Northford.

From other sources

16300. Sent by A. N. Farnham, Westville.

17113. Sent by Hackett Bros., Buckland.

17477, 17509. Sent by F. E. Hitchcock, Woodbury.

Sample **15445** contained over 35 per cent. of moisture, which explains the low potash content.

Mr. Joynt states that there must be some mistake regarding sample **16008** as other lots from the same warehouse contained over 7 per cent. of potash. This sample contained over 37 per cent. of insoluble matters, which explains its low potash content. Another sample, supposed to be from the same lot as the other, **16846**, drawn by the Station agent, contained much less insoluble matter, but only half a per cent. more potash than the other sample.

It will be noted that Canada Ashes are very variable in composition and should be bought, as most of them apparently were this year, on the "unit" basis; that is, a price for each per cent of potash found on analysis.

The cost of water-soluble potash in ashes this year has ranged from 27½ to 32½ cents per pound.

TABLE XVIII. ANALYSES OF WOOD ASHES.

Station Nos.	15445	16530	16567	16597	16608	16668	16677	16846	16964	17176	16915	16300	17113	17477	17509
Percentage Amount of															
Phosphoric acid	1.11	1.91	2.24	1.46	1.42	2.09	1.62	1.96	.....	2.03	1.60	1.89	2.49	2.06	1.25
Water-soluble potash	0.80	4.82	5.28	4.69	2.00	6.22	4.19	2.53	6.39	6.06	4.78	7.93	5.83	3.44	1.78
Insoluble matters	8.39	11.41	15.25	10.77	37.47	10.90	10.68	11.16	10.22	8.82	20.26	4.08	14.57	16.58	18.02
Cost per ton	.....	$28.92[1]	$28.14[1]	$28.13[1]	.....	.....	$27.24[2]	.....	$35.15[3]	$33.33[3]	$25.00	.....	.....	.....	.....

[1] $6 per unit.

[2] $6.50 pet unit. [3] $5.50 per unit.

LIME.

Only four samples of this material have been sent for examination.

17212. English Cliffstone Whiting. Sent by Apothecaries Hall Co., Waterbury, from a manufacturing plant which found it unsuitable for its use. It was a very fine material, containing 55.29 per cent. of lime and 1.32 per cent. of insoluble matter—a very pure carbonate of lime.

16720. Ground limestone. Sold by the Grangers' Lime Co., Hartford, and sampled and sent by C. R. Treat, Orange, contained 37.19 per cent. of lime and 10.79 per cent. of insoluble matter.

15944. Refuse lime from a chemical plant. Sent by J. H. Fay, County Agent, Middletown; contained 36.80 per cent. of lime and 1.67 per cent. of insoluble matter.

16430. Sent by R. E. Eaton, Kent; contained 30.30 per cent. of lime and 2.30 per cent. of insoluble matter. It also contained considerable magnesia.

MUCK OR PEAT.

17539. Sent by E. S. Kepler, Wethersfield.

17291. Sent by William Deubel, Danbury. Stated to be from a large deposit of decayed leaves.

17157. Dried "humus" offered for sale as fertilizer. Sent by G. A. Drew, Greenwich.

17162, 17163. Sent by V. W. Bates, New Haven.

17396. Swamp muck. Sent by Wilfrid Scott, Niantic.

TABLE XIX. ANALYSES OF MUCK OR PEAT.

As Received.

Station No.	17539	17291	17157	17162	17163	17396
Percentage amount of						
Water	80.77	27.22	20.36	41.85	53.92	2.48
Organic and volatile matter	12.93	20.92	68.86	42.76	40.34	11.52
Mineral matter	6.30	51.86	10.78	15.39	5.74	86.00
	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	0.30	0.64	2.80	1.18	1.64	0.56

Calculated Water-free.

Organic and volatile matters	67.30	28.66	86.44	73.54	87.53	11.80
Mineral matters	32.70	71.34	13.56	26.46	12.47	88.20
Nitrogen	1.56	0.88	3.50	2.03	3.55	0.57

The relative value of these peats can only be determined from their dry matter, excluding the very variable amounts of water in them.

The value lies chiefly in the organic or humus-forming material. The amounts of phosphates and potash are quite insignificant in such material. The nitrogen, of which **17157** and **17163** contain as much as most mixed commercial fertilizers, is only very slowly available. It is the residual nitrogen which has resisted decay and solution. Four of these samples have enough organic matter in them to be of value as absorbents and to mix with stable manure if they can be at least half dried economically.

DRIED SLUDGE

Four samples were analyzed for J. F. Jackson of the State Department of Health.

17364. A, Floated Sludge, dried on the ground for three weeks, about one inch deep.

17365. B, Floated Sludge, dried on the ground for three weeks, four inches deep.

17366. C, Floated Sludge, dried on the ground for three weeks, two inches deep.

17367. D, Floated Sludge, dried by heating in bucket over boiler.

TABLE XX. ANALYSES OF DRIED SLUDGE.

Station No.	17364	17365	17366	17367
Percentage of				
Nitrogen as ammonia	0.34	0.35	0.22	0.12
organic	4.76	4.03	3.80	4.98
total	5.10	4.38	4.02	5.10
Water-soluble phosphoric acid	0.09	0.03	none	0.02
Citrate-soluble phosphoric acid	2.47	2.41	2.42	2.93
Citrate-insoluble phosphoric acid	0.54	0.52	0.42	0.54
Total phosphoric acid	3.10	2.96	2.84	3.49
Total potash	0.31	0.27	0.13	0.15

The four samples are quite similar in composition and value. Both the nitrogen and the phosphoric acid are in readily available form and the dried sludge would no doubt be an excellent fertilizer.

MISCELLANEOUS.

A sample of factory waste, **16730**, sent by A. N. Farnham, Westville, contained 1.34 per cent. of nitrogen. A sample of by-product from a factory, **17292**, sent by C. E. Pease, Thompsonville, contained 4.02 per cent. of nitrogen. Of five samples of waste products from a silver-plating company, sent by N. G. Wheeler, Winsted, only one, **16726**, had any considerable fertilizer value. It was a brown powder containing 41.40 per cent. potash as carbonate, muriate and sulphate in about equal proportions. A sample of clay, **17516**, sent by Miss A. B. Platt, Shelton, thought to be of value as a filler in fertilizers, had no fertilizing value. 95.3 per cent. of it was sand and soil.

A sample of clinkers, **16466**, sent by A. N. Pierson, Inc., Cromwell, to determine whether they had any fuel value, contained moisture 0.15 per cent., organic and volatile matter 1.75 per cent., mineral matter 98.10 per cent.

In seven samples of soil the lime requirement was determined by the Jones method, the amount of actual lime needed ranging from 1620 to 4500 pounds per acre.

VARIOUS FUNGICIDES AND INSECTICIDES.

17319 and **17320** are samples of Reynolds' Paris Green and Leggett's Paris Green. The quantities of arsenious acid found in them were 56.50 and 56 per cent. respectively, and of copper oxide 26.60 and 26.80. Both were of normal composition.

A sample of Lead Arsenate, **17119**, sent by John Gotta, Portland, contained 28.53 per cent. of arsenic as arsenic acid, which is about the normal amount.

A sample of anhydrous copper sulphate, **16364**, sent by E. M. Ives, Meriden, was found to be 90.15 per cent. pure. 97.1 per cent. was finer than a 200 mesh.

A sample of formaldehyde solution, **16946**, submitted by Dr. Clinton of this Station, contained 33.65 per cent. by weight of formaldehyde.

A sample of "Sulco-V. B.," **16420**, submitted by Dr. Garman of this Station, contained 3.97 per cent. of pure phenol.

A sample of Niagara Contact Special Dusting Mixture, **16740**, was found to contain 1.62 per cent. of nicotine, equivalent to 2.10 per cent. of nicotine sulphate, calculated as the monacid salt.

A sample of tobacco dust, **16741**, sent by E. M. Ives, Meriden, contained 0.71 per cent. nicotine.

Four nicotine mixtures, submitted by Dr. Britton of this Station, contained respectively 0.29, 0.30, 0.84 and 0.71 per cent. of nicotine.

TWENTY-FIRST REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

FOR THE YEAR 1921

(Being Bulletin 234, Connecticut Agricultural Experiment Station)

BY

W. E. BRITTON, PH.D.

State Entomologist

NEW HAVEN, CONN.

1922

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF

January, 1922

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P. C. Mangelsdorf, B.S., *Assistant.*

In charge of the Tobacco Station.
G. H. Chapman, Ph.D., Windsor, Conn.

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NOTE REGARDING AUTHORSHIP.

For bibliographical purposes, all matter in this Report (Bulletin 234) except where otherwise indicated, should be credited to W. E. Britton.

BULLETIN 234

TWENTY-FIRST REPORT

OF THE

State Entomologist of Connecticut

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

Herewith, I transmit my twenty-first annual report as State Entomologist of Connecticut. The financial statements are for the State fiscal year ending June 30, 1921, but in other matters this report covers the activities of the department for the full calendar year of 1921. This publication contains reports on the various lines of regulatory work placed upon the office by Statute, such as inspecting nurseries, imported nursery stock, and apiaries, and suppressing the gipsy moth. It also includes articles dealing with the mosquito elimination work of the year, the asparagus beetles, injury to tobacco plants by the seed corn maggot, outbreak of the arbor vitae leaf-miner, the corn ear worm, investigations on the violet gall midge, and the European red mite, the tulip-tree scale, the terrapin scale, the pine leaf scale, the euonymus scale, and the cottony maple scale. Short articles and miscellaneous notes are given regarding many other insects.

Respectfully submitted,

W. E. BRITTON,
State and Station Entomologist.

REPORT OF RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST, FROM JULY 1, 1920, TO JUNE 30, 1921.

RECEIPTS.

From E. H. Jenkins, Treasurer	$7,500.00	
Account of 1920, Balance	850.44	
Transferred from Gipsy Moth Account by Board of Control	321.23	
State Comptroller, Gipsy Moth Account	148.87	
M. P. Zappe, Automobile mileage	11.16	
Interest on Bank Deposits	9.59	
		$8,841.29

EXPENDITURES.

For Field, Office and Laboratory Assistance:		
B. H. Walden, salary	$2,000.01	
M. P. Zappe, salary	1,949.98	

Philip Garman, salary	$2,166.71	
Gladys M. Finley, salary	895.50	
Other assistance	224.00	
		$7,236.20
Printing and Illustrations		72.80
Postage		90.72
Stationery		33.06
Telephone and Telegraph		2.33
Office Supplies		59.36
Library		122.25
Laboratory Supplies		58.29
Express, Freight and Cartage		5.01
Tools and Supplies		77.43
Traveling Expenses		316.30
Insurance		92.98
Automobile repairs and Equipment		669.56
Miscellaneous		5.00
		$8,841.29

MEMORANDUM:—This account has been audited by the State Auditors of Public Accounts. The item of $148.87 credited as having been received from the State Comptroller is really a transfer from the appropriation for suppressing gipsy and brown-tail moths and for inspecting imported nursery stock, and covers the time and automobile mileage of members of the department staff while engaged in the work of inspecting imported nursery stock.

SUMMARY OF INSPECTION AND OFFICE WORK.

311 samples of insects received for identification.
97 nurseries inspected.
76 regular certificates granted.
30 duplicate certificates furnished to be filed in other states.
83 parcels of nursery stock inspected and certified.
65 orchards and gardens examined.
21 shipments, containing 126 cases, 1,228,560 plants, imported nursery stock inspected.
10 shipments or 47.6 per cent. found infested with insects or fungi.
751 apiaries, containing 6,972 colonies inspected.
30 apiaries and 88 colonies found infested with European foul brood.
19 apiaries and 39 colonies found infested with American foul brood.
2,067 letters written on official work.
108 circular letters.
192 post cards.
25 reports of inspection to Federal Horticultural Board.
1,505 bulletins, etc., mailed on request or to answer inquiries.
94 packages sent by mail or express.
29 lectures and addresses at institutes, granges and other meetings.

PUBLICATIONS OF ENTOMOLOGICAL DEPARTMENT, 1921.

By W. E. Britton:

Twentieth Report State Entomologist of Connecticut (Bulletin 226), 84 pages, 13 figures, 12 plates; 10,500 copies distributed in April, 1921.

Spray Now to Kill the European Red Mite, Bulletin of Immediate Information No. 13 (mimeographed), 3 pages, 600 copies distributed March 10, 1921.

Check-List of the Insects of Connecticut, Bulletin 31, State Geological and Natural History Survey, 397 pages, distributed in spring by State Librarian at Hartford.

The European Corn Borer, Report Connecticut Board of Agriculture for 1919-1920, page 92; 4 pages, 1921.

Report of Committee on Injurious Insects, Proceedings 30th Annual Meeting Connecticut Pomological Society, page 36.

Report of Committee on Insects and Diseases, Insects; Report Connecticut Vegetable Growers' Association, page 21, 1921.

First Report of the Tree Protection Examining Board (Bulletin 231), 12 pages, 11,500 copies distributed in November, 1921; 1,000 copies in the form of a separate to be used by the Board.

The House Fly as a Carrier of Disease Germs and How Controlled, 12 pages, 2 figures; published as an unnumbered bulletin of the State Department of Health. (Revised Edition.)

By W. E. Britton and G. P. Clinton:

Spray Calendar (Bulletin 224), 44 pages, 95 figures; 11,500 copies distributed in March, 1921.

By W. E. Britton and L. O. Howard:

William Hampton Patton, Entomological News, Vol. XXXII, page 33, February, 1921, 8 pages, 1 plate.

By B. H. Walden:

Progress of Anti-Mosquito Work in Connecticut, Proceedings 7th Annual Meeting New Jersey Mosquito Extermination Association, page 92, 1920.

By M. P. Zappe:

Aphis Control, Report Connecticut Board of Agriculture for 1919-1920, page 96, 1921.

By Philip Garman:

A Study of the Bulb Mite (Bulletin 225), 20 pages, 3 figures, 3 plates; 10,500 copies distributed in March, 1921.

The Grass-Feeding Frog-Hopper or Spittle-Bug (Bulletin 230), 12 pages, 3 figures, 2 plates; 10,500 copies distributed in November, 1921.

The Relation of Certain Greenhouse Pests to a Geranium Leaf Spot (Bulletin 239, Maryland Agr. Expt. Station), 30 pages, 7 figures, October, 1920.

The European Red Mite *Paratetranychus pilosus* Can. & Fanz., in Connecticut, Journal of Economic Entomology, Vol. 14, page 355, 1921.

By Philip Garman and F. L. Stevens:

The Genus *Septoria* Presented in Tabulation with Discussion, Trans. Ill. State Acad. Science, Vol. XIII, page 176, 44 pages, 1920.

DEPARTMENT STAFF AND WORK.

W. E. BRITTON, PH.D., *State and Station Entomologist.*
B. H. WALDEN, B.AGR., *Photographic and General Work.*
M. P. ZAPPE, B.S., *Inspection and General Work.*
} *Assistant Entomologists.*
PHILIP GARMAN, PH.D., *Research Work.*
JOHN T. ASHWORTH, *Deputy in charge of Gipsy Moth Work.*
JAMES A. MCEVOY, *Assistant in Gipsy Moth Work.*
SAMUEL T. SEALY, *Deputy in Charge of Mosquito Work.*
MISS GLADYS M. FINLEY, *Clerk and Stenographer.*

H. W. COLEY, Westport,
A. W. YATES, Hartford,
} *Apiary Inspectors.*

No changes in the personnel of the department staff have occurred during the year, except that Mr. Ashworth who was at first appointed acting deputy in charge of moth work has been promoted to deputy and his appointment made permanent, and Mr. McEvoy has been made assistant in gipsy moth work. Mr. Ashworth, who resides at Danielson, has been in charge of the field work of suppressing the gipsy moth in the eastern end of the State. This work has been done in co-operation with the Federal forces and is described more fully elsewhere in this report.

Mr. Walden has been in charge of the department in the absence of the Entomologist, has done a large part of the photographic work, has aided in making records of the results of the spraying and dusting experiments, and has made field and laboratory studies on the raspberry fruit worm, *Byturus unicolor* Say, and has continued collecting leafhoppers.

Mr. Zappe has been in charge of the inspection of nurseries and of imported nursery stock, and has co-operated with the botanical department in carrying out the series of orchard experiments in dusting and spraying for the control of the chief insect and fungous pests of apple and peach. Mr. Zappe has made studies on the life history of the false apple red bug, the apple leafhopper, the arbor vitae leaf-miner, and has devoted considerable time to rearranging the Coleoptera in the station collection.

Dr. Garman has devoted most of his efforts to research. He has finished a study of the bulb mite and the results were published as Bulletin 225. He has also made studies of the life history and control of the European red mite, *Paratetranychus pilosus,* a pest of orchards discovered in Connecticut last season. He has completed his study of the grass-feeding spittle-bug, and published the results as Bulletin 230. Other species of spittle-bugs (Cercopids) and the violet midge are now being studied. Dr. Garman is preparing a paper on the dragon flies (Odonata) of Connecticut, to be published by the State Geological and Natural History Survey, and the manuscript is nearly completed. Another paper dealing with the mites of Connecticut, also to be published by the Survey, is now in progress, but will require two or three years of study before it can be finished. Dr. Garman's work was interrupted in May by an operation for appendicitis, but he soon recovered and resumed work.

The Entomologist, in addition to the correspondence and other routine work, has devoted much time to the reading of proof on the Check-List of the Insects of Connecticut, which appeared in the spring as Bulletin 31 of the State Geological and Natural History Survey. This is a publication of 397 pages, and has met a favorable reception from entomologists. Much work on the manuscript of the Hemiptera of Connecticut, another paper to be published by the Survey, has been done during the year. All of the necessary editorial work has been done in this office, and the Entomologist is the author of the manuscript of two families, the Aleyrodidae (white flies) and the Coccidae (scale insects). The entire manuscript is now nearly completed, the illustrations are almost finished and it is expected that it will go to the printer shortly. This paper is an important one, much needed in entomological literature which is now very much scattered, and the list of authors contains sixteen names, all specialists.

The Entomologist has devoted considerable time to the work of the Tree Protection Examining Board of which he is chairman. This Board examines applicants and issues certificates to those qualified who wish to conduct the business of protecting trees. The first report of this Board, prepared by the chairman, was published in the report of this Station for 1920, pages 339-350.

The Entomologist has also revised his bulletin on the house fly for the State Health Commissioner, and a new edition has been published.

Mr. Sealy has continued as deputy in charge of mosquito work, and has seen that the ditches have been maintained in each town receiving State aid, and has supervised the small amount of new work which has been done.

Miss Finley has continued to serve as clerk and stenographer of the department.

Messrs. Coley and Yates as heretofore have inspected the apiaries on a *per diem* basis.

From August 1 to September 10, Messrs. Frank D. Luddington, Edward R. Barton and Robert C. Botsford were employed to assist Mr. Zappe in the work of inspecting nurseries.

All members of the staff have worked faithfully and efficiently, and the Entomologist hereby expresses his appreciation of their services.

ENTOMOLOGICAL FEATURES OF 1921.

The preceding winter was one of the mildest on record, and spring came early. Vegetation was advanced two to three weeks ahead of normal, yet no warm weather came until late in May. On the whole it was rather cold and wet during the first half of the season, and though some crops could be started early, those needing a high temperature did not thrive in advance of the normal season. Corn and Lima beans had to be planted over and much seed was destroyed by seed maggots, low temperature and abundance of moisture in the soil.

Apples and pears were in full bloom on April 24, but the weather was cool with a number of cloudy and rainy days, making it unfavorable for bees to work the flowers. On May 12, there was a frost in some parts of the State which injured or entirely ruined the fruit crop, which on the whole was a light one.

The first half of the season was moist but August and September were months of light precipitation, and backward crops had a chance to mature as there were no early frosts.

One of the chief entomological features of the season was the discovery that the apple and thorn skeletonizer *Hemerophila pariana* Clerck, is now distributed nearly all over the State, and specimens were received from, or the work of the insects observed in, many localities. This insect is discussed in greater detail on page 186.

In the apple orchards everywhere, curculio injury was very prominent and it was particularly noticeable in our experiments in spraying and dusting apple orchards. One apple showed 40 curculio marks.

The tent caterpillar, which has been very scarce for several years, is on the increase again and may be expected to become prevalent soon.

The apple aphids were present in the orchards early in the season, but did not do much damage and soon disappeared.

The Oriental peach moth *Laspeyresia molesta* Busck, which was found at Stamford in 1918, has not been noticed in the State during the season, though the members of this department have been on the watch for it.

The peach borer *Synanthedon exitiosa* Say, has been very abundant and destructive during the year and tests of Paradichlorobenzene are now being conducted in the peach orchard at the Station farm for controlling this pest.

The fall canker-worm *Alsophila pometaria* Harr., seems to be on the increase again. Though usually locally abundant this pest has been comparatively scarce for the past three or four years.

San José scale *Aspidiotus perniciosus* Comst., which almost disappeared from orchards a few years ago, was noticeable on the fruit in several orchards in 1921, and was more abundant in nurseries than for several years.

There was practically no injury, at least in the orchards where our dusting and spraying experiments were conducted, from the attacks of the red-banded leaf-roller *Eulia velutinana* Walker, and the lesser apple worm *Enarmonia prunivora* Walsh. Both these insects were abundant in 1920, and caused considerable surface injury to the maturing fruit, late in the season.

The European red mite *Paratetranychus pilosus* Can. & Fanz., which was so injurious in certain orchards in 1920, was much less so in those same orchards in 1921, but was present and caused some damage in other places.

The apple maggot *Rhagoletis pomonella* Walsh, was present in about the usual proportions.

The false apple red bug *Lygidea mendax* Reut., was abundant locally as is the case nearly every year.

The apple seed chalcid *Syntomaspis druparum* Boh., was for the first time discovered in the State at Milford and Cornwall.

The brown-tail moth was not found anywhere within the State during 1921, and no portion of Connecticut is now quarantined on account of this insect.

Gipsy moth scouting this fall shows that there was a considerable wind-spread last May resulting in several towns being added to the infested area in Connecticut.

There was an outbreak of the arbor vitae leaf-miner *Argyresthia thuiella* Packard, around New Haven, and many trees were seriously injured.

The box leaf-miner or midge *Monarthropalpus buxi* Labou, was received from Norwalk.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., continues to be the most prevalent insect pest found in nurseries, and though it infests apple orchards, does not injure them seriously in Connecticut. Many shade and forest trees and cultivated shrubs are attacked and severely injured, and occasionally killed by this insect. The trees and plants most commonly injured are ash, birch, silver maple, butternut, willow, poplar and lilac. It is thought by some entomologists that there are two species of oyster-shell scale, that found upon apple differing somewhat in appearance, as well as in times of hatching and moulting, and in the number of circumgenital pores, from the scale occurring on the other trees named above. Whether correct or not, it is a fact that much damage is done and that control measures must be practiced, especially in nurseries, in order to prevent the destruction of much infested stock annually. All badly infested trees or branches should be cut out and burned, and the remaining portions sprayed about June 10 (in Connecticut) with a contact insecticide like kerosene emulsion or nicotine soap solution to kill the young.

Another sucking insect which seems to be on the increase each year in the spruce gall aphid *Chermes abietis* Kalt. Norway and other kinds of spruces in nurseries are often infested and sometimes seriously injured. One nurseryman has controlled the pest by clipping off and burning the galls as soon as noticed. This practice kept up throughout the season gave good results, and the young trees were remarkably free from galls. Another method is to spray with a contact insecticide either in late fall or in early spring to kill the adults which live over winter on the twigs. At one nursery, for several seasons the spruces have been sprayed in early spring with Scalecide, one part in twenty parts water, with satisfactory results.

The seed corn maggot *Hylemyia cilicrura* Rond., caused serious injury to the newly-set plants in a tobacco field in Windsor in May. Wireworms also injured plants in some plantations.

The cabbage maggot *Chortophila* (*Phorbia*) *brassicae* Bouché,

was present in about the usual numbers and injured early-set plants. The cabbage aphid *Brevicoryne brassicae* Linn., was unusually abundant and infested nearly every field. As the infested plants fail to head or make only loose heads, considerable injury resulted.

The turnip aphid *Aphis pseudobrassicae* Davis, was prevalent during the season and injured turnips in various portions of the State.

The potato aphid *Macrosiphum solanifolii* Ashm., appeared in some fields but shortly disappeared without doing much damage. In one case at least the aphids disappeared after a heavy rain.

Perhaps the outstanding entomological feature of the season was the abundance of the corn ear worm *Chloridea obsoleta* Fabr., which was very prevalent in all parts of the State on late maturing corn, doing considerable damage. This invasion extended throughout all of the northeastern United States.

The asparagus beetle *Crioceris asparagi* Linn., was abundant and unusually destructive in 1921.

White grubs, *Phyllophaga sp.,* were reported as doing injury from several localities. In some cases they injured lawns, and in others they attacked corn and potatoes.

More detailed accounts of some of the most important of these insect pests will be found in the following pages.

INSPECTION OF NURSERIES.

This work was commenced on August 3, and finished on October 1: it was in charge of Mr. M. P. Zappe, who was assisted from August 1 to September 10, by Messrs. F. D. Luddington, E. R. Barton and R. C. Botsford. Mr. Walden inspected seven small nurseries, where certificates were needed, while the other inspectors were examining the larger nurseries.

The new Ford touring car was used by Mr. Zappe for this work, and on account of good weather satisfactory progress was made.

The general condition of the nurseries was found to be about the same as in 1920, some being clean and well cared for, and others showing signs of neglect.

Pests.

In 25 nurseries no pests were found. These were for the most part small nurseries and some were newly established, where with small-sized stock, pests have not yet become prevalent. The principal pests with the number of nurseries infested by each are given below:

Insects: Oyster-shell scale, 36; spruce gall aphid, 31; San José scale, 28; tulip-tree scale, 7; pine leaf scale, 7; scurfy scale, 6; rose scale, 4; *Chermes cooleyi,* 3; terrapin scale, 2; elm scale, 2; white elm scale, 2; euonymus scale, 1; imported pine sawfly, 2; rhododendron lace bug, willow borers, poplar borers, and white pine weevil, 1 each.

Plant Diseases: Poplar canker, 21; crown gall, 4; blister rust on currants, 2; fire blight, 1.

Comparing the above figures with those of last year, it will be noticed that San José scale was found in 28 nurseries instead of in 11 last year; spruce gall aphid in 31 instead of 21 last year, and the poplar canker was present in 21 nurseries as against 13 in 1920. In 25 nurseries instead of 46 last year no pests were found. The proportions of other infestations run about the same as in former years, the oyster-shell scale continuing in the lead.

Five new nurseries have been started during the year. Two of these were inspected in the spring and certificates issued, and they were again inspected in September. These are marked (2) after the names on the list. Two nurseries have gone out of business and the name of one has been changed. One did not clean out the infested stock in time to receive a certificate before this report went to the printer.

Eighty-three separate parcels of nursery stock have been inspected and certificates granted to accommodate shippers.

The nurseryman's list for 1921 contains 94 names, as follows:

Nursery Firms in Connecticut Receiving Certificates in 1921.

Name of Firm.	Address.	Acreage.	Certificate Issued.	No. of Certificate.
Barnes Bros. Nursery Co.	Yalesville	150	Aug. 25	1176
Barnes Nursery & Orchard Co.	Wallingford	20	Aug. 13	1165
Beattie, Wm. H.	New Haven	1	Sept. 6	1186
Benbow, A.	Norfolk	1	Oct. 29	1234
Bertolf Bros.	Sound Beach	25	Sept. 28	1207
Brainard Nursery & Seed Co.	Thompsonville	10	Aug. 31	1182
Braley & Co.	Burnside	1	Aug. 24	1170
Bretschneider, A.	Danielson	2	Aug. 25	1175
Bristol Nurseries, Inc.	Bristol	8	Oct. 3	1216
Burr & Co., C. R.	Manchester, Ellington and Durham	500	Aug. 26	1177
Burroughs, Thos. E.	Deep River	3	Sept. 20	1197
Canner Court Flower Garden Co.	New Haven	2	Sept. 20	1200
Chapman, C. B.	Groton	1	Oct. 8	1218
Chapman, C. E.	North Stonington	4	Oct. 3	1213
Conine Nursery Co.	Stratford	50	Sept. 3	1184
Conley, L. D.	Ridgefield	12	Sept. 29	1210
Conn. Agricultural College (Prof. S. P. Hollister)	Storrs	1	Aug. 25	1172
Conn. Agr. Experiment Station (W. O. Filley, Forester)	New Haven	1	Oct. 22	1229
Crofut & Knapp Farm	Norwalk	20	Dec. 19	1255
Cross Highway Nurseries	Westport	6	Nov. 10	1246
Dallas, Inc., Alexander	Waterbury	2	Oct. 20	1226
Dowd, F. C.	Madison	1	Sept. 15	1194

Name of Firm.	Address.	Acreage.	Certificate Issued.	No. of Certificate.
Elm City Nursery Co., Woodmont Nurseries, Inc.	Woodmont and New Haven	155	Aug. 31	1183
Evergreen Nursery Co.	South Wilton	11	Aug. 30	1180
Fairfield Landscape & Nurseries Co.	Cannondale	5	Nov. 7	1241
Falcon's Flight Farms Nursery (B. Austin Cheney, Prop.)	Litchfield	1	Nov. 7	1240
Gardner's Nurseries	Rocky Hill	1	Nov. 12	1247
Geduldig's Greenhouses	Norwich.	1	Oct. 26	1231
Glenn Terrace Ornamental Nursery (James H. Everett, Prop.)	Mount Carmel	4	Aug. 9	1164
Hartford Park Commissioners	Hartford	1	Nov. 4	1238
Heath & Co.	Manchester	5	Aug. 30	1179
Hilliard, H. J.	Sound View	1	Oct. 3	1213
Hiti Nurseries (J. H. Bowditch, Prop.)	Pomfret Center	8	Aug. 25	1171
Holcomb, Irving	Simsbury	1	Sept. 3	1185
Horan & Son, Jas.	Bridgeport	1	Nov. 3	1235
Houstons' Nurseries	Mansfield	4	Aug. 25	1174
Hoyt's Sons Co., Inc., The Stephen	New Canaan	300	Sept. 26	1205
Hunt & Co., W. W.	Hartford	10	Sept. 9	1187
Isselee, Charles	Darien	10	Oct. 21	1228
Kajok, George	New Haven	1	Sept. 16	1196
Kelley, James J.	New Canaan	1	Nov. 8	1245
Kellner, Herman H.	Danbury	1	Sept. 29	1211
Keso Nursery (J. J. Kelsey, Prop.)	Clinton	1	Sept. 15	1193
Ladd & Nichols, Inc.	Greenwich	2	Nov. 4	1237
Laddin's Rock Nursery (W. L. Marks, Prop.)	Stamford	5	Nov. 15	1248
Langenbach, F. J.	Norwich	1	Oct. 3	1215
Larkin, P. J.	New London	1	Oct. 14	1223
Long, Mrs. J. A.	East Haven	1	Oct. 10	1221
Mallett Co., George A.	Bridgeport	1	Nov. 4	1236
Maplewood Nurseries (T. A. Peabody, Mgr.)	Norwich	1	Oct. 3	1217
Marigold Farm (H. Kelley, Prop.)	New Canaan	4	Sept. 24	1204
Meier, A. R.	West Hartford	1	Nov. 7	1242
Millane Tree Expert Co., The	Middletown	1	Oct. 27	1232
Munro, Charles	New Haven	1	Dec. 31	1256
New Haven Nurseries Co., The	New Haven	10	Oct. 25	1230
New Haven Park Commissioners (G. X. Amrhyn, Supt.)	New Haven	30	Aug. 20	1168
New London Cemetery Association (Ernest E. Rogers, Pres.)	New London	1	Oct. 8	1220
New London County Nurseries (W. J. Schoonman, Prop.)	New London and Stonington	7	Oct. 15	1224
North-Eastern Forestry Co.	Cheshire	20	Aug. 9	1163
Norwalk Nursery	Norwalk	5	Sept. 26	1206
Oakland Nurseries	Manchester	5	Aug. 26	1178
Ouwerkerk & Van der Stam (2)	Yalesville	4	Sept. 29	1208
Palmer, Est. of L. M.	Stamford	5	Sept. 23	1203
Park Gardens	Bridgeport	1	Dec. 3	1252
Pequod Nursery Co.	Yalesville	15	Aug. 17	1167
Phelps, J. Wesson	Bolton	1	Aug. 25	1173
Phelps & V. T. Hammer Co., The J. W.	Branford	2	Dec. 9	1254
Pierson, A. N., Inc.	Cromwell	65	Aug. 22	1169
Polish Orphanage (Rev. L. Bojnowski, Mgr.)	New Britain	1	Sept. 20	1199

Name of Firm.	Address.	Acreage.	Certificate Issued.	No. of Certificate.
Pomeroy, Edwin C.	Northville	1	Sept. 29	1209
Quality Seed Store	Stamford	2	Nov. 8	1243
Reck, Julius	Bridgeport	1	Nov. 8	1244
Rockfall Nursery Co. (P. Marotta, Prop.)	Rockfall	10	Aug. 17	1166
Saxe & Floto	Waterbury	1	Sept. 16	1195
Scheepers, Inc., John	Sound Beach	10	Sept. 15	1191
Schleichert, F. C.	Bridgeport	1	Dec. 3	1253
Scott, J. W.	Hartford	5	Nov. 16	1249
Seely, C. H.	Darien	1	Nov. 16	1250
Sierman, C. H.	Hartford	5	Sept. 15	1190
South Wilton Nurseries	South Wilton	5	Aug. 30	1181
Stannard Hill Greenhouse (J. E. Brooks, Prop.)	Westbrook	1	Oct. 20	1227
Steck, Charles A.	Bethel	2	Oct. 13	1222
Stratfield Nursery Co.	Bridgeport	5	Nov. 28	1251
Traendly & Schenck	Rowayton	2	Nov. 5	1239
Upson, R. E.	Marion	1	Sept. 15	1192
Van Wilgen & Co.	Branford	4	Sept. 13	1188
Verkade's Nurseries	New London	8	Oct. 19	1225
Vidbourne & Co., J.	Hartford	7	Sept. 20	1198
Wallace Nursery	Wallingford	2	Oct. 27	1233
Watrous, Arthur J. (2)	Meriden	1	Sept. 29	1212
Wild, Henry	Riverside	2	Sept. 13	1189
Wilson & Co., C. E.	Manchester	18	Sept. 23	1202
Yale University Forest School	New Haven	1	Sept. 22	1201
Young, Mrs. Nellie A.	Pine Orchard	1	Oct. 8	1219
Total acreage		1,632		

INSPECTION OF IMPORTED NURSERY STOCK.

Though there has been a great decrease in the quantity of nursery stock entering Connecticut since Federal Quarantine No. 37 went into effect, in 1919, the amount received in 1921 considerably exceeded that of the preceding year, not only as regards the number of shipments but also the number of cases and plants, as the following figures show:—

Year.	No. of Shipments.	No. of Cases.	No. of Plants.
1920	17	87	814,491
1921	21	126	1,228,560

This stock was nearly all Manetti rose stock though a few cases contained fruit tree seedlings all of which is to be grafted or budded. Most of the inspection work was done by Mr. Zappe, only one shipment being inspected by Mr. Walden. The time required to make these inspections aggregates 185.5 hours or slightly less than a month of 26 working days of seven and one-half hours each. The cost, amounting to $173.13, was paid out of the appropriation for supressing gipsy and brown-tail moths and inspecting imported nursery stock.

The sources of this imported stock were as follows:

SOURCES OF IMPORTED NURSERY STOCK, 1920-1921.

	No. Shipments.	No. Cases.	No. Plants.
France	5	59	641,000
Holland	10	53	400,060
England	6	14	187,500
	21	126	1,228,560

The following table shows the quantity of stock as inspected by months:—

Month.	No. Shipments.	No. Cases.	No. Plants.
December	7	28	307,750
January	9	56	560,565
February	3	32	296,000
March	1	4	27,245
April	1	6	37,000
	21	126	1,228,560

Two shipments (number of cases not given) containing 4,000 plants reached their destination and were unpacked and distributed by the consignee in the belief that they had been inspected at the port of entry, New York City. This was a mistake as the cases there were examined only by the custom house inspectors; but as notice of shipment was not sent to this office until after the stock had been distributed, it was not inspected.

One shipment of two cases and 30,000 plants was reshipped into New York State, and therefore was neither unpacked or inspected in Connecticut.

No attempt was made to inspect bulbs as was done in 1919, as this work is now done by Federal inspectors at the port of entry.

Of the 21 shipments, 10 shipments or 47.6 per cent. were found to contain insects or other animals, or plant diseases, some of which are well-known pests. Details of these infestations are as follows:—

PESTS FOUND ON IMPORTED NURSERY STOCK.

10 Shipments Infested.

INSECTS.

Calophasia lunula Hubn., pupa. (1 shipment) Louis Leroy's Nurseries, Angers, France.

Cryptophagid beetle on Manetti rose. (1 shipment) Louis Leroy's Nurseries, Angers, France.

Emphytus cinctus Linn. (5 shipments) A. M. Gielen, Oudenbosch, Holland; Vincent Lebreton's Nurseries, La Pyramide, France; Louis Leroy's Nurseries, Angers, France; T. Bidersons, Ltd., Farnham, England; King's Acre Nursery, Hereford, England.

Euproctis chrysorrhoea Linn. Brown-tail moth on apple seedlings. (3 shipments) Georges Benard, Orleans, France; Franco-American Seedling Co., Nantes, France.

Nest of Lepidopterous larvae. (1 shipment) Georges Benard, Orleans, France.

VERTEBRATE ANIMALS.

Frog. (1 shipment) A. M. Gielen, Oudenbosch, Holland.

Mice. (1 shipment) A. M. Gielen, Oudenbosch, Holland.

PLANT DISEASES.

Crown Gall on rose. (5 shipments) A. M. Gielen, Oudenbosch, Holland; Georges Benard, Orleans, France; King's Acre Nurseries, Hereford, England; S. Bide & Sons, Ltd., Patenham, England.

INSPECTION OF APIARIES.

This work has been conducted in the same manner as in preceding years, Mr. H. W. Coley of Westport inspecting in Fairfield, New Haven, Middlesex and New London Counties, and Mr. A. W. Yates of Hartford inspecting in Litchfield, Hartford, Tolland and Windham Counties, each being employed at the rate of six dollars per day and expenses.

Though the preceding winter was a mild one, and most bees gathered ample stores in 1920 to carry them through the winter, warm weather came early and started heavy brood rearing; this later led to starvation in unfed colonies which were short of food. This was the apparent cause of the most excessive swarming known in years, resulting in the increased number of colonies per apiary, for the inspections show that the apiaries are larger, the average being 9.2 instead of 6.5 colonies per apiary as in 1920. Thus in 1921, fewer apiaries were inspected than in 1920, yet the number of colonies was much greater, as the following figures show:—

Year.	No. Apiaries.	No. Colonies.	Average No. Colonies per Apiary.
1920	762	4,797	6.5
1921	751	6,972	9.2

In making these inspections, 122 towns were visited as against 119 towns in 1920. No apiaries have ever been inspected in the towns of Union (Tolland County) and Eastford (Windham County).

Inspections were made in the following 28 towns not visited in 1920:

Fairfield County: Bethel, Newtown and Redding. *New Haven County:* Ansonia and Oxford. *Middlesex County:* Killingworth and Portland. *New London County:* Groton, North Stonington, Old Lyme and Stonington. *Litchfield County:* Plymouth. *Hartford County:* Avon, Canton, Manchester, Windsor and Windsor Locks. *Tolland County:* Somers, Stafford, Tolland and Willington. *Windham County:* Ashford, Chaplin, Hampton, Pomfret, Putnam, Thompson and Woodstock.

On the other hand, inspections were made in 1920 in the following 25 towns, not visited in 1921:—

Fairfield County: Bridgeport, Brookfield, Darien, New Fairfield, Sherman and Weston. *New Haven County:* Bethany and East Haven. *New London County:* Colchester, Griswold and Voluntown. *Litchfield County:* Bridgewater, Canaan, Cornwall, Goshen, New Milford, Norfolk, North Canaan, Roxbury, Salisbury, Sharon and Torrington. *Hartford County:* Bloomfield, Hartland and Rocky Hill.

European foul brood has decreased each year since the inspection service was established in 1909, and in 1921 the percentage of infested apiaries was 3.99 instead of 4.3 in 1920. In 1921 this disease was found in the following 21 towns:

Fairfield County: Greenwich, New Canaan and Stamford. *New Haven County:* Cheshire, Hamden, New Haven, North Haven, Prospect and Wallingford. *Middlesex County:* Durham, Middletown and Saybrook. *New London County:* Old Lyme. *Litchfield County:* Thomaston. *Hartford County:* Manchester, New Britain, Southington and Windsor Locks. *Tolland County:* Coventry and Mansfield. *Windham County:* Pomfret.

American foul brood was present in 2.5 per cent. of the apiaries visited, and in .56 per cent. of the colonies as against 1.18 per cent. and .25 per cent. respectively for 1920. It appeared in 1921 in the following 11 towns:—

Fairfield County: Greenwich and Stamford. *New Haven County:* Derby, Hamden and Wallingford. *Middlesex County:* Durham. *New London County:* East Lyme. *Litchfield County:* Washington. *Hartford County:* Bristol and Simsbury. *Tolland County:* Mansfield.

The statistics of the apiaries inspected in 1921 in each of the 122 towns visited, are arranged by counties in the following pages, and summarized on page 131.

APIARIES INSPECTED IN 1921.

	No. Apiaries Inspected.	No. Apiaries Diseased.	No. Colonies Inspected.	No. Colonies Diseased.
Fairfield County:				
Bethel	9	0	65	0
Danbury	3	0	108	0
Easton	3	0	118	0
Fairfield	5	0	63	0
Greenwich	10	2	54	5**
Monroe	4	0	90	0
New Canaan	5	1	57	8†
Newtown	1	0	44	0
Norwalk	5	0	67	0
Redding	3	0	40	0
Ridgefield	2	0	44	0
Shelton	2	0	55	0
Stamford	21	3	263	5***
Stratford	2	0	26	0
Trumbull	4	1	45	1‡
Westport	6	0	80	0
Wilton	1	0	18	0
	86	7	1,237	19

†European Foul Brood.
**3 American Foul Brood and 2 European Foul Brood.
***3 American Foul Brood and 2 Sacbrood. ‡Sacbrood.

	No. Apiaries Inspected.	No. Apiaries Diseased.	No. Colonies Inspected.	No. Colonies Diseased.
New Haven County:				
Ansonia	4	0	27	0
Beacon Falls	1	0	22	0
Branford	4	1	31	1‡
Cheshire	4	2	44	4†
Derby	5	1	70	1*
Guilford	2	1	39	2‡
Hamden	5	2	36	3**
Madison	5	0	26	0
Meriden	26	0	215	0
Middlebury	1	0	40	0
Milford	1	0	45	0
Naugatuck	7	0	61	0
New Haven	5	2	42	9†
North Haven	5	1	55	25†
Oxford	1	0	12	0
Prospect	5	3	79	4†
Seymour	1	0	22	0
Wallingford	26	10	149	23***
Waterbury	7	0	49	0
Woodbridge	2	0	40	0
	117	23	1,104	72
Middlesex County:				
Chester	5	0	41	0
Clinton	3	0	29	0
Cromwell	6	1	39	1‡
Durham	8	3	159	6****
East Haddam	1	0	12	0
Essex	2	0	30	0
Haddam	3	0	26	0
Killingworth	2	0	11	0
Middlefield	4	0	55	0
Middletown	7	2	97	3†
Old Saybrook	2	0	28	0
Portland	6	0	9	0
Saybrook	3	1	13	1†
Westbrook	1	0	8	0
	53	7	557	11
New London County:				
Bozrah	2	0	22	0
East Lyme	3	1	48	3*
Franklin	4	0	29	0
Groton	5	0	26	0
Lebanon	2	1	21	1‡
Lisbon	1	0	12	0
Montville	1	0	4	0
New London	7	1	77	1‡

*American Foul Brood.
**2 American Foul Brood and 1 European Foul Brood.
***14 American Foul Brood and 9 European Foul Brood.
**** 3 American Foul Brood and 3 European Foul Brood.

	No. Apiaries Inspected.	Diseased.	No. Colonies Inspected.	Diseased.
North Stonington	1	0	3	0
Norwich	10	0	510	0
Old Lyme	3	1	43	2†
Preston	2	0	8	0
Stonington	1	0	16	0
Waterford	4	0	29	0
	46	4	848	7
Litchfield County:				
Barkhamsted	3	0	71	0
Colebrook	2	0	13	0
Harwinton	1	0	6	0
Litchfield	1	0	10	0
Morris	4	0	32	0
New Hartford	1	0	6	0
Plymouth	4	0	7	0
Thomaston	14	1	97	1†
Washington	5	1	163	4*
Watertown	13	0	88	0
Winchester	17	0	88	0
	65	2	581	5
Hartford County:				
Avon	1	0	10	0
Berlin	21	1	187	1‖
Bristol	5	1	38	3*
Burlington	2	0	15	0
Canton	7	0	70	0
East Granby	8	0	43	0
East Hartford	12	0	75	0
East Windsor	11	0	110	0
Enfield	8	0	47	0
Farmington	17	0	90	0
Glastonbury	25	0	125	0
Granby	6	0	59	0
Hartford	23	0	130	0
Manchester	19	2	134	6†
Marlborough	2	0	32	0
New Britain	16	1	134	1†
Newington	8	0	78	0
Plainville	2	0	7	0
Simsbury	9	2	57	2*
Southington	16	1	153	1†
South Windsor	1	0	5	0
Suffield	8	0	66	0
West Hartford	21	0	118	0
Wethersfield	12	1	76	1‡
Windsor	17	0	102	0
Windsor Locks	2	1	14	1†
	279	10	1,975	16

‖Paralysis.

	No. Apiaries Inspected.	Diseased.	No. Colonies Inspected.	Diseased.
Tolland County:				
Andover	2	0	15	0
Bolton	3	0	16	0
Columbia	1	0	5	0
Coventry	8	1	83	1†
Ellington	15	0	73	0
Hebron	1	0	6	0
Mansfield	7	2	76	3**
Somers	5	0	29	0
Stafford	8	0	23	0
Tolland	4	0	27	0
Vernon	1	0	1	0
Willington	11	0	52	0
	66	3	406	4
Windham County:				
Ashford	1	0	8	0
Chaplin	1	0	5	0
Hampton	1	0	5	0
Pomfret	14	2	89	5†
Putnam	5	0	37	0
Thompson	8	0	42	0
Windham	3	0	39	0
Woodstock	6	0	39	0
	39	2	264	5

Summary.

County.	No. of Towns.	No. Apiaries. Inspected.	Diseased.	No. Colonies Inspected.	Diseased.
Fairfield	17	86	7	1,237	19
New Haven	20	117	23	1,104	72
Middlesex	14	53	7	557	11
New London	14	46	4	848	7
Litchfield	11	65	2	581	5
Hartford	26	279	10	1,975	16
Tolland	12	66	3	406	4
Windham	8	39	2	264	5
	122	751	58	6,972	139

	No. Apiaries.	No. Colonies.
Inspected	751	6,972
Infested with European foul brood	30	88
Per cent. infested	3.99	1.26
Infested with American foul brood	19	39
Per cent. infested	2.5	.56
Sacbrood	8	11
Bee paralysis	1	1
Average number of colonies per apiary		9.2
Cost of inspection		$1,981.70
Average cost per apiary		$2.638
Average cost per colony		.24

**1 American Foul Brood and 1 with 1 colony Sacbrood and 1 European Foul Brood.

REPORT OF GIPSY MOTH WORK.

Season of 1920-1921.

By John T. Ashworth and W. E. Britton.

The policy pursued in former years has been continued in work against the gipsy moth. The co-operation between our men and those of the Federal Bureau of Entomology has been most satisfactory and has resulted in greater effectiveness than would be the case if any other system were followed. In general the Federal men have scouted those towns along the border of the infested territory to prevent further spread, while most of the State appropriation has been expended in the towns which were known to be infested.

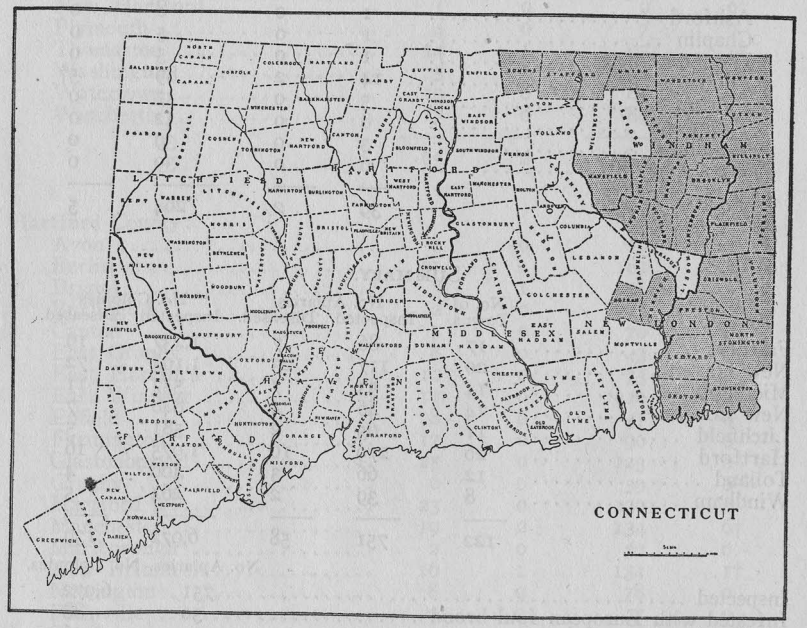

Figure 1. Map of Connecticut showing area now quarantined on account of the gipsy moth.

Mr. Ashworth was promoted to the position of deputy in charge of moth work, in place of Mr. Davis who resigned in June 1920, and has been in immediate charge of all field work. Mr. James A. McEvoy was promoted to the place of Assistant formerly held by Mr. Ashworth.

Infestations were found for the first time in the towns of Somers and Stafford. Mansfield, Windham, Groton and Stonington, which were formerly infested, were not found infested in 1919-1920. Infestations have formerly occurred in Franklin and Sprague, but nothing was found in these towns in 1920. The quarantined area is shown on the accompanying map (see figure 1).

As in former years, single egg-clusters were not counted as infestations in the older and more heavily infested towns, but have been included in the border towns.

All of the work described in this report relates to the gipsy moth. The brown-tail moth has been very scarce for the past few years; though a watch has been kept for infestations, none were found and no control measures are needed at present in Connecticut.

New Equipment.

During the season of 1920-1921 some of the old equipment has been replaced by new. The Ford car that was converted into a truck in 1918, also the two purchased in 1919, were exchanged for two new Ford trucks with delivery bodies.

The Buick touring car bought in 1919, having been driven over 27,000 miles at a cost of about $30.00 for renewed parts, and quite a large outlay being needed in the near future, it was thought an act of economy to turn it in, and purchase a new one, which was done; this brings the motor equipment of the commission up to a high standard for the coming year.

One thousand feet of rubber-covered one-inch spraying hose was also purchased from the Acme Rubber Company of Boston, Mass., it being the policy of those in charge to renew some of the hose each year so as to keep a certain amount of hose on hand; no suction hose was bought as it was thought there was enough on hand at present.

Details of Gipsy Moth Work by Towns.

The following pages give a detailed account of the conditions in each town in the infested area:

Thompson—119 Infestations—2,605 Egg-clusters.

In scouting Thompson this season an agreeable surprise was met as we expected, on account of the deep snow of last year, to find an increase in the number of infestations this year; but instead there was a drop of 15 colonies and 1,737 egg-clusters. However, with this substantial drop, Thompson is still the most heavily infested town in the State.

Scouting was started in Thompson the last of December and finished the first of February, two crews working, one in the eastern and one in the western half of the town. The town is generally

infested throughout, although the northern part adjoining Massachusetts is more heavily infested. There were no very large colonies, but three may be noted as being the largest in the town. The first contained 96 egg-clusters, and was on land owned by the Grosvenordale Mill Co., and is situated on woodland about one-half mile northwest of the mill at Grosvenordale. The second contained 93 egg-clusters, on land owned by L. A. Logee, and situated about one mile west of the lower end of Quadick Reservoir, three apple trees and a stone wall being infested. The third contained 88 egg-clusters, and was on land situated on north side of railroad about three-quarters of a mile west of the road known as the Brandy Hill road, owned by E. C. Bixby. Of these colonies, 90 were sprayed by State crews during June.

Woodstock—33 Infestations—862 Egg-clusters.

The number of infestations in Woodstock was smaller this year than last, although the number of egg-clusters was nearly as great, there being a larger number of single egg-clusters located this year than ever before. This is due to the high winds of last spring. There were only two colonies large enough to mention, one containing 79 egg-masses on two large oaks in a pasture owned by H. I. Hibbard and located about one mile north of the North Woodstock store on the road to Southbridge, Mass., and about 50 yards west of the road. The second was located on land owned by Mr. Anderson just southeast of the Woodstock Fair grounds and consisted of 94 egg-masses on six oaks in a pasture. Twenty-seven of these infestations were sprayed during May and June, 51,400 gallons of poison liquid being used.

Union—32 Infestations—35 Egg-clusters.

Union was scouted by State men this year during April, and 32 infestations were found. All but two of these were single egg-clusters, and were scattered over the entire town. This condition is accounted for by the fact that there was a general wind spread to the west in Massachusetts, New Hampshire and Vermont last spring. The southern end of the spread seemed to end in northern Connecticut, as in the southern portion no trace of the gipsy moth was found west of Groton. No spraying was done in Union as it was thought unnecessary.

Stafford—11 Infestations—12 Egg-clusters.

Stafford was only partly scouted this year, as the men had to be withdrawn before the work was completed. In fact, the larvae were hatched, and feeding, before this was done. However the entire northern half of the town was covered. In all, about 54

miles of roadway were scouted. The result of this work was the finding of 11 colonies, all of which were single egg-masses except one. This contained two egg-masses, and was located in an apple orchard owned by Fred Bonden, situated about a quarter of a mile from the Massachusetts line, in the extreme northeastern corner of the town. Two of the colonies were sprayed by State men during June, as larvae were found feeding at these colonies.

Somers—2 Infestations—2 Egg-clusters.

Somers was the last town to be finished during the scouting season, Federal men doing the work. Two colonies of one egg-cluster each were found. At the one found in the orchard owned by C. H. Withington, larvae were found feeding, so a crew of State men were sent there and the colony was sprayed, 100 gallons of poison being used, after which no trace of the pest was found during the remainder of the season.

Putnam—37 Infestations—877 Egg-clusters.

Last year Putnam was scouted by men on snow-shoes, the snow in some places being so deep that they had no difficulty in going across country, as they could easily step over fences and walls. Therefore it can easily be seen that many egg-clusters were hidden from sight, and this condition explained the increase of colonies in Putnam. Most of these colonies are small, and the old (or hatched) egg-clusters were below the snow-line. Only three colonies are large enough to mention, the first being on land owned by George Page and located in some oak and apple trees, and stone walls in a pasture situated about half way between the Foster Hill road and State road from Putnam to Danielson, and contained 102 egg-clusters. The second contained 87 egg-clusters, and was found in woodland owned by Warren Bradway, near the Thompson line about two miles east of the Windham County Children's Home. The third contained 56 egg-clusters and was in woodland owned by Leverett Burrell about one mile northeast of East Putnam four corners. Thirty-five of the 37 colonies were sprayed during June by State men, and after spraying 189 larvae were found and destroyed.

Pomfret—8 Infestations—188 Egg-clusters.

Pomfret was scouted during November and December, only eight colonies of five egg-clusters or more each being found. Of these only two are large enough to mention, the first contained 56 egg-clusters. Fifty-three of them were old ones. All the egg-clusters at this colony were in a stone wall near a scrub apple tree in a pasture owned by H. Anderson, situated on the north side of the

road known as the Pomfret Landing road. It was very fortunate that the scout turned over a stone at the foot of the apple tree, as there was a pupa case on the under side of the stone, which led to the discovery of this colony. There was no trace of the gipsy moth on the trees or brush around there, but on looking over the wall the men found 56 egg-clusters. The second contained 23 egg-clusters and was in an old apple tree on land owned by Louis Daigle, situated in the northeast corner of the town, about one and one-half miles from the Putnam and Woodstock line. Five of the eight colonies were sprayed in the early part of May, and in looking over the colonies after spraying, seven of the 52 larvae found in the town were found and destroyed.

Eastford—6 Infestations—120 Egg-clusters.

Eastford was the first town scouted by the State men this year. The work was completed November 3d, a total of six infestations containing 101 egg-clusters, also 19 singles were discovered. Of these colonies only one is considered dangerous, that being the one on land owned by Mr. William Warren in woodland on the north side of the road leading east from the cemetery on State road from Phoenixville to Eastford, and containing 28 egg-clusters. The infested area this year is all in the northeastern part of the town or within two and one-half miles of Eastford Post Office. Only three single egg-clusters were found north of Crystal Pond. These were near the village of North Ashford, and in the section south of Phoenixville no trace of the gipsy moth was found. Five of the six colonies were sprayed during May.

Ashford—10 Infestations—13 Egg-clusters.

Ashford was scouted by State scouts the last of April and the first of May. Ten colonies were found, seven of these containing one egg-cluster each, and the other three had two egg-clusters each, all of which were new. This fact, as in other towns, is laid to the high northeast winds during the hatching season of 1920. No spraying was done as the men could not find any larvae, and it was not thought necessary.

Killingly—46 Infestations—653 Egg-clusters.

Killingly was scouted during the latter part of March and the first of April by State crews, two crews being used, one in the northern and one in the southern half of the town.

The results of scouting this year show a drop to less than half the number of egg-masses found last season. The whole town is generally infested throughout, and although no large colonies were discovered, three might be mentioned. The first and second are in woodland owned by John Kussino and Mrs. Cora Shekelton,

respectively, and located in the extreme northeastern corner of the town. The first contained 84 egg-clusters and the second 88 egg-clusters. The third colony was on land owned by T. E. Hopkins and contained 52 egg-masses. This colony was in woodland located on the south side of the old Hartford and Providence Turnpike, via East Killingly.

Forty-four of the colonies were sprayed during May and June; 6,505 larvae were destroyed in Killingly this year, very few of which were found after spraying.

Brooklyn—14 Infestations—232 Egg-clusters.

Brooklyn was scouted by State men this year as in previous years, and no large colonies were located, as can be seen by the large decrease in egg-clusters from the season of 1919, a drop of more than 50% in the total number of egg-clusters found. The infestations are all small and are distributed over the entire town. The largest is one of 29 egg-clusters, and is located on land owned by Mr. Oscar Atwood, situated on the top of Tatnic Hill. This colony is spread over about six acres, in which the brush and small trees have been cut and burned during the past two seasons. Twelve of the colonies were sprayed during the latter part of May by a State crew. One thousand, one hundred and eleven larvae were found in the town, 1,094 being located before spraying and 17 afterwards.

Hampton—4 Infestations—11 Egg-clusters.

State men scouted about two-thirds of this town, then as the eggs hatched early and larvae were crawling, the scouting work was stopped, and the men began applying tanglefoot bands. Four colonies were located, all small, the largest one contained six egg-masses and found on land owned by J. W. Cartwright, about one-half mile west of Hampton village. Two of the colonies were sprayed during June by Federal men.

Chaplin—6 Infestations—35 Egg-clusters.

Chaplin was scouted by Federal scouts this year during the early winter, and six colonies were found. Two of these are worthy of mention. One (Number 2) was in woodland owned by C. W. Morey of Hampton, and situated in the northeastern corner of the town, east of the Natchaug River. This colony contained 23 egg-clusters. The other (Number 3) was in woodland owned by H. H. Darling, about two miles north of the Chaplin Post Office, on the east side of the Ashford road; six egg-masses were found here. Two other colonies of two egg-masses each were also found. These four colonies were sprayed by Federal men in early June.

Mansfield—6 Infestations—5 Egg-clusters—1 Pupa.

Mansfield was scouted by Federal scouts. Six colonies were located, all of which were single egg-clusters except one, that being the one found in an orchard at the Connecticut Agricultural College, and consisted of one female pupa case.

During the month of June, State men went to Mansfield and visited these colonies and found larvae feeding at the colony on land owned by I. J. Wilcox at Merrow Station. One of the State sprayer trucks was sent out and sprayed the territory around this section, and no trace of the pest has been found there since.

Sterling—11 Infestations—139 Egg-clusters.

The scouting in Sterling was completed on December 18, by State men. Eleven infestations containing 92 egg-clusters, and 47 single egg-clusters, making a total of 139 egg-clusters, were found and destroyed. No large colony was found in the town, the largest containing only 16 egg-clusters, and was on land owned by Carl Gallup in the southwest corner of the town, near the Plainfield line. Although only 11 colonies were found, these and the singles were scattered over the entire town. At most of the colonies the trees were banded with tree tanglefoot as they were on high, wind-swept ground, and all of the colonies in Sterling were sprayed during the first of May by State crews. In all, 50 larvae were found and destroyed both before and after spraying.

Plainfield—26 Infestations—368 Egg-clusters.

Scouting was started the last of January and completed the first of March. Twenty-six colonies of five egg-clusters or more each, were located. None are large or dangerous. There are only two that contain over 25 egg-clusters, Number 6 and 7. Number 6 had 48 egg-clusters and was in an apple orchard owned by A. Dearnley and situated in the eastern edge of Plainfield village. Number 7 contained 27 egg-clusters in apple and shade trees on land owned by Edward Pike in Plainfield village.

The territory infested in Plainfield this year was mostly a belt across the entire town extending from Moosup west to the Canterbury line, at what is known as the Black Hill district, although there are two other small groups, one in the northwestern corner and another in the village of Plainfield. One hundred and ninety-four trees at the colonies most open to wind-spread were banded with tanglefoot, and during the latter part of May all but one of the 26 colonies were sprayed by State men. Six thousand, two hundred and three larvae were found and destroyed during the season, only 67 of which were found after spraying.

Canterbury—6 Infestations—127 Egg-clusters.

The scouting of Canterbury was completed on November 12 by State men. The colonies this year are practically in two groups, one in the southwest corner or the Woodchuck Hill district, and the other in the northwest section, near the Hampton line. The first group contained the largest colony found in the town, 51 egg-clusters, and was located in an old apple tree on land owned by Fred L. Hyde. This tree has been pruned and the brush cut and burned. Only three single egg-clusters were found in the eastern half of the town, these being near the Brooklyn line. None of the colonies are considered very dangerous. Thirty-three tanglefoot bands were used at the colonies where it was thought necessary, and during the middle of May, five of the colonies were sprayed.

Scotland—2 Infestations—2 Egg-clusters.

Scotland was scouted by Federal scouts, only two colonies of one egg-cluster each being located, one in the northeastern corner of the town, near the Hampton line, and the other about the center of the Scotland-Windham town line. No spraying was done in this town, but a close watch was kept of the colonies during larva season.

Windham—1 Infestation—1 Egg-cluster.

Windham was scouted by Federal men, one single egg-cluster being located in an apple tree on land owned by Mrs. Francis Campbell, situated in Windham Center, on road to South Windham. It was not thought necessary to spray here, but a close watch was kept of the colony during the summer season.

Voluntown—3 Infestations—45 Egg-clusters.

Voluntown was scouted this year by a State crew during February and the early part of March. All three colonies were found in the southern half of the town, the largest one containing only 23 egg-clusters, in woodland owned by L. B. and F. P. Kinne, situated about two miles south of Voluntown village and near the Griswold line. All three of the colonies were sprayed by State men in May, and in looking over the work during July, only one dead larva was found.

Griswold—7 Infestations—7 Egg-clusters.

Griswold was scouted by State men this year, during the last of March and the first of April. Seven colonies of one egg-

cluster each, were discovered. No spraying was done, as it was not thought necessary.

Preston—5 Infestations—11 Egg-clusters.

Federal men scouted most of Preston during the latter part of December and the first of January. Lack of funds compelled the stopping of the work on January 15. The work was taken up and completed by State men in March. A total of five colonies containing 11 egg-clusters was the result. Of these only one, containing six egg-masses, was thought serious enough for mention. This colony was in woodland owned by Albert Benjamin about two miles southeast of Long Society. This colony and another on land owned by Charles Prue, near Amos Lake, were sprayed the latter part of May by Federal men. Since spraying, the colonies have been inspected and no living larvae, but one dead one, found.

Norwich—5 Infestations—17 Egg-clusters.

Norwich was scouted by State men this year, five colonies being discovered. Two of these are worthy of mention. The first contained eight egg-clusters and was located on an oak on land owned by Charles O'Neill, situated about one mile west of what is known as East Great Plain. The second contained five egg-masses, and was on a large oak on land owned by Mrs. William B. Wilcox, situated about a mile and a half north of the Norwich Reservoir. These two and two others were sprayed during the first of June by a Federal crew.

Lisbon, Sprague, Bozrah, Franklin.

These towns were scouted by Federal crews and no trace of the gipsy moth was found.

North Stonington—9 Infestations—26 Egg-clusters.

North Stonington was scouted by Federal men in December and January. Nine infestations containing 26 egg-clusters were discovered, six of them being single egg-cluster infestations. The other three are described as follows: one contained three egg-clusters and was in an orchard owned by Frank Minor, situated about two and one-half miles west of the North Stonington Post Office, on the road to Ledyard. The second contained 10 egg-clusters, and was in an orchard owned by Dorice G. Lewis, situated in the southeast corner of the town, about a quarter of a mile from the Westerly, R. I., town line. The third was on an oak in a pasture owned by George Brown, situated near the west end of

Spalding Pond, and contained seven egg-clusters. The three colonies mentioned were banded, and sprayed in the summer by a Government sprayer.

Ledyard—3 Infestations—20 Egg-clusters.

As in the case of Preston, Ledyard was partly scouted by Federal men and finished by State men. The result was the finding of three colonies with a total of 20 egg-masses. Two of the colonies contained more than one egg-cluster each. The first was found in an orchard owned by A. J. Sheldon, on a high ridge just east of Rose Hill. This colony contained 17 egg-masses. The other colony was found in an orchard owned by F. Green situated on the west side of the road running north from Vinegar Hill, and contained two egg-masses. Both of the above-mentioned colonies were sprayed during May by Federal men.

Stonington—20 Infestations—29 Egg-clusters.

Stonington was scouted by Federal men. Twenty colonies were discovered, 18 of these being of one egg-cluster each, but as several of them were broken, the colonies were visited by State men during the larva season and close watch kept for signs of feeding and larvae. The largest of the other two colonies was found in an orchard owned by C. R. Johnson, situated on the road running over Hinkley Hill, about a mile west from the State line, and contained seven egg-masses. The other contained four egg-masses, and was in an apple tree on land owned by Harry Mitchell at 19 Mass St., Stillmanville. Both of these colonies were sprayed by Federal men, as was also one of the single egg-cluster colonies, where larvae had been located by State men.

Groton—11 Infestations—13 Egg-clusters.

Groton was partly scouted by Federal men in the early winter, about 15 miles of road being done by them. Later State men were sent to finish the town, and discovered 11 infestations, all except one of them being singles. This one consisted of three egg-clusters in white oaks and stone wall, on land owned by Carl Willis, and situated about a mile northwest of Pequot Hill. This colony was sprayed by Federal men the latter part of May.

New London—No Infestations—No Egg-clusters.

New London was scouted by State men during the latter part of March, and no trace of the gipsy moth found.

Waterford—No Infestations—No Egg-clusters.

Owing to the early season this year Waterford was not fully

scouted. About half (the eastern half) was scouted by State men during the last of March and the first of April, and so not having found any trace of the gipsy moth, the men were moved north.

Montville—No Infestations—No Egg-clusters.

As in the case of Waterford, Montville was only partly scouted this year. A line was drawn north and south through the town west of the village of Fair Oaks, and the territory east of that line was scouted by State men. No trace of the gipsy moth was located in this section of the town.

Statistics of Infestations.

Town	No. of Infestations found	No. of Egg-Clusters destroyed	No. Tangle-foot bands applied	No. Colonies sprayed	Lead-arsenate used, lbs.	No. Larvae killed	
Thompson	119	2,605	0	90	2,301	132	
Woodstock	33	862	0	27	503¼	1,848	
Union	32	35	0	0	0	6	
Putnam	37	877	51	35	624¼	189	
Killingly	46	653	174	44	981¼	6,505	
Pomfret	8	188	61	5	94	52	
Eastford	6	120	64	5	89	383	
Brooklyn	14	232	177	12	234	1,111	
Hampton	4	11	71	3	37¾	27	
Ashford	10	13	0	0	0	0	
Sterling	11	139	146	11	172	50	
Plainfield	26	368	194	25	318½	6,203	
Canterbury	6	127	33	5	81¼	577	
Scotland	2	2	0	0	0	1	
Windham	1	1	0	0	0	0	
Chaplin	6	35	35	4	125	11	
Mansfield	6	5 & 1 pupa	0	1	31	15	
Voluntown	3	45	0	3	56¼	1 dead	
Griswold	7	7	0	0	0	0	
Preston	5	11	16	2	25	1 dead	
Ledyard	3	20	27	2	6¼	357	
Norwich	5	17	5	4	25	9	
North Stonington	9	26	21	3	87½	24	
Stonington	20	29	32	3	25	50	
Groton	11	13	68	1	12½	0	
New London	0	0	0	0	0	0	
Waterford	0	0	0	0	0	0	
Montville	0	0	0	0	0	0	
Stafford	11	12	0	2	4	20	
Somers	2	2	0	1	6¼	25	
Lisbon	0	0	0	0	0	0	
Sprague	0	0	0	0	0	0	
Bozrah	0	0	0	0	0	0	
Franklin	0	0	0	0	0	0	
27 Towns Infested	443	6,455*	1,175	288	5,840	17,597	

*Plus one pupa.

In comparing the statistics in the foregoing table, with corresponding figures for last year, it will be seen that the number of infestations, number sprayed, and number of larvae destroyed, are somewhat greater, though the number of egg-clusters destroyed is less than last year. It will be seen that no infestations were found in the towns of New London, Waterford, Montville, Lisbon, Sprague, Bozrah and Franklin, though Bozrah was infested last year and is still included in the quarantined area shown in figure 1.

The newly infested towns of Somers and Stafford adjoin Massachusetts, and the pest has spread into these towns from Massachusetts.

The following table gives the grand totals of the statistics of the infestations for the past five years:—

Totals of the Infestations for Five-Year Period.

Year	Total No. of Infestations	No. of Egg-Clusters Destroyed	No. Tanglefoot Bands Applied	No. of Infestations Sprayed	No. of Larvae Destroyed
1916	210	3,135	13,165	60	31,671
1917	1,257	6,182	17,690	91	37,800
1918	870	18,393	3,298	392	2,852
1919	312	8,144	3,044	212	12,188
1920	350	9,224	2,314	236	7,612
1921	443	6,455	1,175	288	17,597

Parasites.

A full account of the parasites colonized in Connecticut may be found in the Report of this Station for 1920, page 162. As mentioned therein, it is the policy of those in charge of control work in the State to liberate parasites or natural enemies in sections of the State where there is infestation enough to warrant it. This year, through the courtesy and co-operation of Mr. S. S. Crossman of the Federal laboratory at Melrose, Mass., we were enabled to liberate another egg parasite, *Schedius kuvanae* How., in the northeastern part of the State. The following table gives the names of the towns, and number of parasites liberated in each:

Thompson,	768,000
Putnam,	386,465
Woodstock,	337,960
Killingly,	106,350

These figures show a total of 1,598,775 of these little workers which were liberated in the most thickly infested territory in the State. Although very minute they are very active. It was reported by Mr. McEvoy, who liberated them, that as soon as free, they started to work immediately on egg-masses in the immediate vicinity, 81 being counted on one egg-cluster. From observa-

tions and statistics gathered in the southern part of Massachusetts, an average of 40 per cent. of the eggs gathered in five towns were parasitized, so great things are expected of this parasite.

Financial Statement.

RECEIPTS.

Appropriation for biennial period ending June 30, 1921		$70,000.00
Expended, year ending June 30, 1920	$33,081.11	
Transferred to Insect Pest Account by Board of Control	321.23	33,402.34
Amount available for year		$36,597.66

CLASSIFIED EXPENDITURES FOR THE YEAR ENDING JUNE 30, 1921.

Salaries and Wages:		
John T. Ashworth	$1,800.00	
J. A. McEvoy	1,500.00	
K. E. Buffington	1,316.60	
F. C. Rich	1,206.44	
W. P. Colvin	1,136.40	
C. W. Roth	1,067.90	
J. W. Longo	995.63	
D. La Belle	983.39	
A. J. Gilbert	982.16	
R. G. Newton	980.10	
T. J. Perreault	952.53	
E. Fortin	941.47	
J. W. Thomas	938.60	
D. J. Mondor	898.32	
H. F. Wheeler	879.28	
H. Sweet	697.32	
H. Woodmancy	680.48	
J. H. Higgins	672.56	
H. E. Cook	658.96	
O. Fortin	650.68	
R. A. Spencer	456.56	
J. L. Knight	391.04	
R. Franklin	358.35	
J. Mills	324.60	
Other Labor	4,011.78	
		$25,481.15
Printing and Illustrations		19.74
Postage		11.77
Stationery		2.47
Telegraph and Telephone		6.55
Office Supplies		64.05
Express, Freight and Cartage		92.96
Machinery, Tools and Supplies		2,461.81
Insurance		861.37
Rental and Storage		313.50
Traveling Expenses, Gasoline, Oil, etc.		1,877.43
Automobile Repairs, Tires, etc.		3,762.05
Inspection of Imported Nursery Stock		173.13
Heat and Light		47.77
Miscellaneous		12.75
Total		$35,188.50
Balance, unexpended		$1,409.16

Quarantine Inspections.

Federal quarantines have been established over the infested territory as is shown by the accompanying map, figure 1, page 132. All nursery stock, forest and quarry products shipped from the quarantined area outside of the area into other states must be inspected and certified by Federal inspectors. This applies only to interstate shipments.

In 1920, the State of Connecticut established quarantines on the same area that is covered by the Federal quarantines, so that nursery stock and forest products going from the infested area into uninfested parts of the State, cannot be shipped unless inspected and certified as with the interstate shipments. The Federal inspectors have made most of the inspections, and there have been 527 shipments of forest products and 23 of nursery stock inspected and certified. The present law gives no authority for quarantining quarry products.

NOTES ON THE EUROPEAN RED MITE.

Paratetranychus pilosus C. & F.

By Philip Garman, Ph.D.

In the spring of 1921 a number of spray materials were tested for control of the European red mite in the egg stage. A general report of the work was given by Dr. Britton in Bulletin of Immediate Information Number 13. More complete records are given herein together with a few observations on the habits of the mite which appear to be important.

Eggs began hatching in the field April 13, 1921, at which time apple leaves were about one inch long and the delayed dormant sprays had been applied in most orchards. Mites from eggs which hatched April 13 were observed frequently until May 12, 1921. On May 9 adult males and females were seen, but no eggs. On May 12, the mites began to deposit eggs. Here was a period of a month before egg-laying began. The time for the pink bud application fell about April 21 in 1921, and if applied at this time would have had considerable value in killing the mites. If made later in the season, nicotine-lime-sulphur sprays are less effective unless repeated several times, because of the presence of eggs. Sprays applied then are less likely to be thorough because of increased foliage and are more costly since more spray is required. This is confirmed in part by field tests made in 1920.[1]

An unexpected turn of affairs became evident in early summer, 1921, when it was found that orchards in which the mites had been particularly destructive in 1920, had few, whereas in other orchards, having few in 1920, they became abundant: and this in spite of spraying operations or the lack of them. Such a condition may be attributed to adverse weather conditions which included a rather dry fall, mild winter and early spring with continued cool weather until June; or it may be due to the appearance of numbers of predaceous mites in 1920. The latter is a more plausible explanation in view of the fact that red mites were abundant in 1921 in orchards where they were not numerous in 1920. These orchards might easily have had fewer predaceous enemies than the more heavily infested ones, but they could not easily have been subjected to different weather conditions.

The tests tabulated below were conducted in the laboratory, the twigs being kept in moist jars, and were checked with similar tests in which the twigs were hung outside in the branches of a small apple tree. Twigs with eggs were selected, cut into short lengths, examined with a binocular and clear or dead eggs removed with a needle. The twigs were then dipped in or sprayed with the desired solution.

[1] Report Conn. Agr. Expt. Station for 1920, page 189.

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

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

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

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

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

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

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

TABLE I.

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

Exp. No.	Treatment	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Treated	Date Examined
13.	Scalecide 1 part-15 parts water	669	9	1.3	Apr. 7	Apr. 29
14.	Scalecide 1 part-35 parts water	838	53	6.3	"	"
15.	Scalecide 1 part-25 parts water	744	68	9.1	"	"
16.	Scalecide 1 part-50 parts water	462	47	10.1	"	"
17.	Check no treatment	253	164	65.0	"	"
18.	Check no treatment	100	45	45.0	"	"

TABLE 2.

	Lime-sulphur 1-9					
1.	Nic. Sulphate 1-500	649	189	29.1	Dec. 29	Feb. 23
2.	" " "	2,166	544	25.1	Feb. 8	Mar. 2
	Lime-sulphur					
3.	1 part-9 parts water	403	45	11.1	Apr. 5	Apr. 15
4.	" " "	378	18	4.7	Mar. 12	Mar. 28
5.	" " "	773	268	34.6	Dec. 29	Feb. 23
	Lime-sulphur 1-9					
6.	Nic. Sulphate 1-500	165	80	48.4	Apr. 13	Apr. 28
7.	" " "	221	54	24.4	Apr. 13	Apr. 29
	Lime-sulphur					
8.	1 part-9 parts water	526	351	66.7	Dec. 29	Apr. 28
9.	" " "	652	253	38.8	Mar. 16	Apr. 29
10.	" " "	449	132	29.4	Feb. 17	May 3
11.	" " "	299	83	27.7	Mar. 10	May 2

TABLE 3.

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

TABLE 4.

	B. T. S.					
1.	½ oz.-1 pint water	1,047	368	35.2	Feb. 8	Mar. 2
2.	" " "	374	124	33.2	Apr. 5	Apr. 15
3.	" " "	438	35	7.9	Mar. 12	Mar. 28
4.	" " "	234	34	14.5	Mar. 4	Mar. 25

Notes.

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

Table 2. Nos. 1-5 were kept indoors after treatment; 6-11 outdoors. Nos. 5 and 6 were sprayed, others dipped.

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

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

Exp. No.	Treatment	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Treated	Date Examined
5.	½ oz.-1 pint water B. T. S. ½ oz.-1 pt. water	349	162	46.4	Mar. 16	Apr. 29
6.	N.S. 1 part-500 parts water	282	126	44.6	Apr. 5	Apr. 29

TABLE 5.

1.	Scalecide 1-15[1]	773	27	3.5	Dec. 29	Feb. 23
2.	" 1-15	1,078	0	0.0	Feb. 8	Mar. 2
3.	" 1-15	412	0	0.0	Apr. 5	Apr. 15
4.	" 1-15	67	0	0.0	Mar. 12	Mar. 28
5.	" 1-25	173	0	0.0	Mar. 16	Apr. 4
6.	" 1-50	356	11	3.0	Mar. 16	Apr. 4
7.	" 1-15	119	0	0.0	Mar. 4	Mar. 25
8.	" 1-15	409	135	33.0	Dec. 29	Apr. 28
9.	" 1-15	104	6	5.7	Mar. 9	Apr. 29
10.	" 1-25	341	115	33.7	Mar. 9	Apr. 29
11.	" 1-50	150	8	5.3	Apr. 7	Apr. 29
12.	" 1-15	669	9	1.3	Apr. 7	Apr. 29
13.	" 1-25	744	68	9.1	Apr. 7	Apr. 29
14.	" 1-35	838	53	6.3	Apr. 7	Apr. 29
15.	" 1-50	462	47	10.1	Apr. 7	Apr. 29
16.	" 1-15	326	55	16.8	Feb. 17	May 3

[1] Proportions of Scalecide to water.

TABLE 6. (CHECKS)

Exp. No.	Total Number of Eggs Used	Number Hatched	Per Cent. Hatched	Date Obtained	Date Examined
1.	1,956	345	17.6	Dec. 29	Feb. 23
2.	527	263	49.9	Feb. 9	Mar. 4
3.	60	45	75.0	Feb. 10	Mar. 4
4.	2,421	1,477	61.0	Feb. 8	Feb. 23
5.	334	326	97.6	Apr. 5	Apr. 15
6.	359	324	90.2	Apr. 8	Apr. 28
7.	208	185	88.9	Mar. 4	Mar. 25
8.	402	223	55.4	Mar. 10	Mar. 28
9.	403	333	82.6	Mar. 11	Mar. 28
10.	430	342	79.7	Mar. 12	Mar. 28
11.	255	209	81.9	Mar. 16	Apr. 4
12.	421	181	42.9	Dec. 29	Apr. 28
13.	265	151	56.9	Mar. 16	Apr. 29
14.	253	164	64.8	Apr. 7	Apr. 29
15.	100	45	45.0	Apr. 7	Apr. 29
16.	162	109	67.3	Apr. 13	Apr. 28
17.	120	20	16.6	Apr. 4	Apr. 28
18.	155	85	54.8	Apr. 5	Apr. 29
19.	531	337	63.4	Feb. 17	May 3
20.	188	114	60.6	Mar. 10	May 2

Notes.

Table 5. Tests 1-7 were kept indoors after treatment; 8-16 were kept outdoors. Numbers 10-15 were sprayed, others were dipped in spray solutions.

Table 6. Eggs listed here were not treated with any insecticide. Numbers 1-11 were kept indoors in moist jars; 12-20 outdoors.

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

TABLE 7.

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

Notes.

Table 7. The percentages in the column headed "possible kill" were obtained by comparing each with the check hatch, obtaining the actual hatch, and subtracting this number from 100, thereby obtaining the per cent. killed. Where the per cent. hatched is higher than the check it is obvious that the insecticide has no killing power.

SUMMARY OF VARIOUS TREATMENTS.

TABLE 8.

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

In order to check more fully the results obtained in the foregoing tests, twigs with eggs were collected from an orchard which had been given a delayed dormant spray of Scalecide. Of 434 eggs examined, 35.9 per cent. had been killed. Another batch of eggs showed 71 per cent. and another 95.7 per cent. mortality.

A few tests were conducted in August partly to check results obtained in 1920. Linseed oil emulsion[2] was tried and found very effective. The results of these tests are given in Table 9.

TABLE 9.

Exp. No.	Treatment	No. Live Mites	No. Dead	Per Cent. Killed	Date Treated	Date Examined	Air Temp. During Test	Temp. of Solution Applied
	Lime-sulphur 1-40							
1.	N. S. 1-500	2	36	95.0	Aug. 15	Aug. 16	60-79° F.	71° F.
2.	" "	18	141	88.7	Aug. 17	Aug. 18	60-79° F.	73° F.
	Borax soap							
3.	4 lbs.-48 gals. water	26	128	83.1	Aug. 17	Aug. 18	60-79° F.	89° F.
	Linseed oil emulsion	2						
4.	1 part-20 parts water	5	81	94.1	Aug. 17	Aug. 18	70-74° F.	84° F.
5.	Check, no treatment	84	2	2.3	Aug. 17	Aug. 18	60-79° F.	

Note:—Table 9. Showing results of four different treatments for controlling the European red mite; not in egg stage.

The results of these tests point to the value of miscible oils as ovicides, but it must be remembered that such oils if used in excessive quantities may become dangerous to apple trees, especially if long continued. Some growers have used them for many years with good success and without apparent injury, while others have not had as good success. In the case of miscible oils, therefore, it is best to examine each barrel or can before using, rejecting those which are not completely emulsified when water is added, and

[1] Calculated as in Table 7.

[2] Made according to directions in Mass. Agr. Expt. Station, Bulletin 179, pages 175-176, 1917.

mixing thoroughly, before dilution, the contents of those that are used.

The greatest amount of injury is done to the trunk and larger limbs (it may be several years in appearing) indicating that these parts should be avoided as much as possible in spraying with miscible oils. Again there is danger to the flower buds in the very late sprays, more than with lime-sulphur or substitutes, since the oil works in more among the buds. All these facts, together with the prevailing high price of oil sprays, make many skeptical of their value, but with care and only occasional use, they should prove valuable as orchard sprays.

In the light of present information, it is advisable to apply miscible oils for control of the European red mite in Connecticut before the buds open (late dormant spray), in March or early April. If lime-sulphur delayed dormant spray is used it should be applied as late as possible since it kills young mites after hatching.

We suggest in general the following procedure: follow the usual spray calendar recommendations unless red mite eggs are numerous. If numerous, apply miscible oil as a late dormant spray, to the outer twigs and smaller branches avoiding the trunks and larger branches as much as possible. By no means omit the pink spray with nicotine since this is important in control of newly hatched mites. Apply this spray as thoroughly as possible.

THE VIOLET GALL MIDGE.

Phytophaga violicola (Coquillett).

By Philip Garman, Ph.D.

During the fall of 1920, attention was called to the injuries of this insect by W. W. Thomson and Co., of West Hartford, Conn. At this time it had become numerous enough in their greenhouses to require continual hand picking and was causing a yearly loss estimated at about $1,000.00. The owners were trying to control it by intermittent fumigation with hydrocyanic acid gas (HCN) and by dusting with lime, both of which measures were ineffective. Hand picking infested leaves was also unsatisfactory. Evidently there was something about the insect which required study and the following notes relate to information obtained by the writer (with the aid of W. W. Thomson and Co.) which bear on its life history and control.

History of the Insect in the United States.

The violet gall midge or gall-fly has been known in the United States since about 1896 when it was discovered near Washington,

D. C. It has been reported from Virginia and New York by Chittenden and from Minnesota by Washburn. The New York localities include Nyack, Tappan, Cornwall-on-the-Hudson[1] and Rheinbeck[3] which are not greatly distant from West Hartford. It is not known definitely how it entered the United States or whence it came but it is thought to be tropical in origin and has perhaps been introduced from abroad.

Regarding life history, Chittenden[1] thinks that the maggots do not enter the soil to pupate. Felt[3] observes that the infestations

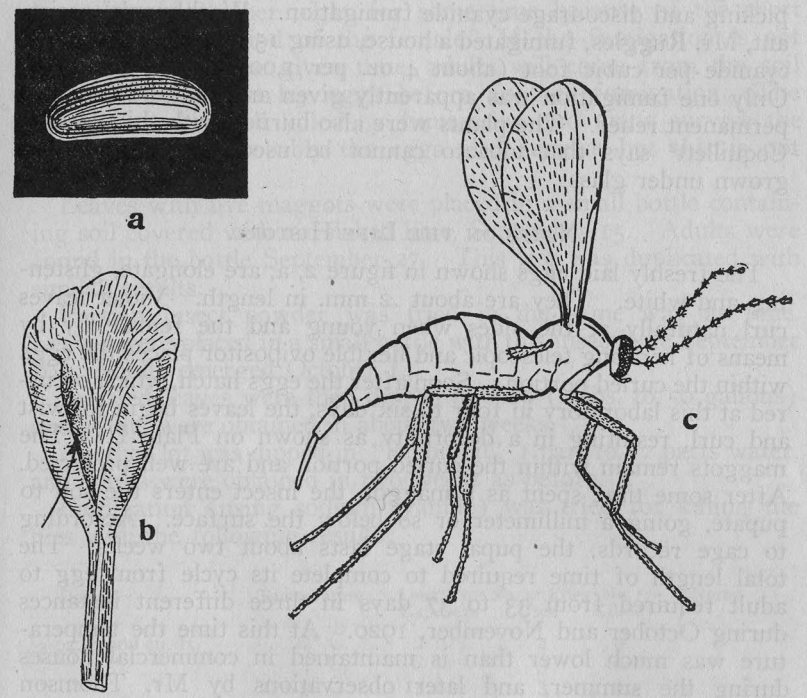

Figure. 2. Violet gall midge. a. egg, enlarged about 100 times; b. young violet leaf with edge rolled back, showing eggs; c. adult female fly, enlarged about 24 times.

in New York houses are local and their relative abundance is largely due to temperature; further that the insects prefer recently opened leaves, apparently laying eggs in such leaves and that there is a marked periodicity in appearance of the larvae. He says that adults rarely leave the plants and few are to be found on the windows; that infested leaves placed on the soil gave forth adults in 10-16 days; and that the maggots enter the soil to pupate.

There is some difference of opinion among authors as to the proper methods of control. Chittenden[1] suggests the use of

hydrocyanic acid gas, but did not test it. He discourages hand picking infested leaves because of injury to the crown of the plant. He suggests the use of air slaked lime thrown into and about the plants, and the free use of buhach or persian insect powder when adults are numerous. Felt's[3] suggestions include care in avoidance of infested plants for setting out, and in keeping the temperature as low as possible in early fall, since the insects are not troublesome at low temperatures. He discourages[4] the use of hydrocyanic acid gas, but thinks it possible that it has value in killing the adult flies. Slingerland and Crosby[6] recommend hand picking and discourage cyanide fumigation. Washburn's[7] assistant, Mr. Ruggles, fumigated a house, using 15 grams of potassium cyanide per cubic foot (about 4 oz. per 1,000) for 35 minutes. Only one fumigation was apparently given and this did not give permanent relief. The plants were also burned with this dosage. Coquillett[2] says that tobacco cannot be used safely on violets grown under glass.

Notes on the Life History.

The freshly laid eggs shown in figure 2, a, are elongate, glistening and white. They are about .2 mm. in length. Violet leaves curl naturally at the sides when young and the female fly by means of her long telescopic and flexible ovipositor places the eggs within the curled portion. Soon after the eggs hatch, which occurred at this laboratory in four to six days, the leaves begin to twist and curl, resulting in a deformity as shown on Plate II. The maggots remain within the curled portion and are well protected. After some time spent as a maggot, the insect enters the soil to pupate, going a millimeter or so below the surface. According to cage records, the pupal stage lasts about two weeks. The total length of time required to complete its cycle from egg to adult required from 33 to 37 days in three different instances during October and November, 1920. At this time the temperature was much lower than is maintained in commercial houses during the summer, and later observations by Mr. Thomson indicate a shorter cycle, possibly three weeks.

Eggs were obtained from adults, in two instances, two days after emergence from the soil (September 27-29, 1920). Emergence of adults takes place during the day or night according to observations made November 2 to 3. A small bottle containing emerging flies was cleared of the latter at 6:00 P. M., November 2. One fly emerged by 8:00 P. M., but no more had emerged by 10:00 P. M. One additional fly had emerged by 8:00 A. M. the next morning, and between 8:00 and 10:00 A. M. a third fly emerged. The flies thus seem to come from the soil at different times during the day or night and are not confined in this regard to any fixed period.

Notes on Control.

Owing to the location of the eggs and maggots within the curled leaves, it seemed inadvisable to use sprays of any sort for their control. It was thought that the maggots or pupae might be killed by applications of insecticide to the soil and to this end insect powder and dry lime were tried without results. Another available method was found in systematic fumigation with hydrocyanic acid gas (HCN) which proved satisfactory from the standpoint of the grower. This treatment kills the adult fly, but must be repeated every other night for some time because of the short preoviposition period of the female. If the fumigation is not repeated within the given time, adults will come from the soil and will mate and lay eggs before another fumigation. The maggots are not all killed by fumigation and many survive the usual dosage. Probably the eggs also survive but this is not certain.

Leaves with live maggots were placed in a small bottle containing soil covered with air slaked lime, September 15. Adults were found in the bottle September 27. This test was duplicated with similar results.

Persian insect powder was tried in the same way as lime. Leaves were placed in a small bottle with this insecticide September 29. Adults emerged October 14.

Infested leaves were then dipped in soap (2 lbs. to 50 gallons) and adults were obtained in about two weeks.

Another lot was dipped in "lemon oil" 1 part to 12 parts water, and adults were obtained in two weeks as before.

Fumigation (using sodium cyanide) was tried for killing the flies with the following results:

Dosage	Temperature	Length of Exposure	No. of Flies Used	No. Killed	Notes
⅛ oz.-1,000 cu. ft.	22° C.	2 hrs.	4	0	
" " " "	14° C.	8 hrs.	3	0	
" " " "	17-19° C.	15 hrs.	3	1	
⅙ oz.-1,000 cu. ft.	15-22° C.	2 hrs.	4	0	
⅙ oz.-1,000 cu. ft.	15-22° C.	2 hrs.	4	0	
⅓ oz.-1,000 cu. ft.	16-19° C.	3 hrs.	2	0	Both apparently dead but revived.
⅓ oz.-1,000 cu. ft.	22° C.	2 hrs.	4	3	
1 oz.-1,000 cu. ft.	19-22° C.	2 hrs.	4	4	All apparently dead; one revived.

All tests were made in a small fumigating box and the atmosphere was dry. While limited in extent the tests show that it is not advisable to reduce the dosage of sodium cyanide much under 1 ounce per 1,000 cubic feet. With leaky houses it would probably require 1-2 ounces to kill the fly.

Violets withstand a heavier dosage than some other plants, but care must be taken with this amount, not to leave the house closed over night.

During June, 1921, the gall midge appeared in considerable numbers in the West Hartford houses. The owners began systematic fumigation every other night, using ¾ to 1 ounce of sodium cyanide to 1,000 cubic feet, and keeping this up until July. An inspection June 8 showed that nearly every plant had injured leaves due to the gall fly. Two 180 foot houses, with 12,000 plants each, were treated. From one of these houses a bed was transplanted to a third house and remained without regular fumigation. An inspection of the houses August 10, 1921, showed that two of the houses were entirely free of the pest, while the bed of plants transplanted to the third house had about one infested or injured leaf to every ten plants. Shortly after August 10, systematic fumigation was started in the third house, and inspections were made regularly until September. It was noted that the galls did not become more numerous but were constantly reduced in numbers. On September 24 none could be found.

As a contrast to their condition in 1920, the plants now had good crowns and were much better able to produce flowers than a year ago. A good many plants died during the summer, but this seemed to be localized and was attributed to other causes. The only injury to the plants from the fumigation was a very slight burning of the margins of some of the leaves, which, however, did not retard the growth of the plants and did not compare with the injury caused by continual hand picking.

In drawing conclusions from the above notes, it is well to consider their incomplete nature. The fact should also be emphasized that fumigation with hydrocyanic acid gas (HCN) is dangerous to plant life and should be done with care. Directions for such work are found in Farmers' Bulletin 880 of the U. S. Department of Agriculture, with which every grower should provide himself. However, it is believed that careful systematic fumigation offers an economical and satisfactory relief from the injuries of a troublesome pest.

Literature.

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AN OUTBREAK OF THE ARBOR VITAE LEAF MINER.

Argyresthia thuiella Packard.

By W. E. Britton and M. P. Zappe.

Some injured arbor vitae twigs were first sent to the Station from New Haven early in April and referred to the botanical department. As no signs of plant diseases were found and small exit holes were noticed, the material was brought to the entomological department on April 12 by Dr. F. A. McCormick. Some of the leaves had been mined and were partly transparent when held up to the light, and small Lepidopterous larvae were found in the mines. On April 13, the authors visited the locality and collected material which was taken to the laboratory and placed in rearing cages in the insectary. More material was gathered May 2. On May 9, pupae were present in the leaves, and on May 20, small moths emerged. There was little difficulty in identifying the species as *Argyresthia thuiella* Packard, and this identification was later confirmed by Mr. August Busck of the United States National Museum, through the kindness of Dr. L. O. Howard, Chief of the Bureau of Entomology.

Injury.

The narrow leaflets were completely mined so that almost all of the chlorophyll was destroyed in the most extreme cases. Large specimen trees were so badly injured that they appeared brown instead of green, and were noticeable from a distance. Practically all of the leaves on the lateral branches had been mined, wholly ruining them as specimen trees. A block of pyramidal trees six to seven feet tall were badly injured and were brown except for the lower branches and the topmost leaves, which were green. Two rows of trees about three feet tall had hardly a green twig left, and from a short distance away looked entirely dead, but close examination showed that new leaves were starting out from the main trunk. These trees are shown on Plate IV, a. Of course all degrees of injury were noticed from the extreme cases cited to only a trace of infestation. Some degree of infestation was observed in many places, on both hedges and specimen trees, but in no other place visited was the injury so marked as in the locality described in New Haven. If a hedge should become badly infested, its beauty would be destroyed for a season at least. Felt[2] states that usually the operations of this pest are confined to a terminal half inch of the leaves here and there, and sometimes its work is so restricted as to involve only one-half or a portion of the leaflet.

Distribution.

The work of this insect was observed in several sections of New Haven and on June 24 at Norwalk and Riverside. Other towns in Connecticut known to be infested by this insect are Wallingford, Milford, Fairfield, Branford, Hamden and Cheshire.

It has been recorded from Canada,[4] Maine,[7] New York,[2] Pennsylvania,[1] New Jersey,[11] Missouri,[9] and the Middle Atlantic States.[14]

Life History and Habits.

Apparently the insect spends the winter as a larva in the mines of the leaflet. It reaches maturity early in May and pupates. The adults begin to emerge about May 20, and keep it up for some time, as on June 1 and June 4 there were many adults present and even more on June 9. They were resting on the trees or perhaps laying eggs, and on being disturbed fairly flew away in swarms from the trees. On June 9, the first egg was found. On June 21, eggs had hatched and young larvae had begun to mine the leaves. They enter the leaves by crawling under the edge of the base next to the twig and in this axil feed their way into the tissues and tunnel between the upper and lower epidermal layers. On July 1, larvae were about three-sixteenths of an inch long, had just finished mining one leaflet and starting on the adjoining one.

Description.

Egg:—Length about .33 mm., thickness about .17 mm., yellowish green, slightly paler than the leaf, more or less irregular in shape because it is nearly always placed between the tip of one leaflet and the base of the adjoining one and fits the available space. Egg is usually laid from 2-5 leaflets below the tip and can scarcely be seen with the naked eye. Under a miscroscope the surface appears roughly sculptured. The appearance of an egg is shown on Plate V, d.

Larva:—Length about 5 mm., thickness about .5 mm., light green varying to darker green with decided reddish tinge. Head, shiny black, cervical shield, black with median pale line, legs and anal plate black; a black spot on each side of last segment just above anal prolegs. Abdominal prolegs light green like body. A narrow black transverse mark on dorsum of penultimate segment. Head bearing light-colored bristles. Each segment bears dorsally a transverse row of short bristles; these are longer on the first and last two segments.

Pupa:—Length 3-4 mm.; thickness about .7 mm., general color leaf green, head light brown, wing sheath narrow and pointed, extending beyond base of fifth abdominal segment. Head smooth, bluntly rounded.

Adult:—Wing-expanse about 8 mm., forewings light-gray, marked with brown as shown on Plate V, c; rear wings light fuscous without markings. Palpi head and face, white; antennae white ringed with brown. Legs and body yellowish-white.

Parasites.

Dr. Felt[2] records a Chalcidid parasite *Pentacnemus bucculatricis* Howard, reared from the infested leaves in New York State.

This parasite was originally described from Missouri.[9] Two Hymenopterous parasites have been reared from the larvae or pupae of the arbor vitae leaf miner in our breeding cages. One is the Chalcidid *Pentacnemus bucculatricis* Howard, just mentioned, and the other a Vipionid, *Apanteles bedelliae* Viereck.

Control Measures.

Several remedies have been suggested for the control of this insect, but very little work along this line has been recorded. During the outbreak of this pest in Connecticut in the summer of 1921, several remedies were tried. One of the nearby nurseries had quite a serious outbreak and the owners were willing to co-operate with us in the test of control measures. A block of about 1,000 small trees four to six feet tall was used in the experiments. About one week after the experimental sprays were applied, the owners sprayed all their other arbor vitae trees, and by some mistake this block was also sprayed. The application contained nicotine sulphate (1 pint to 50 gallons) and soap.

The following sprays were applied in our tests:—

Lead arsenate, 1 pound to 8 gallons of water. This made a very concentrated poisonous spray and was thought to be of some value in killing the young larvae as soon as they hatched from the eggs.

Lime-sulphur, 1 part to 8 parts water, was sprayed on another plot.

Scalecide, 1 part to 8 parts water, showed a very little burning on the new and tender growth.

Kero-spray, 1 pint to 8 gallons. This is a commercial kerosene emulsion which is on the market under the name of "Kero-spray."

Fish-oil emulsion, 1 part to 20 parts water.

Carbolic emulsion, 1 part to 20 parts water.

These two emulsions were made up as follows:

Soap	4 ounces
Water	1 quart
Fish-oil (or carbolic acid) ...	4 ounces

Dissolve the soap in a quart of hot water, add the fish-oil and churn until a thick emulsion is produced. The carbolic emulsion is made just the same except that crude carbolic acid is substituted in place of the fish-oil.

Nicotine sulphate, 2 teasponnsful to 1 gallon of water, was another spray used.

All plots were sprayed twice except the carbolic acid and lead arsenate plots.

The sprays were applied on May 24 and June 4. At this time some of the moths had emerged and were flying around the arbor

vitae trees or resting on the leaves. Two small plots were treated with each of the sprays. In one plot the regular nursery trees were used and in the other smaller trees (less than three feet high) were used that had been transplanted near the larger trees.

On the smaller trees all the old infested leaves were cut off.

In the fall careful counts were made of the number of larvae in leaves of the younger trees, with the following result:

Treatment	Living Larvae
Lead arsenate	14
Lime-sulphur	18
Scalecide	18
Kero-spray	12
Fish-oil emulsion	10
Carbolic acid emulsion	8
Nicotine sulphate	13
Check* (nicotine sulphate and soap)	10

The adult moths are very frail and many of them were killed by being struck by the sprays. It is very easy to hit them with spray because when a tree on which they are resting is touched they immediately fly away. Although the results do not show much difference in the number of larvae present for each kind of spray, the total amount of injury is certainly less than it was early in the spring, so possibly all of these sprays are of some value in controlling the arbor vitae leaf miner.

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*The trees left as checks as well as all others in the experiment were sprayed by the nursery owners with nicotine sulphate and soap. Of course all the treatments given above really had their original treatments plus a spraying of nicotine and soap a week later.

INJURY TO YOUNG TOBACCO PLANTS BY THE SEED CORN MAGGOT.

Hylemyia cilicrura Rond.

On May 25, I was called by telephone by Mr. J. B. Stewart of the Windsor Tobacco Growers' Corporation, at Windsor, and informed that a small maggot was injuring his tobacco plants in one section of the field by tunneling in the stem. As this seemed from his description to be a new or unusual trouble, I stated that I would like to visit his field. It happened that Director Jenkins had planned to visit his field the following day and on Mr. Stewart's invitation I accompanied him.

The field was in light sandy soil, and the plants had been set perhaps two weeks. The whole field was covered with cheese cloth as is the practice where shade grown tobacco is raised. The particular section worst infested was a strip of some twenty acres in area not far from one of the big tobacco sheds. This ground was covered with clover, which was plowed under last spring. We pulled and dug up many plants, thousands of which had been injured. The burrow was usually small and inconspicuous, often escaping notice at first and extended from the outside into the pith just below the surface of the ground. Frequently the burrow was considerably enlarged inside the stem, involving perhaps the whole pith and in some cases extending upwards or downwards for a half inch or more. Injured plants are shown on Plate VI, a. The week preceding our visit, Mr. Stewart was able to find a maggot in nearly every injured stem, but though we cut open many plants not a single stem had a larva in it. Mr. Stewart found one larva in the soil close to the plant, and after a long search, I found a Dipterous pupa in the soil. Twenty or thirty of these were found during the course of the day.

The preceding week Mr. Stewart examined and counted 100 plants and found between 80 and 90 infested. He was able from the general appearance to distinguish the injured plants from those not attacked.

It seemed to the writer that many of the infested plants were so slightly injured that they stood a good chance of recovering, but Mr. Stewart states that any injury to the pith is sufficiently serious so that the plant will never develop a good crop of wrapper leaf tobacco, and this opinion seems to be shared generally by the leading growers. Consequently the twenty acres were reset and no injury from this insect was noticed on the later set plants.

Other growers at various times have noticed similar injury to their tobacco plants, but the exact data have not been collected.

From the pupal material gathered on May 26, several adults

emerged on May 31st, and following, and proved to be a small two-winged fly of the Dipterous family Anthomyiidae. Specimens were sent to the Bureau of Entomology at Washington, where the insect was identified as *Hylemyia cilicrura* Rond., also known as *Phorbia* (or *Pegomyia*) *fusciceps* Zett., and commonly called the "seed corn maggot" and "bean maggot." This insect is closely allied to the cabbage maggot *Chortophila* (*Phorbia*) *brassicae* Bouché, the onion maggot, *Phorbia ceparum* Meigen, and the spinach leaf miner, *Pegomyia hyoscyami* Panz. It attacks a great number of different kinds of plants and its literature is extensive, yet I have so far been unable to find tobacco mentioned as subject to its attacks.

Tucker[11] has recorded similar injury by this insect to young tomato, potato, corn, pea, onion and cauliflower plants in Louisiana. The maggots generally feed upon planted seeds like corn, beans, peas, etc., and sometimes in cold wet seasons prevent the seeds from producing plants. Frequently, however, the plant appears above ground but as the terminal bud has been destroyed it fails to grow and produce leaves. The maggots have also been found feeding upon seed potatoes and onions, and attack cabbages and allied plants in much the same manner as the cabbage maggot, with which this maggot is often associated.

In the spring of 1917, the bean crop was seriously injured in New York State by this insect. "In five townships of one county there was a loss of $15,000.00 for seed destroyed, and in another county the loss on 16,000 acres planted was estimated to be between 50 and 75 per cent."[5] Many growers lost their entire crop.

It seems to be the consensus of opinion that clover and alfalfa or even a heavy application of manure, plowed under, make a favorable breeding place for the seed corn maggot. When these conditions are combined with heavy rainfall and low temperature there is apt to be serious injury from the seed corn maggot. The longer the seeds are in the ground before growth starts the greater the danger.

Shallow covering of seeds in cold wet seasons will materially reduce injury from the seed corn maggot.

The adult is a small grayish fly which closely resembles that of the cabbage maggot, and is shown on Plate VI, b. It occurs throughout the Eastern United States and is the species commonly responsible for injury to cabbage and onions in the southern states according to Chittenden.[2] Hawley[5] states that there are two broods annually and a possible third in certain seasons in western New York.

Some of the more important papers appearing in recent years and dealing with the life history and habits of this insect are as follows:-

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TESTS OF MATERIALS FOR THE CONTROL OF WIREWORMS.

BY M. P. ZAPPE.

In the spring of 1921 shortly after the tobacco plants had been set in the fields, the owners noticed that many plants were being attacked by wireworms. Some of the growers had pet remedies which they tried themselves or recommended to their neighbors.

The growers went to considerable expense to control this insect with various preparations. One of the most highly recommended remedies was to dissolve gum camphor in alcohol and dilute with water. This solution was then used to water the plants.

Several complaints were made to the Experiment Station about the damage caused by wireworms and it was suggested that tests be made to determine the value of some of the remedies that were being used by the tobacco growers. Mr. C. A. Huntington of Windsor, agreed to furnish the wireworms and tobacco plants if we would make some tests at the Station. The plants were set on June 1, 1921, in two rows, 30 in one and 31 in the other. There were 12 plants for each treatment, six in each row, except the check plot which only had seven plants, and the naphthalene plot which had only six plants, three in each row. There were five different treatments, besides the check plot.

The treatments used were turpentine emulsion, fish-oil emulsion, carbolic acid emulsion, gum camphor mixture and naphthalene flakes. The mixtures were made up as follows:

Soap	4 ounces
Turpentine	4 ounces
Water	1 quart

The soap was dissolved in the water by heating and when all dissolved, turpentine added and the mixture was churned until a creamy emulsion was produced. The fish-oil and carbolic acid emulsions were made in the same way except that fish-oil or crude carbolic acid was substituted for the turpentine. The gum camphor mixture was made in a different manner. Gum camphor was dissolved in alcohol until saturated. On a large scale, 8 ounces of this saturated solution was poured into a 50 gallon barrel of water. This diluted mixture was then to be used in watering the tobacco plants.

The trouble with this mixture is that the gum camphor is insoluble in water and when the saturated alcoholic camphor solution is added to water all the camphor is thrown out of the solution and settles in the bottom of the barrel as a precipitate. Then when water is drawn out all the camphor comes at once and the remaining portion of the contents is clear water.

All the treatments were applied soon after the plants were set. The turpentine, fish-oil and carbolic acid emulsions were diluted, 1 part of emulsion to 32 parts of water. The plants were watered with these dilute emulsions, using about 8 ounces to each plant. The naphthalene flakes were scattered around the base of each plant and then covered with a little soil. About one-fourth ounce was used for six plants. A little of the soil was removed from around each plant and replaced after the treatment had been applied.

Four hours after the treatment was applied two worms were placed at the base of each plant with the exception of four plants in the check plot. The supply of wireworms was limited so that four plants in the check plot only received one worm each. The worms immediately worked their way down into the soil at base of plants.

The results of the treatments are shown in the following table:-

	Number Plants Killed	Killed by Wireworms	Cut off by Cutworms
Turpentine emulsion	4	2	2
Fish-oil emulsion	4	1	3
Carbolic acid emulsion	1	1	0
Camphor mixture	2	1	1
Naphthalene flakes	0	0	0
Check	0	0	0

All the injured plants showed injury within a week after they were set. After that time there was no further noticeable injury. The trouble with this experiment was the fact that it was not on a large enough scale. If more worms could have been secured and the experiment carried on more extensively, the results perhaps would have meant more. The only thing the experiment shows

is that the remedies tried were of no value. The plants in the check plot having no treatment of any kind were untouched by the worms. The plants treated with naphthalene were also left untouched while the plants in the camphor and the emulsion plots (which were thought to have some value) were killed by wireworms and cutworms.

THE CORN EAR WORM.

Chloridea obsoleta Fabr.

One of the outstanding features of the year so far as insects are concerned, was the wide-spread distribution and comparative abundance of the corn ear worm. Specimens were received many times and from all counties of the State, and many inquiries by letter and telephone were answered, which were not accompanied by specimens. A brief account of this insect appeared in the Report of this Station for 1919, page 188, with illustrations of injury, larva and adult shown on Plate XXVIII. Of course this insect is a common species which has long been known in Connecticut, and it occurs somewhere in the State nearly every year, though perhaps not noticed in the same locality in successive

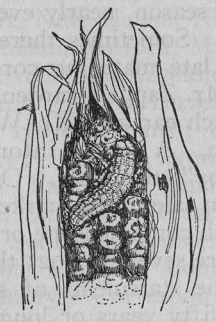

Figure 3. Corn ear worm in characteristic feeding position, much reduced.

seasons. It is the same insect which is known in the South as the cotton boll worm (not boll weevil), the tomato boll worm because it eats holes into ripening tomatoes, and the tobacco bud worm because it eats into the tips of growing shoots and seed pods of the tobacco plant. Scientifically this insect was formerly called *Heliothis armigera* Hübner, but more recently *H. obsoleta* Fabr., and now specialists agree in placing it in the genus *Chloridea*, making its name *Chloridea obsoleta* Fabr.

Injury to Corn and Other Food Plants.*

In the southern states where there are several generations each year and where the corn ear worm is very abundant, the larvae eat holes in the corn leaves as shown by Garman,[7] but in Connecticut the damage is confined to the ears late in the season, usually September and October. The larvae feed upon the soft immature kernels at the tips of the ears, though an occasional one works its way down under the husk between the rows nearly to the base of the ear. In most seasons sweet corn which was planted late or which matures late is the only crop damaged. But when abundant, as in the present season, it attacks field and ensilage corn and is often found feeding on the kernels which are mature and hard. The most of the injury is at the tip of the ear and the tip kernels are often all destroyed or injured so that they must be discarded for seed or for human food. In the canning factories, it is necessary also to cut out with a gouge the injured kernels on the side of the ear. The loss from this insect cannot be accurately measured by the kernels actually eaten or mutilated; the injury from moulds or other fungi which gain an entrance through the depredations of the corn ear worm, must also be taken into account. Garman[7] regards this as being quite as important as the loss from the kernels actually eaten or mutilated, and mouldy corn is considered unsafe to feed animals.

In some gardens this season, nearly every ear contained at the tip one or more larvae. Sometimes there would be four or five per ear. Some of the late maturing corn at the Station Farm, Mount Carmel, and in Mr. Zappe's garden not far away had from one to four larvae in each ear and Mr. Walden found six in one ear at the Station Farm. A grocer informed the writer that all sweet corn was "grubby" this year. On October 8, 1919, the writer saw sweet corn on sale in the market in Washington, D. C., nearly every ear of which contained one or more large caterpillars. That this injury was more severe in 1921 than usual in Connecticut may be evidenced by the statements of several farmers, one of whom had farmed for fifty years or longer, that they had never seen these worms before. Yet frequently infested corn is sent to the Station from some point in the State.

Sanderson[17] estimates that the corn ear worm destroys annually from two to three per cent. of the corn crop of the United States, thus causing a loss of between $30,000,000.00 and $50,000,000.00.

In the southern states this insect seriously injures cotton by eating into the base or side of the bolls, thus destroying or staining the fibers so that the cotton from these bolls must be discarded. With tomatoes the larvae eat holes into the fruits near the stem

* To learn the extent of injury in Connecticut in 1921, 5,100 ears were examined from five plantations, and the percentages of injury were as follows: 11.8, 6.1, 6.4, 1.33, 17.2. In the middle west the injury ran as high as 50, 75 and even 100 per cent.

or on the side of green and ripe tomatoes of all sizes. Whenever a tomato is mutilated by being eaten in such a manner, rot usually sets in, thus destroying it. With tobacco the larvae eat holes into the tips of the new growth and also into the seed pods, yet this insect is not considered an important pest of tobacco.

In addition to corn, cotton, tomato and tobacco, the larvae may feed upon many other vegetable and field crops some of which are:—peas, beans, pumpkin, squash, cucumber, egg-plant, pepper, okra, potato, asparagus, peanut, collard, sorghum, sugar-cane, vetch, cow peas, alfalfa, clover and millet. It also can live upon the wild plants such as bindweed, cocklebur, hemp, horse nettle, wild sunflower, ground cherry and Jamestown weed, and it occasionally attacks such cultivated plants as geranium, gladiolus, mignonette, rose and morning glory. Sometimes the caterpillars attack ripening plums and peaches.

Distribution.

The corn ear worm is found all over the United States, in southern Canada, Mexico and southward to Argentina, the West Indies, throughout Europe, Africa, southern Asia, the East Indies, Australia and New Zealand. In Connecticut it has been received at the Station at various times from nearly all parts of the State as follows:—Bethany 1908; Kensington 1909; New London 1910; Wilton 1913; Westport, New Haven, Northford, Rockville, Colchester, 1919; New Canaan, Milford, Middlebury, Vernon, 1920. In 1921 it has been received from Brookfield Center, Stratford and Shelton, Fairfield County; New Haven, Hamden, Middlebury and Wallingford, New Haven County; Cromwell and East Haddam, Middlesex County; Ledyard, New London County; Roxbury, Woodbury and Lakeville, Litchfield County; Bristol, Unionville, Collinsville, Simsbury, West Hartford, Southington, New Britain, Melrose, South Manchester and Glastonbury, Hartford County; Columbia, Tolland County; Putnam, Pomfret, Killingly, Windham County. Correspondence and telephone communications indicate that it also occurred in Norwich, Fairfield, Wilton, West Cornwall, Thompsonville, Suffield, Hartford, Danbury, Newtown, Redding, Ridgefield and New Canaan. No doubt it has occurred this year in every town in the State. It has also occurred the past season throughout the northern states and in southern Canada.

Life History and Habits.

The adult females lay their eggs on the silk of the corn and the young larvae at first feed upon the silk and later find their way to the kernels. According to Crosby and Leonard[6] the eggs are deposited singly, and though the corn silk seems to be the preferred place, may be laid upon the leaves and tassels and upon the leaves and stems of cotton, tomato, tobacco and other plants if

corn silk is not available. Early emerging moths must necessarily oviposit elsewhere before corn silk is available. Each female is said to lay from 500 upwards to 2,500 eggs. The time required for hatching varies from a week in spring to two weeks in late fall, while in the summer only two or three days are necessary, depending upon the temperature. Likewise the length of the larval stage varies according to temperature and food, ranging from eleven days in hot weather to perhaps a month in spring and late fall. Usually the caterpillars pass through six moulting stages but sometimes pupate after the fifth stage.

When mature the caterpillar goes into the ground from two to seven inches deep, then makes a tunnel lined with silk almost to the surface for the emergence of the adult moth. It then descends to the lower and larger portion of the burrow and pupates. The pupal stage varies from two weeks in summer to three in cooler weather and those transforming late in the fall live through the winter as pupae in the soil. The number of annual generations varies with the latitude and altitude or to make it plainer, with the temperature. Thus in most of the cotton-growing states, there are probably four generations, but in southern Texas and Florida there may be as many as seven. In New Jersey, there are three broods in the southern half of the State, but only two in the northern half. Though its life history has not been thoroughly worked out for Connecticut, it has been called single brooded here, though in certain seasons a partial second brood may be expected.

This insect is never noticed on corn in Connecticut except late in the season or after September 1. If there is only one brood annually and the pupae live through the winter, why shouldn't the adults emerge in May or June? Also if there are two broods, why shouldn't the larvae feed upon the usual host plants in June and July? Some entomologists believe that our invasion late in the fall may be due chiefly to a flight of moths from the southern states. Apparently no one has observed such a flight, but possibly the moths would escape notice as they are not attracted to lights like the cotton moth *Aletia argillacea* Hubn. It is hoped that further observations on the life history of this insect in Connecticut may be recorded next season.

Description.

Egg:—About .5 mm. in diameter, nearly globular, flattened at base and tip; white or yellowish, marked with ridges radiating from the center of the tip.

Larva:—From 1.5-2 inches in length when full-grown, varying from light green to dark brown, but striped longitudinally as follows:—a dark median stripe divided by a narrow white line, a broad stripe above the spiracles, and a pale stripe in the region of the spiracles, margined above with black. The skin has a distinctly granular appearance. Head and legs vary from light to dark tan, under surface varies from nearly white to gray or tan, usually with a pinkish tinge. Each segment bears small tubercles and weak short hairs.

Pupa:—From .75-1 inch in length, smooth, brown, with a pair of caudal setae or spines.

Adult:—From 1.5-1.75 inches wing-spread, ground work buff in color, forewings marked with darker and more brownish suffusions and rather indistinct bands: rear wings paler with veins and submarginal band or cloud of brown. Head, antennae and thorax, light brown: abdomen and legs slightly paler. Under surface paler than upper with discal dots and subdistal transverse bands of forewings showing. Male closely resembles female, though smaller.

Larval, pupal and adult stages are shown on Plate VIII.

Natural Enemies.

Dr. Garman[7] records a bacterial disease of the larvae and seven insect enemies of the corn ear worm in Kentucky. One, *Trichogramma minutum* Riley (*pretiosa*), is a Hymenopterous parasite of the eggs, and the others are all predatory upon the eggs or larvae. Two species of lady beetles, the spotted lady beetle, *Ceratomegilla fuscilabris* Mulsant, and the convergent lady beetle *Hippodamia convergens* Guer.-Men., feed upon the eggs; a Telephorid larva was observed devouring the caterpillars; two true bugs, *Coriscus ferus* Linn., and *Triphleps insidiosus* Say, feed upon the eggs; the larva of the lace wing fly or aphis lion *Chrysopa oculata* Say, was also recorded as a common enemy of the corn ear worm.

Quaintance and Brues[16] give several other enemies of *Chloridea obsoleta* occurring in the South, among which are the following: a Hymenopterous egg-parasite *Telenomus heliothidis* Ashm., two Hymenopterous parasites of the larva, *Microplitis nigripennis* Ashm., and *Perilampus hyalinus* Say; eight species of Tachinid flies, *viz. Frontina armigera* Coq., *F. frenchii* Will., *F. aletiae* Riley, *Winthemia quadripustulata* Fabr., *Exorista ceratomiae* Coq., *Euphorocera claripennis* Macq., *Gonia capitata* DeG., and *Archytas piliventris* Van der Wulp, which are parasitic in the caterpillars or pupae. These authors also mention several species of ants, ground beetles, bugs, toads and birds which are common around cotton fields and which occasionally feed upon some stage of *C. obsoleta*. Some kind of wilt has been noticed in connection with the larvae in Connecticut. A number have been found dead in the ears and others have died in the breeding cages; such larvae usually become soft, turn dark colored and die.

Control Measures.

As a rule control measures have not been practiced in Connecticut, because of the uncertainty of damage. In ordinary seasons the injury has been so slight that control measures are unwarranted. In 1921, however, the damage has been quite severe and if we knew that it would be repeated next year, control measures would certainly be warranted. As it is by no means certain that

this insect will be destructive in Connecticut corn fields next season, the writer hesitates to recommend any form of treatment, though the owners can practice some of the methods if they think best.

Fall plowing will uncover many of the pupae in the soil so that they will be eaten by poultry, wild birds or other animals. As they are not far beneath the surface, most of the pupae will be uncovered or disturbed by this practice. Thorough harrowing will crush some of them and uncover many more.

In New Jersey,[11] sweet corn has been satisfactorily protected by dusting the silk, soon after it appears, with powdered lead arsenate and sulphur, equal parts. As the eggs are laid upon the silk and the young larvae feed upon it, there is an excellent prospect of poisoning them before they can find their way through the husks to the kernels. Perhaps this treatment would not be practicable in large areas of field or ensilage corn, but would be well worth carrying out in the home garden or where corn is grown for seed.

Literature.

The literature regarding this insect is exceedingly voluminous. As much of it applies particularly to cotton, it need not be mentioned here. The following are only a few of the more helpful and readily accessible references:

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THE ASPARAGUS BEETLES.

Nearly all asparagus plantations in Connecticut are each year to some extent infested with the common asparagus beetle *Crioceris asparagi*. Just nineteen years ago a brief account of this insect was printed in the Report of this Station (1902, page 172) but more recent control methods have now supplanted those advised at that time. That same year the twelve-spotted asparagus beetle made its appearance within the State and a note to that effect may be found in the Report of this Station for 1902, page 174. Now the adults of both species may be found together on asparagus plants, both injuring them in much the same manner, though the common or blue asparagus beetle is usually much more abundant than the red or twelve-spotted species. These beetles have been mentioned and control measures advised, in each of the several editions of the Station Spray Calendar.

Both species have been common pests of asparagus in Europe since our earliest records. Both are now widely distributed and well established in the United States, and must be reckoned with, wherever asparagus is grown.

During 1921, asparagus beetles were unusually abundant and caused considerable injury to plantations, one report of serious injury to a large plantation near New Haven being brought to the office with specimens on May 24.

Common Asparagus Beetle.

Crioceris asparagi Linn.

History and Distribution.

Though long known in Europe, this species was not present in this country until about 1856,[3] when it appeared at Astoria, Long Island, near New York City, having apparently been introduced from Europe, though in what manner is unknown. It soon reached the large asparagus plantations of Long Island, and by 1862, it was said to have destroyed more than one-third of the crop in certain localities, occasioning a loss of $50,000.00.[3] It now covers an area reaching from Canada on the north to Cape Hatteras on the south, and westward to the Mississippi River. Separate colonies have also appeared further westward, one in Colorado and three in California.[3] Probably it will soon extend its distribution over the entire northern portion of the United States and perhaps Canada. It remains to be seen whether it continues to spread southward.

The natural means of spread is by the flight of the adults, but undoubtedly hibernating beetles or pupae have been shipped in asparagus roots or in other materials, and perhaps carried long distances.

Life History and Habits.

There are said to be at least two complete annual generations in the northern states, and possibly three or four, further south. In Connecticut the adult beetles appear in May soon after the cutting season begins, and feed and presently lay their eggs upon the tender shoots as shown on Plate IX, c. or upon the more slender growth that comes from young seedlings in or around the bed as shown on Plate IX, a. These eggs are dark brown, elongated-oval, thickness about one-third the length, which is nearly one-sixteenth of an inch. Each egg is fastened endwise to the leaf or stem, and projects from it nearly at a right angle, as shown on Plate IX, a. It is not uncommon to see one egg fastened end to end on top of another as shown in the illustration.

The eggs hatch in a few days and the grubs, "slugs" or larvae which are lead-gray with black shiny heads and legs, begin to feed upon the new foliage. The larvae are soft and wrinkled, gray in

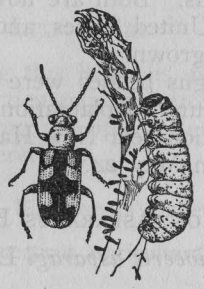

Figure 4. Common or blue asparagus beetle and larva, about twice natural size; the eggs are shown on the new shoot.

color, and present a disgusting appearance as shown on Plate IX, d. As a rule they feed only upon the slender leaves which they are able to clasp, and are not found upon the thick and tender sprouts. Injury to the sprouts is usually the work of the adult beetles.

When fully grown, the larva enters the ground and forms a rounded cell in which it transforms to the pupa and from which the adult beetle emerges in about a week. On Long Island the complete life cycle requires about 30 days but this period may be considerably lessened in a warmer climate and much lengthened in a colder one.

The beetles when abundant often eat holes into the sprouts, but seem particularly fond of the delicate foliage after that has developed, and also eat the bark or rind of the mature plants. Perhaps the most serious injury occurs on new beds or plantations where the plants must grow for a year or two and become strong before cutting begins. In such places both larvae and adults will soon

strip the plants of their leaves and perhaps devour the epidermis of the stems. This greatly weakens the plants so that they do not form strong shoots for later cutting. All new beds, and seedling plants, should be protected from injury and the foliage preserved.

Description of Adult.

The adult of the common asparagus beetle is a striking and beautiful insect about one-fourth of an inch in length and showing a combination of dark blue, yellow and orange red colors. The under side of body, head, antennae, legs and a portion of the wing covers are a dark metallic blue, nearly black. Thorax and outer margins of wing covers are orange red. The inner margins of wing covers and usually three cross bars are dark blue: these cross bars alternate with lemon yellow bars or patches, usually three on each wing cover, one narrow longitudinal one at the base and two about equi-distant from the first and the orange red apical area. There is great variation, however, in the arrangement and size of the yellow and blue areas, grading from forms almost wholly dark blue to those which appear yellow with narrow blue markings. A form common in Connecticut is shown on Plate IX, b.

Twelve-Spotted Asparagus Beetle.

Crioceris duodecimpunctata Linn.

This species is a native of Europe, where it is widely distributed, and though common is not particularly destructive. It was first noticed in this country near Baltimore in 1881,[4] but has spread rapidly until it now covers the entire northeastern United States and extends into Canada. This species was first discovered in Connecticut at New Haven in 1902.[1]

In some localities the twelve-spotted asparagus beetle is reported as being more abundant than the common species, but in Connecticut, so far as my observations go, it is found nearly everywhere with the common species but it is never so abundant and is much less injurious.

Life History and Habits.

The eggs of the twelve-spotted asparagus beetle are laid singly, and in preference upon the old and fruiting plants. Instead of being fastened endwise to the stem or leaf as are the eggs of *C. asparagi,* they are attached sidewise. The larvae feed chiefly upon the pulp of the berries,[5] and therefore are not of great importance as destroyers of foliage. It is where the plant is grown for seed that this species is particularly destructive. The adult beetles feed upon the tender shoots in early summer, and later upon the leaves and eat out irregular areas in the bark of the stems.

The life history is very similar to that of the common species and probably there are the same number of annual generations. The adults pass the winter under rubbish in much the same manner.

Description of Adult.

This beetle, called the red asparagus beetle, is about the same length as *C. asparagi* but is somewhat broader and thicker. The color is uniform reddish-brown above, with six black spots on each wing cover. Antennae, eyes, legs and under surface, blackish. It has been noted that the beetles match the berries very closely in color. The appearance of this species is shown on Plate IX, e.

Natural Enemies of Asparagus Beetles.

If poultry have the run of the asparagus bed they will take care of the beetles early in the season, but later after the plants have reached their growth, some of the beetles will be out of the reach of poultry. However, where poultry have access to the asparagus plantation it will seldom if ever be necessary to spray for the control of the beetles. In the writer's own garden one summer, a neighbor's flock of ducklings entered one day and in a few minutes cleaned the plants of all beetles and larvae.

There are many kinds of predaceous insects that devour the larvae and adults. Lady beetles are prominent among these, and the spotted lady beetle *Ceratomegilla fuscilabris* Muls., and the convergent lady beetle *Hippodamia convergens* Guer., have been recorded as feeding upon the larvae. The spined soldier bug *Podisus maculiventris* Say, and the bordered soldier bug *Stiretrus anchorago* Fabr., both impale the larvae and occasionally the adults on their beaks and suck out the juice. The common wasp, *Polistes pallipes* LeP., and a small dragon fly *Ischnura posita* Hagen, are known to prey upon the larvae of asparagus beetles. A small Hymenopterous or four-winged fly *Tetrastichus asparagi* Crawford, lays its eggs in those of the common asparagus beetle; the eggs hatch and the parasites live in the bodies of the larvae of the host, which die after entering the ground to transform.

In addition to the natural agencies mentioned above, temperature changes occasionally aid the grower in checking the pest. Asparagus beetles are very susceptible to sudden and violent changes in temperature, and in 1896, the intense heat of the first half of August killed many of the larvae in the vicinity of Washington, D. C. In Concord, Mass., hibernating beetles have been killed in immense numbers where a severe cold spell followed a warm one.

Thus it will be seen that under certain favorable conditions these natural agencies are of material assistance in checking the numbers of asparagus beetles.

Artificial Control Methods.

On all newly set beds and where young plants are grown from seed it will usually be necessary to employ some artificial means of keeping the plants free of beetles. If chickens or ducks have the run of the asparagus bed on low plants no other form of control will be needed.

Hand picking may be practiced in very small garden areas, and air-slaked lime dusted upon the plants when wet with dew will kill the larvae. Pyrethrum or insect powder is also of some value in killing the larvae when dusted upon the plants.

The larvae are rather delicate and when knocked or brushed off the plants in hot weather, often die when they reach the hot soil. Frequent syringing with a forceful spray from the garden hose will knock them from the plants and many are unable to return.

In the large cutting fields, it is probably best to make clean cuttings, in which case the beetles are forced to lay their eggs upon the new shoots which are in turn cut in a day or two so that the eggs are destroyed. Another method is to allow certain slender and worthless shoots to grow as trap plants to be cut and burned after they are well infested or to be sprayed with poison before the larvae begin to feed.

I have known several successful growers to practice clean cutting as long as the season lasts, and this in some years would be all that is necessary. In case defoliation threatens the plants, after the cutting season is over a thorough spraying or dusting with lead arsenate will destroy the beetles and save the plants from defoliation. In spraying asparagus it should be borne in mind that the leaves are very narrow and do not readily catch and hold the poison. Hence it is necessary to use a fine spray and to direct it against each plant or row from both sides with plenty of force back of the nozzle in order to coat the leaves as completely as possible. For this purpose it is well to use a strong mixture containing at least six pounds of paste or three pounds of powdered lead arsenate to 50 gallons of water. If the poison is applied as a dust it should be blown upon the plants in early morning when they are wet with dew or just after a shower before they have become dry.

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THE TULIP-TREE SCALE.

Toumeyella liriodendri Gmelin.

This insect occurs throughout the State on tulip trees and each year specimens are received at the Station, and it is also found each year in late summer in the nurseries by the inspectors, when making the annual inspection required by law. This scale was mentioned in Bulletin 151, page 9, with illustrations from a photograph, and both the note and the illustration were reprinted in the Report of this Station for 1905—page 239, and Plate IV, f. As both the report and the bulletin have long been out of print, a new and more complete account of the insect is given here.

This scale occurs chiefly on the lower branches of wild and cultivated tulip trees. Sometimes these branches are killed, but I have never seen cases where the entire tree died from the attacks of the scale, though Professor A. J. Cook states that in 1870, the insect was so abundant on the grounds of the Agricultural College at Lansing, Michigan, that some of the trees were killed outright and others much injured. In Connecticut many tulip trees have lost their lower branches from its attack. Magnolias are also occasionally infested.

This scale is one of our largest species of soft scales; the females are hemispherical in shape, sometimes reaching a diameter of eight millimeters or about one-third of an inch. These are

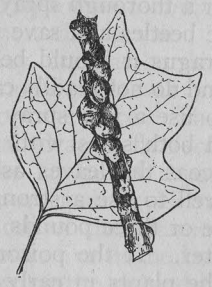

Figure 5. Tulip-tree scale, much reduced.

brown in color and are usually crowded together on the twigs as shown on Plate X, a. The smaller light-colored objects are the shells from which the males have emerged. Some twigs will show a preponderance of females, others of males, though in many cases the sexes are about evenly divided.

There is usually a copious exudation of honey dew which drips upon the foliage underneath, or upon the ground, making it look as if a coating of varnish had been applied. In the honey dew a black fungus or sooty mold grows, giving the surface a blackened

appearance. A fungus grows in the dead bodies of the females, which often adhere for a long time to the twigs, and its white threads of mycelium are rather conspicuous against the brown scales.

The tulip-tree scale was reported as causing severe injury at Hartford in 1895, by Dr. W. C. Sturgis of this Station. Since that time it has been received from many localities in the State. Records of the samples have been kept for twenty years, and it is interesting to note that no specimens of tulip-tree scale were sent to the Station in the years 1908, 1918 and 1919. More specimens were sent in 1902 and 1913 than any other years.

This insect has been received from, or observed in the following localities: Hartford, 1895; Berlin, 1898; South Windsor, 1901; Brookfield Center, Danbury, Bridgeport, New Haven, Southington, Hartford, 1902; New Haven, Hamden, Middletown, 1903; Suffield, Wilton, 1904; Columbia, 1905; Green's Farms, Branford, 1906; New Haven, 1907; Greenwich, Stamford, Waterbury, 1909; Danbury, New Britain, Norwich, 1910; Brookfield Center, Bridgeport, New Haven, Hamden, 1911; New Haven (on magnolia), Columbia, Waterford, Greenwich, Fairfield, 1912; Newtown, Rowayton, Bristol, Plainville, Woodbridge, West Haven, Middletown, Killingworth, Chester, Norwich, 1913; Ridgefield, Deep River, Lyme, New London, East Hartford, 1914; Danbury, Plantsville, Norwich, 1915; Woodbury, Naugatuck, Wilton, Bridgeport, New Haven, 1916; New Canaan, Springdale, New Haven, Middletown, Hartford, Talcottville, Rockville, Pomfret Center, 1917; Stamford, Norwalk, Stratford, Branford, 1919; Fairfield, Stratford, New Haven, Branford, Haddam, 1920; New Haven, Hamden, Guilford (on magnolia), Meriden, Branford, Stratford, Bridgeport, Norwalk, Stamford, 1921.

This scale was described as *Coccus liriodendri* by Gmelin[7] in Europe in 1789, but Cook[3] supposing the American form to be distinct, described it in 1878 as *Lecanium tulipiferae,* and it is under the latter name that the insect is mentioned in the earlier American literature. In fact, the European and American forms were considered as distinct species until 1909, when Sanders[11] after a careful study decided that they were identical, and belonged in the genus *Toumeyella.* Gmelin's name *liriodendri* having priority must be retained. Several writers, notably King and Mrs. Fernald, have placed this insect in the genus *Eulecanium,* where, according to Sanders,[11] it does not belong.

Only one parasite, *Coccophagus flavoscutellum* Ashm., recorded by Dr. L. O. Howard, is known to attack this scale. Houser[8] mentions the fact that a small lady beetle *Hyperaspis signata binotata* Say, was observed at Mineral, Ohio, July 12, 1916, associated with this scale. It is probable that other lady beetles may prey upon the newly-hatched scales.

Life History.

Though the yellow oval eggs were described by Professor Cook, young are found here underneath the female shells, so evidently the species is viviparous in Connecticut, as well as further south as observed by Dr. C. V. Riley.[10] The young appear here early in September according to our observations extending over a period of more than twenty years, and crawl about for a time but soon locate on the bark of the twigs and begin to suck the sap. At first the young are yellow but they soon change to brown. They are nearly black by the time winter approaches, and hibernate when about one-fourth grown.

Remedies.

Spraying the trees as soon as the leaves drop in autumn, with concentrated liquid lime-sulphur, one part in nine parts water, is believed to be the best form of treatment. Probably this mixture would also be effective during the winter and early spring, but possibly it would be more so in the fall before the insects reach the condition in which they pass the winter. At any rate, this lime-sulphur spray applied in the fall has been used successfully by some of the tree-protecting firms.

It is possible that kerosene emulsion, nicotine soap solution, or some other contact insecticide, may also prove effective. Houser[8] obtained good results in Ohio with Scalecide, one part in 15 parts water, applied in March, but miscible oils are not recommended for Connecticut, because there is some evidence to show that the tulip tree, like the sugar maple, is rather susceptible to oil injury.

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THE COTTONY MAPLE SCALE.

Pulvinaria vitis Linn.

Perhaps the most conspicuous of all the scale-insects, particularly during the egg-forming season of early summer, is the cottony maple scale. During the dormant season it is found upon the bark and closely resembles any other large brown soft scale, but after the trees begin to grow the formation of eggs causes the posterior end of the insect to become raised and the egg-sac begins to protrude. This shows as a white cotton-like mass of wax, and increases in size until when fully developed is as long as the insect itself, as is shown on Plate XI, b.

This scale was formerly described as *innumerabilis* by Rathvon and in most of the American literature it occurs under that name. In 1909, Sanders[10] after a careful study proved it to be identical with the European *P. vitis* Linn., and this name having priority must stand. It occurs in the United States and Canada and also in Europe.

In most cases this insect is found sparingly here and there on various host trees and shrubs, but there has been an infestation of silver maples south of the railroad at Sound Beach near Stamford which has persisted for eight or ten years and which has caused considerable injury to the trees and has necessitated control measures. The Connecticut records for the cottony maple scale are as follows:—Norwich, 1905 and 1909; Branford, 1906; New Haven, 1910 and 1917; Milford, 1913; Bridgeport, 1910, 1912 and 1913; South Norwalk, 1912; Sound Beach, 1921; Danbury, 1914; Cheshire, 1913; Wethersfield, 1916; Hartford, 1910. In most of these cases the scales were on silver maple, but the hosts also include red maple, sugar maple, euonymus, black locust, honey locust, and gooseberry. Other reported hosts are: Norway maple, box elder, hercules club, osage orange, red mulberry, apple, pear, plum, peach, hawthorn, currant, gooseberry, lilac, poplar, willow, linden, alder, oak, hackberry, sycamore, grape, rose, sumac, elm, beech, Virginia creeper and poison ivy.

Each female deposits about 3,000 eggs, which are oval, light-colored with a reddish-yellow tinge. The eggs hatch late in June or early in July, and the young at first go to the leaves and establish themselves mostly on the under side along the mid-rib and veins. The males are frail two-winged creatures which mature in August or September, fertilize the females and perish. The females migrate to the twigs just before the leaves drop, and pass the winter on the bark in a partially grown condition.

In some parts of the country the injury caused by this insect is so severe as to kill many trees. Dr. S. A. Forbes[5] ventures the

opinion that in Illinois destructive outbreaks of this insect may be expected to last about eight or ten years, with corresponding periods of scarcity in sections where it becomes established. The disappearance of the insect he considered due to parasites and predaceous insects.

Six Hymenopterous or four-winged flies are known to be parasitic on this scale. All are very small species, and known only by their scientific names as follows: *Coccophagus lecanii* Fitch, *C. flavoscutellum* Ashmead, *Atropates collinsi* Howard, *Aphycus pulvinariae* Howard, *Comys fusca* Howard and *Eunotus lividus* Ashmead. A Dipterous parasite, *Leucopis nigricornis* Egger, has been reared from the cottony maple scale, and the larva of a moth, *Laetilia coccidivora* Comstock, feeds upon it. Three lady beetles, *Rhizobius ventralis* Erichson, *Hyperaspis signata binotata* Say, and the twice-stabbed lady beetle *Chilocorus bivulnerus* Mulsant, have been recorded as preying upon it, the second being abundant at Wooster, Ohio, in July 1916,[6] both larvae and adults devouring the eggs. Both adults and larvae of the third feed upon this insect.

A *Chrysopa* larva and two species of assassin bugs have been observed feeding upon the scales, and the nymphs of *Corizus hyalinus* Fabr. were found working among the egg-masses at Denver.[8] Miss Murtfeldt observed harvest mites feeding upon the eggs in Missouri. One bird, the common English sparrow, has been observed feeding upon the cottony egg-masses.

In regard to remedies for the cottony maple scale, on account of the difficulty of making a thorough application where trees are in foliage, it is best to spray the dormant trees when the twigs and branches can be thoroughly covered. Mr. F. A. Bartlett informs the writer that in his experience the lime-sulphur mixtures have not proven effective against this insect, due perhaps to poor penetrating powers. On the other hand the miscible oils like "Scalecide" diluted at the rate of one part in 15 parts of water, are satisfactory in destroying the partially grown females. Houser[6] also recommends this treatment in the spring just before the buds open. Forbes[5] found that a strong kerosene emulsion containing from 10-12 per cent. of kerosene applied in the summer would kill a majority of the scales, but that one treatment in winter with a 20 per cent. emulsion destroyed more scales than two summer treatments with a 10 per cent. emulsion.

In the use of miscible oils or strong kerosene emulsions, it should be borne in mind that maples may be injured if too much of the oily mixture is allowed to run down the trunks and settle in the ground at the base. The sugar maple especially is very susceptible to oil injuries, but the silver maple is apparently in much less danger of being injured.

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THE PINE LEAF SCALE.

Chionaspis pinifoliae Fitch.

During recent years in Connecticut, it has been rather common to find young pine trees of several species infested with a scale which resembles the scurfy scale of apple and pear, except that it occurs only on the leaves instead of on the bark. Apparently this insect does not gain a foothold on the larger trees, and is not able to persist upon the infested trees after they reach a certain size. The most common habit of this insect is to infest the leaves of small trees which are overshadowed by larger ones. The writer once saw small white pine seedlings four or five years old under a grove of large native pines, which had been killed evidently by this scale. Nearly every year this insect is found in nurseries, when the annual inspection is being made.

This insect occurs throughout the State, and is found in all of the northern United States. It is usually more prevalent around towns and cities than in the open country.

According to our observations and records, the pine leaf scale has occurred in Connecticut as follows:—South Manchester, 1902; Hartford, 1903, 1905; Thompson, 1906; Rainbow, 1907; Hartford, New Haven, 1908; South Manchester, New Haven, 1909; Hartford, 1910; Riverside, 1911; Greenwich, New Canaan, 1912; New Haven, Cos Cob, 1913; Avon, South Manchester, Cos Cob, Bridgeport, 1914; Bridgeport, 1915; New Haven, Norwalk, Hartford, Bristol, 1916; Stamford, New Haven, Hartford, 1917; Wallingford, Cromwell, Bristol, Hartford, Manchester, 1918; Greenwich, New Haven, Hartford, Manchester, 1919; New Haven, Meriden, New Canaan, Cromwell, Westbrook, Hartford, West Hartford, Bristol, Manchester, 1920; New Canaan, Bridge-

port, Meriden, Cromwell, Bristol, Hartford, Simsbury, Rockville, Sharon, Thompsonville, 1921.

In a majority of cases this scale has been found upon Mugho pines in nurseries and ornamental plantings, but it has occurred also on red, Scotch, Austrian, jack, stone and white pines and on *Pinus densiflora* and hemlock. On four occasions, in 1908, in 1909, in 1913 and in 1920, this scale has been sent to the Station on the leaves of hemlock, and on October 23, 1907, the writer examined a tree on the estate of the late J. M. Greist, Westville, where several branches had lost their leaves from the attacks of this insect.[3] Several species of spruce have been recorded as hosts, but the writer has never found this scale on spruce in Connecticut.

There are supposed to be two generations each year in Connecticut, though its life cycle has not been followed closely through the season. The parent female deposits under her shell oval purple eggs and in this stage the insect passes the winter. These eggs were present in specimens received at the Station on September 17, 1921. They begin to hatch during May, but the hatching period is quite a long one so that the two broods are not distinct but overlap somewhat. The scales of both sexes are similar, pear-shaped and white with a yellow pellicle at the narrow end, the males being somewhat smaller. The appearance of this scale is shown on Plate XI, a.

The following two parasites have been reared from the pine leaf scale: *Aphelinus mytilaspidis* LeBaron, and *Perissopterus pulchellus* Howard. The Nitidulid beetle *Cybocephalus nigritulus* Lec., the twice-stabbed lady beetle, *Chilocorus bivulnerus* Mulsant, the painted lady beetle *Harmonia picta* Randall, *Scymnus* sp., and a species of golden eye or lace wing *Chrysopa* sp., have been recorded as being predatory upon the pine leaf scale.

Control measures for the pine leaf scale have not been thoroughly tested for Connecticut. The worst infested branches can be removed and burned and this is usually advisable with any species of scale insect. Probably the best treatment will be to spray during the summer months with kerosene emulsion or with a nicotine soap emulsion. An application soon after the eggs hatch (about June 10) will readily kill the young, but as the young of this species do not all hatch at the same time, it will probably be necessary to repeat the treatment in order to get most of the first brood. Additional treatments should be made after the young of the second brood appear, but until the life history of this species has been worked out for Connecticut, no definite dates can be given for the hatching of the second brood. Houser[9] reports his experience in Ohio in spraying with a weak kerosene emulsion when the young of the first brood were hatching, followed by an application of whale-oil soap in late summer when the young of the second brood appeared. The combined treatment was effective in reducing the infestation.

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THE TERRAPIN SCALE.

Lecanium nigrofasciatum Pergande.

This insect occurs in Connecticut chiefly upon the smaller twigs of the silver maple and the red maple, but occasionally we find it on sugar maple and Norway maple. The writer has received specimens on peach from Philadelphia, Pa., where it is reported as being quite a pest of the peach orchard. It is also recorded as attacking plum, cherry, apple, quince, *Crataegus*, sycamore, Carolina poplar, olive, blueberry, spice bush and *Bumelia*. It occurs throughout the eastern United States westward nearly to the Rocky Mountains, and has been reported from Ontario, Canada.

This insect is commonly known as the terrapin scale, but is sometimes called the black-banded scale, and is one of the smaller of the soft scales, varying from one-sixteenth to one-eighth of an inch in length. It is longer than broad, and of a color varying from reddish-brown to black. Usually it is reddish-brown mottled or banded with black, but occasionally we find one that is uniformly red or black. The scales are usually crowded on the twigs giving the general appearance shown on Plate X, b.

This scale is quite convex with a smooth brown area in the center with ridges radiating from it and becoming more and more pronounced as they reach the margin. The eggs are deposited under the bodies of the females during June and the females soon die. The males appear in August and are very delicate winged creatures, seldom noticed unless reared in the breeding cage. The young establish themselves on the smooth bark of the smaller twigs and branches, usually on the under side, but sometimes entirely encircling them. According to Houser[5] they sometimes migrate

later to a more favorable situation. There is only one generation each year and the winter is passed by the females only, in a partially mature state.

The injury caused by this insect is due to sucking the sap from the twigs throughout the active season and from the leaves for a portion of the summer. Thus a badly infested tree is severely injured. As in the case with a number of scale insects, honey dew is exuded and drips from the twigs, and a black fungus or sooty mold grows therein, giving the foliage a blackened appearance.

In Connecticut, this insect has been identified on silver maple, except where otherwise indicated, from the following localities: Forestville, 1905; Deep River, 1906; Hartford (2) once on sugar maple, South Glastonbury, 1907; New Haven, 1908; Norwich, on red maple, 1909; Thompsonville, 1911; Hartford, Bristol, 1914; New Haven, 1915 and 1916; New Haven, Seymour, Middletown, Danbury, 1920; Milford, Bridgeport, (on red maple), New Haven, Durham, Hartford, Watertown, 1921.

According to Houser[5] a number of minute four-winged flies or Hymenopterous parasites have been reared from the terrapin scale. These are: *Coccophagus lecanii* Fitch, *C. cinguliventris* Gir., *C. longifasciatus* How., *Aphychus stomachosus* Gir., *A. cognatus* How., *Angyrus nubilipennis* Gir., and *Encyrtus* sp. The twice-stabbed lady beetle *Chilocorus bivulnerus* Mulsant, feeds upon the young, and a fungus, probably *Cordyceps clavulata,* is reported as attacking the mature scales.

Control measures against the terrapin scale must be practiced for the most part while the trees are dormant. Summer sprayings to kill the young have been suggested, but as the eggs continue to hatch over a long period, several treatments would be necessary. On account of the foliage, it is difficult to make a thorough application. The most satisfactory time is perhaps in early spring just before the buds open. Badly injured branches should be cut off and burned, and the remaining portions of the tree sprayed. For this purpose, Sanders[9] recommends kerosene emulsion containing from 20-25 per cent. of kerosene. Houser[5] states that the miscible oils applied at the rate of one part in 15 parts of water are entirely satisfactory.

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THE EUONYMUS SCALE.

Chionaspis euonymi Comstock.

This scale injures the species and horticultural varieties of euonymus, all of which are grown for ornament, though it is reported as infesting orange, *Althea,* and bitter sweet *Celastrus scandens,* in some localities. In Connecticut it is perhaps most commonly noticed on the climbing evergreen *Euonymus radicans,* which it often kills in large patches on walls, rendering it unsightly. It is found in the Atlantic States from Massachusetts to Georgia, and has been recorded from Ohio, Mississippi, Texas and California. It was first described by Comstock[3] from Norfolk, Va., in 1880. Outside of the United States it has been reported from Cuba, France, Italy and Japan.

From the records of the State Entomologist's office, the euonymus scale may be reported from Connecticut as follows: Hartford, 1905; Middlebury, 1906; Greenwich, 1910; New Haven, 1912; Stratford, 1913; Bridgeport, 1915; Norwalk, New Haven, Bantam, 1916; Greenwich, Stratford, 1919; New Haven, Wilton, 1920; New Canaan, Saugatuck, Stratford, New Haven, 1921.

Thickly infested plants often look as though covered with snow on account of the pure-white males which are small with parallel margins, and extremely abundant on certain plants or parts of plants. The females are much less abundant, larger and broader, about one-sixteenth of an inch in length, pear-shaped, and dull gray or brown in color. Both sexes are shown on Plate X, c.

Apparently the insect passes the winter as a mature female in New Haven and Washington, D. C., notwithstanding the statements made in some publications that it winters in the egg stage. One minute four-winged Hymenopterous parasite, *Aphelinus fuscipennis* Howard, has been reared from the euonymus scale.

The life history of the euonymus scale has not been worked out in Connecticut, but according to Houser[7] there are at least two broods each season. In 1920 a large plant of *Euonymus radicans* in New Haven was sprayed with kerosene emulsion, containing two gallons of kerosene, one-half pound of soap and one gallon of water, diluted at the rate of one part emulsion to three parts water, thus containing about 16 per cent. of kerosene. On May 15 this was applied to a portion of the vine. Two days later, the

vine was examined and no injury to the foliage was apparent. At this time no young had appeared. On July 1, many young were present on the unsprayed portion, but no young appeared on the branches which were sprayed May 15. On July 8, the entire vine was sprayed with the same kind of mixture used on May 15. At this time the growth was nearly complete and the blossoms had dropped ten days before. The effect of this treatment was not followed up, but the vine had already been considerably injured and the owner had it cut back to the ground the following spring.

Sanders[10] recommends for summer application a kerosene emulsion containing not more than 15 per cent. of kerosene, or a solution of whale-oil soap, a pound in a gallon of water. During the winter or dormant season, a stronger emulsion may be used, up to 20 per cent. on the evergreen species and up to 25 per cent. on the deciduous species of *Euonymus*. He warns against allowing the oily emulsion to collect at the base of the plants on account of danger of injury.

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RAPID SPREAD OF THE APPLE AND THORN SKELETONIZER.

Hemerophila pariana Clerck.

In the Report of this Station for 1920, page 190, may be found a brief account of this insect and its discovery in the State. At the time this article was written, the insect was known to occur in Connecticut only at Greenwich and Stamford. The season of 1921 had not progressed very far before we learned that this insect was much more widely distributed in Connecticut. In addition to the towns mentioned above, the insect was sent to this office from the following towns in 1921: New Canaan, Danbury, West Haven,

Wallingford, Portland and West Cornwall. Entomologists from this department have collected or observed the insect in New Haven, Milford, Hamden, Cheshire, Durham, Hartford, Bantam, Litchfield, Mansfield and Groton. It is therefore known to be present in all of the eight counties of the State except Windham County, but as Mansfield borders on Windham County, it may be considered as being distributed all over the State. Though the work of this insect has been chiefly upon apple, sweet cherry trees in New Canaan were partially defoliated in 1921. On June 24, Mr. Zappe and the writer visited Stamford, Greenwich and Port Chester, N. Y. At that time the moths had just emerged and when disturbed fairly swarmed about some of the infested apple trees in Port Chester. They were also resting upon flowers in the field, nearly every daisy blossom having one or more moths upon it. Smaller numbers of the moths were seen in Greenwich.

The larvae feed upon the upper surface of the leaves, partially and sometimes entirely skeletonizing them. The larva spins a

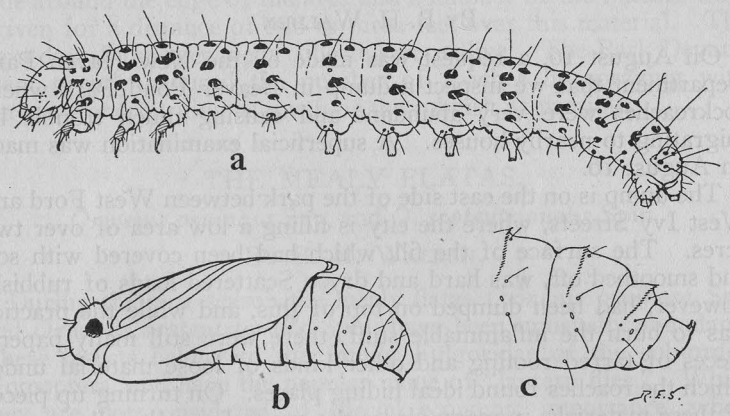

Figure 6. Apple and thorn skeletonizer. a. larva; b. female pupa; c. caudal extremity of male pupa, all greatly enlarged. Drawing lent by U. S. Bureau of Entomology.

light web over the center of the leaf, curling it upward and drawing the margins together especially toward the tip. The leaves are not webbed together like those in the nest of the fall web-worm. In badly infested districts, unsprayed orchards may be completely defoliated. In fact some of the trees in Port Chester observed by the writer on June 24 were quite brown from the attacks of the larvae, and no doubt the injury from later broods would be even more severe because the insects are usually more abundant. Adults were also present and fairly common around New Haven the last days of October, and several were observed on the laboratory windows. Mr. Zappe found the adults to be fairly common

at New Canaan, while inspecting nurseries, and larvae of all sizes were observed. A Tachinid fly *Exorista pyste* Walk. was reared from the pupae.

The structures of the larvae and pupa are shown in the drawing, figure 6. and the appearance of the adult, larva and pupa, is shown on Plate IV, b and c. Further studies will be necessary to ascertain the exact life history of this insect in Connecticut.

Spraying with lead arsenate is the remedy, though it may be necessary to make applications late in the season to prevent injury from the late brood, as the poison applied in May or June is sometimes washed off or new leaves may grow so that the larvae are able to feed upon them without being killed by the poison.

ABUNDANCE OF THE GERMAN ROACH IN A CITY DUMP.

Blattella germanica Linn.

By B. H. Walden.

On August 16, a request was made by the New Haven Park Department that we inspect a dump in Beaver Pond Park where cockroaches were very abundant and causing much trouble by migrating to nearby houses. A superficial examination was made on August 16.

The dump is on the east side of the park between West Ford and West Ivy Streets, where the city is filling a low area of over two acres. The surface of the fill, which had been covered with soil and smoothed off, was hard and dry. Scattered loads of rubbish, however, had been dumped on top of this, and while the practice was to burn the inflammable stuff, there were still many papers. pieces of tarred roofing and other kinds of loose material under which the roaches found ideal hiding places. On turning up pieces of these materials, in many places the ground was literally covered with all stages of the German roach or croton bug, *Blattella germanica* Linn. A few days later a more careful examination was made. It was found that the roaches were well scattered over the dump although they were more numerous near the north edge where there was a bank covered with bushes and small trees. Here the roaches were found in numbers under loose bark and in cavities in the trees. Several specimens of the large American roach *Periplaneta americana* Linn., were also found in similar places in the trees. Associated with the German roaches on the dump were a number of the European house-crickets, *Gryllus domesticus* Linn., which is the second record of the occurrence of this species in the State.

The roaches were active at night and swarmed on the nearby houses and street trees. Roaches were found fully a block away from the dump.

A resident of a house at the end of one of the streets adjoining the park told of killing a great number of the roaches on the side of the house with a proprietary roach powder and called attention to a small shade tree in front of the house on which he killed over one hundred in one evening.

Tests to kill the roaches were made by turning over the material under which they clustered and spraying them with kerosene oil. All of the roaches hit with the oil died in a few minutes.

A proprietary spray was tried in the same manner and while it may have killed the roaches more quickly than kerosene, it did not appear to be any more effective and the cost was about twenty times as much.

Sodium fluoride was given a trial by placing a band about three inches wide around a colony of roaches and driving them through it. Twenty of these roaches were placed in a jar and on the following morning all but one were dead.

The Park Department had spread a quantity of calcium chloride around the edge of the area and a number of the roaches were driven for a distance of two to three feet over this material. The next day all the specimens collected were alive. The Park Department greatly reduced the number of roaches by spraying with kerosene and burning as much of the rubbish as possible.

THE MEALY FLATAS.

Ormenis pruinosa Say, and *O. septentrionalis* Spin.

By B. H. Walden.

During the past season the mealy flatas *Ormenis pruinosa* Say and *Ormenis septentrionalis* Spin. have been unusually abundant. These insects belong to the family Fulgoridae of the sub-order Homoptera, and have the popular name of "lantern flies." While they are not considered of special economic importance, when abundant more or less injury must be caused by their sucking the juice from the stems of the large variety of plants which they attack.

The adult of *Ormenis pruinosa* Say is about one-third of an inch in length, with broad wings folded vertically against the sides of the body. With the wings spread these insects have somewhat the appearance of small moths, though the flight is usually short and feeble. The color is dark gray or brownish, covered with a light, powdery substance giving the insect a pale bluish gray appearance.

The eggs are laid in late summer or early fall in long slits just under the bark of twigs, and are placed end to end, forming ridges in the bark an inch or more in length. According to Riley, these eggs hatch about the middle of May. The nymphs and pupae are

greenish white in color and are covered with a whitish, waxy secretion which often remains on the host plant for several weeks after the insects disappear. The adults emerge early in July. There is only one brood during the season. *O. pruinosa* attacks a number of shrubs and plants, having been recorded on about thirty different plants. Specimens sent to this office were attacking grape, currant and gooseberry.

The adult of *Ormenis septentrionalis* Spin. is slightly larger than *O. pruinosa.* The color is a pale bluish green. The habits are probably similar to those of *O. pruinosa* although our records would indicate that *O. septentrionalis* occurs somewhat later in the season. Both species have been found together on the same plant. Adults of *O. pruinosa* in our collection have been taken from July 5 to September 12. The records for *O. septentrionalis* are from August 6 to October 3.

Where these insects are abundant and causing injury to cultivated plants, the treatment would be to spray throughly with a contact insecticide such as kerosene emulsion or 40% nicotine sulphate.

The mealy flatas were much more abundant this season on some grape vines that were not pruned in the spring than they were in an adjoining yard where the vines were pruned to one or two buds of the previous season's growth. This would indicate that these insects can be controlled by pruning to destroy the eggs. The eggs of *O. pruinosa* and the adults of both species are shown on Plate XII.

MOSQUITO CONTROL WORK.

Season of 1921.

By S. T. Sealy.

All of the salt marsh areas in the towns of Branford, East Haven, Fairfield, Guilford, Groton, Madison, New Haven, Orange and Stamford that have previously been drained for mosquito control have been carefully inspected, patrolled and maintained during the season of 1921.

Many of the ditches that were cut a few years ago had to be almost entirely recut, as drainage had been completely stopped, due to growing vegetation. Several hundred feet of new ditches have been installed to drain low places caused by the meadow sinking.

About 250 acres of marsh land in the Shippan Point section, town of Stamford, that were drained for mosquito elimination by private subscription, were approved and accepted by the Deputy in Charge of Mosquito Work. The maintenance and control work has been done under State supervision this season.

No new work has been done under the State law this year.

Some prominent citizens of Clinton and Westbrook are trying to interest their townspeople in the project of draining the salt marshes in these towns. A preliminary survey and estimated cost of drainage has been prepared for them. A stream that drains off a large amount of the storm water from Westbrook Center has caused considerable trouble. The sand shifted by the winds and tide has repeatedly closed up the outlet, making it necessary to dig it out. The labor costs, which have been rather expensive, have been paid by property owners along the shore. The water held back by a closed outlet flooded a large area, making a serious breeding place for mosquitoes. A survey was made of the brook, and plans and estimates were submitted to Mr. Wilson, a property owner on the shore front. The proposed plan calls for a 24-inch wood pipe-drain, from a point north of the beach in the deep part of stream to go in a straight line through the beach to the low water mark. Both ends of pipe line are to be anchored with concrete bulkheads. The outer end is to be fitted with a suitable tide gate and inner one with a grill to keep rubbish from entering drain. Plan also calls for a clean-out chamber to be placed in the pipe line, so as to make it possible to clean out any sand that might work its way in.

Details of the maintenance work in each town are given below:—

Branford.

The tide-gates at Indian Neck, which have seriously hindered mosquito control in that section in the past, have been replaced by new ones. It is now possible to keep the salt water from flooding the area east of the State road. This area when flooded breeds untold numbers of mosquitoes.

The gates are hung on the new road bridge and are of standard construction. They will undoubtedly last a number of years without repairs.

Mr. L. E. Rice has furnished labor and supervised the cleaning of all drainage ditches on the marshes.

The stone dike in the eastern or Stony Creek section of the town is in need of repairs. It is planned to do some repair work on this dike next season in co-operation with the dike association.

East Haven.

The marshes that are drained have been inspected and ditches cleaned. Building operations and land development along the shore west of Cosey Beach have created several extensive mosquito breeding areas by stopping the natural drainage.

Fairfield.

Maintenance work has been under the immediate direction of Mr. Nicholas Matinck. All the salt marsh ditches have been inspected and cleaned. All low swampy places were oiled with fuel oil when necessary.

Several fresh water breeding areas have been permanently eliminated, and all fresh water streams of any importance have been cleaned or oiled. The labor costs of fresh water operations were paid directly by the town.

Guilford.

Maintenance work on the Guilford marshes has been done by Mr. Frank Blatchley. The drainage ditches are in excellent condition.

On July 18, 1921, a complaint was received at this office saying that mosquitoes were very numerous in Guilford Center. The writer made an inspection of the marshes and a night collection was taken to determine what species of mosquitoes were causing the annoyance.

Following is report of inspection and collection: Inspection made on the marshes July 20, 1921. All ditches draining and in proper condition, scattered surface breeding.

Result of night collection of ten minutes duration taken at Guilford Green:

Mosquitoes taken	15	specimens
Salt marsh species	6	"
Fresh water species	9	"

The heavy infestation of mosquitoes at this time was due to heavy rainfall and exceedingly high tides, causing water to stand in places that under normal conditions would be dry.

Groton.

Salt marsh was regularly inspected and ditches cleaned as often as necessary.

Madison.

Mr. Russell Bartlett has been employed on the marsh land which is not included in the Hammonassett State Park Reservation.

Mr. Joseph P. Synnott has directed the work on the marshes controlled by the State Park Commission and several new ditches have been installed for better drainage.

New Haven.

The marsh along West River from Congress Avenue to Derby Avenue was found to be in very poor shape: several large breeding areas had been formed from lack of proper drainage. This area was inspected and ditches installed wherever necessary to insure good drainage. All other marsh areas in New Haven were inspected, patrolled and the ditches kept cleaned throughout the season.

Orange. (West Haven)*

Several hundred feet of new ditches were installed in the marsh area between Beach Street and Blohm Street, West Haven. The pipe drain at Peck Avenue was cleaned out several times during the season.

It will be necessary to repair or build a new tide-gate at Beach Street next season, as it is now impossible to keep the tide water from flooding the meadow and forming mosquito breeding areas.

Stamford.

The marsh lands in the Shippan Point section of Stamford have been inspected, patrolled and the ditches cleaned several times during the season. It has been necessary to use a considerable amount of fuel oil on the low swampy places and some of the long drainage ditches.

Cost of Maintenance, Season 1921.

Madison	$ 207.00
Guilford	421.50
Branford	1,179.00
Fairfield	1,624.85
New Haven	796.85
Orange	152.00
West Haven	130.10
Groton	72.00
Stamford	258.15
East Haven	90.00
Total	$4,931.45

The total cost for the season is $4,931.45, of which one-fourth, or $1,232.86, is borne by the State. The other three-fourths, or $3,698.59, is collected by the State Comptroller from the towns.

*The town of Orange was divided by the Legislature, and after July 1, 1921 all of the shore portion where this work was done has been called West Haven.

MISCELLANEOUS INSECT NOTES.

Dog Biscuit Infested with Drug Store Beetle:—On June 20, samples of dog biscuit were brought to the Station which had been attacked by the drug-store beetle, *Sitodrepa panicea* Linn. One cake was riddled with holes. This insect is known to attack a large number of stored vegetable foods, and certain plant products used as drugs. Frequent heating or fumigating with carbon disulphide are the remedies.

A Leaf Roller of Hickory:—A number of leaf rollers were collected from a large hickory tree near Forest and Chapel Streets, New Haven, on June 9, by Messrs. Britton and Zappe. The larvae were about an inch in length, yellowish-green, and rolled the leaves in a conspicuous manner. On June 21, three adults emerged. These had a wing-expanse of about an inch, were dark brown, with darker oblique bands on the forewings. Specimens were sent to the Bureau of Entomology, Washington, D. C., and identified by Mr. Carl Heinrich as *Eulia juglandana* Fernald, a species not hitherto recorded from Connecticut.

The Stalk-Borer:—Considerable injury was done to corn and other vegetable crops in 1921, by the stalk-borer, *Papaipema nitela* Guen., which was received from New Britain, Middletown, and Hamden in corn and from Hockanum, Windsor and Cromwell in tobacco. Though we may expect to find the larva of this insect in all kinds of herbaceous stems, these are the first specimens that the writer has seen injuring tobacco plants. A full account of this insect, with illustrations, may be found in the Report of this Station for 1919, page 180.

An Enemy of Japanese Iris:—During June, Mr. F. A. Bartlett of Stamford informed the writer that the blossoms of his Japanese iris plants had been injured and some of them ruined by small black weevils which ate the petals. He was asked to send specimens, and on returning home hunted for some but could not find a single specimen. Later in the season he discovered what he took to be the same species, breeding in the seed pods, and he sent specimens. It proved to be *Mononychus vulpeculus* Fabr., a weevil known to breed in the seed pods of the native flag *Iris versicolor*.

A Curious Caterpillar on Bayberry:—On June 5, Miss G. M. Finley brought to the laboratory some peculiar larvae which were found feeding upon the leaves of bayberry in Hamden. They were about the same color as the leaves, and in outline were notched or serrated. They pupated on June 18, making a loose cocoon of bits of leaf webbed together. Later the adults emerged,

and proved to be beautiful little Geometrid *Aplodes mimosaria* Guenee. Wing-expanse about one inch, color pale green, both front and rear wings being crossed by two narrow whitish lines; fringe pale yellow, costal margin of forewings white, antennae, legs and abdomen white.

Paria canellus Injuring Japanese Walnut:—On April 26, specimens were received from Dr. W. C. Deming of Wilton, with a statement that the beetles were feeding upon the tender terminal leaves of Japanese walnut, thus checking the growth and injuring the trees. The beetles received represented three varieties of the strawberry root worm or borer, *Paria canellus* Fabr., as follows: *aterrimus* Oliv., *gilvipes* Dej., and *quadrinotatus* Say. These beetles are usually abundant and feed upon a large number of plants. Spraying the buds and new leaves frequently with arsenate of lead will prevent extensive injury.

A Bayberry Beetle:—On June 24, Messrs. Zappe and Britton observed that many bayberry bushes along the railroad between Saugatuck and South Norwalk had been defoliated by small shiny green beetles. Many were collected and proved to be *Colaspis favosa* Say, a species accredited to Dakota and Florida, and not previously recorded from Connecticut. These beetles vary in color, some being bluish, some greenish, but all have a bronzy metallic luster. The wing-covers are deeply and regularly punctate. There is also considerable variation in size, the average being about three-sixteenths of an inch in length. As the bayberry is not cultivated except perhaps in parks and on large private estates, this beetle cannot be said to be causing injury. Spraying with lead arsenate will prevent defoliation.

Larvae Feeding Upon Witch Hazel:—On June 2, some curious coiled larvae were found on witch hazel in North Branford by Messrs. Walden and Zappe. They were greenish-white with noticeable granular wax secretion and about one and one-half inches long. They were not carefully examined at the time but on account of their coiled resting position, were supposed to be saw fly larvae and put in a rearing cage. They were nearly full grown and pupated in due season. On October 4, two Noctuid moths emerged which we identified as *Conistra indirecta* Walker, commonly labeled in collections as *Scopelosoma moffatiana* Grote. The forewings are bright rust red with three narrow darker transverse bars. Wing-expanse, about one and one-fourth inches. Larvae are shown on Plate XIII, a.

A New Pest of Willows:—On June 24, Messrs. Britton and Zappe visited several localities in Fairfield County, and in company with Mr. F. A. Bartlett of Stamford, examined several willow trees in Greenwich and Port Chester, N. Y., which had been

partially defoliated by the larvae and adults of a small bluish-green leaf beetle, *Plagiodera versicolora* Laich. This insect is about three-sixteenths of an inch long and is an European species which has recently appeared in the vicinity of New York City; from this point it has now spread into Connecticut and New Jersey. It feeds upon willow and poplar, and injured leaves are shown on Plate XIII, b. Spraying with arsenical poisons is an effective means of control.

An Engraver Beetle Injuring Pine:—On August 30, there was brought to the laboratory, a section of the wood and bark of the trunk of a large white pine tree which had recently died, at Putnam. There were many holes in the bark, and some of these contained Scolytid beetles which were identified as *Ips calligraphus* Germ. This is the largest Scolytid occurring in the north-eastern states and is usually found in dying trees and logs. According to Swaine[1] it enters trees green enough to form pitch tubes, and may at times be considered a primary enemy. Apparently the owner considered that the beetles were responsible for the death of the tree, but no examination was made from this office, and possibly the tree was first injured by some other cause.

Larkspur Plants Injured by Mites:—For a number of years, the writer has observed in his own garden and elsewhere an occasional plant with the newer leaves curled and swollen unnaturally, and that such plants failed to blossom. At first this was thought to be of bacterial origin, but on referring specimens to the botanical department, the report came back that no bacteria or fungi were found. Specimens of such plants were received from Ansonia on May 31, and from New Haven on June 1 and June 3, and are shown on Plate XIV, a. On examining the tissues a few mites were noticed and these were afterward examined by Dr. Garman who identified them as belonging to the genus *Tarsonemus* and probably being *T. pallidus* Banks, the same species known to attack and cause similar injury to chrysanthemum, snap-dragon and cyclamen.[2] If this proves to be true, possibly the plants may be saved by several thorough sprayings with nicotine solution and soap(1 teaspoonful in 1 gallon of water).

The Barberry Web-Worm:—On September 9, twigs of Japanese barberry containing webs and nearly full-grown larvae, were received from Mr. Walter Shaw, New Haven, with a request for information regarding the identity and habits of the insect. The adult is a moth belonging to the family Pyralidae, and bearing

[1] Swaine, J. M., Canadian Bark-Beetles, Part II, 112, 1918.
[2] Report of Connecticut Agricultural Experiment Station for 1914, page 176.

the name of *Omphalocera dentosa* Grote. A full account of this insect with illustrations appeared in an earlier report of this Station.[1] The larvae are black, checkered with white and are less than an inch long when fully grown. They live in tube-like cases formed of leaves and excrement webbed together. The adult moth has a wing-expanse of between one and one and one-fourth inches, and is of a dusty brown color, with a darker area near the center of the costal margins of the forewings. This insect was quite abundant in 1911 and 1912, and defoliated some barberry hedges around New Haven. Apparently it shows a preference for the common barberry *Berberis vulgaris,* but also occasionally attacks the Japanese barberry *B. Thunbergii.* Spraying with lead arsenate will prevent injury by this insect.

The Bumble Flower Beetle Injuring Corn:—On August 29, an ear of sweet corn was received from Mr. C. D. Clark, County Agricultural Agent, Danbury, Conn., from the field of H. M. Knapp, containing a specimen of the bumble flower beetle *Euphoria inda* Linn., which was eating the immature kernels as shown on Plate XV, a. This beetle usually feeds upon fermenting sap, decaying fruits, etc., and is sometimes found in connection with injury caused by other insects. We might expect to find it following the work of the corn ear worm, but in this case it appeared to be the primary cause of injury; it has also been recorded[2] as injuring unripe corn in this manner. On September 12, another specimen was received from the field of G. N. Peterson of Unionville, through B. G. Southwick, County Agricultural Agent, Hartford, on the same ears where corn ear worm was feeding. The beetle is yellowish-brown, sprinkled with small black dots. It is about half an inch in length, and appears in late summer and early fall. There is only one generation each year and the insect breeds in rotting turf, manure, and other decaying vegetable matter. Hand picking is the best remedy for the control of this insect on sweet corn.

The Box-Wood Leaf Miner in Connecticut:—On December 15, 1921, when the manuscript of this report was nearly finished, specimens of the box-wood leaf miner or midge *Monarthropalpus buxi* Labou., were received from South Norwalk. This is an European pest discovered in this country in 1910, but not previously recognized as occurring in Connecticut. The adults emerge the latter part of May and first of June, and lay their eggs. The winter is passed by the larvae which are nearly grown. The most

[1] The Pyralid (*Omphalocera dentosa* Grote), A Pest of Barberry Hedges, Report Connecticut Agricultural Experiment Station for 1911, page 292.
[2] Manual of Vegetable-Garden Insects, by C. R. Crosby and M. D. Leonard, page 231, 1918.

promising control measures should be applied at the time that the adults begin to emerge. Hamilton[1] found that spraying both upper and under surfaces of the leaves with common molasses, one part in three parts water, caused nearly all the adult flies to become entangled in the sticky spray before they could lay eggs. Also spraying once with Black Leaf 40 and once with Black Leaf resinate, each diluted one part to 500 parts water, killed about 80 per cent. of the flies, but this should be repeated every four or five days during the period while the adults are emerging.

The Resplendent Shield-Bearer:—During the season it has been rather common to find apple leaves with several holes through them, caused by the mines of the resplendent shield-bearer, *Coptodisca splendoriferella* Clem. The writer noticed this form of injury on his own grounds, and the winter cases of the insect were received from Danielson, March 15. In preceding years this insect was received from Newtown, February 13, 1913, and from Greenwich on cherry November 17, 1920. It was first recorded from Connecticut by Dr. W. C. Sturgis[2] in 1893, as injuring quince trees in Cheshire. This insect occurs throughout the northern United States from Maine to Minnesota and has been reported from Canada.

The adult is a beautiful gray moth with golden head and ends of forewings marked with gold, silver and dark brown streaks. The eggs are laid on the leaves in May and the young larvae make a blotch-shaped mine in the leaf nearly one-fourth of an inch in diameter. When nearly full grown each larva lines its mine with silk and cuts out the case in the shape of a shield, and goes to the bark. These little cases are fastened to the bark of trunk and twigs and inside the larvae pass the winter. The mines and the winter cases are shown on Plate XIV, b. Very little has been published about this insect and one of the best accounts is by Comstock.[3] A good recent account, though brief, is given by Slingerland and Crosby.[4] There are two broods each season. Where orchard trees are thoroughly sprayed with lead arsenate including nicotine sulphate, probably there will be little or no injury from this curious little insect.

Flea Beetles and Tobacco Wild Fire:—During the tobacco wild fire epidemic in the tobacco seed beds in the spring of 1921, quit a number of flea beetles, *Epitrix cucumeris* Harris, were present. It has long been known that insects often carry diseases

[1] C. C. Hamilton, Journal of Economic Entomology, Vol. 14, page 359, 1921.
[2] Report Connecticut Agricultural Experiment Station for 1893, page 80.
[3] Report U. S. Department of Agriculture for 1879, page 210.
[4] Manual of Fruit Insects, page 75, 1914.

from plant to plant. With this in mind, several attempts were made to transmit the wild fire disease from diseased to healthy plants by means of flea beetles.

Dr. Florence A. McCormick of the botanical department and the writer carried on a few simple co-operative experiments to see if this could be done. Beetles were captured from infected seed beds and then confined in cages containing healthy plants. Others were captured on tomato plants and were confined in petrie dishes containing leaves on which there were large diseased areas. They were then transferred to cages containing healthy plants. In every case the beetles had first eaten diseased plants and later healthy ones. Seventeen attempts were made to transmit the tobacco wild fire disease in this way, but in no case were we successful in producing the disease on healthy plants. These experiments are altogether too meager to be conclusive and should be continued. M. P. Zappe.

Apple Seed Chalcid in Connecticut:—The presence of the apple seed chalcid *Syntomaspis druparum* Boh., in Connecticut, was discovered August 19, 1921, by Dr. Philip Garman, at Cornwall, where some wild apples were badly infested, nearly every fruit showing the external punctures. Dr. Garman afterwards found a few cultivated apples in Mr. Frank N. Platt's orchard at Milford which had been attacked by this insect. The punctures resemble those of the false red-bug, but on cutting open the apple a hard streak will be found connecting each puncture with a seed. This insect is an European species first discovered in this country by Prof. C. R. Crosby at Ithaca, New York, in 1906. It is known to occur throughout the northeastern United States at least as far west as Michigan, and as far south as Virginia. Most of the commercial varieties are not subject to attack but the lady apple and crab apples are often injured. Though there is only one generation each season, and the winter is passed by the larvae in the seeds, it has been found that only a part transform and emerge as adults the following spring. In fact more than half (55 per cent.)[1] lived over two winters in the seeds before transforming. About the only artificial means of control consist in destroying all drop fruit and culls, especially of the wild seedling apples and crab apples. If made into cider the pomace should be destroyed in order to kill the larvae in the seeds, which would probably not be crushed in the press.

Termites Injuring Telephone Wires:—During a damp spell of weather in July 1921, the Southern New England Telephone Company reported insects eating the insulation from their tele-

[1] *Syntomaspis druparum* Boh., The Apple Seed Chalcid, by R. A. Cushman, Journal of Agricultural Research, Vol. VII, page 487, 1916.

phone wires. The writer and one of the Telephone Company's engineers visited the scene of the trouble, which was in the basement of the office building of the New York, New Haven and Hartford Railroad Company. The wires from their switchboard went down to the basement and then up to the various offices in the building. All of the wires were insulated first with rubber and then a fabric covering over the rubber. It was necessary to have all the wires pass from a corridor into another room in the basement before going upstairs. The wires were all massed together, wrapped with tape and conducted through a hole in the top of the door frame. At this point the termites had chewed off the insulation and in some cases exposed the copper wire. Wherever the wire was completely bare, moisture would collect and electrolysis set in, and caused trouble with the telephone service. See Plate XVI, a. The door frame was taken apart and the colony of termites found. The building is built entirely of steel and masonry, and all the termites were in this single wooden door frame. Nobody knew where they came from unless they were in two large boxes of sawdust that were stored nearby. It was recommended that the entire door frame be taken apart and sprayed either with kerosene or hot water and soap.

Late in the fall inquiries were made at the office of the Telephone Company, and the reply stated that no further trouble had been reported. Specimens were not taken for identification, but probably this insect was *Reticulitermes flavipes* Kollar, a species common in this locality. M. P. Zappe.

Rhododendron Lace Bug:—During the summer of 1921, one of the Connecticut nurseries had a serious outbreak of the rhododendron lace bug *Leptobyrsa rhododendri* Horv. The nursery firm thought that the insects were brought in on rhododendrons which they had bought from a North Carolina nursery. This insect is not new to Connecticut, having been taken in Rockville, South Manchester, Middlebury, Greenwich, New Haven and Hamden.

The nursery was visited on July 6, 1921. At this time the insect was in the adult stage. Eggs were also present but no nymphs. Other visits were made during the summer but no nymphs were found at any time. Apparently there is but one brood in Connecticut, although two broods have been recorded from New Jersey. Injured leaves are shown on Plate XV, b. The insects cause injury to the leaves by sucking out the juices from the under side. The injured leaves show whitish spots or lines scattered all over the surface. Often the leaves have a tendency to curl and in extreme cases turn brown and drop off. The under side of the leaves are disfigured by brownish spots along the midrib under which the eggs may be found, also by the excrement of the insects.

Several sprays were tried as control measures. As this is a sucking insect and feeds on the under side of the leaves, a contact spray must be used and must be applied to the under side of the leaves to hit and kill the bugs. One pound of common laundry soap to eight gallons of water sprayed on the under side of the leaves killed all lace bugs that were hit.

Nicotine sulphate (2 teaspoonsful to 1 gallon of water) and one-half ounce of soap was a very effective remedy and killed all that were reached by the spray.

Kerosene emulsion made as follows:

Kerosene	2 gallons
Water	1 gallon
Soap	½ pound

Dissolve soap in hot water, add kerosene and churn until a creamy emulsion appears. Dilute nine times. This was also effective in controlling this insect but more trouble to prepare than some of the other sprays.

Scalecide, 1 part in 25 parts of water, was also tried, but most of the insects ten minutes after spraying were still alive and crawling around on the leaves. Some were killed, but the majority escaped.

This is not an especially hard insect to kill, but perhaps it may be necessary to spray twice in order to kill them all. A few might escape the first treatment which would be killed by the second.

M. P. Zappe.

Parandra Borer Injuring Maple Tree:—On August 10, 1921, the writer examined a sugar maple street tree in front of the premises of Mr. T. S. Allis, 54 Atwater Avenue, Derby. This tree had been injured in preceding years by the maple borer, but in the spring had leafed out well and later the leaves dried up and dropped, only a few green ones remaining. In the trunk which was nearly all dead there were many (perhaps 40-50) exit holes. These holes were nearly circular, but slightly flattened, and in some of them were found living or dead specimens of *Parandra brunnea* Fabr. One beetle was crawling upon the bark of the trunk. The illustrations on Plate XVI, b, show the holes in the trunk and the appearance of the adult beetle. The borer belongs to the Order Coleoptera and family Cerambycidae, and is known to attack and kill various fruit and shade trees, particularly if they have been injured previously. It usually lays its eggs in the dead or decaying wood where a tree has been mutilated or otherwise injured. Chestnut telephone poles are occasionally damaged by this borer, which has also been recorded from ash, black walnut, hickory, beech, chestnut, chinquapin, oak, elm, willow, tulip tree, locust, ailanthus, maple, bass-wood, apple, pear, plum, wild and

cultivated cherry, and pine. According to F. E. Brooks,[1] old apple, pear and cherry trees are especially liable to attack, particularly if they have hollow bases, cavities or decaying areas in the trunk, or if storms have broken their larger branches. Hart[2] calls this insect the heart-wood borer because it tunnels in the heart wood, but its attacks are not confined to the heart wood but may involve the sap wood, either dead or living. Most of the injury is usually in the main trunk or in case of telephone poles according to Snyder,[3] near the ground line or from one to two feet above it.

On July 26, 1905, this beetle was received from South Manchester, where it was found boring in the trunk of an oak tree.

The Parandra borer is a flattened brown beetle nearly three-fourths of an inch in length and emerges during July and August. The female lays eggs in small punctures in the wood around wounds and decayed places, in groups of ten or twelve. The egg is creamy-white, oblong-ovate, and about 1.5 mm. long by .5 mm. thick. It hatches in two or three weeks, and the larva is yellowish-white with a black head. The galleries are very crooked and long but the larva never gets very far away from its hatching point, and when mature, pupates in a cell at the terminus of its burrow. No sawdust is thrown out from the burrows of this beetle, and it is thought that three years are required for this insect to pass from the egg to the adult stage.

As the attacks of this borer always or nearly always follow some other injury or mutilation, the trees should be kept in the best possible condition; remedial measures should be directed against other borers, and if a tree is injured or mutilated, the wounds should be given attention and all cavities cleaned out and filled. All unprotected wood surfaces should be dressed with paint. If all of these matters are given thorough and prompt attention there will be little chance for the entrance of the Parandra borer.

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[1] The Parandra Borer as an Orchard Enemy, Bulletin 262, U. S. Department of Agriculture, 1915.

[2] The Heart-Wood Borer, 26th Report of the State Entomologist of Illinois, page 68, 1911.

[3] The Chestnut Telephone-Pole Borer, Bulletin 94, Bureau of Entomology, U. S. Department of Agriculture, page 3, 1910.

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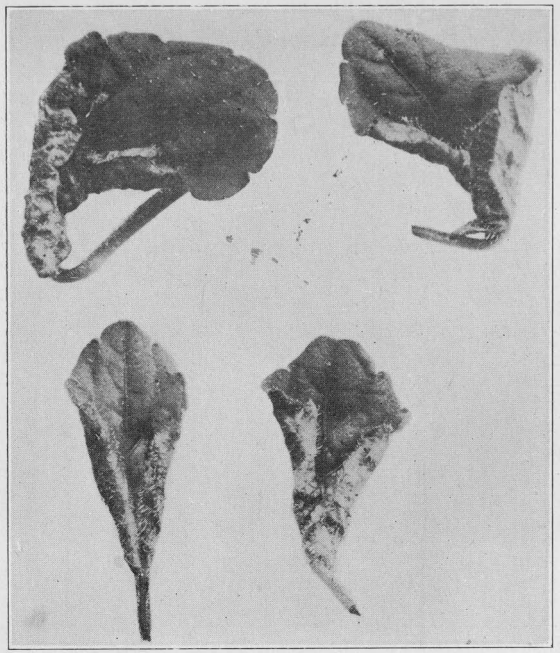
ILLUSTRATIONS.

The illustrations in this report (Bulletin 234) are from the following sources:—text figures are all from drawings as follows:—Figure 1, map drawn by A. E. Moss; Figure 2 drawn by Philip Garman; Figures 3, 4 and 5, from Spray Calendar drawn by Mrs. E. L. Beutenmüller; Figure 6, drawn by R. E. Snodgrass, lent by the U. S. Bureau of Entomology. The Plates are all from photographs; Plates I, III, a, IV, a, by W. E. Britton; Plate II, by Philip Garman; Plates IX, a, c, and d, X, a, by H. A. Doty; Plate XIV, b (except inserts), from the report for 1893 by W. C. Sturgis; all others by B. H. Walden.

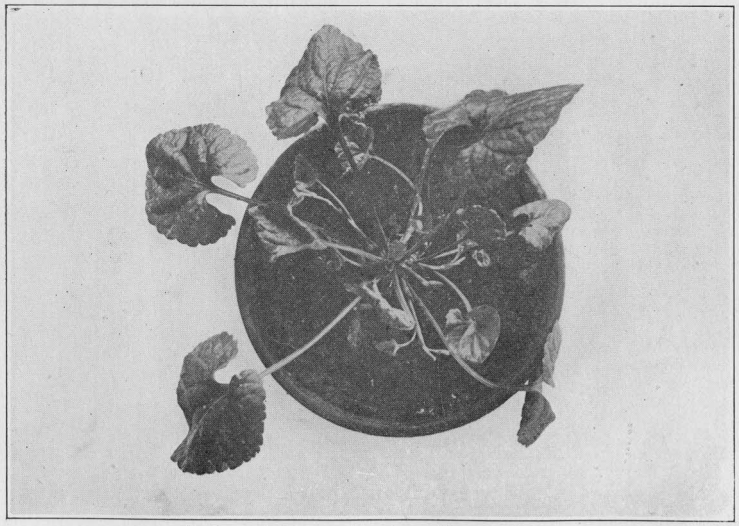
a. Spraying nearby foliage with auto power sprayer, Mechanicsville.

b. Spraying a tall tree with auto power sprayer, Mechanicsville.

GIPSY MOTH WORK.



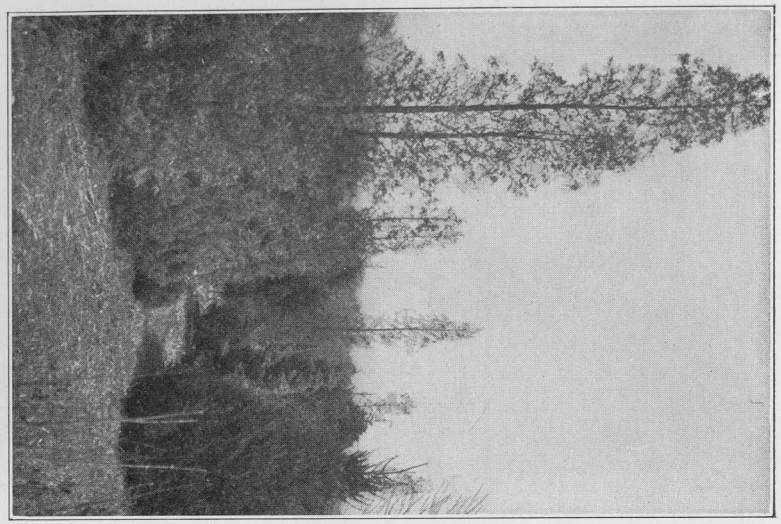
a. Infested and distorted leaves or "galls." About natural size.



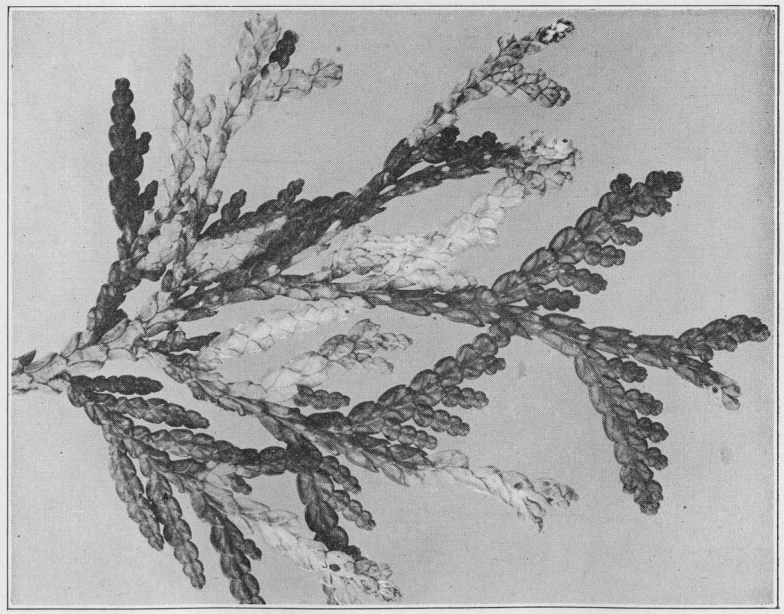
b. Infested plant showing distorted leaves.

VIOLET GALL MIDGE.

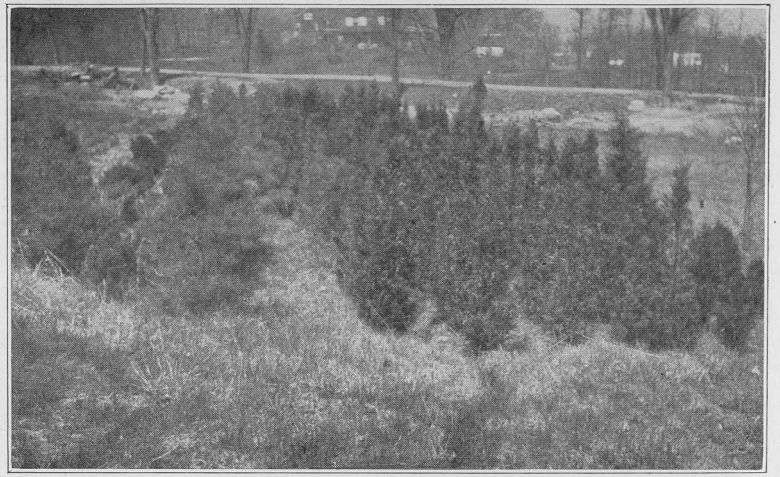
a. Large trees in nursery which were seriously injured and turned brown.



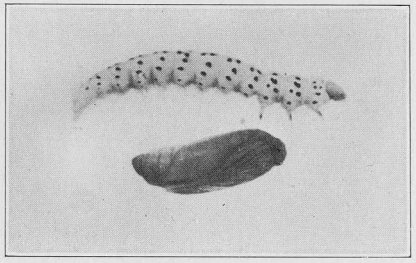
b. Twig of arbor vitae showing mined leaflets. Twice enlarged.



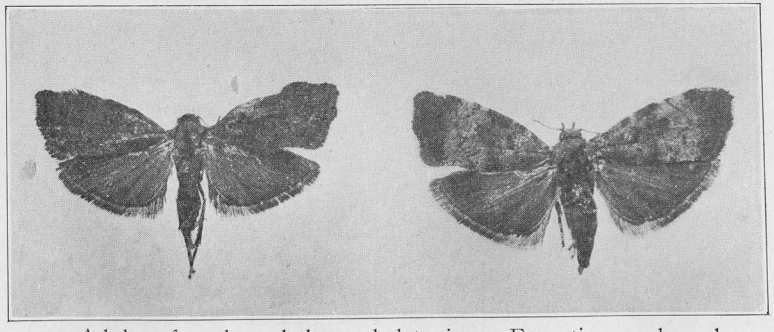
ARBOR VITAE LEAF MINER.



a. Block of pyramidal arbor vitae where experiments were conducted.

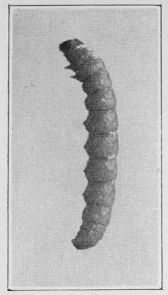


b. Larva and pupa of apple and thorn skeletonizer. Four times enlarged.

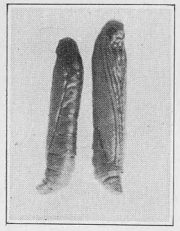


c. Adults of apple and thorn skeletonizer. Four times enlarged.

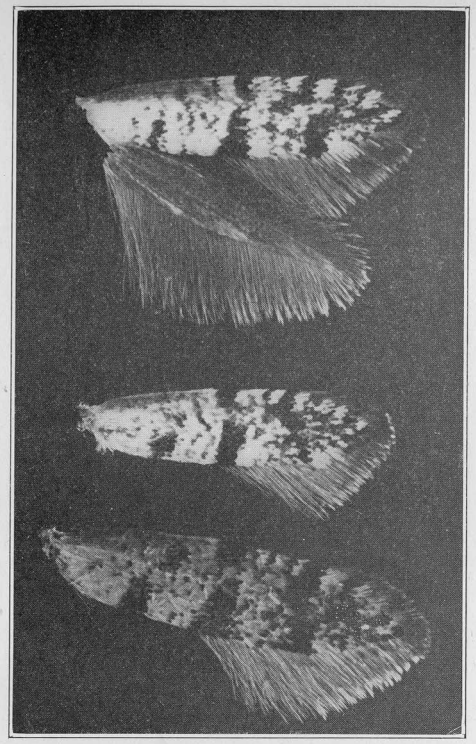
ARBOR VITAE LEAF MINER AND APPLE AND THORN SKELETONIZER.



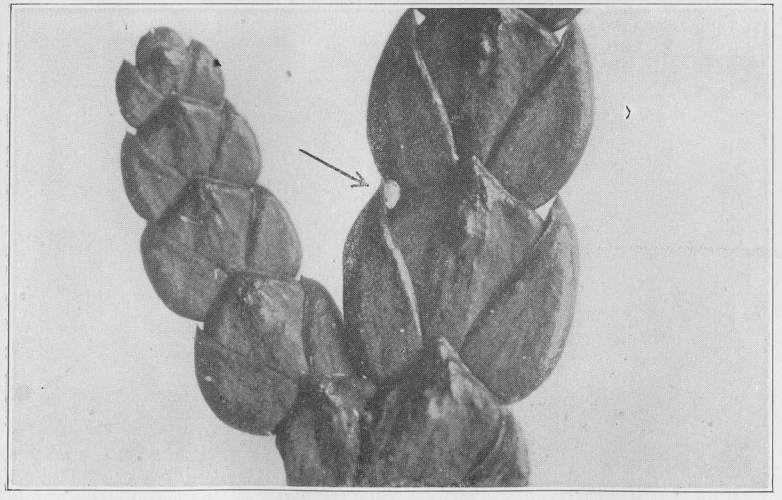
a. Larva. Six times enlarged.



b. Pupae. Six times enlarged.



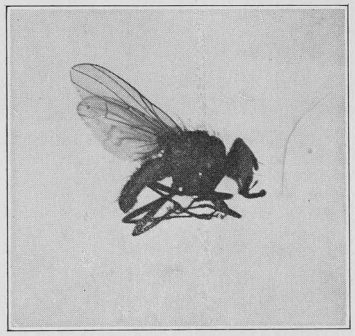
c. Wings of adults. Twelve times enlarged.



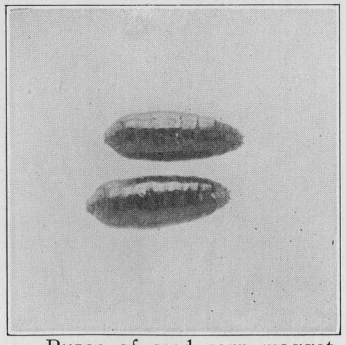
d. Egg on leaflet. Twelve times enlarged.

ARBOR VITAE LEAF MINER.

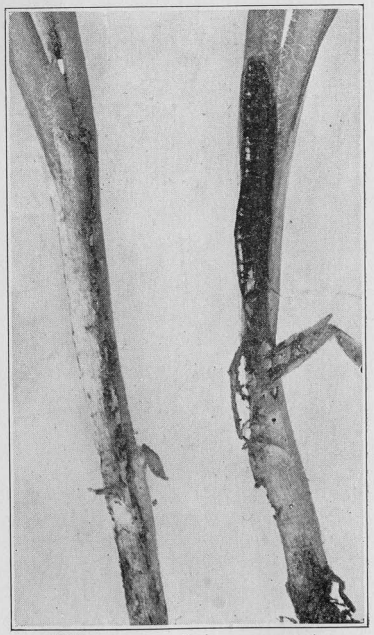
a. Stems of newly-set tobacco plants, showing injury by seed corn maggot. Twice enlarged.



b. Adult of seed corn maggot. Four times enlarged.

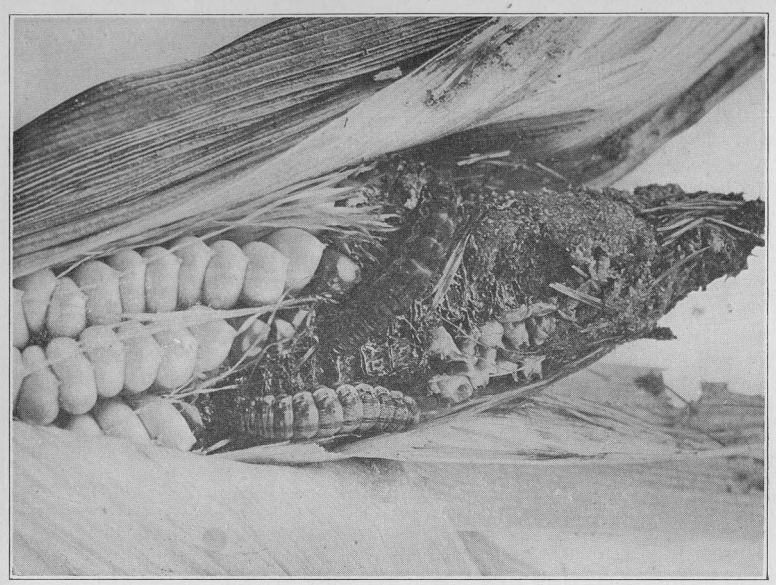


c. Pupae of seed corn maggot. Four times enlarged.

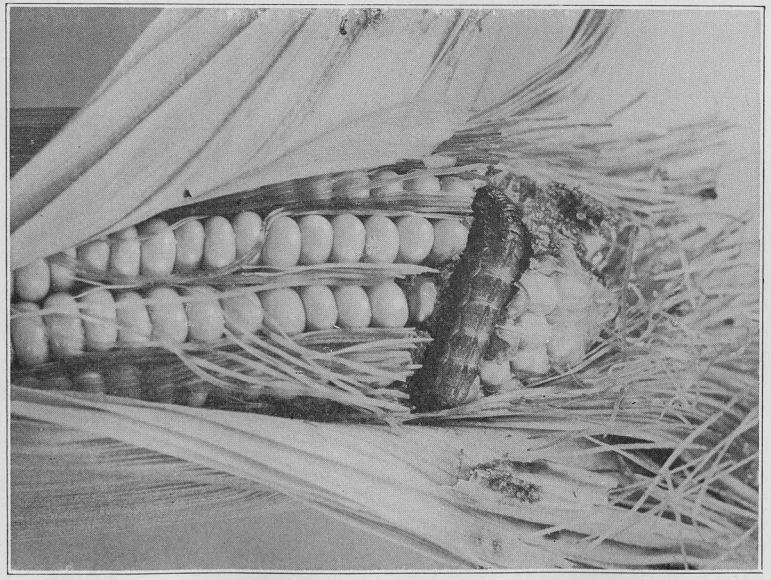


d. Wire worm injury on tobacco plants. Twice enlarged.

TOBACCO PLANTS INJURED BY SEED CORN MAGGOT AND WIREWORMS.

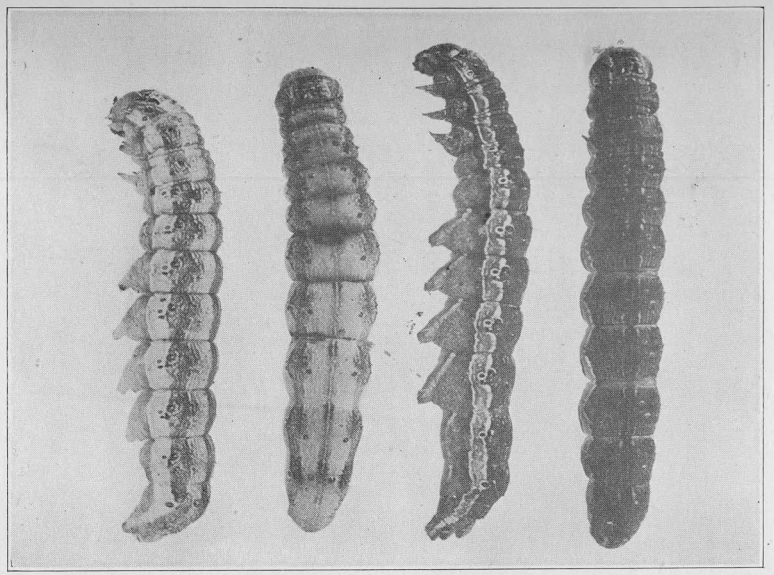


a. Light and dark larvae, feeding at tip of ear. Natural size.

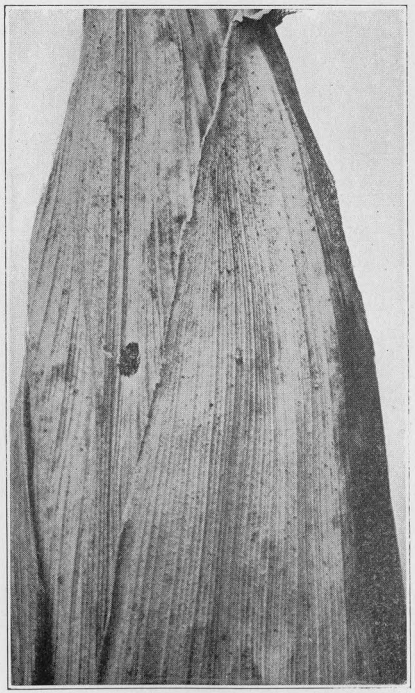


b. Medium colored larva. Natural size.

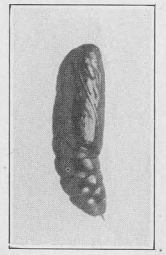
CORN EAR WORM.



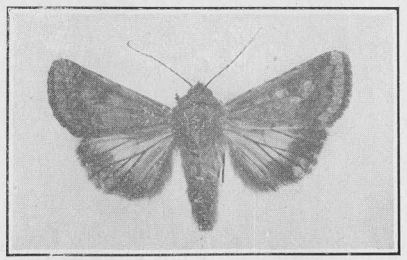
a. Larvae, dorsal and lateral views showing variations in color and markings. Twice enlarged.



b. Tip of ear of corn showing where a half-grown larva has eaten through the husk. Natural size.

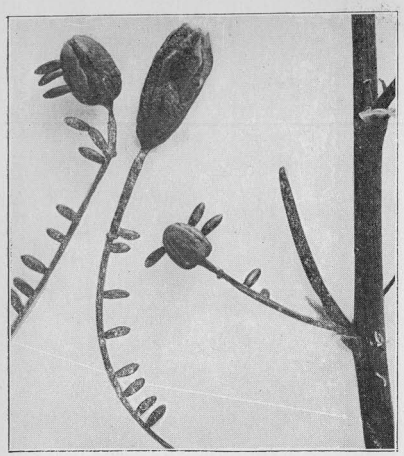


c. Pupa.
Natural size.

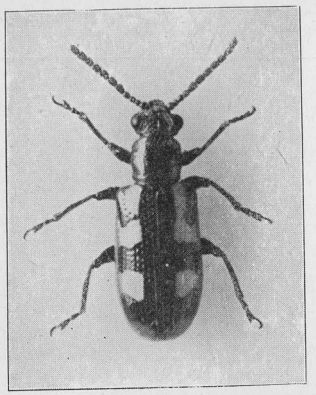


d. Adult moth. Natural size.

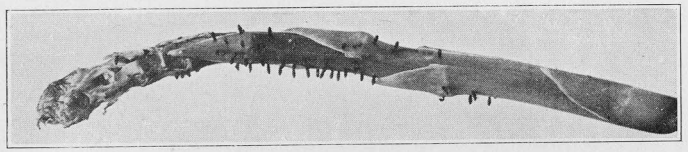
CORN EAR WORM.



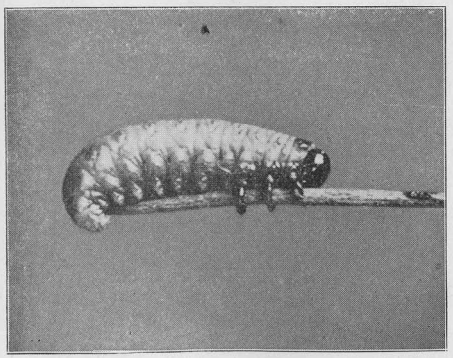
a. Eggs of common asparagus beetle as laid upon mature stems. Much enlarged.



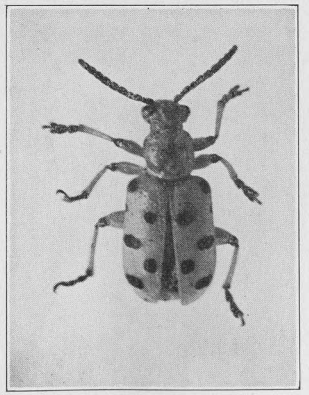
b. Common or blue asparagus beetle. Enlarged about five times.



c. Eggs of common asparagus beetle as laid upon tender shoot. Natural size.

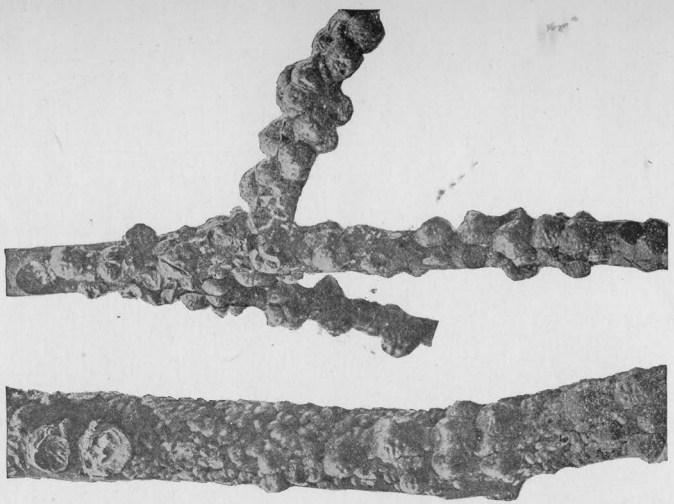


d. Larva of common asparagus beetle. Much enlarged.

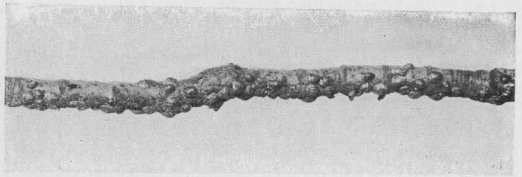


e. Red or 12-spotted asparagus beetle. Enlarged four times.

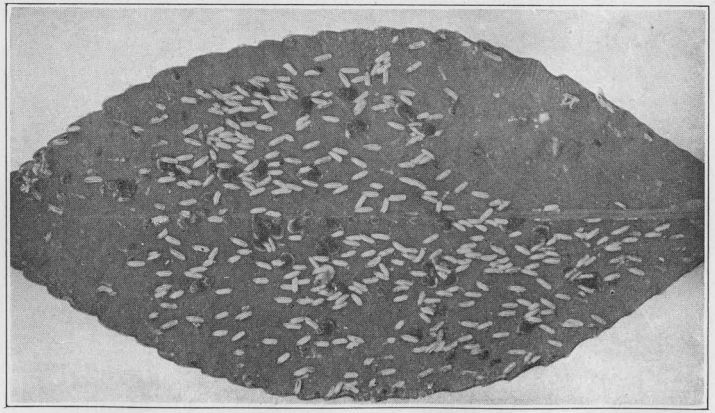
ASPARAGUS BEETLES.



a. Tulip-tree scale. The large brown hemispherical shells are the females, and the smaller gray shells on lower twig are those of the males. About natural size.



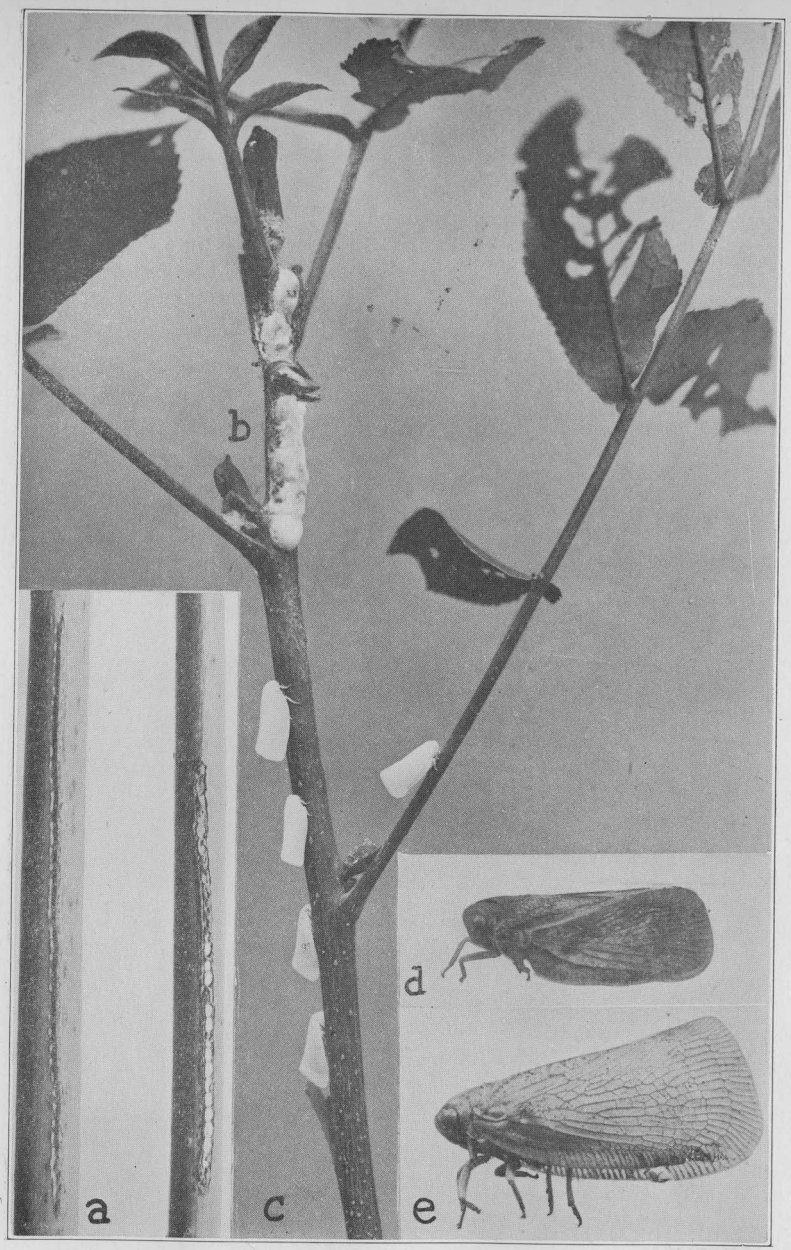
b. Terrapin scale. Natural size.



c. Euonymus scale. The narrow white shells are those of the males: the larger pear-shaped gray ones are females. Twice natural size.

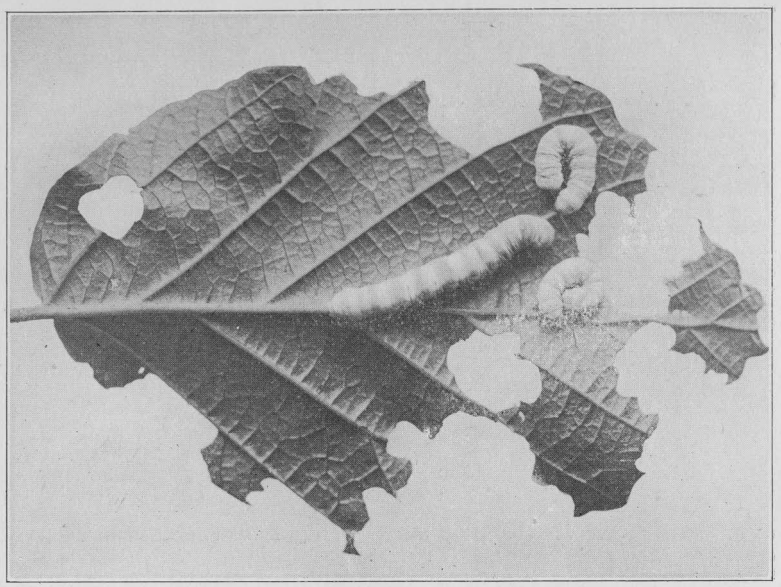
a. Pine leaf scale. Twice enlarged.

b. Cottony maple scale. Natural size.

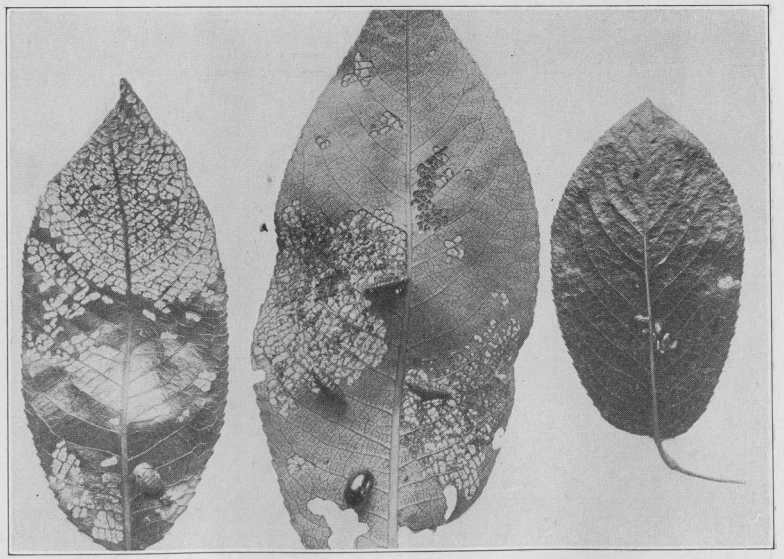


a. Egg-punctures of *Ormenis pruinosa,* twice enlarged; b. Froth masses of *Ormenis septentrionalis,* natural size; c. Adults of *O. septentrionalis,* natural size; d. Adult of *O. pruinosa,* four times enlarged; c. Adult of *O. septentrionalis,* four times enlarged.

THE MEALY FLATAS.



a. Larvae of the moth, *Conistra indirecta* Walker, feeding upon hazel. Natural size.



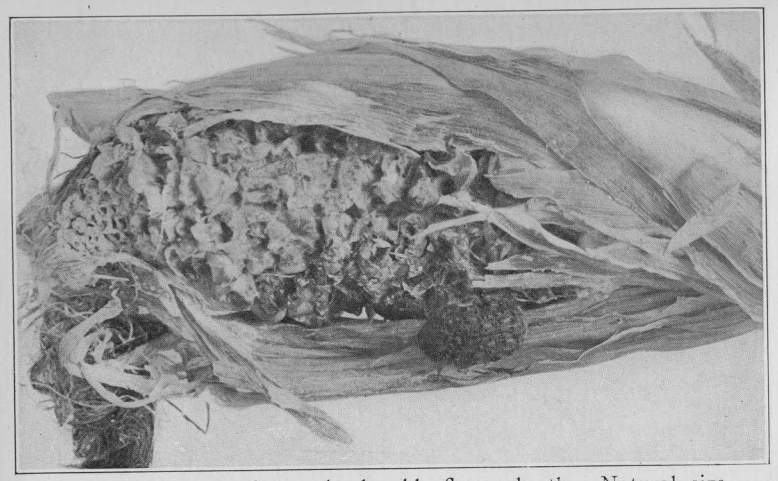
b. Larvae, pupa and adult of *Plagiodera versicolora* Laich., and injury to willow leaves. Slightly enlarged.

INSECTS ATTACKING HAZEL AND WILLOW.

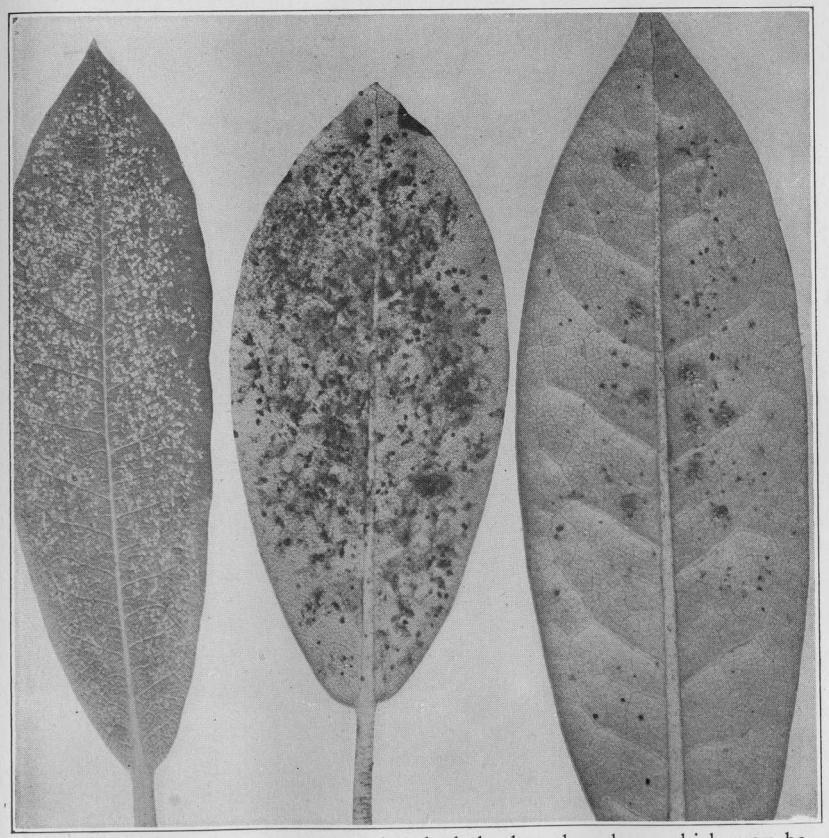
a. Larkspur leaves curled by mites, healthy leaf at left. Somewhat reduced.

b. Quince leaves injured by resplendent shield bearer: insert at left shows mines; insert at right shows winter case of larva. Both greatly enlarged.

LARKSPUR INJURED BY MITES; RESPLENDENT SHIELD BEARER.



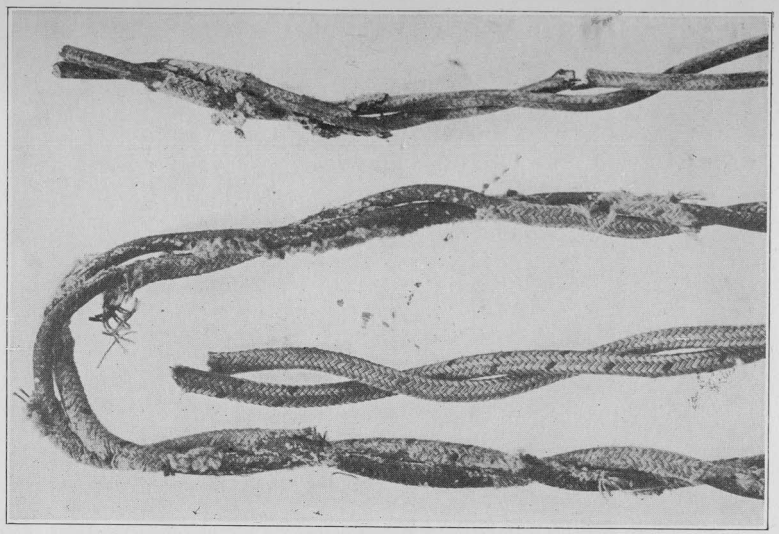
a. Injury to ear of corn by bumble flower beetle. Natural size.



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

BUMBLE FLOWER BEETLE AND RHODODENDRON LACE BUG.

PLATE XVI.



a. Inside telephone wires showing how the covering and insulation was eaten off by white ants. Natural size.

b. Maple tree with exit holes of the Parandra borer: beetle, natural size.

TELEPHONE WIRES INJURED BY WHITE ANTS; PARANDRA BORER.

CONNECTICUT
AGRICULTURAL EXPERIMENT STATION
NEW HAVEN, CONN.

BULLETIN 235 FEBRUARY, 1922

EXPERIMENTS IN DUSTING VERSUS SPRAYING ON APPLES AND PEACHES IN CONNECTICUT IN 1921.

By W. E. Britton, M. P. Zappe and E. M. Stoddard.

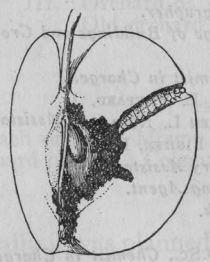


Figure 7. Apple Worm or Codling Moth.

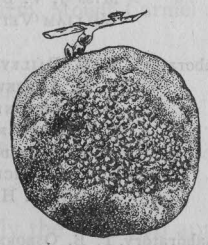


Figure 8. Brown Rot of Peach.

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

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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February, 1922.

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Experiments in Dusting versus Spraying on Apples and Peaches in Connecticut in 1921.

By W. E. Britton, M. P. Zappe and E. M. Stoddard.*

The series of experiments with dusts in comparison with liquid sprays for controlling the common insect and fungous pests of apple orchards in Connecticut, was begun in 1920, and the results printed in the Report of this Station for that year, pages 168-177. This project, considerably enlarged and including peaches, was continued in 1921. In 1920 the tests were all made in one orchard, while in 1921, experiments were conducted in four apple orchards and two peach orchards, as follows:—

APPLE ORCHARDS.

Orchard No. I.	Young orchard, Station Farm, Mount Carmel	96 trees
" " II.	Orchard of W. F. Platt, Orange	97 "
" " III.	Orchard of F. N. Platt, Milford	524 "
	Old orchard, Station Farm, Mount Carmel	40 "
		757 trees

PEACH ORCHARDS.

Station peach orchard, Mount Carmel	150 trees
Peach orchard of M. L. Coleman, Cheshire	113 "
	263 trees

Originally it was planned to use only the first two apple orchards and the peach orchards, but later we were offered the use of the third apple orchard. We desire to express our appreciation and thanks to the owners of orchards No. II and III and to Messrs. M. L. and Raymond Coleman for their co-operation in this work; also to Mr. B. A. Porter in charge of the Wallingford field station of the Bureau of Entomology, for the use of the dusting machine, and for aiding us in making some of the applications, and in scoring the fruit. Mr. George E. Graham of the botanical department of this Station assisted in applying some of the treatments, and Messrs. B. H. Walden and Philip Garman of the entomological department, and F. D. Luddington, E. R. Barton, R. C. Botsford and J. R. Pedersen, temporary employees, aided in gathering and scoring the fruit.

The owners of the orchards furnished spray outfits with team and driver for each of the spray applications in orchards II and III.

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* The planning of these experiments and the preparation of this paper are the joint work of the writers. The applications were made by Messrs. Zappe and Stoddard, who also supervised and took part in the harvesting and scoring of the fruit.

Apples.

MATERIALS USED.

Sprays:—

The liquid spray for all treatments in each of the three apple orchards was made as follows:—

Liquid lime-sulphur	3 gallons
Lead arsenate (dry)	3 pounds
Nicotine sulphate (Black Leaf 40)	¾ pint
Water	100 gallons

Dusts:—

SULPHUR-LEAD DUST.

Powdered sulphur	90 parts
Lead arsenate (dry)	10 parts

This dust was used only in the eastern part of orchard No. III, and as no treatment was given until after the bloom was over and as aphids and red bugs were rather scarce, the nicotine was omitted.

SULPHUR-LEAD-NICOTINE DUST.

Powdered sulphur	90 parts
Lead arsenate (dry)	10 parts
Nicotine sulphate (Black Leaf 40)	1 per cent.

This dust was purchased and should have contained one per cent. nicotine sulphate. During the course of making the applications, there seemed to be considerable difference in the color and odor of the material in some of the containers. Assuming that this might mean a difference in nicotine content, samples were submitted for analysis to Dr. E. M. Bailey of the chemical department, who reported them as follows:

Sample	Nicotine
No. 1	.29 per cent.
" 2	.30 " "
" 3	.84 " "
" 4	.71 " "

It will be noticed that none of these samples contained the full amount of one per cent. of nicotine. As it happened, red bugs, aphids, and leafhoppers were not seriously abundant in any of the orchards where this dust was used.

SANDERS DUST.

Hydrated lime	86 parts
Dehydrated copper sulphate	10 "
Calcium arsenate	4 "

This dust was used only in orchard No. III for the purpose of comparing it with the sulphur-lead dust.

Cost of Dust Mixtures.

The 1921 prices for the dust mixtures were as follows:

Sulphur lead dust and nicotine	$13.50 per hundred
Sulphur lead dust without nicotine	8.50 " "
Sanders dust	8.00 " "

In the dusting operations, between three and four pounds of dust were used per tree for each treatment. The cost of dusting an orchard at the present price of materials is about three times as great as spraying even though the time required to apply the dust is very much less than the time required to spray. If the price of farm labor drops it will mean a still greater saving in favor of the liquid spray.

Apparatus Used.

The dusting machine used in all three orchards was a Niagara duster owned by the Federal Bureau of Entomology, and used at its field station in Wallingford. The machine was constructed to be drawn by a team of horses, but this method was too slow when moving the outfit from orchard to orchard, so the machine was mounted on a Ford ton-truck, thus saving considerable time on the road and in the orchard. The Ford truck had no trouble in pulling this outfit through the orchards (see Plate XIX, a). When the machine was not in use it could easily be unloaded from the truck and stored in a shed.

An Arlington X. L. gasoline power sprayer was used for applying the liquid spray in orchard No. I. This was a new outfit, and the pressure was not very high, running at about 100 lbs. most of the time. Two lines of hose were used with a single nozzle on each rod.

In orchard No. II, the liquid spray was applied with a Friend gasoline power sprayer equipped with a tank holding 150 gallons. Two spray rods were used with two nozzles on each rod, and carrying a pressure of about 200 lbs. One man sprayed from the ground and another sprayed from a tower on the spray rig.

The spray outfit used in orchard No. III was identical with that employed in orchard No. II, except that instead of two lines of hose with double nozzles, a single line of hose with a "spray-gun" was used. The pressure was about 175 lbs., which is about as high as can be used without danger of mechanical injury to the foliage.

Number and Dates of Applications.

Two treatments after blossoming were given in each of the three orchards.

Orchard No. I had a delayed dormant spray of lime-sulphur on April 7. On April 21, the pink treatment of spray and dust was

applied. The calyx treatment was given on May 18 and 19 and the next or young fruit treatment was made on June 20.

Orchard No. 11 had a dormant spray of miscible oil applied by the owner. The pink treatment was given April 22. The calyx treatment was made May 16, and the next or young fruit treatment was given on June 13.

In orchard No. III, no dormant treatment was given by the owner, and no pink treatment was made, as it was too late before the orchard was offered to us for experiment. The calyx treatment was applied on May 16 and 17, and the next application or young fruit treatment was given on June 14, 15 and 16.

Method of Recording Data.

Certain trees promising a crop and situated inside the border of each plot, and representing the chief varieties upon which the tests were made in each orchard, were selected and marked as count trees. In orchard No. I, all trees were used as count trees in obtaining data. In orchard No. II, count trees were as follows:—8 sprayed, 6 dusted, and 7 checks. In orchard No. III, the following number were used as count trees:—12 sprayed, 12 sulphur-lead-nicotine dust, 8 Sanders dust, and 7 checks. For the sulphur-lead-no nicotine treatment, 2 Baldwin trees were used and a composite sample of Greenings from several trees because the crop on this variety was very light. As a rule the count trees were selected near the center of each plot and not adjacent to a plot having a different treatment, on account of the danger of spray or dust getting on to trees that were not intended to be so treated. With the liquid spray there is little danger of this, but the dust is quite apt to drift or be blown upon adjoining trees.

The green dropped fruit from each of the count trees was gathered, counted and examined for insect and fungous injuries, and the data recorded for each tree, at three different times during the season, as follows: July 11 and 12, July 25 and 26, and August 8 and 9. At harvest time the picked fruit was scored in the same manner. Each individual apple was carefully examined and a record made of each insect and fungous injury. Apples that were called "good" were absolutely free from any signs of insects or fungous diseases and might better be called "perfect" for they were free from pests and were perfect except possibly as to size. An apple showing the work of more than one pest would be checked as many times as there were kinds of insect injury or fungous diseases. This very often gave a greater number of injuries than there were apples and in order to get the true amount of any kind of injury all the apples had to be counted, and this number used to compute the percentage of injury or the percentage of good fruit. This scoring of the fruit involved examining separately 150,296 individual apples, equivalent to about 334 barrels.

The figures given in the tables of results from the various plots are percentages of perfect fruit or of injuries even if very slight, and cannot be compared with any commercial grading. For instance an apple that had been bitten by a curculio might only have one or two small blemishes and would be counted as a "curculio" apple, but in a commercial grading of the fruit would easily go as a No. 1 apple. The same is true of other injuries, especially small spots of scab, sooty blotch or fruit speck. After scoring the apples by the above method, all the fruit on several trees was graded as it would be for market. The results obtained by the commercial grading method are of the greatest importance to the fruit grower, and tell at a glance which treatment gives the highest per cent. of No. 1 fruit. See Plates XVII and XVIII. The other method of scoring is of value in showing just where certain treatments fail.

The following table has been prepared to show how the different treatments compare by both methods of recording data.

Scoring for Injuries versus Commercial Grading.

	Scoring Apples Singly					Commercial Grading		
Tree	Good Per Cent.	Codling Moth Per Cent.	Curculio Per Cent.	Other Insects Per Cent.	Fungous Diseases Per Cent.	No. I Per Cent.	No. II Per Cent.	Culls Per Cent.
O1 Sprayed	48.4	.4	42.4	10.4	5.6	82.	15.8	2.2
B7 Nicotine Dust	4.95	.89	24.9	21.1	83.6	46.25	46.25	7.5
B11 Sanders Dust	.99	.43	20.8	18.1	97.5	60.7	32.7	6.6
B15 & C16 Check	0	8.43	32.8	21.5	97.7	20.	60.	20.
D8 Sprayed	33.2	1.46	58.5	9.9	4.38	83.	14.2	2.8
D14 Nicotine Dust	20.2	6.81	61.4	12.1	33.05	66.3	22.1	11.6
D9 Check	0	19.09	73.9	12.6	100.	11.1	33.3	55.6

Orchard No. I.

Orchard No. I was the ten year old Experiment Station orchard located at Mount Carmel. This orchard is just beginning to bear, and consists of 96 trees on a side hill sloping to the west. All trees bearing fruit were used as count trees to check up results. The varieties were Baldwin, Rhode Island Greening, Roxbury Russet, McIntosh, Gravenstein, Duchess of Oldenburg, Fall Pippin, Northern Spy, Sutton Beauty, King, Wealthy, Hurlbut and Stark.

This orchard was divided into three plots. The north plot was treated with liquid spray and the south plot with the 90-10 nicotine dust. The remaining plot in the center of the orchard was used as a check.

NUMBER AND DATES OF APPLICATION.

The spraying and dusting in each orchard was usually done on the same day or on the following day if there was not time enough to finish the work on the first day.

Before the dusting operations began this orchard had a delayed dormant spraying of lime-sulphur on April 7 over the entire orchard. The pink spray was applied on April 21. The weather conditions were very favorable for dusting and spraying on this day, there being a very light breeze from the southeast. The dust flowed very freely and drifted through the orchard for quite a distance.

The calyx treatment was applied on May 18 and 19. The spray was put on in the afternoon of May 18, the dust on the morning of the 19th. The third treatment or young fruit spray was applied on June 20th. At this time there was no wind and the dust could be blown in almost any direction and would hang in the orchard like a fog.

RESULTS OF SPRAYING AND DUSTING.

	Good Per Cent.	Red Bug Per Cent.	Aphis Per Cent.	Curculio Per Cent.	Codling Moth Per Cent.	Other Chewing Insects Per Cent.	Scab Per Cent.	Sooty Blotch Per Cent.	Fruit Speck Per Cent.
Spray	39.9	.02	1.	48.2	5.78	10.5	1.28	1.7	.27
Dust	32.5	.00	.99	55.4	6.48	7.2	7.39	1.39	1.40
Check	24.8	.078	1.09	55.6	22.0	10.5	12.3	15.7	18.0

DISCUSSION OF RESULTS.

The liquid spray gave a higher percentage of good fruit than the dust, and the dust gave more good fruit than where no treatment was applied. With curculio and codling moth the spray gave better control, while with the other chewing insects the dust was a little better and for some unaccountable reason the spray and check plots gave the same result. The amount of aphis and red bug injury was so small that the figures are of no particular value. In the control of the fungous diseases, the spray was of more value than the dust, but the dust was much better than the check.

Orchard No. II.

This is the same orchard and some of the same plots of trees that were used in the season of 1920. The orchard is about 27 years old and has been very well kept. The varieties in the experimental plots were Greening and McIntosh, Fall Pippin and one tree of Hurlbut. The crop was very light this year.

There were 97 trees under experiment, 39 in the spray plot, 49 in the dusted plot and 9 in the check.

TIME OF APPLICATIONS.

The entire orchard had a dormant spray of oil which was applied by the owner. The pink spray was applied on April 22 and the first dust treatment was also applied on this date. The calyx treatment was made on May 16, both liquid and dust being applied on this day. On June 13, another treatment was given.

In this orchard fruit was picked and scored from 21 trees, with the following result:

RESULTS OF SPRAYING AND DUSTING.

	Good Per Cent.	Red Bug Per Cent.	Aphis Per Cent.	Curculio Per Cent.	Codling Moth Per Cent.	Other Chewing Insects Per Cent.	Scab Per Cent.	Sooty Blotch Per Cent.
Spray	48.2	.04	.02	14.7	1.9	4.5	33.3	.04
Dust	19.8	.78	.56	14.3	2.4	5.3	70.	3.25
Check	1.57	9.7	.68	43.7	12.3	11.7	76.	66.5

DISCUSSION OF RESULTS.

As far as the insects are concerned in this orchard, there is not much difference between the dust and the liquid spray. The liquid spray gave over twice the percentage of good fruit that the dust produced, which difference was largely due to the number of scabby apples in the dust treatment. In this orchard neither the spray nor the dust were very effective in controlling scab, due to the fact that the pink treatment was delayed too long on account of inclement weather.

Orchard No. III.

This orchard is located about two miles north of the village of Milford and is divided by a highway running north and south through it. The trees are about 17 years old and are on a fairly level piece of land with woods on two sides. The trees had dense crowns making it rather difficult to reach the centers with spray or dust.

The varieties in this orchard are Baldwin, Greening, Gravenstein, McIntosh and Hurlbut. This orchard had no dormant spray, and afterwards had one treatment less than the others, the pink spray being omitted.

TIME OF APPLICATION.

The first treatment was made at the time the petals had all dropped, on May 16 and 17. The second application was given on June 14, 15 and 16. The wind on these days was very strong and the dusting work was delayed a little on this account.

RESULTS OF SPRAYING AND DUSTING.

	Good Per Cent.	Red Bug Per Cent.	Aphis Per Cent.	Curculio Per Cent.	Codling Moth Per Cent.	Other Chewing Insects Per Cent.	Scab Per Cent.	Sooty Blotch Per Cent.	Fruit Speck Per Cent.
Spray	44.7	5.47	1.18	33.9	5.98	5.98	4.97	3.36	3.28
Sulphur Dust	27.4	3.72	.647	24.3	1.85	6.72	2.08	34.10	38.40
Nicotine Dust	22.6	12.37	.706	40.9	3.63	9.43	10.56	14.83	19.70
Sanders Dust	16.9	8.17	2.03	36.3	10.91	11.13	13.13	33.69	40.70
Check	4.6	16.70	1.24	60.1	26.73	30.09	34.98	29.87	35.25

DISCUSSION OF RESULTS.

As in the other orchards the spray is again better than any kind of dust. There are no striking differences in the results between the three kinds of dust used. The figures show less scab when sulphur dust was used, but the varieties in this particular plot, Baldwins and Greenings, are not ordinarily very susceptible to scab, especially Baldwins. All kinds of dust were less effective than the spray in controlling the fungous diseases.

Comparison of Different Sprays.

In addition to the work on the comparison of dusting and spraying, an experiment was conducted on an orchard of 40 forty-five-year old Baldwin and Greening trees at the Station Farm in Mount Carmel in which four different sprays were compared. This experiment has been conducted for three years, but as the 1921 results are representative of the two previous season's results, only the work and results of this season will be discussed.

MATERIALS USED.

The sprays used in this experiment were liquid lime-sulphur, dry lime-sulphur, B. T. S., and Bordeaux mixture.

LIQUID LIME-SULPHUR.

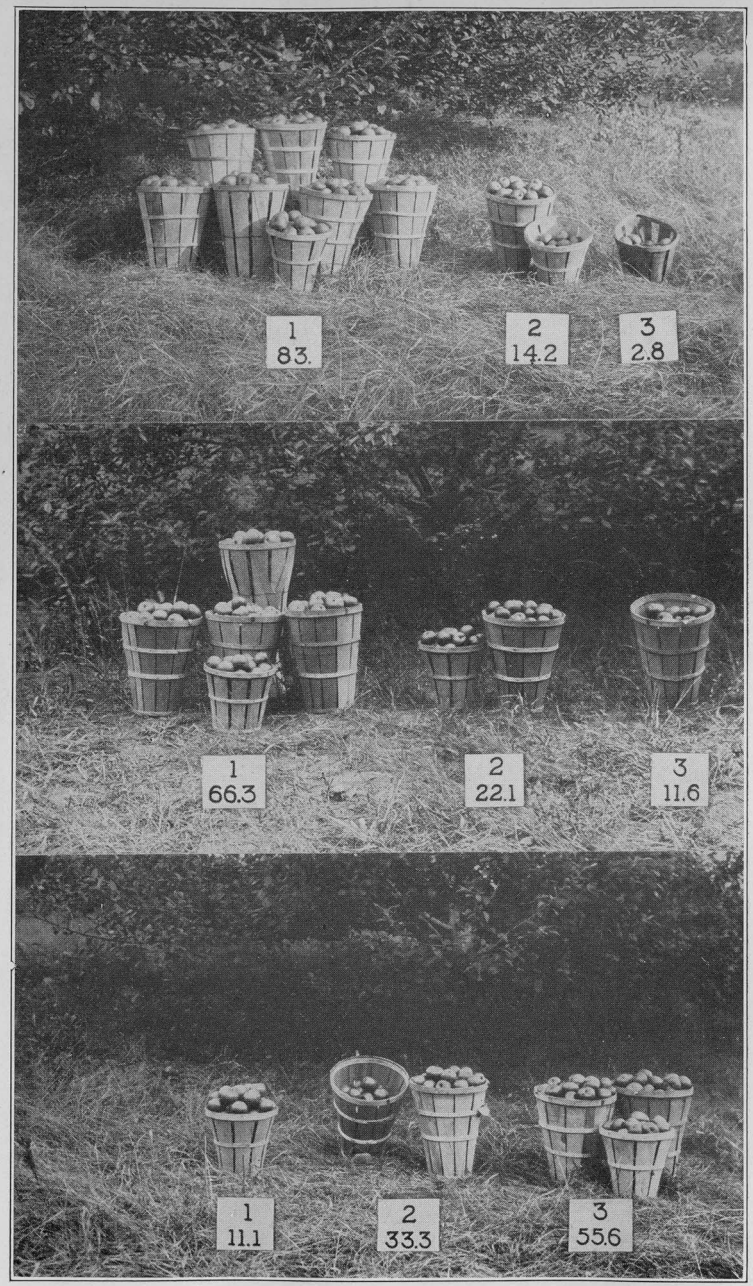
Lime-sulphur	1½ gallons
Lead arsenate (powder)	1½ pounds
Water	50 gallons

DRY LIME-SULPHUR.

Dry lime-sulphur	3 pounds
Lead arsenate (powder)	1½ pounds
Water	50 gallons

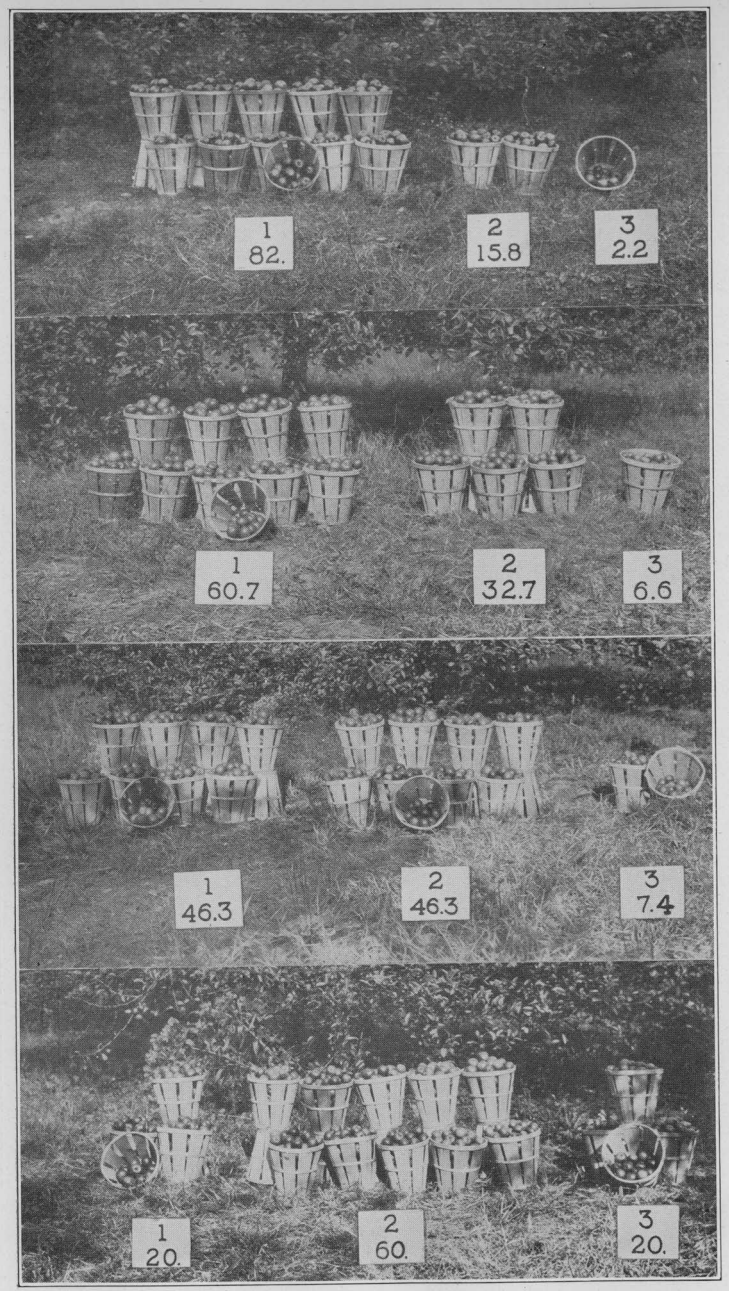
B. T. S.

B. T. S.	1½ pounds
Lead arsenate (powder)	1½ pounds
Lime	3 to 4 pounds
Water	50 gallons



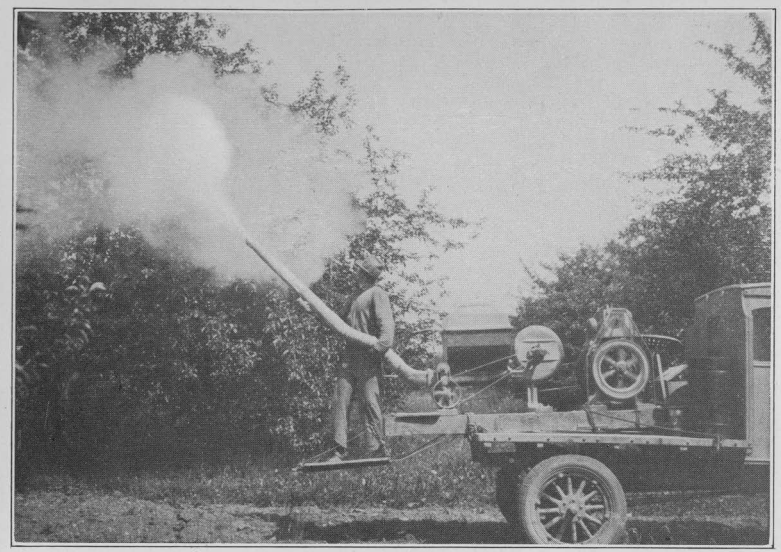
Harvested fruit from orchard No. I. Sprayed fruit at top, dusted fruit in center, and check or untreated fruit at bottom. The percentage of fruit in each grade is shown on the labels.

COMMERCIAL GRADING OF APPLES FROM EXPERIMENT PLOTS.



Harvested fruit from orchard No. III. Sprayed fruit at top, Sander's dust in second view, sulphur-lead-nicotine dust in third view, and check or untreated fruit at bottom. The percentage of fruit in each grade is shown on the labels.

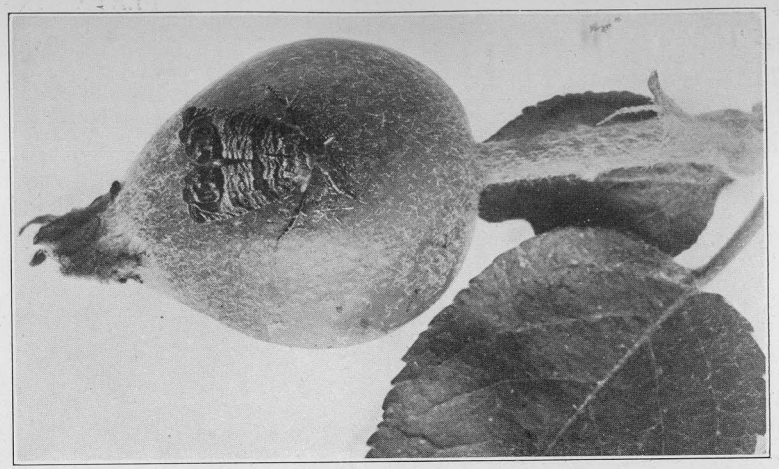
COMMERCIAL GRADING OF APPLES FROM EXPERIMENT PLOTS.



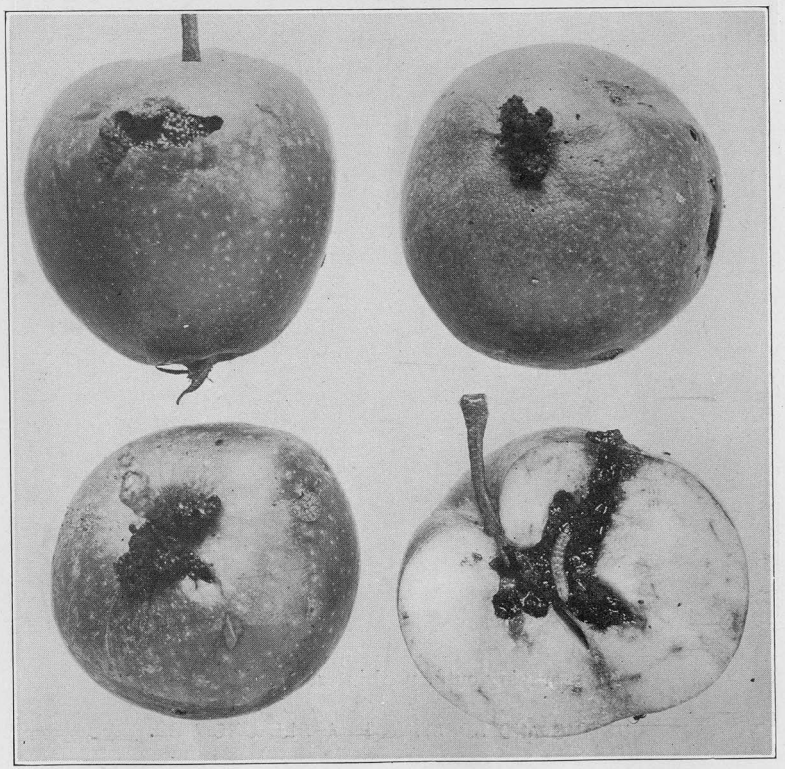
a. Dusting outfit used in experiments.

b. Spraying outfit used in orchard No. II.

DUSTING AND SPRAYING IN APPLE ORCHARD.

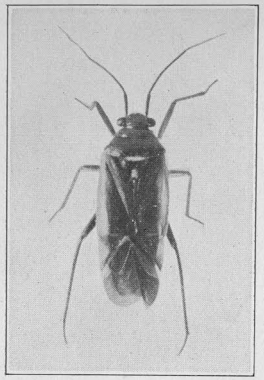


a. Adult moth resting on young apple, twice enlarged.

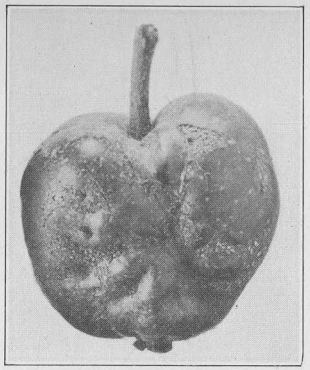


b. Stem, calyx and side injury: section of fruit showing larva in burrow. Natural size.

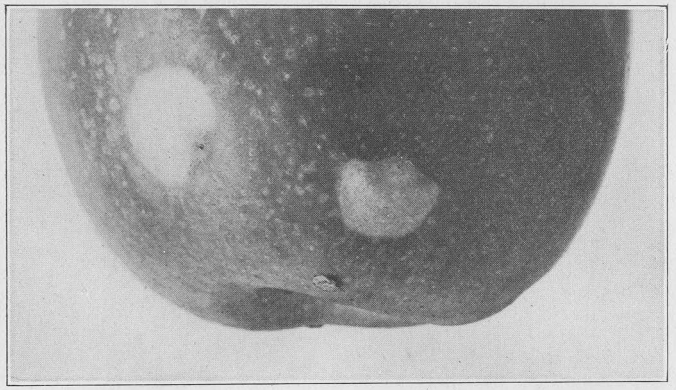
CODLING MOTH.



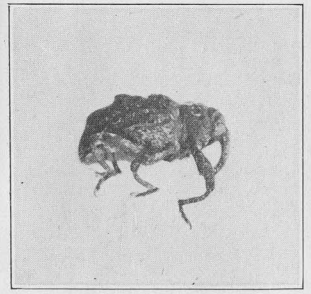
a. Adult red bug. Four times enlarged.



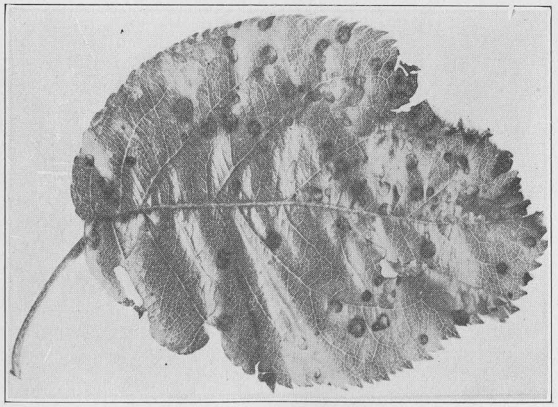
b. Apple injured by red bugs. Natural size.



c. Curculio egg-scars as they appear at harvest time. Natural size.



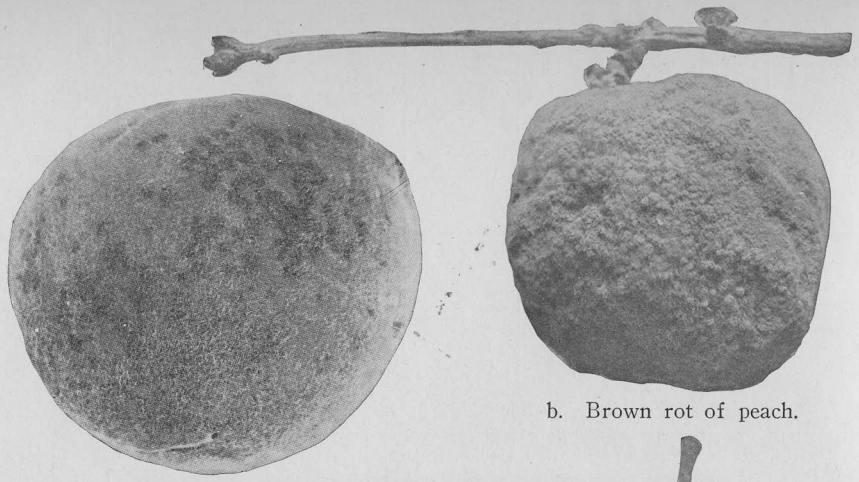
d. Plum curculio side view. Four times enlarged.



e. Spots on apple leaf caused by black rot fungus. Natural size.

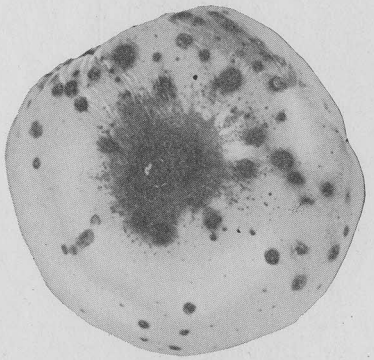
RED BUG, CURCULIO AND BLACK ROT.

PLATE XXII.

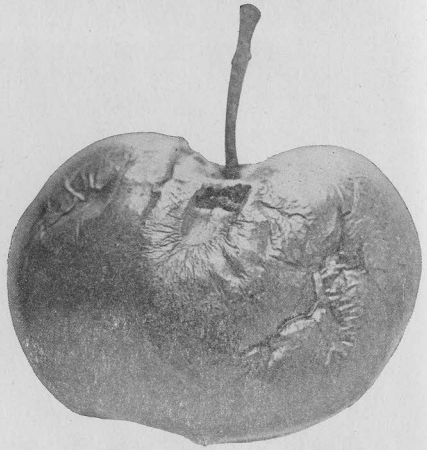


a. Peach Scab.

b. Brown rot of peach.



c. Fruit speck of apple.



d. Black rot of apple.

e. Apple scab.

f. Sooty blotch of apple.

FUNGOUS DISEASES OF PEACH AND APPLE.

BORDEAUX MIXTURE.

Copper sulphate	1 pound
Lime	4 pounds
Lead arsenate (powder)	1½ pounds
Water	50 gallons

APPARATUS USED.

All the applications were made with an Arlington X. L. outfit, using two lines of hose and rods with one Friend nozzle to each rod. This outfit maintained a pressure of 125 pounds.

DATES OF APPLICATION.

The entire orchard had a delayed dormant spray of lime-sulphur 1-9 on April 7. As scab was known not to be abundant in this orchard, the pink spray was omitted. The calyx spray was put on May 19 and the young fruit spray on June 20.

The following table shows the results obtained.

RESULTS OF SPRAYS.

	Good Per Cent.	Red Bug Per Cent.	Aphis Per Cent.	Curculio Per Cent.	Codling Moth Per Cent.	Other Chewing Insects Per Cent.	Scab Per Cent.	Sooty Blotch Per Cent.	Fruit Speck Per Cent.
Dry Lime-Sulphur	72.5	.13	1.24	10.70	.66	8.7	.03	8.42	3.64
Liquid Lime-Sulphur	53.6	.14	1.67	21.76	5.43	17.70	.66	5.24	2.66
B. T. S.	54.2	.34	3.09	22.92	4.92	11.64	.34	13.24	4.57
Bordeaux	52.0	.25	1.8	23.82	8.29	11.85	1.78	9.08	3.86

DISCUSSION OF RESULTS.

In this experiment the dropped fruit was not scored and records were made from harvested fruit from all trees, otherwise the data was taken as described elsewhere in this paper. The check trees did not bear any fruit so no comparison could be made with untreated trees. It will be seen that the dry lime-sulphur gave the highest per cent. of good fruit, this also being true in the two previous seasons' work with this material. Not only was there a higher per cent. of good fruit but the appearance and finish of the fruit was superior to that from the other plots. The B. T. S. gave about the same control of fungous and insect pests as did the lime-sulphur but the fact that it caused considerable injury to the foliage makes it an undesirable material to use. It was estimated that it caused a drop of from 30 to 40 per cent. of the foliage, as compared with no injury from any of the other treatments.

Usually there has been considerable russetting of the fruit on the Bordeaux plot and probably this year was no exception, but on account of the fact that late frosts caused more or less russetting of the fruit on all of the plots, it was not possible to get any data on this point. Because of its tendency to russet the fruit, we do not recommend Bordeaux as a spray for apples.

Chief Pests Attacking the Fruit of Apple Orchards.

INSECTS.

Codling Moth:—This is the chief insect attacking apple orchards and though varying in abundance is present every year in every orchard. It passes the winter as a larva in the cocoon, transforming to a pupa in the spring. The moths emerge soon after the trees blossom and lay their eggs chiefly on the leaves, though sometimes on branches and developing fruit. The egg-laying period extends over several weeks, and in about a week these eggs hatch, and the larvae feed slightly on the foliage but tunnel into the fruit mostly through the calyx. They eat their way to the core, and later burrow to the surface making the traditional worm hole, as shown on Plate XX, b. From 20 to 30 days are required for larval development, when the worms leave the fruit usually before it falls, and seek a protected place to spin the silken case or cocoon. Of those assuming this stage in mid-

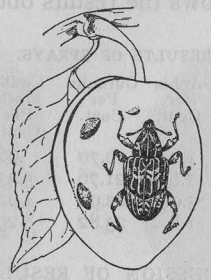


Figure 9. The Plum Curculio.

summer, a portion transform the same season, while those going into their cocoons late in summer or autumn do not emerge as adults until the following season. There is usually one full generation, and a partial second each year in Connecticut.

The codling moth is usually less injurious in orchards which are sprayed each year with arsenical poisons.

Plum Curculio:—The adult is a weevil or snout beetle which hibernates in rubbish heaps, hedgerows, woodlands, *et cætera,* where it can find protection. It appears on trees soon after the buds open, and soon after the fruit sets and the petals drop begins to puncture the young fruit. Two kinds of punctures are made, one for feeding and the other for depositing eggs. The latter are crescent-shaped and the egg is placed just under the skin of the flap on the concave side of the crescent. Egg-laying may extend over nearly the whole season, though most of them are laid during the first month after the blossoms fall. The feeding punctures are small cavities eaten into the surface of the fruit and usually occur in clusters. They may be made late in the season. There is only one generation each year, and this insect usually breeds in

stone fruits. The larvae do not develop in the apple, and the only injury is that caused by the punctures. Plate XXI, c, shows the egg-scars as they appear on the fruit at harvest time. The application of poisons, though of some benefit, is not a satisfactory control for this insect. Much more can be accomplished by abolishing its hibernating places, like rubbish heaps, hedgerows, *et cætera,* in or near the orchard.

Other Chewing Insects:—Many insects might be included under this head, but only a few will be mentioned in connection with the orchards where our experiments were conducted.

Apple Maggot:—This was not a serious pest in these orchards, though present and causing some injury on certain varieties. Later treatments, so that the foliage and fruit will be coated with poison during July, may be effective in poisoning the adults before they lay eggs.

Leaf-Rollers:—In 1920, there was considerable surface injury to fruit late in the season caused by the red banded leaf-roller *Eulia velutinana* Walker, and the lesser apple worm *Enarmonia prunivora* Walsh. Consequently some later treatments were given a portion of some of the plots, but these insects were not noticed in 1921, and the treatments gave no benefit.

Aphids:—The green apple aphid *Aphis pomi* DeGeer, and the rosy aphid *Anuraphis malifoliae* Fitch (*Aphis sorbi* Kalt.) were not prevalent in the experiment orchards in 1921. Some eggs hatched, but the aphids soon disappeared, perhaps on account of cold storms, lady beetles, or other natural agencies, and caused no appreciable injury. For this reason no marked benefit can be shown by the treatment against these insects. The eggs hatch at about the time that the leaf buds begin to unfold. Nicotine sulphate in the delayed dormant, pink and calyx treatments should control these aphids.

Red Bug:—The false apple red bug *Lygidea mendax* Reut. was not abundant in any of the experiment orchards in 1921, but was more prevalent in orchard No. III than elsewhere. Here and also in orchard No. II the check plots showed much more injury than the treated ones. The eggs hatch just before the blossoms open and nicotine sulphate in the pink treatment and in the calyx treatment, if thoroughly applied, should kill most of the nymphs.

FUNGOUS DISEASES.

Scab:—Scab was very prevalent during the past season in most orchards. This can probably be accounted for in two ways; first, the mild winter, which allowed the fungus to carry over in good condition on the old leaves and mature a large crop of spores which infected the young foliage early in the spring, and second the fact that there was a rainy spell which was most favorable for

scab infection and which prevented putting on the pink spray at the proper time. Under Connecticut conditions the pink spray is the important spray for scab control and on varieties which are particularly susceptible it would seem desirable to put on two sprays after the leaves come out and before the blossoms open. It seems to be the consensus of opinion among plant pathologists that it is not feasible to attempt to treat or destroy the leaves under the trees, on which the scab carries over winter, but rather to control it by proper and timely spraying. See Plate XXII, e.

Black Rot:—Black rot was more prevalent, especially on the foliage, during 1921 than usual. This disease was present to a greater or less extent in all the orchards which were observed during the season and probably these represent a general condition throughout the State. Usually Baldwin was the variety most susceptible, although other varieties showed some infection. In one orchard only was any serious damage done and in this only a small number of trees were severely attacked.

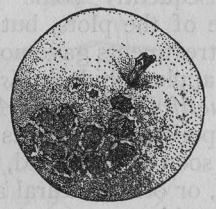


Figure 10. Apple Scab.

On the leaf the black rot fungus makes small dark brown circular spots and later causes the leaf to turn yellow and drop prematurely. This fungus also attacks the fruit, making a brown rotting of the flesh of the apple, which form of infection was noted in a few cases, but nowhere did any serious damage result. The Hurlbut seemed to be more susceptible to fruit infection.

This fungus does not usually do any great amount of damage in Connecticut and if present should be controlled by the ordinary spraying schedule. The infection on the foliage evidently takes place early in the season, making the pink spray important in its control. This fungus is shown on the leaf on Plate XXI, e, and on the fruit on Plate XXII, d.

Fruit Speck:—Fruit speck or "Brook's spot" is a fruit disease and causes the very small irregular black spots on the skin of the apple which on light skinned varieties are usually bordered with red, the spots occurring most abundantly near the calyx end. This disease should not be confused with "Baldwin spot" which is a physiological trouble characterized by brown corky spots

scattered through the tissue of the fruit. Fruit speck, being a fungous disease, can be controlled by spraying with a fungicide while the "Baldwin spot" is not affected by such applications. To control fruit speck successfully, the spraying should be done very thoroughly. The fruit speck fungus does not injure the quality of the fruit but spoils its appearance, and makes an entrance for various decay organisms.

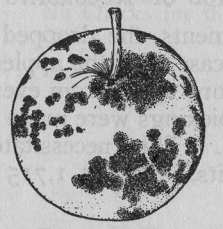


Figure 11. Sooty Blotch of Apple.

Sooty Blotch:—This disease is one of the most common apple diseases and is probably one of the easiest to control by spraying, yet it seems to be true that less attention is paid to it than to other troubles, for instance, a grower will be much alarmed at a heavy scab infection but will almost consider sooty blotch a necessary adjunct to the finish of his fruit. The sooty blotch fungus grows entirely on the skin of the apple and does no harm except to injure its appearance seriously, as is shown on Plate XXII, f.

PEACHES.

In addition to the experiments with dusts and sprays in apple orchards, experiments were conducted to test the comparative values of dusting and spraying on peaches. Two orchards were used, one at Mount Carmel owned by this Station, and the other in Cheshire, owned by Mr. M. L. Coleman.

Apparatus and Materials Used.

In the spraying of both orchards, an Arlington X. L. power sprayer with a 100 gallon tank was used, carrying two lines of hose with one nozzle on each rod, at a pressure of about 125 pounds. The dusting machine used at Mount Carmel was a Niagara duster, being the same one that was used in the apple dusting experiments. The duster used at Cheshire belonged to Mr. Coleman, and was also a Niagara machine.

The spray material used in both orchards was atomic sulphur, at the rate of 10 pounds to 100 gallons of water. The dust used at Mount Carmel was ordinary dusting sulphur, and at Cheshire the dust used for the first two applications was a 70-20-10 mixture, 70 parts of sulphur, 20 parts of lime and 10 parts of lead arsenate. For the third dusting at Cheshire, the lead arsenate and lime were omitted.

Method of Recording Data.

In the peach experiments, the dropped fruit was not gathered and scored as was the case with the apples. No count trees were selected here, but a record taken from every tree which bore fruit. In harvesting, several pickings were made and each fruit examined and injuries recorded. This necessitated the examination of 120,063 individual fruits, or about 1,715 baskets.

Mount Carmel Orchard.

This orchard is ten years old, planted on the brow of a hill sloping toward the west, and comprises 150 trees planted in five rows of 30 trees each. The varieties which were used in this orchard are Elberta, Carman, Champion, Mountain Rose and Greensboro. The orchard was divided into three plots, the north plot was sprayed, the south plot dusted and the center plot left untreated for a check.

Three applications of spray and dust were made in this orchard, the first on May 18th when the "shucks" had all dropped from the young fruit; the second on June 16th and the last on July 13th and 14th. The dust used was the regular dusting sulphur with no lead arsenate or lime added. The liquid spray used was atomic sulphur, 10 pounds to 100 gallons of water, with no lead arsenate. As no arsenical poison was used in this orchard, and as there was practically no scab, the only injuries recorded were those caused by brown rot.

RESULTS OF TREATMENT.

		Good Fruit Per Cent.	Rot Per Cent.
Elberta:			
	Spray	98.6	1.34
	Dust	99.6	.36
	Check	99.6	.38
Carman:			
	Spray	93.	7.2
	Dust	97.5	2.5
	Check	No Checks for this variety	
Champion:			
	Spray	89.3	10.7
	Dust	98.4	1.6
	Check	96.5	3.4
Mt. Rose:			
	Spray	88.2	11.8
	Dust	99.2	.88
	Check	98.5	1.6
Greensboro:			
	Spray	79.9	20.1
	Dust	87.5	12.7
	Check	No Checks for this variety	

Discussion of Results.

On all varieties the dust was more effective in controlling brown rot than the spray. The amount of scab and curculio injury was so slight that no data was taken. The check trees in this orchard had better fruit than the sprayed trees because the trees were close together and the check trees were north of the dusted plot and at every application of dust the wind was from the south or southwest, thus blowing the dust onto the check trees.

Cheshire Orchard.

This orchard is about the same age as the Mount Carmel peach orchard. Because of the size of the orchard, only a portion containing two varieties, Carman and Elberta, was used in the spraying and dusting tests. Mr. Coleman, the owner of the orchard, has been dusting peaches for several years with satisfactory results, and this year he dusted all of his orchard except that portion where the sprayed plot was located. The records of the dusting were taken from a portion of the orchard adjacent to the sprayed plot. A few trees on the edge of the orchard at the end of the sprayed plot were left without treatment as checks. One hundred and thirteen trees were included in the three plots.

This peach orchard, like the other, was given three treatments of spray and dust, on the following dates: May 22, June 18 and July 13. The spray used was atomic sulphur, 10 pounds to 100 gallons of water. No lead arsenate was used in the liquid spray.

The liquid spray was applied with the same outfit as was used at Mount Carmel. The outfit was carried to Cheshire on a Ford truck to save time. On arriving at Cheshire the sprayer was unloaded and a horse used to draw it about the orchard, as the trees were too close to allow the truck to pass through the orchard. Five pickings were made of Carman, August 10, 12, 14, 16 and 19, and four of Elberta, September 2, 5, 7 and 9. There was considerable scab in this orchard, so records were made of light and heavy infestations of scab, together with rot and curculio.

RESULTS OF TREATMENT.

		Good Per Cent.	Rot Per Cent.	Light Scab Per Cent.	Heavy Scab Per Cent.	Curculio Per Cent.
Elberta:						
	Spray	65.	2.66	27.39	1.2	5.52
	Dust	69.9	5.24	22.4	.94	3.24
	Check	17.4	5.81	58.4	17.6	2.91
Carman:						
	Spray	37.4	7.15	43.2	12.12	4.61
	Dust	56.	4.92	27.4	9.4	5.12
	Check	27.3	16.5	38.2	21.7	4.53

It will be noted that on both varieties the dust gave a higher percentage of good fruit than the spray, largely through the more effective control of rot and scab. The lead arsenate in the dust did not control curculio to any appreciable extent. For some unknown reason the curculio injury was less in the check plot in both varieties than in either the dusted or sprayed plot. Peaches scored as "light scab" had only a small amount of scab, and would be graded as No. I. Those scored "heavy scab" would not be included in a No. I grade. Most of the peaches in the curculio column would undoubtedly be included in a No. I grade.

Cost of Dusting and Spraying Peach Orchards.

The price of dusting sulphur without lead arsenate used for dusting the peach orchards was $3.75 per 100 pounds in 1921, and the cost of atomic sulphur in 100 pound lots was $12.75. Allowing one pound of dust and one gallon of spray per tree the cost is, dust 3¾ cents per tree, spray 1¼ cents per tree for one treatment only. There would be quite a saving of time in favor of the dust which would partly offset the higher cost of material and make the treatments more nearly equal in price. However, it is doubtful if it would pay to dust peaches unless a large acreage was to be treated so that enough time could be saved to make an appreciable cut in the labor cost. It would be necessary to have a spray outfit for the dormant treatment and the extra cost of the duster would probably not be offset by the saving of time and slightly better results on a small orchard.

Pests of the Fruit of Peach Orchards.

INSECTS.

Plum Curculio:—The curculio is unquestionably the most important insect attacking the fruit of the peach. This insect has already been discussed on page 218 as an apple pest. In the peach fruit, the larvae develop to maturity and transform. Most of the infested fruits drop early and therefore do not show at harvest time, though the egg-laying and feeding punctures are often apparent. Curculio can best be controlled by getting rid of all hibernating places near the orchard. Arsenical applications, though a help, should not be depended upon as the only means of control.

FUNGOUS DISEASES.

Brown Rot:—Brown rot is the most serious fungous disease that the peach grower has to contend with, but it can be controlled by thorough and timely treatment. Usually this is a disease of the fruit but under favorable conditions such as obtained in the spring of 1921, serious infection of the blossoms on early varieties is likely to take place. Such infection not only kills the blossom but forms a canker which often girdles and kills the entire branch.

The blossom and twig infection seems to be worst in orchards where spraying or dusting has not been regularly practiced, and there are large quantities of mummied fruits on the ground and in the trees to spread the disease early in the season.

Peach Scab:—Peach scab does the larger part of its damage on the fruit, but the fungus infects the twigs and leaves as well. It is from the twigs that the scab fungus is spread to the fruit by the spores falling and being washed onto them by rain. In this connection it is interesting to note that scab spots are always on the upper surface of the fruit. Like many fungous diseases an important factor in scab control is to prevent it from getting a start in the orchard. If an orchard is well sprayed or dusted from the start, scab probably will not be especially abundant.