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Thirty-third and Thirty-fourth Annual Reports

OF

The Connecticut Agricultural Experiment Station

Being the biennial report for the two years ended October 31,

1910

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THE BOARD OF CONTROL.

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF.

September 30, 1910

BOARD OF CONTROL.

His Excellency, Frank B. Weeks, *ex officio, President.*

Prof. H. W. Conn, *Vice President*.......................... Middletown.
William H. Brewer, *Secretary*.......................... New Haven.
E. H. Jenkins, *Director and Treasurer*.......................... New Haven.
George A. Hopson.......................... Wallingford.
C. M. Jarvis.......................... Berlin.
Frank H. Stadtmueller.......................... Elmwood.
James H. Webb.......................... Hamden.

STATION STAFF.

Administration.	E. H. Jenkins, Ph.D., *Director and Treasurer.* Miss V. E. Cole, *Librarian and Stenographer.* Miss L. M. Brautlecht, *Bookkeeper and Stenographer.*
Chemistry. Analytical Laboratory.	John Phillips Street, M.S., *Chemist in Charge.* E. Monroe Bailey, Ph.D., C. B. Morrison, B.S., R. B. Roe, A.B., C. E. Shepard, *Assistants.* Hugo Lange, *Laboratory Helper.* V. L. Churchill, *Sampling Agent.*
Proteid Research.	T. B. Osborne, Ph.D., *Chemist in Charge.* Miss E. L. Ferry, A.B., *Assistant.* Miss Luva Francis, *Stenographer.*
Botany.	G. P. Clinton, S.D., *Botanist.* E. M. Stoddard, B.S., *Assistant.* Miss M. H. Jagger, *Seed Analyst.* Miss E. B. Whittlesey, *Herbarium Assistant.*
Entomology.	W. E. Britton, Ph.D., *Entomologist; also State Entomologist.* B. H. Walden, B.Agr., D. J. Caffrey, B.Agr., A. B. Champlain, *Assistants.* Miss E. B. Whittlesey, *Stenographer.*
Forestry.	Samuel N. Spring, M.F., *Forester; also State Forester and State Forest Fire Warden.* W. O. Filley, *Assistant.* Miss E. L. Avery, *Stenographer.*
Plant Breeding.	H. K. Hayes, B.S., *Plant Breeder.* C. D. Hubbell, *Assistant.*
Buildings and Grounds.	William Veitch, *In Charge.*

Report of the Board of Control

of

The Connecticut Agricultural Experiment Station.

To His Excellency, Frank B. Weeks, Governor of Connecticut:

The Board of Control of The Connecticut Agricultural Experiment Station herewith respectfully submits its report for the two years ending November 1, 1910.

The limit imposed by law on the size of our printed report makes it inadvisable to summarize here the work of the several departments, as has been done in previous years. A detailed account of it will appear in the reports of the members of the Station staff which follow.

We therefore notice only those facts relating to the Station which will not be discussed in the special reports.

The following minute regarding the former director of this Station was adopted by the Board, August 4, 1909:

Professor Samuel W. Johnson, the organizer and for twenty-two years the director of this Station, died at his home in New Haven, July twenty-first, 1909, in his eightieth year.

He entered the Sheffield Scientific School of Yale College as a student and for more than fifty years was a professor in it, sharing in its early struggles and its ultimate success.

His scientific attainments and their public recognition, his service as an educator and his contributions to chemical science may more appropriately be discussed elsewhere. His special work for the advancement of agriculture is all that can be very briefly noted here.

From his youth he devoted his life to the study of chemistry, particularly in its relations to agriculture and to the use of this knowledge in the service of farmers.

He laid well the foundation for the great work he was to do by studying under the masters of the science, Professors John P. Norton and Benjamin Silliman, Jr., at Yale College, and Erdmann, Liebig, Pettenkoffer and von Kobel in Leipsic and Munich.

Thus fully equipped at the beginning, he continued to be a close student of his chosen subject to the end of his life.

His first publications on agricultural subjects were in 1847. Prior to 1853 he began the work of examination of commercial fertiltizers in this State and continued it almost without intermission until it was taken up by the Agricultural Station in 1875.

The early published reports of The Connecticut Agricultural Society and of The Connecticut Board of Agriculture, enriched by his reports, lectures and essays, became classic as an encyclopedia of agricultural science at a time when that science was young and almost unknown to the public. They also showed to Connecticut farmers that the investigator and chemist were of practical help to them and so prepared the way for the reception of the idea of an institution entirely devoted to scientific work in the interest of the farmer.

In 1868 he published How Crops Grow, a book which has been more widely read and studied than any other work on agricultural chemistry which was ever issued. It was reprinted in England, translated into the German, Russian, Swedish, Italian and Japanese languages and used as a text-book in those tongues.

In 1870 he published How Crops Feed, which was similarly translated and used.

These two books presented in small compass and with unsurpassed clearness and conciseness the present state of knowledge of agricultural science. As their author said, "His office has been to digest the cumbrous mass of evidence in which the truths of vegetable nutrition lie buried out of the reach of the ordinary inquirer, and to set them forth in proper order and in plain dress for their legitimate and sober uses."

His greatest achievement for agricultural science and for the farmers of the whole country was in so clearly showing, by his own work of more than twenty years in laboratory and study and on the platform, what an Agricultural Station could do for the help of practical agriculture, as to convince the farmers and lawmakers of this State of the wisdom of establishing such an institution for the first time on this continent.

Thus he secured for Connecticut, with the aid of others who were taught by him, the honor of inaugurating in this country the work of Agricultural Experiment Stations which are now in successful operation in every State in the Union.

Professor Johnson was first of all an earnest student, and a clear thinker. He also had the rare gift of expressing himself in clear, concise, logical English and of discussing scientific facts and theories judicially and accurately and at the same time so simply and effectively as to put them within the understanding of those who had no previous acquaintance with such matters.

As a teacher of agricultural teachers, as a leader in agricultural science, and as the father of the movement to bring to the farmer all the help which the sciences can furnish by means of the Agricultural Stations, he has left a name to be remembered with great honor.

THE MEMBERS OF THE BOARD OF CONTROL of this Station, which is one of the monuments of his life work and which so long enjoyed his direction and counsel, desire to record by this minute their appreciation of his great services to the farmers of this State and to American agriculture.

In the hall of the new building, to which reference is made later, friends of Professor Johnson have placed a bronze tablet with this inscription:

IN MEMORY OF
SAMUEL WILLIAM JOHNSON,
WHO FOR MORE THAN FIFTY YEARS SERVED THE
AGRICULTURE OF THIS STATE AND NATION AS
A TEACHER, AUTHOR AND INVESTIGATOR.
LARGELY THROUGH HIS LABORS THE FIRST
AGRICULTURAL EXPERIMENT STATION
IN THE UNITED STATES WAS
ESTABLISHED IN CONNECTICUT.
DIRECTOR OF THIS STATION FROM 1877 TO 1900.

The following changes in the Station officers and staff have occurred:

George A. Hopson of Wallingford succeeded B. W. Collins of Meriden as a member of the Board of Control, July 1, 1909.

Messrs. C. A. Brautlecht and Clarence Rodman, chemists, resigned in 1909 and were succeeded by Messrs. R. B. Roe, B.A., and C. E. Shepard.

Austin F. Hawes, M.F., State and Station forester, resigned in April, 1909, to become State and Station forester in Vermont. Mr. W. O. Filley served acceptably as acting forester until October 1, 1909, when Samuel N. Spring, B.A., M.F., was appointed forester.

E. M. East, Ph.D., who was for four years our agronomist, resigned September 1, 1909, to accept a professorship in Harvard University. Dr. East has been able, through the courtesy of the University, to retain a general direction of the plant breeding work of the Station, which he inaugurated, and Mr. H. K. Hayes, a graduate of Amherst Agricultural College, has carried on the field and laboratory work as a member of the staff of this Station.

Dr. Clinton, Station botanist, was given two months' leave of absence, being commissioned by Harvard University to visit Japan and to find and bring back alive, if possible, a fungus which is there parasitic on the gypsy moth and which may be useful in fighting the same insect here. This somewhat difficult work he did successfully.

Mr. Paul Graff acted as botanical assistant in the summer of 1909, and Mr. E. M. Stoddard, a graduate of the Connecticut Agricultural College, was made permanent botanical assistant in December, 1909.

Mr. James B. Olcott, for many years in charge of the Station grass garden, to which he was passionately devoted and in which he had gathered the best turf grasses from all quarters of the globe, died on April 23, 1910.

The General Assembly in 1909 appropriated $30,000 to build a fireproof addition to our chemical laboratory. This was begun in October, 1909, and was ready to be roofed in when, on the morning of January 10, 1910, a fire, believed to be of incendiary origin, burned out the building to which the new structure was an addition. Little harm was done to the new construction. The walls of the burned building were not badly damaged, but immediate action was necessary to protect them. The Board, therefore, ordered the rebuilding, with construction uniform with the addition, making of the whole a symmetrical fireproof building. The walls are of brick, floors and roof of reinforced concrete, stairways of steel or concrete, and partitions of steel studding and metal lath. The addition was built for the sum appropriated, $30,000.

From insurance, sales of junk, etc., the Station received $11,064.40, applicable to rebuilding. To complete and equip the rebuilt laboratory has required about $6,500 additional, which the Board has borrowed, believing that the next General Assembly will make an appropriation to cover this amount. The fact that without this building the Station could not do the work required of it in the time which must necessarily elapse before the legislature could take action, in the opinion of the Board, fully justified its action.

Besides the building, the fire destroyed much valuable material, books, apparatus, etc., and has very seriously hindered the regular work of the Station.

Now, for the first time in its history, the valuable collections, scientific apparatus and a portion of the library of the Station are properly protected from loss by fire and are insured to their full value.

In 1910 the Station made a rather full exhibit at five of the Agricultural Society fairs in the State, each of which was open for at least three days. This exhibit is purely educational, setting forth the work of the several departments of the Station and some of the results. Members of the staff were present as far as was possible to explain the work and answer questions. Large numbers visited the exhibit and studied what was shown. It amounted to five weeks of continuous Institute work and, while it greatly interrupted our field and laboratory work, it was quite worth while because it showed to a very large number of farmers of the State what the Station stood for, how it helped and could help them, and established personal relations with the Station staff.

Another very useful adjunct to the Station work has been the experiment field in Centerville, not far from the Station office and laboratories. Here have been conducted the experimental breeding work with corn and tobacco, the testing of lime-sulphur summer sprays on fruit trees, the handling of a neglected orchard, and the growing of a number of field crops—alfalfa, red clover, crimson clover, cowpeas, soy beans and winter vetch.

On August 10, 1910, a field meeting was held at the Station, to informally dedicate the new laboratory building, at which more than four hundred farmers and their wives were present. In the afternoon this company went from the Station to the field and inspected and informally discussed the work there. It is intended to hold this summer field meeting each year.

The field meeting and the fair exhibits have certainly proved themselves to be most interesting and helpful both to the Station and to the farmers of the State. In a state of the size of Connecticut and with our system of steam and trolley roads, we believe that the fair exhibits may be made more effective as a means of agricultural education than the "agricultural education trains," which have been effective in less populous and more widely scattered agricultural communities.

In the two years there have been printed parts of two biennial reports, aggregating eight hundred and fifty-five pages, with fifty plates, in editions of ten thousand copies; five bulletins aggregating one hundred and twenty-one pages, with nineteen figures and plates, in editions of nine thousand three hundred; and ten leaflets on farm matters, to be enclosed in letters.

Within the same time more than sixteen thousand letters and manuscript reports have been written and mailed from the Station.

Members of the staff have made addresses or read papers at eighty-seven farm institutes or meetings of farmers' organizations.

All of which is respectfully submitted.

(Signed) GEORGE A. HOPSON, *Secretary.*

NEW HAVEN, CONN., November 1, 1910.

REPORT OF THE TREASURER, 1909

E. H. JENKINS, in account with THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION for the fiscal year ending September 30, 1909.

RECEIPTS.

Balance on hand, October 1, 1908 (Analysis Fees)		$863.40
State Appropriation, Agriculture	$10,000.00	
State Appropriation, Food	2,500.00	
State Appropriation, Insect Pest	3,000.00	
State Appropriation, Gypsy Moth	1,500.00	
United States Appropriation, Hatch	7,500.00	
United States Appropriation, Adams	5,750.00	
Analysis Fees	7,470.02	
Sale of Farm Products	169.13	
Miscellaneous Receipts	736.32	
From the Lockwood Estate	8,065.88	
		46,691.35
Total		$47,554.75

DISBURSEMENTS.

E. H. Jenkins, salary	$2,800.00
W. H. Brewer, "	100.00
V. E. Cole, "	850.00
L. M. Brautlecht, "	666.67
J. P. Street, "	2,500.00
T. B. Osborne, "	2,333.33
E. M. Bailey, "	1,550.00
C. B. Morrison, "	1,018.33
C. A. Brautlecht, "	960.00
R. B. Roe, "	370.37
C. W. Rodman, "	539.98
W. E. Britton, "	2,000.00
G. P. Clinton, "	1,833.32
A. F. Hawes, "	900.00
W. O. Filley, "	412.90
E. M. East, "	1,966.66
H. K. Hayes, "	250.00
C. S. Leavenworth, "	100.00
J. B. Olcott, "	200.00
H. Lange, "	925.00
V. L. Churchill, "	825.00
William Veitch, "	675.00
Luva Francis, "	583.33
H. W. Kiley (Labor)	728.00

Wm. Pokrob (Labor)	$ 728.00	
C. D. Hubbell "	728.00	
M. Howley "	115.50	
G. Graham "	252.00	
Labor	3,316.43	
Publications	1,522.13	
Postage	335.68	
Stationery	269.28	
Telephone and Telegraph	141.27	
Freight and Express	127.96	
Gas and Kerosene	405.85	
Coal	1,156.25	
Water	127.78	
Chemicals and Laboratory Supplies	1,295.05	
Agricultural and Horticultural Supplies	421.95	
Miscellaneous Supplies	350.41	
Fertilizers	262.09	
Feeding Stuffs	148.61	
Library and Periodicals	1,106.40	
Tools and Machinery	47.56	
Furniture and Fixtures	180.63	
Scientific Apparatus	123.77	
Traveling by the Board	176.40	
Traveling by the Staff	1,091.33	
Traveling in connection with Adams Fund Investigations	282.31	
Fertilizer Sampling	172.25	
Food Sampling	324.39	
Insurance	30.60	
Insect Pest Appropriation to State Entomologist	3,000.00	
Contingent	733.12	
Lockwood Expenses	400.00	
Gypsy Moth Appropriation to State Entomologist	1,500.00	
Betterments	162.21	
Repairs	376.79	
Rental of Land	185.00	
		$46,684.89
State Agricultural Appropriation, on hand, Sept. 30, 1909		869.86
Total		$47,554.75

New Haven, Conn., October 26, 1909.

This Certifies that we have examined the accounts of E. H. Jenkins, Treasurer of The Connecticut Agricultural Experiment Station for the year ending September 30, 1909, have compared the same with the vouchers therefor, and find them correct.

William P. Bailey,
Edward S. Roberts,
Auditors of Public Accounts.

REPORT OF THE TREASURER, 1910

E. H. Jenkins, in account with The Connecticut Agricultural Experiment Station for the fiscal year ending September 30, 1910.

Receipts.

Balance on hand, October 1, 1909 (State Agricultural Appropriation)		$869.86
State Appropriation, Agriculture	$10,000.00	
State Appropriation, Food	2,500.00	
State Appropriation, Insect Pest	3,000.00	
State Appropriation, Gypsy Moth	4,150.00	
United States Appropriation, Hatch	7,500.00	
United States Appropriation, Adams	6,750.00	
Analysis Fees	11,000.00	
Sale of Farm Products	167.81	
Miscellaneous Receipts	283.07	
From the Lockwood Estate	10,501.48	
		55,852.36
Total		$56,722.22

Disbursements.

E. H. Jenkins, director, salary	$2,800.00
E. H. Jenkins, treasurer, "	233.34
W. H. Brewer, salary	100.00
V. E. Cole, "	850.00
L. M. Brautlecht, "	750.00
J. P. Street, "	2,500.00
T. B. Osborne, "	2,400.00
E. M. Bailey, "	1,453.13
C. B. Morrison, "	1,100.00
R. B. Roe, "	1,035.00
C. E. Shepard, "	816.67
W. E. Britton, "	2,000.00
G. P. Clinton, "	2,200.00
E. M. Stoddard, "	554.17
S. N. Spring, "	2,125.00
W. O. Filley, "	521.49
E. M. East, "	333.34
H. K. Hayes, "	1,000.00
C.S.Leavenworth, "	100.00
E. L. Ferry, "	950.62
J. B. Olcott, "	116.67
H. Lange, "	925.00

V. L. Churchill, salary	$ 825.00	
William Veitch, "	675.00	
Luva Francis, "	500.00	
H. W. Kiley (Labor) Sept. 25, 1909, to Oct. 1, 1910	742.00	
Wm. Pokrob " " " " " " " "	742.00	
C. D. Hubbell " " " " " " " "	742.00	
Geo. Graham " " " " " " " "	636.00	
Labor	4,043.83	
Publications	598.46	
Postage	250.51	
Stationery	362.09	
Telephone and Telegraph	139.14	
Freight and Express	255.53	
Gas and Kerosene	438.91	
Coal	1,105.00	
Water	106.86	
Chemicals and Laboratory Supplies	1,147.62	
Agricultural and Horticultural Supplies	253.05	
Miscellaneous Supplies	743.22	
Botanical Supplies	9.93	
Fertilizers	536.83	
Feeding Stuffs	122.04	
Library and Periodicals	534.02	
Tools and Machinery	139.87	
Furniture and Fixtures	786.03	
Scientific Apparatus	399.06	
Traveling by the Board	188.70	
Traveling by the Staff	1,451.56	
Traveling in connection with Adams Fund Investigations	125.81	
Fertilizer Sampling	211.75	
Food Sampling	257.91	
Insurance	1,274.34	
Insect Pest Appropriation to State Entomologist	3,000.00	
Contingent	451.73	
Lockwood Expenses	400.00	
Gypsy Moth Appropriation to State Entomologist	4,150.00	
New Buildings	773.86	
Repairs	793.10	
Grounds	112.27	
Rental of Land	177.50	
		$55,066.96
State Agricultural Appropriation, on hand, Sept. 30, 1910		1,655.26
Total		$56,722.22

New Haven, Conn., November 1, 1910.

This is to Certify that we have examined the accounts of E. H. Jenkins, Treasurer of The Connecticut Agricultural Experiment Station, for the year ending September 30, 1910, have compared the same with the vouchers therefor and find them correct.

William P. Bailey,
Edward S. Roberts,
Auditors of Public Accounts.

E. H. Jenkins, in account with The Connecticut Agricultural Experiment Station for the fiscal year ending September 30, 1910.

Receipts and Disbursements in connection with the rebuilding of the laboratory building destroyed by fire January 10, 1910.

Receipts.

Insurance	$11,023.00	
Salvage	41.40	
		$11,064.40
Loan		6,500.00
Total Receipts		$17,564.40

Disbursements.

Building	$10,483.61	
Fixtures	5,319.38	
Furniture, Tools and Machinery, Apparatus, Library, Laboratory and Office Supplies, and Miscellaneous	1,594.93	
	$17,397.92	
Department of Fire Service, New Haven	25.00	
Total Disbursements		$17,422.92
Balance on hand September 30, 1910		141.48
		$17,564.40

New Haven, Conn., November 1, 1910.

This Certifies that we have examined the account which relates to loss by fire and rebuilding new building, have compared the same with the vouchers therefor and find them correct.

William P. Bailey,
Edward S. Roberts,
Auditors of Public Accounts.

ERRATA.

Page 642. Station No. 25269, for Accident read Occident.
642. For Russell Roller Mill Co. read Russell-Miller Milling Co.
642. Atlantic Gluten Feed is wrongly classed as a maize product. Its gluten comes entirely from wheat.
674. Sixteenth line from top, for XXIII read XXVIII.
678. Seventh line from bottom, for XXIII read XXVIII.

PART I.

Report on Commercial Fertilizers, 1909.

By E. H. JENKINS, *Director,* and JOHN PHILLIPS STREET, *Chemist in charge of the Analytical Laboratory.*

This station is required by statute to analyze yearly at least one sample of every commercial fertilizer which is offered for sale in the state. "Stable manure and the products of local manufacturers of less value than ten dollars per ton," are excepted.

The station is also required to publish these analyses yearly.

DUTIES OF MANUFACTURERS AND DEALERS.

The General Statutes, sections 4581 to 4590, inclusive, make the following requirements regarding commercial fertilizers:

1. The seller is responsible for affixing to every package sold, a label which shall correctly give the number of pounds in the package, name of the fertilizer, name and address of the manufacturer, place of manufacture and a statement of composition, expressed in a way approved by this station.

The place of manufacture is the place where the materials which compose the manufactured article are mixed and put together. The manufacturer is the person or firm which owns or controls the manufacturing plant or machinery.

The statement of composition referred to in the statute must conform to the following requirements:

A statement of the percentages of nitrogen, phosphoric acid (P_2O_5) and potash (K_2O), and of their several states or forms, will suffice in most cases. Other ingredients may be named if desired.

In all cases the percentage of *nitrogen* must be stated. Ammonia may also be given when actually present in ammonia salts, and "ammonia equivalent of nitrogen" may likewise be stated.

The percentages of water-soluble and citrate-soluble phosphoric acid may be given separately or together, and the term "available" may be used in addition to, but not instead of, water-soluble and citrate-soluble.

The percentage of acid-soluble phosphoric acid may be stated or omitted.

In case of bone, fish, tankage, dried meat, dried blood, etc., the statement of chemical composition must take account of the two ingredients, nitrogen and phosphoric acid.

For potash salts the percentage of potash (potassium oxide) must always be given; that of sulphate of potash or muriate of potash may also be stated.

2. The seller is responsible for the payment to the station director, on or before May first, annually, of an analysis fee on every brand sold by him.

The analysis fee for any brand will usually be ten, twenty or thirty dollars, according as one, two, or all three of the ingredients—nitrogen, phosphoric acid and potash—are contained or claimed to exist in the fertilizer.

3. Before any brand of fertilizer is sold in the state, the agent or seller must file with the director of this station two certified copies of the statement named in 1, and a sealed glass jar containing not less than one pound of the fertilizer, with an affidavit that it is a fair average sample.

The agent or seller is free from the three obligations just stated only when the manufacturer or importer fulfils them instead.

4. In any case the agent or seller must annually report to the director of this station his name, residence and post office address and the name of the fertilizers which he sells, with the names and addresses of the manufacturers or importers.

OBSERVANCE OF THE FERTILIZER LAW.

During 1909, forty individuals or firms have entered for sale in this state three hundred and sixteen brands of fertilizers, viz:

Special manures for particular crops	154
Other nitrogenous superphosphates	96
Bone manures and "bone and potash"	22
Fish, tankage, castor pomace and chemicals	44
Total	316

Here follows a list of manufacturers who have paid analysis fees as required by the fertilizer law, and the names or brands of the fertilizers for which fees have been thus paid for the year ending May 1st, 1910. No others than those named below have been legally sold in this state.

Firm.	*Brand of Fertilizer.*
American Agricultural Chemical Co., The, 2 Rector St., N. Y. City.	A. A. C. Co.'s Complete Manure with 10% Potash,
	Complete Tobacco Manure,
	" " " (Carb.),
	Grass and Lawn Top Dressing,
	H. G. Tobacco Manure,
	Potato Fertilizer,
	Tobacco Starter and Grower,
	Dry Ground Fish,
	Fine Ground Bone,
	Grass and Oats Fertilizer,
	Acid Phosphate,
	Muriate of Potash,
	Nitrate of Soda,
	Bradley's Complete Manure for Potatoes and Vegetables,
	Complete Manure for Top Dressing Grass and Grain,
	Corn Phosphate,
	Eclipse Phosphate,
	Farmers' New Method Fertilizer,
	Niagara Phosphate,
	Potato Fertilizer,
	Manure,
	Superphosphate,
	Church's Fish and Potash,
	Crocker's Ammoniated Corn Phosphate,
	Potato, Hop and Tobacco Fertilizer,
	Darling's Blood, Bone and Potash,
	Dissolved Bone and Potash,
	Farm Favorite,
	General Fertilizer,
	Potato Manure,
	East India A. A. Ammoniated Superphosphate,
	Potato Manure,
	Great Eastern General,
	H. G. Vegetable, Vine and Tobacco Fertilizer,
	Northern Corn Special,
	North Western Fish, Bone and Potash,
	Market Garden Phosphate,
	Superphosphate,
	10% Potato Fertilizer,
	Universal Fertilizer,

Firm.	*Brand of Fertilizer.*
American Agricultural Chemical Co., The—*Continued.*	Packer's Union Animal Corn Fertilizer, Gardener's Complete Manure, Potato Manure, Universal Fertilizer, Quinnipiac Climax Phosphate, Corn Manure, Market Garden Manure, Phosphate, Potato Manure, Phosphate, Read's Practical Potato Special, Standard Superphosphate, Vegetable & Vine Fertilizer, Wheeler's Bermuda Onion Grower, Corn Fertilizer, Grass and Oats, Havana Tobacco Grower, Potato Manure, W'm's & C's Americus Ammoniated Bone Superphosphate. Corn Phosphate, H. G. Special Fertilizer, Potato Manure, Potato Phosphate.
American Reduction Co. of Pittsburgh, Pittsburgh, Pa.	Tankage.
Armour Fertilizer Works, The, Baltimore, Md.	All Soluble, Ammoniated Bone with Potash, Bone, Blood and Potash, Complete Potato, Corn King, Fish and Potash, Fruit and Root Crop Special, Grain Grower, H. G. Potato, Market Garden, Bone Meal.
Baker, H. J., & Bro., 100 William St., N. Y. City.	Baker's Pure Castor Pomace.
Berkshire Fertilizer Co., Bridgeport, Conn.	Berkshire Ammoniated Bone Phosphate, Complete Fertilizer, Grass Special, Long Island Special, Potato and Vegetable Phosphate, Tobacco Special, Ground Bone.
Boardman, F. E., Middletown, Conn.	Boardman's Complete Fertilizer.
Bohl, Valentine, Waterbury, Conn.	Self Recommending Fertilizer.

Firm.	*Brand of Fertilizer.*
Bowker Fertilizer Co., 60 Trinity Place, N. Y. City.	Bowker's Bone and Wood Ash Fertilizer, Complete Alkaline Tobacco Grower, Corn Phosphate, Early Potato Manure, Fisherman's Brand Fish and Potash, Gloucester Fish and Potash, Hill and Drill Phosphate, Lawn and Garden Dressing, Market Garden Fertilizer, Potato and Vegetable Fertilizer, Potato and Vegetable Phosphate, Sure Crop Phosphate, Tobacco Starter, Fine Ground Dry Fish, Fresh Ground Bone, Pure Unleached Canada Hard Wood Ashes, Tobacco Ash Elements, Acid Phosphate, Stockbridge Special Complete Manure for Corn and Grain, Stockbridge Special Complete Manure for Potatoes and Vegetables, Stockbridge Special Complete Manure for Seeding Down, Stockbridge Special Complete Manure for Top Dressing, Stockbridge Tobacco Manure, Fresh Milled Kainit, Muriate of Potash, Nitrate of Soda.
Broad Brook Lumber and Coal Co., The, Broad Brook, Conn.	Broad Brook Special.
Buffalo Fertilizer Co., Buffalo, N. Y.	Buffalo Tobacco Producer, Celery and Potato Special, Farmers' Choice, Fish Guano, H. G. Manure, New England Special, Top Dresser, Vegetable and Potato, Bone Meal.
Clark Seed Co., Everett B., The, Milford, Conn.	Clark's Special Mixture for General Use, Special 10% Brand.
Coe-Mortimer Co., The, 24-26 Stone St., N. Y. City.	E. Frank Coe's Celebrated Special Potato Fertilizer, E. Frank Coe's Gold Brand Excelsior Guano,

Firm.	*Brand of Fertilizer.*
Coe-Mortimer Co., The—*Continued.*	E. Frank Coe's H. G. Ammoniated Bone Superphosphate, E. Frank Coe's New Englander Corn and Potato Fertilizer, E. Frank Coe's Red Brand Excelsior Guano, E. Frank Coe's Tobacco and Onion Fertilizer, Genuine Peruvian Guano, Lobos Grade, Peruvian Vegetable Grower, Muriate of Potash, Nitrate of Soda, Sulphate of Potash, Thomas Phosphate Powder, Tankage.
Conn. Fat Rendering and Fertilizing Corp'n, New Haven, Conn.	Tankage.
Conn. Valley Orchard Co., Berlin, Conn.	C. V. O. Co's H. G. Special.
Cooper's Glue Factory, Peter, 13 Burling Slip, N. Y. City.	Pure Bone Dust.
Dennis, George L., Stafford Springs, Conn.	Bone.
Eldredge, T. H., Norwich, Conn.	Eldredge's Special Fish and Potash Fertilizer, Superphosphate.
Essex Fertilizer Co., 39 North Market St., Boston, Mass.	Essex Complete for Potatoes, Roots and Vegetables, Market Garden and Potato Manure, Special Tobacco Manure, Tobacco Starter and Grower, XXX Fish and Potash, Complete Manure for Corn, Grain and Grass, Fertilizer for Grass and Top Dressing, Dry Ground Fish, Ground Bone.
Frisbie, L. T., Co., The, New Haven, Conn.	Frisbie's Corn and Grain Fertilizer, Potato Manure, Fine Bone Meal.
Germofert Mfg. Co., 21 Broad St., Charleston, S. C.	Germofert Patented Fruit and Flower Developer, Potato Manure, Special Cotton Grower.
James, Ernest L., Warrenville, Conn.	James' Bone Phosphate, Ground Bone.

Firm.	*Brand of Fertilizer.*
Lister's Agricultural Chemical Works, Newark, N. J.	Lister's Ammoniated Dissolved Bone, Phosphate, Grass and Oat Fertilizer, No. 2 Corn Fertilizer, Potato Manure, Special Corn Fertilizer, Grass Mixture, Potato Fertilizer, Tobacco Fertilizer, Standard Pure Bone Superphosphate of Lime, Success Fertilizer, 3-6-10 for Potatoes, Animal Bone and Potash, Celebrated Ground Bone Acidulated.
Manchester, E., & Sons, Winsted, Conn.	Manchester's Formula.
Mapes F. & P. G. Co., The, 143 Liberty St., N. Y. City.	Average Soil Complete Manure, Cereal Brand, Complete Manure "A" Brand, Corn Manure, Economical Potato Manure, Fruit and Vine, Potato Manure, Seeding Down Manure, Tobacco Ash Constituents, Manure, Wrapper Brand, Starter, Improved, Top Dresser, Improved, Full Strength, Half Strength, Vegetable Manure, or Complete Manure for Light Soils, Dissolved Bone.
National Fertilizer Co., The, 60 Trinity Place, N. Y. City.	Chittenden's Ammoniated Bone Phosphate, Complete Grass Fertilizer, Root Fertilizer, Tobacco Fertilizer, Conn. Valley Tobacco Grower, Conn. Valley Tobacco Starter, Eureka Potato Fertilizer, Fish and Potash, Formula "A," H. G. Special Tobacco Fertilizer, Market Garden Fertilizer, Potato Phosphate, Tobacco Special with Carbonate of Potash, Universal Phosphate, XXX Fish and Potash,

Firm.	*Brand of Fertilizer.*
National Fertilizer Co., The—*Continued.*	Chittenden's Dry Ground Fish, Ground Bone, Soluble Bone and Potash, Fresh Milled Kainit, Muriate of Potash, Nitrate of Soda.
New England Fertilizer Co., 40A North Market St., Boston, Mass.	Corn and Grain Fertilizer, Corn Phosphate, H. G. Potato Fertilizer, Perfect Tobacco Grower, Potato Fertilizer, Superphosphate, Ground Bone.
Niantic Menhaden Oil and Guano Co., The, South Lyme, Conn.	Bone, Fish and Potash, Corn and Grain Fertilizer, Market Garden Manure, Potato and Vegetable Manure, Acidulated Fish Guano, Dry Ground Fish Guano.
Nitrate Agencies Co., 64 Stone St., N. Y. City.	Nitrate of Soda.
Olds & Whipple, Hartford, Conn.	O. & W.'s Complete Tobacco Fertilizer, Corn and Potato Fertilizer, Fish and Potash, Grass Fertilizer, H. G. Potato Fertilizer, Special Phosphate, Dry Ground Fish, Grey Pomace, Vegetable Potash.
Parmenter & Polsey Fertilizer Co., 40 North Market St., Boston, Mass.	"A. A." Brand, P. & P. Potato Fertilizer, Plymouth Rock Brand, Special Potato Fertilizer, Muriate of Potash.
Pulverized Manure Co., The, 28 Exchange Ave., Chicago.	Wizard Brand Manure.
Rogers & Hubbard Co., The, Middletown, Conn.	Hubbard's Complete Phosphate, Fertilizer for Oats and Top Dressing, Grass and Grain Fertilizer, New Market Garden Phosphate, Potato Phosphate, Soluble Corn and General Crops Manure, Potato Manure, Tobacco Manure, Pure Raw Knuckle Bone Flour, Strictly Pure Fine Bone.

Firm.	*Brand of Fertilizer.*
Rogers Mfg. Co., The, Rockfall, Conn.	All Round, Complete Corn and Onion, Potato and Vegetable, Fish and Potash, H. G. Grass and Grain, Oats and Top Dressing, Soluble Tobacco, Tobacco and Potato, Tobacco Grower, Tobacco Starter, Knuckle Bone Flour, Pure Fine Ground Bone.
Sanderson Fertilizer and Chemical Co., New Haven, Conn.	Atlantic Coast Bone, Fish and Potash, Kelsey's Bone, Fish and Potash. Sanderson's Corn Superphosphate, Formula A, B for Tobacco, Potato Manure, Special with 10% Potash, Top Dressing for Grass and Grains, Fine Ground Bone, Fish, Superphosphate with Potash, Muriate of Potash, Nitrate of Soda.
Shay, C. M., Fertilizer Co., The, Groton, Conn.	Shay's Corn Fertilizer, Grass and Lawn, Potato, Pure Ground Bone, Tankage.
Shoemaker, M. L., & Co., Venango St. and Delaware Ave., Philadelphia, Pa.	"Swift-Sure" Superphosphate for General Use, Superphosphate for Potatoes, Superphosphate for Truck, Corn and Onions, Bone Meal.
Swift's Lowell Fertilizer Co., 40 North Market St., Boston, Mass.	Swift's Lowell Animal Brand, Bone Fertilizer, Dissolved Bone and Potash, Empress Brand, Potato Manure, Phosphate, Ground Bone, Swift's Market Garden Manure, Perfect Tobacco Grower, Potato Grower, Special Corn and Vegetable Manure, Grass Mixture,

Firm.	*Brand of Fertilizer.*
Swift's Lowell Fertilizer Co.,—*Continued.*	Swift's Superior Fertilizer with 10% Potash, Tobacco Manure, Acid Phosphate, Muriate of Potash, Nitrate of Soda.
Wheeler, A. G. & F., Stonington, Conn.	Wheeler's Potato Special.
Wilcox Fertilizer Co., The, Mystic, Conn.	Wilcox's Complete Bone Superphosphate, Fish and Potash, Grass Fertilizer, H. G. Fish and Potash, Tobacco Special, Potato Fertilizer, Onion and Vegetable Manure, Special Superphosphate, Dry Ground Acidulated Fish, Fish, Pure Ground Bone, Acid Phosphate, H. G. Sulphate of Potash, Muriate of Potash, Nitrate of Soda.
Woodruff, S. D., & Sons, Orange, Conn.	Woodruff's Home Mixture.

The analyses which follow are chiefly useful as a guide in making purchases for the next year. Most of them are of brands which are offered year after year in Connecticut and the analyses serve to show whether or not these brands are maintaining their original quality.

The larger part of the year's supply of fertilizers is shipped into the state just before planting time, much of it after river navigation is opened. Many brands are not in market till the middle of April. Obviously these conditions make it impossible for the station to sample and analyze all the brands of fertilizers sold in Connecticut and tabulate and publish the results in time to show the composition of all of them before they are bought and applied.

When new brands are offered, the station endeavors to analyze such brands at once and to distribute the report of the results as quickly and widely as possible. Farmers can aid greatly by calling the attention of the station promptly to new kinds of fertilizers which are offered for sale.

SAMPLING AND COLLECTION OF FERTILIZERS.

During April, May and June, Mr. V. L. Churchill, the sampling agent of this station, visited ninety-eight towns and villages in Connecticut to draw samples of commercial fertilizers for analysis. These places were distributed as follows:

Litchfield County	5
Hartford County	30
Tolland County	11
Windham County	9
New London County	8
Middlesex County	7
New Haven County	16
Fairfield County	12
	98

In these places six hundred and eighty-four samples were taken.

The agent did not find on sale the following brands: American Agricultural Chemical Co.'s Potato Fertilizer, Stockbridge Seeding Down Manure, Lister's Pure Bone Superphosphate of Lime, Parmenter & Polsey's "A. A." Brand, Swift's Lowell Special Grass, Acid Phosphate, Muriate of Potash and Nitrate of Soda, Wheeler's Grass and Oats Fertilizer, The American Agricultural Chemical Co.'s Complete Tobacco Manure (without Carbonate).

As no samples of any of these brands were deposited by the manufacturers at the station, it was impossible to make analyses of them.

With these exceptions, an analysis has been made of every brand of fertilizer which has been entered at the station for sale in Connecticut.

When several samples of a single brand are drawn in different parts of the state, the analysis is usually performed, not on any single sample, but on a mixture made of equal weights of all of the several samples. Thus, it is believed, the average composition of the goods is more fairly represented than by the analysis of single samples.

The station agent is instructed in every case to open at least three packages of each brand for sampling, and, if the number of packages is large, to take a portion from every tenth one, by means of a sampling tube which withdraws a section or core diagonally through the entire length of the bag or barrel.

As a rule, the station will not analyze samples taken from dealer's stock of less than one ton, from stock which has lain over from last season, or from stock which is improperly stored, as in bags lying on wet ground, or exposed to the weather, etc.

The station also analyzes fertilizers sent by purchasers, if the analyses can possibly be of general value and if the samples are taken in strict accordance with the station's instructions for sampling and the correctness of the sample is duly certified.

A sample taken carelessly or incorrectly is quite certain to work injustice both to the seller and buyer. Accuracy of sampling is just as necessary as accuracy of analysis. The sampling is, in reality, a very important part of the analysis.

ANALYSES OF FERTILIZERS.

During the year 737 samples of commercial fertilizers and manurial waste-products have been analyzed. A classified list of them is given below and the results of their examination are given in detail in the following pages.

Samples are analyzed as promptly as possible in the order in which they are received. As soon as an analysis is completed, a copy of it is sent to the party who furnished the sample and also to the manufacturer, in order that there may be opportunity for correction or protest, before the results are published.

DESCRIPTIONS AND ANALYSES OF FERTILIZERS.*

The samples referred to in the following pages were drawn by the station agent, unless the contrary is stated.

The analyses were made by the methods adopted by the Association of Official Agricultural Chemists and the results are always expressed in percentages, or parts per hundred by weight, of the material examined.

Every percentage given has been determined by two separate analyses, usually made by two chemists working independently, and all calculations are also made in duplicate.

* The analyses of fertilizers included in this chapter have been made by Mr. Street, chemist in charge, with the assistance of Messrs. Bailey, Morrison, Brautlecht and Rodman, station chemists, and of Mr. Lange. The results have been discussed by the director.

In order to avoid confusion, each sample, as it is received, is given a consecutive number, by which it is distinguished in the laboratory. As the numbers had become so large as to be somewhat unwieldy, the numbering was begun again at unity in 1900.

CLASSIFICATION OF THE FERTILIZERS ANALYZED.

	Number of Samples.
1. *Containing nitrogen as the chief active ingredient.*	
Nitrate of soda	16
Dried blood	3
Cotton seed meal	217
Castor pomace	6
2. *Containing phosphoric acid as the chief active ingredient.*	
Basic slag, ground phosphate rock, burned bone, etc.	10
Dissolved phosphate rock	13
3. *Containing potash as the chief active ingredient.*	
Muriates and sulphates	21
Kainit	3
"Vegetable potash"	2
4. *Containing nitrogen and phosphoric acid.*	
Bone manures	26
Slaughter house tankage	19
Garbage tankage	3
Dried fish	20
5. *Mixed fertilizers.*	
Dissolved bone and potash	3
Nitrogenous superphosphates and guanos	116
Special manures	161
Home mixtures	17
6. *Miscellaneous fertilizers, manures and amendments*	81
	737

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA OR SODIUM NITRATE.

Nitrate of soda is mined in Chili and purified there before shipment. As offered in the Connecticut market it contains about 15.50 per cent. of nitrogen, equivalent to 94.1 per cent. of pure sodium nitrate. The other usual constituents are moisture and small quantities of common salt and Glauber's salt.

Shipments differ somewhat in composition, as is shown by the sixteen samples which have been analyzed, as follows:

22395. Sampled from stock of Chas. R. Treat, Orange.

22438. Sold by The Coe-Mortimer Co., New York. Sampled from stock of J. G. Schwink, Meriden.

22660. Sold by Buffalo Fertilizer Co., Buffalo, N. Y. Sampled from stock of S. L. Tuttle, Wallingford.

22810. Sampled and sent by Thos. J. Pring & Bros., Wallingford.

22719. Sold by Bowker Fertilizer Co., New York. Sampled from stock of J. Frank Ellwood, Green's Farms.

22665. Sold by Nitrate Agencies Co., New York. Sampled from stock of H. H. McKnight, Ellington.

22531. Sold by The National Fertilizer Co., New York. Sampled and sent by Henry Davis, Thompsonville.

22456. Sold by The American Agricultural Chemical Co., New York. Sampled from stock of F. S. Bidwell & Co., Windsor Locks.

22691. Sold by E. Aspinall, New York. Sampled and sent by Andrew Kingsbury, Rockville, Conn.

Analyses of Nitrate of Soda.

	Charles R. Treat.	Coe-Mortimer Co.	Buffalo Fertilizer Co.	T.J. Pring & Bros.	Bowker.	Nitrate Agencies Co.	National Fertilizer Co.	A. A. C. Co.
Station No.	**22395**	**22438**	**22660**	**22810**	**22719**	**22665**	**22531**	**22456**
Percentage amounts of								
Nitrogen found	15.70	15.34	15.64	15.48	15.40	15.52	15.44	15.60
Nitrogen guaranteed	15.65	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Cost per ton	$47.80*	48.00	50.00	50.00	50.00	52.50	52.40	54.00
Nitrogen cost cents per pound	**15.2**	**15.6**	**16.0**	**16.1**	**16.2**	**16.9**	**17.0**	**17.3**

* Mixed car lot.

	E. Aspinall.	Coe-Mortimer Co.	National Fertilizer Co.	Wilcox Fertilizer Works.	Sanderson F. & C. Co.	Coe-Mortimer Co.	A. A. C. Co.	Woodruff.
Station No.	**22691**	**22472**	**22459**	**22465**	**22425**	**22535**	**22403**	**22388**
Percentage amounts of								
Nitrogen found	15.68	15.44	15.32	15.40	15.54	15.44	15.54	15.20
Nitrogen guaranteed	15.65	15.00	15.00	15.00	15.00	15.00	15.63	----
Cost per ton	55.00	54.00	55.00	56.00	57.00	----	----	----
Nitrogen cost cents per pound	**17.5**	**17.5**	**18.0**	**18.2**	**18.3**	----	----	----

The percentage of nitrogen ranges from 15.70 to 15.20 and averages 15.48, 0.17 higher than last year.

The retail cost of nitrogen ranges from 15.6 to 18.3, the average being 17.1 cents per pound.

22472. Sold by The Coe-Mortimer Co., New York. Sampled and sent by S. R. Spencer, Suffield.

22459. Sold by The National Fertilizer Co., New York. Sampled from stock of H. A. Bugbee, Willimantic.

22465. Sold by The Wilcox Fertilizer Works, Mystic. Sampled from stock at factory.

22425. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled from stock at factory.

22535. Sold by The Coe-Mortimer Co., New York. Sampled from stock of Connecticut School for Boys, Meriden.

22403. Sold by The American Agricultural Chemical Co., New York. Sampled from stock of Andrew Ure, Highwood.

22388. Sampled from stock of S. D. Woodruff & Sons, Orange.

DRIED BLOOD.

Blood collected in slaughter houses is coagulated by cooking and from the coagulum the water is removed by pressure and kiln drying. Thus prepared it contains about 14 per cent. of nitrogen, but often other materials are mixed with the blood which reduce the nitrogen percentage in the product.

If blood is dried at a low heat its nitrogen is quickly available to plants, but if overheated its value as a fertilizer may be much impaired.

22406. Sold by The American Agricultural Chemical Co., New York. Sampled from stock of Andrew Ure, Highwood. Nitrogen found 10.35 per cent.; guaranteed 9.80.

22160. Sold by the Trenton Fertilizer Co., Trenton, N. J. Sampled and sent by W. H. Shumway, Berlin. It was sold for $4.00 per 100 lbs. It contained 13.32 per cent. of nitrogen, 0.54 per cent. of phosphoric acid and 0.59 per cent. of water-soluble potash.

22965. Sampled and sent by E. M. Ives, Meriden, contained 8.90 per cent. of nitrogen.

COTTON SEED MEAL.

(Analyses on pages 16 to 28.)

Decorticated meal is the only kind which Connecticut farmers can afford to buy, either for feed or fertilizer, at ruling prices. It should contain at least 6.5 per cent. of nitrogen.

Analyses of Cotton Seed Meal.

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22125	Humphreys, Godwin & Co., Olds & Whipple, Hartford	Olds & Whipple	8.22	8.00	$34.00	18.4
22493	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.19	7.00	30.25	18.4
22549	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	7.20	7.00	30.50	18.5
22379	H. G. & Co., Memphis, Tenn.	Frank M. Thompson, Warehouse Point	7.23	7.00	30.50	18.5
22128	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	W. C. Sikes, Suffield	6.81	6.50	29.00	18.5
21977	J. E. Soper & Co., Boston, Mass., W. F. Fletcher, Southwick, Mass.	John B. Cannon, Granby	6.96	6.50	29.75	18.6
22415	Arthur Sikes, Suffield	Herman Ude, Suffield	7.05	6.50	30.00	18.6
22150	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros., Suffield	7.30	7.00	31.00	18.6
22149	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	A. E. Pascoe, O. T. Cone, Warehouse Point	7.32	7.00	31.00	18.6
22432	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.10	7.00	30.25	18.6
22433	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.08	7.00	30.25	18.7
22694	H. G. & Co., Memphis, Tenn., The Loomis Bros. Co., Granby	Chas. P. Viets, East Granby	7.35	7.00	31.25	18.7
22547	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	7.14	7.00	30.50	18.7
22590	The Hunter Bros. Milling Co., St. Louis, Mo., N. J. Trench, Granby	E. C. Hills, Southwick, Mass.	6.91	6.50	29.70	18.7
22947	S. D. Viets Co., Springfield, Mass.	A. N. Graves, Windsor Locks	6.75	6.50	29.15	18.8
22378	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.03	7.00	30.25	18.8
22364	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.05	7.00	30.25	18.8
22129	F. W. Brode & Co., Memphis, Tenn.	R. H. Ensign, Simsbury	6.93	6.50	30.00	18.9
22353	Arthur Sikes, Suffield	A. N. Beach, W. Suffield, Miss L. E. Hathaway and others	6.93	6.50	30.00	18.9

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22418	Arthur Sikes, Suffield	H. Fuller, F. R. Soper, J. Welch, C. H. Nelson and others	6.92	6.50	$30.00	18.9
22948	S. D. Viets Co., Springfield, Mass.	A. N. Graves, Windsor Locks	6.66	6.50	29.15	19.0
21821	J. E. Soper & Co., Boston, Mass., W. F. Fletcher, Southwick, Mass.	D. A. Merriam, Granby	6.84	6.50	29.75	19.0
21978	J. E. Soper & Co., Boston, Mass., W. F. Fletcher, Southwick, Mass.	J. B. Cannon, Granby	6.80	6.50	29.75	19.0
22334	Olds & Whipple, Hartford	L. H. Brewer, Hockanum	7.28	7.00	31.50	19.0
22345	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	7.16	7.00	31.00	19.0
22172	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	7.17	7.00	31.00	19.0
22979	American Agricultural Chemical Co., New York	Indian Head Plantations, Tariffville	6.90	8.24	30.00	19.0
22949	S. D. Viets Co., Springfield, Mass.	A. N. Graves, Windsor Locks	6.65	6.50	29.15	19.1
22950	S. D. Viets Co., Springfield, Mass.	A. N. Graves, Windsor Locks	6.65	6.50	29.15	19.1
22599	J. E. Soper & Co., Boston, Mass., Thos. Holt, Southington	Station Agent	6.85	6.50	30.00	19.1
22417	Arthur Sikes, Suffield	E. A. Fuller and others, Suffield	6.98	6.50	30.50	19.1
22349	Arthur Sikes, Suffield	C. F. Whittemore, Suffield	6.86	6.50	30.00	19.1
22368	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	7.91	7.41	34.00	19.1
22162	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	James Gamble, Thompsonville	7.18	7.00	31.25	19.1
22504	Planters' Oil Co., Albany, Ga., E. N. Austin, Suffield	H. W. Prout, Suffield	6.62	6.58	29.25	19.2
22598	Geo. B. Robinson, Jr., New York, W. K. Ackley, East Hartford	W. K. Ackley, East Hartford	7.10	6.50	31.00	19.2
22151	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	G. W. Root and others, West Suffield	7.33	7.00	32.00	19.2

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22580	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.10	7.00	$31.00	19.2
22492	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	6.90	7.00	30.25	19.2
22167	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville, Chas. Chapin, Enfield	7.16	7.00	31.25	19.2
22392	S. D. Viets Co., Springfield, Mass., James Price, Warehouse Point	James Price, Warehouse Point	6.81	6.50	30.00	19.2
22946	S. D. Viets Co., Springfield, Mass.	A. N. Graves, Windsor Locks	6.58	6.50	29.15	19.3
22393	H. G. & Co., Memphis, Tenn., James Price, Warehouse Point	James Price and others, Warehouse Pt.	6.80	6.50	30.00	19.3
22317	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	H. S. Pomeroy and others, Suffield	7.04	7.00	31.00	19.3
22410	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.32	7.00	32.00	19.3
22408	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.29	7.00	32.00	19.3
22593	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	8.08	7.00	35.00	19.3
22522	Olds & Whipple, Hartford	Martin Roberts, Silver Lane	7.31	7.00	32.00	19.3
22726	Planters' Oil Co., Albany, Ga., E. N. Austin, Suffield	E. N. Austin	6.61	6.58	29 25	19.3
22628	Arthur Sikes, Suffield	H. D. Sikes & S. H. Graham, Suffield	6.84	6.50	30.25	19.3
22592	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	8.06	7.00	35.00	19.4
22527	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	8.06	7.82	35.00	19.4
22328	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.28	7.20	32.00	19.4
22343	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.00	6.50	31.00	19.4
22409	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.00	7.00	31.00	19.4
22442	H. G. & Co., Memphis, Tenn., The Loomis Bros. Co., Granby	W. R. Messenger, Granby	7.08	7.00	31.25	19.4
22627	Arthur Sikes, Suffield	Geo. S. Phelps, T. F. Devine, Suffield	6.71	6.50	30.00	19.5

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22416	Arthur Sikes, Suffield	W. A. Soper, W. C. Smith, F. S. Chapell, Suffield	6.99	6.50	$31.00	19.5
22505	Planters' Oil Co., Albany, Ga., E. N. Austin, Suffield	C. A. Prout, Suffield	6.54	6.58	29.25	19.5
22012	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.11	7.20	31.50	19.5
22013	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.10	7.20	31.50	19.5
22037	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.10	7.20	31.50	19.5
22323	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.22	7.20	32.00	19.5
22528	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	8.02	7.82	35.00	19.5
22365	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	7.75	7.41	34.00	19.5
22583	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros., Suffield, Gantley Bros., Windsor Locks	6.98	6.50	31.00	19.5
22340	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.98	6.50	31.00	19.5
22342	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.96	6.50	31.00	19.5
22664	F. W. Brode & Co., Memphis, Tenn., S. L. Tuttle, Wallingford	Station Agent	6.70	6.50	30.00	19.5
22351	Arthur Sikes, Suffield	W. E. Russell, G. B. Parks, Suffield	6.68	6.50	30.00	19.6
22350	Arthur Sikes, Suffield	D. L. Brockett, H. A. Henshaw, N. A. Talmadge, J. Holzapfel	6.68	6.50	30.00	19.6
22407	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.20	7.00	32.00	19.6
22341	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros., C. C. Bissell, Suffield	7.20	7.00	32.00	19.6

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22412	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.21	7.00	$32.00	19.6
22441	H. G. & Co., Memphis, Tenn., The Loomis Bros. Co., Granby	Mrs. J. R. Holcomb, Granby	7.01	7.00	31.25	19.6
22499	H. G. & Co., Memphis, Tenn., The Loomis Bros. Co., Granby	W. R. Messenger, Granby	6.99	7.00	31.25	19.6
22723	S. D. Viets Co., Springfield, Mass., James McCarl, Suffield	Station Agent	6.57	----	29.50	19.6
22728	S. D. Viets Co., Springfield, Mass.	E. S. Seymour, Suffield	6.60	6.50	29.65	19.6
22038	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple, Hartford	7.04	7.20	31.50	19.7
22625	Arthur Sikes, Suffield	D. I. King, Suffield	6.66	6.50	30.00	19.7
22153	American Cotton Oil Co., New York, Spencer Bros., Suffield	Jas. H. Sullivan, John Sullivan, Suffield	6.37	6.18	29.00	19.8
22319	American Cotton Oil Co., New York, Spencer Bros., Suffield	B. L. Root, John Sullivan, Suffield	6.38	6.18	29.00	19.8
22729	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.86	6.50	31.00	19.8
22784	S. D. Viets, Springfield, Mass.	E. S. Seymour, Suffield	6.54	6.50	29.65	19.8
22624	Arthur Sikes, Suffield	James Davis & R. H. Loomis, Suffield	6.62	6.50	30.00	19.8
22006	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. & A. B. Crane, Suffield	6.84	6.50	31.00	19.9
22152	American Cotton Oil Co., New York, Spencer Bros., Suffield	Jas. H. Sullivan and John Sullivan, Suffield	6.32	6.18	29.00	19.9
22355	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	7.58	7.41	34.00	19.9
22366	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	7.60	7.41	34.00	19.9
22380	Hunter Bros. Milling Co., St. Louis, Mo., V. E. Moore, Springfield, Mass.	J. Lynch & Son, Thompsonville	6.72	6.50	30.50	19.9

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22725	American Cotton Oil Co., England, Ark., James Price, Warehouse Point	Geo. S. Phelps and W. H. Daley, Warehouse Point	6.58	6.50	$30.00	19.9
22354	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	7.57	7.41	34.00	20.0
22526	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.79	7.82	35.00	20.0
22591	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	8.18	7.41	36.50	20.0
22546	H. G. & Co., Memphis, Tenn,, The Loomis Bros. Co., Granby	Arthur Beeman, Granby	6.98	7.00	31.75	20.0
22491	H. G. & Co., Memphis, Tenn., The Loomis Bros. Co., Granby	H. W. Viets, Granby	6.88	7.00	31.25	20.0
21990	H. G. & Co.,Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	6.62	6.50	30.25	20.0
22039	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	H. K. Brainard	6.69	----	30.50	20.0
22130	F. W. Brode & Co., Memphis, Tenn.	R. H. Ensign, Simsbury	6 56	6.50	30.00	20.0
22352	Arthur Sikes, Suffield	W. C. Knox and others, Suffield	6.59	6.50	30.25	20.1
22321	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.25	7.41	33.00	20.1
22318	American Cotton Oil Co., New York, Spencer Bros., Suffield	B. L. Root, John Sullivan, Suffield	6.26	6.18	29.00	20.1
22698	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.48	7.00	34.00	20.2
22495	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.22	7.00	33.00	20.2
22344	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.00	7.00	32.00	20.2

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22333	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Christopher Michael, Suffield	7.00	7.00	$32.00	20.2
22320	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	B. L. Root, Jas. O. Haskins, Suffield	6.24	6.50	29.00	20.2
22464	Planters' Oil Co., Albany, Ga., Edmund Halladay, Suffield	Station Agent	6.50	6.58	30.00	20.2
22715	H. G. & Co., Memphis, Tenn., S. D. Viets Co., Springfield, Mass.	Henry Adams, Suffield	6.28	6.50	29.25	20.3
22173	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.20	7.41	33.00	20.3
22545	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	7.67	----	35.00	20.3
22498	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.20	7.00	33.00	20.3
22494	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros.	6.94	7.00	32.00	20.3
22367	H. G. & Co., Memphis, Tenn., Ackley, Hatch & Marsh, New Milford	Ackley, Hatch & Marsh	6.95	6.50	32.00	20.3
22631	Arthur Sikes, Suffield	A. J. Fish and others, Suffield	6.94	6.50	32.00	20.3
22626	Arthur Sikes, Suffield	E. A. Russell and others, Suffield	6.67	6.50	31.00	20.4
22550	H. G. & Co., Memphis, Tenn., H K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	6.78	7.00	31.50	20.4
22859	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.45	----	30 50*	20.5
22860	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.16	----	30.50*	20.5
22861	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.20	----	30.50*	20.5
22862	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.44	----	30.50*	20.5
22863	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.11	----	30.50*	20.5
22864	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.62	----	30.50*	20.5
22865	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.09	----	30.50*	20.5
22866	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.20	----	30.50*	20.5
22867	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.60	----	30.50*	20.5

* On basis of 6.5 per cent. nitrogen.

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22868	American Cotton Oil Co., New York	Conn. Tobacco Corporation, Granby	6.20	----	$30.50*	20.5
22951	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.99	7.41	36.50	20.5
22676	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.38	7.00	34.00	20.5
22331	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	S. J. Colter and others, Suffield	6.88	7.00	32.00	20.5
22582	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros., Suffield, Horace Ellsworth, Windsor	6.59	6.50	31.00	20.6
22695	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	8.12	7.82	37.25	20.6
22677	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.95	7.70	36.75	20.7
22525	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.30	7.00	34.00	20.7
22497	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros.	6.80	6.50	32.00	20.7
22332	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	M. Leahey, West Suffield	6.57	6.50	31.00	20.7
22003	H. G. & Co., Memphis, Tenn., Ackley, Hatch & Marsh, New Milford	Ackley, Hatch & Marsh	6.56	6.50	31.00	20.7
22981	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.88	7.41	36.50	20.8
22696	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	8.04	7.82	37.25	20.8
22952	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.82	7.41	36.50	20.9
22982	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.82	7.41	36.50	20.9
22815	H. G. & Co., Memphis, Tenn., W. H. Root, New Milford	Station Agent	6.52	6.17	31.00	20.9

* On basis of 6.5 per cent. nitrogen.

Analyses of Cotton Seed Meal.

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22125	Humphreys, Godwin & Co., Olds & Whipple, Hartford	Olds & Whipple	8.22	8.00	$34.00	18.4
22493	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.19	7.00	30.25	18.4
22549	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	7.20	7.00	30.50	18.5
22379	H. G. & Co.. Memphis, Tenn.	Frank M. Thompson, Warehouse Point	7.23	7.00	30.50	18.5
22128	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	W. C. Sikes, Suffield	6.81	6.50	29.00	18.5
21977	J. E. Soper & Co., Boston, Mass., W. F. Fletcher, Southwick, Mass.	John B. Cannon, Granby	6.96	6.50	29.75	18.6
22415	Arthur Sikes, Suffield	Herman Ude, Suffield	7.05	6.50	30.00	18.6
22150	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros., Suffield	7.30	7.00	31.00	18.6
22149	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	A. E. Pascoe, O. T. Cone, Warehouse Point	7.32	7.00	31.00	18.6
22432	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.10	7.00	30.25	18.6
22433	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.08	7.00	30.25	18.7
22694	H. G. & Co , Memphis, Tenn., The Loomis Bros. Co., Granby	Chas. P. Viets, East Granby	7.35	7.00	31.25	18.7
22547	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	7.14	7.00	30.50	18.7
22590	The Hunter Bros. Milling Co., St. Louis, Mo., N. J. Trench, Granby	E. C. Hills, Southwick, Mass.	6.91	6.50	29.70	18.7
22947	S. D. Viets Co., Springfield, Mass.	A. N. Graves, Windsor Locks	6.75	6.50	29.15	18.8
22378	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.03	7.00	30.25	18.8
22364	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	The Bissell-Graves Co., Suffield	7.05	7.00	30.25	18.8
22129	F. W. Brode & Co., Memphis, Tenn.	R. H. Ensign, Simsbury	6.93	6.50	30.00	18.9
22353	Arthur Sikes, Suffield	A. N. Beach, W. Suffield, Miss L. E. Hathaway and others	6.93	6.50	30.00	18.9

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22418	Arthur Sikes, Suffield	H. Fuller, F. R. Soper, J. Welch, C. H. Nelson and others	6.92	6.50	$30.00	18.9
22948	S. D. Viets Co., Springfield, Mass.	A. N. Graves, Windsor Locks	6.66	6.50	29.15	19.0
21821	J. E. Soper & Co., Boston, Mass., W. F. Fletcher, Southwick, Mass.	D. A. Merriam, Granby	6.84	6.50	29.75	19.0
21978	J. E. Soper & Co., Boston, Mass., W. F. Fletcher, Southwick, Mass.	J. B. Cannon, Granby	6.80	6.50	29.75	19.0
22334	Olds & Whipple, Hartford	L. H. Brewer, Hockanum	7.28	7.00	31.50	19.0
22345	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	7.16	7.00	31.00	19.0
22172	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville	7.17	7.00	31.00	19.0
22979	American Agricultural Chemical Co., New York	Indian Head Plantations, Tariffville	6.90	8.24	30.00	19.0
22949	S. D. Viets Co., Springfield, Mass.	A. N. Graves, Windsor Locks	6 65	6 50	29.15	19.1
22950	S. D. Viets Co., Springfield, Mass.	A. N Graves, Windsor Locks	6.65	6.50	29.15	19.1
22599	J. E. Soper & Co., Boston, Mass., Thos. Holt, Southington	Station Agent	6.85	6.50	30.00	19.1
22417	Arthur Sikes, Suffield	E. A. Fuller and others, Suffield	6.98	6.50	30.50	19.1
22349	Arthur Sikes, Suffield	C. F. Whittemore, Suffield	6.86	6.50	30.00	19.1
22368	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	7.91	7.41	34.00	19.1
22162	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	James Gamble, Thompsonville	7.18	7.00	31.25	19.1
22504	Planters' Oil Co., Albany, Ga., E. N. Austin, Suffield	H. W. Prout, Suffield	6.62	6.58	29.25	19.2
22598	Geo. B. Robinson, Jr., New York, W. K. Ackley, East Hartford	W. K. Ackley, East Hartford	7.10	6.50	31.00	19.2
22151	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	G. W. Root and others, West Suffield	7.33	7.00	32.00	19.2

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22431	Chapin & Co., Boston, Mass., Ackley, Hatch & Marsh, New Milford	Ackley, Hatch & Marsh	6.75	6.50	$32.00	**20.9**
22791	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.82	6.58	32.50	**21.0**
22700	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.90	7.82	37.00	**21.0**
22734	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	7.98	7.82	37.25	**21.0**
22732	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	7.95	7.82	37.25	**21.0**
22581	American Cotton Oil Co., New York, Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.72	6.50	32.00	**21.0**
22148	American Cotton Oil Co., New York, Spencer Bros., Suffield	Spencer Bros.	6.48	6.50	31.00	**21.0**
22521	Hunter Bros. Milling Co., St. Louis, Mo., H. C. Stowell, East Granby	Geo. Rengerman, East Granby	6.30	6.50	30.25	**21.0**
22817	Olds & Whipple, Hartford	Olds & Whipple	8.10	7.82	38.00	**21.1**
22793	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	8.08	7.82	38.00	**21.2**
22733	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	7.90	7.82	37.25	**21.2**
22594	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	8.06	7.82	38.00	**21.2**
22476	Hunter Bros. Milling Co., St. Louis, Mo., Somers Grain and Lumber Co., Somers	Avery & Daniels, Somers	7.12	6.50	34.00	**21.2**
22584	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.33	7.00	35.00	**21.3**

Analyses of Cotton Seed Meal—*Continued.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22674	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.08	7.00	$34.00	**21.3**
22768	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	8.02	7.82	38.00	**21.3**
22473	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.75	6.50	32.50	**21.3**
22411	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.38	6.50	31.00	**21.3**
22629	Arthur Sikes, Suffield	Fred. A. King and others, Suffield	6.40	6.50	31.00	**21.3**
22818	Olds & Whipple, Hartford	Olds & Whipple	7.98	7.82	38.00	**21.4**
22673	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.05	7.00	34.00	**21.4**
22595	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.28	7.00	35.00	**21.4**
22523	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.30	7.41	35.00	**21.4**
22727	H. G. & Co., Memphis, Tenn., Broad Brook Lumber and Coal Co., Broad Brook	Harry W. Mohn, Warehouse Point	6.20	6.50	30.50	**21.5**
22699	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.04	7.00	34.00	**21.5**
22524	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.60	7.82	36.50	**21.5**
22716	Chapin & Co., Boston, Mass., Ackley, Hatch & Marsh, New Milford	Ackley, Hatch & Marsh	6.98	6.50	34.00	**21.6**
22548	H. G. & Co., Memphis, Tenn., H. K. Brainard, Thompsonville	L. C. Brainard, Thompsonville, Chas. Tilden, Suffield	6.24	6.50	30.75	**21.6**
22630	Arthur Sikes, Suffield	C. S. Fuller and T. F. Devine, Suffield	6.50	6.50	32.00	**21.7**
22872	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.36	7.20	35.75	**21.7**

Analyses of Cotton Seed Meal—*Continued*.

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen cost cents per pound.
22678	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.62	6.58	$32.50	21.7
22671	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.93	7.00	34.00	21.8
22675	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.90	7.00	34.00	21.9
22789	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.77	7.82	38.00	22.0
22787	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.76	7.82	38.00	22.0
22597	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.42	7.41	36.50	22.0
22490	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.82	6.58	34.00	22.1
22585	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.38	7.41	36.50	22.2
22697	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.44	6.58	32.50	22.3
22672	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.78	7.00	34.00	22.3
22819	Olds & Whipple, Hartford	Olds & Whipple	7.10	7.20	35.75	22.5
22596	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.26	7.41	36.50	22.5
22765	H. G. & Co., Memphis, Tenn., The Broad Brook L. & C. Co., Broad Brook	The Broad Brook Lumber and Coal Co.	6.25	----	32.00	22.6
22587	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.92	7.00	35.00	22.6

Analyses of Cotton Seed Meal—*Continued*.

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22785	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.58	7.82	$38.00	22.6
22714	Buckeye Cotton Oil Co., Greenwood, Miss., Arthur Manning, South Manchester	Station Agent	6.32	6.17	32.50	22.7
22475	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	6.86	7.00	35.00	22.7
22786	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.50	7.82	38.00	22.8
22730	Chapin & Co., Boston, Mass., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.62	6.50	34.00	22.8
22496	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.38	6.50	33.00	22.9
22764	H. G. & Co., Memphis, Tenn., The Broad Brook L. & C. Co., Broad Brook	The Broad Brook Lumber and Coal Co.	6.16	....	32.00	22.9
22769	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.96	7.20	35.75	23.0
22766	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.10	7.41	36.50	23.0
22788	H. G. & Co., Memphis. Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.40	7.82	38.00	23.1
22474	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	6.75	7.00	35.00	23.1
22588	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.52	6.58	34.00	23.2
22792	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	6.85	7.20	35.75	23.3
22586	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	6.70	7.00	35.00	23.3

ANALYSES OF COTTON SEED MEAL—*Concluded.*

Station No.	Dealer.	Purchased, Sampled, or Sent by	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
22502	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	6.70	7.00	$35.00	23.3
22501	Hunter Bros. Milling Co., St. Louis, Mo., Olds & Whipple, Hartford	Olds & Whipple	6.67	7.00	35.00	23.4
22767	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	7.00	7.41	36.50	23.4
22816	Olds & Whipple, Hartford	Olds & Whipple	6.80	7.20	35.75	23.5
22589	American Cotton Oil Co., New York, J. E. Soper & Co., Boston, and Olds & Whipple, Hartford	Olds & Whipple	6.40	6.58	34.00	23.6
22770	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	6.86	7.41	36.50	23.8
22790	H. G. & Co., Memphis, Tenn., Olds & Whipple, Hartford	Olds & Whipple	7.17	7.82	38.00	23.9
22731	J. E. Soper & Co., Boston, Mass., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	5.98	6.50	33.00	24.4
22858	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	6.03	7.82	38.00	28.4
22857	H. G. & Co., Houston, Texas, Olds & Whipple, Hartford	Olds & Whipple	5.98	7.82	38.00	28.6
22635	H. G. & Co., Memphis, Tenn., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.31	6.50	....	....
22636	Chapin & Co., Boston, Mass., Spencer Bros., Suffield	Spencer Bros., Suffield, and others	6.68	6.50	....	....
22637	Chapin & Co., Boston, Mass., Spencer Bros., Suffield	Spencer Bros., Suffield, and others	7.14	6.50	....	....
22638	Chapin & Co., Boston, Mass., Spencer Bros., Suffield	Spencer Bros., Suffield, and others	7.05	6.50	....	....
22639	Chapin & Co., Boston, Mass., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	7.35	6.50	....	....
22640	American Cotton Oil Co., New York, Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.57	6.50	....	....
22641	Chapin & Co., Boston, Mass., Spencer Bros., Suffield	Spencer Bros. and others, Suffield	6.68	6.50	....	....

The color or "smoothness" of the meal is no sure indication of its purity, for a considerable quantity of fine ground hulls may be mixed with it and not betray its presence by appearance or feel.

It is now possible, where cotton seed meal is much used, to buy it with a guaranty of composition and to secure from the dealer a rebate in case analysis shows it to be below guaranty.

Two hundred and seventeen samples have been analyzed and in most cases each represented a car lot. Where the station analysis has shown that the meal sample was not as guaranteed, the dealer has in most cases at least made a rebate from the price. The proper sampling of meal is necessary in order to get a correct analysis and to found a claim for a rebate if the analysis shows a deficiency of nitrogen. A sample should be drawn from twenty sacks at least in each car lot, or from fifty sacks in a hundred ton lot. These should be well mixed and a sample of the mixture sent for analysis.

The analyses are given in the preceding table.

The average cost of the meal has been $32.52 per ton, ranging from $29. to $38.

The average percentage of nitrogen has been 7.02, ranging from 8.22 to 5.98.

This is about the same as last year.

The average cost of nitrogen per pound has been 20.5 cents, 1.6 cents higher than last year. For this calculation it is assumed that the samples contain 3.15 per cent. of phosphoric acid and 1.9 per cent. of potash, which are the averages of a large number of determinations.

CASTOR POMACE.

(ANALYSES ON PAGE 30.)

This is the ground residue of castor beans from which castor oil has been expressed or extracted. The nitrogen which it contains is readily available to plants, but the pomace is extremely poisonous to animals, which often eat it greedily when the opportunity offers.

Six samples have been analyzed this year, as follows:

Station No.	Sold by	Sampled and sent by
22503	Olds & Whipple, Hartford,	E. S. Seymour, Suffield.
22721	" " " "	Station Agent.
22335	" " " "	L. H. Brewer, Hockanum.
22462	" " " "	Station Agent.
22414	" " " "	Spencer Bros., Suffield.
22458	H. J. Baker & Bro., N. Y.,	Station Agent.

ANALYSES OF CASTOR POMACE.

		Olds & Whipple.				H. J. Baker & Bro.
Station No.	22503	22721	22335	22462	22414	22458
Percentage amounts of						
Nitrogen found	5.48	5.12	5.05	4.96	4.88	4.82
Nitrogen guaranteed	5.00	5.00	5.00	5.00	5.00	4.11
Cost per ton	$24.00	24.00	24.00	24.00	24.00	26.00
Nitrogen costs cents per pound	**19.9**	**21.3**	**21.6**	**22.0**	**22.4**	**24.7**

The percentages of phosphoric acid and potash in castor pomace are 1.95 and 0.98 respectively. The cost of nitrogen is determined in each case by deducting $2.15—the valuation of the phosphoric acid and potash—from the ton price, and dividing the remainder by the number of pounds of nitrogen in a ton of the pomace.

The cost of nitrogen in castor pomace has ranged from 19.9 to 24.7 cents per pound, the average of the six samples being 22.0 cents, 1.5 cents per pound more than in cotton seed meal.

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

BASIC SLAG PHOSPHATE.

This material is a by-product of the steel manufacture containing from 17 to 19 per cent. of phosphoric acid and 45 to 50 per cent. of lime in finely divided form. The lime is in an efficient form for correcting acidity of the soil. The phosphoric acid is fairly available to plants, though showing small "availability" by the conventional method which is discussed on page 35 of this report. In most cases it will probably be found less quick in its action as a source of phosphoric acid, but more lasting in its effects than acid phosphate.

For top-dressing grass land and for fruit trees it has given very satisfactory results.

The three samples tested were all sold by The Coe-Mortimer Co., New York, under guaranty of 18 per cent. phosphoric acid.

22440. Taken by the station agent from stock of J. G. Schwink, Meriden.

22470. Sampled and sent by S. R. Spencer, Suffield.

22623. Sampled and sent by O. E. Pitcher, Suffield.

ANALYSES OF BASIC SLAG PHOSPHATE.

Station No.	22440	22470	22623
Phosphoric acid	17.32	17.33	17.04
Lime	48.45	.....	.....

GROUND PHOSPHATE ROCK.

The term "floats" is properly applied only to the very fine dust "floated" in an air current from the mills which grind rock to prepare it for treatment with acid and not to the whole ground product, which is much coarser. The use of floats mixed with stable manure has been advocated as the cheapest method of stocking land with phosphates.

The admirable experiments made at the Ohio station give the best knowledge we have on the matter and may be very briefly noticed here, abstracted from Bulletin No. 183 of that station.

Manure which accumulated in the barnyard during the winter was divided into parcels with one of which floats and with another acid phosphate was mixed at the rate of forty pounds to the ton. (This would be about equivalent to one pound per day and head of stock.) Eight tons of each of these two mixtures were used on separate plots of land where corn, wheat and clover were grown in rotation for ten years. The results are calculated from ten weighed crops each of corn and wheat and six crops of hay. (The clover failed in four years and soy beans were sown and turned under in its place.) After deducting the cost of the treatment each application showed a net gain, that is, the use of both the acid phosphate and the floats paid well.

The author of the Bulletin states, page 210:

". . . . it has been unprofitable to use floats instead of acid phosphate, the net return from the manure treated with acid phosphate having been greater than that treated with floats by $2.86 per acre for the yard manure. . . .

"Floats contains about twice as large a percentage of phosphorus as acid phosphate, since floats and sulphuric acid are mixed in approximately equal weights to produce acid phosphate, and hence twice as much phosphorus has been applied to the plots receiving floats as to those receiving acid phosphate. It was expected that, with the progress of the experiment, a larger proportion of the floats would become available, and that the difference in effectiveness between the two materials would gradually diminish, an expectation which has not yet been realized."

And on page 212:

"It is true that a great deal more phosphorus is being stored in the soil dressed with the manure treated with floats than in that on which the acid phosphate is used for treatment, but it appears that in the latter case considerably more phosphorus is being given to the soil than is taken off in the crops, as shown by the following statement of income and outgo on Plot 6."

The statement referred to shows that manure and acid phosphate supplied 44 lbs. of phosphorus and the crops removed 30 lbs.

Summarizing the results it is stated, page 223:

"The net gain from the use of acid phosphate as a manure reënforcement has been greater than that from floats, and the ton of fresh manure, reënforced with 40 pounds of acid phosphate, has produced a 10-year average increase to the value of $4.57 over and above the cost of treatment, or more than double the increase produced by the ton of untreated yard manure."

It must be remembered that these results were obtained on a soil and with crops which responded well to applications of phosphoric acid. They cannot conclusively settle the relative value of acid phosphate and floats on all soils and under all conditions, but are valuable and suggestive as a guide to tests and practice by individual farmers.

21731. Made by Farmers' Ground Rock Phosphate Co., Mt. Pleasant, Tenn. Sent by Lewis Sperry of East Windsor Hill.

22374. Sent by H. B. Cooke, Georgetown.

22156. "Floats." Sent by Andrew Kingsbury, Rockville.

21822. "Phosphate Rock and Floats." Sent by H. S. Lyman, Manchester.

Analyses of Ground Phosphate and Floats.

Station No.	21731	22374	22156	21822
Percentage amounts of				
Phosphoric acid found	31.28	24.43	21.59	21.49
" " guaranteed	32.00	.....	25.00	28.00
Cost per ton delivered	$9.25	9.00	9.00	9.00*

*A rebate of $1.50 per ton allowed because it failed to meet the guaranty.

A sample of phosphatic material, **21712**, which is a residue from an iron manufacture, contained 17.01 per cent. of phosphoric acid with 47.31 per cent. of sand and silicates.

BURNED BONE.

22430 is ground bone which has been used for case hardening and by the process has been roasted without access of air. It contains 0.34 per cent. of nitrogen and 41.12 per cent. of phosphoric acid. Such material is but very slowly available until it has been converted into a superphosphate by treatment with oil of vitriol.

DISSOLVED ROCK PHOSPHATE OR ACID ROCK AND DISSOLVED BONE BLACK.

(Analyses on page 34.)

These materials are made by treating various mineral phosphates, spent bone black, or bone with oil of vitriol.

All of the samples analyzed are dissolved rock phosphate excepting **22783**, which is dissolved bone black. **22539** was sold as E. F. Coe's high-grade soluble bone brand. It is, however, dissolved rock phosphate.

22348. Sampled from stock bought by Charles R. Treat, Orange.

22962. Sold by Bowker Fertilizer Co. Sampled from stock of J. F. Elwood, Greens Farms.

22659. Sold by Buffalo Fertilizer Co. Sampled from stock of S. L. Tuttle, Wallingford.

22484. Sold by The American Agricultural Chemical Co. Sampled from stock of Spencer Bros. and E. Halladay, Suffield.

22533. Sold by The National Fertilizer Co. Sampled and sent by Henry Davis, Thompsonville.

22488. Sold by The Wilcox Fertilizer Co. Sampled from their stock.

22666. Sold by the Nitrate Agencies Co. Sampled from stock of H. H. McKnight, Ellington.

22783. Sold by The American Agricultural Chemical Co. Sampled and sent by L. P. Bissell, Suffield.

22692. Bought of a broker. Sampled and sent by Andrew Kingsbury, Rockville.

Analyses of Acid Phosphate and Dissolved Bone Black.

Station No.	22348	22962	22659	22484	22533	22488	22666	22783	22692	22539	22362	22404	22389
Percentage amounts of													
Water-soluble phosphoric acid	12.02	10.10	12.39	11.85	12.34	13.63	12.10	14.52	11.86	12.42	14.48	11.60	11.63
Citrate-soluble phosphoric acid	1.91	3.39	2.97	3.49	2.33	2.96	3.02	2.24	2.10	3.51	1.85	3.91	3.81
Citrate-insoluble phosphoric acid	0.68	1.54	0.27	0.91	1.53	2.55	1.19	0.61	0.33	0.19	0.68	0.74	0.42
Total phosphoric acid found	14.61	15.03	15.63	16.25	16.20	19.14	16.31	17.37	14.29	16.12	17.01	16.25	15.86
Total phosphoric acid guaranteed	....	....	17.00	....	....	....	....	....	....	....	....	15.00	....
Sum of water-soluble and citrate-soluble phosphoric acid found	13.93	13.49	15.36	15.34	14.67	16.59	15.12	16.76	13.96	15.93	16.33	15.51	15.44
"Available" phosphoric acid guar.	14.00	14.00	16.00	14.00	14.00	....	14.00	16.00	14.00	14.00	14.00	14.00	14.00
Cost per ton	$11.90*	12.00	15.00	15.00	14.40	17.00	16.00	18.75	16.00	....	....	....	....
"Available" phosphoric acid costs cents per pound	**4.3**	**4.4**	**4.8**	**4.9**	**4.9**	**5.1**	**5.3**	**5.6**	**5.7**	....	....	....	....

* Car lot.

22539. Sold by The Coe-Mortimer Co. Sampled from stock bought by Connecticut School for Boys, Meriden.

22362. Sold by The Rogers Manufacturing Co. Sampled from stock of L. M. Benham, Highwood.

22404. Sold by The American Agricultural Chemical Co. Sampled from stock of Andrew Ure, Highwood.

22389. Sampled from stock of S. D. Woodruff & Sons, Orange.

The cost of "available" phosphoric acid has ranged from 4.4 to 5.7 cents per pound when the acid phosphate has been bought in ton lots. In mixed car lots it has been bought for slightly less than 4 cents.

It needs to be repeated that "available phosphoric acid" is purely a trade name for the sum of the water-soluble and citrate-soluble phosphoric acid and has no necessary connection with the availability of the phosphoric acid to crops. Water-soluble phosphoric acid is comparatively readily available to plants. When applied to the soil it quickly becomes insoluble in water, but exists for a time at least in forms which are easily decomposed and absorbed by the action of the plant roots. This is not by any means equally true of all forms of citrate-soluble phosphoric acid. Some of them are, probably, about as quickly and perfectly "available," in the agricultural sense, as water-soluble phosphates, while others are, by comparison, quite "unavailable," and there is no means, at present known, for determining this difference in the laboratory.

The method of citrate extraction was devised for, and is strictly applicable only to, the determination of that part of the phosphoric acid in a plain superphosphate ("acid phosphate," or dissolved rock phosphate) which had been at first dissolved by sulphuric acid but by further chemical reactions has become insoluble in water and was formerly called "backgone" or "reverted" phosphoric acid.

But when this method is applied to such mixed fertilizers as are now in the trade, containing bone, tankage and sometimes iron and aluminum phosphates, citrate-solution dissolves much phosphate which has not been made more soluble by the manufacture than it was originally, and some of which cannot be considered as being quickly "available" to crops.

Potash Salts. Percentage Composition and Cost Per Pound of Potash.

Station No.	Drawn from Stock in possession of	Sampled and sent by	Potash soluble in water. Found.	Potash soluble in water. Guaranteed.	Cost per ton.	Potash costs cents per pound.
	High Grade Sulphate of Potash.					
22439	J. G. Schwink, Meriden, from Coe-Mortimer Co.	Station Agent	52.86	48.0	$48.00	4.5
22530	Henry Davis, Thompsonville, from National Fertilizer Co.	Henry Davis	49.38	48.0	49.90	5.0
22663	S. L. Tuttle, Wallingford, from Buffalo Fertilizer Co.	Station Agent	48.54	48.6	49.00	5.0
23669	James Price, Warehouse Point, from Parmenter & Polsey Fertilizer Co	James Price	50.88	48.0	51.00	5.0
22717	Wilcox Fertilizer Co.	Station Agent	50.57	48.0	52.00	5.1
22471	S. R. Spencer, Suffield, from Coe-Mortimer Co.	S. R. Spencer	50.89	48.0	54.00	5.3
	Double Sulphate of Potash and Magnesia, "Low Grade Sulphate."					
22538	Conn. School for Boys, Meriden, from Coe-Mortimer Co.	Station Agent	27.13	25.00	----	----
	Muriate of Potash.					
22661	S. L. Tuttle, Wallingford, from Buffalo Fertilizer Co.	Station Agent	53.73	50.0	41.00	3.8
22972	T. J. Pring, Wallingford, from Parmenter & Polsey Fertilizer Co.	Station Agent	51.39	50.0	41.00	4.0
22718	J. F. Elwood, Greens Farms, from Bowker Fertilizer Co.	Station Agent	51.68	50.0	42.00	4.1
22396	Chas. R. Treat, Orange	Station Agent	49.72	50.5	41.40*	4.2
22693	Andrew Kingsbury, Rockville	Andrew Kingsbury	51.30	50.5	44.00	4.3
22529	Henry Davis, Thompsonville, from National Fertilizer Co.	Henry Davis	51.03	49.0	44.90	4.4
22426	Sanderson Fertilizer Co.	Station Agent	50.30	50.0	45.00	4.5

*Mixed car lot.

Potash Salts. Percentage Composition and Cost Per Pound of Potash.—*Continued.*

Station No.	Drawn from Stock in possession of	Sampled and sent by	Potash soluble in water. Found.	Potash soluble in water. Guaranteed.	Cost per ton.	Potash costs cents per pound.
22427	C. C. Chapman, Thompsonville, from Rogers Mfg. Co.	C. C. Chapman	49.83	50.0	$45.00	4.5
22466	Wilcox Fertilizer Works	Station Agent	49.84	----	46.00	4.6
22455	F. S. Bidwell & Co., Windsor Locks, from American Agr. Chem'l Co.	Station Agent	50.03	49.0	46.00	4.6
22460	H. A. Bugbee, Willimantic, from National Fertilizer Co.	Station Agent	50.90	49.0	48.00	4.7
22402	Andrew Ure, Highwood, from American Agr. Chem'l Co.	Station Agent	50.96	50.0	----	----
22536	Conn. School for Boys, Meriden, from Coe-Mortimer Co.	Station Agent	52 12	50.0	----	----
22363	L. M. Benham, Highwood, from Rogers Mfg. Co.	Station Agent	49 20	----	----	----
	Kainit.					
22436	A. D. Bridge's Sons, Hazardville, from Bowker Fertilizer Co.	Station Agent	12.79	12.0	16.00	6.3
22461	H. A. Bugbee, Willimantic, from National Fertilizer Co.	Station Agent	13.28	12.0	18.00	6.8
22534	Conn. School for Boys, Meriden, from Coe-Mortimer Co.	Station Agent	13.40	12.0	----	----

III. RAW MATERIALS OF HIGH GRADE CONTAINING POTASH.

HIGH-GRADE SULPHATE OF POTASH.

(Analyses on page 36.)

This chemical should contain about 90 per cent. of pure potassium sulphate (sulphate of potash), or about 49 per cent. of potassium oxide ("potash"), about 1 per cent. less than is contained in muriate, and it should be nearly free from chlorides. The six samples analyzed were of good quality.

The cost of potash in high grade sulphate has been a little over 5 cents a pound.

DOUBLE SULPHATE OF POTASH AND MAGNESIA.

(Analysis on page 36.)

This material is usually sold as "sulphate of potash" or "manure salt," on a guaranty of "48-50 per cent. sulphate," which is equivalent to 25.9-27.0 per cent. of potassium oxide. Besides some 46-50 per cent. of potassium sulphate, it contains over 30 per cent. of magnesium sulphate, chlorine equivalent to 3 per cent. of common salt, a little sodium and calcium sulphates, and varying quantities of moisture.

The single sample analyzed was of average composition.

The cost of potash per pound in double sulphate of potash of good quality is usually somewhat higher than in high grade sulphate.

MURIATE OF POTASH.

(Analyses on pages 36 and 37.)

Commercial muriate of potash contains about 80 per cent. of muriate of potash (potassium chloride), equivalent to 50.5 per cent. of actual potash, 15 per cent. or more of common salt (sodium chloride) and 4 per cent. or more of water.

All of the fourteen samples examined were of standard quality.

The price per pound of actual potash in the muriate has ranged from 3.8 to 4.7 cents.

KAINIT.

(Analyses on page 37.)

Kainit is less uniform in composition than the other potash salts. It contains from 11 to 15 per cent. of potash, more than

that quantity of soda, and rather less magnesia. These "bases" are combined with chlorine and sulphuric acid. It usually contains more water than either the sulphate or the muriate of potash and is sold on a guaranty of 12 to 15 per cent. of potash, or 23 to 25 per cent. "sulphate of potash." It is not properly called, or claimed to be, a sulphate of potash, since it contains more than enough chlorine to combine with all the potash present, and there are sound reasons for believing that its potash exists chiefly as muriate and, to a much less extent, as sulphate. Its action and effects are unquestionably those of a muriate rather than of a sulphate.

The samples analyzed show the usual range of composition.

VEGETABLE POTASH.

This material, sold by Olds & Whipple, Hartford, is understood to be the ashes of beet residues from the beet sugar manufacture.

22463. Sampled from stock of Olds & Whipple, Hartford.
22336. Sampled and sent by L. H. Brewer, Hockanum.

Analyses of Vegetable Potash.

Station No.	22463	22336
Percentage amounts of		
Potash* calculated as muriate	1.85	2.02
Potash* calculated as sulphate	2.23	2.38
Potash calculated as carbonate	19.71	22.34
Total potash	23.79	26.74
Chlorine	1.39	1.52
Sulphuric acid	1.90	2.02
Cost per ton	$43.00	44.00
Potash costs cents per pound	**9.2**	**8.2**

IV. RAW MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

BONE MANURES.

(Analyses on pages 42 and 43.)

The terms "Bone Dust," "Ground Bone," "Bone Meal" and "Bone" applied to fertilizers, sometimes signify material made from dry, clean and pure bones; in other cases these terms refer to the result of crushing fresh or moist bones which have

* See note regarding this calculation, page 104.

been thrown out either raw or after cooking, with more or less meat, tendon and grease, and—if taken from garbage or ash heaps—with ashes or soil adhering; again they denote mixtures of bone, blood, meat and other slaughter-house refuse which have been cooked in steam tanks to recover grease, and are then dried and sometimes sold as "tankage"; or finally, they apply to bone from which a large share of the nitrogenous substance has been extracted in the glue manufacture. When they are equally fine the nitrogen of all these varieties of bone probably has about the same fertilizing value. But this agricultural value of bone depends very largely on its fineness. It is a matter of common observation that a whole bone may lie in the ground for a good while without going to pieces. Fine grinding increases enormously the surface which plant roots and the disintegrating forces of the soil can act upon and by so doing make the nitrogen and phosphoric acid available. Much of the bone now sold is dry and could be easily ground finer than it usually is, and more attention should be paid, both by manufacturers and purchasers, to the fineness of this material. Increased demand for a fine bone dust will soon make it more common in the market.

The table of analyses of bone manures contains a column headed "Valuation per ton."

Valuation of Fertilizers in General.

The valuation of a fertilizer, as practiced at this station, consists in calculating the retail trade-value or cash-cost at freight centers (in raw materials of good quality) of an amount of nitrogen, phosphoric acid and potash equal to that contained in one ton of the fertilizer.

The trade value per pound of these ingredients is reckoned from the current market prices of the standard articles which furnish them to commerce. *The valuation of a fertilizer does not show either its fair price or agricultural value. Nor should it be inferred that the ingredients of a given mixture always have the market value represented by the valuation.*

The valuation, properly understood and used, does, however, furnish a rational basis for comparing the commercial values of fertilizer mixtures.

The consumer, in estimating the reasonable price to pay for high-grade fertilizers, must add to the trade-value of the above-named ingredients a suitable margin for the expenses of manufacture and sale, and for the convenience or other advantage incidental to their use. Valuation no more shows the fair retail price of a fertilizer than quotations of steel billets can show the fair price for small amounts of structural steel of a specified shape. If, however, the prices of steel remain fairly uniform, a comparison of these with the rates charged by different companies *in open competition* for the finished product is a help, though not a perfect guide, to the buyer in studying the bids of different manufacturers.

Trade-Values of Fertilizer Elements for 1909.*

The average trade-values or retail costs in market, per pound, of the ordinarily occurring forms of nitrogen, phosphoric acid and potash in raw materials and chemicals, as found in New England, New York and New Jersey markets during 1908 were as follows:

	Cents per pound.
Nitrogen in nitrates	16½
ammonia salts	17
Organic nitrogen in dry and fine ground fish, meat and blood, and in mixed fertilizers	19
in fine† bone and tankage	19
in coarse† bone and tankage	14
Phosphoric acid, water-soluble	4
citrate-soluble‡	3½
of fine ground bone and tankage	3½
of coarse bone and tankage	3
of cotton seed meal, castor pomace and ashes	3
of mixed fertilizers, if insoluble in ammonium citrate‡	2
Potash as high-grade sulphate in forms free from muriate (or chlorides)	5
as muriate	4¼

The foregoing are, as nearly as can be estimated, the prices at which, during the six months preceding March last, the respective ingredients were retailed for cash, in our large markets, in those raw materials which are the regular source of supply. The valuations obtained by use of the above figures will be found to correspond fairly with the average retail prices, at the large markets, of standard raw materials.

Valuation of Bone and Tankage.

To obtain the valuation of ground bone the sample is sifted into two grades, that finer than $\frac{1}{50}$ inch, "fine," and that coarser than $\frac{1}{50}$ inch, "coarse." (Continued on p. 44.)

* Adopted at a conference of representatives of the Maine, Massachusetts, New Jersey, Rhode Island, Vermont and Connecticut stations held in March, 1909.

† In this report "fine," as appplied to bone and tankage, signifies smaller than $\frac{1}{50}$ inch; and "coarse," larger than $\frac{1}{50}$ inch.

‡ Dissolved from 2 grams of the fertilizer, previously extracted with pure water, by 100 cc. neutral solution of ammonium citrate, sp. gr. 1.09, in thirty minutes, at 65° C., with agitation once in five minutes. Commonly called "reverted" or "backgone" phosphoric acid.

Percentage Composition and Valuation of Bone Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.	Percentage difference between cost and valuation.	Chemical Analysis. Nitrogen. Found.	Chemical Analysis. Nitrogen. Guaranteed.	Chemical Analysis. Phosphoric acid. Found.	Chemical Analysis. Phosphoric acid. Guaranteed.	Mechanical Analysis. Finer than 1-50 inch.	Mechanical Analysis. Coarser than 1-50 inch.
	Sampled by Station Agent.											
22995	Rogers' Fine Ground Bone	Rogers' Manufacturing Co., Rockfall	Manufacturer	$32.00	$31.22	2.5	3.63	3.25	26.87	26.0	78	22
22291	Frisbie's Bone Meal	L. T. Frisbie Co., New Haven	E. Rogers,* Southington	28.00	26.04	7.5	3.80	3.30	22.44	18.0	32	68
23000	Swift-Sure Bone Meal	M. L. Shoemaker & Co.	Spencer Bros., Suffield	36.00	33.16	8.6	5.40	4.53	23.92	20.0	47	53
22360	Rogers' Fine Knuckle Bone Flour	Rogers' Manufacturing Co., Rockfall	L. M. Benham, Highwood	35.00	31.49	11.1	4.09	3.80	25.84	25.0	68	32
22657	Buffalo Bone Meal	Buffalo Fertilizer Co.	Ansonia Flour and Grain Co., Ansonia	28.00	24.92	13.6	2.20	2.87	25.84	22.0	68	32
			J. Reinhard & Sons, Cheshire	30.00								
			S. L. Tuttle,* Wallingford	27.00								
				28.30								
23001	Swift's Lowell Ground Bone	Swift's Lowell Fertilizer Co.	H. K. Brainard, Thompsonville	34.00	28.18	13.6	2.97	2.47	26.38	23.0	72	28
			F. S. Bidwell & Co., Wind. Locks	30.00								
				32.00								
22989	Dennis' Ground Bone	G. L. Dennis, Stafford Springs	Manufacturer	28.00	24.59	13.9	3.82	3.00	21.82	20.0	13	87
22990	Essex Ground Bone	Essex Fertilizer Co., Boston	F. T. Blish Hardware Co., So. Manchester	30.00	25.92	15.7	2.54	2.50	26.99	23.0	50	50
22814	Berkshire Ground Bone	Berkshire Fertilizer Co., Bridgeport	Hotchkiss & Templeton	30.00	25.79	16.3	3.68	2.50	21.54	20.0	44	56
22988	Cooper's Pure Bone Dust	Peter Cooper's Glue Factory	T. H. Eldredge, Norwich	30.00	25.22	19.0	2.02	2.50	29.32	26.0	40	60
22812	A. A. C. Co.'s Bone Meal	American Agl. Chem. Co.	Raymond Bros., South Norwalk	30.00	24.56	22.1	2.58	2.47	24.22	23.0	56	44
22813	Armour's Bone Meal	Armour Fertilizer Works	E. A. Buck & Co., Willimantic	34.00	26.95	22.4	2.93	2.47	25.74	24.0	60	40
			Farmers Supply Co., Bridgeport	32.00								
				33.00								
23002	Wilcox's Pure Ground Bone	Wilcox Fertilizer Works, Mystic	Manufacturer	30.00	24.27	23.6	1.80†	2.47	28.09	24.0	51	49
22994	New England Ground Bone	New England Fertilizer Co.	T. B. Atwater, Plantsville	30.00	24.08	24.6	1.82	2.46	26.43	23.0	70	30
22998	Sanderson's Fine Ground Bone	Sanderson Fertilizer and Chemical Co.	Manufacturer	30.00	22.97	30.6	1.91	2.50	25.00	20.0	59	41
			R. H. Hall, East Hampton	30.00								
22987	Bowker's Fresh Ground Bone	Bowker Fertilizer Co.	Lightbourn & Pond Co., New Haven	33.00	24.35	31.4	2.72	2.50	23.97	20.0	46	54
			A. D. Bridge's Sons, Hazardville	31.00								
				32.00								
22999*	Shay's Pure Ground Bone	C. M. Shay Fertilizer Co., Groton	Knowles-Lombard Co., Guilford	33.00	25.04	31.8	2.39	2.70	25.96	25.0	55	45
			G. M. Williams Co., N. London	33.00								
22997	Hubbard's Raw Knuckle Bone Flour	The Rogers & Hubbard Co., Middletown	Manufacturer	38.00	28.82	31.9	3.88	3.50	25.43	24.5	42	58
22996	Hubbard's Pure Fine Bone	The Rogers & Hubbard Co., Middletown	F. S. Platt Co., New Haven	35.00	25.80	35.7	3.43	2.85	23.03	22.0	41	59
22992	Lister's Celebrated Ground Bone Acidulated	Lister's Agricultural Chemical Works	C. H. Sage, East Canaan	27.00	17.89	50.9	3.40	2.70	10.87	12.0	41	59
22993	Chittenden's Ground Bone	National Fertilizer Co.	H. A. Bugbee, Willimantic	30.00	18.89	58.8	1.97	1.65	18.98	13.7	51	49
	Sampled by purchasers and others.		*Sampled or sent by*									
22670	P. & P.'s Ground Bone	Parmenter & Polsey Fertilizer Co.	James Price, Warehouse Point	28.00	24.21	15.6	1.90	2.47	25.96	23.0	73	27
22794	Sanderson's Ground Bone	Sanderson Fertilizer and Chemical Co.	O. G. Beard, Shelton	28.00	23.99	16.7	2.40	2.05	24.46	20.0	53	47
23003	James' Ground Bone	E. L. James, Warrenville	Manufacturer	29.00	24.79	17.0	4.17	3.00	21.44	20.0	4	96
23835	Sanderson's Ground Bone	Sanderson Fertilizer and Chemical Co.	O. G. Beard, Shelton	28.00	21.96	27.5	2.09	2.50	22.80	20.0	55	45
22161	Ground Bone	Springfield Rendering Co.	George Wilcox, Shaker Station	----	----	----	2.00	---	28.20	----	----	----

* See note on page 44.

* Purchaser.

The nitrogen value of each grade is separately computed by multiplying the pounds of nitrogen per ton by the per cent. of each grade, multiplying the product by the trade-value per pound of nitrogen in that grade, and taking this final product as the result in cents. Summing up the separate values of each grade thus obtained, together with the values of each grade of phosphoric acid, similarly computed, the total is the valuation of the sample.

1. *Bone Manures Sampled by the Station Agent.*

In the tables on pages 42 and 43 are tabulated analyses of twenty-one samples.

GUARANTIES.

Of the samples having a guaranty, seven failed in one particular to meet it but the deficiency was met by a corresponding excess of the other ingredient in most cases, so that a full money equivalent was given for the plant food guaranteed.

22999. Shay's Pure Ground Bone contained 2.39 per cent. of nitrogen and 25.96 of phosphoric acid, the guaranteed percentages being 2.70 and 25 respectively.

COST AND VALUATION.

The average cost per ton of the 21 brands examined was $31.30 and the valuation $25.72. The average cost is nearly a dollar greater than last year and the average valuation nearly three dollars less.

2. *Sampled by Others than the Station Agent.*

In the tables on pages 42 and 43 are included five analyses of samples drawn by others than the station agent. The station is responsible only for the analyses, but not for the correctness of the sampling of these.

SLAUGHTER-HOUSE TANKAGE.

(Analyses on page 46.)

After boiling or steaming various slaughter-house wastes, fat rises to the surface and is removed, the soup is run off and the settlings are dried and sold as tankage. Tankage has a very variable composition. In general, it contains more nitrogen and less phosphoric acid than bone.

In the table are analyses of nineteen samples of this material from the Connecticut market.

In several cases the valuation exceeds the cost and the average cost differs from the valuation by a much smaller amount than in the case of bone.

On the other hand, average tankage is not as finely ground as bone. Both should be much finer than they are in order to be quickly available.

The descriptions of the samples analyzed are as follows:

22424 and **22044** were made by Connecticut Fat Rendering and Fertilizing Corp., New Haven. The first sample was drawn at the factory, the second sampled and sent by George Wilcox, Shaker Station.

22986. Self-Recommending Fertilizer, made by Valentine Bohl, Waterbury, and sampled at the factory.

22902. Made by New England Fertilizer Co., sampled and sent by S. T. Welden, Simsbury.

22856. Made by Springfield Rendering Co., sampled and sent by Somersville Mfg. Co., Somersville.

22658. Made by Buffalo Fertilizer Co., sampled from stock of S. L. Tuttle, Wallingford.

22457 and **22405.** Sold by The American Agricultural Chemical Co. The first sample was drawn from stock of Spencer Bros. and E. Halladay, Suffield, the other from stock of Andrew Ure, Highwood.

22811. Sold by Parmenter & Polsey Fertilizer Co. Sampled and sent by Pring Bros., Wallingford.

22901 and **22900.** Made by New Haven Rendering Co., both of them sampled and sent by S. D. Woodruff & Sons, Orange.

22489. Sold by C. M. Shay Fertilizer Co. Sampled from stock of Knowles-Lombard Co., Guilford.

22437 and **22537.** Sold by The Coe-Mortimer Co. The first was taken from stock of J. G. Schwink and the latter from stock of Connecticut School for Boys, both of Meriden.

22361. Sold by The Rogers Manufacturing Co. Sampled from stock of L. M. Benham, Highwood.

The manufacturers of the last four samples in the table are unknown. Three of them were taken from stock of S. D. Woodruff & Sons and **22346** from stock of Chas. R. Treat of Orange.

GUARANTIES.

Six of the samples of tankage had less of either nitrogen or phosphoric acid than was guaranteed, but in every case this deficiency was fully offset by a surplus, over guaranty, of the other ingredient.

Nos. 22385, 22386 and 22633 had no guaranty of phosphoric acid and contained from 0.6 to 1.1 per cent. less nitrogen than was guaranteed.

Nos. **22385** and **22386** are of questionable origin and value. The percentage of phosphoric acid in them is very much lower than is found in garbage tankage, and the solubility of the nitrogen, as estimated by the neutral permanganate method, is also lower. In seventeen other samples of tankage, 92.5 per cent. of the nitrogen was found to be soluble, but only 83.7 and 81.6 per cent., respectively, in these.

Analyses and Valuations of Slaughter House Tankage.

Station No.	Name of Manufacturer or Wholesale Dealer.	Mechanical Analysis. Coarser than 1-50 inch.	Mechanical Analysis. Finer than 1-50 inch.	Nitrogen found.	Phosphoric acid found.	Cost per ton.	Valuation per ton.	Percentage difference between cost and valuation.
22424	Conn. Fat Rendering and Fertilizing Corp., New Haven	80	20	6.79	12.75	$25.00	$28.28	*11.6
22986	Valentine Bohl, Waterbury	48	52	4.62	20.57	28.00	28.75	*2.6
22902	New England Fertilizer Co.	64	36	5.78	15.61	28.00	28.19	*0.7
22856	Springfield Rendering Co.	70	30	7.40	11.00	30.00	29.87	0.4
22658	Buffalo Fertilizer Co.	48	52	7.41	7.19	30.00	29.29	2.4
22457	American Agricultural Chemical Co.	46	54	6.00	13.62	30.50	28.95	5.3
22811	Parmenter & Polsey Fertilizer Co.	62	38	5.74	13.28	29.00	26.72	8.5
22901	New Haven Rendering Co.	75	25	5.30	16.58	29.00	26.55	9.2
22489	C. M. Shay Fertilizer Co.	74	26	7.33	11.00	33 00	29 32	12.6
22900	New Haven Rendering Co.	77	23	4.88	17.27	29.00	25.57	13.4
22405	American Agricultural Chemical Co.	56	44	5.24	14.64	----	26.41	----
22437	Coe-Mortimer Co.	53	47	5.39	10.13	----	24.19	----
22537	Coe-Mortimer Co.	67	33	5.74	12 18	----	25 69	----
22044	Conn. Fat Rendering and Fertilizing Corp.	49	51	6.36	16.27	----	31.66	----
22361	Rogers Manufacturing Co.	49	51	6.70	12.95	----	30.62	----
22385	Unknown	28	72	5.62	2.29	----	21.32	----
22386	Unknown	29	71	5.52	2.49	----	21.05	----
22633	Unknown	44	56	6.02	16.63	----	31.14	----
22346	Unknown	53	47	6.77	12.73	----	30.39	----

* Valuation exceeds cost.

GARBAGE TANKAGE.

This is prepared from city garbage by extracting the grease and drying the residue. Its nitrogen is believed to be much less readily available than that of slaughter-house tankage.

22720. Made by American Reduction Co., Pittsburgh, Pa. Sampled from stock owned by F. W. Barker, Branford.

22383 and **22384.** Sampled from stock of S. D. Woodruff & Sons, Orange.

Analyses of Garbage Tankage.

Station No.	22720	22383	22384
Percentage amounts of			
Nitrogen	2.07	2.45	2.51
Phosphoric acid	5.08	5.07	5.37
Water-soluble potash	0.82	0.97	0.96

The average nitrogen solubility of the seventeen slaughter-house tankages previously mentioned was 92.5; that of the three garbage tankages was 47.5, 48.0 and 51.1, respectively.

DRY GROUND FISH AND ACIDULATED FISH.

(Analyses on page 48.)

This is a by-product from the manufacture of fish oil, a process which removes from the fish little that is of value as a fertilizer. The fresh fish are cooked by steam, pressed to remove the oil, and dried either in the air, or more commonly, in the large factories, by steam. The scrap is sometimes sprinkled with diluted oil of vitriol, to check putrefaction, whereby the bones are softened and to some extent dissolved. Twenty samples have been examined, seventeen of which are described in the table. Two samples, **22976** and **22977**, were sent as Bowker's Dry Fish by C. W. Beardsley of Milford for examination as to purity and freedom from chemicals. They contained respectively 8.88 and 8.54 per cent. of nitrogen and were pure dry fish scrap.

A sample of crude fish scrap, **21814**, sent by E. E. Burwell of New Haven, contained 4.32 per cent. of nitrogen and 4.57 per cent. of phosphoric acid.

Regarding the tabulated analyses, the samples **21986** and **22485**, made by the Niantic Menhaden Oil and Guano Co., contain less nitrogen than is guaranteed. The manufacturers stated that these were sold in 1908 and did not represent the goods which they were selling this year. Another sample, **23010**, made by the same company and put out in 1909, had a much higher percentage of nitrogen.

GUARANTIES.

With the exceptions above noted, all the samples fully met their guaranties as respects nitrogen. In a few cases the phosphoric acid found was not as much as guaranteed, but the money value of this deficiency was fully made up by the excess of nitrogen.

Percentage Composition and Valuation of Dry Fish.

Station No.	Manufacturer or Dealer.	Sampled by	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric acid. Water-soluble.	Phosphoric acid. Citrate-soluble.	Phosphoric acid. Citrate-insoluble.	Total phosphoric acid. Found.	Total phosphoric acid. Guaranteed.	Cost per ton.	Valuation per ton.	Percentage difference between cost and valuation.
22579	Parmenter & Polsey Fertilizer Co.	James Price, Warehouse Point	8.90	**7.5**	0.88	8.47	1.28	10.63	**11.0**	$40.00	40.96	2.3*
22667	Olds and Whipple	R. M. Thompson, So. Manchester	9.46	**8.6**	0.82	5.25	1.09	7.16	**6.0**	40.00	40.73	1.8*
22316	Essex Fertilizer Co.	B. L. Root from stock of Spencer Bros., Suffield	9.11	**7.5**	0.48	8.41	1.98	10.87	**11.0**	42.00	41.63	0.9
22973‡	Wilcox Fertz. Works	Station agent from factory	8.24	**7.8**	2.15	3.65	0.40	6.20	**5.0**	36.50	35.75	2.1
22487	Sanderson Fertz. & Chem. Co.	Station agent at factory	8.68	**8.3**	1.04	6.84	1.33	9.21	**6.0**	40.00	39.13	2.2
22964	Essex Fertilizer Co.	Station agent from Spencer Bros., Suffield and W. K. Ackley, East Hartford	8.90	**7.5**	0.53	8.37	2.75	11.65	**11.0**	42.50	41.20	3.2
23010†	Niantic Menhaden Oil & Guano Co.	Station agent from Olds & Whipple, Hartford	8.52	**8.2**	0.41	4.95	1.38	6.74	**6.0**	38.00	36.73	3.5
22974	Wilcox Fertz. Works	Station agent from factory and M. E. Thompson, Ellington	8.80	**8.5**	0.65	4.49	1.27	6.41	**6.0**	39.75	37.61	5.7
22428	Rogers Mfg. Co.	C. C. Chapin, Thompsonville	8.13	**8.2**	1.76	3.64	0.70	6.10	**8.0**	38.00	35.13	8.2
22532	National Fertilizer Co.	Henry Davis, Thompsonville	8.17	**8.2**	0.62	6.83	1.25	8.70	....	40.00	36.83	8.6
22963	Bowker Fertilizer Co.	Station agent from A. D. Bridge's Sons, Hazardville and J. F. Ellwood, Greens Farms	8.39	**8.2**	0.64	5.93	1.36	7.93	....	40.50	37.08	9.2
22970	National Fertilizer Co.	Station agent from G. A. Williams, Silver Lane, J. A. Glasnapp, Cheshire, and J. M. Lasbury, Broad Brook	8.42	**8.3**	0.65	4.07	1.38	6.10	....	39.75	35.92	10.7
22486	Olds & Whipple	Station agent from dealer	6.69	**6.0**	0.69	9.79	3.59	14.07	**12.0**	38.00	34.26	10.9
22971‡	Niantic Menhaden Oil & Guano Co.	Station agent from F. H. Rolf, Guilford, and others	4.82	**3.8**	0.32	3.25	3.89	7.46	**3.5**	25.25	22.42	12.6
22483	American Agricultural Chemical Co.	Station agent from Spencer Bros. Suffield, and Edmund Halladay, Suffield	8.50	**8.2**	0.67	4.74	1.05	6.46	...	41.50	36.58	13.4
21986	Niantic Menhaden Oil & Guano Co.	Spencer Bros., Suffield	7.94	**8.2**	0.88	5.13	1.15	7.16	**6.0**	40.00	34.92	14.5
22485†	Niantic Menhaden Oil & Guano Co.	Station agent from Spencer Bros., Suffield, and F. S. Bidwell & Co., Windsor Locks	7.80	**8.2**	0.62	4.47	1.06	6.15	**6.0**	41.00	33.69	21.7

* Valuation exceeds cost. † See note page 47. ‡ Acidulated Fish.

COST AND VALUATION.

The valuations in two cases exceed cost and in six other cases the average percentage difference is less than 7.0. The composition of dry fish is much more constant than that of tankage, the cost of nitrogen and phosphoric acid is somewhat lower, and there can be no question of its ready availability to crops.

MIXTURES OF DISSOLVED PHOSPHATE AND POTASH.

The use of the word "bone" or "animal bone" is misleading unless the brand contains real bone and has nitrogen, which is a necessary constituent of bone. No nitrogen is claimed in any of these fertilizers.

22969. Chittenden's Soluble Bone and Potash. Made by The National Fertilizer Co. Sampled from stock of H. A. Bugbee, Willimantic.

22985. Superphosphate with Potash. Made by the Sanderson Fertilizer and Chemical Co. Sampled from stock of G. W. Eaton, Plainville.

22967. Lister's Animal Bone and Potash. Made by Lister's Agricultural Chemical Works. Sampled from stock of D. H. Carrier & Son, Glastonbury.

Analyses.

Station No.	22969	22985	22967
Percentage amounts of			
Water-soluble phosphoric acid	8.72	6.86	8.77
Citrate-soluble phosphoric acid	2.72	1.33	2.08
Citrate-insoluble phosphoric acid	0.87	0.37	0.60
Total phosphoric acid	12.31	8.56	11.45
Water-soluble potash	2.74	5.30	2.22
Cost per ton	$25.00	24.00	25.00
Valuation per ton	$11.56	11.08	10.61
Percentage difference between cost and valuation	116.3	116.6	135.6

A mixture of 1,500 pounds of acid phosphate and 200 pounds of muriate of potash would contain as much plant food as these mixtures and would cost at the usual retail prices about $16.00.

NITROGENOUS SUPERPHOSPHATES AND GUANOS.

Here are included those mixed fertilizers containing nitrogen, phosphoric acid and, in most cases, potash, which are not designed by their manufacturers for use on any special crop.

"Special Manures" are noticed further on.

1. *Samples Drawn by the Station Agent.*

In the tables, pages 54 to 71, are given analyses of ninety-six samples arranged according to the percentage difference between cost and valuation.

Analyses requiring Special Notice.

A test sample of Woodruff's Home Mixture, **22387**, was analyzed March 22, 1909. The manufacturer states that finding the tankage used in this mixture was not as guaranteed, the formula was changed and **22613**, given on pages 54 and 55, shows the composition of the goods after this change. **22387** had the following composition: Nitrogen 3.03, "available" phosphoric acid 9.66, potash 7.89. The valuation was $25.38 per ton.

Boardman's Complete Fertilizer, **22509**, was found to contain less potash than guaranteed. At request of the manufacturer a second sample was drawn and analyzed. Both analyses appear on pages 54 and 55.

It was not possible to learn the price charged for the Connecticut Valley Orchard Co.'s Fertilizer, **22751**. Therefore no comparison of price and valuation can be made and it is entered in the table on pages 70 and 71.

GUARANTIES.

Of the ninety-six samples collected by the Station, four failed to meet their guaranties in two particulars and nineteen in a single particular—most commonly potash. In all cases, however, a deficiency of one ingredient was made good in money equivalent by other ingredients which exceeded the guaranty.

COST AND VALUATION.

An effort is made to get a statement of cash retail price from each dealer from whom a sample is taken and these statements are in all cases submitted to the manufacturer for criticism. In general an average of the quoted prices forms the basis of comparison between cost and valuation. The price thus used is shown in the tables by full-faced type.

VALUATION.

The method and meaning of valuation is explained on page 40.

The schedule of trade-values is given on page 41. The organic nitrogen in mixed fertilizers is reckoned at the price of nitrogen in raw material of the best quality, 19 cents per pound.

Citrate-insoluble phosphoric acid is rated at 2 cents per pound. Potash is rated at 4¼ cents, if sufficient chlorine is present in the fertilizer to combine with it to make muriate. If there is more potash present than will combine with the chlorine, then this excess of potash is reckoned at 5 cents per pound, except in certain special cases, to be noted later, where carbonate of potash has been used in the mixture.

In most cases the valuation of the ingredients in superphosphates and specials falls considerably below the retail price of these goods. The difference between the two figures represents the manufacturer's necessary charges for converting raw materials into manufactured articles and selling them. The charges are for grinding and mixing, bagging or barreling, storage and transportation, commission to agents and dealers, long credits, interest on investments, bad debts and, finally, profits.

To obtain the Valuation of a Fertilizer, multiply the pounds per ton of nitrogen, etc., by the trade-value per pound. The several products give the values per ton of the several ingredients and their sum is the total valuation per ton.

Percentage Difference shows the percentage excess of the cost price over the average retail cost, at freight centers, of the nitrogen, phosphoric acid and potash contained in the fertilizer and furnishes the best means we have for expressing the *comparative* commercial (but not *agricultural*) value of the different brands.

This information helps the purchaser to determine whether it is better economy to buy the commercial mixed fertilizers, of which so many are now offered for sale, or to purchase and mix for himself the raw materials.

The average cost per ton of the ninety-five nitrogenous superphosphates, of which the costs and valuations are given in the table, is $32.16, the average valuation $20.68, and the percentage difference 55.5.

The average composition and cost of nitrogenous superphosphates for the last six years have been as follows:

	Nitrogen.	Total Phosphoric Acid.	"Available" Phosphoric Acid.	Potash.	Cost per ton.	Percentage Difference.
1904........	2.68	10.02	....	4.31	$31.01	50.1
1905........	2.56	10.02	....	4.59	30.79	45.5
1906........	2.50	9.99	....	4.66	31.00	47.6
1907........	2.81	9.66	....	5.04	32.04	34.6
1908........	2.67	9.63	8.22	4.68	32.28	40.2
1909........	2.69	9.36	8.08	4.89	32.16	55.5

2. *Sampled by Purchasers and Others.*

On pages 70 and 71 are given sixteen analyses of nitrogenous superphosphates which were sent for analysis by interested persons. The station is not responsible for the sampling of these articles.

21981, a sample of Armour's All-Soluble, was drawn by our agent in June, 1908, examined in 1909 at request of the dealer, H. K. Brainard, Thompsonville, and contained nitrogen 2.96, phosphoric acid 9.61, and water-soluble potash 4.07 per cent.

Two samples, **22759** and **22760**, were supposed to represent two special mixtures made for J. I. Webb of Hamden. The buyer informed us later that he had found that the samples were not properly taken. They contained:

Station No.	22759	22760
Nitrogen	2.22	1.92
Total phosphoric acid	8.25	8.32
Water-soluble potash	2.71	2.58

The Selection and Purchase of Commercial Fertilizers.

The farmer must get into the way of studying the actual amount of plant food which he buys and uses, and its cost, and get out of the way of considering only the number of pounds of "phosphate" which he applies per acre and the cost per ton.

The beginning of saving is to drop the idea of using so many "pounds of phosphate" ("phosphate" meaning any mixed fertilizer which is at hand), and take up the idea of using so many pounds of nitrogen, phosphoric acid and potash in the cheapest and most concentrated form. Then the manufacturer will drop his practice of using swamp muck, phosphate dust and other fillers necessary to meet the call for "a $25.00 phosphate" and will search all the more diligently for high-grade goods.

The chief value of the tables of analyses given on pages 54 to 71 is to put the farmer in position to compare fertilizers in two ways: first, by the amounts of nitrogen, phosphoric acid and potash in them, and second, by the cost of these things in the different brands.

The limits imposed by statute on the size of this report forbid any extended discussion of this matter. The farmer can easily make his own "valuation" and his *comparison of relative cost of actual plant food* in any two fertilizers in the following way:

Let us assume that Smith's superphosphate sells for $34.00 and contains, as shown by the tables of analyses, 3.35 per cent of nitrogen, 8.04 per cent. of "available" phosphoric acid and 6.45 per cent. of potash as muriate.

Jones' superphosphate costs only $26.25 per ton and contains 1.33 per cent. of nitrogen, 6.98 per cent. of "available" phosphoric acid and 2.25 per cent. of potash.

Samples like these will be found in abundance in our reports. The question is, which is the cheaper source of plant food, the higher grade, selling at $34.00, or the lower grade, selling at a much lower price?

Multiplying the percentages by twenty will give the number of pounds of each ingredient in the ton. To compare the two we must figure what we get in each for the same money. Let us calculate on the amount purchasable for $30.00. This is done by "rule of three." The proportion for Smith's fertilizer will be:

$34 is to $30 as 67 (pounds of nitrogen in a ton) is to 59 (pounds purchasable for $30.00). The completed calculation shows that for $30.00 there can be bought:

	In Smith's Superphosphate.	In Jones' Superphosphate.
Pounds of nitrogen	59	30
" " phosphoric acid	142	159
" " potash	114	51

To get the amount of plant food purchasable for $30 in Smith's superphosphate the buyer pays freight on 1,760 pounds of fertilizer; while to get the smaller amounts purchasable for the same money in Jones' superphosphate he must pay freight on 2,250 pounds.

The buyer knows as much about the availability of nitrogen in one brand as he does about its availability in the other. The usefulness of the tables of analyses rests in part on the assumption that the manufacturing firms doing business year after year in this State are not using inferior forms of nitrogen. If a farmer knows of dishonest practices, or failures to meet their promises, on the part of any firm, he will, of course, exclude their goods from consideration.

Such a study and comparison as we have outlined above will not in all cases insure the choice of the very best fertilizer in the

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22613†	Woodruff's Home Mixture	S. D. Woodruff & Sons, Orange	Manufacturer	$30.00	$27.48
22612	Manchester's Formula	E. Manchester & Sons, Winsted	*W. J. Warner, Gilead	30.00	26.21
22509†	Boardman's Complete Fertilizer	F. E. Boardman, Route 1, Middletown	Manufacturer	34.00	28.15
22771†	Boardman's Complete Fertilizer	F. E. Boardman, Route 1, Middletown	Manufacturer	34.00	27.23
22958	Wilcox's H. G. Fish and Potash	Wilcox Fertilizer Co., Mystic	Manufacturer W. A. Howard, Woodstock	29.00 29.00	23.04
22610	Wilcox's Fish and Potash	Wilcox Fertilizer Co., Mystic	Manufacturer B. F. Pease, Greenfield Hill	---- 26.00	20.53
22359	Clark's Special Mixture for General Crops	Everett B. Clark Seed Co., Milford	*Leonard M. Benham, Highwood	31.00	23.98
22846	Mapes' Top Dresser, Improved, Full Strength	The Mapes F. and P. G. Co., New York	Mapes' Branch, Hartford Wheeler Bros., Stonington	53.00 ---- 55.00	42.30
22358	Clark's Special 10% Brand	Everett B. Clark Seed Co., Milford	*Leonard M. Benham, Highwood	34.00	26.09
22918	Market Garden Manure	Niantic Menhaden Oil and Guano Co., So. Lyme	F. H. Rolf, Guilford	38.00	28.15
22601	Quinnipiac Market Garden Manure	Amer. Agrl. Chem. Co., New York	C. Buckingham, Southport *W. H. Burr, Westport	35.00 34.00 34.50	25.17
22821	Packers' Union Gardeners Complete Manure	Amer. Agrl. Chem Co., New York	F. M. Loomis, Granby W. H. Billings, Somerville	36.00 35.00 35.50	25.71
22513	Mapes' Vegetable Manure, or Comp. Manure for Light Soils	The Mapes F. and P. Guano Co., New York	Mapes' Branch, Hartford J. P. Barstow & Co., Norwich Birdsey & Raven, Meriden	43.00 44.00 45.00 44.00	31.81
22968	Mapes' Dissolved Bone	The Mapes F. and P. Guano Co., New York	Mapes' Branch, Hartford Wheeler Bros., Stonington	33.00 33.00	23.67
22482	"Swift-Sure" Superphosphate for General Use	M. L. Shoemaker & Co., Philadelphia, Pa.	F. A. Forbes, East Haven Spencer Bros., Suffield F. S. Bidwell & Co., Windsor Locks	32.00 36.00 36.00 34.75	24.70

* Purchaser. † See note on page 50.

Analyses and Valuations.

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
					Total Nitrogen.					Total.		So-called "Available."		Found.		
		As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.
22613	9.2	1.85	0.68	1.84	4.37	**3.3**	2.24	4.19	0.94	7.37	**8.0**	6.43	----	8.20	8.20	**8.0**
22612	14.4	----	2.48	1.34	3.82	**3.5**	4.30	3.15	2.66	10.11	----	7.45	**8.0**	7.04	7.04	**7.5**
22509	20.8	0.34	0.72	2.52	3.58	**3.3**	6.77	1.87	0.14	8.78	----	8.64	**7.0**	9.66	9.66	**10.0**
22771	24.9	0.54	0.47	2.27	3.28	**3.3**	6.29	2.30	0.57	9.16	----	8.59	**7.0**	9.82	9.82	**10.0**
22958	25.9	0.16	0.30	3.08	3.54	**3.3**	3.85	2.54	0.72	7.11	**6.0**	6.39	**5.0**	5.46	5.46	**4.0**
22610	26.6	----	0.42	2.76	3.18	**2.5**	2.69	3.25	1.74	7.68	**6.0**	5.94	**5.0**	4.09	4.09	**3.0**
22359	29.3	----	2.02	1.18	3.20	**3.3**	6.03	2.72	1.48	10.23	----	8.75	**8.0**	6.26	6.26	**7.0**
22846	30.0	4.92	4.16	0.61	9.69	**9.9**	0.22	7.30	1.18	8.70	**8.0**	7.52	----	0.85	3.97	**4.0**
22358	30.3	1.15	1.33	0.72	3.20	**3.3**	4.32	1.95	1.21	7.48	----	6.27	**6.0**	11.43	11.43	**10.0**
22918	35.0	1.36	0.44	2.48	4.28	**4.1**	5.26	2.38	0.50	8.14	**8.0**	7.64	**7.0**	0.58	6.75	**6.0**
22601	37.1	----	1.52	1.73	3.25	**3.3**	7.08	1.68	0.96	9.72	**9.0**	8.76	**8.0**	7.31	7.31	**7.0**
22821	38.1	----	0.74	2.03	2.77	**2.5**	5.67	1.30	1.04	8.01	**7.0**	6.97	**6.0**	0.76	9.72	**10.0**
22513	38.3	2.27	1.99	0.99	5.25	**4.9**	1.07	6.96	0.90	8.93	**8.0**	8.03	**6.0**	0.85	7.83	**6.0**
22968	39.4	----	0.43	2.82	3.25	**2.1**	4.44	10.33	1.78	16.55	----	14.77	**12.0**	----	----	----
22482	40.7	1.04	---	1.86	2.90	**2.9**	8.59	3.14	1.06	12.79	----	11.73	**9.0**	0.70	4.81	**4.5**

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22706	High Grade Manure	Buffalo Fertilizer Co., Buffalo, N. Y.	J. R. Reinhard & Sons, Cheshire	$38.00	$26.89
			Seth Schofield, Stafford Springs	38.00	
22797	A. A. C. Co.'s Complete Manure with 10% Potash	Amer. Agrl. Chem. Co., New York	D L. Clark, Milford	37.00	26.94
			Peck Bros., Plainville	40.00	
				38.50	
22571	Sanderson's Formula A	Sanderson Fert. and Chem. Co., New Haven	Manufacturer	35.00	24.66
			Morse & Landon, Guilford	34.00	
			G. W. Eaton, Plainville	37.00	
				35.25	
22876	Darling's Blood, Bone and Potash	Amer. Agrl. Chem. Co., New York	Elmer Rose, Wallingford	**40.00**	27.91
22451	O. & W.'s Special Phosphate	Olds & Whipple, Hartford	Manufacturer	**35.00**	24.24
22776	Fish and Potash	The Rogers Mfg. Co., Rockfall	G. H. Sloan, Windsorville	29.00	20.73
			Manufacturer	30.00	
			*W. H. Filley, Windsor	31.00	
				30.00	
22945	Swift's Lowell Superior Fertilizer	Swift's Lowell Fertilizer Co., Boston, Mass.	F. E. Weed & Co., New Canaan	42.00	28.32
			Edward White, Rockville	40.00	
				41.00	
22885	Bone, Blood and Potash	Armour Fertilizer Works, Baltimore, Md.	Farmers' Supply Co., Bridgeport	**39.00**	26.86
22895	Kelsey's Bone, Fish and Potash	Sanderson Fert. and Chem. Co., New Haven	Loomis Bros., Granby	**29.00**	19.89
22606	Chittenden's XXX Fish and Potash	National Fertilizer Co., New York	F. H. Rolf, Guilford	26.00	18.34
			G. D. Mosher, Milford	26.00	
			J. & H. Woodford, Avon	28.00	
				26.75	
22757	Bone, Fish and Potash	Niantic Menhaden Oil and Guano Co., So. Lyme	J. P. Barstow & Co., Norwich	**30.00**	20.51
			F. S. Bidwell & Co., Windsor Locks	30.00	
			J. O. Fox, Putnam	30.00	
22888	Market Garden Special	Armour Fertilizer Works, Baltimore, Md.	O. H. Meeker, Danbury	**36.00**	24.56

* Purchaser.

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
22706	41.3	0.17	2.53	0.65	3.35	**3.3**	4.91	2.79	1.15	8.85	**9.0**	7.70	**7.0**	10.49	10.49	**10.0**
22797	42.9	0.20	1.90	1.40	3.50	**3.3**	5.59	1.30	0.91	7.80	**7.0**	6.89	**6.0**	10.31	10.31	**10.0**
22571	42.9	0.78	0.20	2.45	3.43	**3.3**	5.38	2.44	0.74	8.56	**9.0**	7.82	**6.0**	6.81	6.81	**6.0**
22876	43.3	0.28	1.92	2.08	4.28	**4.1**	6.00	1.80	0.92	8.72	**8.0**	7.80	**7.0**	7.21	7.21	**7.0**
22451	44.4	----	0.49	3.90	4.39	**4.1**	0.24	4.60	1.01	5.85	----	4.84	**4.0**	0.70	4.04	**3.0**
22776	44.7	1.10	0.22	2.04	3.36	**3.3**	2.43	2.92	2.38	7.73	**6.0**	5.35	**4.0**	4.32	4.32	**3.8**
22945	44.8	0.79	0.12	2.82	3.73	**3.7**	4.30	2.77	0.67	7.74	**8.0**	7.07	**7.0**	10.51	10.51	**10.0**
22885	45.2	1.52	1.24	1.22	3.98	**4.1**	6.37	1.73	1.29	9.39	**8.5**	8.10	**8.0**	7.23	7.23	**7.0**
22895	45.8	----	0.36	2.40	2.76	**2.5**	2.32	2.58	1.25	6.15	**5.0**	4.90	**4.0**	3 50	5.90	**4.0**
22606	45.9	----	0.90	1.80	2.70	**2.5**	4.64	1.37	1.38	7.39	**6.0**	6.01	**5.0**	3.79	3.79	**3.0**
22757	46.3	----	0.54	2.56	3.10	**2.5**	2.32	3.29	1.73	7.34	**6.0**	5.61	**5.0**	0.53	4.17	**3.0**
22888	46.6	1.05	0.85	1.40	3.30	**3.3**	8.10	0.79	0.09	8.98	**8.5**	8.89	**8.0**	6.83	6.83	**7.0**

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22836	New England Special	Buffalo Fertilizer Co., Buffalo, N. Y.	W. Smith & Son, Canterbury	$30.00	$19.57
			E. H. Talcott, Torrington	28.00	
				29.00	
22806	Berkshire Long Island Special	Berkshire Fertilizer Co., Bridgeport	*W. L. Curtis, Plantsville	37.00	25.15
			Loomis Bros., Granby	38.00	
				37.50	
22910	Chittenden's Formula "A"	National Fertilizer Co., New York	H. A. Bugbee, Willimantic	**35.00**	23.41
22514	Average Soil Complete Manure	The Mapes F. and P. Guano Co., New York	Mapes' Branch, Hartford	37.00	25.26
			Birdsey & Raven, Meriden	39.00	
				38.00	
22956	Wilcox's Complete Bone Superphosphate	Wilcox Fertilizer Co., Mystic	Manufacturer	29.00	18.62
			M. E. Thompson, Ellington	27.00	
				28.00	
22941	Swift's Lowell Market Garden Manure	Swift's Lowell Fertilizer Co., Boston, Mass.	F. E. Weed & Co., New Canaan	**41.00**	27.20
22940	Swift's Dissolved Bone and Potash	Swift's Lowell Fertilizer Co., Boston, Mass	J. D. Beasley, Ellington	**26.00**	17.12
22884	Williams & Clark's High Grade Special	Am'n Agric'l Chem. Co., New York	Peck Bros., Plainville	**39.00**	25.65
22518	North Western Market Garden Phosphate	Am'n Agric'l Chem. Co., New York	C. Buckingham, Southport	33.00	21.98
			Gault Bros., Westport	34.00	
				33.50	
22848	Chittenden's Fish and Potash	National Fertilizer Co., New York	G. A. Williams, Silver Lane	32.00	20.30
			J. A. Glasnapp, Cheshire	30.00	
				31.00	
22684	O. & W.'s Fish and Potash	Olds & Whipple, Hartford	Manufacturer	**29.00**	18.72
22647	Berkshire Complete Fertilizer	Berkshire Fertilizer Co., Bridgeport	Hotchkiss & Templeton, Waterbury	36.00	22.73
			Jacob Glover, Stafford	36.00	
			Avery Bros., Norwich Town	34.00	
				35.25	
22680	Darling's Dissolved Bone and Potash	Am'n Agric'l Chem. Co., New York	S. B. Hoyt, Southington	----	24.32
			J. & H. Woodford, Avon	**38.00**	

* Purchaser.

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		Found.		Guaranteed.
					Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	
22836	48.2	0.16	0.68	1.06	1.90	**1.6**	6.51	3.20	0.69	10.40	**10.0**	9.71	**9.0**	5.85	5.85	**5.0**
22806	49.1	----	1.16	2.40	3.56	**3.3**	4.36	3.14	0.37	7.87	**7.0**	7.50	**6.0**	7.35	7.35	**7.0**
22910	49.5	0.99	1.18	1.28	3.45	**3.3**	5.37	1.67	0.97	8.01	**7.0**	7.04	**6.0**	6.37	6.37	**6.0**
22514	50.4	1.84	1.60	0.57	4.01	**4.1**	1.68	5.91	0.43	8.02	**8.0**	7.59	**7.0**	0.69	6.03	**5.0**
22956	50.4	0.87	0.20	1.23	2.30	**2.1**	6.23	2.47	0.64	9.34	**9.0**	8.70	**8.0**	4.03	4.03	**3.0**
22941	50.7	0.37	0.74	2.99	4.10	**4.1**	3.62	5.09	2.01	10.72	**8.0**	8.71	**7.0**	3.59	5.38	**6.0**
22940	51.9	----	0.02	1.82	1.84	**1.7**	6.15	4.03	1.23	11.41	**10.0**	10.18	**7.0**	2.24	2.24	**2.0**
22884	52.0	1.03	0.50	1.76	3.29	**3.3**	5.29	2.78	1.00	9.07	**9.0**	8.07	**8.0**	8.57	8.57	**7.0**
22518	52.4	1.23	0.16	1.31	2.70	**2.5**	6.82	1.96	0.88	9.66	**9.0**	8.78	**8.0**	6.14	6.14	**6.0**
22848	52.7	0.17	1.30	1.48	2.95	**2.9**	4.88	1.85	1.64	8.37	**7.0**	6.73	**6.0**	4.52	4.52	**4.0**
22684	54.9	----	0.46	2.17	2.63	**2.5**	2.26	3.67	1.81	7.74	----	5.93	**5.0**	0.51	3.89	**3.0**
22647	55.1	0.40	0.67	1.71	2.78	**2.5**	6.58	2.99	0.18	9.75	**9.0**	9.57	**8.0**	6.13	6.13	**6.0**
22680	56.2	0.17	1.60	0.92	2.69	**2.5**	5.03	1.55	0.52	7.10	**7.0**	6.58	**6.0**	7.10	10.56	**10.0**

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22449	North Western Universal Fertilizer	Am'n Agric'l Chem. Co., New York	Spencer Bros., Suffield	$34.00	$21.28
			Edmund Halladay, "	32.00	
			F. S. Bidwell & Co., Windsor Locks	34.00	
				33.25	
22750	Quinnipiac Phosphate	Am'n Agric'l Chem. Co., New York	Gault Bros., Westport	30.00	19.98
			G. M. Williams Co., New London	32.00	
			C. C. Pierce, Putnam	32.00	
				31.25	
22753	New England Superphosphate	New England Fertilizer Co., Boston, Mass	Gideon Brown, South Manchester	33.00	20.50
			B. F. Eddy, East Woodstock	34.00	
			T. E. Green, Plainfield	30.00	
				32.25	
22758	Plymouth Rock Brand	Parmenter & Polsey Fertilizer Co., Boston, Mass	T. J. Pring, Wallingford	**32.00**	20.25
			Arthur Williams, South Woodstock	----	
			F. B. Newton, Plainville	32.00	
22557	Ammoniated Bone with Potash	Armour Fertilizer Works, Baltimore, Md.	E. A. Buck & Co., Willimantic	29.00	18.18
			Farmers Supply Co., Bridgeport	29.00	
			O. H. Meeker, Danbury	28.00	
				28.75	
22555	Church's Fish and Potash	Am'n Agric'l Chem. Co., New York	S. B. Potter, Norwich	28.00	17.23
			A. H. Cashen, Meriden	26.00	
			Wilson & Burr, Middletown	28.00	
				27.25	
22839	E. F. Coe's Red Brand Excelsior Guano	Coe-Mortimer Co., New York	L. A. Gowdy, Hazardville	38.00	24.15
			R. H. Morgan, West Cheshire	38.50	
				38.25	
22922	North Western 10% Manure	Am'n Agric'l Chem. Co., New York	*S. A. Flight, Highwood	**42.00**	26.47
22800	Bradley's Farmers New Method Fertilizer	Am'n Agric'l Chem. Co., New York	Wilson & Burr, Middletown	30.00	18.57
			F. M. Cole, Putnam	29.00	
				29.50	
22556	All Soluble	Armour Fertilizer Works, Baltimore, Md.	Lightbourn & Pond Co., New Haven	**33.00**	20.64
			E. A. Buck & Co., Willimantic	33.00	
			O. H. Meeker, Danbury	33.00	

* Purchaser.

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
22449	56.3	0.24	1.02	1.30	2.56	**2.5**	6.86	2.33	1.04	10.23	**9.0**	9.19	**8.0**	5.34	5.34	**4.0**
22750	56.4	0.49	0.72	1.45	2.66	**2.5**	7.82	2.34	1.66	11.82	**11.0**	10.16	**9.0**	2.16	2.16	**2.0**
22753	57.3	----	0.12	2.48	2.60	**2.5**	4.55	3.98	2.11	10.64	**10.0**	8.53	**8.0**	4.00	4.00	**4.0**
22758	58.0	----	0.14	2.40	2.54	**2.5**	6.43	1.98	0.93	9.34	**9.0**	8.41	**8.0**	4.41	4.41	**4.0**
22557	58.1	0.87	0.31	1.53	2.71	**2.5**	5.28	2.49	0.99	8.76	**8.5**	7.77	**6.0**	2.46	2.46	**2.0**
22555	58.2	0.28	0.24	1.78	2.30	**2.1**	5.37	2.63	1.53	9.53	**7.5**	8.00	**6.0**	2.33	2.33	**2.0**
22839	58.4	0.19	1.04	1.83	3.06	**3.3**	6.12	1.95	0.68	8.75	**9.0**	8.07	**8.0**	7.63	7.63	**7.0**
22922	58.7	----	1.63	1.75	3.38	**3.3**	5.11	1.91	0.95	7.97	**7.0**	7.02	**6.0**	9.96	9.96	**10.0**
22800	58.9	0.63	0.17	1.43	2.23	**1.7**	6.56	2.53	1.85	10.94	**10.0**	9.09	**8.0**	3.20	3.20	**3.0**
22556	59.9	0.90	0.60	1.50	3.00	**2.9**	6.79	1.19	0.32	8.30	**8.5**	7.98	**8.0**	4.16	4.16	**4.0**

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22681	Bowker's Market Garden Fertilizer	Bowker Fertilizer Co., New York	W. T. McKenzie, Yalesville	$37.00	$23.13
			J. Frank Elwood, Greens Farms	36.00	
			Hitchcock Hardware Co., Watertown	38.00	
22877	Darling's Farm Favorite	Am'n Agric'l Chem. Co., New York	Elmer Rose, Wallingford	30.00	18.71
22515	Top Dresser, Improved, Half Strength	The Mapes F. and P. Guano Co., New York	Mapes' Branch, Hartford	34.00	21.46
			F. S. Bidwell & Co., Windsor Locks	35.00	
				34.50	
22480	Bowker's Fisherman's Brand, Fish and Potash	Bowker Fertilizer Co., New York	W. T. McKenzie, Yalesville	29.00	17.81
			A. D. Bridge's Sons, Hazardville	30.00	
			J. Frank Elwood, Greens Farms	27.00	
				28.75	
22820	Baker's A. A. Ammoniated Superphosphate	Am'n Agric'l Chem. Co., New York	Arthur Manning, So. Manchester	**32.00**	19.71
			F. J. Hartz, South Manchester	32.00	
22607	Hubbard's New Market Garden Phosphate	Rogers & Hubbard Co., Middletown	E. L. Oviatt, Milford	36.00	22.57
			H. W. Andrews, Wallingford	34.00	
			F. S. Platt Co., New Haven	40.00	
				36.75	
22650	Farmers' Choice	Buffalo Fertilizer Co., Buffalo, N. Y.	Ansonia Flour & Grain Co., Ansonia	24.00	15.92
			Manchester Elev. Co., Manchester	29.00	
			Seth Schofield, Stafford Springs	26.00	
				26.25	
22919	North Western Superphosphate	Am'n Agric'l Chem. Co., New York	G. W. Eaton, Bristol	**33.00**	20.00
22561	Essex XXX Fish and Potash	Essex Fertilizer Co., Boston, Mass.	W. K. Ackley, East Hartford	32.00	18.48
			Spencer Bros., Suffield	32.00	
			F. C. Benjamin & Co., Danbury	28.00	
				30.75	
22936	Sanderson's Special with 10% Potash	Sanderson Fert. and Chem. Co., New Haven	Manufacturer	**37.00**	22.23
			G. W. Eaton, Plainville	37.00	

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		Found.		Guaranteed.
					Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	
22681	60.0	----	1.00	1.42	2.42	2.5	5.20	2.42	1.16	8.78	7.0	7.62	6.0	9.44	9.44	10.0
22877	60.3	0.10	0.76	1.41	2.27	2.1	6.54	2.43	1.33	10.30	9.0	8.97	8.0	3.50	3.50	3.0
22515	60.8	2.83	1.69	0.38	4.90	4.9	0.72	3.02	0.67	4.41	4.0	3.74	----	0.19	2.00	2.0
22480	61.4	0.36	0.45	1.80	2.61	2.5	3.07	2.37	1.20	6.64	5.0	5.44	4.0	4.29	4.29	4.0
22820	62.4	0.85	0.16	1.57	2.58	2.5	6.98	2.89	2.07	11.94	11.0	9.87	9.0	2.30	2.30	2.0
22607	62.8	0.86	0.06	1.20	2.12	2.0	4.32	3.35	0.29	7.96	7.0	7.67	6.0	10.64	10.64	10.0
22650	64.9	----	0.29	0.85	1.14	0.8	4.89	4.55	1.60	11.04	9.0	9.44	8.0	4.88	4.88	5.0
22919	65.0	0.18	0.46	2.04	2.68	2.5	4.82	4.92	2.17	11.91	10.0	9.74	9.0	2.27	2.27	2.0
22561	66.4	----	0.04	2.24	2.28	2.0	6.05	2.67	1.13	9.85	9.0	8.72	8.0	3.14	3.14	3.0
22936	66.4	0.64	0.22	2.00	2.86	2.5	3.84	2.13	0.43	6.40	8.0	5.97	5.0	8.28	8.28	10.0

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22649	Fish Guano	Buffalo Fertilizer Co., Buffalo, N. Y.	J. & H. Woodford, Avon	$25.00	$14.99
			Manchester Elev. Co., Manchester	25.00	
			Seth Schofield, Stafford Springs	25.00	
22444	Eldredge's Fish and Potash	(Made for) T. H. Eldredge, Norwich	T. H. Eldredge, Norwich	**30.00**	17.95
22913	Chittenden's Market Garden Fertilizer	National Fertilizer Co., New York	Greenwich Hard. Co., Greenwich	38.00	21.54
			L. O. Pomeroy, Suffield	34.00	
				36.00	
22574	Swift's Lowell Animal Brand	Swift's Lowell Fertilizer Co., Boston, Mass.	Spencer Bros., Suffield	34.00	20.78
			T. H. Eldredge. Norwich	36.00	
			Southington Lumber Co., Southington	34.00	
				34.75	
22896	Lister's Ammoniated Dissolved Bone Phosphate	Lister's Agrl. Chem. Works, Newark, N. J.	G. T. Fowler, Branford	**29.00**	17.17
22570	Atlantic Coast Bone, Fish and Potash	Sanderson Fert. and Chem. Co., New Haven	Manufacturer	26.00	15.36
			Morse & Landon, Guilford	24.50	
			G. W. Eaton, Plainville	29.00	
				26.00	
22448	North Western Fish, Bone and Potash	Amer. Agrl. Chem. Co., New York	Spencer Bros., Suffield	**30.00**	17.71
			Edmund Halladay, Suffield	30.00	
			F. S. Bidwell & Co., Windsor Locks	30.00	
22652	Genuine Peruvian Guano, Lobos Grade	Coe-Mortimer Co., New York	J. G. Schwink, Meriden	40.00	24.19
			R. H. Hall, East Hampton	42.00	
				41.00	
22615	Williams & Clark's Ammoniated Bone Superphosphate	Amer. Agrl. Chem. Co., New York	D. B. Wilson Co., Waterbury	35.00	19.99
			R. H. Hall, East Hampton	33.00	
				34.00	
22477	Bradley's XL Superphosphate	Amer. Agrl. Chem. Co., New York	H. K. Brainard, Thompsonville	**34.00**	19.83
			F. S. Bidwell & Co., Windsor Locks	34.00	
			Spencer Bros., Suffield	34.00	

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Found. As Muriate.	Found. Total.	Guaranteed.
22649	66.8	....	0.20	1.00	1.20	**0.8**	5.62	4.45	2.34	12.41	**10.0**	10.07	**9.0**	0.93	2.09	**2.0**
22444	67.1	....	0.32	2.12	2.44	**1.7**	2.57	3.17	1.63	7.37	**6.0**	5.74	**5.0**	4.55	4.55	**4.0**
22913	67.1	0.71	0.82	1.09	2.62	**2.5**	6.81	2.23	1.30	10.34	**9.0**	9.04	**8.0**	5.58	5.58	**6.0**
22574	67.2	....	0.04	2.58	2.62	**2.5**	6.85	2.37	0.69	9.91	**10.0**	9.22	**8.0**	4.02	4.02	**4.0**
22896	68.9	....	0.20	2.00	2.20	**2.1**	6.06	2.88	1.23	10.17	**9.0**	8.94	**8.0**	1.80	1.80	**1.5**
22570	69.3	0.12	0.20	1.54	1.86	**1.7**	1.71	3.27	0.74	5.72	**6.0**	4.98	**4.0**	5.26	5.26	**4.0**
22448	69.4	....	0.28	2.26	2.54	**2.5**	3.31	1.96	0.67	5.94	**5.0**	5.27	**4.0**	4.57	4.57	**4.0**
22652	69.5	1.58	0.64	0.78	3.00	**2.9**	4.37	7.15	2.51	14.03	**14.0**	11.52	**8.0**	1.59	4.57	**4.8**
22615	70.1	0.56	0.38	1.74	2.68	**2.5**	6.46	3.56	1.78	11.80	**10.0**	10.02	**9.0**	2.20	2.20	**2.0**
22477	71.5	0.45	0.34	1.83	2.62	**2.5**	6.14	4.00	1.78	11.92	**11.0**	10.14	**9.0**	2.13	2.13	**2.0**

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22830	Armour's Fish and Potash Mixture	Armour Fertilizer Works, Baltimore	Brower & Malone, Norwalk	$34.00	
			S. V. Osborn, Branford	25.00	$14.56
22773	Chittenden's Ammoniated Bone Phosphate	National Fertilizer Co., New York	H. A. Bugbee, Willimantic	26.00	16.00
			J. M. Clark, Simsbury	29.00	
				27.50	
22925	Hubbard's Complete Phosphate	Rogers & Hubbard Co., Middletown	F. S. Platt Co., New Haven	30.00	17.39
			F. T. Blish Hard. Co., So. Manchester	30.00	
22889	Bowker's Hill and Drill Phosphate	Bowker Fertilizer Co., New York	A. D. Bridge's Sons, Hazardville	34.00	19.53
22955	Wilcox's Special Superphosphate	Wilcox Fertilizer Co., Mystic	Manufacturer	24.50	14.06
22891	Bowker's Bone and Wood Ash Fertilizer	Bowker Fertilizer Co., New York	Hitchcock Hard. Co., Watertown	30.00	16.72
22929	All Round Fertilizer	The Rogers Mfg. Co., Rockfall	H. L. Spear, Suffield	28.00	16.23
			Manufacturer	29.00	
			F. U. Wadhams, Torrington	31.00	
				29.25	
22747	Swift's Lowell Bone Fertilizer	Swift's Lowell Fertilizer Co., Boston, Mass.	T. H. Eldredge, Norwich	32.00	16.56
			Standard Feed Co., Bridgeport	30.00	
			J. D. Beasley, Ellington	28.00	
22710	H. G. Ammoniated Bone Superphosphate	Coe-Mortimer Co., New York	W. A. Burr, West Hartford	35.00	17.49
			J. P. Barstow & Co., Norwich	32.00	
			L. A. Gowdy, Hazardville	30.00	
22511	Complete Manure "A" Brand	The Mapes F. & P. Guano Co., New York	Mapes' Branch, Hartford	36.00	20.05
			F. S. Bidwell & Co., Windsor Locks	37.00	
			Birdsey & Raven, Meriden	38.00	
22842	Lister's Success Fertilizer	Lister's Agrl. Chem. Works, Newark, N. J.	D. C. Burnham, Moodus	30.00	15.61
			C. H. Sage, East Canaan	28.00	
				29.00	

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.			Total Nitrogen.		Phosphoric Acid.			Total.		So-called "Available."		Potash. Found.		
		As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.
22830	71.7	....	0.06	1.78	1.84	2.0	4.94	1.74	1.32	8.00	6.5	6.68	6.0	2.23	2.23	2.0
22773	71.9	....	0.16	1.47	1.63	1.7	6.28	2.28	1.60	10.16	9.0	8.56	8.0	3.07	3.07	2.0
22925	72.5	0.24	0.03	1.32	1.59	1.5	4.79	3.95	0.28	9.02	8.0	8.74	7.0	5.61	5.61	5.0
22889	74.1	....	1.17	1.53	2.70	2.5	6.11	3.03	2.02	11.16	10.0	9.14	9.0	2.26	2.26	2.0
22955	74.3	0.16	0.06	1.04	1.26	1.0	3.09	5.48	2.34	10.91	9.0	8.57	8.0	2.51	2.51	1.5
22891	79.4	0.11	0.20	1.69	2.00	1.7	0.87	5.63	3.30	9.80	8.0	6.50	6.0	3.88	3.88	2.0
22929	80.2	0.73	0.30	0.77	1.80	1.7	6.63	2.39	0.88	9.90	10.0	9.02	8.0	3.00	3.00	2.0
22747	81.2	....	0.05	1.73	1.78	1.7	5.53	3.17	1.14	9.84	9.0	8.70	8.0	3.20	3.20	3.0
22710	83.0	0.24	0.30	1.60	2.14	1.9	5.77	2.08	0.64	8.49	9.0	7.85	8.0	3.84	3.84	3.0
22511	84.5	1.57	0.46	0.65	2.68	2.5	1.20	8.70	2.64	12.54	12.0	9.90	10.0	3.21	3.21	2.5
22842	85.8	0.14	0.22	1.14	1.50	1.2	7.16	2.68	1.24	11.08	10.0	9.84	9.0	2.31	2.31	2.0

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22709	E. F. Coe's Gold Brand Excelsior Guano	Coe-Mortimer Co., New York	J. G. Schwink, Meriden	------	$20.44
			W. A. Burr, W. Hartford	$40.00	
			L. A. Gowdy, Hazardville	36.00	
				38.00	
22880	Quinnipiac Climax Phosphate	Amer. Agrl. Chem. Co., New York	J. P. Lathrop, Plainfield	**28.00**	14.81
22804	Great Eastern General Fertilizer	Amer. Agrl. Chem. Co., New York	R. H. Hall, East Hampton	29.00	14.85
			T. E. Green, Plainfield	28.00	
				28.50	
22646	Packer's Union Universal Fertilizer	Amer. Agrl. Chem. Co., New York	G. W. Eaton, Bristol	30.00	15.04
			F. L. Mackey, Ellington	28.00	
			G. A. Forsyth, Waterford	**29.00**	
22445	Eldredge's Special Superphosphate	(Made for) T. H. Eldredge, Norwich	T. H. Eldredge, Norwich	**28.00**	14.12
22619	Bowker's Gloucester Fish and Potash	Bowker Fertilizer Co., New York	Lightbourn & Pond Co., New Haven	**25.00**	12.47
			Prentice Store, Turnerville	25.00	
22608	Swift's Lowell Empress Brand	Swift's Lowell Fertilizer Co., Boston, Mass.	F. E. Weed & Co., New Canaan	29.00	14.20
			Southington Lumber Co., Southington	28.00	
				28.50	
22882	Read's Standard Superphosphate	Amer. Agrl. Chem. Co., New York	C. W. Fulton, West Hartford	**30.00**	14.68
22799	Bradley's Eclipse Phosphate	Amer. Agrl. Chem. Co., New York	Phineas Platt, Milford	30.00	13.69
			F. M. Cole, Putnam	28.00	
				29.00	
22602	Berkshire Ammoniated Bone Phosphate	Berkshire Fertilizer Co., Bridgeport	F. C. Benjamin Co., Danbury	28.00	13.38
			Hotchkiss & Templeton, Waterbury	30.00	
				29.00	
22560	Bowker's Sure Crop Phosphate	Bowker Fertilizer Co., New York	W. T. McKenzie, Yalesville	29.00	13.44
			E. W. Hubbell Co., Saugatuck	29.00	
			East Berlin Mill Co., East Berlin	30.00	
				29.25	

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
22709	85.9	0.16	0.92	1.32	2.40	**2.5**	6.41	1.55	1.03	8.99	**9.0**	7.96	**8.0**	6.04	6.04	**6.0**
22880	89.1	0.10	0.18	1.18	1.46	**1.0**	4.93	3.59	2.61	11.13	**10.0**	8.52	**8.0**	2.24	2.24	**2.0**
22804	92.0	0.13	0.10	0.90	1.13	**0.8**	5.55	2.91	2.09	10.55	**9.0**	8.46	**8.0**	3.93	3.93	**4.0**
22646	92.8	0.13	0.14	0.87	1.14	**0.8**	5.96	2.48	2.01	10.45	**9.0**	8.44	**8.0**	4.13	4.13	**4.0**
22445	98.3	----	0.12	1.06	1.18	**1.0**	4.03	4.84	2.26	11.13	**10.0**	8.87	**8.0**	2.55	2.55	**2.0**
22619	100.5	----	0.20	0.95	1.15	**0.8**	4.70	4.02	1.62	10.34	**9.0**	8.72	**8.0**	1.13	1.13	**1.0**
22608	100.7	----	0.08	1.42	1.50	**1.2**	5.86	2.33	0.78	8.97	**8.0**	8.19	**7.0**	2.24	2.24	**2.0**
22882	104.4	0.10	0.14	0.86	1.10	**0.8**	6.64	1.95	1.52	10.11	**9.0**	8.59	**8.0**	3.89	3.89	**4.0**
22799	111.8	----	0.12	1.12	1.24	**1.0**	5.56	2.77	2.20	10.53	**9.0**	8.33	**8.0**	2.06	2.06	**2.0**
22602	116.7	0.10	0.20	0.92	1.22	**0.8**	6.38	2.26	0.06	8.70	**9.0**	8.64	**8.0**	2.55	2.55	**2.0**
22560	117.7	0.13	0.20	0.67	1.00	**0.8**	6.80	2.45	1.16	10.41	**10.0**	9.25	**9.0**	2.54	2.54	**2.0**

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22600	Bradley's Niagara Phosphate	Am'n Agric'l Chem. Co., New York	Phineas Platt, Milford Wilson & Burr, Middletown	$28.00 28.00	$12.19
22878	Darling's General Fertilizer	Am'n Agric'l Chem. Co., New York	E. L. Oviatt, Milford	34.00	14.70
22912	Chittenden's Universal Phosphate	National Fertilizer Co., New York	Greenwich Hard. Co., Greenwich	28.00	11.67
22751	Complete High Grade Fertilizer	Made for Conn. Valley Orchard Co.	Conn. Valley Orchard Co.	†	20.16
	Sampled by purchasers and others:		*Sent by*		
23342	Special Mixture No. 2	Wilcox Fertilizer Co., Mystic	R. C. Wilcox & Sons, Guilford	35.00	32.07
22874	Special Mixture	Sanderson Fert. & Chem. Co., New Haven	James I. Webb, New Haven	29.50	25.66
22871	Special Mixture	Sanderson Fert. & Chem. Co., New Haven	James I. Webb, New Haven	29.50	----
22780	Our Brand	Berkshire Fertilizer Co., Bridgeport	C. R. Burr & Co., Manchester	34.00	29.44
23341	Special Mixture No. 1	Wilcox Fertilizer Co., Mystic	R. C. Wilcox & Sons, Guilford	36.00	30.89
22779	Our Brand	Olds & Whipple, Hartford	C. R. Burr & Co., Manchester	34.00	28.34
22921	Our Brand	Olds & Whipple, Hartford	C. R. Burr & Co., Manchester	----	----
22564	Special Mixture	Sanderson Fert. & Chem. Co., New Haven	James I. Webb, New Haven	35.00	28.52
22429	H. G. Complete Fertilizer	Conn. Valley Orchard Co., Berlin	C. A. Parmalee, Deep River	28.00	22.04
22655	H. G. Fertilizer	Conn. Valley Orchard Co., Berlin	C. A. Parmalee, Deep River	28.00	21.78
22622	Peruvian Guano, Lobos Grade	Coe-Mortimer Co., New York	O. E. Pitcher, R. D. 2, Suffield	33.50	25.22
23353	Fish and Potash	Wilcox Fertilizer Co., Mystic	B. E. Shepard, Branford	26.00	19.11
22975	Formula "A" with 10% Sulphate of Potash	Sanderson Fert. & Chem. Co., New Haven	O. G. Beard, Shelton	26.00	24.02
22960	James's Bone Phosphate	Ernest L. James, Warrenville	Manufacturer	30.00	19.79
22795	Formula "A" with 10¢ Sulphate of Potash	Sanderson Fert. & Chem. Co., New Haven	O. G. Beard, Shelton	36.00	23.38
22782	Woodruff's Home Mixture	S. D. Woodruff & Sons, Orange	W. J. Andrews, Cheshire	----	----

† See note on page 50.

Analyses and Valuations—*Concluded.*

Station No.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
22600	129.7	0.16	0.20	0.82	1.18	0.8	4.56	3.57	1.63	9.76	8.0	8.13	7.0	1.25	1.25	1.0
22878	131.3	0.08	0.20	1.25	1.53	1.2	4.33	3.07	1.64	9.04	7.0	7.40	6.0	3.22	3.22	3.0
22912	139.9	----	0.10	0.86	0.96	0.8	4.63	4.11	1.32	10.06	10.0	8.74	8.0	1.12	1.12	1.0
22751	----	----	0.12	2.28	2.40	2.4	7.58	2.19	0.46	10.23	11.0	9.77	9.0	3.90	3.90	4.0
23342	9.1	2.53	0.85	1.96	5,34	4.8	2.56	4.83	1.82	9.21	8.7	7.39	5.5	8.49	8.49	8.1
22874	15.0	2.22	0.10	1.82	4.14	---	3.04	2.49	1.16	6.69	----	5.53	----	7.58	7.58	----
22871	----	----	---	---	4.15	---	----	----	----	----	----	----	----	----	7.73	----
22780	15.5	0.24	1.50	2.34	4.08	3.3	7.73	1.30	0.32	9.35	----	9.03	8.0	8.75	8.75	8.0
23341	16.5	2.00	1.14	2.46	5.60	5.5	1.64	5.57	2.19	9.40	9.0	7.21	5.0	5.85	5.85	6.9
22779	20.0	0.16	0.40	3.54	4.10	3.3	0.36	7.78	1.69	9.83	----	8.14	8.0	7.74	7.74	8.0
22921	----	----	---	---	3.74	---	----	---	----	----	----	----	----	----	8.45	----
22564	22.7	0.61	11.0	2.83	3.55	3.0	1.78	2.20	0.43	4.41	----	3.98	----	14.42	14.42	8.0
22429	27.0	0.18	1.66	1.04	2.88	2.5	6.74	3.33	0.92	10.99	10.0	10.07	9.0	4.44	4.44	4.0
22655	28.6	----	0.12	2.48	2.60	2.5	7.49	1.80	0.45	9.74	11.0	9.29	9.0	5.32	5.32	4.0
22622	32.8	1.22	0.74	1.13	3.09	2.9	4.56	6.89	2.69	14.14	14.0	11.45	8.0	2.10	5.14	4.8
23353	36.1	----	0.34	2.48	2.82	2.5	3.41	2.62	0.88	6.91	6.0	6.03	5.0	4.26	4.26	3.0
22975	49.9	1.84	0.04	1.54	3.42	---	2.20	3.05	1.54	6.79	----	5.25	----	3.69	7.99	----
22960	51.6	0.12	---	1.97	2.09	2.0	2.33	6.30	3.80	12.43	13.0	8.63	10.0	4.83	4.83	3.0
22795	54.0	1.46	0.02	1.41	2.89	---	3.23	2.35	1.52	7.10	----	5.58	----	3.55	8,21	----
22782	----	----	---	---	3.18	3.3	----	---	---	10.36	8.0	----	----	----	8.96	8.0

Connecticut market, but it will go very far toward eliminating from his choice brands which the farmer cannot possibly use to advantage.

In the table below all the analyses on each manuscript page of the tables given on pages 54 to 71 have been averaged and the amounts of plant food purchasable for $30.00 in these averages have been calculated.

PURCHASABLE FOR THIRTY DOLLARS.

	Nitrogen, pounds.	Total phosphoric acid, pounds.	Available phosphoric acid, pounds.	Potash, pounds.
In the first 10 samples in the table	74	149	129	128
" " next 10 " " " "	66	175	156	125
" " " 11 " " " "	58	146	129	112
" " " 10 " " " "	49	162	143	102
" " " 9 " " " "	49	175	153	82
" " " 10 " " " "	47	164	142	93
" " " 10 " " " "	44	187	159	68
" " " 8 " " " "	37	195	166	71
" " " 11 " " " "	30	209	174	63
" " last 6 " " " "	25	298	171	43

This calculation, based not upon valuations, but on cost price and actual composition, shows that in general the fertilizers arranged according to their valuations as in the tables on pages 54 to 71, are in fact arranged in order of the relative economy of purchase of the plant food in them.

SPECIAL MANURES.

Here are included such mixed fertilizers, chiefly nitrogenous superphosphates containing potash, as are claimed by their manufacturers to be specially adapted to the needs of particular crops. Those which are claimed to contain potash in form of carbonate, tobacco specials, are separately considered on pages 104 and 105.

1. *Samples Drawn by Station Agent.*

One hundred and forty analyses are here reported of samples of this kind.

Analyses Requiring Special Notice.

Broad Brook Market Garden and Potato Special, **23007,** of which the analysis is given on pages 86 and 87, contained 3.32 per

cent. of nitrogen with a guaranty of 5.0 per cent. At request of the company, which was disappointed at the results of this test, a second sample, **23351**, sent by the Broad Brook Lumber & Coal Co., was examined and contained 4.13 per cent. of nitrogen, 8.21 of phosphoric acid and 6.80 of potash.

The C. M. Shay Fertilizer Co. stated that the analysis of their potato fertilizer, **22339**, pages 102 and 103, made on a sample sent by Thomas Griswold & Co., Wethersfield, was unsatisfactory and did not fairly represent their goods, being below guaranty in nitrogen. A sample, **22394,** drawn by the station agent from Griswold & Co.'s stock, gave practically the same figures as the other sample, as appears on pages 78 and 79. But a third sample, **23352,** pages 102 and 103, from another purchaser, had the guaranteed composition.

The Rogers & Hubbard Co., on account of the shortage of nitrogen and excess of phosphoric acid in their Hubbard's Oats and Top Dressing, **22562,** pages 80 and 81, asked that another sample should be drawn and tested. This was accordingly done and the analysis, **22852,** on the pages just noted, shows only a very slight shortage of nitrogen, while phosphoric acid and potash are far above guaranty.

The New England Fertilizer Co. stated that analysis **22917,** pages 86 and 87, did not fairly represent their goods and asked that another sample be drawn and tested. This was done with the results given on pages 82 and 83, **23364.**

Bowker's Lawn and Garden Dressing, **22890,** is sold chiefly in small packages for use on private lawns and small garden patches and cannot fairly be compared as to cost and valuation with fertilizers for farm use.

The sample analyzed contained:

Nitrogen as nitrates	0.66
Nitrogen as ammonia	1.76
Nitrogen, organic	0.41
Total nitrogen found	2.83
Total nitrogen guaranteed	3.00
Water-soluble potash found	5.69
Water-soluble potash guaranteed	5.00
Water-soluble phosphoric acid	2.61
Citrate-soluble phosphoric acid	3.26
Citrate-insoluble phosphoric acid	1.06
Total phosphoric acid found	6.93
Total phosphoric acid guaranteed	8.00

GUARANTIES.

Of the one hundred and forty samples examined, thirty-five, or one-quarter of the whole number, are below their guaranties by more than one-tenth per cent., in respect of one or more ingredients. Twelve are below in nitrogen alone, seven in phosphoric acid and twelve in potash, while four are below guaranty in respect of two ingredients.

In most cases the discrepancies are not large and a deficiency of one ingredient is balanced by an excess of some other ingredient.

Four of these special manures, however, are so deficient that they do not contain a full equivalent in money value of the quantities of plant food which they are claimed by their manufacturers to contain. The deficiencies range from one to two dollars per ton.

The deficient brands are:

Shay's Potato Manure, 22394, regarding which see note on page 73; Broad Brook Market and Potato Special, 23007, regarding which see note on pages 72 and 73; and Chittenden's H. G. Special Tobacco, 22911, Chittenden's Conn. Valley Tobacco Starter, 22916.

Cost and Valuation.

The method of ascertaining the retail cash cost price of the special manures and of computing the valuation is the same as described on pages 50 and 51.

The average cost per ton of the one hundred and thirty-five special manures, the cost and valuation of which are given in the tables, was $35.24 per ton, the average valuation $23.54, and the percentage difference 49.7.

In 1908 the corresponding figures were: cost, $35.67; valuation, $26.02; percentage difference, 37.1.

Percentage Composition.

Year.	Nitrogen.	Total phosphoric acid.	"Available" phosphoric acid.	Potash.	Cost per ton.	Percentage difference.
1904	2.92	8.56	....	5.92	$33.93	45.0
1905	2.93	10.38	....	6.13	33.99	41.8
1906	2.99	9.98	....	5.92	34.28	44.6
1907	3.09	9.63	....	5.92	34.48	35.8
1908	3.12	9.49	7.75	6.42	35.67	37.1
1909	3.10	9.63	8.10	6.40	35.24	49.7

A comparison of these figures with those relating to nitrogenous superphosphates, on page 51, shows that as a rule special manures contain more nitrogen and potash than the other nitrogenous superphosphates with the same amount of phosphoric acid and sell at a somewhat higher price.

Even a superficial examination of the tables of analyses shows a very wide range of prices and of content of plant food in these one hundred and thirty-five brands.

There must, therefore, be a great difference between them in the relative economy of their purchase. This is brought out clearly by the following table, which shows how much plant food can be bought for the same money, $30.00, in several groups of these special manures.

Purchasable for Thirty Dollars.

	Nitrogen pounds.	Total phosphoric acid pounds.	"Available" phosphoric acid pounds.	Potash pounds.
In the first 10 samples in the table	68	184	140	137
" next 13 " " "	67	166	136	126
" " 14 " " "	60	150	121	131
" " 12 " " "	64	117	103	116
" " 12 " " "	51	163	137	124
" " 12 " " "	53	140	122	118
" " 9 " " "	50	158	139	102
" " 12 " " "	43	172	153	102
" " 9 " " "	48	176	153	72
" " 10 " " "	42	184	157	77
" " 12 " " "	39	186	159	93
" last 10 " " "	26	187	165	65

The table shows that among fertilizers made by reputable manufacturers and containing practically all that is guaranteed for them, there are some which supply more than twice as much nitrogen, twice as much potash and about the same amount of phosphoric acid as others for the same money.

Another point worthy of notice is that this table, compared with the table of analyses in which the several brands are arranged in order of their percentage difference, shows that as the percentage difference between cost and valuation increases, the probable economy of purchase decreases.

2. *Sampled by Purchasers and Others.*

In the table on pages 102 and 103 are five analyses of special manures, made on samples drawn by others than station agents.

"Fillers" and "Conditioners" in Mixed Fertilizers.

Fillers may have legitimate uses in commercial mixtures.

While their presence increases the freight charges on a given quantity of plant food, yet, when a certain percentage composition is guaranteed and expected, and particularly when the percentages of plant food are quite moderate, a makeweight of some kind may sometimes be desirable. To illustrate:—Imagine a brand with a guaranty of 2-10-2, made to answer a demand for a low-priced fertilizer. Such a fertilizer carries 40 lbs. each of nitrogen and potash and 200 of phosphoric acid in the ton. A mixture of 700 pounds of tankage, 80 of muriate of potash and 950 of acid phosphate will furnish those amounts, but falls short of a ton by 270 pounds. To make the goods conform exactly to the formula it may therefore be necessary and is certainly fair to add 270 pounds of some harmless makeweight. If materials carrying lower percentages of plant food than those above named were used in making the mixture, the addition of a filler would be unnecessary simply because the low grade materials themselves contained enough inert material to take the place of filler. The buyer of mixed goods having high percentages of plant food in them pays less freight for it than the one who gets those fertilizers which carry less plant food to the ton with a filler. For example: The man who buys potash salts of the highest grade pays perhaps $2.00 in freight on 1,000 pounds of actual potash. If he calls for a 25 per cent. potash salt he can get it, but he pays the same freight, $2.00, on 500 pounds of actual potash.

Another common use of inert material is to keep certain mixtures dry and in good "condition" so that they can be stored for the necessary length of time without caking in the bags and can be spread with a machine without clogging it. Mixtures made largely or exclusively of chemicals, like nitrates, potash salts and acid phosphate, are almost certain to cake before they can be shipped, sold and used. Where dry animal or vegetable matter, like cotton seed meal, tankage, or dry bone dust is used with them, this caking is hindered or prevented and these materials also furnish plant food. Other materials, having little or no fertilizing value, can accomplish the same thing and the amount required is relatively small. Finely ground phosphate rock or phosphatic guano, dry, fine, garbage tankage, of which analyses have been given on pages 34 and 37, and dried peat are also used. The last-named material is a powerful absorbent, and it is claimed that one or two hundred pounds of peat per ton will keep the most troublesome mixtures in fine "condition" for many months, while a larger addition makes them too light and bulky to admit of its use.

It is commonly known that large quantities of fine dry peat are sold for the above purpose.

The objections to its use, on the part of the chemist, are that peat contains from 2½ to over 3 per cent. of nitrogen, that this nitrogen is agriculturally inert as compared with the forms for which eighteen or twenty cents per pound are charged, that it has not been possible to distinguish in a mixed fertilizer between nitrogen in this form and nitrogen in more quickly available forms and so, in consequence, such nitrogen appears in the analyses and valuations on a par with more valuable organic forms.

Nineteen of the samples analyzed this year gave reactions which indicated the presence of decayed vegetable matter or peat. In some cases the manufacturers have stated the amount used, which was in no case higher than 312 pounds to the ton of peat containing 2.7 per cent of nitrogen. This means 8.4 pounds of peat nitrogen per ton which, though known to be comparatively inert, is given the same value as the nitrogen of cotton seed meal and dried blood.

In all these cases the solubility of the organic nitrogen has been determined by the neutral permanganate method, as modified by Mr. Street and which need not be here described as it will be given in full in a technical journal. It is sufficient to say here that the organic nitrogen in such raw materials as are generally regarded as being quickly available and in dry mixtures of these materials with acid phosphate and muriate of potash, has when tested by this method a solubility of at least 90 per cent. The nitrogen of peat and of garbage tankage has a solubility of from 40 to 60 per cent.

The nitrogen of the samples from the Connecticut market which contained peat had solubilities ranging from 89.3 to 54.7. In general the larger the proportion of peat nitrogen to total organic nitrogen, the lower the solubility. It is of course quite possible that in some cases the low solubility of the organic nitrogen was due to garbage tankage or other low-grade forms.

It will be necessary hereafter to test the solubility of organic nitrogen in all mixed fertilizers and call attention to those brands containing nitrogen which is not so soluble as that of the standard "ammoniates."

SPECIAL MANURES.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22568	Potato Manure	L. T. Frisbie Co., New Haven	L. T. Frisbie, Hartford	**$34.00**	$31.44
22932	H. G. Soluble Tobacco Manure	Rogers Mfg. Co., Rockfall	Seth Alden, Thompsonville	43.50	37.43
			L. A. Kent, Suffield	45.00	
			Herman Ude, Suffield	45.00	
				44.50	
22394*	Shay's Potato Manure	C. M. Shay Fertilizer Co., Groton	Thos. Griswold & Co.,† So. Wethersfield	**30.00**	24.55
22931	Grass and Grain	Rogers Mfg. Co., Rockfall	Thos. Holt, Southington	41.00	33.44
			G. H. Sloan, Windsorville	**41.00**	
22452	Grass Fertilizer	Olds & Whipple, Hartford	Manufacturer	**34.00**	27.55
22938	Grass and Lawn Fertilizer	C. M. Shay Fertilizer Co., Groton	J. P. Barstow & Co., Norwich	38.00	28.51
			G. M. Williams Co., New London	33.00	
				35.50	
22746	H. G. Soluble Tobacco and Potato	Rogers Mfg. Co., Rockfall	Thos. Holt, Southington	39.00	31.76
			E. T. Hulburt, Somers	40.00	
			G. H. Sloan, Windsorville	40.00	
				39.75	
22775	Oats and Top Dressing	Rogers Mfg. Co., Rockfall	Thos. Holt, Southington	45.00	36.18
			Manufacturer	46.00	
			M. F. Tyler, Plainville	46.00	
				45.75	
22934	H. G. Tobacco Grower	Rogers Mfg. Co., Rockfall	Jos. Greggs, Suffield	37.00	29.95
			Manufacturer	39.00	
				38.00	
22685	Hubbard's Soluble Tobacco Manure	Rogers & Hubbard Co., Middletown	H. W. Andrews, Wallingford	47.00	36.91
			R. H. Hall, East Hampton	**47.00**	
22690	Potato, Onion and Vegetable	Wilcox Fertilizer Co., Mystic	Knowles, Lombard Co., Guilford	34.00	27.08
			B. F. Pease,† Greenfield Hill	35.00	
				34.50	
22567	Corn and Grain Fertilizer	L. T. Frisbie Co., New Haven	E. Rogers,† Southington	**29.00**	22.72

* See notes pages 73 and 74. † Purchaser.

ANALYSES AND VALUATIONS.

Station No.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. 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. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
22568	8.1	1.82	---	1.56	3.38	**2.5**	0.34	14.24	5.12	19.70	**8.0**	14.58	**5.0**	8.48	8.48	**6.0**
22932	18.9	1.24	0.68	3.23	5.15	**5.0**	1.44	7.43	2.66	11.53	**8.0**	8.87	**6.0**	0.94	11.49	**11.0**
22394	22.2	0.43	0.17	2.89	3.49	**4.0**	2.64	4.76	0.99	8.39	**8.0**	7.40	----	6.74	6.74	**6.0**
22931	22.6	0.27	0.04	2.89	3.20	**3.0**	0.08	11.37	7.33	18.78	**16.0**	11.45	----	12.33	12.33	**12.5**
22452	23.4	0.10	0.15	3.87	4.12	**3.3**	0.05	6.63	2.34	9.02	----	6.68	**6.0**	7.51	7.51	**6.0**
22938	24.5	0.85	0.26	3.33	4.44	**4.0**	3.28	5.08	1.52	9.88	**10.0**	8.36	----	6.33	6.33	**6.0**
22746	25.2	0.74	0.56	2.80	4.10	**3.5**	3.45	5.69	2.32	11.46	**9.0**	9.14	**7.0**	0.78	9.23	**8.8**
22775	26.5	3.36	1.08	1.96	6.40	**5.3**	4.58	4.30	1.05	9.93	**9.0**	8.88	**7.0**	8.09	8.09	**7.5**
22934	26.9	1.47	0.38	3.15	5.00	**5.0**	2.17	3.89	1.19	7.25	**5.0**	6.06	**4.0**	0.49	6.97	**6.0**
22685	27.3	2.16	0.42	2.32	4.90	**5.0**	0.67	8.86	3.20	12.73	**10.0**	9.53	**7.0**	1.40	11.72	**10.0**
22690	27.4	1.08	0.66	1.92	3.66	**3.3**	6.34	2.70	0.93	9.97	**8.0**	9.04	**7.0**	4.98	7.40	**6.0**
22567	27.6	----	0.02	2.41	2.43	**1.6**	0.36	12.45	5.18	17.99	**8.0**	12.81	**5.0**	2.83	2.83	**3.0**

SPECIAL MANURES.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22563	Swift-Sure Superphosphate for Potatoes	M. L. Shoemaker & Co., Philadelphia	F. A. Forbes, East Haven F. H. Rolf, Guilford	$32.50 36.00 **34.25**	$26.85
22833	Berkshire Tobacco Special	Berkshire Fertilizer Co., Bridgeport	Manufacturer B. O. Higley, Canton	34.00 **34.00**	26.62
22450	O. & W.'s H. G. Potato Manure	Olds & Whipple, Hartford	Manufacturer	**37.00**	28.90
22772	Mapes' Seeding Down	Mapes F. & P. G. Co., New York City	Mapes' Branch, Hartford	**42.00**	32.63
22687	Top Dressing Grass and Grain	Sanderson Fert. and Chem. Co., New Haven	Manufacturer Morse & Landon, Guilford R. H. Hall, East Hampton	38.00 35.00 38.00 **37.00**	28.73
22957	Wilcox's Grass Fertilizer	Wilcox Fertilizer Co., Mystic	Manufacturer M. E. Thompson, Ellington	36.00 34.00 **35.00**	27.04
22892	Tobacco Producer	Buffalo Fertilizer Co., Buffalo, N. Y.	G. B. Adams, Suffield	**37.00**	28.44
22573	Shay's Corn Fertilizer	C. M. Shay Fertilizer Co., Groton	J. P. Barstow & Co., Norwich Knowles, Lombard Co., Guilford	29.00 30.00 **29.50**	22.52
22562*	Hubbard's Oats and Top Dressing	Rogers & Hubbard Co., Middletown	N. H. Sherwood, Southport John Hoffman,† Cromwell H. W. Andrews, Wallingford	55.00 57.00 55.00 **55.75**	42.11
22688	Wheeler's Potato Special	(Made for) A. G. & F. Wheeler, Stonington	Wheeler Bros.	**33.00**	24.91
22852*	Hubbard's Oats and Top Dressing	Rogers & Hubbard Co., Middletown	Manufacturer W. L. L. Ellis, Ansonia	57.00 **57.00**	42.95
22937	Sanderson's Formula B, for Tobacco	Sanderson Fert. and Chem. Co., New Haven	Manufacturer G. B. Ferris, New Milford A. E. Phelps, Glastonbury	**35.00** ---- 32.30	26.31
22778	Wilcox's H. G. Tobacco Special	Wilcox Fertilizer Co., Mystic	Manufacturer M. E. Thompson, Ellington F. J. Hartz, South Manchester	---- 35.00 **35.00**	26.20

* See note page 73.

† Purchaser.

ANALYSES AND VALUATIONS—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		Found.		Guaranteed.
					Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	
22563	27.6	1.00	---	2.00	3.00	**2.9**	7.63	4.19	1.23	13.05	----	11.82	**8.0**	7.56	7.56	**7.0**
22833	27.7	0.57	0.64	3.51	4.72	**4.1**	2.35	2.12	0.51	4.98	**4.0**	4.47	**3.0**	0.97	5.81	**5.0**
22450	28.0	----	0.85	2.79	3.64	**3.3**	0.34	6.53	1.20	8.07	----	6.87	**6.0**	7.88	11.27	**10.0**
22772	28.7	2.86	0.12	0.25	3.23	**2.5**	----	14.26	4.53	18.79	**18.0**	14.26	----	11.81	11.81	**10.0**
22687	28.8	2.00	0.10	2.26	4.36	**4.0**	6.41	2.29	0.45	9.15	----	8.70	**7.0**	7.40	7.40	**7.0**
22957	29.4	2.27	0.18	1.78	4.23	**4.1**	4.77	3.15	1.00	8.92	**7.0**	7.92	**6.0**	4.19	6.38	**5.0**
22892	30.1	1.28	0.12	2.84	4.24	**4.5**	0.10	6.06	2.55	8.71	**6.0**	6.16	**5.0**	0.25	7.72	**5.5**
22573	31.0	----	0.10	3.18	3.28	**3.0**	2.37	5.34	1.53	9.24	**8.0**	7.71	----	4.53	4.53	**4.0**
22562	32.4	6.40	0.02	1.52	7.94	**8.5**	0.14	8.02	2.88	11.04	**8.0**	8.16	**4.5**	9.73	9.73	**8.0**
22688	32.5	1.24	0.08	1.35	2.67	**2.8**	6.30	1.94	0.38	8.62	----	8.24	**8.0**	10.43	10.43	**10.0**
22852	32.7	7.22	0.02	1.11	8.35	**8.5**	0.07	5.93	2.51	8.51	**8.0**	6.00	**4.50**	11.32	11.32	**8.0**
22937	33.0	1.77	0.06	1.92	3.75	**3.3**	5.06	2.44	1.71	9.21	**10.0**	7.50	**6.0**	1.90	6.81	**6.0**
22778	33.2	0.98	0.10	2.55	3.63	**3.3**	0.06	4.53	6.41	11.00	**7.0**	4.59	**5.0**	1.18	7.34	**7.0**

Special Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22708	Vegetable and Potato	Buffalo Fertilizer Co., Buffalo, N. Y.	J. R. Reinhard & Sons, Cheshire	$34.00	$25.07
			Manchester Elevator Co., Manchester	**34.00**	
22928	Hubbard's Grass and Grain Fertilizer	Rogers & Hubbard Co., Middletown	H. W. Andrews, Wallingford	42.00	30.96
			Arthur Manning, R.D., South Manchester	**42.00**	
22911‡	Chittenden's H. G. Special Tobacco Fertilizer	National Fertilizer Co., New York City	J. M. Lasbury, Broad Brook	**46.00**	33.86
22689	Wheeler's Corn Special	(Made for) A. G. & F. Wheeler, Stonington	Wheeler Bros.	**31.00**	22.69
22621	Top Dresser	Buffalo Fertilizer Co., Buffalo, N. Y.	Ansonia Flour & Grain Co., Ansonia	40.00	29.45
			J. & H. Woodford, Avon	41.00	
			Manchester Elevator Co., Manchester	40.00	
				40.25	
22943	Swift's Lowell Potato Grower	Swift's Lowell Fertilizer Co., Boston	G. S. Jennings, Southport	**36.00**	26.24
22924	Hubbard's Potato Manure	Rogers & Hubbard Co., Middletown	John Hoffman,* Cromwell	----	31.79
				44.00	
22942	Swift's Tobacco Manure	Swift's Lowell Fertilizer Co., Boston	J. & H. Woodford, Avon	**43.00**	31.03
23364†	N. E. Perfect Tobacco Grower	New England Fertilizer Co., Boston	T. J. Kennedy, R. D., Thompsonville	**35.00**	25.20
22707	Ideal Wheat and Corn	Buffalo Fertilizer Co., Buffalo, N. Y.	Ansonia Flour & Grain Co., Ansonia	27.00	20.14
			J. R. Reinhard & Sons, Cheshire	29.00	
				28.00	
22893	Peruvian Vegetable Grower	Coe-Mortimer Co., New York City	R. H. Morgan, West Cheshire	**43.00**	30.85
22897	3-6-10 for Potatoes	Lister's Agric. Chem. Works, Newark, N. J.	Herman Ude, Suffield	**34.00**	24.36
22930	Complete Corn and Onion	Rogers Mfg. Co., Rockfall	Thos. Holt, Southington	35.00	25.40
			E. T. Hulburt, Somers	37.00	
			N. H. Root, New Milford	35.00	
				35.75	

* Purchaser. † See note page 73. ‡ See note on page 74.

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
22708	35.6	----	2.86	0.94	3.80	**2.5**	5.32	3.14	1.48	9.94	**9.0**	8.46	**8.0**	5.56	5.56	**7.0**
22928	35.7	0.20	0.17	2.61	2.98	**2.2**	0.34	9.22	5.22	14.78	**16.0**	9.56	**6.6**	12.93	12.93	**12.0**
22911	35.9	----	2.56	2.76	5.32	**5.8**	4.36	1.90	0.83	7.09	**6.0**	6.26	**5.0**	1.79	9.79	**10.0**
22689	36.6	0.99	0.36	1.33	2.68	**2.1**	6.48	1.85	0.38	8.71	----	8.33	**8.0**	7.67	7.67	**8.0**
22621	36.7	1.03	3.30	1.05	5.38	**5.7**	4.63	2.74	1.16	8.53	**7.0**	7.37	**6.0**	5.60	5.60	**5.0**
22943	37.2	0.71	0.10	2.56	3.37	**3.3**	5.23	1.34	0.35	6.92	**7.0**	6.57	**6.0**	10.08	10.08	**10.0**
22924	38.4	2.43	0.32	2.43	5.18	**5.0**	0.40	8.77	2.92	12.09	**10.0**	9.17	**7.0**	1.20	6.00	**5.0**
22942	38.6	0.68	0.08	3.40	4.16	**4.0**	3.38	3.89	0.92	8.19	**7.0**	7.27	**60**	1.25	10.0	**10.0**
23364	38.9	0.69	0.15	3.03	3.87	**4.0**	0.24	5.56	1.13	6.93	**5.0**	5.80	**4.0**	0.93	6.51	**6.0**
22707	39.0	0.32	0.91	0.83	2.06	**1.6**	5.92	3.61	1.22	10.75	**10.0**	9.53	**9.0**	5.98	5.98	**6.0**
22893	39.4	1.02	1.02	1.72	3.76	**3.3**	4.26	4.78	1.00	10.04	**10.0**	9.04	**8.0**	1.99	10.61	**9.0**
22897	39.6	0.08	1.08	1.57	2.73	**2.5**	4.72	2.09	0.87	7.68	**7.0**	6.81	**6.0**	10.44	10.44	**10.0**
22930	40.7	1.46	0.38	1.74	3.58	**3.5**	4.79	3.45	1.30	9.54	**.0**	8.24	**6.0**	6.95	6.95	**7.0**

Special Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22453	Corn and Potatoes	Olds & Whipple, Hartford	Manufacturer	$34.00	$24.13
22736	Wheeler's Havana Tobacco Grower	Amer. Agric. Chem. Co., N. Y. City	F. M. Loomis, Granby G. A. Peckham, Suffield L. L. Loomis, Granby	35.00 38.00 35.00 **36.00**	25.54
22752	Lister's Potato Manure	Lister's Agric. Chem. Works, Newark, N. J.	J. C. Wilcoxson, Stratford D. H. Carrier & Son, Glastonbury H. N. Fuller, Windsor Locks	38.00 37.50 36 50 **37.25**	26.41
22835	Stockbridge Tobacco Manure	Bowker Fertilizer Co., N. Y. City	W. H. Filley,* Windsor F. R. Green, New Milford	51.00 46.00 **48.50**	34.38
22741	Home Mixture for Corn and Potatoes	Olds & Whipple, Hartford	J. R. Gregg, Suffield H. L. Spear, Suffield	34.00 **34.00**	23.85
22796	H. G. Tobacco Manure	Amer. Agric. Chem. Co., N. Y. City	Broad Brook Lumber Co., Broad Brook	**50.00**	35.06
22517	Chittenden's Eureka Potato Fertilizer	National Fertilizer Co., N. Y. City	H. A. Bugbee, Willimantic G. D. Mosher, Milford	35.00 **35.00**	24.38
22832	Grass Special	Berkshire Fertilizer Co., Bridgeport	Jacob Glover, Stafford Avery Bros., Norwich Town	39.00 36.00 **37.50**	26.00
22559	Stockbridge Top Dressing	Bowker Fertilizer Co., N. Y. City	Lightbourn & Pond Co., New Haven J. Frank Elwood, Greens Farms East Berlin Mill Co., East Berlin	40.00 39.00 42.00 **40.25**	27.81
23009	Lister's Special Grass Mixture	Lister's Agric. Chem. Works, Newark, N. J.	D. H. Carrier & Son, Glastonbury	**36.00**	24.77
22916†	Chittenden's Conn. Valley Tobacco Starter	National Fertilizer Co., N. Y. City	J. M. Lasbury, Broad Brook	**48.00**	33.02
22705	Stockbridge Corn and Grain	Bowker Fertilizer Co., N. Y. City	W. B. Martin, Rockville A. R. Manning, Yantic	39.00 40.00 **39.50**	27.01

* Purchaser. † See note on page 74.

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		Found.		Guaranteed.
					Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	
22453	40.9	1.13	0.10	2.39	3.62	**3.3**	0.45	6.33	1.47	8.25	----	6.78	**6.0**	6.59	6.59	**6.0**
22736	41.0	0.11	1.20	1.41	2.72	**2.5**	5.91	0.86	0.78	7.55	**7.0**	6.77	**6.0**	0.90	10.23	**10.0**
22752	41.0	0.32	1.62	1.71	3.65	**3.3**	7.05	1.59	0.95	9.59	**9.**	8.64	**8.0**	7.30	7.30	**7.0**
22835	41.1	----	3.92	1.78	5.70	**5 8**	3.50	2.00	0.92	6.42	**6.0**	5.50	**4.0**	0.81	9.84	**10.0**
22741	42.6	1.06	0.05	2.48	3.59	**3.3**	0.49	5.86	1.71	8.06	----	6.35	**6.0**	6.58	6.58	**6.0**
22796	42.6	0.28	3.24	2.16	5.68	**5.8**	4.71	1.35	0.23	6.29	**6.0**	6.06	**5.0**	0.68	10.20	**10.0**
22517	43.6	0.64	0.46	1.51	2.61	**2.5**	5.14	2.11	0.96	8.21	**7.0**	7.25	**6.0**	8.68	10.30	**10.0**
22832	44.2	2.38	0.16	2.62	5.16	**5.0**	2.79	2.84	0.47	6.10	**5.0**	5.63	**4.0**	3.81	3.81	**2.0**
22559	44.7	----	2.36	2.56	4.92	**4.9**	3.23	2.75	1.06	7.04	**6.0**	5.98	**4.0**	6.04	6.04	**6.0**
23009	45.3	0.08	0.61	1.26	1.95	**1.7**	9.81	1.01	0.31	11.13	**11.0**	10.82	**10.0**	10.55	10.55	**10.0**
22916	45.4	0.23	4.00	3.47	7.70	**8.3**	0.37	2.68	0.84	3.89	**3.0**	3.05	----	0.31	3.00	**3.0**
22705	46.2	1.46	0.10	1.94	3.50	**3.3**	4.51	5.92	1.98	12.41	**11.0**	10.43	**10.0**	6.99	6.99	**7.0**

SPECIAL MANURES.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
23007*	Broad Brook Market and Potato Special	(Made for) Broad Brook Lumber & Coal Co.	Broad Brook Lumber & Coal Co.	$34.00	$23.20
22519	North Western 10% Potato Fertilizer	Amer. Agric. Chem. Co., N. Y. City	Edmund Halladay, Suffield	36.00	23.13
			D. L. Clark, Milford	32.00	
				34.00	
22703	Packers' Union Potato Manure	Amer. Agric. Chem. Co., N. Y. City	F. L. Mackey, Ellington	33.00	21.63
			G. A. Forsyth, Waterford	**32.00**	
			W. H. Billings, Somerville	31.00	
22777	Swift's Perfect Tobacco Grower	Swift's Lowell Fertilizer Co., Boston	J. & H. Woodford, Avon	39.00	25.78
			J. D. Beasley, Ellington	35.00	
			F. S. Bidwell & Co., Windsor Locks	41.00	
				38.25	
22939	Swift-Sure Guano for Truck, Corn and Onions	M. L. Shoemaker & Co., Phila., Pa.	F. H. Rolf, Guilford	30.00	20.20
22933	Complete Potato and Vegetable Fertilizer	Rogers Mfg. Co., Rockfall	Manufacturer	33.00	22.22
			F. U. Wadhams, Torrington	**33.00**	
22569	Mapes' Economical Potato Manure	Mapes F. & P. G. Co., N. Y. City	Mapes' Branch, Hartford	37.00	25.42
			A. N. Clark, Milford	38.00	
			Southington Lumber Co., Southington	38.00	
				37.75	
22510	Essex Tobacco Starter and Grower	Essex Fertilizer Co., Boston	W. K. Ackley, East Hartford	39.00	26.23
			Spencer Bros., Suffield	**39.00**	
22917†	N. E. Perfect Tobacco Grower	New England Fertilizer Co., Boston	James Case, Collinsville	38.00	25.51
22516	Chittenden's Potato Phosphate	National Fertilizer Co., N. Y. City	H. A. Bugbee, Willimantic	30.00	20.29
			D. L. Clark, Milford	30.00	
			G. D. Mosher, Milford	31.00	
				30.25	
22443	Stockbridge Potato and Vegetable	Bowker Fertilizer Co., N. Y. City	Lightbourn & Pond Co., New Haven	40.00	26.51
			W. T. McKenzie, Yalesville	39.00	
			A. D. Bridge's Sons, Hazardville	40.00	
				39.75	

* See notes pages 72 and 74. † See note on page 73.

ANALYSES AND VALUATIONS—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
					Total Nitrogen.					Total.		So-called "Available."		Found.		
		As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.
23007	46.6	1.18	0.05	1.09	3.32	**5.0**	7.62	1.70	0.45	9.77	----	9.32	----	0.60	7.62	**7.0**
22519	47.0	0.26	0.17	1.41	1.84	**1.7**	3.98	4.89	1.94	10.81	**9.0**	8.87	**8.0**	10.53	10.53	**10.0**
22703	47.9	0.61	0.36	1.41	2.38	**2.1**	6.21	2.64	2.16	11.01	**9.0**	8.85	**8.0**	6.30	6.30	**6.0**
22777	48.4	0.88	0.15	3.07	4.10	**4.0**	0.46	5.32	1.22	7.00	**5.0**	5.78	**4.0**	1.75	6.38	**6.0**
22939	48.5	0.73	0.02	1.11	1.86	**1.7**	6.27	3.85	1.61	11.73	---	10.12	**8.0**	6.05	6.05	**5.0**
22933	48.5	1.25	0.08	1.20	2.53	**2.3**	6.70	3.44	2.64	12.78	**10.0**	10.14	**8.0**	5.21	5.21	**5.0**
22569	48.5	1.84	0.96	0.72	3.52	**3.3**	0.67	5.36	0.79	6.82	**6.0**	6.03	**4.0**	1.12	8.91	**8.0**
22510	48.7	0.82	0.14	3.19	4.15	**4.0**	0.29	5.78	0.90	6.97	**5.0**	6.07	**4.0**	1.30	6.47	**6.0**
22917	49.0	0.64	0.12	2.84	3.60	**4.1**	1.67	4.91	1.25	7.83	**5.0**	6.58	**4.0**	1.74	7.18	**6.0**
22516	49.1	0.32	0.72	1.06	2.10	**2.1**	6.73	1.97	1.73	10.43	**9.0**	8.70	**8.0**	6.23	6.23	**6.0**
22443	49.9	----	1.80	1.61	3.41	**3.3**	3.94	2.61	1.54	8.09	**7.0**	6.55	**6.0**	10.20	10.20	**10.0**

SPECIAL MANURES.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22894	Essex Grass and Top Dressing	Essex Fertilizer Co., Boston	W. K. Ackley, East Hartford	$45.00	$30.03
22740	Essex Complete for Corn, Grain and Grass	Essex Fertilizer Co., Boston	W. K. Ackley, East Hartford	41.40	26.67
			H. Thompson, Plainville	**40.00**	
			Broad Brook Lumber Co., Broad Brook	39.00	
22481	Essex Complete for Potatoes, Roots and Vegetables	Essex Fertilizer Co., Boston	W. K. Ackley, East Hartford	41.00	26.68
			Spencer Bros., Suffield	41.00	
			Knowles-Lombard Co., Guilford	39.00	
				40.25	
22927	Hubbard's Soluble Corn and General Crops	Rogers & Hubbard Co., Middletown	N. H. Sherwood, Southport	35.00	24.15
			John Hoffman,* Cromwell	38.00	
				36.50	
22803	East India Potato Manure	Amer. Agric. Chem. Co., N. Y. City	A. H. Cashen, Meriden	42.00	26.41
			F. J. Hartz, R. D., So. Manchester	38.00	
				40.00	
22944	Swift's Lowell Special Corn and Vegetable Manure	Swift's Lowell Fertilizer Co., Boston	G. S. Jennings, Southport	35.00	24.70
			F. E. Weed & Co., New Canaan	40.00	
				37.50	
22798	Tobacco Starter and Grower	Amer. Agric. Chem. Co., N. Y. City	Arthur Manning, So. Manchester	35.50	24.49
			A. D. Bridge's Sons, Hazardville	39.00	
				37.25	
22447	Mapes' Potato Manure	Mapes F. & P. G. Co., N. Y. City	Mapes' Branch, Hartford	40.00	26.87
			Spencer Bros., Suffield	41.00	
			F. S. Bidwell & Co., Windsor Locks	**41.00**	
			J. P. Barstow, Norwich	42.00	
22959	Wilcox's Potato Fertilizer	Wilcox Fertilizer Co., Mystic	Manufacturer	28.50	18.79
			W. A. Howard, Woodstock	29.09	
				28.75	

* Purchaser.

ANALYSES AND VALUATIONS—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
22894	49.9	0.62	0.17	3.65	4.44	**4.0**	5.45	2.85	0.91	9.21	**8.0**	8.30	**7.0**	8.01	8.01	**8.0**
22740	50.0	0.88	0.05	2.39	3.32	**3.3**	5.04	1.83	0.81	7.68	**7.0**	6.87	**6.0**	10.46	10.46	**10.0**
22481	50.9	0.90	0.10	2.30	3.30	**3.3**	4.80	2.12	0.82	7.74	**7.0**	6.92	**6.0**	10.57	10.57	**10.0**
22927	51.1	0.85	0.10	1.77	2.72	**2.5**	2.61	5.54	1.29	9.44	**8.0**	8.15	**5.5**	9.15	9.15	**8.0**
22803	51.5	----	2.26	1.15	3.41	**3.3**	5.42	1.29	0.38	7.09	**7.0**	6.71	**6.0**	9.25	10.36	**10.0**
22944	51.8	0.77	0.08	2.30	3.15	**3.3**	6.60	1.98	0.93	9.51	**9.0**	8.58	**8.0**	7.19	7.19	**7.0**
22798	52.1	0.86	1.02	1.46	3.34	**3.3**	6.36	2.89	1.36	10.61	**9.0**	9.25	**8.0**	0.65	5.12	**4.0**
22447	52.6	1.63	1.62	0.49	3.74	**3.7**	1.79	7.19	0.78	9.76	**8.0**	8.98	**8.0**	0.70	7.45	**6.0**
22959	53.0	0.49	0.22	1.71	2.42	**2.1**	2.30	4.00	2.07	8.37	**7.0**	6.30	**6.0**	3.47	4.97	**4.5**

Special Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22704	Bowker's Early Potato Manure	Bowker Fertilizer Co., N. Y. City	W. T. McKenzie, Yalesville	$38.00	$24.83
			J. Frank Elwood, Greens Farms	38.00	
22935	Tobacco Starter	Rogers Mfg. Co., Rockfall	E. T. Hulburt, Somers	34.00	22.82
			G. H. Sloan, Windsorville	36.00	
				35.00	
22915	Chittenden's Complete Root	National Fertilizer Co., N. Y. City	G. A. Williams, Silver Lane	**38.00**	24.73
22679	Grass and Lawn Top Dressing	Amer. Agric. Chem. Co., New York City	R. H. Hall, East Hampton	38.00	24.35
			G. L. Dennis, Stafford Springs	37.00	
				37.50	
22620	Celery and Potato Special	Buffalo Fertilizer Co., Buffalo, N. Y.	Ansonia Flour & Grain Co., Ansonia	32.00	21.58
			J. R. Reinhard & Sons, Cheshire	34.00	
			J. & H. Woodford, Avon	34.00	
				33.25	
22645	Bradley's Complete Manure for Potatoes and Vegetables	Amer. Agric. Chem. Co., New York	G. L. Dennis, Stafford Springs	39.00	24.76
			W. B. Martin, Rockville	38.00	
			Avery Bros., Norwich Town	38.00	
				38.25	
22898	Lister's Special Tobacco Fertilizer	Lister's Agric. Chem. Works, Newark, N. J.	G. O. Case, Burnside	**30.00**	19.41
22774	Chittenden's Complete Tobacco Fertilizer	National Fertilizer Co., New York City	S. O. Ranney,* R. D., Windsor Locks	38.00	24.56
			J. M. Clark, Simsbury	**38.00**	
22923	Special Potato Fertilizer	Parmenter & Polsey Fertilizer Co., Boston	J. C. Green, R. D., Eagleville	**39.00**	25.12
22840	Essex Special Tobacco Manure	Essex Fertilizer Co., Boston	F. T. Blish Hdw. Co., South Manchester	45 00	28.64
			W. K. Ackley, East Hartford	**45.00**	
22926	Hubbard's Potato Phosphate	Rogers & Hubbard Co., Middletown	H. W. Andrews, Wallingford	32.00	20.68
			F. S. Platt Co., New Haven	33.00	
				32.50	

* Purchaser.

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
					Total Nitrogen.					Total.		So-called "Available."		Found.		
		As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.
22704	53.0	....	1.42	1.98	3.40	3.3	4.86	3.11	1.69	9.66	8.0	7.97	7.0	6.74	6.74	7.0
22935	53.4	1.32	0.24	2.32	3.88	3.8	2.91	3.25	1.43	7.59	5.0	6.16	4.0	0.40	3.70	3.0
22915	53.7	....	1.98	1.35	3.33	3.3	7.66	1.54	0.87	10.07	9.0	9.20	8.0	6.25	6.25	6.0
22679	54.0	5.16	0.02	0.02	5.20	3.9	2.02	4.29	1.37	7.68	6.0	6.31	5.0	2.35	2.35	2.0
22620	54.1	....	1.12	0.69	1.81	1.6	5.70	3.36	1.30	10.36	9.0	9.06	8.0	9.08	9.08	10.0
22645	54.5	1.52	0.20	1.50	3.22	3.3	5.84	2.87	1.65	10.36	9.0	8.71	8.0	7.08	7.08	7.0
22898	54.6	....	0.64	1.86	2.50	2.1	5.91	3.05	1.47	10.43	9.0	8.96	8.0	0.72	2.81	3.0
22774	54.7	0.27	1.00	2.03	3.30	3.3	7.01	2.36	1.20	10.57	9.0	9.37	8.0	1.90	5.10	5.0
22923	55.3	0.80	0.08	2.37	3.25	3.3	6.32	2.13	1.11	9.56	9.0	8.45	8.0	7.30	7.30	7.0
22840	57.1	0.90	0.08	2.82	3.80	4.0	2.69	3.59	1.22	7.50	7.0	6.28	6.0	4.70	10.23	10.0
22926	57.2	0.82	0.06	1.27	2.15	2.0	5.96	4.13	0.35	10.44	10.0	10.09	9.0	6.05	6.05	5.0

Special Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22609	Swift's Lowell Potato Phosphate	Swift's Lowell Fertilizer Co., Boston	Spencer Bros., Suffield	$36.00	$21.76
			Standard Feed Co., Bridgeport	33.00	
			J. & H Woodford, Avon	34.00	
				34.25	
22899	Lister's Special Potato	Lister's Agric. Chem. Works, Newark, N.J.	H. N. Fuller, Windsor Locks	**27.50**	17.46
22879	Darling's Potato Manure	Amer. Agric. Chem. Co., New York City	Elmer Rose, Wallingford	**32.00**	20.30
22618	Armour H. G. Potato	Armour Fertilizer Works, Baltimore, Md.	Lightbourn & Pond Co., New Haven	33.00	21.66
			E. A. Buck & Co., Willimantic	34.00	
			F. T. Blish Hdw. Co., So. Manchester	36.00	
				34.25	
22756	Potato and Vegetable Manure	Niantic Menhaden Oil & Guano Co., South Lyme	F. H. Rolf, Guilford	31.00	20.87
			J. P. Barstow & Co., Norwich	34.00	
			J. O. Fox, Putnam	35.00	
				33.25	
22479	Quinnipiac Potato Manure	Amer. Agric. Chem. Co., New York City	C. Buckingham, Southport	30.00	19.99
			Gault Bros., Westport	33.00	
			Meeker Coal Co., Norwalk	33.00	
				32.00	
22755	Corn & Grain Fertilizer	Niantic Menhaden Oil & Guano Co., South Lyme	F. H. Rolf, Guilford	**31.00**	19.31
			J. P. Barstow & Co., Norwich	32.00	
			J. O. Fox, Putnam	30.00	
22837	E. F. Coe's Tobacco and Onion Fertilizer	Coe-Mortimer Co., New York City	W. A. Burr, West Hartford	40.00	23.94
			L. A. Gowdy, Hazardville	37.00	
				38.50	
22686	Sanderson's Corn Superphosphate	Sanderson Fert. and Chem. Co., New Haven	Manufacturer	28.00	17.06
			R. H. Hall, East Hampton	27.00	
				27.50	
22883	Read's Vegetable and Vine Fertilizer	Amer. Agric. Chem. Co., New York City	A. H. Cashen, Meriden	**34.00**	21.06
22851	N. E. High Grade Potato	N. E. Fertilizer Co., Boston	B. F. Eddy, East Woodstock	35.00	
			James Case, Collinsville	**35.00**	21.57

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
22609	57.4	----	0.20	2.30	2.50	**2.5**	6.72	2.12	0.78	9.62	**9.0**	8.84	**8.0**	6.08	6.08	**6.0**
22899	57.5	----	0.28	1.64	1.92	**1.7**	5.81	3.37	1.30	10.48	**8.0**	9.18	**8.0**	3.23	3.23	**3.0**
22879	57.6	0.14	0.74	1.84	2.72	**2.5**	4.21	2.72	1.45	8.38	**7.0**	6.93	**6.0**	5.27	5.27	**5.0**
22618	58.1	0.36	0.42	0.92	1.70	**1.7**	6.72	1.57	0.35	8.64	**8.5**	8.29	**8.0**	10.49	10.49	**10.0**
22756	59.3	0.37	0.38	1.97	2.72	**2.5**	5.18	3.07	0.77	9.02	**8.0**	8.25	**7.0**	0.47	4.34	**4.0**
22479	60.1	0.11	0.70	1.83	2.64	**2.5**	4.43	2.51	1.38	8.32	**7.0**	6.94	**6.0**	5.23	5.23	**5.0**
22755	60.5	----	0.30	2.04	2.34	**2.1**	5.57	2.39	0.64	8.60	**8.0**	7.96	**7.0**	0.60	4.24	**3.5**
22837	60.8	0.52	1.10	1.47	3.09	**3.0**	4.51	1.40	0.63	6.54	**7.0**	5.91	**6.0**	4.52	8.73	**8.0**
22686	61.2	0.12	0.08	1.62	1.82	**1.7**	6.24	2.25	0.98	9.47	**9.0**	8.49	**7.0**	3.85	3.85	**2.0**
22883	61.4	0.08	0.24	1.82	2.14	**1.1**	6.90	2.04	1.10	10.04	**9.0**	8.94	**8.0**	6.67	6.67	**6.0**
22851	62.3	----	0.10	2.30	2.40	**2.5**	6.89	1.74	0.96	9.59	**9.0**	8.63	**8.0**	6.33	6.33	**6.0**

SPECIAL MANURES.

Station No.	Name or Brand.	Manufacturer.	Dealer	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
23008	Lister's Corn Fertilizer No. 2	Lister's Agric. Chem. Works, Newark, N. J.	G. O. Case, Burnside	**$31.00**	$19.01
22881	Quinnipiac Potato Phosphate	Amer. Agric. Chem. Co., New York City	G. M. Williams Co., New London	**30.00**	18.36
22572	Sanderson's Potato Manure	Sanderson Fert. and Chem. Co., New Haven	Manufacturer	30.00	18.50
			Morse & Landon, Guilford	30.00	
			G. W. Eaton Estate, Plainville	31.00	
				30.25	
22614	Great Eastern Northern Corn Special	Amer. Agric. Chem. Co., New York City	F. M. Loomis, Granby	30.00	19.20
			R. H. Hall, East Hampton	33.00	
				31.50	
22508	Bradley's Corn Phosphate	Amer. Agric. Chem. Co., New York City	F. S. Bidwell & Co., Windsor Locks	32.00	17.66
			S. B. Potter, Norwich	29.00	
			D. L. Clark, Milford	27.00	
				29.25	
22749	Great Eastern Vegetable, Vine and Tobacco	Amer. Agric. Chem. Co., New York City	R. H. Hall, East Hampton	**33.00**	19.89
			Fred Morton, Rocky Hill	34.00	
			T. E. Green, Plainfield	32.00	
22616	Corn King	Armour Fertilizer Works, Baltimore, Md.	T. H. Eldredge, Norwich	34.00	19.99
			O. H. Meeker, Danbury	32.00	
			F. T. Blish Hdw. Co., South Manchester	34.00	
				33.25	
22605	Bowker's Potato and Vegetable Fertilizer	Bowker Fertilizer Co., New York City	J. Frank Elwood Greens Farms	33.00	20.69
			East Berlin Mill Co., East Berlin	36.00	
				34.50	
22603	Potato and Vegetable Phosphate	Berkshire Fertilizer Co., Bridgeport	F. C. Benjamin & Co., Danbury	30.00	18.56
			Hotchkiss & Templeton, Waterbury	32.00	
				31.00	
22875	Bradley's Complete Manure for Top Dressing Grass and Grain	Amer. Agric. Chem. Co., New York City	A. D. Bridge's Sons, Hazardville	**40.00**	23.89

ANALYSES AND VALUATIONS—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Found. As Muriate.	Found. Total.	Guaranteed.
23008	63.1	0.06	1.00	0.92	1.98	**1.7**	8.41	1.95	0.71	11.07	**11.0**	10.36	**10.0**	4.15	4.15	**4.0**
22881	63.4	0.28	0.75	1.29	2.32	**2.1**	7.18	1.60	1.73	10.51	**10.0**	8.78	**8.0**	2.87	2.87	**3.0**
22572	63.5	----	0.23	1.75	1.98	**1.7**	3.89	1.87	0.69	6.45	**8.0**	5.76	**5.0**	7.49	7.49	**6.0**
22614	64.1	0.48	0.64	1.33	2.45	**2.5**	6.58	3.34	1.73	11.65	**11.0**	9.92	**9.0**	2.47	2.47	**2.0**
22508	65.6	0.22	0.58	1.48	2.28	**2.1**	6.38	2.44	1.29	10.11	**9.0**	8.82	**8.0**	2.37	2.37	**1.5**
22749	65.9	0.80	0.18	1.14	2.12	**2.1**	5.93	2.89	1.71	10.53	**9.0**	8.82	**8.0**	5.73	5.73	**6.0**
22616	66.3	0.58	0.51	1.52	2.61	**2.5**	6.75	1.80	0.53	9.08	**9.0**	8.55	**8.0**	4.35	4.35	**4.0**
22605	66.8	----	0.98	1.54	2.[illegible]	**2.5**	6.72	3.12	2.03	11.87	**9.0**	9.84	**8.0**	3.69	3.69	**4.0**
22603	67.0	----	0.10	2.26	2.36	**1.7**	4.66	2.89	0.19	7.74	**7.0**	7.55	**6.0**	4.47	4.47	**4.0**
22875	67.4	4.92	0.06	0.04	5.02	**4.9**	1.88	4.53	1.37	7.78	**6.0**	6.41	**5.0**	2.45	2.45	**2.5**

Special Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22805	Packers' Union Animal Corn Fertilizer	Amer. Agric. Chem. Co., New York City	G. A. Forsyth, Waterford	$32.00	$18.73
			W. H. Billings, Somerville	31.00	
				31.50	
22512	Mapes' Corn Manure	Mapes F. & P. G. Co., New York City	F. S. Bidwell & Co., Windsor Locks	37.00	21.80
			J. P. Barstow & Co., Norwich	35.00	
			Birdsey & Raven, Meriden	38.00	
				36.75	
22966	P. & P. Potato Fertilizer	Parmenter & Polsey Fertilizer Co., Boston	Arthur Williams, South Woodstock	**31.00**	18.38
22802	Crocker's Potato, Hop and Tobacco	Amer. Agric. Chem. Co., New York City	F. M. Loomis, Granby	31.00	18.19
			L. L. Loomis, Granby	**31.00**	
22841	Lister's Special Corn Fertilizer	Lister's Agric. Chem. Works, Newark, N. J.	J. C. Wilcoxson, Stratford	28.00	17.52
			H. N. Fuller, W. Locks	32.00	
				30.00	
22822	Quinnipiac Corn Manure	Amer. Agric. Chem. Co., New York City	Gault Bros., Westport	31.00	17.75
			J. P. Lathrop, Plainfield	30,00	
				30.50	
22478	Bradley's Potato Manure	Amer. Agric. Chem. Co., New York City	Spencer Bros., Suffield	34.00	19.53
			F. S. Bidwell & Co., Windsor Locks	34.00	
			S. B. Potter, Norwich	33.00	
				33.75	
22554	Bradley's Potato Fertilizer	Amer. Agric. Chem. Co., New York City	H. K. Brainard, Thompsonville	34.00	18.63
			S. B. Potter, Norwich	31.00	
			Wilson & Burr, Middletown	32.00	
				32.25	
22829	Williams & Clark's Potato Manure	Amer. Agric. Chem. Co., New York City	Carlos Bradley, Ellington	32.00	18.20
			Collinsville Grain Co., Collinsville	31.00	
				31.50	
22828	Williams & Clark's Potato Phosphate	Amer. Agric. Chem. Co., New York City	D. B. Wilson Co., Waterbury	35.00	19.89
			George Beaumont, Wallingford	34.00	
				34.50	

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
					Total Nitrogen.					Total.		So-called "Available."		Found.		
		As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed	As Muriate.	Total.	Guaranteed.
22805	68.2	0.48	0.66	1.26	2.40	**2.5**	6.75	2.77	1.74	11.26	**11.0**	9.52	**9.0**	2.45	2.45	**2.0**
22512	68.6	1.14	0.70	0.68	2.52	**2.5**	0.82	8.41	1.64	10.87	**10.0**	9.23	**8.0**	6.90	6.90	**6.0**
22966	68.7	0.15	0.10	1.73	1.98	**1.6**	5.12	2.05	0.60	7.77	**7.0**	7.17	**6.0**	6.10	6.10	**6.0**
22802	70.4	----	0.80	1.40	2.20	**2.1**	6.22	2.59	1.62	10.43	**9.0**	8.81	**8.0**	3.19	3.19	**3.0**
22841	71.2	0.08	0.23	1.65	1.96	**1.7**	5.87	2.90	1.39	10.16	**9.0**	8.77	**8.0**	3.43	3.43	**3.0**
22822	71.8	0.29	0.20	1.79	2.28	**2.1**	6.09	2.85	2.11	11.05	**9.0**	8.94	**8.0**	1.88	1.88	**1.5**
22478	72.8	0.51	0.70	1.46	2.67	**2.5**	4.24	2.15	1.54	7.93	**7.0**	6.39	**6.0**	5.18	5.18	**5.0**
22554	73.1	0 24	0.79	1.29	2.32	**2.1**	6.86	2.23	1.71	10.80	**10.0**	9.09	**8.0**	2.97	2.97	**3.0**
22829	73.1	0.41	0.48	1.29	2.18	**2.1**	6.04	3.08	1.61	10.73	**9.0**	9.12	**8.0**	3.16	3.16	**3.0**
22828	73.5	0.22	1.10	1.26	2.58	**2.5**	4.44	2.70	1.55	8.69	**7.0**	7.14	**6.0**	5.38	5.38	**5.0**

Special Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22954	N. E. Corn Phosphate	N. E. Fertilizer Co., Boston	B. F. Eddy, East Woodstock	$28.00	$16.70
			James Case, Collinsville	30.00	
				29.00	
22831	Fruit and Root Crop Special	Armour Fertilizer Works, Baltimore, Md.	T. H. Eldredge, Norwich	30.00	16.67
			Young Bros Co., Danielson	28.00	
				29.00	
22834	Bowker's Tobacco Starter	Bowker Fertilizer Co., New York City	A. D. Bridge's Sons, Hazardville	**36.00**	20.58
			R. A. Hardin, Glastonbury	-----	
22909	Mapes' Fruit and Vine Manure	Mapes F. & P. G. Co., New York City	Birdsey & Raven, Meriden	**43.00**	24.47
22825	Wheeler's Potato Manure	Amer. Agric. Chem. Co., New York City	W. A. Collins, Jr., Columbia	30.00	17.81
			T. W. Crane, Danbury	34.00	
				32.00	
22617	Complete Potato	Armour Fertilizer Works, Baltimore, Md.	O. H. Meeker, Danbury	30.00	17.21
			S. V. Osborn, Branford	32.00	
			F. T. Blish Hdw. Co., South Manchester	32.00	
				31.25	
22824	Wheeler's Corn Fertilizer	Amer. Agric. Chem. Co., New York City	W. A. Collins, Jr., Columbia	29.00	16.74
			T. W. Crane, Danbury	32.00	
				30.50	
22566	Essex Market Garden and Potato Manure	Essex Fertilizer Co., Boston, Mass.	W. K. Ackley, East Hartford	35.00	18.97
			W. O. Goodsell, Bristol	35.00	
			H. C. Thompson, Plainville	34.00	
				34.75	
22801	Crocker's Ammoniated Corn Phosphate	Amer. Agric. Chem. Co., New York City	J. R. Gregg, Suffield	31.00	16.91
			G. A. Peckham, Suffield	**31.00**	
22558	Armour's Grain Grower	Armour Fertilizer Works, Baltimore, Md.	Lightbourn & Pond, New Haven	29.00	15.09
			T. H. Eldredge, Norwich	28.00	
			O. H. Meeker, Danbury	26.00	
				27.75	

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen: As Nitrates.	Nitrogen: As Ammonia.	Nitrogen: Organic.	Total Nitrogen: Found.	Total Nitrogen: Guaranteed.	Phosphoric Acid: Water-soluble.	Phosphoric Acid: Citrate-soluble.	Phosphoric Acid: Citrate-insoluble.	Total: Found.	Total: Guaranteed.	So-called "Available": Found.	So-called "Available": Guaranteed.	Potash Found: As Muriate.	Potash Found: Total.	Potash: Guaranteed.
22954	73.6	----	0.02	1.72	1.74	**1.6**	6.15	2.83	1.09	10.07	**9.0**	8.98	**8.0**	3.23	3.23	**3.0**
22831	74.0	0.74	0.34	0.57	1.65	**1.7**	5.65	2.59	0.73	8.97	**8.5**	8.24	**8.0**	5.03	5.03	**5.0**
22834	74.9	----	1.10	1.62	2.72	**2.5**	5.66	3.18	2.16	11.00	**9.0**	8.84	**8.0**	0.47	3.13	**3.0**
22909	75.7	1.57	0.08	0.50	2.15	**1.7**	0.36	6.84	1.06	8.26	**7.0**	7.20	**5.0**	1.20	11.80	**10.0**
22825	79.7	0.70	0.12	1.26	2.08	**2.1**	5.28	3.54	2.44	11.26	**9.0**	8.82	**8.0**	3.08	3.08	**3.0**
22617	81.6	0.68	0.28	0.76	1.72	**1.7**	5.76	1.06	0.32	7.14	**7.5**	6.82	**7.0**	6.65	6.65	**6.0**
22824	82.2	0.17	0.14	1.67	1.98	**1.7**	5.98	2.72	1.93	10.63	**9.0**	8.70	**8.0**	2.24	2.24	**2.0**
22566	83.2	----	0.01	2.09	2.10	**2.1**	6.75	1.31	0.90	8.96	**9.0**	8.06	**8.0**	5.08	5.08	**5.0**
22801	83.3	----	0.92	1.20	2.12	**2.1**	6.65	2.65	1.51	10.81	**9.0**	9.30	**8.0**	1.69	1.69	**1.5**
22558	83.9	0.08	0.23	1.38	1.69	**1.7**	6.14	2.29	0.58	9.01	**8.5**	8.43	**8.0**	2.43	2.43	**2.0**

Special Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22827	Williams & Clark's Corn Phosphate	Amer. Agric. Chem. Co., New York City	Phineas Platt, Milford George Beaumont, Wallingford	$32.00 **32.00**	$17.28
22843	Mapes' Cereal Brand	Mapes F. & P. G. Co., New York City	Mapes' Branch, Hartford A. N. Clark, Milford	30.00 **30.00**	15.81
22823	Read's Practical Potato Special	Amer. Agric. Chem. Co., New York City	A. H. Cashen, Meriden C. W. Fulton, West Hartford	32.00 31.00 **31.50**	16.28
22604	Bowker's Corn Phosphate	Bowker Fertilizer Co., New York City	W. T. McKenzie, Yalesville East Berlin Mill Co., East Berlin	31.00 32.00 **31.50**	16.19
22648	Bowker's Potato and Vegetable Phosphate	Bowker Fertilizer Co., New York City	A. D. Bridge's Sons, Hazardville East Berlin Mill Co., East Berlin J. P. Barstow & Co., Norwich	33.00 **34.00** 35.00	17.35
22575	Swift's Lowell Potato Manure	Swift's Lowell Fertilizer Co., Boston	T. H. Eldredge, Norwich Standard Feed Co., Bridgeport Southington Lumber Co., Southington	32.00 30.00 32.00 **31.25**	15.58
22754	N. E. Potato Fertilizer	New England Fertilizer Co., Boston	Rockville Milling Co., Rockville T. E. Green, Plainfield T. B. Atwater, Plantsville	31.00 31.00 34.00 **32.00**	15.86
22826	Wheeler's Bermuda Onion Grower	Amer. Agric. Chem. Co., New York City	W. Smith & Son., Canterbury T. W. Crane, Danbury	30.00 32.00 **31.00**	15.32
22908	Grass and Oat Fertilizer	Lister's Agric. Chem. Works, Newark, N. J.	D. C. Burnham, Moodus	**30.00**	14.61
22651	E. Frank Coe's Celebrated Potato Fertilizer	Coe-Mortimer Co., New York City	J. G. Schwink, Meriden W. A. Burr, West Hartford	30.00 35.00 **32.50**	15.65

Analyses and Valuations—*Continued.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Found. As Muriate.	Found. Total.	Guaranteed.
22827	85.2	....	0.64	1.56	2.20	**2.1**	6.19	2.61	1.50	10.30	**9.0**	8.80	**8.0**	2.10	2.10	**1.5**
22843	89.8	1.34	0.08	0.68	2.10	**1.7**	0.66	6.18	1.32	8.16	**8.0**	6.84	**6.0**	3.71	3.71	**3.0**
22823	93.5	....	0.12	1.02	1.14	**0.8**	3.62	1.63	1.54	6.79	**5.0**	5.25	**4.0**	8.62	8.62	**8.0**
22604	94.6	....	0.26	1.64	1.90	**1.7**	5.35	3.19	1.57	10.11	**9.0**	8.54	**8.0**	2.28	2.28	**2.0**
22648	95.9	....	0.22	1.58	1.80	**1.7**	6.14	3.68	1.57	11.39	**10.0**	9.82	**9.0**	2.92	2.92	**2.0**
22575	100.6	....	....	1.62	1.62	**1.6**	4.63	2.87	0.50	8.00	**8.0**	7.50	**7.0**	4.13	4.13	**4.0**
22754	101.8	....	0.10	1.55	1.65	**1.6**	4.50	3.03	0.70	8.23	**8.0**	7.53	**7.0**	4.27	4.27	**4.0**
22826	102.3	0.12	0.10	0.88	1.10	**0.8**	6.44	2.35	1.97	10.76	**9.0**	8.79	**8.0**	4.29	4.29	**4.0**
22908	105.3	....	0.12	1.00	1.12	**0.8**	5.52	2.58	1.56	9.66	**9.0**	8.10	**8.0**	4.18	4.18	**4.0**
22651	107.7	0.42	0.20	1.04	1.66	**1.7**	5.66	2.30	0.68	8.64	**9.0**	7.96	**8.0**	3.79	3.79	**4.0**

Special Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:				
22850	N. E. Corn and Grain Fertilizer	New England Fertilizer Co., Boston	Rockville Milling Co., Rockville T. E. Green, Plainfield	$29.00 28.00 28.50	$13.50
22961	Grass and Oats	Amer. Agric. Chem. Co., New York City	F. M. Loomis, Granby G. A. Peckham, Suffield	24.00 24.00	11.17
22838	E. F. Coe's N. E. Corn & Potato Fertilizer	Coe-Mortimer Co., New York City	W. E. Warner & Bro., Westville W. A. Burr, West Hartford	28.00 33.00 30.50	11.61
22682	Fruit and Flower Developer	Germofert Mfg. Co., Charleston, S. C.	H. C. Sturgis,* Fairfield	----	23.26
22653	Potato Manure	Germofert Mfg. Co., Charleston, S. C.	H. C. Sturgis,* Fairfield	----	26.72
22683	Special Cotton Grower	Germofert Mfg. Co., Charleston, S. C.	H. C. Sturgis,* Fairfield	----	19.43
22914	Chittenden's Complete Grass Fertilizer	National Fertilizer Co., New York City	J. M. Lasbury, Broad Brook	----	27.66
	Sampled by purchasers and others:		*Sent by*		
22338	H. G. Soluble Tobacco Manure	Rogers Mfg. Co., Rockfall	E. M. Griffin, R.F.D., Granby	43.50	38.45
22339†	Shay's Potato Manure	C. M. Shay Fertilizer Co., Groton	Thos. Griswold & Co., South Wethersfield	30.00	24.31
22565	Potato "2"	Sanderson Fertilizer & Chem. Co., New Haven	James I. Webb, Hamden	35.00	28.26
22711	Swift's Special Corn and Vegetable	Swift's Lowell Fertilizer Co., Boston	J. M. Taylor, Kensington, Conn.	36.00	25.04
23352†	Shay's Potato Manure	C. M. Shay Fertilizer Co., Groton	E. H. McCall, Leonard's Bridge	----	27.28

* Purchaser. † See note page 73.

Analyses and Valuations—*Concluded.*

Station No.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
					Total Nitrogen.					Total.		So-called "Available."		Found.		
		As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.
22850	111.1	----	0.08	1.38	1.46	1.2	5.69	1.79	0.81	8.29	8.0	7.48	7.0	2.20	2.20	2.0
22961	114.9	----	---	---	----	---	9.02	2.38	0.95	12.35	12.0	11.40	11.0	2.24	2.24	2.0
22838	162.7	0.15	0.16	0.64	0.95	0.8	4.81	2.41	0.46	7.68	8.5	7.22	7.5	2.85	2.85	3.0
22682	----	1.00	0.88	1.34	3.22	3.3	0.10	2.96	9.73	12.79	10.0	3.06	4.3	4.39	6.50	6.0
22653	----	1.66	0.90	2.03	4.59	4.1	0.24	2.03	8.35	10.62	10.0	2.27	2.3	0.76	5.63	6.0
22683	---	0.76	0.56	1.56	2.88	2.5	0.19	2.68	10.66	13.53	12.0	2.87	2.0	3.29	3.29	3.0
22914	---	0.15	1.64	2.93	4.72	4.1	5.23	1.67	1.13	8.03	7.0	6.90	6.0	5.47	5.47	5.0
22338	13.1	1.34	0.66	3.22	5.22	5.0	1.58	7.93	1.40	10.91	8.0	9.51	6.0	1.05	12.34	11.0
22339	23.4	0.48	0.12	2.85	3.45	4.0	2.96	4.51	0.97	8.44	8.0	7.47	----	6.55	6.55	6.0
22565	23.8	0.12	0.10	2.55	2.77	3.0	4.52	2.52	1.60	8.64	----	7.04	----	2.30	12.15	12.0
22711	43.8	0.74	0.08	2.46	3.28	3.3	6.62	1.74	1.04	9.40	9.0	8.36	8.0	7.10	7.10	7.0
23352	----	0.88	0.22	3.20	4.30	---	3.26	4.52	1.16	8.94	----	7.78	----	6.17	6.17	----

Special Tobacco Manures, claimed to contain potash, either wholly or in part in form of carbonate.

In the table below are given thirteen analyses of samples representing nine brands of this class of special manures.

All of these mixtures are claimed to contain potash, largely in form of carbonate, and "available" phosphoric acid. The trade name "available phosphoric acid" has already been discussed on page 35 of this report.

Regarding the guaranty of carbonate of potash, in many cases a chemical analysis cannot certainly prove or disprove the statement that potash is present in that form.

In making valuations for these fertilizers, potash sufficient to combine with the chlorine present is calculated as chloride; potash sufficient to combine with all the sulphuric acid present is calculated as sulphate, and any excess of potash remaining is then calculated as carbonate. We repeat that this does not necessarily conflict with the manufacturer's statement that a part or all of the potash was put into the mixture as high-grade carbonate. The matter has been fully discussed in previous reports.

GUARANTIES.

Five samples representing three brands have less than the guaranteed per cent. of potash. This deficiency is, however, in each case balanced as to money equivalent by an overrun of some other ingredient.

Samples Requiring Special Notice.

21812, Olds & Whipple's Complete Tobacco Fertilizer, of which the analysis is given below, was sent by J. R. Gregg, Suffield, and taken in March, 1908.

Tobacco Fertilizers containing Carbonates.

Analyses and Valuations.

Station No.	Name or Brand.	Manufacturer.	Dealer or Purchaser.	Cost per ton.	Valuation per ton.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	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. Calculated as chloride.	Potash. Calculated as sulphate.	Potash. Calculated as carbonate.	Potash. Water-soluble.	Potash. Guaranteed.	Chlorine.	Sulphuric acid.
22702	Complete Tobacco Manure	Am'n Agric'l Chem'l Co., N. Y. City	F. S. Bidwell & Co., Wind. Locks J. & H. Woodford, Avon F. J. Hartz, R. D., S. Manchester	$34.00 36.00 35.00	$30.18	0.18	0.20	4.50	4.88	**4.6**	0.30	5.66	3.48	9.44	**4.0**	5.96	**3.0**	1.38	2.70	1.47	5.55	**5.5**	1.04	2.30
22739	Bowker's Alkaline Tobacco Grower	Bowker Fertilizer Co., N. Y. City	A. D. Bridge's Sons, Hazardville R. A. Hardin, Glastonbury Rose Arnold, Suffield	38.00 ---- 35.00	29.10	0.18	0.06	3.85	4.09	**4.1**	0.58	5.94	5.26	11.78	**5.0**	6.52	**4.0**	0.90	1.63	2.85	5.38	**5.0**	0.68	1.39
22737	Bowker's Ash Elements	" " " " "	G. N. Thompson, Suffield	32.00	26.16	----	----	0.08	0.08	----	0.56	5.47	3.04	9.07	----	6.03	**6.0**	1.25	19.30	----	20.55	**15.0**	0.94	
22738	" " "	" " " " "	W. H. Prout, Suffield	32.00	23.01	----	0.02	0.06	0.08	----	0.84	6.87	3.84	11.55	----	7.71	**6.0**	1.14	14.72	----	15.86	**15.0**	0.86	
22446	Mapes' Tobacco Starter Improved	Mapes F. & P.G. Co., N.Y. City	Mapes' Branch, Hartford Spencer Bros., Suffield F. S. Bidwell & Co., Wind. Locks	37.00 38.00 38.00	24.49	3.78	0.10	0.92	4.80	**4.1**	0.29	7.84	1.07	9.20	**8.0**	8.13	**6.0**	0.80	1.35	----	2.15	**1.0**	0.60	7.40
22844	Tobacco Ash Constituents	" " " " "	Spencer Bros., Suffield Mapes' Branch, Hartford M. H. Mallett, New Milford	35.00 34.00 34.00	24.96	0.35	0.02	0.66	1.03	**0.5**	0.11	2.53	3.67	6.31	**5.7**	2.64	----	1.20	3.30	8.48	12.98	**15.0**	0.90	2.81
22845	Tobacco Manure, Wrapper Brand	" " " " "	Mapes' Branch, Hartford J. H. Smith,* Windsor M. H. Mallett, New Milford	49.00 49.00 49.00	40.59	3.94	0.08	2.54	6.56	**6.2**	0.05	3.80	1.78	5.63	**4.5**	3.85	----	1.40	3.05	6.26	10.71	**10.5**	1.05	2.59
22847	Chittenden's Conn. Valley Tobacco Grower	National Fertilizer Co., N. Y. City	J. M. Lasbury, Broad Brook H. N. Fuller, Windsor Locks	48.00 48.00	33.00	0.30	0.12	4.54	4.96	**4.9**	0.25	3.71	1.02	4.98	**4.0**	3.96	----	0.51	1.40	5.82	7.73	**8.0**	0.38	1.19
22849	Chittenden's Tobacco Special with Carbonate	National Fertilizer Co., N. Y. City	J. M. Lasbury, Broad Brook L. O. Pomeroy, Suffield	36.00 37.00	29.25	0.29	0.10	4.25	4.64	**4.5**	0.21	5.36	2.21	7.78	**4.0**	5.57	**3.0**	0.90	2.21	2.51	5.62	**5.5**	0.68	1.88
22742	Complete Tobacco Fertilizer	Olds & Whipple, Hartford	F. F. Ford, Suffield	36.00	27.92	0.96	0.06	3.92	4.94	**4.5**	0.17	3.35	0.38	3.90	----	3.52	**3.0**	1.05	1.26	3 04	5.35	**5.5**	0.79	1.07
22743	" " "	" " " "	J. R. Gregg,* Suffield	36.00	28.22	0.76	0.08	4.26	5.10	**4.5**	0.27	3.56	0.31	4.14	----	3.83	**3.0**	1.00	1.86	2.32	5.18	**5.5**	0.75	1.58
22744	" " "	" " " "	Manufacturer E. T. Hulburt, Somers H. P. Lane, Suffield L. W. Allen, Suffield L. A. Kent, Suffield H. L. Spear, Suffield	*35.00 37.00 36.00 36.00 36.00 36.00	28.35	0.73	0.07	4.20	5.00	**4.5**	0.05	3.70	0.28	4.03	----	3.75	**3.0**	0.90	1.25	3.11	5.26	**5.5**	0.68	1.06
21812	' " "	" " " "	J. R. Gregg,* Suffield	36.00	31.48	0.50	0.14	4.72	5.36	**4.5**	0.68	3.77	0.26	4.71	----	4.45	**3.0**	0.16	2.20	3.62	5.98	**5.5**	0.12	1.87

* Purchaser.

* F. O. B., Hartford.

22907 is the same brand, sent by J. R. Gregg and sampled from stock of 1909.

22745 is Olds & Whipple's Complete Tobacco Fertilizer, *with extra lime,* and was taken by the station agent from stock of F. F. Ford, Suffield. The partial analyses of these two samples are:

	22907	22745
Nitrogen of nitrates	....	0.56
Nitrogen of ammonia	....	0.07
Nitrogen, organic	....	3.33
Nitrogen, total	4.70	3.96
Total phosphoric acid	....	2.98
Potash calculated as muriate	1.30	....
Potash calculated as sulphate	1.73	....
Potash calculated as carbonate	3.67	....
Potash, total	6.70	4.79

HOME MIXTURES.

In the following table are analyses of seventeen samples of mixtures, which were prepared on the farm or in a factory from a formula given by the purchaser and from the materials which are specified.

No direct comparison between the costs given in the table and the valuations is possible because the cost does not in all cases refer to retail cost per ton of the mixed and bagged goods.

Thus the costs of the mixtures from the Connecticut School for Boys, **22540** and **22541,** cover the unmixed chemicals bought in mixed car lots.

The cost of Mr. Treat's fertilizer, **22347,** covers that of the chemicals at the farm and of mixing.

The costs of **22611**, from the Norwich State Hospital, **22853, 22854** and **22855**, from Mr. Fenn, and **23356** from Mr. Clark, are for goods mixed by a manufacturer according to buyers' formulas and delivered at the farm.

What is included in the cost of **22656** is not known.

The costs of **22712** and **22713** are for chemicals, delivered, unmixed.

23011 is a farm-made mixture of hen manure, night soil and raw phosphate with a few hundred pounds of cotton seed meal and a much larger amount of muriate of potash. It is designed to use on corn in the drill, being supplemented by a good dressing

of stable manure. The estimated cost takes account of cost of material and labor of mixing and screening the mixture so that it could be applied with a machine.

The average composition of these home mixtures is, nitrogen 4.06, phosphoric acid 9.59 and potash 9.75 per cent., being very considerably higher percentages of both nitrogen and potash than are found in average factory-mixed goods.

COTTON HULL ASHES.

Only four samples of this material have been analyzed this year.

22500. Sold by Olds & Whipple, Hartford, sampled and sent by O. J. Hazard, Suffield.

22413. Sold by Spencer Bros., Suffield, sampled and sent by them.

22722. Sold by Olds & Whipple, Hartford, sampled by station agent from stock of G. A. Peckham, Suffield.

22147. Sold by Spencer Bros., Suffield, sampled and sent by J. P. Spencer, Suffield.

Analyses of Cotton Hull Ashes.

Station No.	22500	22413	22722	22147
Percentage amounts of				
Water-soluble potash found	26.47	23.66	22.60	12.96
Water-soluble potash guaranteed	**25.00**	**25.00**	**22.00**	**14.50**
Cost per ton	$51.00	50.87*	50.00	32.00
Water-soluble potash costs cents per lb.	8.6	9.6	9.8	10.2

In calculating the cost of potash per pound an allowance of $5.67 is made for the phosphoric acid contained in the ashes.

WOOD ASHES.

The table, page 110, gives analyses of ten samples of Canada ashes, one of unknown origin and four from domestic manufacturing processes.

Canada ashes vary widely in composition.

The general average of the ten samples tested this year is

Water-soluble potash	4.35
Phosphoric acid	1.51
Lime	30.34
Magnesia	2.78

* $2.15 per unit of water-soluble potash.

HOME MIXTURES. FORMULAS,

Station No.	Made by or for	Formulas. Pounds per Ton of Mixture. Nitrate of Soda.	Muriate of Potash.	Tankage	Acid Phosphate.	Kainit.	Double Sulphate of Potash.	Bone.	High Grade Sulphate of Potash.	Cotton Seed Meal.	Dried Blood.	Bone Black.
22540	Conn. School for Boys, Meriden (Grass)	500	250	500	400	350	---	---	---	---	---	---
22541	Conn. School for Boys, Meriden (Vegetables)	100	200	750	750	---	200	---	---	---	---	---
22347	Chas. R. Treat, Orange	240	360	700	700	---	---	---	---	---	---	---
22611	W. S. Palmer, Norwich State Hospital (Potatoes)	--	400	1104	496	---	---	---	---	---	---	---
22656	Robert B. Fowler, North Guilford	100	300	1000	600	---	---	---	---	---	---	---
22712	W. A. Simpson, Wallingford (Corn)	300	400	500	450	---	---	350	---	---	---	---
22713	W. A. Simpson, Wallingford (Potatoes)	369	---	369	492	---	---	---	400	370	---	---
22853	Dennis Fenn, Milford (No. 3)	100	200	800	---	---	---	200	---	---	100	600
22854	" " " (No. 2)	200	300	800	---	---	---	100	---	---	---	600
22855	" " " (No. 1)	200	200	800	---	---	---	200	---	---	---	600
23011	Fred Lyman, Manchester	---	---	---	---	---	---	---	---	---	---	---
23356	H. E. Clark, Middlebury (Top Dressing)	400	---	---	---	---	---	900	400	---	300	---
22654	S. L. Tuttle, Gaylord Farm Sanatorium, Wallingford	700	400	----	900	---	---	---	---	---	---	---
22375	H. B. Cooke, Georgetown	---	---	---	---	---	---	---	---	---	---	---
22781	R. J. McCleaver, Cheshire	---	---	---	---	---	---	---	---	---	---	---
22400	Andrew Ure, Highwood, No. 1	---	---	---	---	---	---	---	---	---	---	---
22401	Andrew Ure, Highwood, No. 2	---	---	---	---	---	---	---	---	---	---	---

The water-soluble potash is largely in form of carbonate, which in the pure state costs 7½ to 8 cents per pound, but for ordinary farm use is not more valuable than muriate costing 4¼ cents per pound.

The phosphoric acid may be reckoned at 3 cents.

Making this allowance and deducting from the average cost of the ashes, $13.00, leaves $7.40 as the cost of lime and magnesia, of which there is an average of 662 pounds in the ton. This is at the rate of $1.12 per 100 pounds of lime and magnesia, considerably more than the cost of these things in slaked lime.

ANALYSES AND VALUATIONS.

Station No.	Analyses. Nitrogen as Nitrates.	Nitrogen as Ammonia.	Nitrogen, Organic.	Total Nitrogen.	Water-soluble Phosphoric Acid.	Citrate-soluble Phosphoric Acid.	Citrate-insoluble Phosphoric Acid.	Total Phosphoric Acid.	Potash.	Cost and Valuation. Cost per ton.	Valuation per ton.
22540	3.76	0.08	1.36	5 20	2.40	3.09	0.50	5.99	9.47	$28.75*	$30.18
22541	0.88	0.08	1.96	2.92	4.94	4.41	1.06	10.41	8.30	24.25*	25.26
22347	1.54	0.32	2.01	3.87	4.24	4.38	1.18	9.80	10.31	28.60	29.50
22611	----	0.22	3.88	4.10	3.65	5.66	1.14	10.45	10.07	28.38	31.39
22656	0.87	0.10	2.79	3.76	4.42	6.42	2.21	13.05	7.11	28.40	28.76
22712	2.76	0.10	1.72	4.58	2.35	5.43	1.15	8.93	12.23	31.63	32.53
22713	2.56	0.08	2.58	5.22	3.14	2.18	0.46	5.78	9.36	33.60	31.71
22853	0.92	0.10	2.23	3.25	3.32	6.96	3.88	14.16	7.35	37.00	27.18
22854	1.43	0.10	2.17	3.70	3.87	4.83	2.24	10.94	9.91	38.50	29.11
22855	1.54	0.05	1.85	3.44	4.55	4.80	2.21	11.56	8.54	38.00	27.42
23011	0.02	0.24	0.64	0.90	0.31	6.23	4.71	11.25	14.89	20.00	22.47
23356	2.92	0.12	2.36	5.40	0.31	6.35	5.88	12.54	10.32	36.60	36.14
22654	5.20	0.04	----	5.24	5.51	1.28	0.19	6.98	10.55	----	31.66
22375	1.38	0.18	3.32	4.88	0.80	5.61	0.77	7.18	10.04	----	31.19
22781	1.94	0.08	2.56	4.58	1.10	4.80	0.37	6.27	7.16	----	26.88
22400	2.17	0.17	2.88	5.22	3.48	4.48	1.44	9.40	4.67	----	29.15
22401	----	0.10	2.69	2.79	3.31	4.12	1.01	8.44	15.55	----	29.71

* Wholesale.

The lime in ashes, however, is very fine and is in form of carbonate, facts which give it a somewhat higher agricultural value.

LIME-KILN ASHES.

These are ashes from wood used in making quicklime from limestone, which are unavoidably mixed with much lime dust.

21728 and **21729**, sent by R. H. Gardner, Cromwell; **22377**, sent by W. L. Mitchell, New Haven; **23400**, sent by H. B. Cooke, Georgetown.

WOOD ASHES. PERCENTAGE COMPOSITION.

Station No.	Dealer or Purchaser.	Sampled or Sent by	Total Potash.	Water-soluble Potash.	Phosphoric Acid.	Lime.	Magnesia.	Sand.	Charcoal.	Moisture.	Cost per ton.
	Bowker Fertilizer Co., New York City:										
22435	G. D. Hall, Wallingford	Station Agent	...	3.94	1.38	27.65	3.26	21.04	2.72	7.75	$12.50
22662	S. L. Tuttle, Wallingford	Station Agent	...	4.52	1.71	30.42	2.90	15.42	2.23	11.45	12.50
22903	Newell St. John, Simsbury	S. T. Welden, Simsbury	...	3.83	1.32	25.24	...	...	...	...	...
	John Joynt, Lucknow, Canada:										
22724	Olds & Whipple, Hartford	C. H. Eno, Simsbury	...	4.84	1.37	30.10	...	...	...	...	...
22553	Olds & Whipple, Hartford	J. C. Eddy, Simsbury	...	5.67	1.50	28.86	...	...	...	...	...
22761	F. S. Bidwell, Windsor Locks	Station Agent	4.68	4.03	1.41	28.92	2.10	9.70	2.50	21.62	15.00
22984	W. G. & F. Comstock, East Hartford	Purchaser	5.97	5.56	1.66	30.39	2.22	10.87	1.74	16.18	14.00
	F. R. Lalor, Dunville, Ont.:										
22390	L. C. Brainard, Thompsonville	Purchaser	...	2.68	1.20	31.37	3.54	13.46	5.43	18.30	12.50
22552	H. K. Brainard, Thompsonville	H. K. Brainard	...	3.71	1.64	33.64	...	...	...	...	...
	Charles Stevens, Napanee, Ont.:										
22397	M. Keeney, Somerville	Purchaser	...	4.71	1.94	36.86	2.46	6.63	1.66	10.15	12.00
21816	J. E. Perkins, Suffield	The Bissell-Graves Co., Suffield	...	4.69	2.44	33.75	3.26	8.32	4.03	7.53	12.00
	Ashes from Manufacturing Processes:										
23013	From Brick Yard of Brower & Best	J. H. Pease & Son, Thompsonville	...	1.16	1.80	40.28	5.15	19.13	0.62	0.14	...
22905	Foundry Ashes, No. 1	N. J. Robinson, Montowese	...	5.93	2.81	41.18	...	...	...	...	...
22906	Foundry Ashes, No. 2	N. J. Robinson, Montowese	...	3.62	2.19	43.44	...	...	...	...	...
23349	From Muffler of a brass factory	F. M. Peasley, Waterbury	...	4.59	2.43	39.80	4.16	3.27	10.90	1.98	...

ANALYSES.

	21728	21729	22377	23400
Total potash	3.93	0.14	.....	.....
Water-soluble potash	.....	.....	0.20	1.78
Lime	47.35	33.61	36.86	37.30
Magnesia	.....	.....	0.64	13.61
Phosphoric acid	2.17	0.41	0.38	.....
Moisture	0.26	18.80	10.54	.....
Sand	.....	.....	14.73	.....

LIME.

Bulletin 163, of this station, February, 1909, gave analyses of the limestones found in this State and in Massachusetts and of the various forms of agricultural lime made from them, with approximate wholesale prices and freight rates to Connecticut points. The following samples have been analyzed since that bulletin was issued.

Quicklime.

This is made from limestone by roasting to expel carbonic acid and water. As sold it contains more or less of these ingredients, which it absorbs again from the air.

22668, from Farnam's Cheshire Lime Co., Mass.; **22762**, from Buffalo Fertilizer Co., sent by C. M. Abbe, New Haven; **22543**, from Buffalo Fertilizer Co., sent by G. W. Adams, West Suffield; **23389**, bought of F. S. Bidwell & Co., Windsor Locks, sampled and sent by M. Keeney, Somerville.

ANALYSES.

	22668	22762	22543	23389
Lime	86.22	90.84	80.76	88.58
Magnesia	3.55	.....	.....	.....
Sand and iron oxide	1.21	.....	.....	.....
Cost per ton	$8.50*	6.00*	8.00	.....
Lime costs cents per 100 lbs.	49	33	49	.....

Slaked Lime.

This is understood to be made from quicklime by careful slaking with water so as to leave the product dry and fine.

Air-slaked lime results when quicklime exposed to the air absorbs both water and carbonic acid and crumbles to a powder.

* Car lots.

22391, from Farnam's Cheshire Lime Co., Mass., sampled and sent by James Price, Warehouse Point; **22542**, from the Vermont Lime Co., Greenfield, Mass., sampled and sent by A. F. Burnham, East Hartford; **23399**, sent by H. B. Cooke, Georgetown; **22578**, sent by C. J. Dewey, Buckland; **23340**, from Warner-Miller Co., New Haven, sent by E. A. Wilcox, Highwood.

23855, "Air-Slaked Lime" from Warner-Miller Co., New Haven, sampled and sent by D. L. Clarke & Son, Milford. It contains much unburned limestone.

ANALYSES.

	22391	22542	23399	22578	23340	23855
Lime	67.67	75.18	43.66	35.68	61.31	63.28
Magnesia	.....	.....	28.92	29.39	.....	.....
Moisture	.....	.....	.....	10.13	.....	.....
Insoluble	.....	9.30	.....	.....	.....	0.60
Cost per ton	$7.00*	8.00	5.00†	.....	.....	.....
Lime costs cents per 100 lbs.	52	53				

Carbonate of Lime.

22398 and **22399** are fine coral limes from Kissimmee, Fla., sent by F. O. Ives, West Cheshire; **22551** is marl from Caledonia Marl and Lime Co., Caledonia, N. Y., sent by L. C. Brainard, Thompsonville; **22978** is carbonate of lime, sent by George A. Bush, Rahway, N. J.; **22904**, ground oyster shells, from Adamant Plaster Co., Fair Haven, sent by N. J. Robinson, Montowese; **23343**, shell lime from Adamant Plaster Co., sent by G. W. Thorpe, West Cheshire.

ANALYSES.

	22398	23399	22551	22978	22904	23343
Lime	54.52	44.69	49.93	35.69	25.24	41.99
Equivalent carbonate	97.26	79.73	88.26	63.73	45.07	74.98
Insoluble in acid	.....	.....	.....	4.87	.....	.....
Price per ton	.....	.....	$8.50	.....	.....	6.00

The agricultural value of any of these samples of lime depends, not only on the actual quantity of lime in it, but largely also on the *fineness of the product*. Unground oyster shells or limestone will lie for many years in the soil without going to

* Car lot. † Per ton at kiln, 7 miles distant.

pieces. The lime in them is compact and offers much less surface to the solvents of the soil and plant roots than the same amount of lime in finely powdered form.

MISCELLANEOUS FERTILIZERS.

SOOT.

23401. Soot from furnace flues, sent by N. S. Platt, New Haven, contained:

Nitrogen as ammonia	3.40 per cent.	
Nitrogen, organic	1.12	
Total nitrogen	4.52	
Water-soluble potash	0.71	
Moisture		9.63
Organic matter		45.56
Mineral matter		44.81
		100.00

A second sample, **23836**, contained 6.32 of nitrogen and 0.80 per cent. of potash.

The high percentages of nitrogen—higher than usually found in such material—explain its value as a fertilizer.

NITRATE OF POTASH.

22809. Sent by Mrs. A. Pouleur, Windsor, contained 46.84 per cent. of potash.

PULVERIZED SHEEP MANURE.

23355, from Natural Guano Co., Aurora, Ill., and **23354**, from Pulverized Sheep Manure Co., Chicago, both sent by the Elm City Nursery Co., New Haven; **22454**, Wizard Manure, from stock of Lightbourn & Pond, New Haven, and J. P. Barstow & Co., Norwich.

ANALYSES.

	23355	23354	22454
Nitrogen	2.52	2.58	2.50
Phosphoric acid	1.47	1.52	1.54
Potash	2.17	2.00	1.41

The value of this material is, in part, in the fine organic matter it contains, over 60 per cent., which adds to the humus of the soil.

TOBACCO STEMS AND TOBACCO DUST.

21787, sent by Ariel Mitchelson, Tariffville; **22126** and **22127**, tobacco dust, from Red Lion Tobacco Co., Red Lion, Pa., sent by R. E. Abbe, Thompsonville; **22419**, Kentucky stems, bought of Olds & Whipple, Hartford, sent by F. N. Buckland, Glastonbury; **22420**, seed stems, bought of cigar manufacturers and sent by F. N. Buckland; **22520**, bought of R. M. Goodrich, Hartford, sent by Geo. Rengerman, East Granby.

ANALYSES.

	21787	22126	22127	22419	22420	22520
Nitrogen as nitrates	....	0.86	0.39	0.40	0.47	0.66
Nitrogen as ammonia	....	0.14	0.10	0.27	0.43	0.23
Nitrogen, organic	1.63	1.47	1.93	1.07	1.61	1.20
Total nitrogen	1.63	2.47	2.42	1.74	2.51	2.09
Phosphoric acid	0.48	0.56	1.48	0.51	0.52	0.34
Potash	3.70	5.21	5.26	5.18	5.32	5.14
Moisture	17.50	....	....	30.87	17.89	26.64
Cost per ton	$10.40	10.50	....	13.00	12.00	12.00

SALT WASTE.

22045 and **22157** are wastes from powder works sent by Andrew Kingsbury, Rockville. One contained 0.26 per cent. of nitrogen as nitrates and 4.99 of potash; the other 0.29 per cent. of nitrogen and 1.25 of potash.

PLASTER.

22873. Nova Scotia Land Plaster from Adamant Plaster Co., New Haven, sent by A. C. Dickinson, Roxbury, contained 32.81 per cent. of lime, equivalent to 100 per cent. of pure hydrated plaster.

22324 is a precipitated plaster, a by-product of a chemical industry, containing phosphates, as the analysis shows. Sent by E. A. Jones, New Canaan. Made by Independent Baking Powder Co., Jersey City.

ANALYSIS.

Water-soluble phosphoric acid	3.28	per cent.
Citrate-soluble phosphoric acid	1.57	"
Insoluble phosphoric acid	2.06	"
Total phosphoric acid	6.91	"
Lime	27.14	"

LAVA FERTILIZER.

23348. Mount Pelée Lava Fertilizer, from the American Health Association, Clifton, N. J., sent by W. H. Shumway, Berlin, who states that it is claimed to destroy all insects in the soil and keep plants in a healthy condition, free from disease. Cost, $15.00 per ton. It contains 0.86 per cent. of nitrogen, 0.27 per cent. of phosphoric acid and 0.07 per cent. of water-soluble potash; 40.31 per cent. of the material is insoluble in hydrochloric acid.

The following samples were sent without data as to source or price and have not any general interest or value, but are given here following our invariable rule to publish every analysis which is made.

21997, from S. C. Lewis, Stratford; **22010**, from H. C. Humphrey, N. Y.; **22808**, from Mrs. A. Pouleur, Windsor; **23360** and **23361**, from Harriet L. Merrow, Merrow; **23365**, from Miss Freda Gernon, New Milford.

ANALYSES.

	21997	22010	22808	23360	23361	23365
Nitrogen	1.19	4.64	....	0.95	2.20	0.30
Phosphoric acid	1.38	5.69	....	38.30	23.13	1.64
Potash	0.07	3.66	1.26	....	....	3.45

PEAT OR SWAMP MUCK.

22357. Black soil, having somewhat the appearance of muck, sent by B. W. Francis, West Cheshire. **22980**, Swamp Muck, sent by J. S. Dewey, Tariffville, contained 1.38 per cent. of nitrogen. **23385, 23386** and **23387**, sent by E. L. Conant, from swamps on his farm at New Canaan. **23385** was taken from a swamp of several acres in which the peat is from three to nine feet deep. The sample came from one foot below the surface, and **23386**, about two and one-half feet below the surface. Both had been dug three or four weeks and stored in a dry cellar. **23387** is from a neighboring swamp.

23391. Sent by C. W. Scranton, Madison, from a swamp on his farm. He is using this to compost with fish.

23392 and **23393** are dried peat, sold as filler or "conditioner" for commercial fertilizer. See page 75.

23394. Sent by Elters Button, Waterbury, from his swamp.

ANALYSES.

As received.

	22357	23385	23386	23387	23391	23392	23393	23394
Moisture	12.24	81.62	88.73	61.92	9.65	14.43	10.76	80.49
Organic and volatile	2.31	17.56	10.93	9.16	87.16	67.15	68.98	16.83
Mineral matter	85.45	0.82	0.34	28.92	3.19	18.42	20.26	2.68
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen total	....	0.36	0.18	0.38	1.46	2.81	3.04	0.64
of which as ammonia ...	....	0.03	0.03	0.02	0.16	0.10	0.16	....

Water-free.

	23385	23386	23387	23391	23392	23393	23394
Organic and volatile	95.52	96.99	24.05	96.48	78.47	77.29	86.26
Mineral matter	4.48	3.01	75.95	3.52	21.53	22.71	13.74
	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	1.98	1.60	0.42	1.61	3.28	3.40	3.28

The nature of these peats is best compared by examining their composition in water-free condition.

Three of them, two from Mr. Conant's swamp and one from Mr. Scranton's, contain over 95 per cent. of vegetable matter or humus and these are the most valuable. Mr. Button's sample and the two peats sold as dryers would no doubt make excellent absorbents. Mr. Conant's third sample, **23387**, could probably not be handled to any profit. It contains too little vegetable matter and too much sand and soil.

The farm value of peat does not rest on its action as a fertilizer. It contains only very small amounts of either phosphoric acid or potash and while it may contain, in the water-free condition as the analyses show, from 0.40 to 3.40 per cent. of nitrogen, yet this nitrogen is in an insoluble and relatively inert condition. It is clear that this must be so. Peat is formed by the slow decay of vegetable matter under water and with a very limited supply of air. What is soluble and readily decomposable is decomposed and dissolved during the process, leaving as peat the residues which strongly resist any change.

Peat, nevertheless, has an agricultural value as an amendment depending, as Johnson has shown, on

1. Its remarkable power of absorbing and holding water both as a liquid and as vapor:
2. Its power of absorbing ammonia and other gases:

3. Its action in modifying the decay of organic (animal) and vegetable bodies:
4. Its effect in promoting the disintegration and solution of mineral matters in the soil:
5. Its influence on the temperature of the soil.

There is not space here to discuss these points in detail. A special bulletin on the subject is planned to call again to the attention of farmers the work done by Professor S. W. Johnson on the subject many years ago. It must suffice here to say that nothing makes so effective an absorbent in stables as dried or half-dried peat and that the experience of Connecticut farmers many years ago indicated that a compost of equal parts of peat and horse manure was equally as effective as the same weight of horse manure alone.

The great trouble is in getting peat dry enough where it is dug to make the necessary hauling not too expensive.

THE ASEXUAL TRANSMISSION OF VARIATIONS IN THE POTATO.

A following paper by Dr. East on the transmission of variations in the potato from one generation to another through the tubers, will not be generally distributed, because it is a technical discussion of research work, the details of which are of interest chiefly to students of the principles of heredity.

It will be included in the bound report which is supplied to all libraries, and copies will be sent on application to those who wish to have it.

The points established in this paper which are of practical interest and importance to potato growers and breeders may be briefly summarized as follows:

A study of variation in the tubers within a single variety of potatoes has shown three things of special interest to the commercial grower:

1. Variations in resistance to drought are not inherited. They are due to variations in different individuals in the time of setting tubers. If the tubers are very small at the time of the drought the plants will survive; if the tubers are more than half mature at that time, the vitality of the plant will have been used to such

an extent in their production that the plant is likely to die prematurely. Tubers from such plants have less vigor than those from plants that have matured normally.

2. Inherited variations sometimes take place in tuber reproduction, but they are rare and are simply losses of unimportant characters. No grower should expect, therefore, to obtain varieties by this means that will possess a greater commercial value than is possessed by the parent variety.

3. The numerous variations in yield, size, etc., that are always present in potato varieties are due to circumstances of environment and are not inherited. Continued selection of large tubers, therefore, will not increase the average size of the variety. On the other hand, if tubers which are diseased or immature are planted, the resulting plants have less vigor and the yield is thereby decreased.

THE TRANSMISSION OF VARIATIONS IN THE POTATO IN ASEXUAL REPRODUCTION.*

By Edward M. East.

TABLE OF CONTENTS.

* The experimental work reported in this paper was conducted as a project under the federal appropriation for agricultural experiment stations, known as the Adams Fund. The field and laboratory work were done at the Connecticut Agricultural Experiment Station; the results were assembled at the Bussey Institution of Applied Biology of Harvard University.

Introduction.

In a previous paper (3), two series of data were presented, each giving the results from one year's selection of the extremes of a highly variable but accurately determined fluctuating character of the common potato, *Solanum tuberosum* L., when these extremes were reproduced asexually. The character under consideration was the total content of nitrogen determined by the Kjeldahl process. In one series, extremes averaging 14.07 per cent. and 8.75 per cent. in total nitrogenous matters when calculated to water-free basis, yielded crops averaging 14.70 per cent. and 12.59 per cent., respectively; in the other series, extremes averaging 18.06 per cent. and 13.37 per cent. in total nitrogenous matters, yielded crops averaging 10.90 per cent. and 9.29 per cent., respectively. These figures were due apparently to a correlation between mother and daughter tubers—if one may be allowed to use such terms—and yet the evidence even at that time did not appear to the writer to justify a conclusion that asexual fluctuations were inherited.

In the first place, the material at our disposal was a commercial stock, with nothing to guarantee its purity but our own judgment. Furthermore, it was slightly affected with scab and was treated with formalin for this disease. This treatment, poor soil and weather conditions, and the use of Paris green were so unfavorable to development that but few normal tubers resulted. This loss limited the data of the first series to one year, besides increasing the experimental error by making it impossible to compare tubers of the same state of maturity. The crop from the extremes of the second series, though much better than that of the first series, was small and could not be regarded as a normal crop of tubers. It was also a commercial stock. This experiment was terminated by a loss of the crop while it was in storage.

These statements show that it is impossible to conclude that our own observations included cases of definite inherited change among nitrogen fluctuations; on the other hand, the authenticity of certain cases reported by others, where permanent changes

such as loss of color have occurred in somatic tissue, cannot be doubted. Furthermore, in an exhaustive review of the work of previous investigators (3), the writer also found evidence that in rare instances heritable change in shape, size and chemical composition *may have occurred;* yet it was quite evident that in most of these cases the already complex question had been rendered more complex by refusing to distinguish between factors that belong essentially to the study of heredity, and factors that are primarily those of the physiology of development. In spite of the unconvincing nature of the published records concerning these other changes, there is no *a priori* reason to believe that the color variations noticed in commercial practice are the only transmissible variations that occur; and in any case the nature, frequency and causes of variations that do occur are entirely undetermined.

These reasons were of themselves sufficient to make it desirable to have the work repeated, with the experimental errors eliminated as far as possible; but there was still another reason for its repetition. Since the previous experimental work had been completed, Johannsen had published his classic monograph on "Erblichkeit in Populationen und in reinen Linien" (5), in which he concluded, first, that in a pure family line arising from a single self-fertilized seed, fluctuations are not inherited; second, that gametic changes may take place within a pure line, and when such a change occurs in an individual, its progeny at once forms a separate pure line or biotype. This piece of work was so excellent in all of its features that many biologists were at once convinced that his conclusions were correct. Other investigators have waited for corroborative evidence. Such evidence has recently been forthcoming. Jennings' (4) beautiful investigations concerning inheritance in protozoa lead him to exactly the same conclusions that Johannsen had obtained with beans as a material. Johannsen left asexual fluctuations out of consideration, although no essential distinction has yet been shown between them and fluctuations of a pure line propagated by sexual reproduction. Jennings, by his work on unicellular organisms, has proved the great similarity between inheritance in sexual pure lines and inheritance in asexual reproduction. In this paper is shown the similarity between the inheritance of fluctuations in asexual reproduction in multicellular organisms and that in the classes treated by Johannsen and Jennings. Although the data are comparatively few, still they are sufficient, I think, to give a relatively high probability to this conclusion.

The Material and its Treatment.

In 1906 a number of both foreign and domestic varieties of potatoes was gathered together to observe the frequency with which differentiations occurred within a variety reproduced by tubers. In 1907 other varieties were added until they included over seven hundred named commercial varieties as well as a large number of seedlings. The sources of the varieties in Europe were Vilmorin, Andrieux & Cie. for France and Germany, and Sutton & Co. and Thos. Scarlett for England and Scotland. In the United States practically all of the introducers of commercial varieties contributed to the collection. Observations were made upon this stock in 1906, 1907, 1908 and 1909, although a number of varieties were discarded in 1908 because their characteristics were the same as those of other varieties. Among our unnamed seedlings was one of Early Rose, the seed from which it was grown being in all probability self-fertilized. It had no color either in the sprouts or in the skin; its shape was short oval round; its eyes deep. There were several excellent reasons why it would make a good subject for an investigation of the correlation between mother and daughter tubers when extreme fluctuations were selected. Having been raised from the seed in 1901, selected from a single hill in 1902, and carefully propagated by tubers for four years, there was no question but that we were dealing with a single variety wherein any variations present were produced asexually. In addition, there is reason to believe that the characters that it possessed are all recessive, as follows: white tubers, recessive to colored tubers; white flowers, recessive to colored flowers; deep eyes, recessive to normal eyes; roundness, recessive to elongation. Our reasons for this belief will be published in a separate paper. That the exact characters possessed by the variety are of some importance will be seen later when the evidence tending to show that bud variations are always losses of dominant characters, is produced.

Our material in 1906 for this portion of the investigation, then, consisted of about four bushels of tubers that had been

produced from a single tuber in 1902. From this stock one hundred and seventeen representative tubers with the following weight distribution were selected for analysis.

TABLE I.

Distribution of Weights of Tubers of Original Stock, Crop of 1906.

A. = 137 ± 2.06 S. D. = 32.97 ± 1.45 C. V. = 24.07% ± 1.21%

Class centers in grams	85	105	125	145	165	185	205	225	245	265	285
Frequency	2	25	40	28	11	4	2	3	0	1	1

These tubers were sampled with a cork borer twelve millimeters in diameter, lengthwise but slightly to each side of the center—a method that previous experience had shown to be accurate (3). One of these samples was cut up and dried to constant weight at a temperature of 104° C., in a glycerol oven through which a current of hydrogen was passing. This gave the dry matter determination. The total nitrogen was determined by the regular Kjeldahl method as used by the Association of Official Agricultural Chemists. The total nitrogen was multiplied by the factor 5.5 and called total nitrogenous matters, although it is recognized that this factor may vary in a vegetable like the potato where the different nitrogen compounds are numerous. Yet the very fact that there are various compounds of nitrogen should give us a greater chance to determine whether variations in ability to assimilate nitrogen, constant in succeeding seasons, are produced with frequency in somatic cell division.

In discussing the data obtained, the simplest biometrical constants have been calculated, using the formulæ given by Davenport (1). The computations were all checked, but not in every case by two individuals. In each instance all of the figures have been used, although there are a few cases where strict mathematical treatment would call for the rejection of one or two extreme variates.

I believe that in cases where individual analysis is impossible, this modern statistical treatment is a great aid in concentrating the attention on the meaning of the figures *en masse,* yet there is no desire to argue that this treatment brings out more than can be seen by careful examination of the original data.

Inheritance of Fluctuations in Composition.

Results from the Analysis of the 1906 Crop.

The results of the analysis of the crop of 1906, from which were made our first selections for planting, are given in tables four to seven.

The classes in the frequency distribution of dry matter are centered on the even per cents. The mean is $18.15 \pm .118$ per cent., which is close to the average in water-free substance that analyses of a number of American varieties have shown. They are moderately variable, the coefficient of variation being $10.47 \pm .463$ per cent. Owing largely to the fact that in the highly variable character, weight, one or two individuals were found with a low per cent. of dry matter, the correlation between weight and dry matter is $-.275 + .058$. It is probable that the moderately wet period, during the time these tubers were maturing, is the cause of this, although it may very well be that there is generally a slight minus correlation between dry matter and weight.

The nitrogenous matters calculated to fresh material show a regular distribution with a mean of $1.92 \pm .015$ per cent. The standard deviation is $.248 \pm .011$, and the coefficient of variation is $12.95 \pm .580$ per cent. When calculated to dry basis the mean is $10.75 \pm .129$ per cent.; the standard deviation is $2.08 \pm .091$; the coefficient of variation is $19.35 \pm .740$ per cent. There is no correlation between the weight of the tubers and the per cent. of nitrogenous matters, fresh basis; when calculated to dry basis, however, there is a slight correlation with weight, namely, $.121 \pm .061$. As this correlation is only twice the probable error, we cannot be certain that it is a true value.

There is no doubt concerning the negative relationship between dry matter and nitrogenous matter, as the correlation coefficient is $-.346 \pm .055$ when dealing with nitrogenous matters, fresh basis. The constant is naturally greatly increased when we use the dry matter as a basis for reducing the nitrogenous matters to comparable form. It then becomes $-.758 \pm .026$. This relationship between dry matter and nitrogenous matters is not unexpected, for it is pretty definitely established that in all starch-storing plant parts, relatively more nitrogenous compounds are formed in the early stages of growth, and relatively more

starchy compounds in the final stages. This fact should be remembered when we consider correlation between mother and daughter tubers; for it follows that the relative percentage of dry matter is a better criterion of maturity than is the weight (although actual dry matter content varies widely in different seasons), and we should try as far as is possible to compare tubers of the same degree of maturity.

Results from Growing the Extreme Nitrogen Fluctuations of the 1906 Crop.

From the one hundred and seventeen tubers of the 1906 crop that had been analyzed, ten tubers high in nitrogenous matters and ten tubers low in nitrogenous matters were selected for planting in 1907. The basis upon which they were selected was their per cent. of nitrogen, calculated to fresh basis, for the determination of dry matter took about seven days and it was thought best to plant the tubers before its completion. Table two, however, shows that the calculation to dry basis in no case affected the classification of the individual.

TABLE II.

EXTREME NITROGEN FLUCTUATIONS PLANTED IN 1907.

High Nitrogen Extremes.				Low Nitrogen Extremes.			
Wt. grams.	Dry matter.	Nit. mat. fresh b.	Nit. mat. dry b.	Wt. grams.	Dry matter.	Nit. mat. fresh b.	Nit. mat. dry b.
119	18.02	2.48	13.76	136	17.32	1.53	8.83
165	16.40	2.34	14.27	158	18.11	1.45	8.01
145	14.75	2.36	16.00	203	16.01	1.42	8.87
118	17.98	2.37	13.18	129	18.72	1.30	6.95
137	16.40	2.49	15.12	187	18.30	1.63	8.91
146	16.13	2.42	15.00	151	19.09	1.52	7.96
138	16.83	2.38	14.14	106	18.90	1.50	7.94
106	18.81	2.36	12.50	114	19.85	1.61	8.11
110	15.35	2.36	15.37	103	19.26	1.61	8.36
113	17.74	2.28	12.85	120	21.66	1.43	6.60
Ave 130	16.84	2.38	14.22	141	18.72	1.50	8.05

Each of the ten tubers of each selection was cut in four pieces of as equal weight as possible. It has been found by many experiments, that if other conditions are equal, the yield increases directly with the size of the seed piece; therefore, we endeavored to have our selected tubers and the planted pieces as uniform in size as possible. Notwithstanding the desire to obtain a normal crop, a sufficient number of tubers could not be analyzed to have the extremes especially uniform, nor were the planted pieces large enough to yield very good crops. References to table nineteen, however, will show that a fairly normal crop was obtained.

The tubers were planted on uniform soil in contiguous rows. They were allowed to develop naturally, the larvæ of the potato beetle being removed by hand and no sprays of any kind used. The season was somewhat dry during July and the first part of August, but there was a normal rainfall in the spring and in the latter part of the summer.

The chemical determinations upon the crop were made in the same manner as before. Where possible three tubers were analyzed from each hill. This would give twelve analyses of daughter tubers from each mother tuber. In a few cases, however, only one tuber was large enough for the analysis to have any value. The complete data are shown in tables twenty and twenty-one.

Table nine shows the correlation between weighted mothers and their daughter tubers in nitrogenous matters, dry basis, from the high nitrogen plot. The coefficient of correlation $-.387 \pm .054$ shows that there was no positive correlation between the deviations of mothers and daughters of this one selection; nor was there any positive correlation between mothers and daughters in the low nitrogen plot. For the fact that there is a minus correlation as high as $-.510 \pm .051$, I have no explanation. It is undoubtedly a physiological phenomenon, connected with the various states of maturity of different individuals. It illustrates how easily data from one season might show a positive correlation that would be mistaken for a proof of the inheritance of fluctuations. (See paper No. 3.)

Table eleven shows to better advantage that there was absolutely no inheritance of fluctuations. The weighted arithmetic means of the weighted mothers were 2.23 per cent. and 1.55 per cent. for the high and the low nitrogen plots, respectively, yet the frequency distribution of the daughters is so nearly the same as to be quite remarkable when the small number of individuals is considered. Both have the same mode at 2.5 per cent.

The means are $2.51 \pm .028$ per cent. and $2.51 \pm .027$ per cent. respectively. Two aberrant individuals raise the coefficient of variation in the high nitrogen plot to $17.41 \pm .800$, while in the low nitrogen plot it is $15.62 \pm .771$; but if these two individuals are discarded the variability is about the same.

The similarity of the progeny of the two plots is just as great when we examine the nitrogenous matter figures calculated to water-free material. The weighted arithmetic means of the weighted mothers of the high and of the low nitrogen plots are $14.11 \pm .073$ per cent. and $8.12 \pm .015$ per cent. respectively, yet the means of the daughters are $12.74 \pm .171$ per cent. and $12.81 \pm .170$ per cent. respectively.

In tables thirteen, fourteen and fifteen we have considered a possible inheritance of fluctuations in dry matter. Taking the high and low nitrogen plots separately, the coefficients of correlation between mothers and daughters are $-.140 \pm .062$ and $-.286 \pm .063$, respectively. There is no reason why we should not add the data from these two plots together, however, for they were grown side by side on the level land, and had the same treatment in each case. When this is done the coefficient of correlation is $-.194 \pm .045$, which shows that there is no inheritance of fluctuations of dry matter.

Results from Growing the High Nitrogen Extremes from the High Nitrogen Plot of 1907 and the Low Extremes from the Low Nitrogen Plot of 1907.

From the analyzed tubers from the high nitrogen plot, the ten highest in nitrogenous matters, fresh basis, of those of normal development, were selected for planting in the high nitrogen plot of 1908. In like manner the ten tubers lowest in nitrogenous matters, fresh basis, of those of normal development in the low nitrogen plot, were selected for planting in the low nitrogen plot of 1908. Each tuber was divided into four nearly equal parts and planted as in 1907. The two selections were also planted in contiguous rows as before, although not on the soil formerly used.

A six weeks' drought during the growing season of this year killed some of the plants before tubers were set, and reduced the yield of all the plants. We were able to do some irrigation after the first two weeks of drought, but even this lack of water limited the setting of the tubers, so that we were able to find but sixty-seven tubers large enough to be worth analyzing.

The complete data resulting from these analyses are recorded in tables twenty-two and twenty-three. In table sixteen we have the correlation between weighted mothers and daughters from both plots in per cent. dry matter, *viz.*, .228 ± .078. This result is the first positive correlation coefficient that we have found, and as it is small and the number of individuals is small, it can have but little weight in our general conclusions. The mean of the weighted mothers being 19.01 ± .100 per cent.,

TABLE III.

EXTREME NITROGEN FLUCTUATIONS PLANTED IN 1908.

High Nitrogen Extremes.				Low Nitrogen Extremes.			
Wt., grams.	Dry matter.	Nit. mat. fresh b.	Nit. mat. dry b.	Wt., grams.	Dry matter.	Nit. mat. fresh b.	Nit. mat. dry b.
90	16.60	3.29	19.82	77	19.57	2.03	10.37
114	17.60	2.91	16.53	109	19.08	1.87	9.80
68	20.50	3.10	15.12	88	21.43	2.02	9.43
94	18.70	2.87	15.35	88	20.62	1.97	9.55
79	19.30	3.19	16.53	105	18.28	2.06	11.27
74	18.80	3.30	17.55	114	19.81	2.14	10.80
67	21.10	3.17	15.02	118	18.55	2.14	11.53
99	17.20	3.14	18.25	168	19.80	2.08	10.50
72	18.20	2.97	16.32	92	19.28	2.18	11.30
89	16.90	3.29	19.47	92	18.79	2.21	11.76
Ave. 85	18.49	3.12	17.00	105	19.52	2.07	10.63

and that of the daughters being only 12.19 ± .129 per cent., shows that the tubers have not obtained their normal development and from this their normal dry matter. This fact is shown also by their small size (tables twenty-two and twenty-three). Since we have seen before that much more of the total amount of nitrogenous matters contained in each tuber is formed early in the season than is stored later, we can place much more dependence in the total nitrogen determination than in the dry matter determination. The abnormality of the dry matter, however, affects the reduction of the percentage of the nitrogenous matters to water-free basis.

Although the number of individuals analyzed in 1908 was small, the resulting distribution of nitrogenous matters, when

considered in the form in which they were brought together in tables seventeen and eighteen, should carry considerable weight. We are dealing, in the crop from each plot, with extremes that have been selected for two years to try to force them apart in their composition. We are really dealing, then, with a very large population from which the middle, *i. e.*, the mediocre individuals have been dropped out. If there is the slightest amount of inheritance of these deviations, the weighted arithmetic mean of the high nitrogen plot should be higher than the weighted arithmetic mean of the low nitrogen plot. But this is not the case: the means are 2.32 ± .028 per cent, and 2.48 ± .033 per cent., respectively, the nitrogenous matters, fresh basis, even averaging somewhat higher in the low nitrogen plot. The percentage of variation is also about the same in each plot, 10.26 ± .860 per cent. and 11.24 ± .942 per cent. When reduced to the basis of water-free material by use of the aberrant dry matters, the mean of the high nitrogen plot, 20.6 ± .459 per cent., is slightly higher than that of the low nitrogen plot, 19.3 ± .358 per cent., but this difference is within the limit of probable errors.

Table nineteen may be mentioned here. It was added to show the total crops obtained from each tuber planted. It sustains former conclusions by several investigators, that there is a positive correlation between weight of seed tubers and size of crop.

We may conclude from this part of the investigation that neither the relative content of dry matter nor that of the nitrogenous matters of the potato can be changed by the selection of fluctuations and their subsequent asexual reproduction.

Note.—The crop of 1908 was so much reduced by the unfavorable season that it seemed scarcely worth while to continue the experiment with such seed; the selections were made as usual, however, and were planted in 1909. As was expected, the plants had no vitality and the crop of 1909 was discarded.

INHERITANCE OF FLUCTUATIONS IN YIELDING POWER.

Many experiments have been conducted to find out whether the yielding power of a variety of potatoes can be increased by selection from the highest yielding plants. The writer previously has reviewed the evidence (3) and shown that it is inconclusive. In a more recent investigation, that of Waid (6 and

7) of the Ohio Agricultural Experiment Station, a positive conclusion is reached. This conclusion seems to have enlisted the support of as eminent a student of genetics as Webber (8). There are a number of points, however, upon which Waid's work needs explanation. In the first place, he seems to have taken no account of the well-known fact, that if other conditions are equal, the yield increases directly with the size of the seed piece, owing to the greater amount of stored food upon which the young plant may draw. In the second place, Waid apparently used a commercial stock, and was not absolutely certain that he was dealing with a single variety. Many varieties now upon the market are exactly alike in external characteristics and are often mixed by seedsmen, although from having originated from separate seedlings and different parents, their yielding powers may be quite different. Furthermore, we know that stock of the same asexually produced variety may be quite different in its yielding power when grown under different soil and climatic conditions. This fact, which may account for differences in Waid's own results in the second and third seasons, as well as the differences in yield in his first selections in his commercial stock, is purely a physiological phenomenon of development and should be separated from the question of inheritance which is under discussion. If actual permanent differences in yielding power are produced by asexual variation in normal, mature, healthy tubers, the yielding power of a variety could be raised by selection. We know that deterioration takes place when immature or diseased tubers are used for reproduction; this is not due to the inheritance of a variation, but to the effect upon the vitality of the plant of starting it from a diseased tuber, or from a tuber which from immaturity has not a sufficient amount of nutriment stored up for the use of the young plant. There is no question here of selection in the ordinary sense, but of selection similar to the separation of heavy from light tobacco seed, because the former gives healthier plants although their hereditary characters are the same as those of the plants from the light seed. In the same way, with potatoes it is a question of having external conditions favorable for a mature crop free from disease, and not of selection of high yielding plants to increase the yield through a variation actually transmitted to the descendants of a varying somatic cell.

In 1906 we had in stock a supply of the well-known variety Rural New Yorker No. 2, which had been grown from a single hill in 1904. A selection of tubers from the five best yielding hills was planted in 1907, and compared with five normal hills producing only one-half as much. The five best yielding hills averaged 1,200 grams of tubers per hill, with an average set of eight tubers. The check hills averaged 600 grams, with a set of four tubers each. Ten hills were planted in each case, two tubers being planted from each hill. In every case pieces of about the same weight were planted. The yield from the high yielding selections was at the rate of 101 bushels per acre; while the yield from the check hills was at the rate of 128 bushels per acre.

In 1908, four tubers from each of the best two hills were again planted from the progeny of Selection A, the high yielding hills of 1906. These were checked with four tubers from two normal, but not high yielding hills of Selection B. This year the selected hills of Selection A average 1,000 grams per hill, while the selected hills from Selection B averaged 600 grams per hill. As above, tubers of the same size were planted in each case. Selection A yielded at the rate of 96 bushels per acre; Selection B yielded at the rate of 90 bushels per acre.

In 1909 the best two hills, averaging 1,100 grams, from Selection A, were again planted, and compared with the two normal hills of Selection B, averaging 700 grams per hill. The yield from Selection A was at the rate of 115 bushels per acre; while the yield from Selection B was at the rate of 120 bushels per acre, although the four hills were planted with equal-sized tubers as before.

It is admitted that these plots were very small and that the thirty hills of the 1906 crop forming the basis of selection do not allow the selection of wide extremes, yet I have succeeded a number of times in isolating strains of maize of different yielding power with about the same number of individuals as a basis. In maize, where there is a constant state of hybridation between natural biotypes, such isolation is possible; in asexual reproduction in the potato, I do not believe it to be a common possibility. I admit, however, that in rare cases it is not without the bounds of probability that changes occur in the somatic cells whereby real differences in inherent yielding ability are produced. It may be that the results of Waid mentioned above were from one of these instances. Attention has been called to other possible explanations of them, because it seems desirable that great caution should be used in recommending asexual selection to commercial growers as a means of actual improvement of the crop, in view of the facts, first, that out of many investigations on the point no indisputable evidence of improvement has been reported, and second, that even the questionable instances of positive results are extremely rare.

Inheritance of Power of Resisting Inhospitable Environment.

A number of investigators have noticed individual plants within a variety that have remained green after the majority had died. In several cases these instances have been cited as due to disease resistance in the plants in question, the disease that they were supposed to have resisted being the leaf spot disease caused by the fungus *Alternaria solani,* commonly known as early blight. In no case have I found it recorded that the dead plants were given a *post-mortem* and the cause of death actually determined as early blight. Since they have died and in the process have had spotted leaves, it has merely been taken for granted that early blight was the cause of death. Several investigators have selected seed tubers from the dead plants and also from those remaining alive, and from a comparison of their respective progenies, have made the claim that the latter transmitted the power of disease resistance.

The writer kept over 700 varieties under observation in 1907 with the idea of obtaining data upon the question. There was very little injury due to fungi during the year. Dr. G. P. Clinton did not find late blight, *Phytophthora infestans,* until just before the first frost, and then found only a few affected plants. It is possible that early blight was present during the summer, but the important immediate cause of death was the physiological trouble, tip-burn. This trouble is present every season, although more in evidence whenever there is a long drought. It starts at the large water-pore at the end of the leaf and continues over the surface until the leaf gradually dries up and dies. I examined a large number of plants of different varieties

and found that the rate at which the plant succumbed to tip-burn under given weather conditions depended almost entirely upon the stage of growth of the plant. Plants that had not begun to set tubers withstood long periods of drought. The resistance to drought decreased slowly until the tubers reached about 75 grams in weight, and then decreased very rapidly, so that plants with tubers two-thirds their normal size could withstand very little dry weather. When the largest of the tubers were removed from a plant where they were one-quarter normal size, the plants continued to withstand the drought better than other plants of the same variety where all the metabolic activities were being used to store up food in tubers. Of course mutilations such as punctures of flea beetles contributed to the susceptibility of the plants in question and only varieties with about the same amount of injury from this source were taken into consideration.

In the following varieties plants were found that died at least one month before others: Magnum, Warrior, Gov. Folk, Up-to-date, Table Talk, Solief and Gem of Aroostook. From each of these varieties, tubers of the short-lived and the long-lived plants were selected as seed tubers for the next season. Since the tubers from the short-lived plants were not mature, it would not have been a strictly fair comparison to have selected large tubers from the long-lived plants, even though the latter were cut to the same sized seed pieces as the former. For this reason whole tubers of the same size were selected in each case. In the resulting crop there were two cases in which plants among the progeny of the long-lived plants were themselves long-lived, and two cases where plants from the short-lived plants were long-lived; but in each case the remaining plants of both selections died at about the same time.

It must be mentioned, however, that another variety, Mills Banner, was among those from which tubers of long-lived and short-lived plants were grown. In this case all of the progeny of Plant A, the long-lived plant, were themselves long-lived, while all of the progeny of Plant B, the short-lived plant, were short-lived. Owing to this fact, a very careful examination of the progeny of each plant was made, and led to the discovery that all of the progeny of Plant A had pink sprouts, while all of the crop from Plant B had white sprouts. Either a bud variation had taken place or an accidental mixing of two varieties had occurred.

As a result of these experiments I would not go so far as to say that variations in power of resisting physiological or fungous diseases *do not occur* in asexual reproduction, but I do believe that the relative probability that the commercial grower will obtain disease-resisting varieties by this means is negligible. In most cases of so-called disease resistance within the variety, non-infection would be the proper term; and when there is apparently a marked difference in vitality, it is due to differences in maturity at the time the plants are called upon to withstand inhospitable environmental conditions. The fact that seed pieces planted at the same time produce plants that are at different stages of maturity at the same time, has nothing to do with the question under discussion. It may be due to any of several causes, such as differences in size of seed piece, varying amounts of soil fertility, injury of the buds of the subterranean stem, or removal of young tubers by rodents.

Inheritance of Variations Generally Classed as Bud Variations.

In a former paper (2), the following statement was made in regard to bud variation in the potato:

"In the potato bud variation has almost always been confined to color variations. Mr. A. W. Sutton (in a personal communication) makes this statement: 'I have no hesitation in affirming that there is no potato in commerce to-day in England, and I might say in Europe, which owes its origin as a distinct potato to bud variation in any form whatever.' After a wide inquiry in the United States, I believe that the statement is also true for this country. Mr. Sutton cites 'Forty-fold,' 'Beauty of Hebron,' and 'Paulsen's Blue Giant,' as having varied from colored skins to white. Mr. P. deVilmorin, also, has kindly given me two instances of the same sort. In this country I have seen three color variations, and collected evidence concerning five others—apparently authentic—that are losses of color characters. But two exceptions to the rule have appeared. Mr. Sutton reports that 'Rector of Woodstock,' which was originally white, has produced a purple variegated skin. In this case, however, it is unknown whether the parent tuber possessed the power of forming the purple dye, as is indicated in some of our white varieties by their purple sprouts.

"There has appeared a similar variation also in the 'White Pearl,' reported to me by Prof. E. R. Bennett. This potato, white in color with pink sprouts, appears to have produced a purple spotted variety. Old potato growers, however, say that the parent of the 'White Pearl' had a purple skin."

The authentic evidence, that we had at that time, included but one case where a colorless variety had sported to a colored variety—the Rector of Woodstock—and even this case is doubtful from our meager knowledge of the parent variety. Although my personal knowledge has increased materially since the above was published, I have no reason to change the opinion then expressed, that practically all, if not quite all bud variations are losses of a dominant or an epistatic character allowing the appearance of a recessive or a hypostatic character. A detailed statement of the cases that have come under my observation follows.

Changes in Color.

La Bretonne, Early Sunrise, Bole Zoegling and Seedling No. 60, all pink or red varieties, have produced white variations that were constant the next season. The change affected only the color of the tuber. Seedling No. 853 in its third year from seed produced one white tuber, the remaining tubers being the normal purple. This variation came true the next year.

Several apparent changes from white to colored tubers appeared, but the changes were not constant. Arabella, Solief and Crown Jewel, all varieties in which the sprouts have a slight pink color, produced individual tubers with a marked pink coloration. The next season, however, the tubers produced by them were exactly like those of the normal variety. In 1907 tubers of the varieties Prizetaker and Aradaras appeared with deep red protuberances (Plate III). Unfortunately, neither of these protuberances produced plants. Even had the variation been constant, however, it could not have been said that color was produced by an absolutely colorless variety, for in each case the normal tubers have some pink in their sprouts.

Changes in Shape.

Four marked changes in shape from long to round tubers have been observed. In the varieties Silver Hill and Early Ohio these changes were permanent. A close observer could recognize other characteristics of the parent varieties in the round tubers, but in each case the change from a long-tubered variety to a round-tubered variety was quite distinct. Two other long-tubered varieties, White Beauty and Seedling No. 842, also produced round variations, but in these two cases the progeny were all long like their parent varieties. Two other variations were noted where the change was not permanent. State of Maine and Orphan, two oval varieties, produced single plants upon which all of the tubers were very much elongated, approaching the Lady Finger in shape. These tubers were grown the next year in comparison with normal tubers of the same variety. In both cases the crops were exactly like those regularly produced by the varieties.

Changes from Shallow to Deep Eyes.

Four permanent bud variations were observed in another chapter which, though similar to change in form, evidently affects a separately inherited factor. Potato varieties to have a commercial value must have rather shallow eyes, otherwise too much substance will be lost in peeling; but sometimes a bud variation occurs in which the tuber appears as if it had had wires attached to all of its eyes whereby the latter were drawn in toward the center of the tuber. This gives the tuber an irregular appearance very well illustrated in Plate II. Such variations appeared in varieties State of Maine, Early Ohio, Endurance and Seedling No. 843. In each case they were permanent.

Change in Habit of Growth of Tubers.

A peculiar change appeared in the variety called Pennsylvania, which is illustrated in Plate III. It consists of a prolongation of the so-called bud end of the tuber into a stem which bears another tuber at its extremity. On occasional tubers in other varieties this phenomenon has occurred, but only in this case has it been permanent and characteristic of the variety, although these abnormal tubers have been planted a number of times. I have heard the matter mentioned by old potato growers, not as a bud variation but as an indication that the variety has become reduced in vigor. The plants produced from these abnormal tubers in the Pennsylvania variety were all abnormal. Of course some tubers were formed in the regular manner on

each plant, but each plant had at least one tuber showing the aberrant form. We have no evidence concerning the inheritance of this last variation in sexual reproduction, but the changes affecting the other three characters are changes from dominant to recessive. This does not prove that the reverse changes never occur, but if no such changes have been recorded by all of the numerous observers of this widely grown crop, they must be rare indeed.

Attempts to Produce Variations through Grafts.

A brief account of some experiments with grafted tubers is given here because it is thought that they have some interest in connection with asexual variation, even though the results are negative. The material used was taken from fourteen different varieties, giving several chances to find varieties that would graft upon each other. Five varieties with white skin were utilized, *viz.*, Early Carman, Moneymaker, Thorburn (white), Snowball and Clyde; in addition, Prizetaker, a variety with a white skin but with light pink sprouts, was included. The red-skinned varieties in use were Early Sunrise, Old Hemlock and Stray Beauty; while Sturtevant, Venezuela and S. Commersonii violet (Labergerie) comprised the purple-skinned varieties.

Over one hundred attempts were made to make grafts between buds of colored and white tubers. In each case we endeavored to cut the bud in half at its apical point and to graft half buds from colored and colorless tubers. Various methods of technique were tried, winding with soft twine being about as successful as the use of grafting wax. The tubers were placed where they could grow in the laboratory, and were carefully examined each day. In every grafted sprout the growing tissue of either one or the other of the two plants gained the ascendancy and in three or four days the upper point of the other sprout was left far behind. This portion of the sprout, while it did not dry up and die, did not increase in size, and was soon almost surrounded by the growing tissue of the other part of the sprout. It was quite evident that the new plant was always formed from the growing tissue of *one* variety.

The second experiment consisted in inserting a bud cut from a tuber of a colorless variety, with a brass cork borer, into a hole of the same size in a colored tuber; or *vice versa*. The other buds of the tuber were cut away and their places filled with grafting wax. Sixty of these various combinations were made and planted. When the young stems were two or three inches above the ground they were all dug up and examined. Seventy-five per cent. of the tubers had developed adventitious buds from the surrounding tuber. These sprouts were removed and the tubers replanted.

Twenty-three plants produced tubers, but absolutely no influence of the stock could be seen. It seems reasonable to suppose that a migrating character like color, when so placed that it could be utilized by the young stem, would be carried into the growing tissue and again appear in the progeny, but this was not the case. There appeared to be no influence on the scion either as a direct addition, or as a loss of a color character, or as a separate variation produced by influence of the stock. From this experience we suspect that many of the so-called graft-hybrids in the potato were merely plants exactly like the stock, produced from it by unnoted adventitious buds.

General Conclusions.

The investigations reported in the foregoing pages suggest very forcibly that the behavior of variations reproduced by budding is in many ways essentially like that of variations coming from seed. The inherited variations that were found have all but one concerned characters that mendelize in sexual reproduction, and as there is no evidence upon the inheritance of the one exception, it may be left out of consideration. Five cases of loss of color, two changes from long to round shape and four changes from shallow to deep eyes have come under our observation, all of which are common differences between seedlings out of a selfed fruit from our much crossed commercial varieties. If the causes and mechanism of production of both sexual and asexual variations are not similar or identical, it is very peculiar that no distinction between the two classes has been found. It is true that all of the asexual variations have been losses of characters, while in sexual reproduction the formation of new characters occurs. If no progressive variations occur in asexual reproduction, it must mean that there is a mechanical drawback to their production that sexual reproduction does not share; but the fact that they have not come under our observation simply proves them to be much rarer than the retrogressive variations. The last explanation parallels sexual variation, where retrogressive changes are very much more common than progressive changes, yet it seems important to call attention to a possible difference in the mechanical origin of sexual and asexual variations.

Any discussion regarding the mechanism of the production of variations is of course pure speculation, yet one cannot help feeling that the production asexually of changes that mendelize, throws some light on the subject. It follows that segregation may occur in the somatic cells, and that by division of one of these cells a line of descendants originates lacking a Mendelian character that is present in the parent cell. This fact does not develop anything new in regard to the relative importance of the chromosomes and the cytoplasm as bearers of hereditary characters, but it certainly seems to show that Mendelian segregation *is not limited to the reduction division in the maturation of sexual cells.*

Considering the amount of material under observation, the occurrence of twelve inherited variations is an unexpectedly high rate of frequency. Of course the careful scrutiny of the crop in every hill would partially account for a higher frequency than is observed by commercial growers. It might also be accounted for by the large number of colored varieties in our collection, as colored varieties form a very small proportion of the crop in the United States. Compared with an anemophilous crop like maize the per cent. of varying plants is very small, but compared with a close-fertilized crop like tobacco the difference in numbers, while still considerably less, is not remarkable. But should unobserved changes have occurred in ten times the quantity observed, there is no reason to recommend asexual selection as a commercial means of actual improvement. No changes that are of commercial value have yet been found, and, if they occur, they are rare indeed. The commercial grower would be swamped in trying out the numerous fluctuating variations that are not inherited, with scant possibility of ever finding a favorable inherited variation. Mature tubers free from disease should always be planted, but this precaution is made simply to give the young plants a normal start in life, and does not change their hereditary characters.

The classification of all of the permanent bud variations as losses of characters shows the investigation of the possible inheritance of fluctuations in composition in a new light. Since the variety used in the investigation was recessive in all the characters whose behavior in sexual reproduction is known, less probability exists that an inherited change might take place that would obscure the results on the class of variations immediately concerned. This being the case, we may feel some confidence in a conclusion that fluctuations (variations due to surrounding conditions) are not inherited. Furthermore, there is little doubt but that the cases of so-called disease resistance should be classed as noninherited fluctuations due to various physiological causes.

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TABLE IV.

Correlation between per cent. Dry Matter and Weight of Tubers in Grams, Crop of 1906.

Weight in Grams \ Per cent. Dry Matter	14	15	16	17	18	19	20	21	22	23	
85						1				1	2
105	2	2	1	5	4	4	6	1			25
125		1		5	11	10	6	4	3		40
145	1	1	4	6	6	5	3	2			28
165		1	3	3	3		1				11
185			1	1	1	1					4
205			1	1							2
225	1			1					1		3
245											0
265					1						1
285	1										1
	5	5	10	22	26	21	16	7	4	1	117

Per cent. Dry Matter.

A. = 18.15 ± .118
S. D. = 1.90 ± .083
C. V. = 10.47 ± .463

Weight in Grams.

A. = 137 ± 2.06
S. D. = 32.97 ± 1.453
C. V. = 24.07 ± 1.21

Coef. Cor. −.275 ± .058

TABLE V.

Correlation between Weight in Grams and per cent. Nitrogenous Matters, fresh Basis, Crop of 1906.

Nitrogenous Matters, fresh basis. \ Weight in Grams.	85	105	125	145	165	185	205	225	245	265	285	
1.3			1									1
1.5		1	1	2	1		1					6
1.7	1	4	17	7	5	2		1				37
1.9	1	5	10	9	4	2	1	1		1		34
2.1		10	6	4								20
2.3		5	4	4	1			1			1	16
2.5			1	2								3
	2	25	40	28	11	4	2	3	0	1	1	117

Weight in Grams.

A. = 137 ± 2.06
S. D. = 32.97 ± 1.453
C. V. = 24.07 ± 1.21

Nitrogenous Matters, fresh basis.

A. = 1.915 ± .015
S. D. = .248 ± .011
C. V. = 12.95 ± .580

Coef. Cor. = −.056 ± .062

TABLE VI.

CORRELATION BETWEEN WEIGHT IN GRAMS AND PER CENT. NITROGENOUS MATTERS, DRY BASIS, CROP OF 1906.

Weight in Grams.

Nitrogenous Matters, dry basis.	85	105	125	145	165	185	205	225	245	265	285	
7	1		2									3
8		4	3	1	1							9
9		1	10	5	1	1	1	1				20
10	1	6	14	8	5	2				1		37
11		2	3	5	1			1				12
12		3	4		2	1	1					11
13		6	2	3								11
14			1	3	1							5
15		2	1	2							1	6
16		1		1				1				3
	2	25	40	28	11	4	2	3	0	1	1	117

Weight in Grams.

A. = 137 ± 2.06
S. D. = 32.97 ± 1.453
C. V. = 24.07 ± 1.21

Nitrogenous Matters, dry basis.

A. = 10.75 ± .129
S. D. = 2.08 ± .091
C. V. = 19.35 ± .740

Coef. Cor. = .121 ± .061

TABLE VII.

CORRELATION BETWEEN PER CENT. DRY MATTER AND PER CENT. NITROGENOUS MATTERS, FRESH BASIS, CROP OF 1906.

Dry Matter.

Nitrogenous Matters, fresh basis.	14	15	16	17	18	19	20	21	22	23	
1.3						1					1
1.5			1	1	1	2			1		6
1.7				12	10	5	6	2	1	1	37
1.9	1	1	3	1	8	7	7	5	1		34
2.1	1	1	2	6	2	4	3		1		20
2.3	3	3	2	2	4	2					16
2.5			2		1						3
	5	5	10	22	26	21	16	7	4	1	117

Per cent. Dry Matter.

A. = 18.15 ± .118
S. D. = 1.90 ± .083
C. V. = 10.47 ± .463

Per cent. Nitrogenous Matters, fresh basis.

A. = 1.915 ± .015
S. D. = .248 ± .011
C. V. = 12.95 ± .580

Coef. Cor. −.346 ± .055

TABLE VIII.

CORRELATION BETWEEN PER CENT. DRY MATTER AND PER CENT. NITROGENOUS MATTERS, DRY BASIS, CROP OF 1906.

Dry Matter.

Nitrogenous Matters dry basis.	14	15	16	17	18	19	20	21	22	23	
7						1			1	1	3
8					1	3	2	2	1		9
9			1	1	3	4	5	4	2		20
10				10	11	7	8	1			37
11			1	2	4	4	1				12
12		1	2	3	3	2					11
13		1	2	5	3						11
14	1		2	1	1						5
15	2	2	2								6
16	2	1									3
	5	5	10	22	26	21	16	7	4	1	117

Per cent. Dry Matter.

A. = 18.15 ± .118
S. D. = 1.90 ± .083
C. V. = 10.47 ± .463

Per cent. Nitrogenous Matters, dry basis.

A. = 10.75 ± .129
S. D. = 2.08 ± .091
C. V. = 19.35 ± .740

Coef. Cor. −.758 ± .026

TABLE IX.

CORRELATION IN PER CENT. NITROGENOUS MATTERS, DRY BASIS, BETWEEN MOTHERS SELECTED FOR HIGH NITROGEN, AND DAUGHTERS CROP OF 1907.

Per cent. Mothers.

Per cent. Daughters.	12	13	14	15	16	
8			2			2
9			4	5		9
10		1	9	3	1	14
11			3	7	4	14
12		2	6	7	4	19
13	4	3	7	5	2	21
14	3	2	1	1		7
15	5	3	1	1		10
16		2	1	2		5
17		2		2	1	5
18		2	1			3
19		1				1
20		2				2
21						0
22		1				1
	12	21	35	33	12	113

Per cent. Nitrogenous Matters, dry basis, Mothers.

A. = 14.11 ± .073
S. D. = 1.147 ± .051
C. V. = 8.13 ± .365

Per cent. Nitrogenous Matters, dry basis, Daughters.

A. = 12.74 ± .171
S. D. = 2.698 ± .121
C. V. = 21.18 ± .992

Coef. Cor. −.387 ± .054

TABLE X.

Correlation in per cent. Nitrogenous Matters, dry Basis, between Mothers selected for Low Nitrogen, and Daughters Crop of 1907.

Per cent. Daughters. \ Per cent. Mothers.	7	8	9	
7			1	1
8	1		1	2
9	1		3	4
10	1	3	2	6
11	3	8	6	17
12	5	12	5	22
13	1	5	4	10
14	3	5	6	14
15		8	2	10
16	2	2	1	5
17	1	2		3
18		1		1
19				0
20	1	2		3
	19	48	31	98

Per cent. Nitrogenous Matters, dry basis, Mothers.

A. = 8.122 ± .015
S. D. = .222 ± .011
C. V. = 2.733 ± .131

Per cent. Nitrogenous Matters, dry basis, Daughters.

A. = 12.81 ± .170
S. D. = 2.493 ± .120
C. V. = 19.46 ± .972

Coef. Cor. −.510 ± .051

In the tables on the next page note the wide difference between the selected mother tubers. There are two classes vacant between the highest of the low nitrogen mother tubers and the lowest of the high nitrogen tubers, yet the progeny of each selection show frequency distributions so nearly the same that they might be interchanged. There is evidently no inheritance of these fluctuations.

TABLE XI.

Frequency Distribution of Nitrogenous Matters, fresh Basis, in High and in Low Nitrogen Plots of 1907, Compared with Weighted Mothers.

Classes in per cent.	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.9	4.1	A.	S. D.	C. V.
Daughters High Nit.			1	14	17	14	25	14	12	10	4		1		1	2.51 ± .028	.437 ± .020	17.41 ± .800
Weighted Mothers High Nit.						78	35									2.23		
Weighted Mothers Low Nit.	10	56	32													1.55		
Daughters Low Nit.		1	3	4	10	18	27	16	6	8	3	2				2.51 ± .027	.392 ± .019	15.62 ± .771

TABLE XII.

Frequency Distribution of Nitrogenous Matters, dry Basis, in High and in Low Nitrogen Plots of 1907, Compared with Weighted Mothers.

Classes in per cent.	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	A.	S. D.	C. V.
Daughters High Nit.		2	9	14	14	19	21	7	10	5	5	3	1	2	0	1	12.74 ± .171	2.698 ± .121	21.18 ± .992
Weighted Mothers High Nit.						12	21	35	33	12							14.11 ± .073	1.147 ± .051	8.13 ± .365
Weighted Mothers Low Nit.	19	48	31														8.12 ± .015	.222 ± .011	2.73 ± .131
Daughters Low Nit.	1	2	4	6	17	22	10	14	10	5	3	1	0	1			12.81 ± .170	2.493 ± .120	19.46 ± .972

TABLE XIII.

CORRELATION IN PER CENT. DRY MATTER BETWEEN MOTHERS SELECTED FOR HIGH NITROGEN, AND DAUGHTERS CROP OF 1907.

Per cent. Daughters. \ Per cent. Mothers.	15	16	17	18	19	
16	1		1	1		3
17		1	2	3		6
18		3		6	1	10
19	7	6	1	9	3	26
20	8	7	3	4	7	29
21	2	10	1	3		16
22	1	7	2	4		14
23	1	2	1	2	1	7
24	1					1
25			1			1
	21	36	12	32	12	113

Per cent. Dry Matter, Mothers.
A. = 16.81 ± .084
S. D. = 1.316 ± .059
C. V. = 7.829 ± .351

Per cent. Dry Matter, Daughters.
A. = 19.98 ± .111
S. D. = 1.745 ± .078
C. V. = 8.734 ± .395

Coef. Cor. = −.140 ± .062

TABLE XIV.

CORRELATION IN PER CENT. DRY MATTER BETWEEN MOTHERS SELECTED FOR LOW NITROGEN, AND DAUGHTERS CROP OF 1907.

Per cent. Daughters. \ Per cent. Mothers.	16	17	18	19	20	22	
15					1		1
16			1	1	1	1	4
17			3	1	1		5
18			4	4	2	2	12
19	1		5	4	2	2	14
20	4	1	5	11	1	4	26
21	5	1	1	9	1		17
22	1	3		7			11
23	1	1		4			6
24				1			1
25							0
26		1					1
	12	7	19	42	9	9	98

Per cent. Dry Matter, Mothers.
A. = 18.66 ± .105
S. D. = 1.545 + .074
C. V. = 8.28 ± .4.02

Per cent. Dry Matter, Daughters.
A. = 19.93 ± .131
S. D. = 1.923 ± .093
C. V. = 9.649 ± .469

Coef. Cor. −.286 ± .063

TABLE XV.

CORRELATION IN PER CENT. DRY MATTER BETWEEN MOTHERS, AND DAUGHTERS CROP OF 1907, CONSIDERING BOTH HIGH AND LOW NITROGEN PLOTS.

Per cent. Daughters. \ Per cent. Mothers.	15	16	17	18	19	20	21	22	
15						1			1
16	1		1	2	1	1		1	7
17		1	2	6	1	1			11
18		3		10	5	2		2	22
19	7	7	1	14	7	2		2	40
20	8	11	4	9	18	1		4	55
21	2	15	2	4	9	1			33
22	1	8	5	4	7				25
23	1	3	2	2	5				13
24	1				1				2
25			1						1
26			1						1
	21	48	19	51	54	9	0	9	211

Per cent. Dry Matter, Mothers.
A. = 17.67 ± .079
S. D. = 1.70 ± .056
C. V. = 9.62 ± .316

Per cent. Dry Matter, Daughters.
A. = 19.96 ± .085
S. D. = 1.83 ± .060
C. V. = 9.17 ± .301

Coef. Cor. −.194 ± .045

TABLE XVI.

CORRELATION IN PER CENT. DRY MATTER BETWEEN MOTHERS, AND DAUGHTERS CROP OF 1908, CONSIDERING BOTH HIGH AND LOW NITROGEN PLOTS.

Per cent. Daughters. \ Per cent. Mothers.	17	18	19	20	21	
8			1			1
9	1		1		1	3
10	2	1	1	1		5
11	4	3	3	1	1	12
12	4		4	5	2	15
13		1	8	8	1	18
14	1		4	4	1	10
15		1		1		2
16		1				1
	12	7	22	20	6	67

Per cent. Dry Matter, Mothers.
A. = 19.01 ± .100
S. D. = 1.21 ± .071
C. V. = 6.37 ± .371

Per cent. Dry Matter, Daughters.
A. = 12.19 ± .129
S. D. = 1.56 ± .091
C. V. = 12.79 ± .757

Coef. Cor. .228 ± .078

TABLE XVII.

Frequency Distribution of Nitrogenous Matters, fresh Basis, in High and in Low Nitrogen Plots of 1908, Compared with Weighted Mothers.

Classes in per cent.	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	A.	S. D.	C. V.
Daughters High Nit.	2	10	9	8	3	1			2.32 ± .028	.238 ± .020	10.26 ± .860
Weighted Mothers High Nit.						6	16	11	3.13		
Weighted Mothers Low Nit.		26	7						2.14		
Daughters Low Nit.	2	3	6	10	8	3	1		2.48 ± .033	.280 ± .023	11.24 ± .942

TABLE XVIII.

Frequency Distribution of Nitrogenous Matters, dry Basis, in High and in Low Nitrogen Plots of 1908, Compared with Weighted Mothers.

Classes in per cent.	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25*	27†	33	A.	S. D.	C. V.
Daughters High Nit.							2	3	3	2	1	8	5		4		1	3	1	20.6 ± .459	3.91 ± 3.25	18.98 ± 1.63
Weighted Mothers H. Nit.							6	4	9	5	4	5								17.36		
Weighted Mothers L. Nit.	2	14	10	7																10.67		
Daughters Low Nit.				1		1	1	5	2	4	2	1	7	4	3	2				19.3 ± .358	3.05 ± .253	15.80 ± 1.35

* One class vacant and omitted.
† Five classes vacant and omitted.

TABLE XIX.

The Relation between Weight of Tuber and Yield in Selections for Low Nitrogen.

Weight Seed tuber 1906.	Yield 1907 (grams).	Hills planted 1908.	Weight seed tuber 1908.	Yield 1908 (grams).
136	644			
158	1472	53–56 41–44	77 109	380 75
203	1560	49–52 45–48	88 88	220 30
129	1522			
187	1741	57–60	105	354
151	1797	65–68	114	543
106	1665	69–72	118	100
114	1776	61–64 73–76	168 69	1635 423
103	1530	77–80	92	964
120	1149			

TABLE XX.

High Nitrogen Extremes of 1906 and their Progeny of 1907

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight, grams.
Mother tuber, No. 19		18.02	2.48	13.76	119
Daughter tuber	1	19.4	2.09	10.77	114
"	1	19.1	2.81	14.71	122
"	1	19.4	2.00	10.31	103
Daughter tuber	2	22.4	1.97	8.79	66
"	2	22.9	2.17	9.47	55
"	2	21.6	2.11	9.77	37
Daughter tuber	3	23.0	1.98	10.65	115
"	3	22.2	2.18	9.82	66
"	3	21.3	1.74	8.17	49
Daughter tuber	4	19.3	1.86	9.63	272
"	4	19.2	1.98	10.31	123
	4	----	----	----	....

TABLE XX—*Continued.*

HIGH NITROGEN EXTREMES OF 1906 AND THEIR PROGENY OF 1907.

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight, grams.
Mother tuber, No. 33		16.49	2.34	14.27	165
Daughter tuber	5	21.3	2.49	11.69	94
"	5	21.8	2.52	11.56	74
"	5	21.5	1.99	9.25	59
Daughter tuber	6	17.6	2.20	12.50	90
"	6	19.8	2.52	12.72	59
"	6	19.8	2.53	12.77	49
Daughter tuber	7	20.5	2.43	11.85	70
"	7	20.0	1.97	9.85	53
"	7	21.7	2.14	9.86	41
Daughter tuber	8	21.6	2.77	12.82	49
"	8	22.8	2.92	12.80	43
"	8	21.5	2.20	10.23	30
Mother tuber, No. 35		14.75	2.36	16.00	145
Daughter tuber	9	19.4	2.17	11.18	60
"	9	21.0	2.64	12.57	60
"	9	23.8	2.94	12.35	29
Daughter tuber	10	19.3	2.11	10.93	219
"	10	19.0	2.49	13.10	138
"	10	23.0	2.69	11.70	68
Daughter tuber	11	19.1	2.16	11.31	150
"	11	19.8	2.30	11.61	95
"	11	15.8	2.66	16.83	58
Daughter tuber	12	18.8	1.95	10.37	149
"	12	19.2	2.32	12.08	109
"	12	20.1	2.24	11.14	81
Mother tuber, No. 49		17.98	2.37	13.18	118
Daughter tuber	13	18.4	3.69	20.05	37
"	13	18.8	4.11	21.86	21
"	13	21.3	2.52	11.83	17
Daughter tuber	14	Did not grow			
Daughter tuber	15	16.6	3.29	19.82	90
" [1]	15	17.9	3.00	16.76	59
"	15	16.4	2.27	13.84	41
Daughter tuber	16	17.9	2.26	12.62	116
"	16	22.1	3.19	14.43	39
"	16	19.9	1.97	9.90	33

1. Planted in hills 21, 22, 23, 24 (1908).

TABLE XX—*Continued.*

HIGH NITROGEN EXTREMES OF 1906 AND THEIR PROGENY OF 1907.

	From Hill Ho.	Dry Matter.	Nit Mat. fresh basis.	Nit. Mat. dry basis.	Weight, grams.
Mother tuber, No. 55		16.40	2.49	15.12	137
Daughter tuber	17	17.1	2.64	15.44	114
"	17	20.5	2.42	11.80	85
"	17	18.6	2.44	13.12	69
Daughter tuber	18	19.2	2.17	11.30	83
"	18	19.9	2.61	13.11	75
"	18	19.5	3.09	15.84	43
Daughter tuber	19	21.5	2.42	11.25	185
" [2]	19	17.6	2.91	16.53	114
"	19	21.6	2.11	9.77	59
Daughter tuber	20	21.2	2.44	11.51	75
"	20	20.9	2.70	12.92	67
"	20	21.6	2.03	9.39	43
Mother tuber, No. 57		16.13	2.42	15.00	146
Daughter tuber	21	21.5	1.94	9.02	111
"	21	22.8	2.27	9.95	82
"	21	18.7	2.91	15.56	48
Daughter tuber	22	20.1	2.33	11.59	97
"	22	19.4	2.23	11.49	76
"	22	21.5	2.46	11.44	59
Daughter tuber	23	18.9	2.45	12.96	190
"	23	21.2	1.96	9.24	116
"	23	22.5	1.97	8.75	69
Daughter tuber	24	20.6	2.29	11.11	85
"	24	18.5	2.51	13.56	80
"	24	22.1	1.99	9.00	45
Mother tuber, No. 107		16.83	2.38	14.14	138
Daughter tuber	25	22.5	2.45	10.89	120
"	25	24.7	1.92	7.77	93
"	25	22.8	2.06	9.03	63
Daughter tuber	26	16.0	2.53	15.81	113
"	26	21.8	2.71	12.43	79
"	26	20.2	2.79	13.81	55
Daughter tuber	27	19.8	2.48	12.52	104
"	27	17.4	2.28	13.10	62
"	27	21.0	2.19	10.43	52
Daughter tuber	28	19.4	2.35	12.11	110
"	28	17.5	3.21	18.34	49
"	28	20.5	2.70	13.17	38

2. Planted in hills 33, 34, 35, 36 (1908).

TABLE XX—*Concluded.*

HIGH NITROGEN EXTREMES OF 1906 AND THEIR PROGENY OF 1907.

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight, grams.
Mother tuber, No. 138		18.81	2.36	12.50	106
Daughter tuber, 1	29	20.5	3.10	15.12	68
"	29	20.3	3.11	15.32	60
"	29	22.7	3.04	13.39	60
Daughter tuber	30	19.8	2.81	14.19	63
"	30	18.7	2.51	13.42	62
"	30	20.5	2.62	12.78	61
Daughter tuber, 2	31	18.7	2.87	15.35	94
"	31	19.9	2.93	14.72	67
"	31	20.2	3.02	14.95	54
Daughter tuber	32	19.4	2.46	12.68	75
"	32	18.3	2.56	13.99	70
"	32	20.1	2.82	14.03	56
Mother tuber, No. 144		15.35	2.36	15.37	110
Daughter tuber	33	20.0	2.40	12.00	90
"	33	----	----	----	----
"	33	----	----	----	----
Daughter tuber	34	20.2	2.44	12.08	99
"	34	21.2	2.56	12.07	98
"	34	----	----	----	----
Daughter tuber	35	20.1	2.39	11.89	120
"	35	20.4	2.18	10.68	88
"	35	22.1	2.52	11.40	69
Daughter tuber	36	19.7	2.07	10.50	118
" 3	36	19.3	3.19	16.53	79
"	36	19.9	2.56	12.86	76
Mother tuber, No. 155		17.74	2.28	12.85	113
Daughter tuber, 4	37	18.8	3.30	17.55	74
"	37	18.1	3.00	16.57	69
" 5	37	21.1	3.17	15.02	67
Daughter tuber	38	18.6	2.76	14.84	114
"	38	20.1	2.65	13.18	76
"	38	17.9	2.62	14.64	54
Daughter tuber, 6	39	17.2	3.14	18.25	99
"	39	19.4	2.31	11.90	91
" 7	39	18.2	2.97	16.32	72
Daughter tuber, 8	40	16.9	3.29	19.47	89
"	40	19.7	2.56	12.99	78
"	40	20.2	3.19	15.79	58

1. Planted in hills 1, 2, 3, 4 (1908).
2. Planted in hills 29, 30, 31, 32 (1908).
3. Planted in hills 13, 14, 15, 16 (1908).
4. Planted in hills 25, 26, 27, 28 (1908).
5. Planted in hills 9, 10, 11, 12 (1908).
6. Planted in hills 5, 6, 7, 8 (1908).
7. Planted in hills 37, 38, 39, 40 (1908).
8. Planted in hills 17, 18, 19, 20 (1908).

TABLE XXI.

LOW NITROGEN EXTREMES OF 1906 AND THEIR PROGENY OF 1907.

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight, grams.
Mother tuber, No. 4		17.32	1.53	8.83	136
Daughter tuber	41	21.88	2.30	10.51	60
"	41	----	----	----	----
"	41	----	----	----	----
Daughter tuber	42	25.81	2.20	8.52	70
"	42	21.06	2.68	12.73	55
"	42	22.52	1.79	7.95	53
Daughter tuber	43	22.41	2.42	10.80	44
"	43	21.63	3.10	14.33	39
"	43	----	----	----	----
Daughter tuber	44	19.56	2.68	13.70	111
"	44	----	----	----	----
"	44	----	----	----	----
Mother tuber, No. 10		18.11	1.45	8.01	158
Daughter tuber, 1	45	19.57	2.03	10.37	77
"	45	19.01	2.24	11.78	83
"	45	20.35	2.60	12.78	67
Daughter tuber	46	19.60	2.88	14.70	61
"	46	----	----	----	----
"	46	----	----	----	----
Daughter tuber, 2	47	19.08	1.87	9.80	109
"	47	20.08	2.45	12.20	109
"	47	16.51	2.43	14.72	118
Daughter tuber	48	Did not grow			
Mother tuber, No. 13		16.01	1.42	8.87	203
Daughter tuber	49	20.06	2.10	10.47	65
"	49	21.08	2.27	10.77	55
"	49	19.12	2.78	14.54	70
Daughter tuber	50	21.02	2.46	11.70	103
"	50	20.04	2.28	11.38	74
" 3	50	21.43	2.02	9.43	88
Daughter tuber	51	23.06	1.69	7.33	56
"	51	20.69	3.08	14.89	88
"	51	20.23	2.36	11.67	116
Daughter tuber	52	21.52	2.41	11.20	78
"	52	20.05	2.48	12.37	100
" 4	52	20.62	1.97	9.55	88

1. Planted in hills 53, 54, 55, 56 (1908).
2. Planted in hills 41, 42, 43, 44 (1908).
3. Planted in hills 49, 50, 51, 52 (1908).
4. Planted in hills 45, 46, 47, 48 (1908).

TABLE XXI—*Continued.*

LOW NITROGEN EXTREMES OF 1906 AND THEIR PROGENY OF 1907.

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight, grams.
Mother tuber, No. 52		18.72	1.30	6.95	129
Daughter tuber	53	20.01	2.30	11.50	78
"	53	19.98	2.73	13.66	120
"	53	----	----	----	----
Daughter tuber	54	17.74	2.57	14.49	312
"	54	18.94	1.87	9.87	206
"	54	----	----	----	----
Daughter tuber	55	20.86	2.36	11.31	76
"	55	21.24	2.37	11.16	50
"	55	15.94	2.57	16.12	68
Daughter tuber	56	19.87	2.37	11.92	93
"	56	20.85	1.79	8.58	48
"	56	18.18	2.43	13.36	45
Mother tuber, No. 101		18.30	1.63	8.91	187
Daughter tuber	57	16.75	2.15	12.83	215
"	57	18.79	2.66	14.15	96
"	57	20.53	1.94	9.45	66
Daughter tuber	58	18.33	2.22	12.11	147
"	58	17.34	2.46	14.18	117
" 5	58	18.28	2.06	11.27	105
Daughter tuber	59	17.97	2.28	12.68	105
"	59	17.94	2.48	13.82	99
"	59	15.80	2.53	16.01	88
Daughter tuber	60	18.91	2.54	13.43	97
"	60	19.71	2.41	12.22	92
"	60	18.56	2.60	14.01	83
Mother tuber, No. 132		19.09	1.52	7.96	151
Daughter tuber, 1	61	19.81	2.14	10.80	114
"	61	19.81	2.39	12.06	127
"	61	20.18	2.31	11.44	100
Daughter tuber	62	19.91	2.47	12.40	111
"	62	20.10	2.38	11.84	73
"	62	20.73	3.44	16.60	65
Daughter tuber	63	21.71	2.60	11.97	93
"	63	22.52	2.45	10.88	84
"	63	23.86	2.94	12.32	85
Daughter tuber	64	20.79	2.91	14.00	129
"	64	18.90	3.04	16.08	74
"	64	----	----	----	----

5. Planted in hills 57, 58, 59, 60 (1908).
1. Planted in hills 65, 66, 67, 68 (1908).

TABLE XXI—*Continued.*

LOW NITROGEN EXTREMES OF 1906 AND THEIR PROGENY OF 1907.

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight, grams.
Mother tuber, No. 146		18.90	1.50	7.94	106
Daughter tuber	65	22.79	2.54	11.14	158
"	65	23.21	2.73	11.76	104
"	65	23.23	2.62	11.28	104
Daughter tuber	66	21.36	2.53	11.84	88
"	66	22.18	2.67	12.04	70
"	66	22.31	2.54	11.38	69
Daughter tuber	67	17.43	2.35	13.48	96
"	67	20.26	2.56	12.63	60
"	67	----	----	----	----
Daughter tuber, 2	68	18.55	2.14	11.53	118
"	68	21.43	2.66	12.41	68
"	68	----	----	----	----
Mother tuber, No, 148		19.85	1.61	8.11	114
Daughter tuber, 3	69	19.80	2.08	10.50	168
" 4	69	19.28	2.18	11.30	92
"	69	14.97	2.63	17.57	69
Daughter tuber	70	Did not grow			
Daughter tuber	71	21.28	3.26	15.32	95
"	71	15.60	3.15	20.19	72
"	71	19.19	2.66	13.86	60
Daughter tuber	72	18.08	2.49	13.77	173
"	72	16.84	2.51	14.90	124
"	72	18.46	2.80	15.17	83
Mother tuber, No. 153		19.26	1.61	8.36	103
Daughter tuber	73	21.53	2.71	12.58	99
"	73	18.81	3.15	16.74	91
"	73	20.57	2.33	11.33	73
Daughter tuber	74	20.01	2.90	14.49	88
"	74	21.63	2.78	12.85	78
"	74	19.57	2.85	14.56	85
Daughter tuber	75	21.86	3.20	14.64	46
"	75	21.21	3.29	15.51	44
"	75	----	----	----	----
Daughter tuber	76	17.85	2.76	15.46	87
"	76	17.58	3.53	20.08	87
"	76	22.46	3.04	13.53	58

2. Planted in hills 69, 70, 71, 72 (1908).
3. Planted in hills 61, 62, 63, 64 (1908).
4. Planted in hills 73, 74, 75, 76 (1908).

TABLE XXI—*Concluded.*

LOW NITROGEN EXTREMES OF 1906 AND THEIR PROGENY OF 1907.

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight, grams.
Mother tuber, No. 157		21.66	1.43	6.60	120
Daughter tuber	77	Did not grow			
Daughter tuber	78	19.65	2.44	12.41	157
" 5	78	18.79	2.21	11.76	92
"	78	18.84	2.95	15.66	91
Daughter tuber	79	19.95	2.74	13.73	141
"	79	19.89	1.59	7.99	63
"	79	19.63	2.43	12.38	58
Daughter tuber	80	17.83	3.09	17.33	75
"	80	18.28	2.26	12.36	75
"	80	16.28	3.33	20.45	57

5. Planted in hills 77, 78, 79, 80 (1908).

TABLE XXII.

HIGH EXTREMES FROM THE HIGH NITROGEN PLOT OF 1907 AND THEIR PROGENY OF 1908.

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight.
Mother tuber (from tuber No. 49 in 1906)	15*a*	16.60	3.29	19.82	90
Daughter tuber	22	11.99	2.44	20.35	90
"	22	12.04	1.88	15.61	58
"	23	10.77	2.16	20.05	102
"	24	10.69	2.28	21.33	86
"	24	8.96	2.06	22.99	84
Mother tuber (from tuber No. 55 in 1906)	19*b*	17.60	2.91	16.53	114
Daughter tubers all too small to analyze.					
Mother tuber (from tuber No. 138 in 1906)	29*a*	20.50	3.10	15.12	68
Daughter tubers all too small to analyze.					
Mother tuber (from tuber No. 138 in 1906)	31*a*	18.70	2.87	15.35	94
Daughter tuber	29	9.24	2.51	27.16	62
"	32	12.63	2.66	21.06	50
Mother tuber (from tuber No. 144 in 1906)	36*b*	19.30	3.19	16.53	79
Daughter tuber	13	9.94	2.28	22.93	126
"	13	11.01	2.14	19.43	74
"	14	13.60	2.05	15.07	92
"	14	11.49	2.41	20.97	78
"	14	12.74	2.29	17.97	61
"	15	14.24	2.11	14.81	102
"	15	12.02	2.45	20.38	72
"	16	12.64	2.11	16.69	84
"	16	14.03	2.21	15.75	50
Mother tuber (from tuber No. 155 in 1906)	37*a*	18.80	3.30	17.55	74
Daughter tuber	25	10.57	2.26	21.38	125
"	27	8.47	2.79	32.94	61
Mother tuber (from tuber No. 155 in 1906)	37*c*	21.10	3.17	15.02	67
Daughter tuber	9	12.07	2.18	18.06	71
"	10	11.10	2.50	22.52	60
"	11	9.37	2.56	27.32	56
"	12	11.88	2.05	17.25	52

TABLE XXII—*Concluded.*

HIGH EXTREMES FROM THE HIGH NITROGEN PLOT OF 1907 AND THEIR PROGENY OF 1908.

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight.
Mother tuber (from tuber No. 155 in 1906)	39*a*	17.20	3.14	18.25	99
Daughter tuber	5	10.19	2.35	23.06	72
"	6	10.29	2.79	27.11	85
"	8	10.88	1.87	17.18	80
Mother tuber (from tuber No. 155 in 1906)	39*c*	18.20	2.97	16.32	72
Daughter tuber	37	10.67	2.12	19.86	66
"	38	10.48	2.11	20.13	62
"	39	11.05	2.30	20.81	60
"	40	13.12	2.58	19.66	50
Mother tuber (from tuber No. 155 in 1906)	40*a*	16.90	3.29	19.47	89
Daughter tuber	17	11.98	2.44	20.36	69
"	17	13.88	2.27	16.35	50
"	20	11.24	2.29	20.37	82
"	20	11.59	2.88	24.85	51

TABLE XXIII.

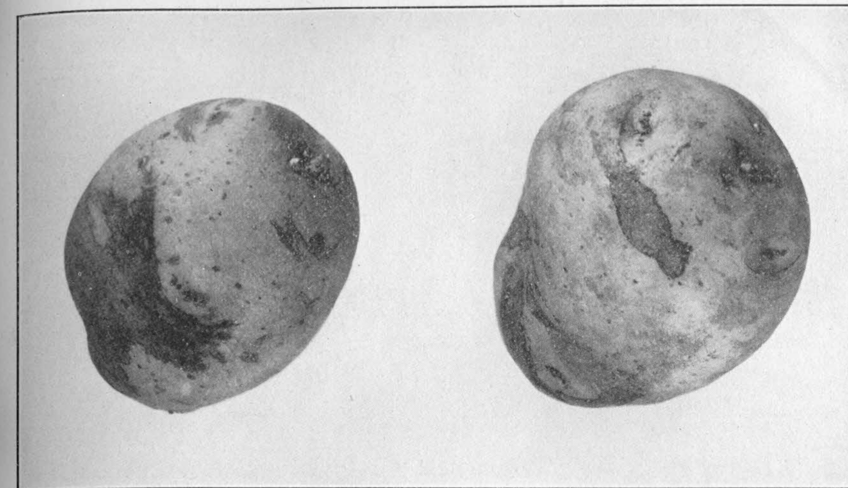
LOW EXTREMES FROM THE LOW NITROGEN PLOT OF 1907 AND THEIR PROGENY OF 1908.

	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight.
Mother tuber (from tuber No. 10 in 1906)	45*a*	19.57	2.03	10.37	77
Daughter tuber	53	10.39	2.38	22.91	70
"	56	12.51	2.81	22.46	88
Mother tuber (from tuber No. 10 in 1906)	47*a*	19.08	1.87	9.80	109
Daughter tubers all too small to analyze.					
Mother tuber (from tuber No. 13 in 1906)	50*c*	21.43	2.02	9.43	88
Daughter tuber	51	13.61	2.36	17.34	64
"	52	12.87	3.13	24.32	120
Mother tuber (from tuber No. 13 in 1906)	52*c*	20.62	1.97	9.55	88
Daughter tubers all too small to analyze.					
Mother tuber (from tuber No. 101 in 1906)	58*c*	18.28	2.06	11.27	105
Daughter tuber	57	14.97	2.43	16.23	121
"	58	16.36	2.70	16.50	56
"	60	11.48	2.74	23.87	116
Mother tuber (from tuber 132 in 1906)	61*a*	19.81	2.14	10.80	114
Daughter tuber	65	12.68	2.61	20.58	69
"	66	10.80	2.41	22.31	153
"	67	12.76	2.66	20.85	113
"	67	13.06	2.77	21.21	71
"	68	11.60	2.58	22.24	85
"	68	11.58	2.57	22.19	57
Mother tuber (from tuber No. 146 in 1906)	68*a*	18.55	2.14	11.53	118
Daughter tubers all too small to analyze.					

TABLE XXIII—*Concluded.*

LOW EXTREMES FROM THE LOW NITROGEN PLOT OF 1907 AND THEIR PROGENY OF 1908.

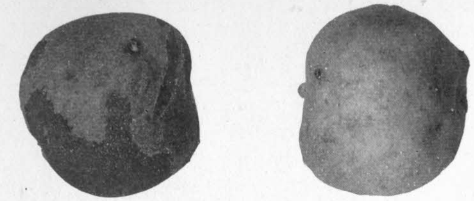
	From Hill No.	Dry Matter.	Nit. Mat. fresh basis.	Nit. Mat. dry basis.	Weight.
Mother tuber (from tuber No. 148 in 1906)	69*a*	19.80	2.08	10.50	168
Daughter tuber	61	13.85	2.49	17.97	77
"	61	13.39	2.33	17.40	59
"	61	12.47	2.92	23.41	60
"	62	13.10	2.70	20.61	101
"	62	14.18	2.95	20.80	81
"	62	12.77	2.32	18.17	66
"	63	12.12	2.43	20.05	167
"	63	11.85	2.69	22.70	126
"	63	13.21	2.01	15.21	69
"	64	14.11	2.03	14.38	71
"	64	13.76	2.41	17.51	76
"	64	15.10	1.82	12.05	69
Mother tuber (from tuber No. 148 in 1906)	69*b*	19.28	2.18	11.30	92
Daughter tuber	74	13.18	2.37	17.98	54
Mother tuber (from tuber No. 157 in 1906)	78*b*	18.79	2.21	11.76	92
Daughter tuber	77	13.04	2.49	19.10	70
"	77	13.13	2.47	18.81	60
"	79	13.15	2.08	15.81	63
"	79	11.93	2.55	21.37	102
"	79	12.32	1.93	15.66	84
"	80	12.61	2.62	20.78	89
"	80	12.42	----	----	109
"	80	13.78	2.25	16.32	103



a. Rector of Woodstock. The only instance known where bud variation has produced color. It is unknown whether mother variety possessed purple sprouts.

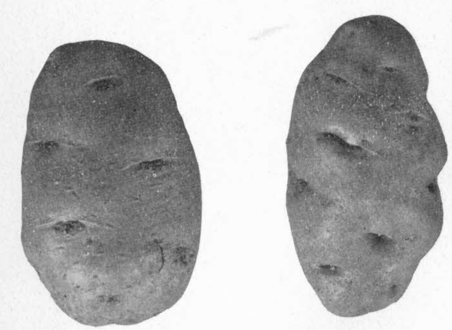
b. La Bretonne. The white-skinned variation at the right was constant.

BUD VARIATION IN COLOR.



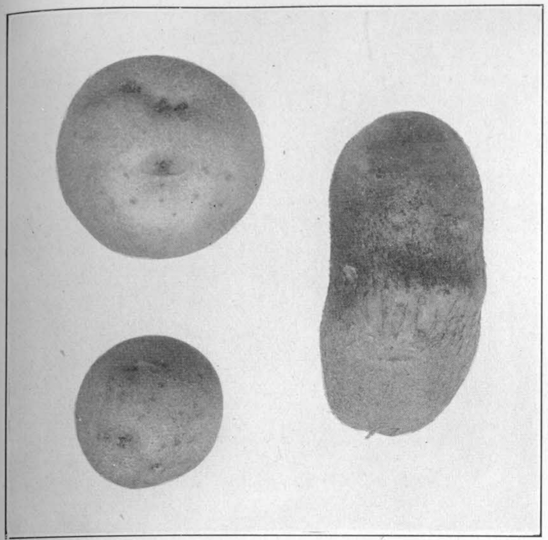
a. Early Sunrise. White variation at the right was constant.

b. Bole Zoegling. White variation at the right was constant. The apparent color in the reproduction is due to the corky layer having been rubbed off in places.

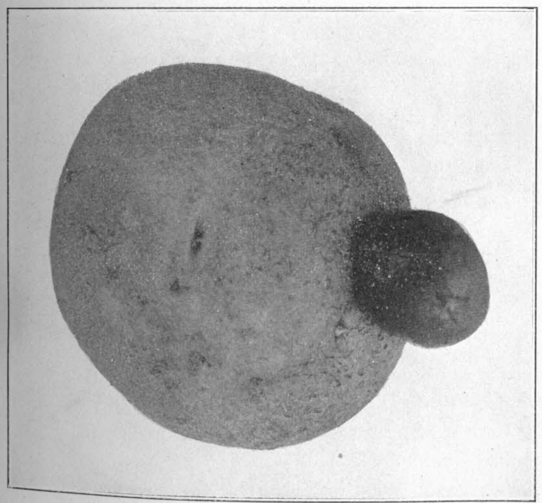


c. Early Ohio. Deep-eyed variation at the right was constant.

BUD VARIATION IN COLOR AND DEPTH OF EYE.



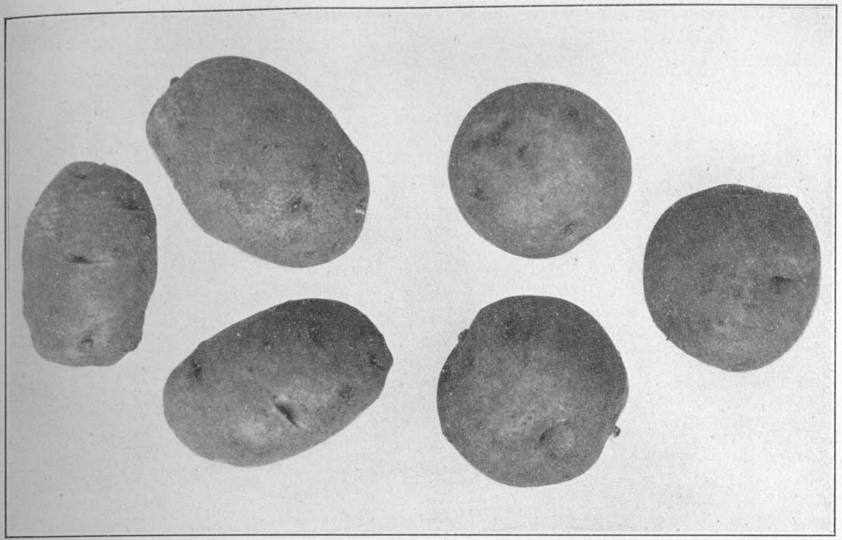
a. Aradaras. Apparent pink variation at right. Not constant.



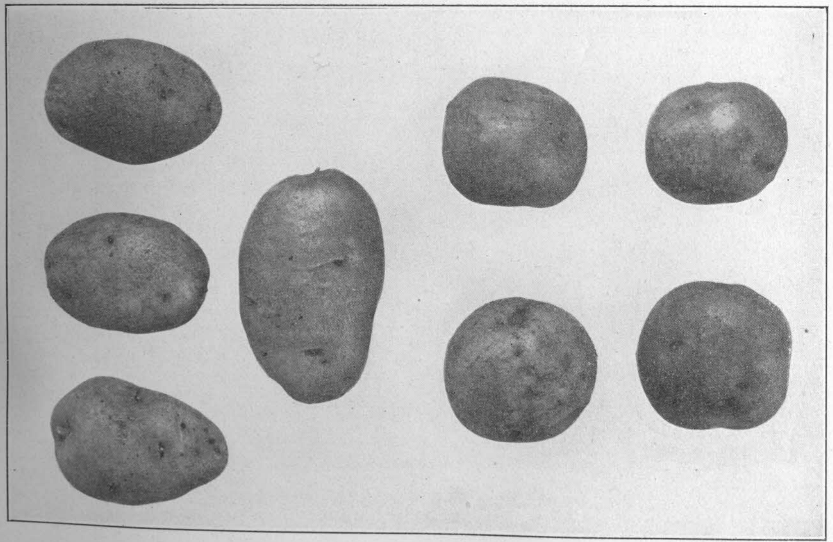
b. Prizetaker. Apparent pink variation at bud end. Not constant.

c. Peculiar variation in habit of tuber formation. Constant.

ODD BUD VARIATIONS.

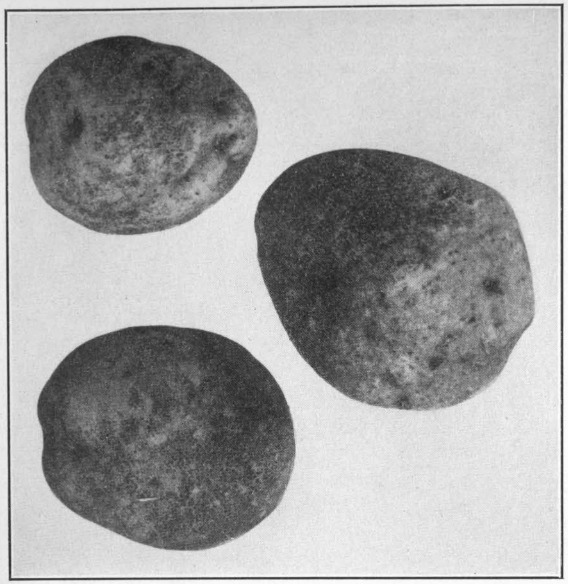


a. Early Ohio. Round variation at the right was constant.

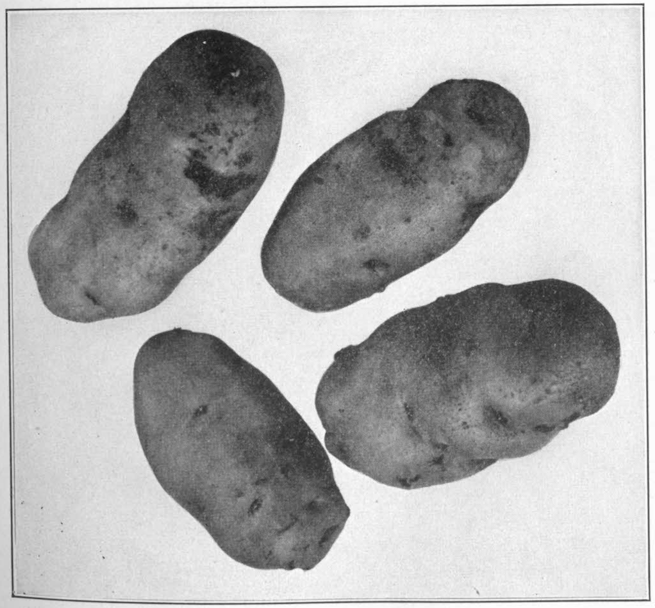


b. Silver Hill. Round variation at the right was constant.

BUD VARIATIONS IN SHAPE.



a. Normal State of Maine.



b. An elongated variation of above. It was evidently due to some attending condition during growth, for it did not reproduce itself.

BUD VARIATIONS NOT INHERITED.

New Haven, December 1, 1909.

To His Excellency, Frank B. Weeks, Governor of Connecticut:

As required by law, this station respectfully submits to you the Fourteenth Report on Food Products for the year ending July 31, 1909, by John Phillips Street.

Respectfully yours,

E. H. Jenkins, *Director.*

PART II.

FOURTEENTH REPORT ON FOOD PRODUCTS AND SECOND REPORT ON DRUG PRODUCTS, 1909.

(Examined during the year ending July 31, 1909.)

BY JOHN PHILLIPS STREET.*

This station is required by law to make examinations of food products and drugs and to report to the dairy commissioner all cases of adulteration which are discovered. Under this law the sampling agent of the station has visited a considerable number of places and has bought a large number of samples which have been examined and all cases of adulteration reported to the dairy commissioner. An account of this work is given in the following pages.

The dairy commissioner and his deputy have sent a large number of samples of vinegar and butter, the sale of which is regulated by special statutes, as well as samples of other foods and drugs, which he is authorized to take under the food law. These are but briefly noticed here, being discussed in the commissioner's report, where account is also given of the results of prosecution under the law.

Lastly, a considerable number of samples of food and drug products have been examined for individuals, which will likewise receive brief mention.

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*The analytical work herein described was done jointly with Messrs. Bailey, Morrison, Brautlecht, Rodman and Roe.

I. FOOD PRODUCTS.

BREAKFAST FOODS.

Forty-eight kinds or brands of cereal breakfast foods have been found on sale in the State and examined here.

Their names and manufacturers are given in Table I and their analyses, weights of packages and prices in Table II.

The results of this work are briefly summarized as follows: In general they show evidence of care and cleanliness in their preparation and are enclosed in attractive cartons which protect them from contamination. In no case has any adulterant or inferior admixture been found and the foods were apparently made from the grains named on the label. The foods are chiefly made from corn, oats, rice, wheat or barley. The whole grain, or a portion of it, freed from most of the chaff, is crushed or ground. In some cases it is cooked more or less, or by suitable ferments a part of the starch is made more soluble, "predigested." Many of the ready cooked cereals have a little added salt.

The weights of the contents of the packages in all but four cases equaled or exceeded the weights stated on the labels. The largest deficiency amounted to more than six per cent. This shortage cannot be explained by the drying of the goods after packing, and if at all common or constant, is too large.

The cost per pound varies greatly. In general, the prices of corn and oat products are lowest, rice next, while wheat and barley cost considerably more than the others. In general, cost bears a much closer relation to the attractiveness of the package than to the probable nutritive value of the contents. But the care taken in the selection of the grain and in its manufacture are of course elements of cost which cannot be determined solely by laboratory tests nor by the purchaser.

In general, ready cooked or "predigested" cereals cost two or three times as much per pound as those not thus treated.

Regarding chemical composition, the oat foods contain much more protein (nitrogenous matter) and fat and have a higher energy value than the other cereal preparations, wheat ranks next as regards protein and fat, followed by barley and corn, but the three are not very unlike in energy value.

Silly reports of the presence of drugs or poisons in certain brands of breakfast food have been investigated repeatedly by others and proved to be false.

It remains to notice the statements on the labels of these foods, which to comply with the national and state laws must be truthful and not misleading.

The following do not, in our opinion, fully comply with the law, or are at least objectionable:

20998. *E-C Corn Flakes Toasted.* "The thorough cooking converts the starch into digestible substances."

Unconverted starch is a perfectly digestible substance and a healthy person can digest it himself quite as safely and conveniently as a factory. This article contains a high percentage of water-soluble carbohydrates, but also 61.31 per cent. of unconverted starch. Only a small portion of the starch has therefore been converted.

21000. *Cook's Flaked Rice.* "Expert's analysis shows that Flaked Rice contains 87 per cent. nutriment, beef 45 per cent., potatoes 21 per cent." "One pound Flaked Rice contains 21 per cent. more life-giving nourishment than a pound of beef and a pound of potatoes combined."

The sample analyzed contained 86.83 per cent. of nutritive matter, substantiating the first clause of the claim. As to composition it should be noted, however, that the nutriment in this food, as in potatoes, consists chiefly of carbohydrates, nearly all of it insoluble starch, while in beef, protein constitutes most of the nourishment. The comparison of foods as to value, without considering the nature of the nourishment in them, is almost as futile as a comparison of punctuality and temperature.

21381. *Milk Rice.* "Nature provided Rice exclusively for human use. It contains in a larger degree the properties of pure, fresh milk than any other grain. Before rice is dried or ripened in the fields the center of each grain is milk."

The term "milk" is sometimes applied to the white juice of certain plants, but never with the idea that there is any resemblance to milk, the food, save in color and consistence. Two of the characteristics of milk are its high fat and its low ash content; the reverse is true of Milk Rice. No grains possess in any marked degree the properties of milk. The statements of the manufacturer are clearly false and misleading.

21020. *Quaker Puffed Rice.* "The wonderful invention of puffing rice cooks the starch granules so thoroughly that Quaker Puffed Rice is very largely a predigested food."

In spite of a large amount of soluble carbohydrates, it still contains 61.76 per cent. of insoluble starch. It is misleading to claim for a partially dextrinized food that it is predigested," because no digestive process has been employed and the changes brought about in the food have little relation to those caused by digestive ferments.

21184. *Holland Rusk.* The words "Made in Holland" appear on the label in large letters under a picture of a typical Dutch windmill; in small and inconspicuous type "Holland, Mich." is designated as the place of manufacture. The label is misleading, and the food is clearly misbranded.

21181. *Force.* "The Natural Food for Creating Power, Repairing Waste, Maintaining Energy." "Force is food, not medicine—food for tired nerves, overworked brains, flabby muscles, weak digestions. . . . A simple preparation of the Whole of the Wheat and Barley Malt, prepared by a process of careful malting and heating Peculiar to Itself. All the nourishing effects of wheat are in it with the tonic effect of malt."

Force contains less water-soluble carbohydrates than most foods of its class. Any real food is for tired nerves, overworked brains, etc. There is nothing in the description of its preparation or its chemical composition to indicate any very peculiar adaptation to the wants of the system.

21034. *Grape-Nuts.* "A Food for Brain and Nerve Centres." "Made by compounding and scientifically baking Wheat, Barley and a small amount of salt and yeast. There are no other ingredients whatsoever in Grape-Nuts." "In the processes the starch of the grains is largely transformed into grape-sugar." "The human system will absorb a greater amount of nourishment from Grape-Nuts than from a like amount of any other known food."

While our analysis shows the presence of a large amount of soluble carbohydrates, 36.34 per cent. of insoluble starch still remains. Exception may well be taken to the claim that Grape-Nuts is distinctly a brain or nerve food. Any real food is also brain food. The claims as to its nutritive power are likewise exaggerated.

21301. *Hornby's Steam Cooked Oat Meal.* "Steam cooking the kernels for several hours, thereby converting the starch into dextrine, then again drying by superheated air, which imparts a delicious flavor while preparing them for ready assimilation. . . . After drying in fire kilns for several hours, the hulls and impurities are removed." "Carbohydrates, 65.05, protein, 17.63, fat 7.38, phosphates, 3.53, water, 6.41."

Our analysis agrees with the claimed composition only in respect to carbohydrates. The figure given for phosphates, even if meant for total mineral matter, is twice as large as shown by analysis. The starch in this food is only slightly converted into dextrin, as it contains 59.23 per cent. of insoluble starch and only 3.69 per cent. of soluble carbohydrates. The statements on the package are not correct.

21686. *Saxon Wheat Food.* "A brain, nerve and muscle food."

Exception must be taken to such a claim for reasons before stated.

20963. *Cream of Wheat.* "Is not only one of the most delicate and delicious breakfast foods ever offered to the public, but in addition containing a very large percentage of gluten, is one of the most healthful and nutritious foods known."

The statement as to gluten is vague and somewhat misleading, as the table shows that it contains no more protein than the average food of its class. Moreover, most of these other wheat preparations contain quite as much nutriment as this.

21377. *Wheatlet.* "Exceptionally rich in the nitrogenous and phosphatic food elements necessary as a sustaining power for mental and physical labor."

Compared with the analyses of the other wheat preparations, it is seen that Wheatlet is not "exceptionally rich" in either of the elements specified.

21095. *Malt Breakfast Food.* "The Choicest Whole Wheat Scientifically Combined with the Best Barley Malt. Rich in Malt, Gluten and Phosphates." "Proteids, 11.63, Carbohydrates, 77.00, Fats, 1.75, Lignin and Cellulose, 0.73, Ash, 1.05, Water, 7.84."

The claimed analysis agrees satisfactorily with our results. It contains slightly more protein than any of the other wheat preparations examined, and is moderately high in ash. It is no richer in phosphates, however, than many of the other breakfast foods. The malting process is very incomplete, for only about 13 per cent. of the protein and 20 per cent. of the starch have been rendered soluble.

20972. *Wheatena.* "The first of all breakfast foods, the best of all breakfast foods."

The enthusiasm of the manufacturer of this food is scarcely justified by the analysis.

21166. *Christian's Laxative Cereal Flakes.* Its claim, as "laxative," is probably based upon the fact that foods made from whole wheat are more laxative than those prepared from the more starchy portions. The examination reveals nothing which could give it more of this effect than other whole wheat meals.

TABLE I. LIST OF BREAKFAST FOODS EXAMINED WITH NAMES OF MANUFACTURERS.

Cerealine. American Hominy Co., Indianapolis.
Christian's Laxative Cereal Flakes. Christian's Natural Food Co., New York.
Cook's Flaked Rice. The American Rice Food & Mf'g. Co., Matawan, N. J.
Cook's Malto Rice. The American Rice Food & Mf'g. Co., Matawan, N. J.
Cream of Wheat. Cream of Wheat Co., Minneapolis.
E-C Corn Flakes Toasted. Egg-O-See Cereal Co., Chicago.
Force. The Force Food Co., Chicago.
F S Granulated Hominy. Quaker Oats Co., Chicago.
Grandmother's Crushed Oats. The Great Atlantic & Pacific Tea Co., New York.
Grandmother's A. & P. Selected Farina. The Great Atlantic & Pacific Tea Co., New York.
Grape Nuts. Postum Cereal Co., Battle Creek, Mich.
Health Brand White Oats. Lewis DeGroff & Son, New York.
Hecker's Farina. Hecker-Jones-Jewell Milling Co., New York.
Holland Rusk. B. Arendshorst & Sons, Holland, Mich.
H. O. New Process Hominy. The H. O. Co., Buffalo.
Hornby's Steam Cooked Oat Meal. The H. O. Co., Buffalo.
Kellogg's Toasted Corn Flakes. Toasted Corn Flake Co., Battle Creek, Mich.
Korn Kinks. The H. O. Co., Buffalo.
Malt Breakfast Food. The Malted Cereals Co., Burlington, Vt.
Mapl-Flake. Hygienic Food Co., Battle Creek, Mich.
Milk Rice. Milkrice Co., Chicago.
Mother's Crushed Oats. The Great Western Cereal Co., Chicago.
Nichols Snow White Samp. Austin, Nichols & Co., New York.

Paw-Nee Rolled Oats. The Pawnee Cereal Co., Cedar Rapids, Iowa.
Pettijohn's Breakfast Food. The American Cereal Co., Chicago.
Pillsbury's Best Cereal. Pillsbury-Washburn Flour Mills, Minneapolis.
Premier Farina. Francis H. Leggett Co., New York.
Premier 15 Minute Oat Flakes. Francis H. Leggett Co., New York.
Post Toasties. Postum Cereal Co., Battle Creek, Mich.
Pure Quaker Oats. The Quaker Oats Co., Chicago.
Quaker Best Yellow Corn Meal. The Quaker Oats Co., Chicago.
Quaker Cracked Wheat. The American Cereal Co., Chicago.
Quaker Puffed Rice. The Quaker Oats Co., Chicago.
Quaker Toasted Corn Flakes. The Quaker Oats Co., Chicago.
Quaker Wheat Berries. The Quaker Oats Co., Chicago.
Ralston Health Food. Ralston Purina Co., St. Louis.
Ralston Hominy Grits. Ralston Purina Co., St. Louis.
Saxon Wheat Food. The American Cereal Co., Chicago.
Scotch Brand Pearled Barley. The Quaker Oats Co., Chicago.
Shredded Whole Wheat. The Shredded Wheat Co., Niagara Falls.
Sovereign 15 Minute Oat Flakes. The Union Pacific Tea Co., New York.
Street Brand Perfection Farina.
Street Brand Perfection Hominy.
Triscuit. The Natural Food Co., Niagara Falls.
Wheatena. The Wheatena Co., New York.
Wheatlet. The Franklin Mills Co., Lockport, N. Y.
White Rose Brand Rolled Oats. Seeman Bros., New York.
Zest. The American Cereal Co., Chicago.

Standards of Composition.

The only standards yet adopted by this station, which can be applied to these foods, are those for corn meal and oatmeal.

"*Corn meal* is meal made from sound maize grain, and contains not more than fourteen (14) per cent. of moisture, not less than one and twelve-hundredths (1.12) per cent. of nitrogen, and not more than one and six-tenths (1.6) per cent. of ash."

"*Oatmeal* is meal made from hulled oats, and contains not more than twelve (12) per cent. of moisture, not more than one and five-tenths (1.5) per cent. of crude fiber, not less than two and twenty-four hundredths (2.24) per cent. of nitrogen, and not more than two and two-tenths (2.2) per cent. of ash."

The analyses show that all the foods of these two classes satisfy the standards in all particulars.

Methods of Analysis.

The methods used were those generally employed for the analysis of cattle foods, with the following additions:

TABLE II.—BREAKFAST FOODS. PRICES, WEIGHTS AND ANALYSES.

Station No.	Brand.	Net weight ounces.	Price in cents. Per package.	Per pound.	Water.	Ether Extract.	Crude Fiber.	Protein (N x 6.25).	Ash.	Nitrogen-Free Extract.	Starch.	Chlorin as Sodium Chlorid.	Water Extract. Total.	Protein.	Ash.	Carbohydrates.
	TO BE COOKED BEFORE USING.															
	Barley Preparation.															
21127	Scotch Pearled Barley	17.8	10	9.0	12.12	0.89	0.26	9.50	0.96	76.27	69.24	----	6.73	1.81	0.78	4.14
	Corn Preparations.															
21258	Nichols' Snow White Samp	30.9	10	5.2	13.39	0.32	0.47	7.75	0.28	77.79	78.24	----	2.55	0.31	0.13	2.11
21298	H. O. New Process Hominy	29.9	10	5.3	11.34	0.32	0.17	8.00	0.35	79.82	74.42	----	2.89	0.31	0.18	2.40
21370	F. S. Granulated Hominy	74.1	25	5.4	13.25	0.96	0.17	8.00	0.42	77.20	75.66	----	3.04	0.69	0.34	2.01
21328	Quaker Yellow Corn Meal	46.4	12	4.1	12.30	0.80	0.16	7.50	0.53	78.71	75.71	----	2.24	0.75	0.34	1 15
21262	Ralston Hominy Grits	29.9	10	5.3	11.28	2.89	0.44	9.00	0.96	75.43	70.93	----	5.31	1.19	0.76	3.36
21281	Street Perfection Hominy	31.0	6	3.1	12.43	1.29	0.14	7.87	0.40	77.87	74.52	----	3.38	0.50	0.30	2.58
	Oat Preparations.															
21400	Health Brand White Oats	32.9	12	5.8	10.92	7.81	0.97	13.75	1.95	64.60	58.78	----	7.63	2.19	0.56	4.88
21125	Grandmother's Crushed Oats	28.1	10	5.7	10.65	6.48	0.59	14.94	1.85	65.49	59.12	----	5.07	1.31	0.67	3.09
21300	Mother's Crushed Oats	24.3	10	6.6	10.85	6.08	0.87	15.62	1.63	64.95	58.39	----	6.86	1.00	0.74	5.12
21301	Hornby's Steam Cooked Oat Meal	28.8	15	8.3	10.58	6.67	0.80	16.12	1.67	64.16	59.23	----	5.79	1.19	0.91	3.69
21240	Premier Fifteen Minute Oat Flakes	24.2	10	6.6	11.34	5.36	0.57	17.12	1.78	63.83	56.59	----	8.76	1.06	1.20	6.50
21189	Paw-Nee Rolled Oats	25.1	10	6.4	10.75	6.65	0.78	15.81	1.91	64.10	59.74	----	6.50	0.81	0.92	4.77
21224	Pure Quaker Oats	24.2	10	6.6	10.83	5.95	0.92	15.94	1.93	64.43	56.70	----	7.14	0.56	0.97	5.61
20942	White Rose Rolled Oats	30.4	12	6.3	10.34	7.96	0.70	14.25	1.87	64.88	59.01	----	8.21	1.81	0.57	5.83
21165	Sovereign Fifteen Min. Oat Flakes	34.3	15	7.0	10.75	5.82	0.92	16.50	2.00	64.01	57.99	----	5.86	1.56	1.06	3.24
	Wheat Preparations.															
21369	Quaker Cracked Wheat	29.9	15	8.0	11.72	2.32	1.65	9.31	1.72	73.28	63.62	----	9.35	3.06	1.29	5.00
21686	Saxon Wheat Food	25.4	15	9.4	9.75	1.68	0.54	12.81	0.77	74.45	69.58	----	5.03	1.06	0.45	3.52
20963	Cream of Wheat	28.7	15	8.4	13.12	0.89	0.15	11.50	0.55	73.79	71.10	----	6.79	2.81	0.31	3.67
21377	Wheatlet	28.7	15	8.4	12.20	1.56	0.30	12.81	0.78	72.35	66.21	----	7.23	2.69	0.58	3.96
21018	Grandmother's A. & P. Farina	16.2	6	5.9	12.92	0.61	0.06	10.75	0.56	75.10	71.72	----	6.76	2.81	0.48	3.67
21019	Hecker's Farina	15.8	10	10.1	12.73	0.74	0.07	10.00	0.57	75.89	71.19	----	6.10	2.75	0.33	3.02
21009	Premier Farina	15.6	10	10.3	14.06	0.89	0.14	11.12	0.54	73.25	70.99	----	8.34	3.06	0.29	4.99
21095	Malt Breakfast Food	30.0	15	8.0	9.56	1.45	1.04	13.75	1.36	72.84	53.49	----	17.00	1.75	1.00	14.25
20996	Pillsbury's Best Cereal	31.8	15	7.6	11.34	0.74	0.11	11.50	0.48	75.83	74.08	----	4.75	1.00	0.20	3.55
21190	Ralston Health Food	29.2	15	8.2	12.36	1.72	1.12	11.87	1.41	71.52	64.41	----	7.87	2.31	1.16	4.40
20997	Street Perfection Farina	16.0	10	10.0	13.07	1.06	0.14	10.25	0.50	74.98	71.10	----	6.34	2.44	0.30	3.60
20972	Wheatena	25.2	15	9.5	10.44	2.78	0.64	11.25	0.70	74.19	69.75	----	6.79	1.19	0.65	4.95
21001	Pettijohn's Breakfast Food	23.0	11	7.6	10.26	1.97	2.00	9.12	1.70	74.95	64.01	----	10.80	1.19	0.87	*8.74
21166	Christian's Laxative Cereal Flakes	21.3	25	18.8	13.04	1.37	1.00	10.37	1.67	72.55	61.20	----	11.42	2.25	1.06	8.11
	READY TO SERVE.															
	Corn Preparations.															
21299	Cerealine	10.4	9	13.8	11.17	0.42	0.04	6.94	1.52	79.91	60.19	0.74	23.06	0.81	1.17	*21.08
20998	E-C Corn Flakes, Toasted	10.3	10	15.5	12.12	0.34	0.17	6.62	2.20	78.55	61.31	1.39	30.50	0.50	2.00	*28.00
21128	Korn Kinks	8.1	5	9.9	11.98	0.42	0.10	7.44	2.16	77.90	66.32	1.11	15.70	0.56	1.68	*13.46
20999	Post Toasties	10.8	10	14.8	11.67	0.26	0.21	6.56	1.78	79.52	53.94	0.96	29.37	0.00	1.52	*27.85
21183	Quaker Toasted Corn Flakes	10.7	8	12.0	11.60	0.38	0.01	6.75	1.30	79.96	68.34	0.51	28.35	0.50	1.28	*26.57
21028	Kellogg's Toasted Corn Flakes	9.7	10	16.5	11.67	0.23	0.16	6.37	2.72	78.85	55.52	1.90	29.17	0.69	2.10	*26.38

* Soluble starch present.

TABLE II.—BREAKFAST FOODS. PRICES, WEIGHTS AND ANALYSES.—*Continued.*

Station No.	Brand.	Net weight ounces.	Price in cents. Per package.	Per pound.	Water.	Ether Extract.	Crude Fiber.	Protein (N x 6.25).	Ash.	Nitrogen-Free Extract.	Starch.	Chlorin as Sodium Chlorid.	Water Extract. Total.	Protein.	Ash.	Carbohydrates.
	Rice Preparations.															
21000	Cook's Flaked Rice	15.1	12	12.7	12.60	0.12	0.22	7.81	0.35	78.90	78.24	----	4.17	0.00	0.15	*4.12
21126	Cook's Malto-Rice	17.2	8	7.4	11.30	0.15	0.07	7.62	0.57	80.29	74.13	----	9.46	0.94	0.21	8.31
21381	Milk Rice	7.7	10	20.8	12.33	0.15	0.24	6.87	3.19	77.22	62.60	2.51	33.70	0.56	2.83	*30.31
21020	Quaker Puffed Rice	7.5	10	21.3	12.22	0.16	0.14	7.56	0.39	79.53	61.76	----	31.92	2.69	0.20	*29.03
	Wheat Preparations.															
21184	Holland Rusk	6.7	10	23.8	10.99	5.14	0.04	12.06	1.31	70.46	55.80	----	16.55	1.06	1.15	14.34
21039	Triscuit	13.0	10	12.3	10.27	1.38	1.74	11.00	1.73	73.88	60.75	----	10.10	1.00	1.03	*8.07
21280	Shredded Whole Wheat	13.4	12	14.3	8.52	1.43	2.57	11.00	1.53	74.95	63.06	----	9.50	1.06	1.10	*7.34
21282	Zest	11.5	9	12.5	10.67	1.21	1.24	9.00	2.59	75.29	60.08	0.36	35.29	1.19	2.05	*32.05
21181	Force	12.9	15	18.6	10.68	1.14	1.14	10.62	2.75	73.67	59.85	0.48	12.79	1.44	1.95	*9.40
21182	Mapl-Flake	11.1	15	21 6	10.82	1.22	1.21	9.25	2.80	74.70	58.28	0.54	16.16	1.19	2.45	*12.52
21096	Quaker Wheat Berries	7.9	10	20.3	9.75	2.00	1.17	14.00	1.40	71.68	57.11	----	23.54	3.00	1.25	*19.29
21191	Quaker Wheat Berries	6.5	10	24.6	10.25	1.86	1.38	13.56	1.40	71.55	48.32	----	29.38	3.19	1.28	*24.91
21034	Grape-Nuts	16.5	12	11.5	10.34	0.63	1.45	11.50	1.85	74.23	36.34	0.13	39.20	1.81	1.37	*36.02

* Soluble Starch present.

Water-Soluble Matter. Weigh 6 gms. of substance into a 200 cc. flask, fill to the mark with water, adding a few drops of chloroform; shake at half-hour intervals for eight hours, then allow to stand for sixteen hours longer. Filter, pipette 100 cc. of filtrate into a tared dish and evaporate to apparent dryness on the water bath. Dry to constant weight in air bath under 90° C. Determine ash in the dried extract in the usual way. In another 100 cc. portion of the filtrate determine the soluble protein, (or protein may be determined in the well-washed residue from the first filtration).

DISCUSSION OF THE ANALYSES.

The average composition of the several groups of breakfast foods, calculated from our analyses, is as follows:

	Water.	Fat.	Fiber.	Protein.	Ash.	Nitrogen-Free Extract.
Ready to serve.						
Corn	11.70	0.34	0.12	6.78	1.75	79.31
Rice	12.11	0.14	0.17	7.47	1.04	79.07
Wheat	10.25	1.78	1.33	11.33	1.82	73.49
To be cooked.						
Barley	12.12	0.89	0.26	9.50	0.96	76.27
Corn	12.33	1.10	0.26	8.02	0.49	77.80
Oat	10.78	6.53	0.79	15.56	1.84	64.50
Wheat	11.90	1.41	0.64	11.17	0.95	73.93

The chief chemical differences are in the content of fat and protein, the corn foods containing the lowest and the oat products the highest percentages, with the wheat products intermediate. The "ready to serve" foods contain more ash because of the salt added for seasoning purposes.

The fuel value of the various groups is shown below, together with the cost of 100 calories in each:

	Calories per lb. of food.	Cost per 100 Calories—Cts.
Ready to serve.		
Corn	1617	0.85
Rice	1617	0.96
Wheat	1654	1.07
To be cooked.		
Barley	1634	0.55
Corn	1645	0.29
Oat	1766	0.37
Wheat	1611	0.58

Except with the oat foods, where a relatively high figure is obtained, the fuel values show only small differences. However, when the cost per 100 calories is considered, the varieties are very large and give useful data as to the relative cost of the foods. Again, it is shown that the "ready to serve" preparations are the more expensive, on the average costing more than twice as much as the other foods. In each class the corn foods are the cheapest per calorie and the wheat foods the most expensive.

The amount of water extract measures quite closely the soluble carbohydrates (sugar, dextrin, etc.) present in the foods. It will be seen from the tables that with few exceptions the foods which require cooking contained relatively small amounts of soluble carbohydrates, an average of 4.53 per cent., compared with 19.95 per cent. in the "ready to serve" foods. These differences are mainly due to the partial conversion of starch into dextrin, either by cooking or by the action of various diastatic ferments or yeasts.

The average percentage of water-soluble substances in the two classes of food is:

	Total Food.	Total Protein.	Total Ash.	Total Nitrogen-Free Extract.
Ready to serve	22.5	12.9	86.5	26.1
To be cooked	6.8	13.4	56.6	6.3

The higher solubility of the "ready to serve" foods is very marked, and chiefly affects the nitrogen-free extract. The higher solubility of the ash has little significance, being due to the addition of salt; and furthermore, the total ash in the foods is low, in no case reaching 3 per cent.

The water-soluble carbohydrates added to the starch (water-insoluble) should nearly equal the total nitrogen-free extract. This is not always the case. The difference is greatest in the "ready to serve" foods, and is chiefly due to the presence of soluble starch, which was not determined separately and is included with the water-soluble carbohydrates. For instance, in Milk Rice, Quaker Puffed Rice and Zest, the sum of the two fractions is 92.91, 90.79 and 92.13, while the total nitrogen-free extract is 77.56, 79.53 and 75.62, respectively. All the foods containing soluble starch are designated by an asterisk in the tables.

The range in weight, selling price and cost per pound of material is shown in the following tabulation:

	Weight of Package. Oz.	Price of Package. Cts.	Cost per Pound. Cts.
Ready to serve.			
Corn	8.1–10.8	5–10	9.9–16.5
Average	10.0	8.7	13.8
Rice	7.5–17.2	8–12	7.4–21.3
Average	11.9	10.0	15.6
Wheat	6.5–13.4	9–15	11.5–24.6
Average	11.1	11.4	17.7
To be cooked.			
Barley	17.8	10.0	9.0
Corn	29.9–74.1	6–25	3.1–5.4
Average	40.4	12.2	4.8
Oat	24.2–34.3	10–15	5.7–8.3
Average	28.0	11.6	6.6
Wheat	15.6–31.8	6–25	5.9–18.8
Average	24.1	13.7	9.3

COFFEE.

Twenty-eight samples of coffee were examined, six unground and twenty-two ground. Four of the ground coffees were sold in bulk, the others in packages, and full weight was given in practically every case.

None of the samples examined was found adulterated.

By comparing this result with the station's first examination of coffee in 1896, the great improvement in the purity of this food is clearly shown. In that year, of forty-four samples of unground coffee examined, eleven, or 25 per cent., were adulterated; in the same year, of sixty-five ground coffees, fifty-eight, or 89 per cent., were adulterated.

Below will be found the brands examined this year:

Unground Coffee.

Bower and Bartlett, Boston. Blue Ribbon Brand.
German American Coffee Co., New York. Iowa Brand.
Edwin J. Gillies & Co., New York. Rising Sun.
The Great Atlantic and Pacific Tea Co., New York. Sultana Brand.
Mrs. Mary McGuire, Torrington. Our Own Blend.
R. W. Parrott, Bridgeport. Yoma Blend.

Ground Coffee.

C. S. Allen, Wallingford. Peep O' Day Brand.
John P. Augur, New Haven. Crescent Mill Pure Ground Tiger.
Alexander H. Bill & Co., Boston. Tudor.

Brown, Thomson & Co., Hartford. Special Blend.
Brownell & Field Co., Providence, R. I. Autocrat.
The F. C. Bushnell Co., New Haven. Golden Star.
Chase & Sanborn, Boston. Seal Brand.
Lewis DeGraff & Son, New York. Health Brand.
B. Fischer & Co., New York. Golden Crown.
Fleming & Cowan, Hartford. Our Favorite.
Frey Bros., Torrington. Our Middlesex Brand.
Chas. G. Lincoln & Co., Hartford. Puritan Boy.
W. J. Madigan, Hartford. Butterfly Brand.
G. H. Miller, New London. My Own Brand.
Miner, Read & Garrette, New Haven. Sunrise Breakfast.
John A. Pilgard, Hartford. Old Glory.
United Drug Co., Boston. Symond's Inn.
Thos. Wood & Co., Boston. Coffee.
In bulk:—East India Tea Co., Bridgeport.
Lawlor & Dwyer, Ansonia.
Standard Tea Co., Hartford.
Thomas T Store, New Haven.

CONDENSED MILK.

Thirty-six samples of condensed milk, representing all the brands of both sweetened and unsweetened milk which could be found on sale in the State, have been examined. The names of the brands and their analyses are given in Tables III and IV. A brief summary of this examination follows:

All the samples bought were in apparently sound condition except Dr. Hand's. The can of this brand was swelled and the contents almost solid. It was therefore rejected and another sample obtained.

The statements of weight of contents, where given on the labels, were correct. From the weight of the net contents of each can and its cost is calculated the cost per pound. The costs of sweetened condensed milk range from 8.9 to 22.7 cents per pound, averaging 12.4. The costs of unsweetened condensed milk range from 9.5 to 16.9 cents, the average being 11.5 cents.

Examination of the table of analyses shows no general relation between the composition or degree of concentration of the milk and its price.

Condensed milk is so much used as a substitute for fresh milk, and even for cream, that the relation of the costs of condensed and fresh milk is important. This comparison can best be made

on the basis of the content of fat, which is the most valuable constituent. The sweetened milk contained from 7.94 to 10.06 per cent. of fat, and averaged 9.36 per cent; the unsweetened from 7.20 to 10.20, with an average of 8.66 per cent. One pound of fat cost $1.33 on the average in both the sweetened and unsweetened milks, the range of cost in the former being from 94 cents to $2.69, and in the latter from $1.09 to $1.87. Assuming that one quart of fresh milk weighs 2.25 pounds, and that it contains 4 per cent. of fat, one pound of fat would cost 66 and 89 cents in milks costing the retail buyer 6 and 8 cents respectively. In other words, fat in condensed milk costs from 1.5 to 2 times as much as fat in fresh milk. This increased cost does not seem unreasonable, especially when the cleanliness of the product and the cost of its manufacture are considered. These calculations, however, apply only to the average cost. In certain brands the cost of fat is excessive. For instance, in two brands the condensed milk costs 22.7 and 21.4 cents per pound, making one pound of fat in these brands cost $2.37 and $2.69 respectively, or about four times as much as it would cost in milk selling at 6 cents per quart, and about three times as much as in milk at 8 cents per quart.

The sweetened milk, with five exceptions, meets the legal requirements. In four samples the percentages of fat in the calculated milk solids were abnormally low, although the percentage of fat in the condensed milk was normal. This merely indicates an inversion of cane sugar during condensation, as is explained below. The fifth sample, Dr. Hand's, is made from low grade or partially skimmed milk.

Unsweetened milk should contain *at least* 7.75 per cent. of fat. Van Camp's contained only 7.20 per cent., and Wilson's and Libby's were but slightly above the minimum, and all three contained considerably less milk solids than the standard requires.

The discussion on the following pages shows that if the directions for use given on the labels are followed, the resulting mixtures will contain, in all but one case, only about half as much solids or fat as good cow's milk.

Attention is also called to the composition of human milk at different periods with the prescriptions given for making substitutes by diluting condensed milk, which shows that these

TABLE III.—ANALYSES OF SWEETENED CONDENSED MILK.

Station No.	Brand.	Price per can, cents.	Weight of contents. Found oz.	Weight of contents. Claimed oz.
21374	*Baby Brand. Borden's Condensed Milk Co., New York	18	12.7	----
20964	Challenge Brand. Borden's Condensed Milk Co., New York	10	12.6	----
21241	Dairy Brand. Borden's Condensed Milk Co., New York	10	14.9	----
21854	Daisy Brand. Borden's Condensed Milk Co., New York	13	15.6	----
21069	Defiance Brand. Borden's Condensed Milk Co., New York	10	12.7	----
21675	Eagle Brand. Borden's Condensed Milk Co., New York	15	15.9	----
21341	Full Weight Brand. Borden's Condensed Milk Co., New York	12	15.6	----
21007	*Magnolia Brand. Borden's Condensed Milk Co., New York	10	14.4	----
21171	Pine Tree Brand. Borden's Condensed Milk Co., New York	9	14.6	----
21097	Thistle Brand. Borden's Condensed Milk Co., New York	10	13.1	----
21263	Tip Top Brand. Borden's Condensed Milk Co., New York	12	14.9	----
21283	*Champlain Brand. Champlain Condensed Milk Co., Richmond, Vt.	10	14.8	----
21052	Emery. Emery Food Co., Chicago	10	11.4	11
21654	†Dr. Hands' C. M. with Phosphates and Hypophosphites. The Dr. Hand Condensed Milk Co., Scranton, Pa.	18	13.4	----
21284	*Gilead. M. B. & F. S. Hubbell, New Haven	8	14.4	----
21375	Star Brand. Michigan Condensed Milk Co., New York	10	14.7	----
21011	Sweet Clover Brand. Mohawk Condensed Milk Co., Rochester, N. Y.	10	14.8	----
21852	Sweet Clover Brand. Mohawk Condensed Milk Co., Rochester, N. Y.	10	14.6	----
20967	Grandmother's A. & P. Northern Condensed Milk Co., Philadelphia	9	13.5	----
20995	Ruby Brand. The Vermont Condensed Milk Co., Richmond, Vt.	10	13.2	----
21866	*Silver Chord. The Vermont Condensed Milk Co., Richmond, Vt.	8	14.4	----
21098	Vermont Brand. The Vermont Condensed Milk Co, Richmond, Vt.	10	14.8	----
21853	Vermont Brand. The Vermont Condensed Milk Co., Richmond, Vt	10	14.8	----
21635	Vermont Brand. The Vermont Condensed Milk Co., Richmond, Vt.	10	14.9	----
21035	Pride of Wayne Brand. Wayne County Condensed Milk Co., Ontario Center, N. Y.	9	13.4	----

*Addition of cane sugar not stated on the label.
†Duplicate sample from G. C. Hamilton, Bridgeport, received in spoiled condition.

dilutions supply very much less of the essential food ingredients than mother's milk, while nearly two-thirds of the nutritive matter may consist of cane sugar.

DISCUSSION OF THE ANALYSES.

The following standards have been adopted for condensed milk:

TABLE III.—ANALYSES OF SWEETENED CONDENSED MILK—*Continued.*

Station No.	In Material as sold. Water.	Total Solids.	Cane Sugar.	Milk Solids.	Ash.	Protein (Nx6.38.)	Milk Sugar.	Fat.	In Milk Solids. Ash.	Protein.	Milk Sugar.	Fat.
21374	27.62	72.38	40.61	31.77	1.73	7.91	12.53	9.60	5.44	24.90	39.44	30.22
20964	31.32	68.68	29.22	39.46	1.82	8.10	20.24	9.30	4.61	20.53	51.29	23.57
21241	25.22	74.78	43.42	31.36	1.60	8.10	12.08	9.58	5.10	25.83	38.52	30.55
21854	26.28	73.72	43.45	30.27	1.50	8.17	11.50	9.10	4.96	26.99	37.99	30.06
21069	26.13	73.87	40.91	32.96	1.73	8.47	13.13	9.63	5.25	25.70	39.83	29.22
21675	24.87	75.13	44.03	31.10	1.86	8.04	11.95	9.25	5.98	25.85	38.43	29.74
21341	23.85	76.15	41.00	35.15	1.95	8.80	14.95	9.45	5.55	25.04	42.53	26.88
21007	23.81	76.19	42.11	34.08	1.76	8.80	13.66	9.86	5.16	25.82	40.09	28.93
21171	29.89	70.11	32.97	37.14	1.64	7.98	18.50	9.02	4.42	21.49	49.80	24.29
21097	25.16	74.84	41.12	33.72	1.86	8.10	13.70	10.06	5.52	24.02	40.63	29.83
21263	25.08	74.92	39.94	34.98	1.88	8.29	15.24	9.57	5.37	23.70	43.57	27.36
21283	29.30	70.70	39.11	31.59	1.71	7.85	12.43	9.60	5.41	24.85	39.35	30.39
21052	28.89	71.11	39.23	31.88	1.54	8.61	12.84	8.89	4.83	27.01	40.27	27.89
21654	29.75	70.25	35.34	34.91	1.99	8.43	16.55	7.94	5.70	24.15	47.41	22.74
21284	30.21	69.79	36.75	33.04	1.62	8.10	14.14	9.18	4.90	24.52	42.80	27.78
21375	25.79	74.21	42.36	31.85	1.78	8.49	12.59	8.99	5.59	26.66	39.52	28.23
21011	24.29	75.71	42.97	32.74	1.79	8.74	12.26	9.95	5.47	26.70	37.44	30.39
21852	24.73	75.27	44.05	31.22	1.59	8.42	11.82	9.39	5.09	26.97	37.86	30.08
20967	28.84	71.16	29.64	41.52	1.75	7.91	22.85	9.01	4.21	19.05	55.04	21.70
20995	26.58	73.42	40.68	32.74	1.65	8.23	12.82	10.04	5.04	25.14	39.15	30.67
21866	25.46	74.54	42.33	32.21	1.91	8.49	12.30	9.51	5.93	26.36	38.19	29.52
21098	25.90	74.10	40.97	33.13	1.71	8.36	13.80	9.26	5.16	25.23	41.66	27.95
21853	25.41	74.59	43.56	31.03	1.62	8.23	11.57	9.61	5.22	26.52	37.29	30.97
21635	28.17	71.83	40.54	31.29	1.70	8.43	11.28	9.88	5.43	26.94	36.05	31.58
21035	24.52	75.48	44.83	30.65	1.63	8.36	12.29	8.37	5.32	27.28	40.09	27.31

"*Condensed milk, evaporated milk,* is milk from which a considerable portion of water has been evaporated, and contains not less than twenty-eight (28) per cent. of milk solids, of which not less than twenty-seven and sixty-six hundredths (27.66) per cent. is milk fat."

"*Sweetened condensed milk* is milk from which a considerable portion of water has been evaporated and to which sugar (sucrose) has been added, and contains not less than twenty-eight (28) per cent. of milk solids, of which not less than twenty-seven and sixty-six hundredths (27.66) per cent. is milk fat."

TABLE IV.—ANALYSES OF UNSWEETENED CONDENSED MILK.

Station No.	Brand.	Price per can, cts.
21269	Peerless Brand. Borden's Condensed Milk Co., New York	10
21674	Highland Brand. Helvetia Milk Condensing Co., Highland, Ill.	13
21261	Our Pet Brand. Helvetia Milk Condensing Co., Highland, Ill.	10
21150	Wilson's Indiana Condensed Milk Co., Sheridan, Ind.	10
20966	A. & P. Brand. St. Charles Condensing Co., St. Charles, Ill.	10
20965	St. Charles. St. Charles Condensing Co., St. Charles, Ill.	9
20971	Van Camp's. The Van Camp Packing Co., Indianapolis, Ind.	10
21215	Blue Label Brand. Wayne County Condensed Milk Co., Rochester, N. Y.	10
21935	Hylac Brand. The Federal Packing Co., New York	5
22057	Libby's. Libby, McNeill & Libby, Chicago	10
22061	Silver Cow. St. Charles Condensing Co., St. Charles, Ill.	10

The methods of analysis used are given in detail on page 191.

In 1904 this station examined twenty-eight samples of sweetened, and in 1906, eight samples of unsweetened condensed milk. For comparison the averages of those analyses are brought together with those secured this year in the following table:

TABLE V.

AVERAGES.	SWEETENED. 1904. (28 Samples)	SWEETENED. 1909. (25 Samples)	UNSWEETENED. 1906. (8 Samples)	UNSWEETENED. 1909. (11 Samples)
Net weight, oz.	14.0	14.2	11.6	13.9
Cost per can, cents	10.3	10.8	8.5	9.7
Cost per pound, cents	11.8	12.3	11.7	11.5
In original material.				
Water	26.08	26.68	71.85	71.87
Total solids	73.92	73.32	28.15	28.13
Cane sugar	40.32	40.05	.....	.....
Milk solids	33.60	33.27	28.15	28.13
Ash	1.90	1.73	1.68	1.55
Protein	8.77	8.30	7.75	7.57
Milk sugar	14.07	13.88	11.03	10.34
Fat	8.86	9.36	7.69	8.67
In the milk solids.				
Ash	5.68	5.23	5.97	5.51
Protein	26.17	25.09	27.53	26.91
Milk sugar	41.76	41.37	39.18	36.76
Fat	26.39	28.31	27.32	30.82

TABLE IV.—ANALYSES OF UNSWEETENED CONDENSED MILK—*Continued.*

Station No.	Weight of Contents.		In Material as sold.						In Milk Solids.			
	Found oz.	Claimed oz.	Water.	Total Solids.	Ash.	Protein (Nx6.38).	Milk Sugar.	Fat.	Ash.	Protein.	Milk Sugar.	Fat.
21269	15.9	----	69.21	30.79	1.71	8.36	11.45	9.27	5.55	27.15	37.19	30.11
21674	12.4	12	70.60	29.40	1.60	7.85	10.95	9.00	5.44	26.70	37.25	30.61
21261	12.5	12	71.62	28.38	1.63	7.08	10.71	8.96	5.74	24.95	37.74	31.57
21150	15.7	16	75.27	24.73	1.53	6.70	8.75	7.75	6.19	27.09	35.38	31.34
20966	11.9	----	71.54	28.46	1.43	7.66	10.80	8.57	5.02	26.91	37.96	30.11
20965	12.0	----	71.58	28.42	1.34	7.66	10.55	8.87	4.71	26.95	37.13	31.21
20971	16.9	16	74.85	25.15	1.29	6.89	9.77	7.20	5.13	27.39	38.85	28.63
21215	15.8	----	70.98	29.02	1.57	7.53	10.93	8.99	5.41	25.95	37.66	30.98
21935	6.5	----	70.13	29.87	1.70	8.17	9.80	10.20	5.69	27.35	32.81	34.15
22057	16.8	16	74.08	25.92	1.50	7.15	9.39	7.88	5.79	27.58	36.23	30.40
22061	16.5	----	70.86	29.14	1.72	8.17	10.63	8.62	5.90	28.04	36.48	29.58

This comparison shows that the manufacturers are now supplying about the same amount of sweetened milk in their packages as in 1904 at an increased cost of 0.5 cent. They are also supplying about 20 per cent. more unsweetened milk per can at an increased cost of 1.2 cents, so that the cost per pound of the condensed milk is slightly lower than in 1906. The composition of the samples analyzed in 1904 is quite like that of those examined this year, except in fat content, which is higher this year by 0.5 per cent. in the sweetened milk, and nearly 1 per cent. higher in the unsweetened milk. The milk solids are about the same, but the fat in these solids increases by 1.92 per cent. in the sweetened, and by 3.50 per cent. in the unsweetened. These figures indicate that the average condensed milk sold in the Connecticut market is of distinctly higher quality than it was five years ago. The ratio of protein to fat is a useful indication of the quality of the original milk used, a whole milk of good quality usually showing considerable more fat than protein. The above tabulation shows that this ratio has increased from 1.01 to 1.13 in the sweetened milk, and from 0.99 to 1.15 in the unsweetened.

The standards for both kinds of condensed milk require that it shall contain not less than 28 per cent. of milk solids, of which not less than 27.66 per cent. is milk fat. The required percentage of milk solids is based on the analysis of a large number of samples of condensed milk, and the percentage of milk fat in those solids is derived from the Government standard for milk, *viz.*, 3.25 per cent. of fat and 11.75 per cent. total solids. Such milk is by no means a high-grade milk, and there can be no difficulty in maintaining the required proportion of fat, provided the manufacturer uses only whole milk in his factory. This fact is clearly shown by the following tabulation, in which are given the analyses of typical milk from the United States,

TABLE VI.—AVERAGE COMPOSITION OF COW'S MILK.

Authority.	Total Solids.	Fat.	Solids not Fat.	Per Cent. of Fat in Solids.
English (Richmond, 1906)	12.70	3.73	8.97	29.37
" (Richmond, 1907)	12.64	3.71	8.93	29.35
" (Richmond, 1908)	12.69	3.75	8.94	29.56
" (Vieth)	12.90	4.10	8.80	31.78
Canadian (McGill)	12.62	3.80	8.82	30.11
German (Koenig)	12.83	3.69	9.14	28.76
German (Fleischmann)	12.25	3.40	8.85	27.25
Dutch (Fleischmann)	12.00	3.25	8.75	27.08
American (Van Slyke)	12.90	3.90	9.00	30.23
" (Van Slyke, cheese factory)	12.60	3.75	8.85	29.76
" (Voorhees, Ayrshire)	12.70	3.68	9.02	29.05
" (Voorhees, Guernsey)	14.48	5.02	9.46	34.66
" (Voorhees, Holstein)	12.12	3.51	8.61	28.96
" (Voorhees, Jersey)	14.34	4.78	9.56	33.33
" (Voorhees, Shorthorn)	12.45	3.65	8.80	29.32

Canada and several European countries. In every case they represent the average of a large number of analyses.

With the exception of Fleischmann's analyses of typical low-grade German and Dutch milks, these analyses, representing about 200,000 samples of milk, show that a requirement of 27.66 per cent. of fat in the solids is considerably lower than that found in average milk. Voorhees' analyses of the milk of pure bred cows show that the fat ratio increases with the high fat content of Guernsey and Jersey milk, in the latter reaching 34.66 per cent. Van Slyke's figures represent a compilation of the analyses of 5,552 samples of American milk, and probably reflect more accurately the true market conditions in this country. In these the fat makes up 30.23 per cent. of the solids.

It will be seen from our tables of analyses that the fat in the milk solids in the unsweetened condensed milk ranged from 28.63 to 34.15 per cent., with an average of 30.82 per cent., while in the sweetened milk it ranged from 21.70 to 31.58 per

cent., with an average of 28.31 per cent. The unsweetened milks in every case exceeded the standard requirement in this respect, while the average agreed very closely with Van Slyke's figures. In the sweetened milk, however, we find four samples showing only 23.57, 24.29, 22.74 and 21.70 per cent. of fat in the milk solids, and yet their fat content is 9.30, 9.02, 7.94 and 9.01, respectively, all except the third, indicating condensed milk of good quality. It will be noted, also, that these same four samples have abnormally high percentages of lactose, 20.24, 18.50, 16.55 and 22.85 per cent., respectively, and that the milk solids are correspondingly high and the cane sugar correspondingly low. This is no doubt due to a partial inversion of the cane sugar during condensation, so that the method used for determining lactose in the finished product gives the sum of the lactose and of the invert sugar calculated as lactose. It is quite possible that inversion of cane sugar in all samples may increase the calculated amount of lactose and hence diminish the ratio of fat solids.

Omitting these four samples, the average for sweetened milk is 32.32 per cent. milk solids, 9.47 per cent. fat and 29.31 per cent. of fat in the milk solids. Assuming this average of 32.32 per cent. for the milk solids of the four brands in question, the percentages of fat in the milk solids would be 28.77, 27.91, 24.57 and 27.88 respectively, all reaching the standard satisfactorily with the exception of the third, which appears to have been manufactured from a low-grade milk.

The standard requires a minimum of 7.75 per cent of fat ($28 \times 27.66 = 7.75$). In the sweetened milks the fat ranged from 7.94 to 10.06, with an average of 9.36 per cent.; in the unsweetened from 7.20 to 10.20, with an average of 8.67 per cent. All the sweetened milks satisfied this standard, only one, Dr. Hand's, closely approaching the minimum. In the unsweetened milks, Van Camp's contained only 7.20 per cent. of fat, Wilson's exactly equaled the minimum, 7.75 per cent., and Libby's contained only 7.88 per cent., slightly above the minimum. These three samples were likewise deficient in milk solids, containing 24.73, 25.15 and 25.92 per cent. respectively.

Degree of Condensation.

The composition of a condensed milk depends not only upon the quality of the milk condensed, but also on the amount of this condensation. In sweetened condensed milk the concentration is carried much further than in the unsweetened variety. It is important to determine the degree of condensation, as thereby a good idea may be obtained as to the composition of the original milk. The calculation of this factor is a comparatively easy matter in the case of unsweetened milk, for here we are dealing with the normal constituents of milk, and, excepting water, in normal proportions. In sweetened milk, however, containing varying amounts of cane sugar, the whole relation of the constituent solids is changed and the problem is much more complicated.

Various methods of calculation have been devised for this purpose, which give approximately correct results. The amount of ash is very constant in milks of widely different origin, seldom varying much from 0.7 per cent. Accordingly, if the percentage of ash found in an unsweetened condensed milk be divided by 0.7, the quotient represents quite accurately the degree of condensation. This method is also applicable to sweetened milks, although here, of course, it is necessary to reduce the ash to a cane-sugar-free basis before making the division.

The amount of solids-not-fat also is a comparatively constant factor in milk, especially in the milk of the average American herd. As a rule, however, the solids-not-fat increases somewhat with the solids and the fat. For instance, Voorhees' figures on page 182, for pure-bred cows, show a variation from 8.61 for Holsteins to 9.56 for Jerseys. Authorities differ, therefore, on the proper figure to assume for solids-not-fat. The Federal standard, and that of several of the states, requires 8.5 per cent., and that being the standard, would be a reasonable factor to apply. Others have suggested 8.9 per cent. as representing average American milk; while still others suggest 9.3 per cent., as being the highest figure likely to be shown by the milk of mixed herds, and therefore giving the manufacturer the benefit of every doubt. The writer suggests still another method, based on the percentage of lactose. The analyses made by Voorhees of the milk of pure-bred Ayrshire, Guernsey, Holstein, Jersey and Shorthorn cows show a remarkable constancy in this ingredient, the averages being 4.84, 4.80, 4.69, 4.85 and 4.80, respectively. Accordingly, the factor 4.8 for lactose has been applied to

TABLE VII. DEGREE OF CONDENSATION.

Sweetened.

Brand.	Times Condensed. Calculation based on				Calculated Fat in Original Milk.				Ratio Protein to fat 1:
	.7 per cent. Ash	8.5 per cent. Solids not fat	8.9 per cent. Solids not fat	9.3 per cent. Solids not fat	.7 per cent. Ash	8.5 per cent. Solids not fat	8.9 per cent. Solids. not fat	9.3 per cent. Solids not fat	
Baby	4.16	4.39	4.19	4.01	3.88	3.68	3.85	4.03	1.21
*Challenge	3.67	5.01	4.78	4.58	3.58	2.62	2.74	2.87	1.14
Dairy	4.04	4.53	4.33	4.14	4.19	3.74	3.92	4.09	1.18
Daisy	3.79	4.40	4.20	4.03	4.25	3.66	3.83	3.99	1.11
Defiance	4.19	4.64	4.43	4.25	3.89	3.52	3.69	3.84	1.14
Eagle	4.74	4.59	4.38	4.20	3.49	3.60	3.77	3.94	1.15
Full Weight	4.73	5.12	4.89	4.68	3.39	3.13	3.28	3.42	1.08
Magnolia	4.34	4.92	4.70	4.50	3.92	3.46	3.62	3.79	1.12
*Pine Tree	3.50	4.94	4.72	4.51	3.85	2.72	2.85	2.98	1.13
Thistle	4.51	4.73	4.52	4.32	3.79	3.61	3.78	3.96	1.24
Tip Top	4.47	4.98	4.76	4.55	3.56	3.20	3.35	3.40	1.15
Champlain	4.01	4.25	4.06	3.88	3.93	3.71	3.88	4.06	1.22
Emery	3.61	4.45	4.25	4.07	4.05	3.29	3.44	3.59	1.03
Dr. Hand's	4.40	4.91	4.69	4.48	2.79	2.50	2.62	2.74	0.94
Gilead	3.46	4.19	4.00	3.83	3.96	3.27	3.42	3.58	1.13
Star	4.41	4.66	4.45	4.26	3.54	3.35	3.51	3.66	1.05
Sweet Clover	4.49	4.70	4.49	4.30	3.89	3.71	3.88	4.05	1.14
" "	4.06	4.59	4.38	4.20	4.13	3.66	3.83	4.00	1.12
*Grandmother's	3.56	5.44	5.20	4.97	3.60	2.35	2.46	2.58	1.14
Ruby	3.97	4.50	4.30	4.12	4.21	3.76	3.94	4.11	1.22
Silver Chord	4.73	4.63	4.42	4.23	3.49	3.56	3.73	3.90	1.12
Vermont	4.14	4.76	4.55	4.35	3.79	3.30	3.46	3.61	1.11
"	4.10	4.47	4.27	4.08	4.15	3.81	3.99	4.17	1.17
"	4.09	4.24	4.05	3.87	4.06	3.92	4.10	4.29	1.17
Pride of Wayne	4.23	4.75	4.54	4.34	3.59	3.19	3.34	3.50	1.00
Average	**4.23**	**4.61**	**4.40**	**4.21**	**3.82**	**3.48**	**3.65**	**3.80**	**1.13**

*Omitted from average for reasons stated on page 183.

TABLE VIII. DEGREE OF CONDENSATION.

Unsweetened.

Brand.	Times Condensed. Calculation Based on					Calculated Fat in Original Milk.					Ratio Protein to fat 1:
	.7 per cent. Ash	8.5 per cent. Solids not fat	8.9 per cent. Solids not fat	9.3 per cent. Solids not fat	4.8 per cent. Milk Sugar	.7 per cent. Ash	8.5 per cent. Solids not fat	8.9 per cent. Solids not fat	9.3 per cent. Solids not fat	4.8 per cent. Milk Sugar	
Peerless	2.44	2.52	2.41	2.31	2.39	3.80	3.68	3.85	4.01	3.88	1.11
Highland	2.29	2.40	2.29	2.19	2.28	3.93	3.75	3.93	4.11	3.95	1.15
Our Pet	2.33	2.28	2.18	2.09	2.23	3.85	3.93	4.11	4.29	4.02	1.27
Wilson's	2.19	2.00	1.91	1.83	1.82	3.54	3.88	4.06	4.23	4.26	1.16
A. and P.	2.04	2.34	2.23	2.14	2.25	4.20	3.66	3.84	4.00	3.81	1.12
St. Charles	1.91	2.30	2.20	2.10	2.20	4.64	3.86	4.03	4.22	4.03	1.16
Van Camp's	1.84	2.11	2.02	1.93	2.04	3.91	3.41	3.56	3.73	3.53	1.05
Blue Label	2.24	2.36	2.25	2.15	2.28	4.01	3.81	3.99	4.18	3.94	1.19
Hylac	2.43	2.31	2.21	2.12	2.04	4.20	4.42	4.62	4.81	5.00	1.25
Libby's	2.14	2.12	2.02	1.94	1.96	3.68	3.72	3.90	4.06	4.07	1.10
Silver Cow	2.46	2.41	2.30	2.21	2.21	3.50	3.58	3.75	3.90	3.90	1.06
Average	**2.21**	**2.29**	**2.18**	**2.09**	**2.15**	**3.93**	**3.79**	**3.97**	**4.13**	**4.04**	**1.15**

the unsweetened milks analyzed; it is not applicable to the sweetened milks with our present methods of analysis.

These methods have been employed in computing Tables VII and VIII, and a useful comparison is thereby furnished.

For the reasons already stated (see page 183), the Challenge, Pine Tree and Grandmother's brands are omitted in this consideration. The table shows the wide variations arising from the different methods of calculation in the sweetened milk. These are summarized as follows:

SWEETENED MILK.

TIMES CONDENSED.

Calculation based on		
0.7% ash	3.46–4.74	Ave. 4.23
8.5% solids-not-fat	4.19–5.12	" 4.61
8.9% " " "	4.00–4.89	" 4.40
9.3% " " "	3.83–4.68	" 4.21

FAT IN ORIGINAL MILK.

Calculation based on		
0.7% ash	2.79–4.25	" 3.82
8.5% solids-not-fat	2.50–3.92	" 3.48
8.9% " " "	2.62–4.10	" 3.65
9.3% " " "	2.74–4.29	" 3.80

The closest agreement is shown between the 0.7 per cent. ash basis and 9.3 per cent. solids-not-fat. However, as the latter figure is applicable only to the highest grade of milk, which is probably seldom used in condensaries, it would appear that the ash basis also gives too high a degree of condensation in sweetened milks. On the whole, the basis of 8.9 per cent. of solids-not-fat seems to supply the fairest data whereby to judge the quality of a milk. Whatever basis is used, the Dr. Hand brand is shown to be made from a milk of poor quality, probably skimmed, the fat in the original milk, calculated by the four methods, being 2.79, 2.50, 2.62 and 2.74 per cent., respectively. In the other brands none of the methods of calculation used indicates the use of a milk below the standard quality (3.25 per cent. of fat), except in three cases, where one of the methods gives figures slightly below the standard.

With the unsweetened milks any of the methods gives satisfactory results. The variations are much smaller and the averages are remarkably close, as the following tabulation shows:

UNSWEETENED MILK.

TIMES CONDENSED.

Calculations based on		
0.7% ash	1.84–2.46	Ave. 2.21
8.5% solids-not-fat	2.11–2.52	" 2.29
8.9% " " "	1.91–2.41	" 2.18
9.3% " " "	1.83–2.31	" 2.09
4.8% milk sugar	1.82–2.39	" 2.15

FAT IN ORIGINAL MILK.

Calculation based on		
0.7% ash	3.50–4.64	" 3.93
8.5% solids-not-fat	3.41–4.42	" 3.79
8.9% " " "	3.56–4.62	" 3.97
9.3% " " "	3.73–4.81	" 4.13
4.8% milk sugar	3.53–5.00	" 4.04

Here again the 9.3 per cent. solids-not-fat gives apparently high results, and the 8.9 per cent. seems to afford the most satisfactory working basis for comparison. All the milk used in the unsweetened brands was above the standard quality.

The Uses and Applications of Condensed Milk.

The labels of most of the brands of condensed milk give directions for its use as a drink, alone or with tea or coffee, as a cooking adjunct, or as a food for infants. It is interesting and important to know just what sort of a product will be supplied by following these directions. Table IX has been calculated from the actual analyses to show the mixture obtained for general use when prepared exactly as directed on the label. In the case of alternative proportions of water, *i. e.*, 3 or 4 parts to 1 of milk, the average, in this case, 3.5, has always been taken. No directions were given with seven brands of the sweetened and with six brands of the unsweetened, so they are of course omitted from this tabulation. Of the sweetened milks, the Emery brand is the only one that would yield, according to directions, a milk containing normal quantities of milk solids and fat, and even this would contain a great excess of cane sugar. The other sweetened milks would yield products containing from 5.5 to 8.8 per cent. of milk solids, and from 1.5 to 2.2 per cent. of fat; in other words, a mixture only a little over half as rich as milk of good quality. None of the brands can be diluted with more than 1.5 parts of water to one of milk and yield a product which equals fresh milk in fat content.

In the unsweetened milks, the Blue Label brand alone yields a product approaching good milk in richness. A dilution of 1 part of milk with 3 parts of water can yield a milk of standard composition in none of the unsweetened milks.

TABLE IX.—COMPOSITION OF MIXTURES OF CONDENSED MILK AND WATER PREPARED AS DIRECTED FOR GENERAL USE.

Station No.	Brand.	Proportion of Milk to Water.	Water.	Milk Solids.	Cane Sugar.	Ash.	Protein.	Milk Sugar.	Fat.
	Sweetened.								
20964	Challenge	1 to 3 or 4.	84.7	8.8	6.5	0.4	1.8	4.5	2.1
21241	Dairy	1 to 3 or 4.	83.4	7.0	9.6	0.4	1.8	2.7	2.1
21854	Daisy	1 to 4 or 5.	86.6	5.5	7.9	0.3	1.5	2.0	1.7
21069	Defiance	1 to 3 or 4.	83.6	7.3	9.1	0.4	1.9	2.9	2.1
21341	Full Weight	1 to 3 or 4.	83.1	7 8	9.1	0.4	2.0	3.3	2.1
21007	Magnolia	1 to 3 or 4.	83.1	7.5	9.4	0.4	1.9	3.0	2.2
21171	Pine Tree	1 to 4 or 5.	87.2	6.8	6.0	0.3	1.5	3.4	1.6
21097	Thistle	1 to 3 or 4.	82.4	7.5	9.1	0.4	1.8	3.1	2.2
21263	Tip Top	1 to 3 or 4.	83.4	7.7	8.9	0.4	1.8	3.4	2.1
21052	Emery	1 to 1 or 2.	71.6	12.7	15.7	0.6	3.4	5.1	3.6
21654	Dr. Hand's	1 to 4 or 5.	87.2	6.4	6.4	0.4	1.5	3.0	1.5
21011	Sweet Clover	1 to 4.	84.8	6.6	8.6	0.4	1.7	2.5	2.0
20967	Grandmother's	1 to 4.	85.7	8.4	5.9	0.4	1.6	4.6	1.8
20995	Ruby	1 to 3 or 4.	83.7	7.3	9.0	0.4	1.8	2.9	2.2
21098	Vermont	1 to 3 or 4.	83.5	7.4	9.1	0.4	1.8	3.1	2.1
21853	"	1 to 3 or 4.	83.4	6.9	9.7	0.4	1.8	2.6	2.1
21635	"	1 to 3 or 4.	84.0	7.0	9.0	0.4	1.9	2.5	2.2
21035	Pride of Wayne	1 to 3 or 4.	83.2	6.8	10.0	0.4	1.9	2.7	1.8
	Unsweetened.								
21150	Wilson's	1 to 1 or 2.	90.1	9.9	----	0.6	2.7	3.5	3.1
20965	St. Charles	1 to 3.	92.9	7.1	----	0.4	1.9	2.6	2.2
20971	Van Camp's	1 to 1 or 2.	89.9	10.1	----	0.5	2.8	3.9	2.9
21215	Blue Label	1 to 1 or 2.	88.4	11.6	----	0.6	3.0	4.4	3.6
22057	Libby's	1 to 3.	93.5	6.5	----	0.4	1.8	2.3	2.0

For cooking purposes and for a beverage, deficiency in fat may be of comparatively minor importance, although the nourishing qualities of the milk are thereby reduced. In infant feeding, however, where fat is the most essential ingredient in the milk, and where cane sugar, in the opinion of many physiologists, is especially to be avoided, the composition of the milk obtained by following the manufacturer's directions is of the greatest importance. Condensed milk is largely used for feeding infants and young children, and it is exceedingly important that the parents should not be misled by erroneous directions.

TABLE X.—COMPOSITION OF MIXTURES FOR INFANT FEEDING PREPARED AS DIRECTED.

Station No.	Brand and Age of Infant.	Proportion of Milk to Water.	Water.	Milk Solids.	Cane Sugar.	Ash.	Protein.	Milk Sugar.	Fat.
	First Week.								
21150	Wilson's	½ teaspo'nf'l Milk, ¼ " Sugar, 1 oz. Water	95.47	1.50	3.03	0.09	0.41	0.53	0.47
21215	Blue Label	"	95.21	1.76	3.03	0.09	0.46	0.66	0.55
21261	Our Pet	"	95.25	1.72	3.03	0.10	0.43	0.65	0.54
21674	Highland	"	95.19	1.78	3.03	0.10	0.48	0.66	0.54
	Average		**95.28**	**1.69**	**3.03**	**0.10**	**0.45**	**0.62**	**0.52**
	One Month.								
21011	Sweet Clover	1 to 13.	94.59	2.34	3.07	0.13	0.62	0.88	0.71
20965	St. Charles	1 to 6 or 7.	96.21	3.79	--	0.18	1.02	1.41	1.18
20967	Grandmother's	1 to 13.	94.92	2.96	2.12	0.13	0.56	1.63	0.64
21654	Dr. Hand's	1 to 14 or 16.	95.61	2.18	2.21	0.12	0.53	1.03	0.50
21374	Baby	1 to 14 or 16.	95.48	1.98	2.54	0.11	0.49	0.78	0.60
21675	Eagle	1 to 14 or 16.	95.30	1.95	2.75	0.12	0.50	0.75	0.58
	Average		**95.35**	**2.53**	**2.12**	**0.13**	**0.62**	**1.08**	**0.70**
	Two Months.								
21011	Sweet Clover	1 to 11.	93.69	2.73	3.58	0.15	0.73	1.02	0.83
20965	St. Charles	1 to 5 or 6.	95.63	4.37	--	0.21	1.18	1.62	1.36
20967	Grandmother's	1 to 11.	94.07	3.46	2.47	0.15	0.66	1,90	0.75
21654	Dr. Hand's	1 to 12 or 14.	94.99	2.49	2.52	0.14	0.60	1.18	0.57
21374	Baby	1 to 12 or 14.	94.82	2.28	2.90	0.12	0.57	0.90	0.69
21675	Eagle	1 to 12 or 14.	94.63	2.22	3.15	0.13	0.57	0.86	0.66
	Average		**94.64**	**2.93**	**2.43**	**0.15**	**0.72**	**1.25**	**0.81**
	Three Months.								
21011	Sweet Clover	1 to 10.	93.12	2.97	3.91	0.16	0.79	1.11	0.91
20967	Grandmother's	1 to 10.	93.53	3.78	2.69	0.16	0.72	2.08	0.82
21374	Baby	1 to 10 or 12.	93.97	2.64	3.39	0.14	0.66	1.04	0.80
21675	Eagle	1 to 10 or 12.	93.74	2.59	3.67	0.16	0.67	0.99	0.77
	Average		**93.59**	**3.00**	**3.41**	**0.15**	**0.71**	**1.31**	**0.83**
	Three to Six Months.								
21654	Dr. Hand's	1 to 8 or 10.	92.98	3.49	3.53	0.20	0.84	1.66	0.79
	Six Months.								
21011	Sweet Clover	1 to 9.	92.43	3.27	4.30	0.18	0.87	1.23	0.99
20967	Grandmother's	1 to 9.	92.88	4.16	2.96	0.18	0.79	2.29	0.90
	Average		**92.65**	**3.72**	**3.63**	**0.18**	**0.82**	**1.76**	**0.95**
	Six to Twelve Months.								
21654	Dr. Hand's	1 to 6 or 8.	91.22	4.36	4.42	0.25	1.05	2.07	0.99
	One Year.								
21011	Sweet Clover	1 to 6.	89.18	4.68	6.14	0.26	1.25	1.75	1.42
20965	St. Charles	1 to 3.	92.90	7.10	--	0.33	1.91	2.64	2.22
20966	A. and P.	1 to 3 or 4.	93.68	6.32	--	0.32	1.70	2.40	1.90
20967	Grandmother's	1 to 6.	89.84	5.93	4.23	0.25	1.13	3.26	1.29
21374	Baby	1 to 6 or 7.	90.35	4.23	5.42	0.23	1.05	1.67	1.28
21675	Eagle	1 to 6 or 7.	89.99	4.14	5.87	0.25	1.07	1.59	1.23
	Average		**90.99**	**5.40**	**3.61**	**0.27**	**1.35**	**2.22**	**1.56**
	Ten to Twelve Months.								
21261	Our Pet	10 teasp'nful Milk, ½ " Sugar, 4½ oz. Water	92.45	6.42	1.13	0.37	1.60	2.42	2.03
21674	Highland	"	92.23	6.64	1.13	0.36	1.77	2.47	2.04
	Average		**92.34**	**6.53**	**1.13**	**0.36**	**1.69**	**2.44**	**2.04**

A number of the brands give specific directions for the preparation of mixtures suitable for infants from one week to one year old. The composition of these mixtures has been calculated and grouped according to the age of the child for whom they are intended (Table X).

It is a well-known fact that the composition of human milk changes greatly with the period of lactation, the first milk, the colostrum, being very rich in nitrogenous bodies and relatively deficient in milk-sugar; after six months the composition becomes relatively constant. The following analyses made by Camerer and Söldner (*Zeit. Biol.*, 1898, **36**, 277) indicate these variations in composition:

ANALYSES OF HUMAN MILK.

Days after birth of child.	No. of Analyses.	Total Solids.	Ash.	Protein, (N x 6.38).	Milk Sugar, (Water-free).	Fat.
1-3 (Colostrum)	4	12.65	0.41	3.25	4.96	2.92
5-6	3	12.09	0.30	1.83	5.83	3.26
8-12	10	12.12	0.28	1.73	6.16	3.11
20-40	15	12.48	0.22	1.30	6.52	3.91
60-140	14	11.79	0.19	1.10	6.81	3.31
170 and over	10	11.44	0.18	0.94	6.78	3.20

A comparison of the calculated composition of the mixtures made for infants of different ages, according to the directions indicated, with the composition of human milk at the same age periods, shows how deficient a diet, as compared with mother's milk, is furnished if the manufacturer's directions are followed. This criticism applies to every brand in the table, for in no case do they even approximate the composition of human milk in all the ingredients. Nor could this condition with the sweetened milk be remedied entirely even by the addition of cream, cod liver oil or some similar oil, and milk sugar, for there will always be an excess of cane sugar present, even when its addition is not specifically directed. The desirability of the presence of cane sugar in the diet of very young children is a matter of much controversy among physiologists, yet each of the four brands of unsweetened milk, which recommend a formula for infants one week old, directs that cane sugar shall be added, making up nearly two-thirds of the solids of the mixture. The following summary shows the average relation of these mixtures to human milk at the period specified.

Age of child.	Relation of Condensed Milk Mixture to Human Milk.			
	Ash.	Protein.	*Milk Sugar.	Fat.
1 week	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{9}$	$\frac{1}{6}$
1 month	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{6}$	$\frac{1}{5}$
3 months	$\frac{3}{4}$	$\frac{2}{3}$	$\frac{1}{5}$	$\frac{1}{4}$
6 months	O. K.	O. K.	$\frac{1}{4}$	$\frac{3}{10}$
1 year	+	+	$\frac{1}{3}$	$\frac{1}{2}$

* Cane sugar present in excessive amounts in nearly every individual case.

Methods of Analysis.

1. *Preparation of Sample.* Weigh the can and contents. Transfer the entire contents of the can to a 2-liter flask with water, and make to the mark (Solution A). (This gives an approximately 20 per cent. solution of the milk.) The weight of the dried can subtracted from that of the original package gives net weight of the milk.

2. *Total Solids.* Pipette 5 cc. of Solution A into a tared flat-bottomed aluminum dish, wash out pipette into the dish, and dilute to about 25 cc. with water. Heat on a boiling water bath for two hours, then to constant weight in a water oven at 100° C., cooling in a desiccator.

3. *Ash.* Evaporate 5 cc. of Solution A in a platinum dish, ignite the residue, cool and weigh in the usual manner.

4. *Protein.* Determine nitrogen by the Kjeldahl method in 5 cc. of Solution A, and multiply by 6.38.

5. *Lactose.* Dilute 40 cc. of Solution A in a 500 cc. flask to about 200 cc., add 10 cc. of the Fehling copper sulphate solution and 1.8 cc. of two-thirds normal potassium hydroxid; make up to 500 cc. with water, shake and filter. In a 350 cc. beaker mix 25 cc. of the copper sulphate solution and 25 cc. of the alkaline tartrate solution, add 50 cc. of water and heat to boiling, then add 100 cc. of the filtered milk solution and boil for two minutes. Collect the copper suboxide on a tared Gooch crucible in the usual manner, dry at 100° C. and weigh.

6. *Sucrose.* Determine by difference, deducting the milk solids (lactose + protein + fat + ash) from the total solids.

7. *Fat—Centrifugal Method.* Measure 25 cc. of Solution A into a Babcock test bottle, rinsing out the pipette with a little water. Add 4 cc. of Fehling's copper solution, shake gently and allow to stand for some minutes, or until coagulation is complete. Fill to the neck with water

and whirl in the centrifuge for three or four minutes, or until the supernatant liquid becomes clear and the coagulum a compact mass. Decant the supernatant liquid, filtering through a funnel fitted with a small piece of cotton, which may be used for the subsequent filtrations as well. Add more water to the coagulum in the bottle and shake until all is in suspension. Fill to neck with water and whirl as before, decanting and filtering as before, and repeat this operation once more. Introduce the cotton and any adhering coagulum into the bottle, pushing the cotton down by a stirring rod and thereby cleaning the neck of the bottle. Dilute with water to about 17.6 cc. and add 17.5 cc. of sulphuric acid (Babcock strength). Shake very thoroughly for four or five minutes (this being essential to obtain a clear fat column). Proceed as in the regular Babcock method, placing the bottles in a bath at 70-75° for a few minutes before reading. The fat reading multiplied by 18 and divided by the weight of material taken equals per cent. of fat in the sample.

Roese-Gottlieb Method. Measure 10 cc. of Solution A into the tube, rinsing the pipette with about 1 cc. of water. Add 1 cc. of strong ammonia and mix thoroughly. Add about 10 cc. of 92 per cent. alcohol, the total volume in tube at this point being a little less than 22 cc., to enable supernatant ethers to be drawn off later. Mix contents thoroughly and add 30 cc. of absolute ether, again shaking for four or five minutes, allowing the liquid to run from end to end of the tube. Then add 30 cc. of petrolic ether (B. P. 30°-40°), and shake thoroughly for one minute. Allow to settle for from fifteen to thirty minutes. Draw off as much of supernatant liquid as possible (all except about 1 cc.), and repeat operation of adding ether, shaking, petrolic ether and again shaking, exactly as before. Draw off the solvent and repeat the operation a third time. Collect the solvent in a tared flask, evaporate at gentle heat over hot air current or over a steam pipe, the last traces being blown out by a current of air forced through cotton to exclude dust. Dry at 100° for about thirty minutes and weigh.

Comparison of Fat Methods.

All the samples were tested for fat in duplicate by both the Babcock-Leach (centrifugal) and the Roese-Gottlieb methods. The decantation method, as outlined above in the centrifugal method, was found to possess marked advantages over the usual method of pipetting. Two extractions by the Roese-Gottlieb method did not remove all the fat, and a third extraction was made in every case. The following tabulation shows the increased amount of fat obtained by this third extraction in a series of determinations in both the sweetened and unsweetened milk.

In every case but one fat was obtained by third extraction, amounting to from 0.06 to 0.76 per cent.; the average increase was 0.19 per cent. For accurate work the third extraction is therefore necessary.

A comparison of the two fat methods, as shown by the results in the

Milk Taken. gms.	Fat Obtained. Two Extr. gm.	Fat Obtained. Three Extr. gm.	Per Cent. of Fat. Two Extr.	Per Cent. of Fat. Three Extr.
2.099	.1880	.1990	8.96	9.48
2.099	.1887	.1958	8.99	9.32
2.100	.1795	.1915	8.36	9.12
2.100	.1883	.1882	8.97	8.97
1.680	.1334	.1361	7.92	8.10
1.915	.1635	.1663	8.54	8.74
2.400	.1542	.1580	6.43	6.58
1.865	.1681	.1693	9.01	9.07
2.045	.1939	.1962	9.48	9.64
1.893	.1420	.1450	7.50	7.66
1.620	.1355	.1376	8.36	8.49
2.230	.1670	.1707	7.49	7.63
2.075	.1785	.1830	8.60	8.82
2.243	.1840	.1877	8.20	8.36
2.108	.2044	.2087	9.70	9.90
2.100	.1894	.1907	9.02	9.08
2.040	.1683	.1717	8.25	8.42
2.105	.1874	.1899	8.90	9.02
1.768	.1409	.1453	7.97	8.22
2.253	.1950	.1977	8.66	8.77
1.800	.1564	.1580	8.69	8.78
Ave.	.1717	.1755	8.48	8.67

table, indicates that on the average slightly higher results were obtained by the centrifugal method.

In twenty-five samples of sweetened milk higher results were secured in eighteen cases by the centrifugal method and in seven cases by the Gottlieb, the results by the former method being on the average 0.15 per cent. higher. In the unsweetened milk the results are even more favorable to the centrifugal method, nine of the ten samples showing higher fat by this method, with an average of 0.34 per cent. higher.

Comparison of Lactose Methods.

The official method for lactose requires boiling for six minutes with the copper reagent. It has been claimed that this comparatively long period of boiling might cause high results, the sucrose appearing to throw down some copper. All the samples were tested by the official method as well as by a method which involved boiling for two minutes. In twenty-six samples of sweetened milk the six minutes' boiling gave higher results in every case, ranging from 0.01 to 0.51, with an average of 0.30 per cent. In the unsweetened milk, as would be expected, the differences were less, one sample showing 0.03 per cent. less by the longer boiling; the other samples, however, gave higher figures by from 0.03 to 0.35, with an average of 0.14 per cent.

TABLE XI. COMPARATIVE FAT AND LACTOSE DETERMINATIONS.

Sweetened Milk.

Fat.			Lactose.		
Babcock-Leach.	Roese-Gottlieb.	Difference.	2 min.	6 min.	Difference.
9.95	9.37	−0.58	12.25	12.58	+0.33
9.22	8.95	−0.27	11.80	12.11	+0.31
9.26	9.12	−0.14	13.57	13.83	+0.26
9.61	9.83	+0.32	11.56	11.87	+0.31
8.94	8.81	−0.13	11.45	11.63	+0.18
9.30	9.05	−0.25	20.11	20.34	+0.23
10.04	9.45	−0.59	12.61	12.88	+0.27
8.18	7.75	−0.43	12.20	12.53	+0.33
8.89	8.58	−0.31	12.82	13.24	+0.42
9.63	9.67	+0.04	12.92	13.43	+0.51
10.06	10.29	+0.23	13.69	14.14	+0.45
8.85	8.81	−0.04	18.37	18.65	+0.28
9.58	8.92	−0.66	11.92	12.10	+0.18
9.43	9.12	−0.31	12.32	12.60	+0.28
9.18	8.50	−0.68	13.97	14.32	+0.35
7.75	8.24	+0.49	16.36	16.68	+0.32
----	----	----	12.30	12.78	+0.48
9.57	9.85	+0.28	15.23	15.44	+0.21
9.29	9.54	+0.25	14.73	15.06	+0.33
8.99	8.87	−0.12	12.57	12.99	+0.42
9.09	9.29	+0.20	11.88	12.22	+0.34
9.88	9.80	+0.08	11.18	11.54	+0.36
8.84	8.81	−0.03	22.82	22.83	+0.01
9.40	8.93	−0.47	12.28	12.37	+0.09
9.86	9.62	−0.24	13.65	13.92	+0.27
Ave. **9.28**	**9.13**	**−0.15**	**13.78**	**14.08**	**+0.30**

TABLE XII.—COMPARATIVE FAT AND LACTOSE DETERMINATIONS.

Unsweetened Milk.

Fat.			Lactose.		
Babcock-Leach.	Roese-Gottlieb.	Difference.	2 min.	6 min.	Difference.
8.73	7.99	−0.74	10.49	10.84	+0.35
8.96	8.40	−0.56	10.66	10.76	+0.10
----	----	-- --	10.75	11.00	+0.25
10.20	10.08	−0.12	----	----	-----
7.88	7.97	+0.09	----	----	-----
8.62	8.56	−0.06	----	----	-----
8.57	8.18	−0.39	10.67	10.87	+0.20
7.20	6.53	−0.67	9.76	9.91	+0.15
7.75	7.26	−0.49	8.62	8.59	−0.03
9.11	9.09	−0.02	11.24	11.24	+0.03
8.83	8.42	−0.41	10.88	10.94	+0.06
Ave. **8.59**	**8.25**	**−0.34**	**10.38**	**10.52**	**+0.14**

GELATIN.

The standard for gelatin is as follows:

"*Gelatin (edible gelatin)* is the purified, dried, inodorous product of the hydrolysis, by treatment with boiling water, of certain tissues, as skin, ligaments, and bones, from sound animals, and contains not more than two (2) per cent. of ash and not less than fifteen (15) per cent. of nitrogen."

Gelatin is derived from collagen, the chief constituent of connective tissue. By proper treatment any form of connective tissue can be made to yield gelatin. Hide clippings yield glue, a crude form of gelatin, and much commercial gelatin is simply a purified glue, derived from such a source. Isinglass, obtained from the swimming bladder of the sturgeon and other fish, is the purest form of gelatin. The gelatin obtained from calves' feet, free from bone, is also of high quality.

Gelatin is very soluble in boiling water, and on cooling sets into a jelly. This jellying will occur in a solution containing as little as 1 per cent. of gelatin.

Gelatin is very easily digested in the stomach. However, it is not capable of building tissues, and cannot be considered as a satisfactory substitute for proteins. Its chief value in feeding is as a protein sparer, "being able to save from destruction half its weight of proteid, or twice as much as is spared by an equal quantity of carbohydrate."* It must be remembered, however, that in the usual animal diet not more than one-eighth of the total nitrogen is in the form of gelatin, and that "probably not more than 25 to 30 grammes (about 1 ounce) of the latter substance can conveniently be taken in a day."† A large helping (6 ounces) of calf's foot jelly contains less than one-half ounce of gelatin, the remainder being largely sugar and water. In convalescence jellies are of service as a pleasant supplement to the ordinary diet, but the actual nutriment they supply from the gelatin itself is relatively small.

The cost of gelatin naturally depends upon the source from which it is derived, that from calves' feet being much more expensive than the usual commercial gelatin, and that from isinglass being even more costly. Ordinary chemical analysis reveals

* Hutchinson, "Food and the Principles of Dietetics," 1906, p. 77.
† *Loc. cit.*

TABLE XIII.—ANALYSES OF GELATIN.

Station No.	Brand.	Dealer.	Net Weight of Package.	Price of Package.	Cost per oz. of Material.	Water.	Ash.	Gelatin (Nx5.55).	Undetermined.	Form of Nitrogen. Total.	Ppt. by Zinc Sulphate.	Insoluble & Coagulable.
			oz.	cts.	cts.							
22073	*Refined Sparkling Gelatine. S. S. Adams, New Haven	*New Haven:* S. S. Adams	1.06	8	7.5	13.90	1.98	83.58	0.54	15.06	15.00	Tr.
22192	Calves' Foot Gelatine. The Baker Co., New York and Shell, Va.	*Danielson:* Waldo Bros.	1.31	10	7.6	12.26	1.70	84.25	1.79	15.18	15.12	Tr.
22055	*Transparent Gelatine. James Chalmers Sons, Williamsville, N. Y.	*New Britain:* John Clauson	1.90	15	7.9	14.18	1.75	84.80	+0.73	15.28	14.88	Tr.
22074	Peter Cooper's Clarified Gelatine	*New Haven:* The Mohican Co.	2.19	10	4.6	13.30	2.55	83.03	1.12	14.96	14.96	Tr.
22103	Instant Powdered Gelatine. J. & G. Cox, Edinburgh, Scotland	*New Haven:* F. J. Markle Co.	1.55	15	9.7	13.81	1.80	84.36	0.03	15.20	15.20	Tr.
22036	Crystal Gelatine. Crystal Gelatine Co., Boston	*New Haven:* Weiss Bros.	1.02	10	9.8	12.09	1.18	85.36	1.37	15.38	15.32	....
22076	Grandmother's A. & P. Gelatine. The Great Atl. & Pac. Tea Co., New York	*New Haven:* Atlantic & Pacific Tea Co.	2.05	5	2.4	12.63	1.95	84.58	0.84	15.24	14.08	Tr.
22111	*Flag Brand Calves' Foot Gelatine. Keefe & Davis	*New London:* F. H. Davis & Co.	0.95	10	10.5	12.05	3.20	83.69	1.06	15.08	15.10	....
22056	*No. 1 Sparkling Calves' Head Gelatine. C. B. Knox, Johnstown, N. Y.	*New Britain:* Andresen & Elmgren	1.16	15	12.9	13.75	1.77	84.69	+0.21	15.26	14.40	Tr.
22186	Keystone Silver White Gelatine. Michigan Carbon Works, Detroit	*Norwich:* J. P. Holloway	1.73	10	5.8	12.35	2.50	84.25	0.90	15.18	15.12	Tr.
22049	*Minute Plain Gelatine. Minute Tapioca Co., Orange, Mass.	*New Haven:* Weiss Bros.	1.76	10	5.7	10.05	0.80	72.83	†16.32	13.12	13.00	Tr.
22112	White Rose Brand Gelatine. Seeman Bros., New York	*New London:* Burr Bros.	1.31	10	7.6	14.50	2.23	82.97	0.30	14.95	15.00	....
22078	*Star Brand Calves Foot Gelatine. Star Gelatine Co., New York	*New Haven:* D. M. Welch & Son	0.99	5	5.1	14.70	1.40	83.14	0.76	14.98	14.80	Tr.
22212	*Sparkling Gelatine. Swampscott Gelatine Co., Boston	*Willimantic:* Willimantic Cash Store	1.09	10	9.2	13.15	1.60	83.69	1.56	15.08	15.12	....
22233	*Granulated Gelatine. W. W. Walker Co., Hartford	*Hartford:* Boston Branch Grocery	1.41	10	7.1	11.06	1.35	87.02	0.57	15.68	15.60	....
22054	*Sparkling Gelatine, Ground. The Williams & Carleton Co., Hartford	*New Britain:* John Clauson	1.34	10	7.5	13.41	1.12	85.14	0.33	15.34	14.84	Tr.

* Contains separate package of color, shown to be in each case a coal tar color.

† Largely sugar.

little as to the source of the gelatin, and in this examination no attempt has been made to solve that problem. A high ash would indicate an imperfect method of manufacture, and a low nitrogen content an impure article, but neither of these determinations affords definite information as to the quality of the gelatin.

Sixteen samples of commercial gelatin were analyzed. All but one, No. 22049, satisfied the standard's requirements for nitrogen (this sample contained a large quantity of sugar); four exceeded the maximum allowed by the standard for ash, Nos. 22074, 22111, 22186, and 22112. In most samples practically all of the nitrogen was precipitated by zinc sulphate, but in Nos. 22076 and 22056 appreciable quantities of nitrogen were unaffected by this reagent, showing the presence of nitrogenous matter other than gelatin. Not more than traces of insoluble and coagulable nitrogen were found in any sample.

Nine of the sixteen samples were accompanied by a separate package of coloring matter to be used in preparation of the jelly. In every case this was a coal-tar color, giving the reaction of a Bordeaux. The gelatins themselves ranged from almost pure white to yellowish-gray in color.

Only two samples were guaranteed as to weight, Nos. 22111 and 22078, in both of which two ounces were claimed; the net weight of both samples was a trifle less than one ounce.

The net weight of all the samples varied between about one and two ounces, with a cost of from 5 to 15 cents per package, the gelatin costing from 2.4 to 12.9 cents per ounce, a very wide range in price.

To summarize, six samples did not satisfy the established standard, or were short weight, viz.:

22049. *Minute Plain Gelatin* (low nitrogen).
22074. *Peter Cooper's Clarified Gelatine* (high ash).
22186. *Keystone Silver White Gelatine* (high ash).
22112. *White Rose Brand Gelatine* (high ash).
22111. *Flag Brand Calves' Foot Gelatine* (high ash and short weight).
22078. *Star Brand Calves' Foot Gelatine* (short weight).

GRAPE JUICE.

The standard for grape juice is as follows:

"*Grape juice, grape must,* is the fresh fruit juice obtained from grapes (*Vitis* species), has a specific gravity (20° C.) not less than 1.0400 and not exceeding 1.1240; and contains in one hundred (100) cubic centimeters (20° C.) not less than seven (7) grams nor more than twenty-eight (28) grams of total sugars, in terms of reducing sugars, not less than twenty (20) centigrams and not more than fifty-five (55) centigrams of grape ash, and not less than fifteen (15) milligrams nor more than seventy (70) milligrams of phosphoric acid (P_2O_5)."

Nine samples were examined; six of these purported to be pure grape juice, two admitted the addition of cane sugar, and one was carbonated.

The specific gravity in all cases lay within the limits of the standard; the total sugars likewise satisfied the standard, ranging from 11.0 to 20.6 per cent. Cane sugar as such was present in traces only, but this by no means indicates that it was not used. For instance, in **21308**, where not over 5 per cent. of cane sugar was claimed to have been added, the analysis showed but 0.5 per cent.; this was undoubtedly due to the inversion of the cane sugar by the juice's acidity.

McGill* suggests that "it is highly probable that wherever the dry solids much exceed 15 per cent., sugar has been added to the grape juice." Such is the case in three of our samples, in two of which the use of sugar is declared on the label. The high percentage of solids in the third sample, **21010**, 26.22, points strongly to the addition of sugar.

Unmistakable traces of alcohol were found, ranging from 0.17 to 0.68 per cent. by volume. The acidity, calculated as tartaric, ranged from 0.28 to 1.27 per cent. The low acidity of **21050** is somewhat suspicious, but may possibly be due to a loss of volatile acids during the removal of the carbonic acid which was present in this sample.

No foreign coloring matter was found in any of the samples, nor was salicylic acid, benzoic acid or saccharin detected in any case.

* Canada Int. Rev. Dept., Bull. 166, 6.

TABLE XIV.—ANALYSES OF GRAPE JUICE.

Station Number.	Brand.	Dealer.	Price per Bottle.	Specific Gravity at 15.6° C.	Alcohol by Volume.	Solids.	Acids other than Carbonic as Tartaric.	Cane Sugar.	Invert Sugar.	Polarization. Direct.	Polarization. After Inversion.	Polarization. Temperature.	Color.	*Preservatives.
			Cts.									°		
21050	Randall's Carbo-Grapo. Chatauqua Fruit Co., Ripley, N. Y.	*Meriden*: Boston Grocery Co.	12	1.0580	0.40	14.50	0.28	0.0	11.0	−3.2	−3.2	24	Natural.	None.
21247	Gleason's Grape Juice. The Gleason Grape Juice Co., Fredonia, N. Y.	*Norwich*: Grover and Herrick	25	1.0670	0.54	16.31	0.91	0.0	13.7	−4.0	−4.0	24	Natural.	None.
21017	A. & P. Grape Juice. The Great Atlantic and Pacific Tea Co., New York	*Stamford*: Atlantic & Pacific Tea Co.	10	1.0600	0.50	14.80	0.71	0.0	17.9	−5.2	−5.2	24	Natural.	None.
21038	[1]Naboth Brand. The Naboth Vineyards, Brocton, N. Y.	*Norwalk*: Broggiano's Confec'nery	15	1.0876	0.67	20.85	1.17	0.5	12.1	−4.0	−4.6	24	Natural.	None.
21268	Paw Paw Grape Juice. Paw Paw Grape Juice Co., Paw Paw, Mich.	*Hartford*: Wise, Smith & Co.	10	1.0674	0.68	16.14	0.74	0.3	12.7	−4.0	−4.4	24	Natural.	None.
21010	Randall's Gold Medal Brand. The Randall Grape Juice Co., Ripley, N. Y.	*Stamford*: Olympia Candy Co.	10	1.1062	0.40	26.22	1.03	0.7	15.1	−5.1	−6.0	24	Natural.	None.
20975	Schühle's Pure Grape Juice. John Schühle, Distributed by Apothecaries Hall, Waterbury.	*Waterbury*: Brass City Drug Co.	25	1.0577	0.17	13.21	0.82	0.0	15.8	−4.6	−4.6	24	Natural.	None.
21045	[2]Vineland Grape Juice. The Vineland Grape Juice Co., Vineland, N. J.	*Meriden*: H. E. Bushnell	15	1.0843	0.58	20.49	0.96	0.3	12.7	−4.0	−4.4	24	Natural.	None.
21032	Welch's Grape Juice. The Welch Grape Juice Co., Westfield, N. Y.	*Stamford*: Marron's Pharmacy	15	1.0617	0.37	14.93	1.27	0.0	20.6	−6.0	−6.0	24	Natural.	None.

[1]Guaranteed to contain granulated sugar not over 5 per cent.
[2]Guaranteed small per cent. of cane sugar added.

* Salicylic acid, benzoic acid, saccharin.

JELLY POWDERS.

These preparations are widely used as quick desserts. They consist chiefly of cane sugar, with sufficient gelatin to make a jelly, and are variously flavored and colored to simulate the flavor and color of natural fruits. As a rule their compound nature is more or less clearly indicated on the label.

Of the twelve samples examined, all but three were stated on the label to be artificially colored. The color of *Bromangelon* was claimed to be "pure vegetable coloring." It was instead from cochineal, an insect.

It should be clearly understood that certain so-called fruit extracts, like banana, pineapple, strawberry and raspberry, are usually synthetic, and, therefore, the consumer, in using jelly powders and similarly flavored materials, bearing the names of these flavors, should not be misled into believing that the genuine fruit flavor is being supplied in all cases.

As shown on another page, the average analysis of fifteen commercial gelatins sold in this State was 13.14 per cent. water, 1.87 per cent. ash, and 84.30 per cent gelatin. The jelly powders, reported in Table XV, on the average contained 1.63 per cent. water, 0.27 per cent. ash, 8.52 per cent. gelatin and 88.95 per cent. cane sugar, the three substances first named being almost entirely derived from the commercial gelatin used. It is evident, therefore, that these jelly powders on the average consist of about one part of commercial gelatin and nine parts of cane sugar. For this sugar the buyer pays on the average about 22 cents per pound.

OTHER DESSERT PREPARATIONS.

Four miscellaneous dessert preparations were also examined. The descriptions follow:

22030. *Imperial Wine Jelly, Sherry,* artificially colored with vegetable color. Made by E. C. Rich, New York. Sold by Geo. Chitty, New Haven. Cost, 10 cents per package of 8.4 ounces.

22034. *Lipton's Delicious Gelatin Jelly Tablet,* Artificially Colored Compound, Strawberry Flavor. Made by Thomas Lipton, New York. Sold by The Mohican Co., New Haven. Cost, 10 cents per package of 5.8 ounces.

TABLE XV.—ANALYSES OF JELLY POWDERS.

Station No.	Brand.	Dealer.	Net Weight of Package.	Price per package.	Cost per ounce of material.	Water.	Ash.	Gelatin (N x 5.55).	Sucrose.	Undetermined.	Form of Nitrogen. Total.	Form of Nitrogen. Precipitated by Zinc Sulphate.	Color.
			oz.	cts.	cts.								
22032	Burnham's Jellycon, Lemon. E. S. Burnham Co., New York	*New Haven:* The Mohican Co.	4.3	9	2.1	1.46	0.17	8.33	90.08	+0.04	1.50	1.46	* ....
22075	D-Zerta. Raspberry. D-Zerta Food Co., Rochester, N. Y.	*New Haven:* H. Hahn	4.3	10	2.3	2.55	0.30	11.99	85.36	+0.20	2.16	2.12	Artificial.
22033	Jello-O, Raspberry, The Genesee Pure Food Co., LeRoy, N. Y.	*Ncw Haven:* The Mohican Co.	3.5	9	2.5	1.95	0.30	12.43	86.40	+1.08	2.24	2.20	*Artificial.
22027	Grandmother's A. & P. Jelly Powder, Strawberry. The Great Atlantic & Pacific Tea Co., New York	*New Haven:* Atl. & Pac. Tea Co.	3.9	10	2.6	1.17	0.25	7.22	90.99	0.37	1.30	1.28	*Coal-tar.
22063	Gelvet, Lemon. Michigan Carbon Works, Detroit, Mich.	*New Britain:* Murphy's Grocery	4.4	10	2.3	2.16	0.20	7.77	88.45	1.42	1.40	1.36	Natural.
22031	Mohican Brand Jelly Powder, Orange. The Mohican Co.	*New Haven:* The Mohican Co.	5.3	8	1.5	1.25	0.18	6.22	92.57	+0.22	1.12	1.08	*Coal-tar.
22035	Plymouth Rock Coffee Jelly. Plymouth Rock Gelatine Co., Boston	*New Haven:* John P. Hugo	1.9	25	12.9	2.00	0.90	13.54	80.81	2.75	2.44	2.40	Caramel.
22202	Hoople's Strawberry Jelly. Raines & Co., New York	*Putnam:* W. H. Mansfield & Co.	4.6	10	2.2	1.97	0.35	9.44	84.97	3.27	1.70	1.68	*Coal-tar.
22028	Tryphosa, Raspberry. E. C. Rich, New York	*New Haven:* Geo. Chitty	6.9	10	1.4	1.14	0.13	5.77	92.80	0.16	1.04	1.04	*Coal-tar.
22029	Tryphosa, Strawberry. E. C. Rich, New York	*New Haven:* Geo. Chitty	6.9	10	1.4	0.92	0.20	5.55	92.87	0.46	1.00	1.00	*Coal-tar.
22113	White Rose Brand Jelly Powder, Raspberry. Seeman Bros., N. Y.	*New London:* Burr Bros.	5 3	10	1.9	1.57	0.10	6.22	91.44	0.67	1.12	1.08	*Coal-tar.
22064	Bromangelon, Strawberry. The Stern & Saalberg Co., N. Y.	*New Britain:* Sovereign Trading Co.	4.5	10	2.2	1.40	0.20	7.77	90.63	0.00	1.40	1.40	*Cochineal.

* Artificial color declared on the label.

22184. *Our-Pie Preparation,* for making lemon flavored pies, substitute color. "Made from cereal, vegetable and fruit products. Does not contain gelatine." Made by D-Zerta Food Co., Rochester, N. Y. Sold by J. P. Holloway, Norwich. Cost, 10 cents per package of 6.2 ounces.

22185. *Fruit Puddine, Flavored Rose Vanilla.* Made by Fruit Puddine Co., Baltimore, Md. Sold by Joseph Connor & Sons, Norwich. Cost, 10 cents per package of 8 ounces.

The analyses of these materials follow:

	22030	22034	22184	22185
Water	15.77	15.80	5.24	10.25
Ash	0.33	0.10	2.16	1.60
Gelatin ($N \times 5.55$)	9.16	9.88	....	....
Protein ($N \times 6.25$)	....	....	2.25	0.31
Sucrose (sugar)	63.22	71.35	47.45	Present
Starch	....	....	43.04	81.34
Undetermined	11.52	2.87	....	6.50
Total Nitrogen	1.65	1.78	0.36	0.05
Nitrogen ppt. by zinc sulphate	1.60	1.72	....	....
Color	Caramel	Artificial	Natural	Artificial

LARD.

One hundred and four samples of lard were examined, of which ninety-seven were not found to be adulterated, while seven were compound lard sold as "lard," and therefore must be classed as adulterated. The adulterated samples in every case were shown to consist largely of cotton seed oil with a certain percentage of beef stearin.

TABLE XVI.—ANALYSES OF ADULTERATED LARD.

Station No.	Dealer.	Price per pound cents.	Refractive Index at 40° C.	Halphen Test	Belfield Test.
21863	*Bridgeport:* Public Market	10	1.4633	Deep red	Beef stearin
21865	*Bridgeport:* Centennial Tea Co.	10	1.4633	Deep red	Beef stearin
22058	*New Britain:* Murphy's Grocery	10	1.4633	Deep red	Beef stearin
22174	*New London:* A. Gordon	10	1.4629	Deep red	Beef stearin
21942	*Stamford:* Empire State Tea Co.	10	1.4626	Deep red	Beef stearin
21881	*Waterbury:* F. I. Fabricant	10	1.4626	Deep red	Beef stearin
21879	*Waterbury:* J. P. McCarthy	12	1.4633	Light red	Beef stearin

The sale of compound lard for lard is a fraud akin to the sale of oleomargarine for butter. Even if the product is designed

merely as a substitute for lard and is sold at wholesale under its true name, when retailed as "lard" it is morally, as well as legally, an adulterated food product.

The analyses of the adulterated samples are given in Table XVI.

Lard has been examined a number of times by this station; a summary of these examinations is given in the following tabulation:

	Not found Adulterated.	Adulterated.	Per cent. Adulterated.
1896	75	43	36.4
1900	150	10	6.3
1902	111	55	33.1
1903	67	63	48.5
1905	47	24	33.8
1906	81	34	29.6
1907	86	20	18.9
1908	107	7	6.1

In the samples examined this year the physical constants varied as follows:

	Refractometer Reading at 40°.	Refractive Index at 40°.
Lard not found adulterated	49.5–51	1.4590–1.4600
Adulterated lard	55 –56	1.4626–1.4633

LEMON EXTRACT.

The standard for lemon extract is as follows:

"*Lemon extract* is the flavoring extract prepared from oil of lemon, or from lemon peel, or both, and contains not less than five (5) per cent. by volume of oil of lemon."

Since the alcohol in a good extract costs about four times as much as all the other constituents together, certain manufacturers reduce this cost by substituting dilute alcohol, or in rare cases, even wood alcohol. Lemon oil, however, is practically insoluble in dilute alcohol, hence by reducing the strength of the alcohol the manufacturer cuts out the lemon oil almost entirely, and renders the extract almost worthless for flavoring purposes. Many of the brands on the market contain so little lemon oil that it can hardly be detected either by chemical analysis or by the nostrils. They are commonly made either by shaking lemon oil with weak alcohol and removing the excess of oil, or by dissolving a little "citral" or other substitute in dilute alcohol, thus securing the so-called "terpeneless" lemon extracts.. These extracts are often colored with turmeric tincture or, more commonly, with a coal-tar dye. An ounce of such an extract selling for 10 cents contains material costing but a fraction of a cent, and very inferior as a flavor.

Fifty-five samples of lemon extract, representing forty brands, have been examined this year. Twenty-two of these were not found to be adulterated, fifteen were adulterated in one or more particulars, and eighteen were labeled compound or imitation.

The pure extracts ranged from 5.13 to 10.75 per cent. of lemon oil by volume and from 77.75 to 90.78 per cent. of alcohol by volume.

Of the adulterated extracts, one contained glycerol, two were low in lemon oil, six were both low in lemon oil and artificially colored, and six were artificially colored. The percentage of lemon oil ranged from none at all to 10.66, the alcohol from 24.31 to 85.47 per cent. Three samples which contained unusually large quantities of lemon oil were artificially colored. No. **21401**, *Foss's Extract,* showed artificial color in one bottle and not in another purchased from the same dealer at the same time. The labeling of the cartons showed that they represented different shipments, and the adulterated sample was undoubtedly of old stock. The two samples of *Arthur's Extract* and the two of *Boston Lemon Flavoring* represented two distinct varieties of these brands. Certain other samples showed wide variations in the labeling of the bottle and carton; this will be referred to in more detail in connection with the compound extracts.

Of the eighteen compound or imitation extracts only one was legally labeled.

The law requires that the compound nature of any food product must be clearly stated on the label. A compound substance must not be named from one of its ingredients, nor must the label bear any misleading information. For instance, a solution of citral and coloring matter should not be labeled either "lemon flavor" or "extract of lemon" or "compound extract of lemon," but "imitation lemon extract" or "artificial lemon extract," or "extract of citral." If the preparation contained some genuine oil of lemon with the citral it should not be labeled "compound lemon extract," but "compound lemon and citral extract" or "compound citral and lemon extract," according to which principle preponderates. Artificial colors should be declared on the label whenever present. The label of the carton and that of the bottle should be identical in all essential particulars.

Below is shown the nature of the illegality of the labels of the individual extracts:

20938. Label illegal, as it contained only a trace of lemon oil and "citral" is not included in the brand name.

21403. Same objections as against **20938.**

21058. Bottle and carton labeled differently, the latter, which the buyer sees, illegally, "citral" not being included in the brand name.

21107. Contains *over 39 per cent. of wood alcohol,* which is illegal in any food product. Contains only a trace of lemon oil and therefore should not be labeled "Compound Lemon." It is also artificially colored, which is not declared on the label.

21172. Bottle labeled "Dil. Lemon .40%," etc.; carton labeled "Oil Lemon .40%," etc. It contains only .09 per cent. lemon oil.

22174. It contains no lemon oil and therefore is illegally labeled "Compound Lemon Extract." It is guaranteed to contain .15.76 oil lemon. This guarantee is false and the two decimal points render it very misleading.

21106 and **21297.** They are illegally labeled "Compound Extract Lemon," as they contain no lemon oil. Their artificial color is not declared on the label and the following statement is false and misleading: "These extracts are of great strength. They are known to all who have used them as the Best."

21636a. It is illegally labeled "Extract of Compound Lemon," as it contains no lemon oil.

21636b. Labeled the same as **21636a,** and bought at the same time and place. It is below standard in lemon oil and no other ingredient is stated in the brand name.

21194. Guaranteed to contain 8 parts of best oil of lemon in 138 parts. It contains only a trace, and contains 5.46 per cent. of sugar, not declared in the formula. Carton and bottle labeled differently.

TABLE XVII.—LEMON EXTRACT NOT FOUND ADULTERATED.

Station No.	Brand.	Station No.	Price per Bottle, cts.	Capacity of Bottle, fl. oz.	Specific Gravity at 15.6° C.	Alcohol by Volume.	Lemon Oil by Volume. Polariscope Method.	Lemon Oil by Volume. Mitchell's Precipitat'n Method.	Refractive Index of Precipitated Oil at 30° C.	Color.
21193	Andresen's Pure Extract Lemon. C. Andresen, New York	21193	20	2.2	.8364	87.77	5.13	5.00	1.4704	Natural
21239	Republic Lemon Extract. Austin, Nichols & Co., New York	21239	10	1.5	.8253	90.25	5.94	5.90	1.4704	Natural
21773	Republic Lemon Extract. Austin, Nichols & Co., New York	21773	18	1.9	.8508	81.25	5.19	5.30	1.4691	Natural
21368	Highly Conc. Flavoring Extract Lemon. The W'm Boardman & Sons Co., Hartford.	21368	20	1.9	.8422	80.46	5.63	5.90	1.4685	Natural
21217	Burnett's Superior Extract of Lemon. Joseph Burnett Co., Boston.	21217	20	1.9	.8206	88.42	10.75	10.60	1.4704	Natural
21644	Superior Flavoring Extract Lemon. W. D. & F. A. Casey, Willimantic.	21644	20	2.1	*	*	5.38	5.30	1.4691	Natural
21092	Supreme Conc. Extract Lemon. W. D. & F. A. Casey, Willimantic.	21092	10	0.9	*	*	6.56	6.20	1.4678	Natural
21216	Clover Brand Pure Flavoring Extracts Lemon.	21216	15	1.8	.8635	77.75	5.78	5.60	1.4704	Natural
21245	Mayflower Extract of Pure Lemon. The A. Colburn Co., Philadelphia.	21245	25	2.8	.8326	86.26	5.00	5.20	1.4704	Natural
21399	Health Brand Pure Lemon. Lewis DeGroff & Son, New York.	21399	25	1.7	.8473	80.49	6.08	6.10	1.4691	Natural
21397	Imperial Pure Fruit Flavoring Extracts Lemon. Springfield, Mass.	21397	8	1.2	.8407	83.68	5.06	5.20	1.4688	Natural
21303	Premium Lemon Flavor. McMonagle & Rogers, Middletown, N. Y.	21303	25	2.2	.8196	90.78	6.88	6.80	1.4685	Natural
21376	Mohican Pure Extract of Lemon. The Mohican Co., New York.	21376	25	4.0	*	*	4.41	5.50	1.4697	Natural
21673	Mohican Pure Extract of Lemon. The Mohican Co., New York.	21673	25	4.2	.8599	79.18	4.50	5.40	1.4700	Natural
21781	Pure Extract Lemon. The T. R. Sadd Co., Willimantic.	21781	20	2.2	.8275	87.34	5.13	5.20	1.4688	Natural
21013	Pure Concentrated Extract Lemon. The C. F. Sauer Co., Richmond, Va.	21013	10	0.9	*	*	5.81	5.80	1.4681	Natural
21672	Pure Concentrated Extract Lemon. The C. F. Sauer Co., Richmond, Va.	21672	10	1.0	.8570	79.70	6.22	6.50	1.4675	Natural
21401b	Foss' Pure Extract of Lemon. Schlotterbeck & Foss Co., Portland, Maine.	21401b	20	1.9	*	*	9.41	9.30	1.4688	Natural
21671	Foss' Pure Extract of Lemon. Schlotterbeck & Foss Co., Portland, Maine.	21671	25	1.9	.8353	79.83	9.56	9.40	1.4681	Natural
21108	Williams' Pure Extract of Lemon. The Williams & Carleton Co., Hartford.	21108	25	1.9	*	*	6.09	6.00	1.4685	Natural
21351	Williams' Pure Extract of Lemon. The Williams & Carleton Co., Hartford.	21351	20	1.9	.8332	84.63	5.97	5.90	1.4691	Natural
20968	Pure Flavoring Extracts, Lemon. Worth Extract Co., New York.	20968	10	0.9	.8523	81.42	5.19	5.20	1.4681	Natural

* Sample exhausted.

TABLE XVIII.—ADULTERATED LEMON EXTRACTS.

Station No.	Brand.	Station No.	Price per Bottle, cts.	Capacity of Bottle, fl. oz.	Specific Gravity at 15.6° C.	Alcohol by Volume.	Lemon Oil by Volume. Polariscope Method.	Lemon Oil by Volume. Mitchell's Precipitation Method.	Refractive Index of Precipitated Oil at 30° C.	Color.
21637	Arthur's Extract Pure Lemon. 5c and 10c Drug Cabinet Co., New Haven.	21637	10	1.4	.9421	44.42	0.10	Trace		Natural
21646	Arthur's Extract Pure Lemon. 5c. and 10c. Drug Cabinet Co., New Haven.	21646	10	1.4	.8898	67.67	1.90	2.10	1.4694	
21633	Atwood's Better Stronger Lemon. New Haven Extract Co., New Haven.	21633	10	1.1	*	*	4.33	4.30	1.4691	Turmeric
21402	[1] Crawford's Fine Flavors, Lemon. W. M. Crawford, Stafford Springs.	21402	25	1.9	.8740	81.91	4.93	5.10	1.4688	Natural
21160	[2] Premium Brand Extract of Lemon. East India Tea Co., Bridgeport.	21160	15	1.6	.9730	24.31	0.00	0.00		Turmeric
21218	Harris' Pure Extract Lemon. Frank E. Harris, Binghamton, N. Y.	21218	20	2.2	.8446	83.08	4.31	4.40	1.4685	Artificial
20969	[3] Climax Brand Highly Conc. Extract of Lemon. The Hub Grocery Co.	20969	10	1.6	.9670	33.83	0.00	0.00		Natural
21339	Extract Lemon. Lawlor & Dwyer, Ansonia.	21339	15	1.6	.8528	74.28	5.34	5.40	1.4678	Turmeric
21270	[4] Ideal Brand Extract Lemon. John H. McGuire, Hartford.	21270	20	1.6	.9487	41.49	0.00	0.00		Artificial
21051	[5] Boston Lemon Flavoring. Puritan Drug Co., Boston.	21051	10	1.5	.9618	33.83	Trace	0.00		Artificial
21257	[6] Boston Lemon Flavoring. Puritan Drug Co., Boston.	21257	10	1.4	.8998	62.08	1.09	1.30	1.4710	Artificial
21091	[7] Foss' Pure Extract Lemon. Schlotterbeck & Foss Co., Portland, Maine.	21091	20	1.9	.8445	85.47	9.59	9.20	1.4678	Artificial
21401a	[8] Foss' Pure Extract Lemon. Schlotterbeck & Foss Co., Portland, Maine.	21401a	20	2.0	*	*	9.75	9.60	1.4685	Artificial
21271	A Pure Concentrated Extract of Lemon. Union Extract Co., Buckland.	21271	25	1.9	.8346	79.85	10.66	10.20	1.4710	Artificial
21302	Ambassador Brand Extract of Lemon. James Van Dyk Co., New York.	21302	10	1.4	.8518	73.79	5.90	5.94	1.4685	Artificial

[1] Contains glycerol. [2] "Oil Lemon, Grain Alcohol and Harmless Coloring" on carton but not on bottle. [3] "Oil of Lemon, Grain Alcohol and Harmless Coloring" on carton but not on bottle. "The superiority of these extracts consists in their perfect purity and great strength.....being so highly concentrated a small quantity only need be used." [4] "3/5 Standard Strength, Formula by Volume: Oil Lemon 3%, Alcohol 50%, Water 50%, Artifically Colored" on both carton and bottle. [5] Labels on bottle and carton variable: on bottle "Made from Best Lemon Oil and Fresh Fruit, contains no Citral and no Lemongrass; Oil Lemon (Sanderson's) 3%, Lemon Peel 2%, Cologne Spirits 30%, Water to make 100%:" on carton "Prepared from Purest Materials; Oil Lemon (Sanderson's) 2.5%, Cologne Spirits 44%, Color q. s.," Water to make 100%." [6] Label on bottle and carton the same as on the bottle of No. 21051 except that "color q. s." is added. [7] [8] No. 21091 consisted of two bottles labeled with the same wording but in slightly different type. The tops of the cartons were different; one read "Foss' Lemon," the other "This bottle contains two ounces, full measure." No. 21401 likewise consisted of two bottles, which were labeled alike except that (b) (see table XVII) bore a sticker around the neck with Serial No. The ends of the cartons were correspondingly different. * Sample exhausted.

TABLE XIX.—COMPOUND AND IMITATION LEMON EXTRACTS (ILLEGALLY LABELED).

Station No.	Brand.	Dealer.	Station No.	Price per bottle, cts.	Capacity of bottle, fluid ounce.	Specific gravity at 15.6° C.	Alcohol by volume.	Lemon Oil by Volume. Polariscope Method.	Lemon Oil by Volume. Mitchell's Precipitation Method.	Refractive Index of Precipitated Oil at 30° C.	Color.
20938	[1] O. K. Compound Lemon Flavoring. The C. L. Cotton P. & E. Co., Earlville, N. Y.	*Meriden:* Booth's Grocery	20938	10	1.7	*	*	0.13	0.00	....	Natural
21403	[2] O. K. Compound Lemon Flavoring. The C. L. Cotton P. & E. Co., Earlville, N. Y.	*Stafford Springs:* F. J. Chandler	21403	10	1.8	.9716	22.38	0.14	0.00	....	Natural
21058	[3] O. K. Imitation Lemon Flavoring. The C. L. Cotton P. & E. Co., Earlville, N. Y.	*Meriden:* Booth's Grocery	21058	10	1.9	*	*	0.10	0.00	....	Artificial
21107	Dingwall's Compound Lemon. M. C. Dingwall, New Haven	*New Haven:* M. C. Dingwall	21107	10	1.4	.9533	39.14[4]	0.11	0.00	....	Artificial
21172	[5] The Eureka Brand Imitation Flavor of Lemon. Hartford, Conn.	*Danbury:* M. McPhelemy Est.	21172	10	1.7	.9426	47.70	0.09	0.00	....	Natural
21774	[6] Royal Palm Compound Lemon Extract. Franklin Extract Co., New York	*Danielson:* A. H. Armington	21774	10	2.2	.9747	22.50	0.00	0.00	....	Artificial
21106	[7] Star Brand Compound Extract Lemon. Wm. J. Fuller & Son, New Haven	*New Haven:* D. M. Welch & Son	21106	10	1.2	.9784	24.12	0.00	0.00	....	Artificial
21297	[7] Star Brand Compound Extract Lemon. Wm. J. Fuller & Son, New Haven	*New Haven:* D. M. Welch & Son	21297	10	1.2	*	*	0.00	0.00	....	Artificial
21636 a	[8] Sterling Extract of Compound Lemon. J. H. Howland, Middletown, N. Y.	*New Haven:* J. Wagner	21636 a	10	1.4	*	*	0.00	0.00	...	Natural

* Sample exhausted.

[1] Labeled "Composed of Citral from Oil Lemon, Citral—Dilute Alcohol, Vegetable Color. Serial No. 370." On carton "grain" inserted before "alcohol." [2] Same as No. 20938. [3] Labeled "O. K. Imitation Lemon Flavoring Composed of Citral from Oil Lemon, Diluted Grain Alcohol, Vegetable Color." Carton labeled "O. K. Compound Lemon Flavoring. Colored. Composed of Oil Lemon, Terpeneless, Grain Alcohol, Water, Vegetable Color." [4] 95 per cent. of the alcohol is methyl (wood) alcohol. [5] Labeled "Artificially colored Dil. Lemon .40%, Citral .10%, Grain Alcohol dil. 99.50%." Carton labeled "Turmeric colored, Oil Lemon, .40%, Dil. Grain Alcohol 99.50%, Citral, 10%, Coloring, a trace." [6] Labeled "Oil Lemon, .15.76, Lemon color M 5, alcohol and water enough to make 100 parts." [7] Labeled "Prepared from Oil Lemon, Alcohol, Water, Artificial Color." Carton bore no formula, but these words: "These extracts are of great strength. They are known to all who have used them as the Best." [8] No formula given; the two bottles were of very unequal strength.

TABLE XIX.—COMPOUND AND IMITATION LEMON EXTRACTS (ILLEGALLY LABELED)—*Continued.*

Station No.	Brand.	Dealer.	Station No.	Price per bottle, cts.	Capacity of bottle, fluid ounce.	Specific gravity at 15.6° C.	Alcohol by volume.	Lemon Oil by Volume. Polariscope Method.	Lemon Oil by Volume. Mitchell's Precipitation Method.	Refractive Index of Precipitated Oil at 30° C.	Color.
21636 b	[8] Sterling Extract of Compound Lemon. J. H. Howland, Middletown, N. Y.	*New Haven:* J. Wagner	21636 b	10	1.4	.8211	89.83	3.44	3.60	1.4685	Natural
21194	[9] Our Special Extract of Lemon, Compound. The McKee Medicine Co., Middletown	*Middletown:* O. Thompson & Co.	21194	10	1.6	*	*	0.40[10]	0.00	....	Artificial
21398	[11] Our Special Extract of Lemon, Com. The McKee Med. Co., Middletown	*Middletown:* O. Thompson & Co.	21398	10	1.4	.9592	46.11	0.00[12]	0.00	....	Artificial
21012	[13] Oakdale Flavoring Compound Lemon. Oakdale Packing Co., Philadelphia	*Stamford:* N. Y. Cash Grocery	21012	10	1.6	.9571	33.12	0.00	0.00	....	Natural
21340	[14] Sterling Brand Imitation Flavor of Lemon. Hartford, Conn.	*Ansonia:* Logan Bros. Co.	21340	15	1.9	.9373	40.19	0.10	0.00	....	Turmeric
21220	[15] St. John's Flavor of Lemon Compound. St. John & Co., New York	*New London:* F. H. Davis	21220	10	1.8	.9785	29.36	0.05	0.00	....	Artificial
21782	[15] St. John's Flavor of Lemon Compound. St. John & Co., New York	*New Britain:* D. M. Fickman	21782	10	1.6	.9944	32.08	0.00	0.00	....	Artificial
21195	[16] Supreme Concentrated Extract Lemon	*Middletown:* New England Tea Co.	21195	20	1.8	.9602	37.07	0.00	0.00	....	Artificial
	LEGALLY LABELED.										
21129	[17] P. C. Brand Imitation Lemon Flavor. Patterson-Cabell Co., Jersey City, N. J.	*Bridgeport:* L. Mooney	21129	10	1.0	.9670	27.99	0.19	0.00	....	Natural

[8] No formula given; the two bottles were of very unequal strength. [9] On the bottle "Pure" is indistinctly overstamped with "Compound." The carton bears this formula "Best Oil of Lemon, 8 parts, Glycerine, 2 parts, Proof Spirits, 128 parts, Lemon Color, a trace." [10] The polariscope reading indicated 5.88 per cent. of lemon oil; the extract contained 5.46 per cent. of sugar, giving the corrected value for lemon oil as reported. A second bottle of the same purchase gave 4.84 by the polariscope and 2.50 per cent. by the precipitation method. The sample being exhausted it was impossible to correct for the sugar. [11] Labeling the same as for No. 21194; formula on carton but not on bottle. [12] The polariscope reading indicated 5.79 per cent. of lemon oil; 4.97 per cent. of sugar was present, giving the corrected value for lemon oil as reported. [13] "Alcohol, Extract Lemon Peel, Oil Lemon, Water," on sticker on back of bottle and carton. [14] Bottle labeled "Turmeric colored, Oil Lemon, .40%, Water, 62.50%, Alcohol, 37.00%, Citral, .10%, Coloring, a trace." Carton labeled, the same except "Oil Lemon, 40%." [15] Bottle labeled as indicated in table. "Composed of 68.00 pure proof alcohol, 30.75 water, pure lemon oil and turmeric a trace, colored artificially." Carton labeled "Imitation Lemon Flavor" with same formula as on bottle. [16] No formula given on bottle nor any indication of its being a compound extract. Carton labeled "Lemon Compound, Sol. Oil Lemon, 85 pts., Sol. Oil Limes, 75 pts., Spirits, 155 pts., Water, 685 pts., colored." [17] Labeled "Composed of Terpeneless Oil of Lemon, Citral, Diluted Alcohol, Artificially colored."

21398. Same guarantee as **21194**; contains no lemon oil, and 4.97 per cent. of sugar, not declared in the formula. Carton and bottle labeled differently.

21012. Illegally labeled "Compound Lemon," as it contains no lemon oil.

21340. Bottle labeled "Oil Lemon .40%," etc.; carton labeled "Oil Lemon 40%," etc. It contains only a trace of lemon oil.

21220 and **21782.** Bottles labeled "Compound," the cartons labeled "Imitation."

21195. Carton labeled "Lemon Compound, Sol. oil Lemon, 85 pts.," etc. The bottle label gave no indication of its compound nature. It contained no lemon oil.

In conducting our examination it was found that in several cases extracts from the same manufacturer, and labeled identically, varied greatly in composition, some containing no lemon oil and others several per cent.

Selling Prices.

While prices vary greatly, the *average* price of pure lemon extract per 2 ounces has been 18.4 cents, of the adulterated extracts 19.1 cents and of the compound extracts 13.5 cents.

Tables XVII, XVIII and XIX give the detailed analyses of the pure, adulterated and compound extracts respectively, the brand name used in all cases being that given on the bottle label.

MAPLE SYRUP.

The standard for syrup and maple syrup is:

"*Syrup* is the sound product made by purifying and evaporating the juice of a sugar-producing plant without removing any of the sugar."

"*Maple syrup* is syrup made by the evaporation of maple sap or by the solution of maple concrete, and contains not more than thirty-two (32) per cent. of water and not less than forty-five hundredths (0.45) per cent. of maple-syrup ash."

"*Sugar syrup* is the product made by dissolving sugar to the consistence of a syrup, and contains not more than thirty-five (35) per cent. of water."

Thirty samples were examined this year, of which eight were not found to be adulterated and twenty-two were labeled so as to indicate their compound nature.

TABLE XX.—ANALYSES OF MAPLE SYRUP NOT FOUND ADULTERATED.

Station No.	Brand.	Dealer.	Price per Bottle.	Total Solids.	Sucrose by Clerget.	Hortvet Number.	Lead Number (Winton).	Ash.
			cts.					
22270	Austin, Nichols & Co., New York. Sunbeam Brand	*New Haven*: The Mohican Co.	25	68.05	60.74	1.65	1.32	0.55
22189	Clark, Chapin & Bushnell, New York. Golden Crown Brand Pure Sap	*Norwich*: R. F. Smith	30	66.61	64.03	1.07	1.22	0.50
22080	The Great Atlantic & Pacific Tea Co., New York. A. & P. Pure	*New Haven*: Atl. & Pac. Tea Co.	15	65.55	58.74	1.69	1.69	0.58
22272	W. J. Lamb Co., West Somerville, Mass. Pure	*New Haven*: John Gilbert & Sons	30	65.10	57.35	1.32	1.62	0.49
22198	Francis H. Leggett & Co., New York. Premier Pure Sap	*Putnam*: E. T. Tucker	25	65.66	63.76	1.14	1.33	0.56
22279	Stoddard, Gilbert & Co., New Haven. Hermitage Brand	*Bridgeport*: Osborne Bros.	25	62.96	57.06	1.79	1.68	0.73
22271	The Vermont Maple Sugar & Syrup Co., New Haven. Pure	*New Haven*: Conrad Rausch	25	62.67	56.29	1.37	1.18	0.44
22234	Welch Bros. Maple Co., Burlington, Vt. Vermont's Finest Quality	*Hartford*: Boston Branch Grocery	30	68.37	62.85	1.34	1.28	0.58

TABLE XXI.—ANALYSES OF COMPOUND* MAPLE SYRUP.

Station No.	Brand.	Dealer.	Price per Bottle.	Total Solids.	Sucrose by Clerget.	Hortvet Number.	Lead Number (Winton).	Ash.
			cts.					
22224	†Austin, Nichols & Co., New York. Hudson Brand Syrup	*Rockville:* McNeill & Conway	10	66.54	62.56	0.08	0.09	0.06
22090	†Austin, Nichols & Co., New York. Republic Brand Syrup	*New Haven:* O. Nestle	15	65.16	58.43	0.16	0.83	0.13
22250	†Bay State Maple Syrup Co., Boston. Mt. Mansfield Brand Fancy Sugar Syrup	*Hartford:* F. L. Churchill	10	68.21	64.60	0.18	0.27	0.30
22081	‡Boyle & Williams, Bradford, Pa. Silver Seal Table Syrup	*New Haven:* The Mohican Co.	10	66.06	61.43	0.19	0.27	0.17
22276	†Falcon Packing Co., New York. Old Homestead Syrup	*Bridgeport:* Public Market	15	68.55	66.08	0.08	0.24	0.11
22260	†Fred Fear, New York. My Wife's Syrup	*Stamford:* E. P. Jordan	10	65.64	59.59	0.16	0.29	0.37
22246	†The R. M. Fitz Gerald Co., Hartford. Mascot Pure Syrup Fancy Quality	*Hartford:* Wm. Walker	10	67.06	63.27	0.23	0.34	0.29
22277	†Hallett Table Water Co., Bridgeport. Pure Cane and Maple Nonquit Syrup	*Bridgeport:* Centennial Tea Co.	15	65.92	58.73	0.16	0.92	0.75
22208	†Huntington Maple Syrup & Sugar So., E. Providence, R. I. Gold Leaf Syrup	*New Haven:* D. M. Welch & Son	10	66.92	66.57	0.11	0.13	0.09
22118	†Huntington Maple Syrup & Sugar Co., E. Providence, R. I. Gold Leaf Syrup	*New London:* Atl. & Pac. Tea Co.	10	67.46	64.08	0.05	0.22	0.09
22286	‡Huntington Maple Syrup & Sugar Co., E. Providence R. I. Home Brand Syrup	*Danbury:* M. McPhelemy Est.	25	65.57	59.75	0.14	0.36	0.04
22280	†W. J. Lamb Co., West Somerville, Mass. Gold Brand Syrup	*Bridgeport:* Public Market	15	63.30	59.55	0.14	1.22	0.14
22285	†Francis H. Legget & Co., New York. Nabob Pancake Syrup	*Danbury:* Robertson & Menzie	20	65.63	63.29	0.21	0.62	0.14
22091	†F. J. Markle, New Haven. Gold Medal Brand Fancy Syrup	*New Haven:* F. J. Markle	10	68.85	67.91	0.11	0.15	0.04
22278	†New England Maple Syrup Co., Boston. Golden Tree Syrup	*Bridgeport:* H. Isenberg & Co.	10	68.67	62.59	0.22	0.36	0.05
22082	†New England Maple Syrup Co., Boston. Golden Tree Syrup	*New Haven:* Kohn Bros.	25	70.44	65.27	0.34	0.63	0.55
22259	‡M. Schoenberg & Co., New York. White Label Table Syrup	*Stamford:* Cash Premium Store	10	65.86	51.02	0.17	0.17	0.18
22079	†Vermont Maple Syrup Co., New Haven. Favorite Brand Fancy Syrup	*New Haven:* E. Schoenberger & Sons	10	68.68	67.11	0.11	0.09	0.08
22264	†Vermont Maple Syrup Co., New Haven. Peerless Brand Fancy Syrup	*So. Norwalk:* Central Food Co.	15	68.28	67.61	0.04	0.28	0.04
22089	†Vermont Maple Sugar & Syrup Co., New Haven. Pride of the Farm Brand Fancy	*New Haven:* A. H. Waterbury	10	68.03	67.75	0.15	0.10	0.06
22117	†Vermont Maple Sugar & Syrup Co., New Haven. Pride of the Farm Brand Fancy	*New London:* Reddin's Cash Grocery	15	68.91	68.21	0.15	0.09	0.05
22265	‡Waltemade Bros. Co., New York. Colonial Brand Syrup	*So. Norwalk:* A. F. Beckman & Co.	15	68.30	66.49	0.12	0.24	0.18

* Stated on the labels to be mixtures.

† Stated on the label to be blend of cane and maple sugar or syrup.

‡ Stated on the label to be blend of maple and cane sugar or syrup.

This station has made three earlier examinations of this product, and the results are tabulated below, together with those of this year, except for the year 1896, when many samples were doubtless passed as unadulterated because of the imperfect methods of analysis at that time available.

	1906.	1907.	1909.
Not found adulterated	3	7	8
Adulterated	17	5	..
Compound	19	11	22
Per cent. adulterated	43.6	21.7	0.0

There has been a marked improvement in the accuracy of the labeling, many brands previously classed as adulterated now being labeled "compound" or "blend." There is considerable room, however, for further improvement in the matter of labeling. The Federal government, and this station as well, has ruled that in compounds or blends the predominating ingredient must be named first in the label—for instance, "maple and cane sugar" or "cane and maple sugar." If this ruling were strictly enforced, four of the samples reported in Table XXI would be technically illegal, as they are stated to be blends of maple and cane sugar, whereas in fact the cane sugar largely predominates. Furthermore, in the great majority of the "compound" samples, maple syrup is present in only very small quantities, in some cases mere traces. The proper label for most of these samples would be "Sugar Syrup, Maple Flavor."

In only one of the compound syrups does the word "maple" appear in the brand name, **22277**, *Pure Cane and Maple Nonquit Syrup*. This sample had a strong brown-sugar taste, with no maple flavor whatever. Its low Hortvet number indicates the absence of any considerable amount of maple syrup, and its relatively high ash is due to brown sugar. **22082** is the only compound sample having a strong maple flavor; in the others it is very slight or entirely absent, as in **22260** and **22280**, which have a molasses-like and honey-like flavor respectively.

The standards for maple syrup refer only to the ash and water content. The samples classed as not adulterated all satisfy the ash standard, ranging from 0.44 to 0.73 per cent. Only two of the samples, however, satisfy the minimum requirement for total solids, 68 per cent. The others range from 62.67 to 66.61 per cent.

The total solids of the compound samples range from 63.30 to 70.44 and the ash from 0.04 to 0.75 per cent.

Methods of Analysis.

The methods used were those given in the Report of this station for 1906, pages 130 and 131. The range of value obtained for the Hortvet number, the Winton number and the ash is shown below:

	Not found Adulterated. Max.	Min.	Ave.	Compound. Max.	Min.	Ave.
Hortvet No.	1.79	1.14	1.42	0.34	0.05	0.15
Winton No.	1.69	1.18	1.42	1.22	0.09	0.36
Ash	0.73	0.44	0.55	0.75	0.04	0.18

OLIVE OIL.

All of the forty-four samples purchased by the station from groceries and delicatessen stores were found to be free from cottonseed, sesame and peanut oils. The specific gravity at 15.5° C. ranged from 0.915 to 0.917, and the refractive index at the same temperature from 1.4704 to 1.4713. The detailed analyses are given in Table XXII.

This is the sixth general examination made by this station of the olive oil sold in Connecticut. The following tabulation summarizes the results of the six inspections:

	Not found Adulterated.	Adulterated.	Per cent. Adulterated.
From grocers.			
1897	37	23	38.3
1900	45	28	38.4
1905	19	0	0.0
1906	25	0	0.0
1907	7	0	0.0
1908	44	0	0.0
From druggists.			
1897	13	5	27.8
1900	17	13	43.3
1905	21	9	30.0
1906	55	11	16.7
1907	65	11	14.5

The above tabulation shows the great improvement in the purity of this food product, especially as sold by grocers. Since 1905 no adulterated olive oil has been found in their stock.

TABLE XXII.—OLIVE OIL (CONTAINING NO COTTON SEED, SESAME OR PEANUT OILS).

Station No.	Brand.	Price per bottle, cents.	Capacity of bottle, fl. oz.	Specific gravity at 15.5° C.	Refractive Index at 15.5° C.
22289	Amorelli Brand Pure Lucca Oil	25	4.4	.916	1.4710
22084	Barton & Guestier, Bordeaux. Olive Oil Superfine Clarified	25	3.8	.915	1.4706
22262	Barton & Guestier, Bordeaux. Olive Oil Superfine Clarified	25	3.7	.915	1.4707
22273	Beaumarchand Brand, Nice. Virgin Olive Oil, Qualité extra Supérieure	22	4.5	.916	1.4713
22254	Beaumarchand Brand, Nice. Virgin Olive Oil, Qualité extra supérieure	25	4.7	.916	1.4710
22255	Beaumarchand Brand, Nice. Virgin Olive Oil, Qualité extra Supérieure	25	4.7	.916	1.4710
22296	Philip Berio & Co., Lucca. Pure Olive Oil	60	30.5	.916	1.4704
22298	Philip Berio & Co., Lucca. Pure Olive Oil	65	30.5	.916	1.4704
22268	Bertrand Frères, Grasse. Fontenelle Brand Huile d'Olive Extra Surfine	25	3.9	.916	1.4707
22114	J. Blumers & Bro. Olive Oil Qualité Extra	25	3.7	.916	1.4707
22092	Boy Père & Fils, Salon. Olive Oil, Extra Gold, The Duck	20	4.1	.915	1.4704
22295	The F. C. Bushnell Co., New Haven. Butter-Nut Huile d'Olive Qualité Superfine	25	4.7	.916	1.4704
22266	Caron Brand, Virgin Olive Oil, Extra Quality	40	8.9	.916	1.4707
22292	W. A. Castle, Springfield, Mass. Castle's Cream Olive Oil	25	4.7	.916	1.4710
22210	W. A. Castle, Springfield, Mass. Castle Brand Cream Olive Oil	25	4.4	.916	1.4704
22263	Chapnelle & Co., Marseilles. Pure Olive Oil	25	4.2	.916	1.4707
22231	Cochrane & Co., Buffalo, N. Y. Extra Virgin Olive Oil	25	7.1	.916	1.4710
22284	Delice Huile d'Olive Extra Qualité, Bordeaux	40	9.0	.916	1.4710
22097	De Possel Fils, Marseille. Virgin Olive Oil	40	7.5	.916	1.4707
22244	Falcon Packing Co., New York. Delviso Brand, Pure Olive Oil	25	4.4	.916	1.4710
22283	Ferrier Brand, Preignac. Strictly Pure Olive Oil	20	4.0	.916	1.4710
22294	Ferrier Brand, Preignac. Strictly Pure Olive Oil	15	2.3	.916	1.4707
22098	Gilbert Brand Olive Oil, Nice	25	4.2	.918	1.4704
22261	The Great Atlantic & Pacific Tea Co., New York. A. & P. Brand Huile d'Olive	23	4.1	.916	1.4710

TABLE XXII.—OLIVE OIL (CONTAINING NO COTTON SEED, SESAME OR PEANUT OILS)—*Continued.*

Station No.	Brand.	Price per bottle, cents.	Capacity of bottle, fl. oz.	Specific gravity at 15.5°C.	Refractive Index at 25°C.
22291	A. Guilhon Frère Aîne, Bordeaux. Finest French Olive Oil	25	4.7	.916	1.4710
22274	J. Guiraud & Cie., Marseille. Trauda Brand Pure Olive Oil	23	4.8	.916	1.4710
22269	Edward E. Hall & Son, New Haven. Italian Olive Oil	35	8.3	.916	1.4707
22211	H. J. Heinz Co., Pittsburgh. Pure Olive Oil	30	7.7	.917	1.4704
22293	Lalance Brand, Marseille. Finest Sublime Olive Oil	25	4.7	.916	1.4707
22193	A. Lombardi & Co., Marseilles. Pure Lucca Oil	25	5.0	.916	1.4704
22297	Luigi fu Co., Matteucci. Lucca. Sublime Olive Oil	75	32.3	.916	1.4704
22230	Nicelle Olive Oil Co., New York. White Label Brand Nicelle Olive Oil	25	4.5	.916	1.4710
22290	Olive Growers Association, Los Angeles, Cal. Sylmar Brand Pure California Olive Oil	35	5.3	.916	1.4710
22245	James G. Powers & Co., New York. Red Shield Brand Olive Oil	25	5.0	.916	1.4707
22115	L. A. Price, Bordeaux. Huile d'Olive Vièrge, Qualité Extra Supérieure	10	2.1	.916	1.4704
22187	S. Rae & Co., Leghorn. Finest Sublime Lucca Oil	25	4.6	.916	1.4704
22199	S. Rae & Co., Leghorn. Finest Sublime Lucca Oil	25	3.9	.915	1.4704
22299	Alfonso Romani, Lucca. Pure Olive Oil Superfine	60	33.3	.917	1.4704
22267	Roulan Brand Huile d'Olive Superfine Clarifée	25	4.7	.916	1.4707
22256	Seeman Bros., New York. La-Rose Blanche Brand Triple Clarified Olive Oil	25	4.4	.916	1.4707
22275	George W. Smith, Bridgeport. Sublime Olive Oil	20	5.0	.916	1.4710
22116	Triat Brand Virgin Olive Oil, Bordeaux	25	4.8	.916	1.4704
22229	Vermiglio, Mazzitelli & Co., Messina. Pure Italian Olive Oil	25	4.8	.916	1.4704
22214	R. C. Williams & Co. Ternay Brand Pure Olive Oil	25	4.9	.916	1.4704

The quality of the oil sold by druggists has also improved, although as late as 1907 over one-seventh was still found adulterated with either cottonseed or sesame oils. The effect of the law on correct labeling is shown by the fact that in 1905 thirteen and in 1906 eleven samples were labeled "compound," which in the past had been sold as pure olive oil.

PICKLES.

Thirty-four samples of pickles and relishes were analyzed; twenty-two of these were sold as sweet pickles.

The labels on eighteen of the samples indicated their compound nature, while on the remaining sixteen there was no indication of the use of prohibited preservatives or artificial sweeteners. The labels claimed that eight samples contained alum, seventeen benzoic acid, six saccharin, and six turmeric or other vegetable color, either alone or in combination.

The analyses, as given in Table XXIII, show that fourteen samples were sweetened with sugar, one with glucose, one with saccharin and five with both sugar and saccharin.

Nineteen samples were preserved with benzoic acid or one of its salts. In two of these, **21331** and **21071,** this preservative was not declared on the label.

All but two of the samples contained small quantities of oxid of aluminum, ranging from 0.007 to 0.074 per cent., with an average of 0.030 per cent. None of the samples was colored with copper.

In the absence of published standards for this food product, only five of the samples failed to meet the general requirements of the law. The deficiencies were as follows:

21033. *The Celebrated White Label Pickles,* M. Schoenberg & Co., New York. Guaranteed to be prepared from granulated sugar, etc. It contained no cane sugar, but did contain considerable glucose (1.60 per cent.), and is therefore misbranded.

21331. *Old Virginia Chutney Relish,* McMechen Preserving Co., Wheeling, W. Va., contained benzoic acid, not declared on the label.

21071. *Choice Sweet Pickles,* The Silver Lane Pickle Co., Silver Lane, East Hartford, Conn., contained benzoic acid, not declared on the label.

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TABLE XXIII.—ANALYSES OF PICKLES.

Station No.	Brand.	Price per bottle, cents.	Weight of contents. Solid portion, oz.	Weight of contents. Liquid portion, oz.	Sweetening Material.	Chemical preservative.	Oxid of Aluminum in the pickles.	In the liquid portion. Cane sugar.	In the liquid portion. Invert sugar.	In the liquid portion. Total sugar.	In the liquid portion. Total solids.	In the liquid portion. Acidity calculated as acetic acid.
							%	%	%	%	%	%
20970	Extra Quality Republic, Sweet Mixed. Austin, Nichols & Co., New York	10	6.5	2.9	Sugar*	Benzoic acid†	0.032†	0.2	8.2	8.4	14.05	1.95
21144‖	Fancy Chop Pickles, Holland Relish. Beutel Pickling and Canning Co., Bay City, Mich.	10	12.2	----	Sugar*	Benzoic acid†	0.007†	----	----	----	----	----
21054	Gherkins. A. C. Blenner & Co., New Haven	10	6.4	3.2	----	----	0.050	0.0	0.0	0.0	3.85	2.00
21003	Sweet Pickles. A. C. Blenner & Co., New Haven	5	6.5	2.2	----	----	0.050	----	----	----	4.67	1.20
21104	Diamond Brand India Relish. A. C. Blenner & Co., New Haven	10	9.2	----	----	Benzoic acid†	0.036	----	----	----	----	----
21094	Sweet Pickles. J. A. Budlong & Son Co., Providence, R. I.	20	4.4	3.8	Sugar*	----	0.016	0.4	19.6	20.0	22.37	2.18
21246	Sweet Pickles. Cruikshank Bros. Co., Pittsburg, Pa.	10	6.3	3.0	Sugar*	Benzoic acid†	0.000	0.0	15.2	15.2	16.52	0.95
21304	Country Club India Relish. John T. Doyle Co., New Haven	10	7.5	2.3	Sugar* Saccharin†§	Benzoic acid†	0.018	0.2	12.2	12.4	16.85	2.74
20973	Preserved Sweet Mixed. H. J. Heinz Co., Pittsburg, Pa.	25	9.6	3.2	Sugar*	----	0.024	0.6	27.7	28.3	33.12	3.20
21057	Sour Mixed Red Star Brand. The Leroux Cider and Vinegar Co., Toledo, O.	10	5.1	2.1	Sugar*	----	0.030	0.3	7.5	7.8	9.44	2.75
21055	Gherkins. Libby, McNeill & Libby, Chicago	10	4.6	2.8	----	----	0.032	----	----	----	0.89	3.20
21008	Sweet Gherkins. Libby, McNeill & Libby, Chicago	15	7.0	2.0	Sugar*	----	0.000	0.2	21.4	21.6	28.69	2.57
21331	Old Virginia Chutney Relish. McMechen Preserving Co., Wheeling, W. Va.	10	10.2	----	----	Benzoic acid	0.020	----	----	----	----	----
21133	Old Virginia Dill Pickles. McMechen Preserving Co., Wheeling, W. Va.	10	6.2	2.8	----	----	0.026	0.0	0.0	0.0	3.35	0.92
21056	Gherkins Prize Medal. Miner, Read & Garrette, New Haven	10	6.2	2.3	----	----	0.032	----	----	----	1.75	2.76

* Consists chiefly of invert sugar formed from cane sugar during the process of pickling. † Declared on the label. § Here used to designate various related coal-tar products with sweetening power 400-500 times greater than ordinary sugar. ‖ Colored with turmeric or other vegetable color; declared on label.

TABLE XXIII.—ANALYSES OF PICKLES—*Continued.*

Station No.	Brand.	Price per bottle, cents.	Weight of contents. Solid portion, oz.	Weight of contents. Liquid portion, oz.	Sweetening Material.	Chemical preservative.	Oxid of Aluminum in the pickles.	In the liquid portion. Cane sugar.	In the liquid portion. Invert sugar.	In the liquid portion. Total sugar.	In the liquid portion. Total solids.	In the liquid portion. Acidity calculated as acetic acid.
							%	%	%	%	%	%
21043	20th Century Brand Sweet, Jas. G. Powers & Co., New York	10	5.8	3.0	Sugar* Saccharin†§	Benzoic acid†	0.064†	0.0	2.6	2.6	4.65	2.60
21357	Empire Gherkins. Recht & Rosenbaum, N. Y.	10	7.4	3.4	----	----	0.074	0.0	0.0	0.0	4.66	2.12
21016	Empire Sweet Gherkins. Recht & Rosenbaum N. Y.	12	7.6	3.2	Saccharin†§	Benzoic acid†	0.056†	----	----	----	2.41	2.08
21033	Celebrated White Label. M. Schoenberg & Co., New York	12	6.3	3.1	Glucose	Benzoic acid†	0.026	----	----	----	8.46‡	2.03
21103	Warfield Brand. Seeman Bros., New York	10	6.9	1.6	----	----	0.036	----	----	----	2.36	2.20
21330	Warfield Brand Extra Spiced. Seeman Bros., New York	10	8.1	2.8	----	----	0.048†	0.0	0.0	0.0	2.25	1.68
21015‖	Sweet Spiced. C. K. Sherwood Co., New York	10	6.9	3.7	Sugar* Saccharin†§	Benzoic acid†	0.030†	0.0	1.4	1.4	3.81	1.20
21071	Choice Sweet. The Silver Lane Pickle Co., Silver Lane, East Hartford	10	6.1	2.8	Sugar*	Benzoic acid	0.024	0.3	8.8	9.1	11.38	1.88
21222	Sweet. The Silver Lane Pickle Co., Silver Lane	10	5.3	3.6	Sugar*	Benzoic acid†	0.020	0.2	12.2	12.4	12.37	2.72
20974	Bunker Hill Sweet Mixed. Skilton, Foote & Co., Boston	15	8.6	4.7	Sugar*	Benzoic acid†	0.032	0.0	9.3	9.3	13.73	1.89
21130	Magic City Brand. Squire Dingee Co., Chicago	15	14.2	7.0	----	----	0.018	0.0	0.0	0.0	1.95	2.48
21185	Piccalilli. The Standard Co., Hartford	10	11.3	----		Benzoic acid†	0.016	----	----	----	----	----
21092	Superior Sweet. The Standard Co., Hartford	10	7.0	3.1	Sugar*	----	0.024	5.2	12.5	17.7	20.63	1.74
21014‖	Sweet Gherkins. The Williams Bros. Co., Detroit	10	6.7	3.4	Sugar*	Benzoic acid†	0.018	0.8	13.1	13.9	21.59	2.53
21146	Highland Brand Gherkins. The Williams Bros. Co., Detroit	10	7.9	3.9	----	----	0.034	0.0	0.0	0.0	3.36	3.12
21053	Sweet Relish Wilco Brand. The Williams Bros. Co., Detroit	10	7.8	1.7	Sugar*	Benzoic acid†	0.060	0.2	9.9	10.1	16.36	2.27
21044‖	Sweet Mixed. The Williams Bros. Co., Detroit	10	7.1	3.5	Sugar*	Benzoic acid†	0.036†	0.2	12.5	12.7	16.30	1.92
21002‖	Sweet Mixed. Richard Zastrow, New Haven	10	7.9	4.0	Saccharin†§	Benzoic acid†	0.034	0.0	0.0	0.0	1.28	1.68
21105‖	Sweet Relish. Richard Zastrow, New Haven	10	9.7	2.4	Saccharin†§	Benzoic acid†	0.014	----	----	----	4.65	2.04

* Consists chiefly of invert sugar formed from cane sugar during the process of pickling. † Declared on the label. ‡ Contains 1.60 per cent. glucose. § Here used to designate various related coal-tar products with sweetening power 400-500 times greater than ordinary sugar. ‖ Colored with turmeric or other vegetable color; declared on label.

21002. *Sweet Mixed Pickles,* and **21105,** *Sweet Relish,* Richard Zastrow, New Haven, Conn. Both guaranteed to be preserved with sugar, etc. Neither contained more than a trace of sugar, the sweetening being due almost entirely to saccharin.

The contents of the bottles were carefully separated into solid and liquid portions and each weighed. The solid portion made up from 53 to 100 per cent. of the contents.

SARDINES IN OIL.

The U. S. Department of Agriculture referred the question of the proper labeling of sardines to the Bureau of Fisheries, which reached the following conclusion (F. I. D. 64):

"Commercially the name sardine has come to signify any small, canned clupeoid fish; and the methods of preparation are so various that it is impossible to establish any absolute standard of quality. It appears to this Department that the purposes of the pure-food law will be carried out and the public fully protected if all sardines bear labels showing the place where produced and the nature of the ingredients used in preserving or flavoring the fish."

The above conclusion will be adopted in judging sardines sold in this State. The essential requirements are that the fish shall be small and belong to the clupeoid family, and that the statements on the label regarding the country where they are packed and the oil in which they are packed shall be truthful.

TABLE XXIV.—BRANDS EXAMINED.

Packed in America.

Elephant Brand Superior Quality. L. D. Clark & Sons, Eastport, Me.
Vender Brand American Sardines. Columbian Canning Co., Lubec, Me.
Pennant Brand American Sardines. Farnsworth Packing Co., Brooklin, Me.
Penobscot Brand American Sardines. Farnsworth Packing Co., Brooklin, Me.
Blue Ribbon Brand American Sardines. M. E. Holmes Canning Co., Eastport, Me.
Sunrise Sardines. M. E. Holmes Canning Co., Eastport, Me.
Tiger Brand Sardines in Mustard Sauce. Independent Canning Co., Eastport, Me.
Sardines. A. LeCroix & Fils, California Fish Co., Los Angeles, Cal.
Eagle Brand American Sardines. Lubec Manufacturing & Canning Co., North Lubec, Me.

Indian Chief Brand Sardines. Lubec Sardine Co., Lubec, Me.
Keystone Brand Sardines. Macnichol Packing Co., Eastport, Me.
Ocean Brand American Sardines in Mustard Sauce. Maddocks Packing Co., Boothbay Harbor, Me.
Orphan Boy Brand Sardines. H. Midwood's Sons, Providence, R. I.
Gilded Dome Fancy Sardines. Pierce, Austin & Co., Boston, Mass.
Gold Label Maine Sardines. Edward T. Russell & Co., Prospect Harbor, Me.
Conqueror American Sardines. Seacoast Canning Co., Eastport, Me.
Continental American Sardines. Seacoast Canning Co., Eastport, Me.
Extra Quality Fried Sardines. Sunset Packing Co., West Pembroke, Me.
Sunset Brand Sardines à la Française. Sunset Packing Co., West Pembroke, Me.
V. Bossange Fancy Sardines. Wm. Underwood Co., Boston, Mass.
Alfred Teissier Extra Fancy Sardines. Wm. Underwood Co., Boston, Mass.
Moose-a-bec Brand American Sardines. Wm. Underwood Co., Mt. Desert and Jonesport, Me.

Packed in Austria.

Austrian Sardines. Packed for Menzel & Co., New York.

Packed in France.

Sprats a l'Huile. LeFret & Cie., Nantes.
Kermabon Brand French Sprats, Douarnenez.
Linec Brand French Sprats.
Mon Rêve, Grosset Brand. B. & P. Rolland, Bordeaux.
Napoléon Little Fish de Luxe à l'Huile, Douarnenez.
Poissons a l'Huile. L. LeGlizic, Douarnenez.

Packed in Great Britain.

La Princesse Sprats in Oil.

Packed in Norway.

Jupiter Brand Smoked Norwegian Sardines, Bergen.
Larsen Brand Norwegian Smoked Sardines.
Peer Gynt Brand Sardines. H. Heljesen, Sunde.
Smoked Norwegian Sardines. Ronneberg's Preserving Co., Stavanger.
Smoked Norwegian Sardines. Ronneberg's Preserving Co., Stavanger.

Packed in Portugal.

Bon Jean Brand Sardines Extra Quality.
Great Boat Race Brand Portuguese Sardines.
Landel Brand Portuguese Sardines, Olkão.
Mariannic Sardines a l'Huile.
Marzan Brand Portuguese Sardines, Cezimbra.

Packed in Spain.

L'Union Ibérique Brand Spanish Sardines. Jean B. Ceroneira, Vigo.
Sardines Extra Fine. L'Union Ibérique, Vigo.
Tour de Monde Sardines. J. G. G. Rianjo, Coruña.

Packed in Sweden.

The Lighthouse Brand Smoked Sardines. The Swedish Preserving Union, Gothenburg.

The forty-four samples were all found to be small clupeoid fish, either true sardines, herring, menhaden or sprats.

The number of fish per can varied from 5 to 32; the average length of the fish, exclusive of the head which was rarely present, from 2 to 6 inches, and the average weight of the fish from 2.7 to 19 grams. The number of fish usually varied inversely with the size of the fish.

When separated as well as can be by careful draining, the oil made up from 5 to 26 per cent. of the weight of the total contents of the cans, averaging about 14 per cent. Two samples consisted of sardines packed in mustard sauce, and in these it was impossible to determine the net weight of the fish.

The selling price ranged from 5 to 15 cents per can, the size of the fish and the kind of oil used appearing to be the determining factors, rather than the weight of fish sold. The smaller fish, presumably fish of more delicate flavor, as a rule commanded the higher price.

According to the labels of the cans the fish were packed in eight different countries, twenty-two in America, chiefly in Maine; one in Austria, six in France, one in Great Britain, five in Norway, five in Portugal, three in Spain and one in Sweden. Aside from the general appearance of the fish, we have no way to prove the accuracy of these statements; the character of the fish, length, size and weight, indicated that the country of packing was correctly stated in all cases.

The claims as to the oil used in packing were, twelve cottonseed, twelve olive, three peanut, one salad, and fourteen no oil specified. We found nineteen packed in cottonseed oil, one in cottonseed and sesame, fourteen in olive, eight in peanut; two samples were packed in mustard sauce.

Of the twelve samples claimed to contain cottonseed oil, that oil was found in every case. Of the twelve samples claimed to con-

TABLE XXV.—SARDINES IN OIL.

Station No.	Brand.	Price per box in cents.	Net weight grams. Fish.	Net weight grams. Oil.	Nature of Fish. Number.	Nature of Fish. Average weight, gms.	Nature of Fish. Average length, ins.	Butyro-refractometer at 15.5° C.	Nature of Oil. Claimed.	Nature of Oil. Found.
	Packed in America.									
22249	Elephant Brand	5	104	25	7	14.9	4-5	1.4738	Best Salad	Cotton Seed
22242	Vender Brand	10	120	17	10	12.0	4	1.4737	Cotton Seed	Cotton Seed
22222	Pennant Brand	7	95	20	10	9.5	4	1.4744	Cotton Seed	Cotton Seed
22104	Penobscot Brand	5	111	20	7	15.9	6	1.4747	Cotton Seed	Cotton Seed
22200	Blue Ribbon Brand	10	114	11	17	6.7	4	1.4738	Cotton Seed	Cotton Seed
22096	Sunrise	5	114	8	6	19.0	3.5-4	1.4732	Cotton Seed	Cotton Seed
22182	Tiger Brand	10	*290	....	13	....	6	---	Mustard (Sauce)	....
22223	Le Croix	15	130	20	24	5.4	3	1.4744	Olive	Cotton Seed
22066	Eagle Brand	5	104	11	17	6.1	2.5-3.5	1.4739	Cotton Seed	Cotton Seed
22247	Indian Chief Brand	5	98	13	14	7.0	3	1.4738	Cotton Seed	Cotton Seed
22105	Keystone Brand	5	108	15	13	8.3	4	1.4735	Cotton Seed	Cotton Seed
22209	Ocean Brand	10	*300	....	5	....	6	....	Mustard (Sauce)	....
22191	Orphan Boy Brand	10	177	18	29	6.1	4	1.4741	Not Specified	Cotton Seed
22287	Gilded Dome	10	141	22	14	10.1	4	1.4738	Not Specified	Cotton Seed and Sesame
22069	Gold Label	8	102	25	10	10.2	3-3.5	1.4743	Cotton Seed	Cotton Seed
22107	Conqueror	5	103	10	13	7.9	4	1.4741	Cotton Seed	Cotton Seed
22183	Continental	5	80	15	10	8.0	4	1.4741	Cotton Seed	Cotton Seed
22106	Sunset, Extra Quality	9	150	18	12	12.5	5	1.4741	Not Specified	Cotton Seed
22232	Sunset Brand	10	103	20	10	10.3	3	1.4744	Not Specified	Cotton Seed
22288	V. Bossange	9	105	29	16	6.6	4	1.4741	Not Specified	Cotton Seed
22243	Alfred Teissier	10	107	24	21	5.1	3	1.4744	Not Specified	Cotton Seed
22071	Moose-a-bec	10	117	18	5	23.4	3.5	1.4743	Cotton Seed	Cotton Seed
	Packed in Austria.									
22094	Menzel	10	106	14	6	17.7	4	1.4726	Olive	Olive
	Packed in France.									
22281	Le Fret	10	72	15	9	8.0	3.5	1.4735	Peanut	Peanut
22072	Kermabon Brand	10	73	11	12	6.1	3.5	1.4724	Peanut	Peanut

* Packed in mustard sauce; could not separate.

TABLE XXV.—SARDINES IN OIL—*Continued.*

Station No.	Brand.	Price per box in cents.	Net weight grams. Fish.	Net weight grams. Oil.	Nature of Fish. Number.	Nature of Fish. Average weight, gms.	Nature of Fish. Average length, ins.	Butyro-refractometer at 15.5° C.	Nature of Oil. Claimed.	Nature of Oil. Found.
	Packed in France.									
22102	Linec Brand	13	84	12	12	7.0	2.5	1.4723	Peanut	Peanut
22070	Grosset Brand	10	88	15	16	5.5	3-3.5	1.4727	Not Specified	Peanut
22101	Napoléon	10	68	15	21	3.2	2-2.5	1.4717	Not Specified	Peanut
22095	Le Glizic	13	59	21	21	2.8	2	1.4723	Not Specified	Peanut
	Packed in Great Britain.									
22215	La Princesse	10	90	20	10	9.0	4	1.4726	Not Specified	Peanut
	Packed in Norway.									
22065	Jupiter Brand	10	86	24	32	2.7	2-3	1.4725	Olive	Olive
22087	Larsen Brand	15	100	18	17	6.5	2.5-3	1.4722	Olive	Olive
22248	Peer Gynt Brand	10	96	11	18	5.3	3	1.4738	Olive	Olive
22190	Ronneberg	13	97	18	28	3.5	3	1.4741	Olive	Olive (?)
22201	Ronneberg	15	86	19	28	3.1	3	1.4726	Olive	Olive
	Packed in Portugal.									
22086	Bon Jean Brand	10	88	13	10	8.8	3	1.4734	Not Specified	Olive (?)
22251	Great Boat Race Brand	10	102	19	12	8.5	3.5	1.4738	Olive	Olive
22068	Landel Brand	10	109	9	17	6.4	3	1.4719	Olive	Olive
22093	Mariannic	14	108	7	10	10.8	3-3.5	1.4728	Not specified	Peanut
22108	Marzan Brand	10	100	20	13	7.7	4	1.4723	Olive	Olive
	Packed in Spain.									
22100	L'Union Ibérique	10	92	25	11	8.4	3.5	1.4710	Olive	Olive
22208	L'Union Ibérique	15	151	7	13	11.6	4	1.4726	Olive	Olive
22282	Tour de Monde	10	102	15	7	14.6	4	1.4750	Not Specified	Olive (?)
	Packed in Sweden.									
22067	Lighthouse Brand	12	96	14	18	5.3	2.5-3	1.4733	Not Specified	Olive

tain olive oil, eleven contained olive and one cottonseed oil. The three samples claimed to contain peanut oil contained that oil. Of the fifteen samples in which the kind of oil was not specified, six contained cottonseed, one a mixture of cottonseed and sesame, five peanut and three olive oil. While it is desirable that the kind of oil should be stated, this is not obligatory, but when it is stated the statement must be correct, or the sample is misbranded.

The only sample, therefore, that can be classed as misbranded is **22223**, whose label read as follows: *Sardines in Olive Oil, California Fish Co., Los Angeles, Cal., A. Le Croix and Fils.* In this sample cottonseed, not olive, oil was used.

It is interesting to note that all of the American samples were packed in cottonseed oil, except the two where mustard sauce was used; all the French and the single British in peanut oil; all the Norwegian, Spanish, the single Austrian and Swedish, and four of the five Portuguese in olive oil, the fifth Portuguese in peanut oil.

The following summary shows the average characteristics of the sardines attributed to the different countries:

	Selling Price. cts.	Net Weight. gms.	Weight of Fish. gms.	Weight of Oil. gms.	No. of Fish.	Average Weight of Fish. gms.	Average Length of Fish. inches.
American	7.9	132	114	18	13	8.8	3.9
Austrian	10.0	120	106	14	6	17.7	4.0
French	11.0	89	74	15	15	4.9	2.8
British	10.0	110	90	20	10	9.0	4.0
Norwegian	12.6	113	95	18	25	3.8	2.9
Portuguese	10.8	115	101	14	12	8.4	3.8
Spanish	11.7	131	115	16	10	11.5	3.8
Swedish	12.0	110	96	14	18	5.3	2.8

SAUSAGE.

The standard for sausage is as follows:

"*Sausage, sausage meat,* is a comminuted meat from neat cattle or swine, or a mixture of such meats, either fresh, salted, pickled or smoked, with added salt and spices and with or without the addition of edible animal fats, blood and sugar, or subsequent smoking. It contains no larger amount of water than the meats from which it is prepared contain when in their fresh condition, and if it bears a name descriptive of kind, composition or origin, it corresponds to such descriptive name. All animal tissues used as containers, such as casings, stomachs, etc., are clean and sound and impart to the contents no other substance than salt."

TABLE XXVI—PORK SAUSAGE.

Station No.	Brand.	Dealer.	Price per lb.	Water.	Starch from Sources other than Condiments.
			cts.		
21926	Made by dealer	*Waterbury:* Albert Bley	12	47.86	Considerable corn
22020	Deerfoot Farm, Southborough, Mass.	*New Haven:* E. E. Hall	25	36.55	Small amount corn
21924	" " " "	*Waterbury:* H. B. Sanderson.	25	38.39	Small amount corn
21907	Hammond	*Bridgeport:* H. Isenberg & Co.	14	41.73	Much corn
21908	"	*Bridgeport:* G. H. Moorey	12	44.19	Considerable corn
21893	S. J. Hugo & Sons, New Haven	*New Haven:* S. J. Hugo & Sons	15	56.91	Medium corn
21900	" " " "	*New Haven:* Harry Benjamin	15	57.82	Small amount corn
21918	" " " "	*Derby:* Schuessler's Delicatessen	18	58.11	Small amount corn
21937	Made by dealer	*Stamford:* E. P. Jordan	12	42.39	None
22014	Lenox Farm	*New Haven:* D. M. Welch & Son	16	40.80	Small amount corn
22019	" "	*New Haven:* The Mohican Co.	18	35.34	Small amount corn
21904	Mueller	*Bridgeport:* D. E. McNamara	10	39.29	Considerable corn
21906	"	*Bridgeport:* The Union Market	10	40.38	Much corn
21938	"	*Stamford:* P. Hoffman	12	43.22	Much corn
21909	Made by dealer	*Bridgeport:* M. M. Nagel	18	56.05	Hardly any
21910	North Star	*Bridgeport:* Public Market	17	33.16	Hardly any
21897	Made by dealer	*New Haven:* L. Pfaff & Son	15	44.03	Considerable potato
21896	J. P. Squires, Boston	*New Haven:* Broadway Cash Market	10	47.47	Considerable corn
21902	Brookfield Brand, Swift & Co.	*Bridgeport:* Public Market	18	37.63	None
22017	Columbia Brand, Sperry & Barnes (?)	*New Haven:* E. Schoenberger & Sons	9	42.74	Considerable corn
22018	* " " " "	*New Haven:* Geo. Chitty	10	48.38	Considerable corn
22021	" " " " (?)	*New Haven:* E. Schoenberger & Sons	9	42.85	Small amount corn
21888	Standard Brand, " "	*New Haven:* Louis Loeffels	16	37.48	None
22015	†Superior Brand, " "	*New Haven:* A. Basserman	14	38.48	None
22016	" " " "	*New Haven:* H, J. Finnigan	14	35.98	Small amount corn
21962	Sperry & Barnes	*Danbury:* M. J. Barrett	16	32.99	Much corn

* Marked Sausage with cereal. † Marked Sausage with 5% cereal.

TABLE XXVI—PORK SAUSAGE—*Continued.*

Station No.	Brand.	Dealer.	Price per lb.	Water.	Starch from Sources other than Condiments.
			cts.		
21948	Sperry & Barnes	*Norwalk:* Adams Provision Co.	16	33.92	Considerable corn
21949	" "	*So. Norwalk:* Public Market	16	34.37	Small amount corn
21915	" "	*Ansonia:* P. W. Fogarty	14	34.41	None
21898	" "	*New Haven:* A. A. Eisele	15	36.01	Considerable corn
21940	" "	*Stamford:* C. E. Knapp	18	38.36	None
21885	" "	*New Haven:* Booth Meat Co.	12	39.33	Considerable corn & potato
21887	" "	*New Haven:* E. Berhuter	12	39.42	Considerable corn
21899	" "	*New Haven:* E. Schoenberger & Sons	10	41.35	Considerable corn
21939	" "	*Stamford:* D. I. Graf	12	41.83	Much corn
21917	" "	*Ansonia:* A. C. Christensen	12	41.84	Considerable corn
21894	" "	*New Haven:* B. Apler	12	42.81	Much corn
22022	" "	*New Haven:* G. H. Youngerman	12	46.51	Medium corn
21903	" "	*Bridgeport:* The Central Market	10	43.54	None
21925	" "	*Waterbury:* Rush Bros.	12	43.93	Considerable corn
21916	" "	*Ansonia:* Ansonia Trading Co.	14	44.54	Considerable corn
21905	" "	*Bridgeport:* Newfield Market	12	44.99	Small amount corn
22023	" "	*New Haven:* Booth Meat Co.	12	43.22	Very little corn
21928	" "	*Waterbury:* A. J. Dauch	12	47.84	Hardly any
21923	" "	*Waterbury:* Dauch & Weir	12	50.12	Considerable potato
21886	Manufacturer unknown	*New Haven:* A. Duhan	14	39.00	Considerable corn
21895	" "	*New Haven:* E. Schoenberger & Sons	10	41.92	Much corn
21919	" "	*Derby:* H. N. Atwood	12	44.71	Medium corn
21927	" "	*Waterbury:* Model Market Co.	12	43.78	Medium corn
21950	" "	*Norwalk:* Whitlock's Market	16	35.20	Considerable corn
21963	" "	*Danbury:* People's Cash Market	14	46.20	None

Fifty-one samples of pork sausage were examined. No tests were made for preservatives, which are quite commonly used with this material, the examination being limited to the determination of water and the detection of non-condimental starch.

This method of examination was suggested by the frequent claim that starchy material is added to sausage to increase its water-holding power, and thereby decrease the actual amount of meat delivered to the consumer.

Mayrhofer's* method, a provisional method of the Association of Official Agricultural Chemists, was given a thorough trial. Not only did it yield discordant results, but in certain samples, where abundant starch was shown to be present by the microscope, this method gave mere traces. The results secured, believed to be below the actual content of starch, are therefore not published in Table XXVI. The starch determined in thirty-one samples ranged from a trace to 2.36 per cent., with an average of 0.73 per cent.; only eight samples contained more than 1 per cent.

All the samples were examined under the microscope for starches other than condimental with the following results: Eight contained none, eighteen small amounts, eighteen considerable and seven much starch. Forty samples contained cornstarch, two potato starch, and one both corn and potato starch.

The percentage of water ranged from 32.99 to 58.11, with an average of 42.52. The relation of water and starch content is shown in the following tabulation:

Starch.	*Water.* Max.	Min.	Ave.
Much	43.22	32.99	40.70
Considerable	50.12	33.92	42.15
Small amount	58.11	33.16	44.30
None	46.20	34.41	39.81

Contrary to the usual supposition, the presence of added starch seems to have had but little influence on the water content, for the average water in eight samples containing no starch is only slightly less than that in seven containing the most starch, and none of the latter reach the maximum figure, 46.20, found in one "no starch" sample. Furthermore, of the four samples showing the highest water content, 56.91, 57.82, 58.11 and 56.05, three contain only small amounts of starch, and the fourth

* Forschungs-Ber. Lebensm., 1896, *3*, 141; 1897, *4*, 47.

only medium amounts. On the other hand, eight samples, showing much or considerable starch under the microscope, contained less than 40 per cent. of water, three of them less than 35 per cent. The highest water found, 58.11 per cent., was in a sample containing only a small amount of starch; the lowest water, 32.99 per cent., in a sample containing much starch. Lean meat has high water-absorption powers and it would seem from the analyses here recorded that the relative amounts of lean and fat meat in the sausage mixture had quite as much as, if not more, influence on the water content than the cereal or potato starch added.

"TEMPERANCE" DRINKS.

Eleven samples of the so-called "temperance" drinks were analyzed. These were examined as to alcohol, the nature of the sweetening agent, coloring matter and preservatives.

Two samples, "Raspberry Shrub" and "Wine Mint," were stated on the label to contain benzoic acid. Neither benzoic nor salicylic acid were found in any of the other samples.

"Wine Mint," "Coco Cola" and one sample of "Ron-Bre" contained over 1 per cent of alcohol, while both samples of "Iron Brew" and the second sample of "Ron-Bre" contained smaller amounts. "Kolox," "Moxie" and "Phenix" contained no alcohol.

The coloring was artificial in every case; in three samples a coal-tar dye was used, in the others caramel.

The solid matter ranged from 0.60 to 64.41 per cent., consisting almost entirely of sugar in all cases. "Ruby Vim Syrup," "Raspberry Shrub," "Wine Mint" and "Coco Cola" contained over 50 per cent. of solids; all of the other samples contained less than 10 per cent.

Saccharin was found in one sample of "Ron Bre." This sample was a remarkably dilute preparation, consisting essentially of water containing traces of sugar and iron, colored with caramel and sweetened with saccharin.

"Coco Cola" contained the active drug caffeine.

The "iron" preparations, "Iron Brew" and "Ron Bre," the latter apparently an abbreviation of the former, contained mere traces of iron. The two analyses of "Ron Bre" show it to be an extremely weak preparation of varying composition.

TABLE XXVII.—ANALYSES OF "TEMPERANCE" DRINKS.

Station No.	Brand.	Price per bottle.	Specific gravity at 15.6° C.	Alcohol by volume.	Solids.	Cane Sugar.	Invert Sugar.	Polarization. Direct.	Polarization. After Inversion.	Polarization. Temperature °C.	Color.	Preservative.
20981	Ruby Vim Syrup. The Buckingham Pharmacy, Waterbury	15	....	....	61.59	1.1	61.8	—16.6	—18.0	25	Artificial	....
21248	Raspberry Shrub. Curtis & Moore, Boston, Mass.	25	....	....	64.23	19.3	40.1	7.8	—17.4	25	Artificial	*Benzoic acid
21167	Wine Mint. Curtis & Moore, Boston, Mass.	25	1.3131	1.28	64.41	35.5	24.8	28.4	—17.8	25	Artificial	*Benzoic acid
21192	Kolox Undina Brand. The Granite Rock Spring, Higganum	13	1.0361	0.00	9.17	7.1	0.3	7.0	—2.2	25	Caramel	None
20925	Moxie Nerve Food. Moxie Nerve Food Co. of New England, Boston & New York	20	1.0252	0.00	6.49	3.7	1.0	4.0	—0.9	25	Caramel	None
21285	Phenix. Puritan Carbonating Co., Millis, Mass.	15	1.0190	0.00	5.04	4.1	0.3	4.2	—1.2	25	Caramel	None
21072	Coco Cola. (Druggist's label)	15	1.2492	1.38	50.42	1.3	47.8	—12.4	—14.1	25	†Caramel (?)	None
21102	Iron Brew. Bottled by E. F. Blakeslee, New Haven	5	1.0357	0.47	8.32	2.2	4.5	1.0	—1.9	25	‡Caramel	None
21236	Iron Brew. Bottled by Albert O. Neff, Mystic	5	1.0356	0.32	8.44	5.8	4.9	4.4	—3.2	25	‡Caramel	None
21170	Ron-Bre. Sold by Gigliotti Bros., Danbury	5	1.0148	1.05	3.76	1.5	1.0	1.2	—0.8	25	‡Caramel	None
21164	Ron-Bre. Sold by Candy Kitchen, So. Norwalk	10	1.0023	0.41	0.60	0.1	0.0	0.2	0.1	25	‡Caramel	§None

* Declared on label. † Caffeine present. ‡ Contains traces of iron. § Saccharin present.

VANILLA EXTRACT.

The standard for vanilla extract is as follows:

"*Vanilla extract* is the flavoring extract prepared from vanilla bean, with or without sugar or glycerin, and contains in one hundred (100) cubic centimeters the soluble matters from not less than ten (10) grams of the vanilla bean."

This standard does not state definitely the amount of vanillin that should be present, but it does exclude synthetic vanillin, coumarin and caramel, or other artificial coloring matter.

Five vanilla extracts, made by Winton and Silverman at this station,* from beans of different grades, contained from 0.065 to 0.215 per cent. of vanillin. Leach† found in the examination of a large number of brands that gave every indication of purity, that the vanillin varied from 0.050 to 0.200 per cent., so that we may safely conclude that an extract containing much more than 0.20 per cent. of vanillin contains artificial vanillin. It must be remembered that the vanillin content does not altogether determine the value of an extract, as the minute quantities of various resins and other extractive matters, always present in a pure extract, have an important influence on the delicacy of its flavor and aroma.

Sixty-five samples were examined this year, and the analyses are shown in Tables XXVIII, XXIX and XXX, together with seven samples collected by the Dairy Commissioner.

Forty-one of these samples were not found to be adulterated, two were artificially colored, and one of these also adulterated with coumarin, twelve were compounds illegally labeled, and seventeen were compounds or imitations labeled in conformity with the law.

In the extracts classed as not adulterated the vanillin ranged from 0.11 to 0.29 per cent., with an average of 0.20, the figures in no case being sufficiently high to warrant with certainty the conclusion that synthetic vanillin had been used. Moreover, the appearance of the lead acetate precipitate was normal in all cases. None of these samples contained over 0.02 per

* Report, 1901, 150.
† "Food Inspection and Analysis," 1904, 732.

Table XXVIII.—Vanilla Extract not Found Adulterated.*

Station No.	Brand.	Dealer.	Price per bottle.	Capacity of bottle.	Vanillin.
			cts.	fl. oz.	
21932	Finest Extract of Vanilla. Acker, Merrall & Condit Co., New York	*Stamford:* Acker, Merrall & Condit Co.	50	4.3	0.24
2745	Arthur's Pure Extract of Vanilla. The 5c. and 10c. Drug Cabinet Co., New Haven	*New Haven:* The 5c. and 10c. Drug Cabinet Co.	10	1.1	0.22
22085	Banquet Vanilla. Austin, Nichols & Co., New York	*New Haven:* Kohn Bros.	10	1.5	0.15
21873	Republic Extract Vanilla. Austin, Nichols & Co., New York	*Bridgeport:* Joseph Keegan	25	2.1	0.25
21844	Pure Extract Vanilla. Baker Extract Co., Springfield, Mass.	*New Haven:* R. F. Copeland	25	1.9	0.14
22213	Old Homestead Flavoring Extracts Vanilla. Bennett, Sloan & Co., New York	*Willimantic:* W. D. Casey	10	1.0	0.23
21657	Extract Vanilla. Joseph Burnett Co., Boston, Mass.	*New Haven:* E. E. Hall & Son	50	4.0	0.23
21934	Pure Extract of Vanilla. W. Burton & Co., New York	*Stamford:* Empire State Tea Co.	15	1.7	0.22
21957	Pure Extract of Vanilla. W. Burton & Co., New York	*So. Norwalk:* A. F. Beckman & Co.	10	1.1	0.23
21930	Pure Extract Vanilla. J. M. Carolan & Co., New York	*Stamford:* N. Y. Cash Grocery Co.	18	2.1	0.24
21650	Charter Oak Brand Pure Vanilla. Made at Hartford, Conn.	*New Haven:* C. F. Clark	10	1.1	0.28
21653	Charter Oak Brand Pure Vanilla. Made at Hartford, Conn.	*New Haven:* Cushman Cash Co.	10	0.9	0.27
21872	Mayflower Extract Pure Vanilla. The A. Colburn Co., Philadelphia	*Bridgeport:* H. Isenberg & Co.	10	1.0	0.15
21956	Mayflower Extract Pure Vanilla. The A. Colburn Co., Philadelphia	*Norwalk:* Grand Central Grocery	10	1.0	0.22
22077	Vanilla Extract. Colgate & Co., New York	*New Haven:* H. Hahn	25	2.2	0.21
22216	Fine Flavors Vanilla. W. M. Crawford, Stafford Springs	*Stafford Springs:* Andrew Whiton	25	2.0	0.11
21912	Country Club Pure Extract Vanilla. The John T. Doyle Co., New Haven	*Bridgeport:* Newfield Market	10	1.2	0.19
22110	Davisco Brand Vanilla. F. H. Davis & Co., New London	*New London:* F. H. Davis & Co.	25	2.2	0.19
21649	Foss' Pure Extract Vanilla	*New Haven:* W. D. Minor	25	1.9	0.24
2673	Foss' Pure Extract Vanilla	*Willimantic:* Milton Hall	25	2.1	0.19

* None of these samples contained coumarin or artificial color.

† Guaranteed three-fifths standard strength.

Table XXVIII.—Vanilla Extract not Found Adulterated*—*Continued.*

Station No.	Brand.	Dealer.	Price per bottle.	Capacity of bottle.	Vanillin.
			cts.	fl. oz.	
21967	Acme Pure Extract of Vanilla. Edwin J. Gillies & Co., New York	*Danbury:* M. J. Shanley	20	2.1	0.18
21884	Gold Seal Brand Extract Pure Vanilla	*Waterbury:* Model Market Co.	10	1.0	0.11
21859	Good Value Extract Pure Vanilla. Binghamton, N. Y.	*New Haven:* P. Leshine	10	1.1	0.13
22188	Helmet Brand Pure Vanilla	*Norwich:* McCarthy Bros.	10	1.1	0.20
21869	Howco Pure Flavoring Extracts Vanilla	*Bridgeport:* Howland Dry Goods Co.	18	1.8	0.13
21874	Nabob Flavoring Extracts Vanilla. Francis H. Leggett & Co., New York	*Bridgeport:* Pike Bros. Co.	20	2.0	0.18
3010	Concentrated Fruit Extract Vanilla. The McKee Medicine Co., Middletown, Conn.	*Middletown:* A. M. Bidwell	25	2.0	0.14
21832	Vanilla. McMonagle & Rogers, Middletown, N. Y.	*New Haven:* John Gilbert & Son	55	4.0	0.18
21929	Extract of Vanilla. The Miller Mfg. Co., New York	*Stamford:* W. W. Waterbury	40	3.9	0.25
21830	Mohican Pure Extract of Vanilla	*New Haven:* The Mohican Co.	25	3.6	0.17
21870	Monogram Brand Pure Vanilla	*Bridgeport:* Public Market Co.	45	3.8	0.28
21656	Patca Brand Pure Extract of Vanilla. Patterson-Cabell Co., Jersey City, N. J.	*New Haven:* Mendel & Freedman	10	1.9	0.16
21829	Puritan Extract of Vanilla. Puritan Drug Co., Boston	*New Hæven:* M. C. Dingwall	25	2.0	0.14
21652	Pure Concentrated Extract Vanilla. The C. F. Sauer Co., Richmond, Va.	*New Haven:* S. S. Adams	10	0.9	0.29
21867	Pure Highly Conc. Extract Vanilla. G. W. Smith, Bridgeport	*Bridgeport:* Village Store Co.	15	2.1	0.17
21959	Extract Pure Vanilla. J. E. Thompson, New York	*Norwalk:* F. D. Lawton	25	2.1	0.27
21968	Highly Concentrated Vanilla. VanDuzer Extract Co., New York	*Danbury:* Ehle's Cash Grocery	25	2.0	0.27
21833	Ambassador Brand Extract of Vanilla. James Van Dyk Co., New York	*New Haven:* VanDyk Tea and Coffee Co.	19	1.9	0.19
21922	Delicious Flavoring Extracts Vanilla. Dist. by J. D. Welch & Co., New Haven	*Ansonia:* D. M. Welch & Son	20	1.8	0.26
21883	Pure Flavoring Extracts Vanilla. Worth Extract Co., New York	*Waterbury:* Mrs. Moore	10	1.0	0.17
21964	Pure Flavoring Extracts Vanilla. Worth Extract Co., New York	*Danbury:* Danbury Grocery	15	2.3	0.17

* None of these samples contained coumarin or artificial color.

† Guaranteed three-fifths standard strength.

TABLE XXIX.—ADULTERATED OR ILLEGALLY LABELED COMPOUND VANILLA EXTRACT.

Station No.	Brand.	Dealer.	Price per bottle.	Capacity of bottle.	Vanillin.	Coumarin.	Color.
	Adulterated.		cts.	fl. oz.			
21831	Searle's Concentrated Extracts Vanilla. Hetfield & Searle Extract Co., New York	*New Haven:* U. L. Frank Tea Co.	15	2.2	0.23	0.05	Artificial
21655	Premium Brand Vanilla, Full Standard Strength	*New Haven:* Carlson Tea and Butter Co.	25	1.7	0.11	0.00	Artificial
	Illegally Labeled.						
21876	Centennial Highly Concentrated Extract of Vanilla	*Bridgeport:* Centennial Tea Co.	10	1.9	0.02	0.00	Artificial
21850	Blue Bell Brand Compound Vanilla Flavor. The John T. Doyle Co., New Haven	*New Haven:* H. M. Tower	10	1.6	0.26	0.04	Artificial
21875	Premium Brand Extract of Vanilla. East India Tea Co., Bridgeport	*Bridgeport:* East India Tea Co.	15	1.6	0.04	0.03	Artificial
21843	Extra Strength Star Brand Compound Vanillin, Cumarin Vanilla Extract. Wm. J. Fuller & Son, New Haven	*New Haven:* D. M. Welch & Son	10	1.6	0.26	0.06	Artificial
3011	Artificial Extract of Vanilla. The McKee Medicine Co., Middletown	*Middletown:* A. M. Bidwell	10	1.6	0.43	0.08	Artificial
21632	Atwood's Extra Strong Vanilla. New Haven Extract Co., New Haven	*Whitneyville:* O'Connell's Grocery	10	1.0	0.52	0.05	Artificial
21651	Atwood's Extra Strong Vanilla. New Haven Extract Co., New Haven	*New Haven:* Wray & Co.	10	1.2	0.50	0.05	Artificial
22109	Concentrated Compound Extract of Vanilla. Nichols & Harris, New London	*New London:* Reddin's Cash Grocery	25	1.8	0.11	0.04	Artificial
21868	Boston Vanilla Flavoring. Puritan Drug Co., Boston	*Bridgeport:* Wheeler & Co.	10	1.4	0.58	0.12	Artificial
22025	Boston Vanilla Flavoring. Puritan Drug Co., Boston	*Meriden:* McBride & Co.	10	1.6	0.48	0.12	Artificial
21933	Tropic Brand Conc. Extract of Vanilla. The Tropic Co., New York	*Stamford:* Hepton Tea and Coffee Co.	10	1.4	0.12	0.00	Artificial
21871	Sovereign Vanilla Flavoring. The Union Pacific Tea Co., New York	*Bridgeport:* Union Pacific Tea Co.	25	2.1	1.25	0.00	Natural

TABLE XXX.—COMPOUND OR IMITATION VANILLA EXTRACT LEGALLY LABELED.

Station No.	Brand.	Dealer.	Price per bottle.	Capacity of bottle.	Vanillin.	Coumarin.	Color.
			cts.	fl. oz.			
21931	Columbia Brand Imitation Vanilla Flavor	*Stamford:* Columbia Tea Co.	15	1.7	0.13	0.07	Artificial
2688	O. K. Vanilla Flavoring Substitute. The C. L. Cotton Perf. and Extr. Co., Earlville, N. Y.	*Stafford Springs:* T. J. Chandler	10	2.1	0.12	0.11	Artificial
3007	O. K. Vanilla Flavoring Substitute. The C. L. Cotton Perf. and Extr. Co., Earlville, N. Y.	*Meriden:* M. W. Booth	10	1.8	0.12	0.12	Artificial
22026	O. K. Compound Vanilla Substitute. The C. L. Cotton Perf. and Extr. Co., Earlville, N. Y.	*Meriden:* Booth's Grocery	10	1.9	0.11	0.12	Artificial
21911	Crescent Brand Vanilla Substitute	*Bridgeport:* Public Market	10	1.4	0.11	0.05	Artificial
22053	Eden Brand Vanilla Substitute. Lewis DeGroff & Son, New York	*New Britain:* Wm. Foulds	10	1.3	0.11	0.03	Artificial
21936	Harrison Brand Vanilla Substitute. Lewis De Groff & Son, New York	*Stamford:* E. P. Jordon	10	1.6	0.08	0.08	Artificial
21921	Improved Substitute for Vanilla, Eureka Brand. Made at Hartford	*Ansonia:* P. W. Fogarty	10	1.6	0.32	0.05	Artificial
21860	Grand Union Extract Vanilla and Tonka. Grand Union Tea Co., Brooklyn	*New Haven:* Grand Union Tea Co.	20	1.9	0.22	0.03	Natural
21958	20th Century Vanilla Substitute. Jas. G. Powers & Co., New York	*So. Norwalk:* Edwin Wilcox	10	1.3	0.07	0.08	Artificial
22024	Prefect Brand Imitation Flavor of Vanilla. Made at Hartford	*Meriden:* Union Tea Co.	15	1.6	0.27	0.03	Artificial
21920	Sterling Brand Imitation Flavor of Vanilla. Made at Hartford	*Ansonia:* Logan Bros.	15	1.7	0.29	0.04	Artificial
2753	St. John's Imitation Vanilla Flavor. St. John & Co., New York	*New Britain:* D. F. Fickman	10	1.5	0.10	0.06	Artificial
21643	St. John's Imitation Vanilla Flavor. St. John & Co., New York	*New Britain:* D. F. Fickman	10	1.9	0.09	0.07	Artificial
21901	St. John's Vanilla Substitute. St. John & Co., New York	*New Haven:* Harry Benjamin	10	1.7	0.11	0.08	Artificial
21851	Stuart Brand Improved Substitute for Vanilla. Made at Hartford	*New Haven:* Logan Bros.	10	1.8	0.28	0.05	Artificial
22062	Webb's Brand XX Vanilla and Tonka. Prepared at Springfield, Mass.	*New Britain:* Wray & Co.	10	1.5	0.34	0.023	Natural

cent. of coumarin, and no artificial color was observed in any case.

The following extracts were adulterated:

21831. *Searle's Concentrated Extracts Vanilla,* Hetfield & Searle Extract Co., New York, contained coumarin and was artificially colored.

21655. *Premium Brand Vanilla,* Full Standard Strength, contained artificial color.

Illegally Labeled Extracts.

Twelve samples were illegally labeled, as follows:

21876. Not "highly concentrated" as it contained only 0.02 per cent vanillin.

21850. Contains coumarin, which was not indicated in the brand name on the label.

21875. Contains coumarin, which was not indicated in the brand name on the label; an extract much below standard strength.

21843. Technically illegal, as the labels of the carton and bottle do not agree, the artificial color not being indicated on the former. The phrases "extra strength" and "they are known to all who have used them as the BEST" are likewise objectionable.

3011. Synthetic vanillin used, as well as artificial color, but neither stated on the label.

21632 and **21651.** Carton was labeled "Atwood's Extracts are Best (Vanilla) and Strongest"; the bottle was labeled "Atwood's Extra Strong Vanilla Compound. Prune Juice, Burnt Sugar, Vanillin and Coumarin are used in connection with Vanilla Beans to preserve and retain the Vanilla flavor." These two labels in no wise agree; synthetic vanillin was not declared in the brand name and the extracts are not the "best" and "strongest."

22109. Carton labeled "Concentrated Compound Extract Vanilla"; the bottle "Extra Vanilla."

21868 and **22025.** The brand name does not indicate the presence of synthetic vanillin and coumarin, or the artificial color.

21933. The artificial color is not indicated in the brand name.

21871. Synthetic vanillin is not indicated in the brand name.

Legally Labeled Imitations or Substitutes.

Seventeen samples were legally labeled imitations or substitutes; five were marked "imitation," ten "substitute" and two "Vanilla and Tonka Extract." Proper formulas were given in all cases, which were shown to agree with the analysis.

Selling Price and Volume of Bottles.

Fourteen samples guaranteed on the label a net volume ranging from one to four ounces. No serious discrepancy in volume was noted, five guaranteed 4 ounces contained from 3.6 to 4.3 ounces, eight guaranteed 2 ounces contained from 1.8 to 2.2 ounces, and one guaranteed 1 ounce contained 1.1 ounces.

With few exceptions the volume of the extract and the selling price bore a quite constant relation. For instance, in the unadulterated extracts on the average 1.1 ounces was supplied for 10 cents, 2 ounces for 20 cents, 2.2 ounces for 25 cents and 4 ounces for from 40 to 55 cents.

The average selling price per bottle of the unadulterated extracts was 20.7 cents for 1.97 ounces, or 10.5 cents per ounce; in the adulterated extracts 20 cents for 1.95 ounces, or 10.3 cents per ounce; and in the compound extracts 12.1 cents for 1.62 ounces, or 7.5 cents per ounce. The compound extracts are very properly on the average sold for a lower price than the high-grade extracts made from the vanilla bean only.

MISCELLANEOUS FOODS.

22088. HAZELDELL BRAND SYRUP, Pure Strawberry Syrup, 40 per cent., Pure Apple Syrup, 20 per cent., Pure Corn Syrup, 40 per cent., $^1/_{10}$ of 1 per cent. Benzoate Soda added. Made by The John T. Doyle Co., New Haven. Sold by A. N. Loeb, New Haven. Price, 10 cents per bottle.

It contained 68.13 per cent. total solids, polarization direct at 21°, + 84.0, polarization after inversion at 21°, + 68.9, lead number, 1.08, ash, 0.32.

22258. DELFT PEANUT OIL. Made by Franco-Dutch Oil Works, Calvé-Delft, Delft, Holland. Sold by Wise, Smith & Co., Hartford. Price, 25 cents per bottle, containing 6.1 ounces.

It showed a specific gravity at 15.6° of 0.916, and a refractive index of 1.4717 at 15.5°. No cottonseed or sesame oil present.

21124. TRUMILK, Fresh Milk in Powder Form. Made by Merrell-Soule Co., Syracuse, N. Y. Sold by Atlantic and Pacific Tea Co., Bridgeport. Price, 10 cents per can.

It contained 3.78 per cent. water, and 96.22 total solids, divided as follows: ash, 6.00, protein ($N \times 6.38$), 25.65, fat, 27.36, and lactose, 37.21.

II. DRUG PRODUCTS.

LINIMENTUM CAMPHORAE.

(Camphor Liniment.)

The U. S. P. requires that 200 gms. of camphor and 800 gms. of cottonseed oil be introduced into a suitable flask, and a gentle heat applied, by means of a water bath, loosely stoppering the flask during the operation; the flask should be agitated occasionally until the camphor is dissolved. In other words, the liniment is a 20 per cent. solution of camphor in cottonseed oil.

Owing to the danger of loss of some of the camphor by volatilization when heat is applied, some pharmacists prefer to make the solution in the cold, which requires more time but secures the same product. There is the danger, however, that through carelessness the camphor may not be entirely dissolved and that the material may be dispensed before complete solution is effected. Several of the samples examined this year contained undissolved camphor, showing that this method of preparation had been employed.

The terms "camphor liniment" and "camphorated oil" seem to be used synonymously by Connecticut druggists, the latter name being most generally employed. While in practically every instance "camphor liniment" was asked for at the time of purchase, fully 90 per cent. of the samples were labeled "camphorated oil" when dispensed. It is apparent, therefore, that our druggists consider them the same preparation and that the standard of 20 per cent. camphor should be applied even when the sample is marked "camphorated oil."

Methods of Analysis.

Refractive Index. The refraction of the oil was determined at 25° in the butyro-refractometer without removal of the camphor. The purpose

of this determination was the detection of the oil used. It was shown by experiment that the presence of the camphor had but little effect on the refractive index of the liniment, especially when cottonseed oil was used.

Camphor. The results reported in the main tables were secured by heating about 5 grams of the liniment in an aluminum dish on the water bath until the odor of camphor was absent, followed by one-hour periods of heating in the water oven until constant weight was secured. (In some cases a slight increase of weight was observed due to the oxidation of the oil.) The presence of water in the liniment naturally caused high results by this method.

An alternative method, used in connection with the above in the Dairy Commissioner's samples, consisted in the polarization of the liniment in a 100 mm. tube, using a color screen, consisting of a 50 mm. tube containing a 10 per cent. solution of potassium bichromate, to correct for the

POLARIZATION OF CAMPHOR IN COTTON SEED OIL.

Polarization, 100 mm. (Ventzke).	Camphor per cent.	Polarization, 100 mm. (Ventzke).	Camphor per cent.	Polarization, 100 mm. (Ventzke).	Camphor per cent.	Polarization, 100 mm. (Ventzke).	Camphor per cent.
−0.3	0.0	7.3	5.3	14.5	10.3	21.6	15.3
+0.8	0.8	7.8	5.6	15.0	10.7	22.1	15.7
1.1	1.0	8.3	6.0	15.5	11.0	22.6	16.0
1.6	1.3	8.7	6.3	16.0	11.3	23.1	16.3
2.1	1.7	9.2	6.6	16.5	11.6	23.6	16.7
2.6	2.0	9.7	7.0	16.9	12.0	24.1	17.0
3.0	2.3	10.2	7.3	17.4	12.3	24.6	17.3
3.5	2.6	10.7	7.7	17.9	12.6	25.1	17.6
4.0	3.0	11.2	8.0	18.3	13.0	25.7	18.0
4.5	3.4	11.6	8.3	18.8	13.3	26.2	18.3
5.0	3.7	12.0	8.6	19.2	13.6	26.7	18.7
5.4	4.0	12.6	9.0	19.7	14.0	27.2	19.0
5.9	4.3	13.0	9.3	20.1	14.3	27.5	19.3
6.4	4.6	13.5	9.6	20.6	14.6	28.2	19.7
6.9	5.0	14.0	10.0	21.1	15.0	28.7	20.0

TABLE XXXI.—COMPARATIVE RESULTS ON CAMPHOR.

Evaporation.	Polariscope.	Evaporation.	Polariscope.	Evaporation.	Polariscope
1.1	0.6	10.5	10.0	15.9	15.8
2.8	2.9	10.5	10.1	15.8	16.1
7.3	7.4	10.1	10.3	16.4	16.5
7.9	7.8	10.6	10.9	16.6	16.5
8.9	8.6	11.3	11.2	16.5	17.0
9.2	9.0	12.3	12.3	17.3	17.5
8.9	9.2	13.0	13.0	17.8	17.6
9.7	9.6	13.1	13.1	17.6	17.8
9.5	9.7	13.1	13.2	18.0	17.8
9.7	9.7	13.5	13.5	18.3	18.3
9.7	9.7	14.2	14.3	19.7	19.7
9.8	9.9	14.9	14.9	21.1	21.1

TABLE XXXII.—CAMPHORATED OIL UP TO STANDARD.*

Station No.	Dealer.	Cost per bottle, cents.	Capacity of bottle, fl. oz.	Refractive Index at 25° C.	Per cent. of Camphor.
21335	*Ansonia:* The Bristol Drug Co.	10	2	1.4704	18.9
20950	*Bethel:* Chas. J. English	20	2	1.4697	22.7
21390	*Branford:* Hoadley & Hutchinson	15	2	1.4697	21.1
21139	*Bridgeport:* Atlantic Hotel Pharmacy	15	2	1.4702	23.3
21145	Damtoft & Meyer	15	2	1.4704	22.3
21138	Lee's Pharmacy	15	2	1.4700	18.8
21144	J. A. Leverty & Bro.	10	2	1.4700	18.2
21137	Edward Toucey	15	2	1.4694	18.1
21683	*Bristol:* Merriman Bros.	20	2	1.4741	26.5
21783	Bristol Pharmacy	20	2	1.4720	19.8
21682	Perry N. Holley	25	2	1.4697	19.5
21768	*Danielson:* W. W. Woodward	15	2	1.4717	19.4
21765	A. G. Beckley & Co.	20	2	1.4723	19.4
21180	*Danbury:* Phillip Simon	15	2	1.4700	22.9
21178	Doran's Drug Store	20	2	1.4697	21.4
21179	E. W. Baldwin	20	2	1.4696	20.5
21319	*Derby:* G. H. Harding	15	2	1.4700	19.8
21104	*Greenwich:* W. E. Finch	25	4	1.4697	18.6
21279	*Hartford:* Anton Hellman	15	2	1.4697	22.8
21276	D. G. Stoughton & Co.	25	2	1.4700	22.7
21278	The Sissa Pharmacy	10	2	1.4697	22.0
21392	*Litchfield:* Crutchs' Pharmacy	15	2	1.4700	23.9
21393	Pratt's Pharmacy	20	2	1.4697	20.6
21394	J. Wolcott Wheeler	20	2	1.4697	20.2
21412	*Manchester:* W. H. Grant	20	2	1.4704	18.1
21068	*Meriden:* Lamping's Pharmacy	25	2	1.4704	19.9
21065	Meriden House Drug Store	20	2	1.4707	19.2
21067	Graeber's Pharmacy	10	2	1.4704	18.9
21214	*Middletown:* Jos. P. Kinsella	20	2	1.4695	20.3
21761	*Moosup:* J. W. Tuckerman	15	2	1,4723	19.7
21744	*Mystic:* H. N. Wheeler	20	2	1.4704	20.5
21746	Starr Bros. Drug Co.	20	2	1.4700	19.7
21359	*Naugatuck:* John J. Kehoe	15	2	1.4697	23.3
21365	Naugatuck Drug Co.	15	2	1.4697	19.0
21076	*New Britain:* Crowell the Druggist	20	2	1.4700	20.1
21078	Bergquist Bros.	20	2	1.4704	18.5
20939	*New Canaan:* Central Pharmacy	20	2	1.4672	22.0
21116	*New Haven:* Morris Pharmacy	15	2	1.4700	25.7
21314	A. B. Simpkin	15	2	1.4700	21.7
20933	J. Linde & Son	20	4	1.4697	21.1
21293	S. L. Salisbury	13	2	1.4704	21.0
20932	J. M. Jacobs	25	4	1.4700	21.0
20935	E. Wadewitz	35	4	1.4700	20.0
21317	Chas. Fleishner	10	2	1.4797	20.0
21312	A. B. Hall	15	2	1.4704	19.0
20934	Keane's Pharmacy	25	4	1.4710	18.6
20931	A. F. Wood's Sons	25	4	1.4702	18.6
21118	T. J. Beck	15	2	1.4700	18.5

* Includes samples less than 10 per cent. below U. S. P. strength.

TABLE XXXII.—CAMPHORATED OIL UP TO STANDARD*—*Continued.*

Station No.	Dealer.	Cost per bottle, cents.	Capacity of bottle, fl. oz.	Refractive Index at 25° C.	Per cent. of Camphor.
21229	*New London:* McBride's Pharmacy	20	2	1.4700	23.8
21221	Downey's Pharmacy	20	2	1.4700	22.3
21225	Randale's Drug Store	15	2	1.4698	22.2
21226	E. Callahan	15	2	1.4696	21.1
21227	Taylor's Pharmacy	15	2	1.4692	20.5
21228	Sayle's Pharmacy	20	2	1.4700	19.6
20944	*New Milford:* W. N. Noble	20	2	1.4697	21.9
20943	Albert Evitts	25	2	1.4697	19.4
21037	*Norwalk:* H. Glendenning & Co.	35	4	1.4704	19.4
21750	*Norwich:* P. F. Bray	20	2	1.4697	23.2
21751	Bisket & Meech	20	2	1.4697	20.1
21238	John A. Dunn	23	2	1.4704	18.5
21250	The Lee and Osgood Co.	20	2	1.4700	18.1
21775	*Putnum:* Henry L. Burt	10	2	1.4707	25.2
21411	*Rockville:* Fred Woodhall & Co.	15	2	1.4704	22.5
21408	W. H. Sills	15	2	1.4700	19.3
21409	F. E. Metcalf	15	2	1.4700	19.0
21660	*So. Manchester:* The Rapeley Drug Co.	15	2	1.4697	20.7
21413	T. Weldon & Co.	20	2	1.4704	18.1
21030	*Stamford:* C. S. Finch	25	4	1.4704	18.7
21404	*Stafford Springs:* Anders Jacobsen	15	2	1.4697	20.0
21690	*Thompsonville:* John A. Williams	25	2	1.4710	19.0
21691	Geo. R. Steele	25	2	1.4707	18.2
21391	*Torrington:* C. H. Dougal	10	2	1.4704	19.7
21387	*Wallingford:* Geo. A. Smith	10	2	1.4697	21.5
21648	*Waterbury:* Mrs. Moore†	10	-	1.4704	18.9
20989	G. Leslie Dexter & Co.	15	2	1.4704	18.8
20979	West End Drug Store	20	2	1.4723	18.2
20980	Callender & Haggerty	35	4	1.4697	18.1
21687	*Windsor Locks:* J. W. Roberts	15	2	1.4704	19.2
21701	*Winsted:* G. L. Fancher	15	2	1.4700	21.9
21700	C. C. Buck	15	2	1.4700	20.3
21699	The Baird Pharmacy	15	2	1.4704	19.4

* Includes samples less than 10 per cent. below U. S. P. strength.
† Arthur's Camphorated Oil. The Five and Ten Cent Drug Cabinet Co., New Haven.

dispersion of the camphor. The table on page 239, based on one prepared by H. C. Lythgoe,* will be found convenient in calculating results.

The two methods were compared on thirty-six samples with excellent results, as the tabulation shows. The average camphor by the two methods was identical, and the greatest variation was 0.5 per cent.; in twenty-eight of the samples the variation was 0.2 per cent. or less. The polarization method is much quicker and, it is believed, more accurate, as the disturbing effect of the presence of water and easily oxidized oils are thereby eliminated.

* Report, Mass. Board of Health, 1907, p. 380.

TABLE XXXIII.—CAMPHORATED OIL BELOW STANDARD.

Station No.	Dealer.	Cost per bottle, cents.	Capacity of bottle, fl. oz.	Refractive Index at 25° C.	Per cent. of Camphor.	Per cent. U. S. P. Strength.
21336	*Ansonia:* S. W. Smith & Co.	15	2	1.4707	9.6	48.0
20949	*Bethel:* P. J. Garvin	20	2	1.4697	16.4	82.0
21389	*Branford:* John A. Morton	15	2	1.4697	12.2	61.0
21155	*Bridgeport:* J. A. Leverty & Bro.	10	2	1.4702	17.8	89.0
21142	The Cyrus Pharmacy	15	2	1.4700	13.1	65.7
21158	Wilma M. Bachman	15	2	1.4707	6.5	32.5
21143	Dupee's Pharmacy	15	2	1.4705	0.0	0.0
21680	*Bristol:* Madden's Drug Store	15	2	1.4697	13.8	69.0
21681	Perry N. Holly	20	2	1.4697	12.1	60.5
21707	*Canaan:* John L. Thurlough	15	2	1.4704	13.0	65.0
21695	*Collinsville:* H. A. Smith	15	2	1.4697	17.8	89.0
21693	E. A. Hough	15	2	1.4704	15.5	77.5
21696	Geo. F. Lewis	15	2	1.4707	8.2	41.0
21169	*Danbury:* Reed & Co.	15	2	1.4705	17.2	86.0
21767	*Danielson:* The Burroughs Drug Co.	15	2	1.4720	15.9	79.5
21766	L. J. Morin	20	2	1.4723	9.8	49.0
21753	*Greeneville:* John A. Morgan	20	2	1.4723	15.3	76.5
21752	W. J. Galvin & Co.	25	2	1.4735	10.3	51.5
21353	*Hartford:* Rickman Bros.	15	2	1.4697	16.0	80.0
21277	T. J. Blake, Jr.	15	2	1.4700	14.8	74.0
21354	D. W. Tracy	15	2	1.4697	14.8	74.0
21355	D. G. Stoughton & Co.	25	2	1.4700	14.5	72.5
21356	Pike's Drug Store	20	2	1.4694	5.9	29.5
21352	P. J. Cavanaugh	20	2	1.4704	3.9	19.5
21758	*Jewett City:* William Soule	20	2	1.4717	17.3	86.5
21759	L. V. L'Heureaux	20	2	1.4704	15.8	79.0
21659	*Manchester:* Balch & Brown	15	2	1.4697	17.7	88.5
21066	*Meriden:* V. W. Schmelzer	15	2	1.4707	9.6	48.0
21212	*Middletown:* H. N. Lincoln	10	2	1.4672	14.8	74.0
21211	Bergquist Bros.	10	2	1.4698	13.8	69.0
21213	Henry Woodward	10	2	1.4822	9.7	48.5
21762	*Moosup:* W. H. Sargent	15	2	1.4723	7.6	38.0
21745	*Mystic:* Mystic Pharmacy	20	2	1.4697	17.8	89.0
21077	*New Britain:* Halloran's Drug Store	15	2	1.4711	16.8	84.0
21079	Joseph H. Lutz	10	2	1.4710	15.9	79.5
21784	Odell's Pharmacy	20	2	1.4707	7.8	39.0
20940	*New Canaan:* L. M. Monroe	20	2	1.4697	16.9	84.5
21291	*New Haven:* G. D. Farovid	13	2	1.4704	17.9	89.5
21638	Mayer & Loeb*	10	-	1.4700	17.3	86.5
21117	T. J. Lynch	15	2	1.4700	16.0	80.0
21290	T. P. Gillespie & Co.	10	2	1.4704	15.1	75.5
21115	C. A. Lamb	15	2	1.4700	13.0	65.0
21292	C. H. Conway	15	2	1.4710	11.2	56.0
21294	J. T. Hillhouse	15	2	1.4697	10.5	52.5
20930	James A. Notkin	20	4	1.4700	8.9	44.5
21316	James A. Notkin	15	2	1.4697	8.7	43.5
21315	C. P. Cipolla	15	2	1.4697	8.6	43.0
21251	*Norwich:* Wm. H. Nicholson	15	2	1.4703	9.5	47.5

* Arthur's Camphorated Oil. The Five and Ten Cent Drug Cabinet Co., New Haven.

TABLE XXXIII.—CAMPHORATED OIL BELOW STANDARD—*Continued.*

Station No.	Dealer.	Cost per bottle, cents.	Capacity of bottle, fl. oz.	Refractive Index at 25° C.	Per cent. of Camphor.	Per cent. U. S. P. Strength.
21249	*Norwich:* B. A. Herrick	23	2	1.4713	5.1	25.5
21777	*Putnam:* G. E. Dresser	15	2	1.4717	14.3	71.5
21716	Simon Farley	10	2	1.4717	12.0	60.0
21410	*Rockville:* E. F. Wilson	15	2	1.4704	16.3	81.5
21326	*Shelton:* Fred S. Sanford	15	2	1.4707	13.3	66.5
21661	*So. Manchester:* O. L. Wickes & Co.	20	2	1.4697	14.1	70.5
21041	*So. Norwalk:* E. W. Kelley, Jr.	30	2	1.4707	16.8	84.0
21405	*Stafford Springs:* A. C. Eaton	20	2	1.4700	12.0	60.0
21025	*Stamford:* Goulden's Pharmacy	30	2	1.4704	16.6	83.0
21026	Parker & Ward	30	2	1.4710	11.4	57.0
21741	*Stonington:* Burtsch's Drug Store	15	2	1.4672	9.7	48.5
21740	Dr. C. E. Brayton & Co.	15	2	1.4704	7.0	35.0
20962	*Torrington:* Jas. N. Banziger	10	2	1.4700	14.4	72.2
20961	E. W. Nolan	10	2	1.4704	13.4	67.0
20960	Claxton's Pharmacy	10	2	1.4697	9.5	47.5
21386	*Wallingford:* A. B. Pixley	15	2	1.4697	17.9	89.5
21388	J. D. Tucker	15	2	1.4700	16.1	80.5
21385	T. F. Collins	15	2	1.4697	11.2	56.0
20988	*Waterbury:* Apothecaries Hall Co.	15	2	1.4704	16.7	83.5
20994	N. A. Upham	25	2	1.4700	16.4	82.0
20991	McCarthy Pharmacy	10	2	1.4704	14.9	74.5
21737	*Waterville:* T. B. Carney & Co.	25	2	1.4704	11.0	55.0
21738	Geo. A. Sayers	20	2	1.4700	17.3	86.5
21083	*Willimantic:* Leonard's Pharmacy	15	2	1.4668	2.9	14.5
21082	J. J. Hickey & Co.	10	2	1.4675	1.1	5.5
21688	*Windsor Locks:* J. W. Browning	20	2	1.4704	16.9	84.5
21702	*Winsted:* Judson's Pharmacy	15	2	1.4700	17.3	86.5
21704	Phelps' Pharmacy	15	2	1.4768	11.8	59.0
21703	W. H. Mills	10	2	1.4777	9.0	45.0

It is frequently claimed that not only is camphor lost during the preparation of the liniment with heat, but that even greater losses occur in dispensing the finished product. To test these claims a solution was made up strictly according to the U. S. P. proportions, using 12.5 gms. of camphor and 50 gms. of oil. After solution was effected the original 62.5 gms. weighed 62.4725 gms., a loss of only .0275 gms., or 0.04 per cent.

A portion of the liniment thus prepared was placed in a bottle, kept uncorked in a closet at room temperature (20° to 25° C.), and examined at intervals for camphor. The following results were obtained:

Original mixture	19.89%	camphor.
After 26 hours	19.89%	"
" 166 "	19.78%	"
" 362 "	19.69%	"

After standing uncorked for one day in a moderately warm place there was no loss of camphor. After seven days a loss of only 0.11 per cent. The very severe test of standing uncorked for fifteen days caused a loss of but 0.20 per cent. In the preceding tables we have classed as up to standard all samples containing 18 per cent. or more of camphor, an allowance of 10 per cent. variation from the standard, certainly a very generous allowance.

One hundred and fifty-eight samples were collected by the station, seventy-seven of which were less than 90 per cent. of U. S. P. strength. The analyses are given in Tables XXXII and XXXIII.

The selling price ranged from 10 to 25 cents for 2-ounce bottles, and from 20 to 35 cents for 4-ounce bottles.

The samples ranged in camphor from none at all to 26.5 per cent., with an average of 16.69 per cent. A summary follows:

41	samples	contained	from	20–26	per cent.
40	"	"	"	18–20	" "
23	"	"	"	16–18	" "
25	"	"	"	12–16	" "
15	"	"	"	9–12	" "
10	"	"	"	5–9	" "
4	"	"	less than	5	" "

The refractive indices in a number of samples were abnormal for cottonseed oil. The refractive index of cottonseed oil at 25° C. ranges from 1.4702 to 1.4722. The indices of the camphorated oil classed as up to standard ranged from 1.4672 to 1.4741, while those below standard ranged from 1.4668 to 1.4822. In the nine samples giving the abnormal refractive indices the Hübl iodine number was determined in both the original and decamphorated oils, the absorption period being four or sixteen hours. The results secured appear below.

No. 21683 consisted largely of cottonseed oil, but the high refractive index and iodine number indicated an impure oil. No. 21752 likewise consisted largely of an impure cottonseed oil. No. 21212 gave only a moderate Halphen reaction for cottonseed oil, and contained no sesame oil (Baudouin test). The free fatty acids in 100 gms. of sample were equivalent to 52 cc. $\frac{N}{10}$ KOH. For various reasons the data exclude corn, palm, olive and castor oils. A mixture of cottonseed oil and lard oil would refract as

ANALYSES OF SOLVENT OILS.

Station No.	Butyro Refractometer at 25° C.	Refractive Index at 25° C.	Hübl Iodine Number. Original Oil. 4 hrs.	Original Oil. 16 hrs.	Decamphorated Oil. 4 hrs.	Halphen Test.	Conclusions.
21683	73	1.4741	117.8	119.1	----	Yes	Impure cottonseed oil.
21752	72	1.4735	91.5	----	79.2	Yes	Impure cottonseed oil.
21212	62	1.4672	40.3	----	42.9	Yes	Cottonseed oil, and low refracting oil, probably lard oil.
21213	86.5	1.4822	38.4	----	43.9	Yes	Cottonseed oil, a mineral oil, and possibly linseed oil.
21741	62	1.4672	75.1	----	72.2	No	Olive oil.
21083	61.5	1.4668	73.7	----	77.0	No	Olive oil.
21082	62.5	1.4675	81.9	----	79.1	No	Olive oil.
21704	77.5	1.4768	101.4	101.6	98.6	Yes	Impure cottonseed oil.
21703	79	1.4777	158.0	161.8	150.1	No	Probably linseed oil.

this sample did, but the iodine number should be higher. The content of free fatty acids would tend to reduce this number and might bring it down to the number shown by the sample.

No. 21213 showed a very high refractive index and low iodine number. Saponification and extraction of the soap solution with ether gave a fluorescent solution, indicating the presence of a hydrocarbon (mineral) oil. Since hydrocarbon oils do not absorb iodine to any appreciable extent under the conditions of the Hübl method, the effect of its presence in the sample is to lower the iodine number. The high refractive index can only be accounted for by the presence of some high refracting oil like linseed oil.

Nos. 21741, 21083 and 21082 contained no cottonseed oil, and consisted chiefly of olive oil, the oil formerly required by the U. S. P. formula.

No. 21704 consisted of an impure cottonseed oil. No. 21703 contained no cottonseed oil; its high refractive index and iodine number indicated that it was probably largely linseed oil.

Dairy Commissioner's Samples.

It is the practice of the station, in order to save the expense of the triple samples required by the law, to take single samples of foods and drugs, analyze them, and report those found to be adulterated, misbranded, or below standard to the Dairy Commissioner. He in turn, or his deputy, takes second samples from the stock of the dealers reported, and prosecutions are based on the analyses of these samples made by the station. A possible objection to this method is that if it be noised abroad that the station is examining a certain class of materials, the Dairy Commissioner is quite likely to find the samples he takes fully up to standard. On the other hand, while prosecutions are often

TABLE XXXIV.—CAMPHORATED OIL UP TO STANDARD* (DAIRY COMMISSIONER'S COMPARED WITH STATION'S SAMPLES).

Station No.	Dealer.	Dairy Commissioner.		Station.	
		Refractive Index at 25° C.	Camphor.	Refractive Index at 25° C.	Camphor.
2703	*Bridgeport:* Dupee's Pharmacy	1.4707	19.0	1.4705	0.0
2702	Wilma M. Bachman	1.4704	18.4	1.4707	6.5
2726	*Bristol:* Madden's Drug Store	1.4685	18.9	1.4697	13.8
2799	*Collinsville:* E. A. Hough	1.4704	19.7	1.4704	15.5
2667	*Hartford:* Pike's Drug Store	1.4697	20.1	1.4694	5.9
2666	P. J. Cavanaugh	1.4697	19.2	1.4704	3.9
2676	T. J. Blake, Jr.	1.4704	19.2	1.4700	14.8
2677	*New Britain:* Joseph H. Lutz	1.4704	20.0	1.4710	15.9
2747	*New Haven:* The 5c & 10c Drug Cabinet Co.	1.4704	21.1	------	...
2768	*Norwich:* John A. Morgan	1.4704	23.1	1.4723	15.3
2715	Wm. H. Nicholson	1.4697	23.0	1.4703	9.5
2759	*Putnam:* G. E. Dresser	1.4704	18.0	1.4717	14.3
2710	*Shelton:* Fred S. Sanford	1.4685	22.0	1.4707	13.3
2793	*So. Manchester:* Wickes & Quinn	1.4697	18.3	1.4697	14.1
2658	*Torrington:* E. F. Nolan	1.4704	27.0	1.4704	13.4
2660	Claxton's Pharmacy	1.4694	21.5	1.4697	9.5
2661	Jas. N. Banziger	1.4697	21.2	1.4700	14.4
2685	*Wallingford:* T. F. Collins	1.4704	19.9	1.4697	11.2
2684	D. J. Tucker	1.4704	18.2	1.4700	16.1
2674	*Willimantic:* J. J. Hickey & Co.	1.4697	21.2	1.4675	1.1

* Includes samples less than 10 per cent. below U. S. P. strength.

thus avoided, the real purpose of the law, namely, that the consumer shall be offered only pure foods and drugs, is in great measure accomplished.

The effect of this method of examination is shown very clearly in the examination of camphorated oil this year. At the instance of the station the Dairy Commissioner collected fifty samples of camphorated oil from druggists whom the station had reported as selling material below standard. Analyses of these samples showed that twenty of them now met the station's requirements, while thirty were still more than 10 per cent. below standard.

It will be observed from the table, where the two sets of samples are compared, that in the "up to standard" samples the average percentage of camphor rose from 11.0 to 20.4, while in the samples still below standard there was a slight increase from

TABLE XXXV.—CAMPHORATED OIL BELOW STANDARD (DAIRY COMMISSIONER'S COMPARED WITH STATION'S SAMPLES).

Sample No.	Dealer.	Dairy Commissioner.		Station.	
		Refractive Index at 25° C.	Camphor.	Refractive Index at 25° C.	Camphor.
2707	*Ansonia:* S. W. Smith & Co.	1.4704	16.5	1.4707	9.6
2711	*Branford:* John A. Morton	1.4704	13.5	1.4697	12.2
2701	*Bridgeport:* The Cyrus Pharmacy	1.4704	13.0	1.4700	13.1
2769	*Canaan:* John L. Thurlough	1.4707	11.9	1.4704	13.0
2761	*Danielson:* The Burroughs Drug Co.	1.4704	17.8	1.4720	15.9
2762	L. J. Morin	1.4710	17.6	1.4723	9.8
2665	*Hartford:* Rickman Bros.	1.4685	14.6	1.4697	16.0
2668	D. G. Stoughton & Co.	1.4697	11.2	1.4700	14.5
2664	D. W. Tracy	1.4697	9.7	1.4697	14.8
2725	*Jewett City:* L. V. L'Heureaux	1.4704	15.8	1.4704	15.8
2698	*Meriden:* V. W. Schmelzer	1.4704	12.3	1.4707	9.6
2696	*Middletown:* Bergquist Bros.	1.4710	16.5	1.4698	13.8
2693	H. N. Lincoln	1.4678	15.2	1.4672	14.8
2694	Henry Woodward	1.4710	13.1	1.4822	9.7
2765	*Moosup:* W. H. Sargent	1.4710	7.4	1.4723	7.6
2751	*New Britain:* Odell's Pharmacy	1.4717	9.2	1.4707	7.8
2739	*New Haven:* Mayer & Loeb*	1.4707	17.5	1.4700	17.3
2687	C. A. Lamb	1.4704	14.3	1.4700	13.0
2679	J. T. Hillhouse	1.4704	10.9	1.4697	10.5
2681	Conway & Currier	1.4697	10.1	1.4710	11.2
2669	James A. Notkin	1.4700	8.6	1.4700	8.9
2766	*Norwich:* W. J. Galvin & Co.	1.4717	17.0	1.4735	10.3
2691	Engler & Smith	1.4707	14.9	------	---
2760	*Putnam:* Simon Farley	1.4704	10.0	1.4717	12.0
2734	*Rockville:* E. F. Wilson	1.4704	17.0	1.4704	16.3
2733	*Stafford Springs:* A. C. Eaton	1.4704	7.8	1.4700	12.0
2714	*Stamford:* Parker & Ward	1.4704	9.9	1.4710	11.4
2662	*Waterbury:* McCarthy Pharmacy	1.4700	13.2	1.4704	14.9
2672	*Willimantic:* Leonard's Pharmacy	1.4700	9.7	1.4668	2.9
2757	*Windsor Locks:* H. N. Lebell	1.4704	16.1	------	---

* Arthur's Camphorated Oil. The Five and Ten Cent Drug Cabinet Co., New Haven.

12.1 to 12.9 per cent. The improvement in certain individual samples was very marked; for instance, one that contained no camphor at all rose to 19 per cent., four others originally containing less than 7 per cent., in the second samples showed from 18 to 21 per cent. On the other hand, twenty-two samples showed very little or no improvement. It is to be observed, also, that in every case but one, No. 2693, the oil used was cottonseed; samples 2674 and 2672, the station samples being made with olive oil, contained cottonseed oil only; sample 2694, the station sample containing mineral oil and a high refracting oil, contained only cottonseed oil as required. On the whole the improvement is quite satisfactory, and while by our method of taking samples twenty druggists have escaped the chance of prosecution, our inspection has at least resulted in supplying consumers with twenty more stores where they can purchase standard camphorated oil.

CASTOR OIL.

(*Oleum Ricini.*)

The Pharmacopœia describes castor oil as "a fixed oil expressed from the seed of *Ricinus communis* Linné." "A pale

TABLE XXXVI.—CASTOR OIL NOT FOUND ADULTERATED.

Station No.	Dealer.	Price per bottle, cents.	Specific Gravity at 25° C.	Refractive Index at 25° C.	Iodine Absorption No.	Solubility in Alcohol
21105	*Greenwich*: H. C. Boswell	20	.9584	1.4768	87	Complete
21062	*Meriden*: N. P. Forcier	10	.9594	1.4765	87	Complete
21064	H. T. Graeber	10	.9554	1.4762	88	Complete
21063	West End Pharmacy	10	.9574	1.4762	88	Complete
21074	*New Britain*: J. P. Connors	15	.9564	1.4765	87	Complete
21075	Geo. M. Ladd	10	.9531	1.4765	88	Complete
21073	S. P. Storrs	10	.9544	1.4762	87	Complete
21120	*New Haven*: J. J. Alling	10	.9534	1.4768	89.6	Complete
21639	*Mayer & Loeb	10	.9274	1.4768	84	Complete
21121	C. B. Storer	10	.9531	1.4765	88	Complete
21119	Frank Thompson	10	.9534	1.4771	88	Complete
20936	E. Wadewitz	15	.9534	1.4765	87	Complete
21040	*South Norwalk*: F. H. Baxter	15	.9594	1.4765	87	Complete
21029	*Stamford*: †Cash Premium Store	10	.9594	1.4765	88	Complete
21021	A. L. Embree	15	.9594	1.4765	87	Complete
21022	W. H. Jones	15	.9594	1.4765	86	Complete
20987	*Waterbury*: John B. Ebbs	10	.9584	1.4762	87	Complete
20993	Ideal Pharmacy	15	.9594	1.4768	86	Complete
20985	Picarelli's Pharmacy	25	.9554	1.4765	87	Complete
20986	Waterbury Drug Co.	15	.9594	1.4765	87	Complete
21085	*Willimantic*: Chas. De Villiers	10	.9554	1.4765	88	Complete
21084	Fred Rogers	10	.9554	1.4777	86	Complete

* Arthur's Castor Oil. The Five and Ten Cent Drug Cabinet Co., New Haven.

† Howland's Pure Cold Pressed Castor Oil. Vernon Mfg. Co., Mount Vernon, N. Y.

yellowish or almost colorless, transparent, viscid liquid, having a faint, mild odor, and a bland, afterwards acrid and generally offensive taste. Specific gravity: 0.945 to 0.965 at 25° C." It should be soluble in three times its volume of 92.5 per cent. alcohol, and its iodine value should be not less than 86 nor more than 89 after eight hours' absorption. The refractive index at 25° C. should be between 1.4758 and 1.4771.

Twenty-two samples were examined, all but two of which bore simply the druggist's label.

With the exception of Arthur's Castor Oil, **21639**, all the samples met the U. S. P. requirements. This sample was low in specific gravity and in iodine absorption power, but no foreign oil was detected in it. The other samples ranged in specific gravity from .9531 to .9594, refractive index from 1.4672 to 1.4777, and iodine number from 86 to 89.6.

CATARRH POWDERS.

These powders are very commonly used, not only to mitigate the disease specified, but also as a means of securing cocaine by those addicted to that drug, some of them containing nearly 4 per cent. of cocaine hydrochlorid. The sale of any cocaine preparation is illegal in this State except on a physician's prescription.

Six samples were examined last year for the Dairy Commissioner, but no details were supplied in our last report. These are now included, together with seven additional samples collected this year, as follows:

2121. *Anglo-American Med. Co.'s Catarrhal Powder* (contains 10 gr. cocaine to the ounce or 2.5 per cent.), Anglo-American Med. Co., Chicago, Ill., Toronto, Can. (Formerly sold as Dr. Agnew's Catarrhal Powder.) Sold by W. H. Crowell, New Britain; price, 50 cents per bottle. *It contained 0.88 per cent. cocaine.*

21047. *Dr. Birney's Catarrh Pulver,* Birney Catarrhal Powder Co., Chicago, New York (Sodium bicarbonate, sodium benzoate, eucalyptol and menthol, combined with 1⅞ per cent. cocaine hydrochlorate). Sold by Graeber's Pharmacy, Meriden; price, 50 cents per package. *It contains 1.10 per cent. cocaine hydrochlorid.*

2097. *Dr. Coles Catarrh Cure,* The Cole Medicine Co., Brooklyn, N. Y. Sold by John F. Berger, Ansonia; price, 25 cents per bottle. *It contained 3.77 per cent. cocaine hydrochlorid.* **2095,** same brand, sold by Waterbury Drug Co., Waterbury; same price. *It contained 3.08 per cent. cocaine hydrochlorid.* **2100,** same brand, sold by S. H. Williams & Co., New Haven; same price. *It contained 3.22 per cent. cocaine hydrochlorid.* These three samples are also illegally labeled a "cure."

2093. *Gray's Catarrh Powder* (eight grains cocaine hydrochlorid to the ounce), The Gray Medicine Co., New York. Sold by Edward Toucey, Bridgeport; price, 25 cents per bottle. *It contained 1.66 per cent. cocaine hydrochlorid.* **2096,** same brand, sold by Apothecaries Hall Co., Waterbury; price, 50 cents per bottle. *It contained 1.68 per cent. cocaine hydrochlorid.* **3035** and **20978,** same brand, sold by the same druggists, respectively, a few months later (guaranteed to contain no harmful drugs). No cocaine was present in either sample.

20977. *Dr. Marshall's Aromatic Catarrh and Headache Snuff* (It contains no cocaine, morphine nor other injurious drugs), F. C. Keith, Cleveland, O. Sold by Callender & Haggerty, Waterbury; price, 25 cents per bottle. No cocaine was present.

20976. *Dr. Sage's Catarrh Remedy,* World's Dispensary Medical Asso., Buffalo, N. Y. Sold by Buckingham Pharmacy Co., Waterbury; price, 50 cents per package. No cocaine was present.

21027. *Dr. R. Schiffmann's Asthmador* (Perfectly Harmless), R. Schiffmann, St. Paul, Minn. Sold by Borg Bros. & Co., Stamford; price, 50 cents per package. No cocaine was present.

21046. *Asthma Powder* used by Inhalation, prepared for Whitman Chemical Co., Boston, Mass. Sold by A. M. Campbell, Meriden; price, 25 cents per package. No cocaine was present.

Seven of the thirteen samples contained from 0.99 to 3.77 per cent. cocaine hydrochlorid. Five of these bore a statement on the label that they contained cocaine and there is no possible legitimate excuse for their sale. It is understood by the station that Dr. Coles Catarrh Cure has been withdrawn from sale in this State. The formula for Gray's Catarrh Powder has evidently been changed, as the later samples contained no cocaine. It will be interesting to note whether this now cocaineless catarrh powder continues to maintain its former popularity.

The sale of the following catarrh powders is shown by our analysis to be illegal except on a physician's prescription:

Anglo-American Med. Co.'s Catarrhal Powder.
Dr. Birney's Catarrh Pulver.
Dr. Coles Catarrh Cure.
Gray's Catarrh Powder (old formula).

"Bing."

The search of a boy prisoner arrested in New Haven revealed an empty bottle, to the contents of which the prisoner attributed his downfall. The drug store of George D. Farovid (City Drug Store), New Haven, where the material had been purchased, was visited by representatives of County Health Officer C. E. Hoadley and of the Dairy Commissioner and six samples of the powder, called *"Bing,"* were bought and submitted to the station for analysis. These contained 2.79, 2.77, 2.81, 1.95, 2.79 and 2.81 per cent. of cocaine, respectively.

Two other suspicious samples were submitted by Mr. Hoadley, **22164,** *Menthol Snuff,* sold by a New Haven druggist, and **22165,** an unnamed white powder bought in a New Haven cheap lodging-house. The former consisted largely of menthol, and contained no morphine and only a trace of cocaine. The latter contained no cocaine, but responded to positive tests for morphine.

COD LIVER OIL.

(*Oleum Morrhuae.*)

The U. S. Pharmacopœia defines cod liver oil as "a fixed oil obtained from the fresh livers of *Gadus morrhua* Linné, and of other species of *Gadus.*" "A pale yellow, thin, oily liquid, having a peculiar, slightly fishy, but not rancid odor and a bland, fishy taste."

Its specific gravity should be between 0.918 and 0.922 at 25° C. It should be "only very slightly acid to blue litmus paper which has been previously moistened with alcohol (limit of *free fatty acids*)." Its iodine absorption value, after standing four hours, should not be less than 140 nor more than 150.

The Pharmacopœia also prescribes certain tests for detecting the presence of seal oil and other fish oils, but in our experience these tests give no satisfactory results. Tolman* made an extensive study of American cod liver oils of known purity and

* Jour. Amer. Chem. Soc., 1906, *28*, 388.

TABLE XXXVII—COD LIVER OIL.

Station No.	Manufacturer or Dealer.	Place of Sampling.	Specific gravity at 25° C.	Refractive Index at 25° C.	Iodine No. Hübl.	Reichert-Meissl No.	Free Fatty Acids as Oleic.
							%
21136	Cod Liver Oil	*Bridgeport:* J. N. McNamara	.923	1.4765	159.0	0.4	0.65
20948	" " "	*Bethel:* Chas. J. English	.921	1.4771	158.5	0.2	0.48
21286	" " " Squibb. E. R. Squibb & Sons, New York and Brooklyn	*New Haven:* Le Grand Cannon	.921	1.4768	152.8	0.3	0.47
21237	" " "	*Norwich:* Woodworth's Drug Store	.921	1.4759	152.7	0.9	0.49
21275	" " "	*Hartford:* W. J. Galvin	.923	1.4765	151.9	0.6	0.52
21350	" " "	*Hartford:* L. H. Tracy	.922	1.4759	151.6	0.5	0.57
20990	Pure Norwegian Cod Liver Oil	*Waterbury:* The McCarthy Pharmacy	.922	1.4765	151.4	0.6	0.90
24230	Cod Liver Oil	*New London:* Nichols & Harris	.922	1.4762	151.2	0.8	0.51
21348	" " "	*Hartford:* L. G. Harris	.923	1.4759	151.1	0.8	0.69
21366	" " "	*Naugatuck:* S. Gladding, Jr.	.922	1.4765	151.0	0.3	0.63
21112	" " "	*New Haven:* J. H. Levy	.921	1.4762	150.7	0.6	0.50
21334	" " "	*Ansonia:* W. H. Collins	.923	1.4768	150.5	0.4	0.81
21347	" " "	*Hartford:* J. P. Barnett	.922	1.4759	151.3	0.3	0.53
21151	" " "	*Bridgeport:* W. L. Watson & Co.	.922	1.4765	150.2	0.2	0.53
20945	" " "	*New Milford:* Albert Evitts	.921	1.4771	150.1	1.2	0.93
21080	" " "	*New Britain:* City Drug Store	.922	1.4771	150.0	0.6	2.02
21274	Norway Cod Liver Oil	*Hartford:* J. K. Williams	.922	1.4759	150.0	0.2	0.56
21309	Cod Liver Oil	*New Haven:* J. M. Jacobs	.922	1.4765	149.9	0.4	0.58
21088	" " "	*Willimantic:* City Drug Store	.921	1.4765	149.7	1.1	0.65
20902	" " "	*Waterbury:* Myles A. McCarthy	.921	1.4765	149.6	0.6	0.48
21006	" " "	*Greeenwich:* Greenwich Drug Store	.922	1.4765	149.6	0.4	0.46
21210	" " "	*Middletown:* Hartman Drug Co.	.923	1.4765	149.5	0.9	0.63
21310	" " "	*New Haven:* Oak Pharmacy	.923	1.4765	149.2	0.8	0.72

TABLE XXXVII—COD LIVER OIL—*Continued.*

Station No.	Manufacturer or Dealer.	Place of Sampling.	Specific gravity at 25° C.	Refractive Index at 25° C.	Iodine No. Hübl.	Reichert-Meissl No.	Free Fatty Acids as Oleic.
							%
20983	Cod Liver Oil	*Waterbury:* A. T. Webster	.921	1.4765	149.1	0.3	0.55
21395	" " "	*Litchfield:* The Wheeler Pharmacy Co.	.923	1.4765	149.0	0.4	1.26
21199	Pure Norwegian Cod Liver Oil	*Middletown:* Bergquist Bros.	.922	1.4759	148.7	0.2	0.69
21059	Cod Liver Oil	*Meriden:* V. W. Schmelzer	.922	1.4765	148.2	0.5	0.66
21061	" " "	*Meriden:* A. M. Campbell	.921	1.4762	148.2	0.5	0.72
21168	" " "	*Danbury:* Shepard's Pharmacy	.922	1.4765	148.2	0.8	0.57
21320	" " "	*Derby:* Henry B. Peck	.921	1.4759	147.9	0.4	0.60
21252	" " "	*Norwich:* Steimer's Pharmacy	.922	1.4762	147.7	0.7	0.89
21311	" " "	*New Haven:* Ferraioli & Boccagna	.923	1.4968	147.6	0.7	0.75
21024	Genuine Norwegian Cod Liver Oil	*Stamford:* Borg Bros. and Co.	.921	1.4959	147.6	0.3	0.93
21081	Cod Liver Oil	*New Britain:* Chas. Scherp	.921	1.4765	147.3	0.6	0.75
21090	" " "	*Willimantic:* Saml. Chesbro	.922	1.4765	147.1	1.1	0.80
21289	" " "	*New Haven:* E. Healy's Pharmacy	.923	1.5765	147.0	1.4	0.81
21313	" " "	*New Haven:* S. & R. Negbaur	.923	1.4765	146.4	0.6	0.66
21023	" " "	*Stamford:* J. K. Lawrence	.923	1.4765	146.4	0.1	1.20
21113	" " "	*New Haven:* J. Linde & Son	.921	1.4765	146.2	0.6	0.61
21321	" " "	*Derby:* Kelty's City Pharmacy	.921	1.4762	145.7	0.2	0.58
21110	" " "	*New Haven:* J. A. Notkin	.920	1.4762	145.5	1.2	0.54
21287	" " "	*New Haven:* H. J. Sperry	.922	1.4756	145.4	0.9	0.64
20984	" " "	*Waterbury:* Nugent's Pharmacy	.922	1.4765	145.3	0.8	0.73
21036	" " "	*Norwalk:* W. C. Baur	.921	1.4759	145.0	0.4	0.68
21325	" " "	*Shelton:* Apothecaries Hall	.923	1.4768	145.0	0.6	1.20
21156	Pure Norwegian Cod Liver Oil	*Bridgeport:* Wilma H. Bachman	.921	1.4759	144.9	0.7	0.43
21154	Cod Liver Oil	*Bridgeport:* W. H. Gardner	.922	1.4765	144.5	0.9	0.86

TABLE XXXVII—COD LIVER OIL—*Concluded.*

Station No.	Manufacturer or Dealer.	Place of Sampling.	Specific gravity at 25° C.	Refractive Index at 25° C.	Iodine No. (Hübl.)	Reichert-Meissl No.	Free Fatty acid as Oleic.
21349	Cod Liver Oil	*Hartford:* Brown's Drug Store	.923	1.4765	144.4	0.2	0.63
20937	" " "	*New Haven:* W. A. Spalding	.920	1.4765	144.1	0.4	0.38
21031	" " "	*Stamford:* Marron's Pharmacy	.920	1.4759	141.0	0.5	0.63
21114	" " "	*New Haven:* E. Wadewitz	.920	1.4759	143.5	0.1	0.94
21253	" " "	*Norwich:* C. C. Treat	.923	1.4759	143.0	0.8	1.15
21176	Pure Norwegian Cod Liver Oil	*Danbury:* Kinner & Benjamin	.921	1.4759	142.2	0.3	0.49
20956	Cod Liver Oil	*Torrington:* C. H. Dougal	.921	1.4753	142.2	0.1	1.32
21177	" " "	*Danbury:* Wheeler's Drug Store	.921	1.4750	141.8	0.6	0.74
21288	" " "	*New Haven:* Hull's Corner Drug Store	.921	1.4753	141.7	0.2	0.77
21131	Genuine Medicinal Cod Liver Oil	*Bridgeport:* F. B. Brill	.920	1.4750	141.5	0.1	0.62
21152	Cod Liver Oil	*Bridgeport:* J. A. Leverty & Bro.	.920	1.4753	141.5	1.0	0.61
20954	" " "	*Torrington:* Apothecaries Hall	.921	1.4753	141.4	0.9	0.88
21153	Pure Cod Liver Oil	*Bridgeport:* Brinkerhoff Bros.	.920	1.4750	141.1	0.7	0.80
20946	Cod Liver Oil	*New Milford:* W. N. Noble	.930	1.4771	141.1	1.5	2.78
20947	" " "	*Bethel:* P. J. Garvin	.921	1.4771	140.4	0.4	0.75
21135	" " "	*Bridgeport:* W. J. Nichols	.923	1.4756	140.1	0.9	0.68
20953	" " "	*Torrington:* South End Pharmacy	.921	1.4753	139.8	0.3	0.76
21060	" " "	*Meriden:* F. M. Kibbe & Co.	.920	1.4753	138.3	0.9	0.64
21042	" " "	*South Norwalk:* Plaisted's Drug Store	.920	1.4750	137.6	0.4	0.82
21111	" " "	*New Haven:* Alling's Drug Store	.921	1.4753	135.5	0.6	1.08
20955	" " "	*Torrington:* Migeon Ave. Pharmacy	.933	1.4771	119.6	2.9	3.22
21231	" " "	*New London:* McBride's Pharmacy	.926	1.4789	113.4	2.2	8.58
21333	" " "	*Ansonia:* Ansonia Drug Store	.920	1.4796	96.2	8.1	8.20

concluded, with the exception of the specific gravity limits, "that the standards and tests of the U. S. Pharmacopœia, which are satisfactory for Norwegian oils are not applicable to the American oils, which are liable to show more variation, and the color tests as laid down are not characteristic of cod liver oil but only of fish liver oils. Further, the nitric acid test is liable to give misleading results with many pure cod liver oils of American origin."

Recognizing the valuelessness of these tests, they were abandoned early in our investigation, and our examination was confined to a determination of specific gravity, refractive index, Hübl iodine number, Reichert-Meissl number and the free fatty acids. The methods of analysis used were those given in Bull. 107 (revised) U. S. Department of Agriculture, Bureau of Chem., pp. 129-142. The only deviation from the official methods was in the case of iodine number, where, in those samples not falling within the limits of the U. S. P. standard, new determinations were made strictly according to the U. S. P. requirement of four hours. The result of this comparison will be referred to later.

Seventy samples were analyzed. In only one case was a distinguishing brand name used, all the others bearing the druggists' label. Six were labeled "Norwegian," the others simply "cod liver oil."

The following tabulation contain a summary of our results, excluding four distinctly inferior samples, compared with those secured by Tolman with twenty pure American oils.

	Tolman (20 analyses).			Connecticut (66 analyses).		
	Max.	Min.	Ave.	Max.	Min.	Ave.
Specific gravity at 25° C.	0.9220	0.9174	0.9200	0.9230	0.9200	0.9216
Index of refraction at 25° C.	1.4779	1.4748	1.4767	1.4771	1.4750	1.4761
Iodine number	172.6	135.4	152.4	159.0	135.5	146.8
Reichert-Meissl number	------	------	------	1.4	0.1	0.6
Free fatty acids	------	------	------	2.02	0.38	0.74

The two sets of analyses are shown to agree remarkably well, the widest variation being in the maximum iodine number, due to a single abnormal sample included in Tolman's results. The U. S. P. limits for specific gravity are found to be entirely reasonable, but our iodine numbers confirm Tolman's conclusion that "the range of iodine number of 140-150 as given in the Pharmacopœia seems to be exceedingly narrow." In seven samples the iodine number was determined with both three- and four-hour periods of absorption with the following results:

No.	3 hrs.	4 hrs.
21152	138.3	141.5
21153	136.7	141.1
21060	136.9	138.3
21042	135.5	137.6
21111	138.5	135.5
21231	113.4	113.4
21333	100.6	96.2
Ave.	128.6	129.1

The differences are insignificant in all cases, the longer period naturally as a rule giving slightly higher iodine values. "The higher the iodine value, the less oxidation can have taken place, and if the medicinal properties be valued by the amount of unsaturated fatty acids, then the higher iodine value the better the oil."* The same authority claims that for the valuation of medicinal cod liver oil, the acid value, iodine value, and the Reichert-Meissl value furnish the most valuable indications. He claims that the best steam cod liver oils contain from 0.3 to 1.5 per cent. of free fatty acids (calculated as oleic acid), and that the Reichert-Meissl value should not exceed 0.5, a higher number indicating that the livers employed had not been fresh. The following tabulation shows the acid value and free fatty acids (as oleic) as reported by Lewkowitsch:

	Color.	Acid Value.	Free Fatty Acids.
Raw medicinal oil	Pale	7.38	3.79
" " "	Somewhat darker	7.35	3.87
" " "	Darkest	7.72	3.96
Pale oil, obtained from livers by decay	Pale	21.20	10.90
Brown oil, obtained from livers by decay	Brown	54.40	28.00
Medicinal oil	Yellow	----	0.36
Scotch cod oil	Brown	----	9.73
Newfoundland cod oil	Red-brown	----	23.31
Medicinal oils	------	----	0.34—0.60

In our examination the acid value was not determined, but this can be calculated with approximate accuracy from the free

* Lewkowitsch, Chem. Tech. and Anal. Oils, Fats and Waxes, 1904, ii, 668.

fatty acids (as oleic), by multiplying the latter by 1.9893.* Applying this factor in our samples, the free fatty acids ranged from 0.38 to 2.02, and acid values from 0.76 to 4.02. Only five samples exceeded Lewkowitsch's limit for free fatty acids; these contained 2.02, 2.78, 3.22, 8.58 and 8.20.

The Reichert-Meissl numbers ranged from 0.1 to 1.4, thirty-eight exceeding 0.5; in only three samples were these numbers considered objectionably high, where value of 2.2, 2.9 and 8.1 were obtained.

Summarizing our examination, we found that sixty-six samples ranged from .920 to .923 specific gravity, from 1.4750 to 1.4771 refractive index, from 135.5 to 159.0 iodine number, from 0.1 to 1.4 Reichert-Meissl number, and from 0.38 to 1.32 free fatty acids; these samples ranged in color from a pale yellow to a light yellowish-brown, except **20945** and **20956**, which were somewhat off color. While they doubtless varied considerably in quality, they all satisfied acceptably the standard for pure cod liver oil.

In four samples, however, we found considerable variations from the standards, and while we cannot class them as adulterated, they were certainly of inferior quality, and, with the exception of one constant in one sample, at variance with the U. S. P. requirements. These are summarized below:

SAMPLES BELOW STANDARD.

Station No.	Dealer.	Color.	Specific Gravity at 25° C.	Refractive Index at 25° C.	Iodine No.	Reichert-Meissl No.	Free Fatty Acids.
20946	W. N. Noble	Brownish	0.930	1.4771	141.1	1.5	2.78
20955	Migeon Ave. Pharmacy	Brown-red	0.933	1.4771	119.6	2.9	3.22
21231	McBride's Pharmacy	"	0.926	1.4789	113.4	2.2	8.58
21333	Ansonia Drug Store	"	0.930	1.4796	96.2	8.1	8.20

All of these samples showed high specific gravity, high Reichert-Meissl numbers, high free fatty acids, all but the first low iodine numbers, and the last two high indices of refraction; they were all also much off color. No certain indication of the presence of foreign oils was shown in any case, although **21231** and **21333** were so viscid that they could not be pipetted. The high

* Lewkowitsch, i, 279.

free fatty acids, and Reichert-Meissl numbers in these two samples indicated that badly decomposed livers had been used in the manufacture of the oils, and the low iodine numbers that the stearine had been very incompletely removed.

Analytical Note:—Mr. Bailey in his work on the saponification of the oils observed that upon the addition of about ten drops of strong sodium hydroxid to about 5 cc. of oil in a test tube more or less pronounced color changes took place. As a rule the oils became orange yellow, changing in some cases to a rather dark brown. Such oils produced a soap solution varying in color from light yellow to dark brown but not opaque. Between these two colors so many shades occurred as to make any distinction difficult. Other samples, however, produced with soda a very dark solution almost at once and gave on saponification a very dark soap solution which was opaque. It was observed that the standard high-grade oils gave the lighter colored soap solutions. Six samples, **21395, 20954, 20946, 20955, 21231** and **21333** gave the dark, opaque solutions; it will be noted that four of these are included in our "below standard" table, where other variations from the standards indicated their marked inferiority.

COCA WINE.

(*Vinum Cocae.*)

The Pharmacopœia requires that Coca Wine shall be made by the following formula:

65 cc. fluidextract of coca.
75 cc. alcohol.
65 gms. sugar.
Red wine, to make 1,000 cc.

Fluidextract of coca should contain 0.5 gm. of the ether-soluble alkaloids of coca per 100 cc., so that 1,000 cc. of coca wine should contain 0.325 gm. of these alkaloids.

Under the Connecticut law cocaine, its salts, and preparations containing the same, can be sold to the general public only on a physician's prescription, and even then under certain limitations. All of the samples herewith reported were bought in the open market without a physician's prescription, and without the seller being informed that the samples were bought for this station. A large number of the druggists visited refused to sell coca wine to the station's representative, and there is no question as to the trade's knowledge of the restrictions covering its sale. The amount of the alkaloid contained in coca wine is small, but that makes its use none the less insidious and dangerous.

TABLE XXXVIII.—COCA WINE.

Station No.	Brand.	Dealer.	Price per bottle, cts.	Specific gravity at 15.6° C.	Alcohol. By weight.	Alcohol. By volume.	Extract.	Polarization at 24° C. Direct.	Polarization at 24° C. After Inversion.
21087	Geo. L. Claflin & Co., Providence, R. I., Coca Wine	*Willimantic:* Chas. deVillers	75	1.04701	19.48	25.75	19.94	−1.7	−2.20
21323	The Maltine Mfg. Co., New York. Maltine with Coca Wine	*Derby:* Henry B. Peck	50	1.11007	12.43	17.35	36.83	+16.6	+16.72
20928	Mariani & Co., New York. Vin Mariani	*New Haven:* Mark N. Sullivan	100	1.01445	13.90	17.75	9.34	+0.4	−1.21
20926	Theodore Metcalf Co., Boston. Metcalf's Coca Wine	*New Haven:* J. A. Caryl	90	1.04786	15.56	20.50	18.76	−5.2	−5.94
21070	Reed & Carnrick, New York. Carnrick's Coca Muscatel	*New Britain:* J. R. Halloran	75	1.03609	15.35	20.05	15.55	−0.4	−0.44
21332	Druggist's label	*Ansonia:* The Bristol Drug Co.	50	1.02133	19.19	24.70	12.95	+0.7	−5.06
21157	" "	*Bridgeport:* Wilma M. Bachman	50	1.03405	14.12	18.35	14.59	+5.5	−4.07
21048	" "	*Meriden:* F. M. Kibbe & Co.	45	0.99962	17.81	21.80	6.56	−0.8	−0.88
21049	" "	*Meriden:* Meriden House Drug Store	35	1.08647	15.92	21.75	29.25	−0.4	−0.44
20924	" "	*New Haven:* G. H. Bishop	50	1.06825	12.83	17.25	23.25	−5.4	−5.72
20927	" "	*New Haven:* James T. Eagny	40	1.06516	17.65	23.60	24.12	−2.3	−5.94
20929	" "	*New Haven:* James A. Notkin	25	1.03548	18.06	23.55	16.33	−1.7	−6.44
21305	" "	*New Haven:* Oak Pharmacy	45	1.03328	15.40	20.05	14.83	+0.8	+0.88
21235	" "	*New London:* McBride's Pharmacy	75	1.03749	15.43	20.10	15.94	−2.8	−3.96
21243	" "	*Norwich:* Herrick Pharmacy	90	1.07715	17.64	23.85	27.35	−2.0	−2.42
20982	" "	*Waterbury:* H. W. Lake Drug Co.	50	1.03378	18.86	24.55	16.15	−0.7	−5.28
21089	" "	*Willimantic:* Samuel Chesbro	50	1.01942	16.48	21.00	11.47	−2.6	−2.86
21086	" "	*Willimantic:* Leonard's Pharmacy	25	1.05325	12.72	16.90	19.23	−3.8	−4.29

The determination of cocaine in this material presents considerable difficulty, and while physiological and chemical tests gave indications of its presence in many of the samples, the small amount of the wine at our disposal made the certain identification of the cocaine difficult and in some cases impossible. For this reason no cocaine results are reported in the tables.

Practically the sale of these wines is illegal in every case. If a wine contains no cocaine its sale as coca wine is illegal, an essential ingredient being absent; if it does contain cocaine its sale is illegal for the reasons referred to above.

The following brands contained on the label information as to the presence of cocaine and there is no possible excuse for their sale without a physician's prescription:

21323. *Maltine with Coca Wine.* "Each fluidounce contains Erythroxylon Coca, 30 grains."

20926. *Metcalf's Coca Wine.* "From Fresh Coca Leaves."

21070. *Carnrick's Coca Muscatel.* "Each fluidounce contains repercolated extract of coca leaves, 1 drachm."

The sample of *Vin Mariani*, **20928**, was labeled as follows: "Vin Mariani under this label is guaranteed free from cocaine." This preparation in past years has contained cocaine, but it would appear from their statement, which was confirmed by our tests, that cocaine is no longer present. While this fact would render its sale legal, it would also seem that by the removal of the cocaine, whatever virtues the preparation possessed other than those common to ordinary wine, were likewise removed.

The analytical data obtained in the examination of these samples is given in Table XXXVIII.

KOLA WINE.

21324. *Wampole's Kola Wine.* Sold by Fred S. Sanford, Shelton. Price, 50 cents per 8 ounces. The sample was sold on the agent's request for Coca Wine. The analysis was as follows:

Specific gravity at 15.6°	1.02178
Alcohol by weight	16.15
Alcohol by volume	20.75
Extract	12.01
Polarization at 24°, direct	—4.4
" " after inversion	—4.4

The smallness of the sample prevented a certain test for the presence of cocaine. Not being a U. S. P. preparation, the absence of a statement on the label of the percentage of alcohol renders the sale of this preparation illegal.

SOLUTION OF HYDROGEN DIOXIDE.

(*Aqua Hydrogenii Dioxidi.*)

The U. S. Pharmacopœia defines this preparation as "a slightly acid, aqueous solution of Hydrogen Dioxide, which should contain, when freshly prepared, about 3 per cent., by weight, of absolute Hydrogen Dioxide, corresponding to about 10 volumes of available oxygen."

Among other requirements given in that work are the following:

"Upon removing the stopper from the bottle not more than a slight pressure should be observed."

"If to 25 cc. of the Solution, 5 cc. of tenth-normal potassium hydroxide V. S. be added, and the mixture be evaporated to about 10 cc., and 3 drops of phenolphthalein T. S. be added, not less than 2.5 cc. of tenth-normal sulphuric acid V. S. should be required to discharge the red color of the solution after continued boiling (limit of *free acids.*)"

"If 20 cc. of the Solution be evaporated to dryness upon a water-bath, and the drying completed at 120° C. (248° F.), not more than 0.03 gm. of solid residue should remain (limit of *total solids*)."

Thirty-two samples of hydrogen dioxide, or, as it is more commonly called, hydrogen peroxide, were examined. In addition to the U. S. P. tests given above, the actual amount of hydrogen dioxide was determined, and an examination was made as to the nature of the preservative used, and the source of the acidity. The results of this examination are shown in Tables XXXIX and XL.

The samples were bought in various sized containers, ranging from one-quarter of a pound to a pound, and costing from 5 to 75 cents. One-fourth pound samples varied in cost from 5 to 35 cents, one-half pound samples from 17 to 50 cents, and pound packages from 50 to 75 cents, extremely wide variations, and, as will be shown later, but little dependent upon the quality of the product.

Twenty-one samples were either guaranteed 3 per cent. H_2O_2 and 10 volumes of available oxygen, or were marked U. S. P., which indirectly guarantees the same strength. One sample was guaranteed 12 volumes of available oxygen and two 15 vol-

TABLE XXXIX.—HYDROGEN DIOXIDE (HYDROGEN PEROXIDE).

Station No.	Manufacturer or Distributor.	Dealer.	Price of Sample.	Weight of Sample.	Guaranty. Hydrogen Dioxide.	Guaranty. Available Oxygen.	Guaranty. Acetanilid per fl. oz.
			cts.	lb.	%	vol.	gr.
23059	A. D. S. Peroxide of Hydrogen. American Druggists' Syndicate, N. Y.	*So. Norwalk:* Platner & Bradley	25	$\frac{1}{2}$	-	--	$\frac{1}{6}$
23014	Hydrogen Peroxide. Albany Chemical Co., Albany, N. Y.	*Bridgeport:* Edward Toucey	20	$\frac{1}{4}$	3	10	$\frac{1}{6}$
23264	" " " " " "	*Middletown:* Buell & Blatchley	35	$\frac{1}{2}$	3	10	$\frac{1}{6}$
23291	" " Apothecaries Hall, Waterbury	*New Britain:* J. F. Burns	25	$\frac{1}{4}$	3	10	*
23142	" " " " "	*Waterbury:* Apothecaries Hall	35	$\frac{1}{2}$	3	10	*
23296	Arthur's Hydrogen Peroxide. The Arthur Chemical Co., New Haven	*New Haven:* F. Woolworth & Co.	10	$\frac{1}{4}$	3	10	$\frac{3}{16}$
23032	Peroxide of Hydrogen. Prep. for Carleton & Hovey Co., Boston	*Greenwich:* Wm. E. Finch	45	$\frac{1}{2}$	3	10	$\frac{3}{16}$
23321	Hydrogen Peroxide. Prep. for Conway & Currier, New Haven	*New Haven:* Conway & Currier	15	$\frac{1}{4}$	-	--	$\frac{12}{100}$
23092	Hydrogen Peroxide. Dist. by L. F. Curtis, Bridgeport	*Bridgeport:* L. F. Curtis	20	$\frac{1}{4}$	3	10	$\frac{1}{6}$
23273	Osborn's Hydrogen Peroxide. Custer Chemical Co., New York	*Meriden:* Meriden House Drug Store	15	$\frac{1}{4}$	3	10	$\frac{3}{16}$
23295	Hydrogen Peroxide. Dist. by Hull's Corner Drug Store, New Haven	*New Haven:* Hull's Corner Drug Store	17	$\frac{1}{2}$	3	10	$\frac{1}{6}$
23265	Hydrogen Peroxide. Hydrox Chemical Co., New York	*Middletown:* F. W. Woolworth & Co.	10	$\frac{1}{4}$	3	10	$\frac{3}{16}$
23244	" " " " " " "	*Norwich:* L. A. Bardol & Co.	5	$\frac{1}{4}$	3	10	$\frac{3}{16}$
23048	Peroxide of Hydrogen. Dist. by J. K. Lawrence, Stamford	*Stamford:* J. K. Lawrence	40	$\frac{1}{2}$	3	10	--
23194	" " " Lehn & Fink, New York	*New London:* Moon's Pharmacy	25	$\frac{1}{4}$	-	--	$\frac{12}{100}$
23121	" " " " " " " "	*Danbury:* Barnum Pharmacy	30	$\frac{1}{4}$	-	--	$\frac{12}{100}$
23209	Hydrogen Peroxide. Mallinckrodt Chem. Works, St. Louis	*Norwich:* N. D. Sevin & Son	50	1	3	10	.0004

* Guaranteed preserved with boric acid.

TABLE XXXIX.—HYDROGEN DIOXIDE (HYDROGEN PEROXIDE)—*Continued.*

Station No.	Manufacturer or Distributor.	Dealer.	Price of Sample.	Weight of Sample.	Guaranty. Hydrogen Dioxide.	Guaranty. Available Oxygen.	Guaranty. Acetanilid per fl. oz.
			cts.	lb.	%	vol.	gr.
23307	Peroxide of Hydrogen. Charles Marchand, New York	*Hartford:* Sisson Drug Co.	75	1	§4.6	15	--
23313	" " " " " " "	*New Haven:* C. W. Whittlesey Co.	32	$\frac{1}{4}$	§4.6	15	--
23272	" " " " " " "	*Meriden:* N. P. Forcier	35	$\frac{1}{4}$	--	--	--
23219	Hydrogen Peroxide Merck.	*Norwich:* Lee & Osgood	25	$\frac{1}{4}$	3	10	--
23310	Per-Man-Eo Peroxide of Hydrogen. Middletown Chem. Co., Middletown, N. Y.	*New Haven:* City Hall Drug Store	25	$\frac{1}{2}$	3	10	$\frac{3}{16}$
23266	†Hydrogen Peroxide. Prep. for John J. Murphy, Middletown	*Middletown:* John J. Murphy	25	$\frac{1}{4}$	--	--	$\frac{3}{16}$
23046	Dioxogen. The Oakland Chemical Co., New York	*Stamford:* Borg Bros.	50	$\frac{1}{2}$	§3.7	12	--
23093	Hydrogen Peroxide. Parke, Davis & Co., Detroit	*Bridgeport:* Brinkerhoff Bros.	35	$\frac{1}{2}$	--	--	$\frac{3}{16}$
23312	Aqua Hydrogenii Dioxidi. Powers-Weightman-Rosengarten Co., Phila.	*New Haven:* C. G. Spalding	10	$\frac{1}{4}$	3	10	.018%
23316	Aqua Hydrogenii Dioxidi. Powers-Weightman-Rosengarten Co., Phila.	*New Haven:* E. A. Gessner	15	$\frac{1}{4}$	3	10	.018%
23315	Hydrogen Peroxide, Prep. for Shartenberg & Robinson Co., New Haven	*New Haven:* Shartenberg & Robinson Co.	10	$\frac{1}{4}$	3	10	$\frac{3}{16}$
23314	Solution Hydrogen Peroxide, Squibb. E. R. Squibb & Sons, New York	*New Haven:* C. W. Whittlesey Co.	15	$\frac{1}{4}$	--	10	--
23322	Ozo Hydrogen Peroxide. Henry Thayer & Co., Cambridge, Mass.	*New Haven:* 6 Corner Drug Store	25	$\frac{1}{4}$	--	--	$\frac{3}{16}$
23311	‡Peroxide of Hydrogen. Prep. for E. L. Washburn Co., New Haven	*New Haven:* E. L. Washburn Co.	15	$\frac{1}{4}$	3	10	$\frac{3}{16}$
23306	Hydrogen Peroxide. Williams & Carleton Co., Hartford	*Hartford:* M. M. Taylor	25	$\frac{1}{4}$	3	10	$\frac{3}{16}$

† Bears same Serial No. as 23306. ‡ Bears same Serial No. as 23265 and 23244.

§ Calculated from guaranty of available oxygen (1% H_2O_2 = 3.29 volumes O).

TABLE XL.—ANALYSES OF HYDROGEN DIOXIDE.

Station No.	Brand.	Hydrogen dioxide.		Available oxygen.		Total Solids.		‡Acidity 25cc. H_2O_2 =cc. $\frac{N}{10}$ K O H.	Acetanilid. Grs. per fl. oz.	Pressure on opening bottle.	Phosphoric acid (H_3PO_4). Per cent.
		Kingzett method.	Potassium permanganate method.	Kingzett method.	Potassium permanganate method.	Per cent.	Color.				
23059	A. D. S.	2.68	2.73	8.82	8.98	.053	White	0.95	none	slight	.015
23014	Albany	2.91	2.95	9.58	9.71	.068	Brownish	2.17	0.120	none	.015
23264	Albany	2.75	2.79	9.04	9.18	.106	Brownish	2.68	0.073	slight	.037
23291	Apothecaries Hall	3.13	3.05	10.30	10.03	.069	Brownish	2.92	0.144	slight	.019
23142	Apothecaries Hall	2.87	2.90	9.46	9.54	.089	Brownish	3.48	0.144	slight	.021
23296	Arthur	2.95	2.98	9.72	9.80	.128	Cream	2.47	0.168	none	.010
23032	Carleton & Hovey	1.89	1.91	6.22	6.28	.083	Cream	1.88	0.060	none	.015
23321	Conway & Currier	2.65	2.74	8.74	9.01	.366	Cream	9.25	0.144	slight	.227
23092	Curtis	2.92	3.00	9.60	9.87	.097	Brown	2.35	0.144	slight	.051
23273	Custer, (Osborn's)	2.82	2.88	9.30	9.48	.152	Cream	2.26	0.144	slight	.007
23295	Hull	2.98	3.01	9.80	9.90	.086	Brownish	2.19	0.168	slight	.022
23265	Hydrox	2.87	2.86	9.46	9.41	.120	Brown	4.12	0.168	slight	.046
23244	Hydrox	2.82	2.88	9.30	9.48	.067	Brown	2.95	*	none	.021
23048	Lawrence	1.77	1.74	5.82	5.72	.171	White	1.55	none	slight	.010
23194	Lehn & Fink	2.91	2.95	9.58	9.71	.134	Cream	2.87	†	none	.007
23121	Lehn & Fink	2.86	2.91	9.41	9.58	.157	Cream	3.05	0.135	slight	.003
23209	Mallinckrodt	2.89	2.92	9.52	9.61	.125	Brown	2.69	0.144	slight	.010
23307	Marchand	3.49	3.56	11.48	11.71	.068	Cream	5.13	none	none	.002
23313	Marchand	2.55	2.64	8.40	8.69	.095	Cream	6.05	none	none	.004
23272	Marchand	0.63	0.63	2.07	2.07	.126	Brown	9.20	none	none	.003
23219	Merck	2.47	2.52	8.12	8.29	.142	White	1.64	none	none	.001
23310	Middletown (Per-Man-Eo.)	3.06	3.13	10.08	10.30	.100	Brown	4.16	0.168	slight	.008
23266	Murphy	2.54	2.54	8.34	8.36	.130	Cream	3.10	0.073	none	.007
23046	Oakland (Dioxogen)	3.43	3.50	11.28	11.52	.042	Brownish	1.40	none	slight	.006
23093	Parke, Davis & Co.	2.91	2.96	9.58	9.74	.050	Brownish	2.50	0.204	slight	.019
23312	Powers-Weightman-Rosengarten	2.89	2.95	9.52	9.71	.122	Cream	2.17	0.048	slight	.007
23316	Powers-Weightman-Rosengarten	2.77	2.84	9.13	9.34	.124	White	1.00	0.072	slight	.002
23315	Shartenberg & Robinson	2.63	2.74	8.65	9.01	.102	Brownish	6.32	0.192	slight	.028
23314	Squibb	3.20	3.15	10.53	10.36	.089	Cream	3.68	none	none	.008
23322	Thayer (Ozo)	2.67	2.78	8.79	9.15	.109	Brownish	3.42	0.120	none	.038
23311	Washburn	2.76	2.79	9.07	9.18	.085	Brown	3.22	0.144	none	.020
23306	Williams & Carleton	2.76	2.84	9.07	9.34	.089	Cream	1.80	0.060	none	.000

* See duplicate sample 23265. † See duplicate sample 23121. ‡ SO_3 present in all but Nos. 23014, 23093, 23306 and 23314. Cl present in all samples, only traces in 23093. Nitric acid not detected in any sample.

umes. The remaining eight samples bore no direct guaranty, but as they were sold under a U. S. P. name, they must be held to the strength therein laid down.

It is a recognized fact that hydrogen dioxide readily decomposes on keeping. To obviate this many manufacturers add small amounts of sulphuric or hydrochloric acid as a preservative; phosphoric acid also is sometimes used for the same reason. It appears, however, that at the present time the most popular preservative used is acetanilid, sometimes alone and sometimes with either sulphuric or hydrochloric acid. The Pharmacopœia recognizes the difficulty in keeping hydrogen dioxide up to standard strength, and permits the presence of a certain amount of acid, the acidity of 25 cc. of the solution not to exceed the equivalent of 2.5 cc. of tenth-normal potash. No recognition is given, however, to acetanilid, and as it is a foreign substance, its presence must be clearly stated on the label to render the sale of the material legal.

Twenty-three of the samples were guaranteed to contain acetanilid in quantities varying from three-sixteenths to one-sixth of a grain per fluidounce. In two samples boric acid was claimed as the preservative; in the remaining seven samples no preservative was indicated.

Methods of Analysis.

Hydrogen Dioxide:—The Pharmacopœia directs the use of the potassium permanganate method for the assay of hydrogen dioxide. This method has received considerable unfavorable criticism, chiefly because of the inaccuracies introduced by the presence of the usual preservative agents. To comply with the U. S. P. requirements this method has been used in the work here reported, as well as that suggested by Kingzett,* which appears to overcome the objection against the permanganate method. The slightly modified Kingzett method as used by us follows:

Measure 10 cc. of hydrogen dioxide into a 100 cc. flask, add 40 cc. sulphuric acid (sp. gr. 1.3) and make up to 100 cc. with water. Run 10 cc. of this solution into 10 cc. of 10 per cent. potassium iodide solution. Let stand for five minutes, add a few drops of starch solution (the addition of starch is rarely necessary) and titrate with tenth-normal sodium thiosulphate. One cc. of tenth-normal thiosulphate is equivalent to 0.001688 gm. of hydrogen dioxide, or 0.000794 gm. of available oxygen, or 0.556 cc. of available oxygen.

In the table comparative results by both methods are shown. The results for hydrogen dioxide vary from identity by both methods to 0.11

* Jour. Chem. Soc., 1880, *37*, 792.

per cent. higher by the permanganate method. The Kingzett method averages 2.73 per cent., the permanganate 2.77 per cent., showing that for practical purposes either method may be used, although it is believed that the results by the former are slightly more accurate.

Acidity:—It was found that the exact manipulation of the U. S. P. method gave very uncertain results, and we accordingly adopted the following modification, which proved very satisfactory:

Pipette 25 cc. of the solution into a small porcelain casserole, add 5 cc. tenth-normal potassium hydroxide, and evaporate to about 10 cc. Add two drops of phenolphthalein and about 4 cc. of tenth-normal sulphuric acid, boil for one minute, add tenth-normal potassium hydroxide to appearance of color, then one drop of tenth-normal sulphuric acid and boil for another minute. Repeat this operation until boiling of the neutral or slightly acid solution develops no further color. The volume of tenth-normal alkali minus the volume of tenth-normal acid gives the equivalent acidity of 25 cc. of the solution in terms of cubic centimeters of tenth-normal alkali.

Acetanilid:—The method used was that suggested by Waller,* as follows:

In a side-neck flask of 200 cc. capacity, place about 6 or 7 gms. of stick potash or soda, dissolve with 20 cc. of water and add 25-30 gms. of finely granulated zinc (this quantity is doubtless a very large excess, but lack of time prevented a certain demonstration of this statement). Add a measured amount of hydrogen dioxide (not over 50 cc.), and connect the flask on one side with a flask to supply steam, arranging the tube to deliver steam near the bottom of the solution; connect on the other side with a condenser, which should deliver into a Peligot bulb or similar contrivance whereby the distillate is immediately brought in contact with moderately strong hydrochloric acid.

Raise the heat slowly and when nearly half of the contents have distilled over, start to pass the steam through. The end of the distillation of the anilin is uncertain. When it is judged that all has come over, detach the receiver, and collect further distillate in another vessel and titrate separately.

Prepare the volumetric bromide solution by Seidell's method.†

Preliminary tests with this method on hydrogen dioxide solutions, which showed no acetanilid by the iso-nitril reaction, gave the following results:

.050 gm.	acetanilid	added,	.052 gm.	recovered.
.025	"	"	.026	"	"
.025	"	"	.026	"	"

Total Solids:—The U. S. P. method was used.

Phosphoric Acid:—The residue from the determination of total solids (=20 cc. hydrogen dioxide) was dissolved in hydrochloric acid, and phosphoric acid determined by the usual fertilizer method.

* Jour. Ind. and Eng. Chem., 1909, *1*, 262.
† Jour. Am. Chem. Soc., 1907, *29*, 109.

Results of Examination.

The amount of hydrogen dioxide ranged from 0.63 to 3.49 per cent. Three samples exceeded the required strength, six showed a deficiency less than 0.10 per cent., seven a deficiency from 0.11 to 0.20 per cent., five a deficiency from 0.21 to 0.30 per cent., six a deficiency from 0.33 to 0.53 per cent.; three were deficient over one per cent.; and two over two per cent.

Granting a variation of 10 per cent from the standard strength, twenty-one samples could be passed on the basis of content of hydrogen-dioxide, while eleven were deficient by 0.33 to 2.37 per cent. absolute dioxide, or were, in other words, only from 21 to 89 per cent. of standard strength.

The Pharmacopœia sets the limit of total solids at 0.03 gm. for 20 cc. of the solution, or 0.15 per cent. The solids in the samples examined ranged from 0.042 to 0.366 per cent. Only two samples appreciably exceeded the limit. The color of the solids varied from white to a dirty brown.

The acidity of 25 cc. of the solution ranged from 0.95 to 9.25 cc. of tenth-normal alkali. Fourteen samples fell within the U. S. P. limit of 2.5 cc., five required from 2.50 to 3.0 cc., eight from 3.0 to 5.0 cc., and five over 5.0 cc. All but four of the samples, Nos. 23014, 23093, 23306 and 23314, indicated the presence of sulphuric acid. Chlorin was found in all samples, No. 23093 showing only a trace. Nitric acid was detected in no case. Phosphoric acid was found in all samples except No. 23306, but in many cases only in traces, seventeen samples showing less than 0.01 per cent. In No. 23321, however, this acid was found in very excessive quantities, viz., 0.227 per cent.

Acetanilid was found in twenty-two of the twenty-three samples guaranteed to contain it, in quantities ranging from 0.060 to 0.204 grains per fluidounce, as a rule in substantial agreement with the claimed amounts. No acetanilid could be detected in No. 23059, although it was claimed on the label. Seven other samples contained no acetanilid. This preservative was found in Nos. 23291 and 23142 to the amount of 0.144 grains per fluidounce. This was not stated on the labels of these samples, and the boric there claimed to be present we were unable to detect.

In no case was more than a slight pressure observed on opening the bottles.

Conformity to the U. S. P. requirements was by no means confined to the higher priced samples.

Summary.

The results of the examination may be summarized as follows, "standard strength" or "satisfies guarantee" meaning in all cases a deficiency of less than ten per cent.; an asterisk (*) denotes that acetanilid was present but was legally declared on the label:

Satisfies Guarantee and U. S. P. Requirements.

23046. Oakland (Dioxogen).

Standard Strength and Satisfy U. S. P. Requirements, Acetanilid present but declared on label.

***23014.** Albany.
***23296.** Arthur.
***23295.** Hull.
***23316.** Powers-Weightman-Rosengarten.
***23093.** Parke, Davis & Co.
***23312.** Powers-Weightman-Rosengarten.
***23306.** Williams and Carleton.
***23092.** Curtis.
***23273.** Osborn.

Satisfy U. S. P. Requirements except as to Limit of Acidity.

***23264.** Albany.
***23265.** Hydrox.
***23244.** Hydrox.
***23194.** Lehn and Fink.
***23121.** Lehn and Fink.
***23209.** Mallinckrodt.
***23310.** Middletown.
23314. Squibbs.
***23311.** Washburn.

Satisfy U. S. P. Requirements except as to Limit of Acidity. Acetanilid present but not declared on label.

23291. Apothecaries Hall.
23142. Apothecaries Hall.

Below Standard Strength.

23059. A. D. S. (89.3%).
***23059.** Carleton & Hovey (63.0%).
23219. Merck (82.3%).

Below Standard or Guaranteed Strength, and exceed U. S. P. limit of acidity.

23307. Marchand (75.9%).
23313. Marchand (55.6%).
†23272. Marchand (21.0%).
***23266.** Murphy (84.7%).
***23315.** Shartenberg & Robinson (87.7%).
***23322.** Thayer (89.0%).

Below Standard Strength, and High Solids.

23048. Lawrence (57.7%).

Below Standard Strength, High Solids, High Acidity.

23321. Conway & Currier (88.3%).

TINCTURE OF IODINE.

Forty-three samples were examined. Of these twenty-eight showed less than a 10 per cent. variation from the U. S. P. standard.

Fourteen samples were below standard, ranging from 6.22 to 4.28 gms. of iodine per 100 cc., or from 88.9 to 61.1 per cent. U. S. P. The druggists selling the deficient samples were as follows:

T. Weldon & Co., South Manchester (88.9).
Madden's Drug Store, Bristol (87.6).
H. N. Lebell, Windsor Locks (87.1).
Balch & Brown, Manchester (85.9).
Burton L. Bennett, Bristol (85.7).
Perry N. Holley, Bristol (82.4).
John L. Thurlough, Canaan (82.0).

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† While this sample showed a very high acidity, 9.20, as well as a great deficiency in hydrogen dioxide, it is only fair to the manufacturer to state that this material came to us in the original container with the seal unbroken, but *not* enclosed in a carton or the customary paper covering. Moreover, the glass was white, not amber as in the case of all other samples but the Marchand brands, and it is not difficult to understand the reason for its abnormal composition. This explanation, however, in no way helps the purchaser of this sample, who received a material only one-fifth of the standard strength.

Anders Jacobsen, Stafford Springs (87.1).
Modern Pharmacy (D. P. Auclair), Jewett City (80.0).
Waterville Drug Store (G. A. Sayers), Waterville (80.0).
Burtsch's Drug Store, Stonington (77.7).
P. F. Bray, Norwich (76.6).
H. A. Smith, Collinsville (68.7).
George E. Dresser, Putnam (61.1).

A sample sold by W. W. Woodward, Danielson, while of standard strength, was incorrectly labeled "Iodine" instead of "Tincture of Iodine."

The average of the forty-three samples was 6.52 gms. of iodine per 100 cc., compared with 6.43 gms. last year for ninety-two samples.

LIME WATER.

(Liquor Calcis.)

The U. S. Pharmacopœia defines lime water as "a saturated aqueous solution, which should contain not less than 0.14 per cent. of pure Calcium Hydroxide ($Ca(OH)_2$)."

"Fifty cc. should require for complete neutralization, not less than 19 cc. of tenth-normal sulphuric acid V. S. (corresponding to about 0.14 per cent. of calcium hydroxide), phenolphthalein T. S. being used as indicator."

Forty-one samples were examined by the U. S. P. method. These contained from 0.030 to 0.173 per cent. calcium hydroxid. Thirty samples equalled or exceeded the required strength, two were slightly below, while nine were distinctly inferior. The following tabulation shows the druggists selling the low grade lime water, together with its relation to U. S. P. strength:

	U. S. P. per cent.
T. J. Blake, Jr., Hartford	86.4
Coughlin's Pharmacy, Danbury	79.3
C. E. Pickard & Co., Bridgeport	72.1
J. T. Hillhouse, New Haven	55.0
F. E. Graves, Hartford	46.4
Brennan's Drug Store, Naugatuck	37.1
6 Corner Drug Store, New Haven	30.7
J. A. Leverty & Bro., Bridgeport	25.7
D. J. Tucker, Wallingford	21.4

MISCELLANEOUS DRUG PREPARATIONS.

BAY RUM. **21378.** *Superior Bay Rum,* J. H. Frost, New Haven; price, 20 cents per pint. It had a specific gravity at 15.6° C. of .9492, and *contained 33.54 per cent. by volume of methyl (wood) alcohol, and was artificially colored.*

21372. *Bay Rum,* J. H. Frost, New Haven; price, 50 cents per 2 ounce jar. *A crystalline solid, colored with a coal-tar dye, and containing 93.32 per cent. of common salt.* Loss at 100° C., 5.17 (volatile oil and water). This is a grossly adulterated article sold to barbers in unfair competition with high-grade bay rum. The manufacturer recommends the use of two ounces to make one gallon and one-half, using either water, grain alcohol or wood alcohol as desired.

PERFUMERY. **21371.** *Eau de Vie Cologne,* and **21373,** *Violet Water,* J. H. Frost, New Haven; price of each, 50 cents per 2 ounce jar. These preparations are similar to **21372,** except for the perfume used. The samples *contained 97.71 and 96.62 per cent. of common salt,* and lost at 100° C., 0.27 and 0.62 per cent., respectively. *Both were colored with a coal-tar dye.*

CASTOR OIL PILLS. **21642.** *Arthur's Castor Oil Pills,* commonly known as Compound Cathartic Pills, U. S. P., The Five and Ten Cent Drug Cabinet Co., New Haven. Sold by Mayer & Loeb, New Haven; price, 10 cents a box. In analysis they agreed quite closely with the U. S. P. preparation. Soluble in alcohol, 34 per cent., insoluble in alcohol (mercurous chlorid and sugar), 66 per cent., soluble in ether (gamboge resin and yellow wax), about 5 per cent., insoluble in ether (jalap, colocynth and gamboge gum), about 17 per cent. The sample is *misbranded, as no castor oil is present.*

EXTRACT OF PEPPERMINT. **21634.** *Williams' Pure Extract Peppermint,* The Williams & Carleton Co., Hartford, Conn. Sold by O'Connell's Grocery, Whitneyville; price, 10 cents per bottle. It contained 3.2 per cent. oil of peppermint, whose refractive index was 1.4638 at 20° C. Its specific gravity was .88897 at 15.6° C., and it contained 66.92 per cent. of alcohol by volume (no methyl alcohol present). This sample satisfied the flavoring extract standard.

SPIRITS OF PEPPERMINT. **21640.** *Arthur's Spts. Peppermint, U. S. P.* (contains alcohol 85.5), The Five and Ten Cent Drug

Cabinet Co., New Haven. Sold by Mayer & Loeb, New Haven; price, 10 cents per bottle. Spiritus Menthae Piperitae of the U. S. P. is a 10 per cent. solution of oil of peppermint in strong alcohol. This sample contained 10.8 per cent. oil of peppermint and 83.08 per cent of alcohol by volume (no methyl alcohol present). The oil had a refractive index of 1.4618 at 20° C.

Extract of Witch Hazel. **21641.** *Williams' Pure Extract Witch Hazel* (Pure Grain Alcohol, 15 per cent.), The Williams & Carleton Co., Hartford, Conn. Sold by Mayer & Loeb, New Haven; price, 10 cents per bottle. It showed a specific gravity of .98008 at 15.6° C., and contained 15.67 per cent. of alcohol by volume (no methyl alcohol present).

21647. *Double Distilled Witch Hazel* (Contains 15 per cent. alcohol), bottled for The Five and Ten Cent Drug Cabinet Co., New Haven. Sold by Mrs. Moore, Waterbury; price, 10 cents per bottle. It had a specific gravity of .98381 at 15.6° C. and contained 12.82 per cent. of alcohol by volume (no methyl alcohol present), somewhat lower than the amount claimed.

MISCELLANEOUS MATERIALS SENT BY PRIVATE INDIVIDUALS.

Milk. Forty-four samples of milk were tested. Thirty-six satisfied the legal standard, five were low in solids, two were skimmed and one was watered.

Cream. Twelve samples were tested, three of which contained artificial thickeners (in two cases sucrate of lime). One sample contained only 7.9 per cent. of fat; the other samples ranged from 13.0 to 17.5 per cent. of fat, all but one being below the standard.

Butter. Six samples were tested, and no adulteration was detected. Two of the samples, however, were of inferior quality.

Vinegar. Seven samples were tested, four of which were below standard in acidity.

Lemon Flavoring. The single sample sent in contained but 0.20 per cent. of lemon oil by volume, and was, therefore, far below standard.

Root Beer. The single sample showed a specific gravity at 15.6° C. of 1.0157, and contained 2.03 per cent. alcohol by volume (or 1.58 per cent. by weight), and 4.83 per cent. of extract (calculated).

Tri-Krema. Made by Curtis & Moore Co., Boston. It contained starch, a vegetable gum, probably tragacanth, and a small amount of gelatin, equal to 0.40 per cent. nitrogen. The material was sold as a thickener of ice cream, sherbet, whipped cream, etc.

Altar Wine. This sample had the following analysis: Specific gravity at 15.6° C., 1.0291, alcohol by volume, 17.22 (by weight, 13.25), extract, 13.00 gms., acidity as tartaric, 0.802 gms., ash, 0.1364 gm., alkalinity of ash, 13.2 cc. $\frac{N}{10}$ NaOH, sulphurous acid, 0.0067 gm., all in terms of 100 cc. of the wine. It contained no methyl alcohol or salicylic acid.

Sugar Gems. Sold by John Mason, East Orange, N. J. Some quotations from the literature accompanying this sample are worthy of notice.

"Sugar Gems have now their absolute healthfulness placed beyond all doubt. The world's highest authorities . . . . , after thorough testing, state unanimously that this sweetener, under its various names, is *perfectly harmless* . . . . Sugar Gems are beyond all doubt *The Only Safe Sweetener* for children or nursing mothers, and the safest sweetener for everybody. . . . There are many very inferior imitations. The elements from which Sugar Gems are made are essentially the same, and in the same proportions as those of the delicious and costly Attar of Roses—the difference being caused only by the way in which the atoms are brought together. Sugar Gems are white—symbol of their unchanging Purity and Goodness. The natural color of sugar is brown, but a false whiteness is given by a mineral bluing in the 'refinery,' where dirty laborers sweat in a terrible heat over the harmful stuff . . . . Gems are 500 times stronger than sugar . . . . Try an 8 lbs.-strength Box, postpaid for 25 cents."

The sample proved to be essentially the coal-tar product, saccharin. The quotations above cited are mendacious and misleading. Saccharin has an important use in the diet of diabetics, to whom sugar in any form is poison, but its harmlessness is by no means proved. It certainly has no place in the diet of a normal man. Granting the truth of the statement that the "Gems are 500 times stronger than sugar," the "8 lbs.-strength Box" would contain only about one-quarter ounce of the substance, for which 25 cents is charged, four times the usual retail price of saccharin. The chemical similarity of saccharin and Attar of Roses is of course wholly imaginary.

Confectionery. Eleven samples were examined at the request of H. P. Fairchild, a graduate student at Yale University, to test the purity of the cheap grades of candy sold at the Greek-American stores in New Haven. The examination included a test of the purity of the chocolate used, the presence of mineral adulterants and the use of coal-tar colors. Six samples consisted of various chocolate-covered candies, three were mixed candies, one was peanut butter lozenges, and one wintergreen creams. The percentage of fat in the chocolate coatings ranged from 27.09 to 34.63, with a melting point of 28° to 29° C., and a refractive index of 1.4552 to 1.4572 at 40°C., corresponding satisfactorily to the constants for cacao butter. The ash in all cases was free from iron and other mineral adulterants.

The ash in ten samples ranged from 0.01 to 0.58 per cent.; in the peanut butter lozenges it was 0.95 per cent. The oil in this last-named sample had a refractive index of 1.4613 at 40° C., corresponding to that constant for arachis oil.

A red coal-tar dye was detected in five samples, and a yellow green and brown dye each in one sample. The dyes were not identified. These dyes constituted the only impurities found and were confined to five samples, three of which were the mixed candies.

Another sample of chocolate-coated taffy was sent in with the report that it had caused sickness. The chocolate coating contained 1.53 per cent. ash, and no adulteration or harmful substance was detected.

Headache Wafers. The sample was guaranteed to contain 5 grains of acetanilid per wafer; the two wafers analyzed contained 4.77 and 5.03 grains, about 50 per cent. of the total weight.

Formalin. The sample tested contained 36.30 per cent. of formaldehyde, very close to the U. S. P. strength.

Castor Oil Pills. The pills contained no castor oil, and they were therefore misbranded and their sale illegal.

One sample each of ginger, cinnamon, cornstarch, olive oil and tincture of iodine were examined and found pure and of standard strength.

Proprietary Medicines.

Six samples of medicine made by The Archibald-Ayers Co., New York, were submitted by a New Haven physician. The

smallness of the samples prevented a complete analysis, but the following data were secured:

21716. *The Archibald-Ayers Tonic.* "Unexcelled for all Catarrhal Conditions of the Blood affecting the Nose, Throat, Bronchial Tubes, Lungs, Stomach, Liver and Bowels, Kidney and Bladder, weak and irritable Heart, etc. Tones Digestion, enriches the Blood, etc." Price, $3.00 per bottle. The sample was acid to litmus, specific gravity at 15.6° C., 1.0332, alcohol by volume, 11.35 per cent. (8.72 by weight), extract, 12.45 per cent., ash, 1.70 per cent. Immersion refractometer at 20° C., 31 (no methyl alcohol), polarization at 24° C. before and after inversion, $\pm$ 0° (no sucrose). Residue on evaporation appeared like glycerol. Qualitative tests in the ash showed carbonates, chlorides, sulphates, phosphates, magnesia, much potash, and a trace of sodium.

21717. *Blood Medicine* (no label). Price, $5.00 per bottle. The sample was acid to litmus, specific gravity at 15.6° C., 1.0686, alcohol by volume, 18.30 per cent. (13.59 by weight), extract, 23.62 per cent., ash, 1.71 per cent. Immersion refractometer at 20° C., 39 (no methyl alcohol), polarization at 24° direct $+$ 10.5, after inversion $+$ 11.2 (sucrose none, glucose (?) 6.00 per cent.). Qualitative tests in ash showed carbonates, trace of sulphates and chlorides, phosphates, much potash, magnesia, and a trace of sodium. Port wine is evidently the base of this preparation, and from taste, odor and general appearance it seemed to be a coca wine. There was insufficient sample to permit identification of the suspected alkaloid.

21718. *Cerate.* "For Ovarian Pains, Inflammation, Displacement of Womb, Neuralgia, Pains in Back, Limbs, Spine and Nervous Disorders." Price, $3.00 per box. Loss on evaporation at 100° C., 5.12 per cent. (largely camphor); the filtered fat had a refractive index of 1.4567 at 40° C., corresponding to that of cacao butter, which is the base of the preparation.

21719. *Archibald-Ayers' Pile Salve.* "For Rectal Inflammation, Irritation, Protruding or External Hemorrhoids (Piles), Fissures, Fistula, Bleeding, Pain, Soreness and Swelling." Price, $3.00 per box. Loss on evaporation at 100° C., 2.73 per cent. (largely camphor); the filtered fat had the same refraction as **21718**, cacao butter again being the base of the preparation.

21720. *Archibald-Ayers' Pile Remedy.* "This remedy properly applied will remove and cure irritation, congestion, and swelling of painful or bleeding piles, fistula, fissure or tumors in rectum, etc." Price, $7.00 per box of twenty-eight suppositories; color, brownish. Loss on evaporation at 100° C., 4.39 per cent. (largely camphor). This is apparently the same material as **21718** in a different form.

21721. Same label as **21720.** Price, $7.00 per box of twenty-eight suppositories; color, greenish. Loss on evaporation at 100° C., 2.85 per cent. (largely camphor). This is apparently the same material as **21719.**

In the absence of a complete analysis it is not fair to state that these preparations possess no medicinal value, although the circumstances attending their sale strongly savor of quackery. Whether their value as medicine is large or nothing at all, a very important consideration is their exorbitant price. In **21716** and **21717** the addition of a small amount of medicament has increased the cost of an inferior grade of wine from a few cents to from $3.00 to $5.00 per half pint. In the case of the suppositories, which weighed about 0.5 gm. each, $225 per lb. was paid for what was almost entirely cacao butter.

Four other samples, purporting to be catarrh medicines, were sent in by another New Haven physician. They were made by Hayes-Agnew, Buffalo, N. Y. Like the other set of samples, only a small quantity was submitted and the analysis is therefore far from complete and entirely qualitative.

22131. Marked "No. 781." A milky-white emulsion, very viscid. Peppermint oil present, no iodides, bromides or chlorides present. By the official method for total alkaloids an appreciable residue more or less crystalline (hair-like crystals) was obtained, too small to test further except with concentrated nitric acid. No color was produced on this treatment. Atropine, caffeine, conine and other alkaloids might behave thus, but no confirmatory tests could be made.

22132. Marked "No. 967." A colorless liquid. Iodides present, no bromides or chlorides present, no iron was found. A test for alkaloids resulted as in previous sample.

22133. Marked "No. 769 A. C." A pink liquid. Iodides present in quantity, no bromides, chlorides or iron present. Alkaloids as in **22131.**

22134. Marked "No. G. P." A yellow liquid. No iodides, bromides or chlorides present, iron present. The alkaloids were isolated as in **22131.** The colorless residue treated with concentrated nitric acid gave a yellow color. This reaction might indicate codeine, morphine, thebaine and other alkaloids. On heating with nitric acid morphine should give a red color, but no red color was obtained. There was no evidence of morphine, and no other alkaloid could be identified.

FOOD AND DRUG PRODUCTS EXAMINED FOR THE DAIRY COMMISSIONER IN THE YEAR ENDING JULY 31, 1909.

The following samples were referred to this station by the Dairy Commissioner for examination:

Butter and Butter Substitutes. Of the sixty samples examined, twenty were unadulterated, twenty-four were oleomargarine and sixteen were renovated butter. Four samples of oleomargarine were sold without the display of the required sign, and fourteen samples of renovated butter unstamped. Eleven samples sold as butter proved to be oleomargarine and two renovated butter. Three samples sold as renovated butter were oleomargarine. Six samples of oleomargarine were examined for color with negative results.

Catsup. One sample examined was a properly labeled "compound"; the other was marked "made with benzoate of soda." It contained 0.24 per cent. of the preservative.

Cod Fish. The one sample examined contained no preservative.

Cream. One sample thickened with sucrate of lime was examined.

Lard. The four samples examined were found to be compound lard, but in each case were sold for pure lard.

Lemon Extract. Of the twenty-seven samples examined, four were not adulterated, fourteen were adulterated, and nine compounds, eight of which were illegally labeled.

Meat Juice. The sample examined was below standard.

Milk. One hundred and fourteen samples were examined; of these eighty-three were of standard composition. Of the deficient samples fifteen were watered and seven were skimmed.

Molasses. No adulteration was found in the two samples examined.

Pickles. The single sample examined was not found to be adulterated.

Preserves. The single sample examined was a properly labeled "compound."

Vanilla Extract. Sixteen samples were examined. Five of these were pure, one was adulterated and ten were compounds. Seven of the latter were illegally labeled in one or more particulars.

Vinegar. Two hundred and five samples were examined, of which one hundred and fifty-five were up to standard, twenty-eight were below standard, and twenty-two were illegally sold. The latter class includes samples of syrup, distilled and sugar vinegars sold as cider, malt or wine vinegar.

Waverly Shortening. This was a lard substitute properly labeled "compound" and consisted of beef stearin and cotton-seed oil.

Bay Rum. Five samples were examined, four of which were adulterated. Three contained methyl alcohol and one was a solid consisting chiefly of common salt, colored with a coal-tar dye.

Beef, Iron and Wine. The two samples examined were illegally labeled.

Spirits of Camphor. The single sample examined was of standard strength.

Castor Oil Pills. The sample was misbranded, as it contained no castor oil.

Camphor Liniment. Of the fifty samples examined, thirty were below standard. (See page 246.)

Catarrh Remedies. Four samples were examined, three of which were illegally sold, as they contained cocaine. (See page 249.)

Tincture of Ginger. The single sample examined was of standard strength.

Headache Pills. The sample contained the amount of acetanilid guaranteed on the label.

Tincture of Iodine. Six samples were examined, two of which were below standard.

Lime Water. Six samples were examined, four of which were below standard.

TABLE XLI.—SUMMARY OF RESULTS OF EXAMINATION OF FOOD AND DRUG PRODUCTS IN 1909.

	Not found *Adulterated.	*Adulterated or below standard.	Compound.	Total number examined.
Sampled by Station.				
Breakfast Foods	35	14	--	49
Coffee	28	--	--	28
Condensed Milk	32	4	--	36
Dessert Preparations	--	--	--	4
Gelatin	10	6	--	16
Grape Juice	6	1	2	9
Jelly Powders	2	1	9	12
Lard	97	7	--	104
Lemon Extract	22	15	18[1]	55
Maple Syrup	8	--	22	30
Milk Powder	1	--	--	1
Olive Oil	44	--	--	44
Peanut Oil	1	--	--	1
Pickles	14	2	18[2]	34
Sardines	43	1	--	44
Sausage	--	--	--	51
Syrup	--	--	1	1
Temperance Drinks	--	--	--	11
Vanilla Extract	38	2	25[3]	65
Bay Rum	--	2	--	2
Camphor Liniment	81	77	--	158
Castor Oil	22	--	--	22
Castor Oil Pills	--	1	--	1
Catarrh Powders	5	1	--	6
Coca Wine	--	--	--	18
Cod Liver Oil	66	4	--	70
Cologne	--	1	--	1
Hydrogen Dioxide	1	22	9	32
Tincture of Iodine	28	15	--	43
Kola Wine	--	1	--	1
Lime Water	32	9	--	41
Extract of Peppermint	1	--	--	1
Spirits of Peppermint	1	--	--	1
Violet Water	--	1	--	1
Extract of Witch Hazel	2	--	--	2
Total	620	187	108	995
Sampled by Dairy Commissioner.				
Butter and Butter Substitutes	20	34	6	60
Catsup	--	--	2	2
Cod Fish	1	--	--	1
Cream	--	--	1	1
Jam	--	1	--	1
Lard	--	4	--	4

* Also includes misbranding.
[1] 17 illegally labeled.
[2] 3 illegally labeled.
[3] 11 illegally labeled.

TABLE XLI.—SUMMARY OF RESULTS OF EXAMINATION OF FOOD AND DRUG PRODUCTS IN 1909—*Continued.*

	Not found *Adulterated.	*Adulterated or below standard.	Compound.	Total number examined.
Sampled by Dairy Commissioner.				
Lemon Extracts	4	14	9[4]	27
Meat Juice	--	1	--	1
Milk	83	31	--	114
Molasses	2	--	--	2
Pickles	1	--	--	1
Preserves	--	--	1	1
Vanilla Extracts	5	1	10[5]	16
Vinegar	155	50	--	205
Waverley Shortening	--	--	1	1
Bay Rum	1	4	--	5
Beef, Iron and Wine	--	2	--	2
Spirits of Camphor	1	--	--	1
Camphor Liniment	20	30	--	50
Castor Oil Pills	--	1	--	1
Catarrh Remedy	1	3	--	4
Tincture of Ginger	1	--	--	1
Headache Pills	1	--	--	1
Tincture of Iodine	4	2	--	6
Lime Water	2	4	--	6
Total	302	182	30	514
Sampled by Health Officers, Consumers and Dealers.				
Butter	6	--	--	6
Castor Oil Pills	--	1	--	1
Catarrh Remedies	1	4	--	5
Cinnamon	1	--	--	1
Confectionery	7	5	--	12
Corn Starch	1	--	--	1
Cream	1	10	1	12
Formalin	1	--	--	1
Ginger	1	--	--	1
Headache Wafers	1	--	--	1
Tincture of Iodine	1	--	--	1
Lemon Extract	--	1	--	1
Milk	36	8	--	44
Olive Oil	1	--	--	1
Proprietary Medicines	--	--	--	10
Root Beer	--	--	--	1
Sugar	3	--	--	3
Sugar Gems	--	1	--	1
Tri-Krema	--	--	--	1
Vinegar	3	4	--	7
Wine	--	1	--	1
Total	64	35	1	121
Total from all sources	986	404	139	1630

* Also includes misbranding. [4] 8 illegally labeled. [5] 7 illegally labeled.

PART III.

COMMERCIAL FEEDING STUFFS.

BY E. H. JENKINS AND J. P. STREET.*

THE LAW REGULATING THEIR SALE.

Section 4591 of the general statutes of Connecticut so defines the term "concentrated commercial feeding stuff" that it covers practically all feeds *excepting the following*:—hay and straw, whole seeds, unmixed meal made directly from any one of the cereals or from buckwheat, and feed ground from whole grain and sold directly from manufacturer to consumer.

Section 4592 requires that every package of concentrated commercial feeding stuff shall bear a statement giving the name and address of manufacturer or importer, the number of net pounds in the package, the name of the article and the percentage of protein and fat contained in it.

Section 4593 requires every manufacturer, importer, agent, or seller to file with this station, upon request, a certified copy of the statement above described.

The penalty prescribed for violation of the foregoing sections is not more than $100 for the first offense and not more than $200 for each subsequent offense.

Section 4595 authorizes this station to take samples from any manufacturer, importer, agent, or dealer, in a prescribed fashion, and requires this station to analyze, annually, at least one sample of each brand which it has collected and to publish these analyses in station bulletins, "together with such additional information in relation to the character, composition and use thereof as may be of importance."

* The analytical work here described has been done by Messrs. Street, Morrison, Roe and Shepard. The report has been prepared mainly by Mr. Street.

The dairy commissioner is charged with the enforcement of the provisions of these sections of the statutes.

In compliance with these requirements the following report has been prepared. The utmost brevity of discussion of work is made necessary by the limit imposed by law on the size of the report.

During the fall of 1909 the station sampling agent visited 45 towns and villages of this State and collected 226 samples of feeds as prescribed by law. The results of the chemical and microscopical examination of these samples are here given and discussed.

There are also given 75 analyses of samples sent by individuals.

Oil Seed Products.

Cotton Seed Meal, Sampled by the Station.

(Analyses on pages 300 and 301.)

Of the fifteen samples, one, **23557**, sold by C. A. Conant, Boston, had neither brand nor guaranty on the bags as required by law. The following brands failed to meet their guaranteed protein content by the amounts given: American Cotton Oil Co.'s, by 1.44 per cent., Buckeye brand by 1.44 per cent, Dixie brand, two samples, by 2.37 and 1.94 per cent., respectively, J. E. Soper's by 3.00 per cent., Star brand by 1.69 per cent.

One sample of the *Buckeye Brand,* **23511**, contained an excess of hulls, as shown by the percentage of fiber.

The average per cent. of protein is 39.83, somewhat lower than last year, while the average price is over two dollars higher.

Cotton Seed Meal, sampled by Purchasers.

21817, *Dixie Brand,* Humphreys, Godwin & Co., Memphis, Tenn., guaranteed 41 per cent. protein; sent by L. C. Brainard, Thompsonville; contained 42.31 per cent. protein.

21823, *Green Diamond Brand,* Chapin & Co., Boston; sent by Meech & Stoddard, Middletown; contained 43.06 per cent. protein.

21998, sent by Colchester Grain & Coal Co., Colchester; guaranteed 38.5 per cent. protein; contained 39.62 per cent. protein.

22322, sent by Meech & Stoddard, Middletown; guaranteed 39 per cent. protein; contained 39.62 per cent. protein.

22544, Hunter Bros. Milling Co., St. Louis, Mo., guaranteed 38.5 per cent. protein; sent by R. B. Eno, Weatogue; contained 42.56 per cent. protein.

23837, Humphreys, Godwin & Co., Memphis, Tenn.; sent by The Coles Co., Middletown; contained 38.37 per cent. protein.

23838, Humphreys, Godwin & Co., Memphis, Tenn.; guaranteed 41 per cent. protein; sent by The Coles Co., Middletown; contained 36.87 per cent protein.

23839, *Dixie Brand,* Humphreys, Godwin & Co., Memphis, Tenn.; guaranteed 41 per cent. protein; sent by L. C. Brainard, Thompsonville; contained 41.37 per cent. protein.

23841, sent by Meech & Stoddard, Middletown; guaranteed 39 per cent. protein; contained 39.12 per cent. protein.

23842, J. E. Soper & Co., Boston, Mass.; guaranteed 38.5 per cent. protein; sent by The T. E. Main & Sons Co., Moosup; contained 39.44 per cent. protein.

23861, *Buckeye Brand,* The Buckeye Cotton Oil Co., Cincinnati, O.; guaranteed 39 per cent. protein; sent by Wheeler & Co., Bridgeport; contained 37.31 per cent. protein.

23865, *Dixie Brand,* Humphreys, Godwin & Co., Memphis, Tenn.; guaranteed 38.5 per cent. protein; sent by T. S. Gold & Son, West Cornwall; contained 37.13 per cent. protein.

23892, sent by The Coles Co., Middletown; contained 40.69 per cent. protein.

23896, *Dixie Brand,* Humphreys, Godwin & Co., Memphis, Tenn.; guaranteed 38.5 per cent. protein; sent by H. B. Coger, Botsford; contained 37.75 per cent. protein.

23897, Humphreys, Godwin & Co., Memphis, Tenn.; sent by The Coles Co., Middletown; contained 41.13 per cent. protein.

23923, and **23924**, sold by Bosworth Bros., Putnam, and W. E. Wheelock, Quinnebaug, respectively, and sent by L. H. Healey, North Woodstock, contained 39.00 and 38.38 per cent. protein.

22011, *Prime Cotton Seed Feed,* Southern Fibre Co., Portsmouth, Va.; guaranteed 10 per cent. protein; sent by F. Chamberse, Waterbury; contained 10.62 per cent. protein.

23860. A sample of cotton seed meal from R. W. Jennings, Torrington, from a car lot, contained 27.75 per cent. of protein, ten and three-quarters per cent. less than guaranteed. It was stated later that the sample was taken from a single sack which had been torn open, and therefore represented nothing more than the contents of one sack. Later Mr. Jennings sent another sample with the statement that it was a portion of a sample drawn from twenty-one bags. It came in four packages in which protein was separately determined. The percentages were 37.38, 37.19, 37.30, 36.94, being practically alike, the average being 37.20. At the same time the shipper's agent drew fourteen samples from different sacks, sending half of each to the seller and half to this station. In each of these protein was determined with the following percentage results: 38.13, 36.75, 37.88, 36.63, 35.25, 33.88, 39.00, 35.81, 28.13, 36.63, 38.75, 36.63, 37.94, 39.31; average, 36.48.

Obviously two bags in the fourteen contained very inferior meal. Excluding them, the average protein is 37.40, about what was found in the sample sent by Mr. Jennings. The average of the car is good, but the purchaser of a single bag or two might get very poor meal. There is no good excuse for the presence of such inferior meal. On the other hand, those drawing samples should take great care to have the sample sent representative of the whole lot, thus avoiding unnecessary work and misunderstanding. At least twenty sacks should be opened and sampled from each car lot.

It is now possible for users of cotton seed meal in car lots to buy it with a guaranty and also with an agreement from the seller, which appears on every tag, to deduct from the cost for any deficiency in protein under named and reasonable conditions.

Linseed Meal, sampled by the Station.

(Analyses on pages 300 and 301.)

Three samples of new process and four of old process meal satisfied their guaranties in every case except Sample **23606**, which was low in fat.

Linseed Meal, sampled by the Purchasers.

22124. Old Process meal, sent by Meech & Stoddard, Middletown; contained 35.12 per cent. protein.

22381. Old Process meal, *Cow Brand,* New Jersey Oil & Meal Co.; guaranteed 30 per cent. protein; sent by C. D. Stillson, Stepney Depot; contained 26.69 per cent. protein and 8.45 per cent. fiber. A microscopical examination showed it to contain a rather large amount of weed seeds and cocoa shells.

Wheat Products.

Whole Wheat.

21818. Wheat damaged by smoke and water and then probably kiln dried; sent by D. O. Meeker, West Cheshire; contained 12.19 per cent. protein and 1.85 per cent fat.

Bran from Winter Wheat.

(Analyses on pages 300 to 303.)

23527, Voigt's Bran did not have a guaranty as required by law, but the manufacturer, on being advised of the law, has taken steps to conform with it. The other fifteen samples were properly guaranteed and twelve of them met their guaranties. *Vimco Bran,* **23506,** was 1.06 per cent. low in protein, and *Adrian Bran,* **23590,** the bran of the Southwestern Milling Co., **23500,** and that of Hecker-Jones-Jewell Milling Co., **23437,** were all low in fat.

Bran from Spring Wheat.

(Analyses on pages 302 and 303.)

23565, *Lucky Bran,* and **23573,** the bran of the Geo. Urban Milling Co., were not guaranteed as required by law. The Geo. Urban Milling Co., on being advised, write that the matter will be properly attended to. The samples of these brans had considerably less fat than average wheat bran. The other ten samples were properly guaranteed and had the guaranteed amounts of protein and fat.

The single sample of unclassified bran satisfied its guaranty.

Middlings from Winter Wheat.

(Analyses on pages 304 and 305.)

The ten samples were properly guaranteed and all satisfied their guaranties except **23465,** Hecker-Jones-Jewell Milling Co., which was slightly low in fat.

Middlings from Spring Wheat.

(Analyses on pages 304 and 305.)

23549, *New Star Middlings,* and the middlings of the Geo. Urban Milling Co., **23572,** were not guaranteed as required by law. The other fourteen samples were properly guaranteed and all satisfied their guaranties except **23620**, *Bay State,* and **23619**, *Sleepy Eye,* which were low in fat.

Of the two unclassified middlings, one satisfied its guaranty; the other, **23501**, *Colonial Middlings,* likewise satisfied its guaranty, but is not pure wheat middlings, as it contains a corn product; its selling price, $32.00, was over $2.00 higher than the average price of standard middlings.

Wheat Feed from Winter Wheat.

(ANALYSES ON PAGES 306 AND 307.)

23495, *Hope Mills Feed,* and **23497**, *Snowflake Mixed Feed,* were not guaranteed as required by law, but the manufacturers, being advised of the law, have taken steps to comply with it. The other fifteen samples were properly guaranteed, and all satisfied their guaranties except **23597**, *Cream Feed,* and **23616**, *Star and Crescent Mixed Feed,* which were both low in fat.

Wheat Feed from Spring Wheat.

(ANALYSES ON PAGES 306 TO 309.)

23626, *Lucky Mixed Feed,* and **23588**, *Faylor's Mixed Feed,* were not guaranteed as required by law. The other nine samples were properly guaranteed and all satisfied their guaranties.

Of the unclassified wheat feeds, **23499**, *Columbia Mixed Feed,* did not bear the required guaranty, but we are assured by the manufacturers that it will be properly tagged hereafter. The other two samples were properly guaranteed and both satisfied their guaranties.

Red Dog Flour.

(ANALYSES ON PAGES 308 AND 309.)

The single sample was not guaranteed as required, but was of average composition.

Wheat Feeds, sampled by Purchasers.

21987, *Winona Bran,* and **21988**, *Globe Bran,* sent by Wilson H. Lee, Orange, contained 16.00 and 16.75 per cent. protein, respectively. **22469**, middlings, sent by E. DeWolfe, Rockville, contained 15.69 per cent. protein and 1.75 per cent. ash. **23357**, middlings, Eckhart & Swan Milling Co., Chicago, Ill., sent by E. H. Lyman, Torrington, contained 10.27 per cent. water, 16.69

per cent. protein and 5.95 per cent. fat. **22329**, *Huron Mixed Feed,* Chapin & Co., Boston, Mass., sent by G. M. White & Co., Hartford, contained 17.25 per cent. protein. **23395**, wheat feed, sent by Abner Hendee, New Haven, contained 17.19 per cent. protein.

MAIZE PRODUCTS.

Maize Meal.

One sample of corn meal, **23864**, made by H. B. Coger, Botsford, contained 8.94 per cent. protein.

Maize (Grain).

Eight samples of corn were analyzed, chiefly in connection with variety tests of high protein strains. **21982**, **21983** and **21984**, sent by Geo. S. Anthony, Wallingford, contained 10.44, 10.37 and 10.25 per cent. protein, respectively. **22042** and **22043**, sent by Dennis Fenn, Milford, contained 9.06 and 9.56 per cent. protein. **22421**, **22422** and **22423**, sent by David S. Kelsey, West Hartford, contained 11.12, 8.75 and 10.06 per cent. of protein, respectively.

Gluten Feed, sampled by the Station.

(ANALYSES ON PAGES 308 TO 311.)

Nine brands were found on sale in the State, and these are represented by sixteen analyses.

Atlantic Gluten Feed, made by the Atlantic Starch Works, Westport, satisfied its guaranty. This is made from wheat gluten and contains from four to five per cent. more protein than the high-grade corn gluten feeds, while its price is somewhat lower.

Buffalo Gluten Feed, made by the Corn Products Refining Co., Chicago. Three of the four samples met their guaranties. One was deficient in fat. All the samples were stated to be artificially colored.

Cream of Corn Gluten Feed, made by the American Maize Products Co., New York. One of the two samples was deficient in fat, and one was stated to be artificially colored.

Crescent Gluten Feed, made by the Corn Products Refining Co., New York. The single sample failed to meet its fat guaranty; it was stated to be artificially colored.

Clinton Gluten Feed, made by the Clinton Sugar Refining Co., Clinton, Ia. Both samples substantially met their guaranties.

Globe Gluten Feed, made by the Corn Products Refining Co., New York and Chicago. The three samples all met their protein guaranties but one was deficient in fat. All were stated to be artificially colored.

Jenks Gluten Feed, made by the Huron Milling Co., Harbor Beach, Mich., substantially met its guaranty. It contains a low per cent. of ash with a high per cent. of fat, 9.12, indicating the possible addition of corn germ to the feed.

K. K. K. Gluten Feed, made by the J. C. Hubinger Bros. Co., Keokuk, Ia., and *New England Gluten Feed,* from J. E. Soper & Co., Boston, both satisfied their guaranties.

Gluten Feeds, sampled by Purchasers.

21820, *Wheat Gluten,* sent by Meech & Stoddard, Middletown, contained 39.12 per cent. protein. **21989,** unknown brand, made by the Corn Products Refining Co., sent by Wilson H. Lee, Orange, contained 26.94 per cent. protein. **22123,** *Gluten Feed,* sent by Meech & Stoddard, Middletown, contained 20.81 per cent. protein. **22159,** *International Gluten Feed,* made by the Globe Elevator Co., Buffalo, N. Y., guaranteed 20 per cent. protein, sent by H. G. Manchester, Winsted, contained 21.56 per cent. protein. **23898,** *Crescent Gluten Feed,* made by the Corn Products Refining Co., guaranteed 25 per cent. protein, sent by Andrew Kingsbury, Rockville, contained 27 per cent. protein.

Hominy Feed, sampled by the Station.

(ANALYSES ON PAGES 310 TO 313.)

Nineteen samples were analyzed, all of which were guaranteed, and substantially met their guaranties except **23482,** which was slightly deficient in fat.

Hominy Feed, sampled by Purchasers.

22373, sent by H. B. Cooke, Georgetown, contained 11.62 per cent. protein. Two samples of *Blue Ribbon Hominy Chop,* sold by J. E. Soper & Co., Boston, both guaranteed 10 per cent. protein, and sent by Fred Lyman, Manchester, and Spencer Bros., Suffield, contained 11.12 and 10.81 per cent. protein, respectively.

Star Feed.

(ANALYSES ON PAGES 312 AND 313.)

This material, made by the Toledo Elevator Co., Toledo, O., is a mixture of hominy feed, corn and cob meal, and a small amount of salt. It contains only about four-fifths as much protein as hominy feed, and over twice as much fiber, while its selling price is only about $2.00 per ton less. The three samples analyzed met their guaranties.

Miscellaneous Maize Products.

(ANALYSES ON PAGES 312 AND 313.)

23443, *Corn Feed Meal,* made by the Quaker Oats Co., Chicago, satisfied its guaranty. It is made from yellow hominy feed, and conforms with the composition of high-grade hominy feed.

23493, *Screenings from Cracked Corn,* sold by W. O. Goodsell, Bristol, bore no guaranty. Its analysis showed it to contain considerable corn bran.

Corn and Cob Meal.

22168, 22169, and **22170,** sent by R. H. Ensign, Simsbury, contained 8.81, 7.75 and 8.00 per cent. protein respectively, somewhat higher percentages than usually found in this product.

RYE PRODUCTS.

(ANALYSES ON PAGES 312 AND 313.)

One sample of rye feed, **23529,** made by the H. D. Stone Milling Co., Rochester, N. Y., was not guaranteed as required by law. The firm stated that it did not sell in sacks but often filled it in purchasers' sacks. The purchaser or dealer within this state is therefore responsible for properly tagging the packages.

BUCKWHEAT PRODUCTS.

(ANALYSES ON PAGES 312 AND 313.)

One sample each of buckwheat feed and middlings was analyzed, both of which satisfied their guaranties. The feed contained considerable of the hulls as shown by the high fiber percentage, 25.07. The middlings, as usual, was a very high-grade feed.

One sample of buckwheat flour, **23863**, made by E. F. Barnes, Rock Dale Mills, Mass., and sent by H. B. Coger, Botsford, contained 9.12 per cent. protein.

Barley Products.

Malt Sprouts.

(Analyses on pages 314 and 315.)

The two samples analyzed, met their protein guaranties, but were both somewhat low in fat. A guaranty of 2 per cent. is too high for pure malt sprouts.

A sample, **22356**, sent by Fred Lyman, Manchester, contained 27.37 per cent. protein.

Dried Distillers' Grains.

(Analyses on pages 314 and 315.)

Four samples, representing three brands, were analyzed. All of these were high-grade products, but *Connecticut Gluten,* **23516**, showed a marked deficiency in both protein and fat, and one sample of *Ajax Flakes* was over one per cent. low in protein. Attention is again called to the impropriety of giving the name "gluten feed" to distillery by-products.

Dried Brewers' Grains.

(Analyses on pages 314 and 315.)

The three samples analyzed were of good quality and satisfied their guaranties, except **23571**, *Schlitz's Dried Grains,* which was deficient in fat.

22158, made by The James Hanley Brewing Co., Providence, R. I., guaranteed 20 per cent. protein, sent by Andrew Kingsbury, Rockville, contained 24.87 per cent. protein.

Mixed Feeds.

The following paragraphs from an address of Dr. H. P. Armsby, a leading authority in animal nutrition, are worth the attention of manufacturers and of purchasers of mixed feeds:

"The feeder of the future will utilize by-product feeds to an extent as yet unrealized. He will pass in review the crude products of the farm, and all the hundred and one wastes of manufacturing operations, to see if perchance they still contain energy which he can extract. Like the miner, he will be ready to work

low-grade ore, provided there is a sufficient margin of profit. Even the small amounts of available energy contained in such feeds as oat hulls, corn cobs and the like will be utilized and their waste energy saved as rapidly and as far as economic conditions render profitable, and to aid in rendering this possible is to render service to mankind.

"It must be clearly understood, however, that this desirable end is not to be attained by any species of pious fraud. The manufacturers of mixed feeds are of late making much of the importance of by-product materials, a most sound proposition in itself, but one which hardly justifies all the corollaries which some of them appear to draw from it. That corn cobs, for example, contain a certain small amount of available energy does not render it an act of benovolence to induce the farmer to feed them, as Mike wanted his whisky supplied, 'unbeknownst,' in some mixed feed with a high-sounding name or as an inconspicuous admixture to some well-known material. Such surreptitious kindness is in danger, in the long run, of recoiling upon its author. We shall not effect the needed economies of the future by coaxing or beguiling the feeder into utilizing these low-grade materials as ingredients of patent feeds or pre-digested mixtures or ready-balanced rations, but by teaching him their true value and educating him to make his own mixtures and balance his own rations."

Corn and Oat Feeds.

(Analyses on pages 314 to 317.)

Nine of the samples included in this group are chiefly composed of corn and oat products. The composition of some of these indicates that they are mixtures of the whole of these two grains. Others indicate, however, that an inferior part of the grain has been used in their compounding; this is particularly noticeable in **23414**, *Jim Dandy Feed,* which contains a large proportion of oat hulls, with very little corn.

23598, *Cox's Oat Feed,* consists very largely of oat hulls, and shows only 5.06 per cent. protein with 25.92 per cent. of fiber. Such a feed at the price given cannot be an economical purchase under any possible circumstances.

One sample of *Korn-Oato* did not bear the required guaranty but the manufacturer states that it is now attached to all packages. **23558**, *Provender,* did not meet its protein guaranty, and **23512**, *Korn-Oato,* was low in fat.

Corn and Oats Feeds, sampled by Purchasers.

22371, sent by H. B. Cooke, Georgetown, contained 11.19 per cent. protein. **23012** and **23347**, sent by the manufacturer, Meech & Stoddard, Middletown, contained 6.87 and 7.00 per cent. protein, respectively, and the latter 3.35 per cent. fat. **23862**, sent by H. B. Coger, Botsford, contained 9.50 per cent. protein.

22632, *Oat Dust,* screened from high-grade Montana oats, sent by Meech & Stoddard, Middletown, contained 10.94 per cent. protein and 4.90 per cent. ash.

Wheat and Corn Cob Feeds.

(ANALYSES ON PAGES 316 AND 317.)

These feeds, while sold as *Mixed Feeds,* a name properly belonging from trade usage only to mixtures of wheat bran and middlings, bore tags which indicated the presence of corn cob. They sell on the average for about $3.00 less than genuine wheat feed, although one of the samples examined this year cost $30.00 per ton, and they contain only about two-thirds as much protein as wheat feed. The three samples examined were guaranteed, and all satisfied their guaranties.

Proprietary Horse Feeds.

(ANALYSES ON PAGES 316 AND 317.)

Of the eight samples examined, one, **23550**, *Molac Molasses Horse Feed,* did not bear the required guaranty. The manufacturers write that this was an oversight which has been corrected. *Sucrene Horse and Mule Feed,* **23622**, and *Algrane Horse Feed,* **23475**, were below guaranty in fat, and *Bonnie Horse Feed,* **23430**, was below guaranty in both fat and protein.

Molac Molasses Horse Feed contains corn and oat products, a little cotton seed and linseed meals, weed seeds and molasses.

Hexagon for Horses contains crushed oats and a corn product.

Sucrene Horse and Mule Feed contains corn, oats, barley and wheat products, weed seeds and molasses.

"Ubiko" Horse Feed contains wheat, corn and oat products, and cotton seed and linseed meals.

Buffalo Horse Feed contains corn, oats and a small amount of a wheat product.

Bonnie Horse Feed and Algrane Horse Feed contain corn, oat and wheat products.

Sugarota Horse Feed contains wheat, oats, and corn products, cotton seed meal, a little linseed meal, some weed seeds and molasses.

Proprietary Dairy and Stock Feeds.

(ANALYSES ON PAGES 318 TO 321.)

All of the twenty-six feeds of this class examined bore the required guaranties except **23494**, *Quaker Molasses Dairy Feed.* The manufacturers write that this was through an oversight which has been corrected. Of the other samples, two, **23484** and **23555**, *Sugarota Dairy Feed,* were below guaranty in protein, and three, **23431**, *Bonnie Dairy Feed,* **23537**, *Badger Stock Feed,* and **23603**, *Derby Stock Feed,* were below guaranty in fat.

Sucrene Dairy Feed contains distillery products, corn, oat and wheat products, cotton seed meal, a little linseed meal, weed seeds and molasses.

Unicorn Dairy Ration contains wheat, corn and brewery products, and cotton seed and linseed meals.

Biles' Union Grains contains wheat and corn products, distillery residues, malt sprouts, and cotton seed and linseed meals.

Blatchford's Calf Meal contains linseed, cotton seed and bean meals with fenugreek.

Buffalo Creamery Feed contains corn, wheat and oat products and cotton seed meal.

Daisy Dairy Feed contains corn, oat and rye products, malt sprouts, barley residues, cotton seed meal, some weed seeds and molasses.

Sterling Stock Feed contains corn, oat and wheat products, and a small amount of cotton seed meal.

Bonnie Dairy Feed contains corn, wheat and oat products and cotton seed meal.

New England Stock Feed contains ground corn and oats (largely hulls).

Badger Dairy Feed contains wheat and oat products, malt sprouts, distillery residues, ground alfalfa, cotton seed meal (?), some weed seeds and molasses.

Badger Stock Feed contains cracked corn, oat product, malt sprouts, ground alfalfa, some weed seeds and molasses.

Electric Stock Food contains barley and corn products, malt sprouts, some oat hulls and molasses.

Sugarota Dairy Feed contains wheat and oat products, distillery residues, linseed meal, cotton seed meal and some weed seeds and molasses.

Quaker Molasses Dairy Feed contains wheat, corn and oat products, weed seeds and molasses.

Schumacher's Stock Feed contains corn, oat and barley products.

Schumacher's Calf Meal contains ground oats, wheat product, linseed meal and a small amount of cotton seed meal.

Derby Stock Feed contains corn and oat products and possibly some cotton seed meal.

Alfalfa Stock Feed contains cracked corn, coarsely ground alfalfa and a wheat product.

Buf-Ce-Co Stock Feed, Wirthmore Stock Feed, Haskell's Stock Feed and *Economy Feed* consist chiefly of corn and oat products.

Dairy Feeds Sampled by Purchasers.

21815, *Bonnie Horse Feed,* sent by The Ferris Coal Co., South Norwalk, guaranteed 10.50 per cent. protein, contained 14.12 per cent. **22370**, *Biles' Union Grains,* guaranteed 24 per cent. protein, sent by H. B. Cooke, Georgetown, contained 25.00 per cent. **22372**, *Daisy Dairy Feed,* sent by A. W. Northrup, Ridgefield, guaranteed 14 per cent. protein, contained 16.50 per cent. **23859**, *Stock Food,* sold by The L. C. Daniels Grain Co., Hartford, sent by Geo. E. Brown, Bloomfield, contained 11.44 per cent. protein.

Proprietary Poultry Feeds.

(Analyses on pages 320 and 321.)

The eleven samples all bore the required guaranties. **23469**, *H. O. Poultry Feed,* and **23600**, *Purina Mill Feed Mash,* were both below guaranty in fat.

Buffalo Poultry Feed contains wheat, corn and a small amount of oat products.

Queen Poultry Mash contains corn and wheat products and ground alfalfa.

G. W. Alfalfa Meal and *Peters' Ground Alfalfa* consist of ground alfalfa, rather mature and carrying a large percentage of crude fiber.

Bonnie Poultry Feed and *H. O. Poultry Feed* consist chiefly of wheat and corn products.

Park & Pollard's Dry Mash Feed contains wheat, corn and oat products, ground alfalfa and animal matter.

Park & Pollard's Growing Feed contains chiefly corn, wheat and oat products.

Purina Mill Feed Mash contains wheat and corn products, ground alfalfa, a very small amount of dried blood and possibly a little cotton seed meal.

American Poultry Feed contains wheat and corn products with a little oats.

Every Morning Mash Feed contains wheat and corn products, ground alfalfa, animal matter and a small amount of cotton seed meal.

23464, *Hen-E-Ta Bone Grits,* made by the Hen. E. Ta. Bone Co., Flemington, W. Va., guaranteed 30 per cent. pure bone ash, and sold by R. G. Havis, New Haven, at $45.00 per ton, contained 10.07 per cent. phosphoric acid, equivalent to 22 per cent. calcium phosphate.

21819, *Beef Scrap,* said to be made from the refuse of extract of beef, sold by Park & Pollard Co., Boston, sent by D. W. Meeker, West Cheshire, price $3.00 per hundred, and guaranteed 75 per cent. protein, contained 82.69 per cent. protein and 10.33 per cent. fat.

Condimental Food.

23697, *Kow-Kure,* made by the Dairy Association Co., Lyndonville, Vt., sold by J. T. Benham Est., New Haven, price $1.00 per can.

It is recommended for "abortion (slinking), barrenness (failure to breed), scouring, bunches in the udder, red-water, and 'off feed.' Kow-Kure assists nature in removing retained afterbirth, makes pure blood, corrects stomach disorders, improves the appetite, and being a safe and powerful tonic, it makes a larger flow of milk." It is claimed to be compounded of twelve drugs, which we have made no attempt to identify completely. A partial analysis showed 13.94 per cent. protein, 14.19 per cent. total ash, 6.29 per cent. ash soluble in water and 0.81 per cent. sand (insoluble in acid). The following ash ingredients were determined: iron oxide, 4.90 per cent., calcium oxide, 0.58 per cent., magnesium oxide, 4.03 per cent., phosphoric anhydride, 1.24 per cent., and sulphuric anhydride, 3.59 per cent., indicating that the mineral part of the mixture consisted chiefly of magnesium sulphate (Epsom salt) and an iron salt, probably the sulphate.

The exorbitant price of this and similar preparations, if nothing else, should prevent their use by the stockman, to whom economy is a matter of vital importance.

Apple Pomace.

23984, sent by J. A. Thompson & Son, Melrose, had the following composition:

Water	74.54
Ash	0.73
Protein	1.08
Fiber	3.38
Nitrogen-free Extract	19.13
Ether Extract	1.14
	100.00

Summary.

The following table shows the number of samples analyzed, the number sold without the required guaranty and also the number which failed to meet the manufacturer's guaranty.

Kind of Feed.	No. of Samples.	No. with Guaranty.	No. without Guaranty.	* Low in Protein.	* Low in Fat.	* Low in Both.
Cotton Seed Meal	15	14	1	4	-	2
Linseed Meal	7	7	-	-	1	-
Wheat Bran	29	26	3	1	3	-
Wheat Middlings	28	26	2	-	3	-
Wheat Feed	33	26	7	-	2	-
Gluten Feed	16	16	-	-	4	-
Hominy Feed	19	19	-	-	1	-
Star Feed	3	2	1	-	-	-
Rye Feeds	4	3	1	.	-	-
Buckwheat Feeds	2	2	-	-	-	-
Malt Sprouts	2	2	-	-	1	-
Distillers' Grains	4	4	-	1	-	1
Brewers' Grains	3	3	-	-	1	-
Corn and Oat Feeds	10	9	1	1	1	-
Wheat and Corn Cob Feeds	3	3	-	-	-	-
Horse Feeds	8	7	1	-	2	1
Dairy and Stock Feeds	26	25	1	2	3	-
Poultry Feeds	11	11	-	-	2	-
Bone Ash	1	1	-	-	-	-
Miscellaneous	2	1	1	-	-	-
	226	207	19	9	24	4

* Deficiencies of less than one per cent. protein and 0.25 per cent. fat are ignored in this tabulation.

Digestibility of Feeding Stuffs.

Table I shows the digestion coefficients, or percentages of the food elements which are digestible by neat cattle (Lindsey's Compilation, 17th Report Mass. (Hatch) Agrl. Station, 1905, page 240 *et seq.*).

TABLE I.

DIGESTION COEFFICIENTS.

	Protein.	Fiber.	Nitrogen-free Extract.	Fat.
Cotton Seed Meal	84	35	78	94
Linseed Meal, new process	84	74	80	89
Linseed Meal, old process	89	57	78	89
Corn Meal	66	..	92	91
Homing Meal and Star Feed	65	67	89	92
Gluten Feed	85	76	89	83
Wheat Bran	77	39	71	63
Wheat Middlings	77	30	78	88
Wheat Mixed Feed	78	62	77	87
Rye Feed	80	..	88	90
Oats	77	31	77	89
Buckwheat Middlings	85	17	83	89
Malt Sprouts	80	34	69	100
Dried Distillers' Grains	73	95	81	95
Dried Brewers' Grains	81	49	57	89
Corn and Oat Feed, Provender	71	48	83	87
Wheat and Corn Cob Feed	63	28	71	92

THE AVERAGE COMPOSITION, DIGESTIBILITY AND SELLING PRICE OF COMMERCIAL FEEDS.

Table II contains a summary of the facts given in more detail in Table III and shows, first, the average composition of these feeding-stuffs as determined by our recent examination and arranged according to their percentage of protein; second, the amount of digestible matter in each feed, as far as we have been able to calculate it, and third, the average retail prices of the feeds in October and November last.

The feeds examined are tabulated in six groups. The statement on page 322 gives the average number of pounds of digestible protein, fiber and nitrogen-free extract and fat purchasable for one dollar in each of these groups.

TABLE II.—AVERAGE COMPOSITION OF FEEDS AND SELLING PRICE.

	In 100 pounds of feed are contained pounds of						In 100 pounds of feed are contained pounds of digestible				
	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract (Starch, etc.).	Ether Extract (fat).	Protein.	Fiber.	Nitrogen-free Extract.	Fat.	Cost per ton.
I. Protein over 30 per cent.											
Cotton Seed Meal	8.12	6.28	39.83	8.10	29.52	8.15	33.5	2.8	23.0	7.7	$34.85
Linseed Meal, new process	10.10	6.08	37.42	8.10	35.03	3.27	31.4	6.0	28.0	2.9	37.33
" " old process	10.31	5.36	34.66	7.20	36.66	5.81	30.8	4.1	28.6	5.2	36.00
Gluten Feed, Atlantic	5.21	1.13	32.81	1.40	58.38	1.07	27.9	1.1	52.0	0.9	30.00
Buckwheat Middlings	12.21	4.83	32.13	8.88	33.59	8.36	27.3	1.5	27.9	7.4	32.00
Ajax Flakes	5.51	2.70	30.25	10.86	37.52	13.16	22.1	10.3	30.4	12.5	34.00
II. Protein 30-25 per cent.											
Gluten Feed, Cream of Corn	8.57	2.38	27.75	7.22	51.12	2.96	23.6	5.5	45.5	2.5	32.00
Dried Brewers' Grains	8.18	3.22	27.71	13.32	40.65	6.92	22.4	6.5	23.2	6.1	29.33
Gluten Feed, Crescent	9.44	5.12	27.63	6.75	49.55	1.51	23.5	5.1	44.1	1.3	31.40
Corn Distillers' Grains	6.47	1.80	27.63	14.70	36.11	13.29	20.2	14.0	29.2	12.6	30.40
Gluten Feed, Globe	9.61	3.79	27.25	7.63	49.17	2.55	23.2	5.8	43.8	2.1	32.00
" " Buffalo	9.88	4.81	27.11	6.75	48.51	2.94	23.0	5.1	43.2	2.4	31.75
Malt Sprouts	9.91	5.63	27.10	10.38	45.40	1.58	21.7	3.5	31.3	1.6	27.50
Gluten Feed, Jenks	8.61	0.80	26.50	6.12	48.85	9.12	22.5	4.7	43.5	7.6	34.00
Connecticut Gluten	8.16	4.01	26.25	8.58	41.23	11.77	19.7	8.2	33.4	11.2	32.00
Unicorn Dairy Ration	9.05	2.96	25.94	8.86	45.73	7.46	----	----	----	----	33.00
III. Protein 25-20 per cent.											
Gluten Feed, New England	9.00	1.00	24.94	7.39	54.16	3.51	21.2	5.6	48.2	2.9	34.00
" " K. K. K.	7.55	1.53	24.81	7.98	53.72	4.41	21.1	6.1	47.8	3.7	32.00
Union Grains, Biles' Ready Ration	9.20	5.13	24.17	9.30	44.21	7.99	----	----	----	----	33.33
Gluten Feed, Clinton	10.00	0.95	22.63	6.65	55.63	4.14	19.2	5.1	49.5	3.4	32.00
Buffalo Creamery Feed	9.35	4.34	20.50	9.62	50.05	6.14	----	----	----	----	32.00
Ubiko Horse Feed	8.45	3.64	20.38	9.34	51.04	7.15	----	----	----	----	34.00
IV. Protein 20-15 per cent.											
Badger Dairy Feed	9.77	7.58	19.00	12.01	47.49	4.15	----	----	----	----	27.00
Wheat Middlings	10.74	4.39	17.52	5.76	56.44	5.15	13.5	1.7	44.0	4.5	29.94
Wheat Mixed Feed	10.60	5.35	16.76	7.12	55.44	4.73	13.1	4.4	42.6	4.1	30.00
Sucrene Dairy Feed	9.17	8.21	16.75	10.26	50.88	4.73	----	----	----	----	28.00

TABLE II.—AVERAGE COMPOSITION OF FEEDS AND SELLING PRICE—*Continued.*

	In 100 pounds of feed are contained pounds of						In 100 pounds of feed are contained pounds of digestible				
	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract (Starch, etc.).	Ether Extract (fat).	Protein.	Fiber.	Nitrogen-free Extract.	Fat.	Cost per ton.
Buckwheat Feed	10.09	3.58	16.31	25.07	40.79	4.16	----	----	----	----	$26.00
Quaker Molasses Dairy Feed	8.98	6.02	16.25	12.75	53.02	2.98	----	----	----	----	28.00
Sugarota Dairy Feed	9.33	7.97	15.94	18.24	42.71	5.81	----	----	----	----	27.70
Wheat Bran	10.10	6.67	15.86	9.21	53.37	4.79	12.2	3.6	37.9	3.0	27.90
Daisy Dairy Feed	8.35	7.68	15.69	12.55	52.67	3.06	----	----	----	----	28.00
Sugarota Horse Feed	10.14	8.06	15.44	19.71	40.97	5.68	----	----	----	----	29.00
Rye Middlings	11.95	3.06	15.34	3.43	63.25	2.97	----	----	----	----	30.50
Electric Stock Feed	9.78	6.78	15.31	9.55	56.20	2.38	----	----	----	----	27.00
V. Protein 15-10 per cent.											
Rye Feed	11.69	3.12	14.44	2.99	64.76	3.00	11.6	----	57.0	2.7	30.00
Badger Stock Feed	10.54	6.58	13.31	14.89	51.38	3.30	----	----	----	----	32.00
Alfalfa Stock Feed	10.94	5.31	12.12	11.68	57.13	2.82	----	----	----	----	34.00
Derby Stock Feed	8.65	3.61	12.00	10.79	58.46	6.49	----	----	----	----	32.00
Algrane Horse Feed	10.73	4.13	11.94	10.08	59.02	4.10	----	----	----	----	34.00
Buffalo Horse Feed	10.05	3.46	11.50	8.75	61.71	4.53	----	----	----	----	33.00
Schumacher's Stock Feed	9.42	4.15	11.50	10.96	59.15	4.82	----	----	----	----	33.00
Wheat and Corn Cob Feed	10.09	4.18	11.39	15.33	55.94	3.07	7.2	4.3	39.7	2.8	26.67
Sterling Stock Feed	9.57	4.82	11.25	8.00	61.12	5.24	----	----	----	----	30.00
Economy Feed	8.53	3.24	11.25	14.08	56.77	6.13	----	----	----	----	30.00
Molac Molasses Horse Feed	10.09	5.73	10.88	11.69	59.24	2.37	----	----	----	----	25.00
Hominy Feed	9.97	2.73	10.70	4.36	63.78	8.46	7.0	2.9	56.8	7.8	31.42
Wirthmore Stock Feed	7.86	4.09	10.50	8.91	61.24	7.40	----	----	----	----	32.00
VI. Protein under 10 per cent.											
Haskell Stock Feed	8.47	3.03	9.94	6.02	64.38	8.16	----	----	----	----	32.00
Sucrene Horse and Mule Feed	10.80	6.11	9.13	8.55	62.41	3.00	----	----	----	----	29.00
Star Feed	9.74	3.01	8.79	10.15	61.23	7.08	5.7	6.8	54.5	6.5	29.00
Buf-Ce-Co Stock Feed	9.53	2.74	8.75	8.41	65.37	5.20	----	----	----	----	31.00
Corn and Oats Feeds	9.28	3.90	8.53	12.44	62.08	3.77	6.1	6.0	51.5	3.3	30.20
Hexagon for Horses	9.18	4.34	8.50	13.76	58.73	5.49	----	----	----	----	32.00
New England Stock Feed	10.05	4.20	8.13	14.52	57.41	5.69	----	----	----	----	34.00

Table III.—Analyses of Commercial Feeds Sampled in 1909.

Station No.	Brand.	Retail Dealer.	Analyses.						Price per ton.
			Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	
	Oil Seed Products. *Cotton Seed Meal.*								
23578	Choice. American Cotton Oil Co., Memphis, Tenn.	*Moosup:* T. E. Main & Son	7.72	6.51	39.56	8.51	29.39	8.31	$34.00
23436	——. H. E. Bridges & Co., Memphis, Tenn.	*New Canaan:* C. H. Fairty	8.51	6.60	42.06	8.26	27.28	7.29	34.00
23531	Owl Brand. F. W. Brodé, Memphis, Tenn.	*Thompsonville:* H. K. Brainard	7.14	7.38	41.69	7.50	27.88	8.41	35.00
23511	Buckeye. Buckeye Cotton Oil Co., Cincinnati, O.	*Middletown:* Meech & Stoddard Co.	7.64	6.37	37.56	10.43	30.95	7.05	35.00
23560	" " " " "	*Mystic:* Mystic Grain Co.	7.25	6.58	41.56	6.83	30.02	7.76	35.00
23557	——. *C. A. Conant, Boston, Mass.	*Westerly:* C. W. Campbell & Co.	7.19	6.45	41.25	6.05	29.59	9.47	34.40
23452	Dixie Brand. Humphreys, Godwin & Co., Memphis, Tenn.	*Wallingford:* E. E. Hall	8.31	5.67	41.00	8.29	28.94	7.79	33.00
23509	Dixie Brand. Humphreys, Godwin & Co., Memphis, Tenn.	*Waterbury:* D. L. Dickinson & Son	8.32	6.29	40.25	7.25	29.25	8.64	35.00
23547	Dixie Brand. Humphreys, Godwin & Co., Memphis, Tenn.	*New London:* Arnold Rudd Co.	9.13	5.69	38.63	9.23	30.02	7.30	35.00
23586	Dixie Brand. Humphreys, Godwin & Co., Memphis, Tenn.	*Putnam:* Bosworth Bros.	9.42	5.98	36.56	9.42	30.83	7.79	34.40
23594	Prime. Hunter Bros. Milling Co., St. Louis, Mo.	*Willimantic:* H. A. Bugbee	7.39	5.93	40.00	7.67	30.11	8.90	34.00
23522	Choice Bolted. J. E. Soper & Co., Boston, Mass.	*Hartford:* L. C. Daniels Grain Co.	7.55	6.21	39.38	8.09	28.48	10.29	37.00
23528	——. * " " " "	*Hartford:* Smith, Northam & Co.	9.27	6.23	38.00	8.03	31.18	7.29	38.00
23591	Prime. " " " "	*Willimantic:* E. A. Buck & Co.	7.72	6.07	40.69	7.67	29.74	8.11	35.00
23582	Star Brand. *J. Lindsay Wells Co., Memphis, Tenn.	*Danielson:* Young Bros. Co.	9.19	6.20	39.31	8.27	29.18	7.85	34.00
----		Average guaranty	----	----	39.93	----	----	7.08	
----		Average of these 15 analyses	**8.12**	**6.28**	**39.83**	**8.10**	**29.52**	**8.15**	**34.85**
----		Average digestible	----	----	**33.5**	**2.8**	**23.0**	**7.7**	
	Linseed Meal, New Process.								
23473	American Linseed Co., Chicago, Ill.	*New Haven:* Abner Hendee	10.28	6.19	37.56	8.51	34.13	3.33	37.00
23530	" " " "	*Unionville:* F. D. Lawton & Son	10.10	6.33	37.31	7.94	35.15	3.17	38.00
23592	" " " "	*Willimantic:* E. A. Buck & Co.	9.93	5.71	37.38	7.85	35.81	3.32	37.00
----		Average guaranty	----	----	36.00	----	----	1.00	
----		Average of these 3 analyses	**10.10**	**6.08**	**37.42**	**8.10**	**35.03**	**3.27**	**37.33**
----		Average digestible	----	----	**31.4**	**6.0**	**28.0**	**2.9**	
	Linseed Meal, Old Process.								
23433	American Linseed Co., New York	*So. Norwalk:* Manuel T. Hatch	10.20	4.93	36.56	7.39	35.45	5.47	38.00
23480	" " " "	*Meriden:* Meriden Grain and Feed Co.	11.50	5.12	34.69	7.13	35.99	5.57	33.00
23562	Mann Bros. Co., Buffalo, N. Y.	*Groton:* Groton Grain Co.	9.02	5.03	36.63	6.02	36.30	7.00	37.00
23606	*Geo. B. Robinson, New York	*Winsted:* E. Manchester & Sons	10.54	6.34	30.75	8.27	38.91	5.19	36.00
----		Average guaranty	----	----	32.00	----	----	5.50	
----		Average of these 4 analyses	**10.31**	**5.36**	**34.66**	**7.20**	**36.66**	**5.81**	**36.00**
----		Average digestible	----	----	**30.8**	**4.1**	**28.6**	**5.2**	
	Wheat Products. *Bran from Winter Wheat.*								
23418	Pennant Rich Bran. Allen Baker Comm. Co., St. Louis, Mo.	*Guilford:* Morse & Landon	10.29	6.65	16.75	8.32	53.67	4.32	29.00
23466	Gold Bond Bran. Central Mill. Co., Lyons, Kan.	*Branford:* S. V. Osborn	10.86	6.88	17.31	8.99	51.55	4.41	28.00
23607	Chapin & Co., St. Louis, Mo.	*Winsted:* E. Manchester & Sons	10.57	6.87	19.25	7.90	50.70	4.71	27.00

* Statement of dealer.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1909—*Continued.*

Station No.	Brand.	Retail Dealer.	Analyses. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	Price per ton.
	WHEAT PRODUCTS—*Continued.*								
	Bran from Winter Wheat.								
23446	Cumberland Mills, Nashville, Tenn.	*Danbury:* F. C. Benjamin & Co.	10.18	6.40	16.00	8.14	54.16	5.12	$27.00
23590	Adrian Bran. Detroit Mill. Co., Detroit, Mich.	*Willimantic:* E. A. Buck & Co.	10.03	6.00	15.75	7.99	56.06	4.17	27.00
23437	Hecker-Jones-Jewell Mill. Co., New York	*New Canaan:* C. H. Fairty	9.80	6.13	15.37	9.25	54.92	4.53	28.00
23427	Hunter Bros. Mill. Co., St. Louis, Mo.	*Norwalk:* Holmes, Keeler & Selleck Co.	10.12	6.20	16.44	8.56	54.14	4.54	28.00
23412	Hunter, Robinson, Wenz Mill Co., St. Louis, Mo.	*Guilford:* G. F. Walter	9.71	6.85	15.69	8.89	53.91	4.95	29.00
23561	Powerful Standard Bran. A. B. McCrillis & Son, Boston, Mass.	*Mystic:* J. L. Manning & Co.	9.56	7.05	14.63	10.06	53.76	4.94	27.00
23602	Seward City Mills, Seward, Neb.	*Winsted:* Platt & Co.	10.24	7.13	14.88	8.97	54.11	4.67	30.00
23500	Southwestern Mill Co., Kansas City, Mo.	*New Britain:* C. W. Lines Co.	10.48	7.21	15.75	9.71	52.68	4.17	27.00
23612	Star and Crescent Milling Co., Chicago, Ill.	*Winsted:* F. W. Woodruff & Sons	10.19	6.43	16.50	9.35	52.28	5.25	28.00
23471	Stott's Bran. David Stott, Detroit, Mich.	*New Haven:* Abner Hendee	12.01	6.93	15.81	7.80	52.78	4.67	27.00
23584	Updike Milling Co., Omaha, Neb.	*Danielson:* Young Bros. Co.	9.90	6.68	15.31	8.79	54.93	4.39	26.00
23506	Vimco Bran. Valley City Mill Co., Grand Rapids, Mich	*Waterbury:* The Spencer Grain Co.	10.07	5.94	16.19	8.00	54.82	4.98	29.00
23527	Voigt's Bran. Voigt Milling Co., Grand Rapids, Mich	*Hartford:* Smith, Northam & Co.	10.73	5.61	15.88	6.91	56.29	4.58	29.00
----		Average of these 16 analyses	**10.30**	**6.56**	**16.09**	**8.60**	**53.80**	**4.65**	**27.88**
----		Average digestible	----	----	**12.4**	**3.3**	**38.2**	**2.9**	
	Bran from Spring Wheat.								
23419	Winona Bran. Bay State Mill. Co., Winona, Minn.	*Ansonia:* Ansonia Flour and Grain Co.	10.12	6.85	15.44	9.24	53.40	4.95	28.00
23576	Imperial Bran. Duluth Superior Mill. Co., Duluth, Minn.	*Plainfield:* A. C. Tillinghast	9.57	6.40	15.38	9.97	53.64	5.04	28.00
23580	Coarse Bran. Wm. G. Crocker, Minneapolis, Minn.	*Danielson:* Quinnebaug Grist Mill	9.93	7.05	14.81	11.07	52.24	4.90	27.00
23565	Lucky Bran. Federal Milling Co., Lockport, N. Y.	*Norwich:* Norwich Grain Co.	10.67	6.68	16.38	10.05	50.78	5.44	27.00
23595	Marshall Mill Co., Marshall, Minn.	*Colchester:* A. C. Case	8.93	7.41	15.31	10.98	52.06	5.31	28.00
23589	Seal of Minnesota Bran. New Prague Mill Co., New Prague, Minn.	*Willimantic:* E. A. Buck & Co.	9.23	7.37	15.00	10.43	52.68	5.29	26.00
23543	Northwestern Consol. Mill. Co., Minneapolis, Minn.	*Manchester:* Little & McKinney	9.29	7.05	15.50	10.25	52.44	5.47	29.00
23439	Pillsbury's Bran. Minneapolis, Minn.	*Danbury:* Keeler Grain Co.	10.05	6.65	15.75	10.39	52.22	4.94	30.00
23456	Sleepy Eye Milling Co., Sleepy Eye, Minn.	*New Haven:* R. G. Davis	11.15	5.47	16.37	7.03	55.32	4.66	28.00
23541	Fancy Bran. Geo. Tileston Mill Co., St. Cloud, Minn.	*Rockville:* Edward White	8.16	7.23	15.13	11.21	52.90	5.37	28.00
23573	Geo. Urban Milling Co., Buffalo, N. Y.	*Plainfield:* J. P. Kingsley & Son	9.53	6.86	15.44	10.79	52.53	4.85	27.00
23488	Washburn-Crosby Co., Minneapolis, Minn.	*Southington:* Southington Lumber and Feed Co.	10.24	6.40	15.13	10.38	52.47	5.38	30.00
----		Average of these 12 analyses	**9.74**	**6.78**	**15.47**	**10.15**	**52.73**	**5.13**	**28.00**
----		Average digestible	----	----	**11.9**	**4.0**	**37.4**	**3.2**	
	Bran, unclassified.								
23459	Anchor Bran. Kemper Mill and Elev. Co., Kansas City, Mo.	*New Haven:* R. G. Davis	11.10	7.20	16.87	7.82	52.56	4.45	27.00

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1909—*Continued.*

Station No.	Brand.	Retail Dealer.	Analyses. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	Price per ton.
	WHEAT PRODUCTS—*Continued.* *Middlings from Winter Wheat.*								
23621	Liberty Fancy Middlings. Allen Baker Comm. Co., St. Louis, Mo.	*Thomaston:* L. E. Blackmer	10.33	4.12	17.88	4.22	58.01	5.44	$30.00
23609	Ballard's Ship Stuff. Ballard & Ballard Co., Louisville, Ky.	*Winsted:* E. Manchester & Sons	10.75	4.86	17.75	5.36	56.57	4.71	28.00
23444	Daisy Middlings. Daisy Roller Mill, Milwaukee, Wis.	*Danbury:* F. C. Benjamin & Co.	10.03	4.67	16.37	7.77	56.20	4.96	30.00
23548	Apex Middlings. Detroit Mill. Co., Detroit, Mich.	*New London:* Arnold Rudd Co.	10.35	4.14	16.75	5.52	58.12	5.12	30.00
23426	Fancy White Middlings. Hecker-Jones-Jewell Mill. Co., New York	*Norwalk:* Holmes, Keeler & Selleck Co.	10.45	4.14	20.06	4.32	54.82	6.21	33.00
23465	"H" Middlings. Hecker-Jones-Jewell Mill. Co., New York	*Branford:* S. V. Osborn	11.15	5.40	17.12	7.49	53.57	5.27	29.00
23476	Hunter Bros. Mill Co., St. Louis, Mo.	*New Haven:* Abner Hendee	12.56	3.85	17.44	4.08	57.35	4.72	27.00
23413	Hunter, Robinson, Wenz Mill. Co., St. Louis, Mo.	*Guilford:* G. F. Walter	11.22	4.03	17.44	4.35	58.05	4.91	32.00
23587	Climax Middlings. David Stott, Detroit, Mich.	*Putnam:* Bosworth Bros.	10.89	4.04	17.31	5.58	56.65	5.53	28.40
23417	Vimco Middlings. Valley City Mill. Co., Grand Rapids, Mich.	*Guilford:* Morse & Landon	11.23	3.99	16.06	4.41	59.35	4.96	30.00
----		Average of these 10 analyses	**10.90**	**4.32**	**17.42**	**5.31**	**56.87**	**5.18**	**29.74**
----		Average digestible	----	----	**13.4**	**1.6**	**44.4**	**4.6**	
	Middlings from Spring Wheat.								
23620	Flour Middlings. Bay State Mill. Co., Winona, Minn.	*Torrington:* D. L. Talcott	11.87	3.86	18.63	4.18	56.28	5.18	31.00
23552	Snowball Middlings. Seymour Carter, Hastings, Minn.	*New London:* Beebe & Bragaw	10.76	4.52	17.81	5.62	56.54	4.75	32.00
23535	No. 8 Middlings. Chapin & Co., Milwaukee, Wis.	*Suffield:* Spencer Bros.	11.08	4.07	18.50	5.54	55.19	5.62	33.00
23579	Standard Middlings. Wm. G. Crocker, Minneapolis, Minn.	*Danielson:* Quinnebaug Grist Mill	10.28	5.30	17.69	7.57	53.90	5.26	28.00
23608	Choice Middlings. Crystal Mill. Co., Lake Crystal, Minn	*Winsted:* E. Manchester & Sons	11.38	4.82	17.19	6.73	54.68	5.20	28.00
23575	S. Middlings. Duluth Superior Mill. Co., Duluth, Minn.	*Plainfield:* A. C. Tillinghast	10.54	4.40	17.38	6.09	56.30	5.29	30.00
23596	Choice Middlings. Eagle Roller Mill Co., New Ulm, Minn.	*Colchester:* A. C. Case	9.80	5.11	17.13	8.51	53.67	5.78	28.00
23457	Ben Hur Middlings. Hennepin Mill Co., Minneapolis, Minn.	*New Haven:* R. G. Davis	11.11	4.76	17.50	6.60	54.40	5.63	27.00
23549	New Star Roller Mill Co., Wahpeton, So. Dak.	*New London:* P. Schwartz Co.	10.54	3.98	16.25	6.05	57.43	5.75	28.00
23442	Pillsbury's B Middlings, Minneapolis, Minn.	*Danbury:* Keeler Grain Co.	9.96	4.59	18.19	6.68	55.38	5.20	30.00
23491	Pillsbury's A Middlings, Minneapolis, Minn.	*Plainville:* F. B. Newton	10.54	3.81	18.69	4.70	57.03	5.23	33.00
23533	Pillsbury's Daisy Middlings, Minneapolis, Minn.	*Thompsonville:* H. K. Brainard	11.79	3.24	18.44	2.35	59.38	4.80	35.00
23619	Sleepy Eye Milling Co., Sleepy Eye, Minn.	*Torrington:* D. L. Talcott	9.82	4.98	16.75	6.72	58.90	2.83	30.00
23542	Fancy Middlings. Geo. Tileston Mill Co., St. Cloud, Minn.	*Rockville:* Edward White	10.52	3.75	17.13	4.60	58.32	5.68	30.00
23572	Geo. Urban Milling Co., Buffalo, N. Y.	*Plainfield:* J. P. Kingsley & Son	10.35	4.17	17.44	5.98	57.14	4.92	28.00
23416	Standard Middlings. Washburn-Crosby Co., Minneapolis, Minn.	*Guilford:* Morse & Landon	10.47	5.45	17.75	6.92	54.50	4.91	28.00
----		Average of these 16 analyses	**10.68**	**4.43**	**17.65**	**5.93**	**56.19**	**5.12**	**29.94**
----		Average digestible	----	----	**13.6**	**1.8**	**43.8**	**4.5**	

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1909—*Continued.*

Station No.	Brand.	Retail Dealer.	Analyses. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	Price per ton.
	WHEAT PRODUCTS—*Continued.* *Middlings, unclassified.*								
23501	*Colonial Middlings. Miner-Hilliard Mill. Co., Wilkesbarre, Pa.	*New Britain:* C. W. Lines Co.	10.27	3.29	12.56	6.10	61.08	6.70	$32.00
23604	Occidental Flour Middlings	*Winsted:* Theo. Wachter	10.01	4.51	16.50	7.60	56.09	5.29	32.00
	Mixed Feed from Winter Wheat.								
23534	Acme Feed. Acme Evans Co., Indianapolis, Ind.	*Suffield:* Spencer Bros.	11.06	5.77	18.06	7.30	53.17	4.64	31.00
23597	Cream Feed. " " " "	*Colchester:* A. C. Case	11.26	5.16	17.75	6.56	55.08	4.19	30.00
23623	Apex Fancy. Allen Baker Comm. Co., St. Louis, Mo.	*Thomaston:* L. E. Blackmer	10.64	5.88	16.00	7.47	55.91	4.10	28.00
23510	Bull's Eye. Blish Milling Co., Seymour, Ind.	*Derby:* Peterson-Hendee Co.	10.40	5.95	17.38	7.39	54.42	4.46	29.00
23495	Hope Mills. J. Andrew Cain, Versailles, Ky.	*Bristol:* W. O. Goodsell	11.87	4.82	16.75	5.84	56.97	3.75	32.00
23611	Erie. Chapin & Co., St. Louis	*Winsted:* E. Manchester & Sons	10.14	6.15	16.88	7.58	54.02	5.23	29.00
23449	Harter's. The Harter Milling Co., Toledo, O.	*Wallingford:* E. E. Hall	11.24	5.47	17.06	7.18	54.41	4.64	28.00
23422	Manhattan. Hecker-Jones-Jewell Mill. Co., New York	*Ansonia:* Ansonia Flour and Grain Co.	11.18	5.35	15.56	7.99	54.99	4.93	29.00
23593	Queen. Hecker-Jones-Jewell Mill. Co., New York	*Willimantic:* H. A. Bugbee	9.39	6.23	16.00	8.69	55.03	4.66	28.00
23447	Sunshine. Hunter Bros. Mill. Co., St. Louis, Mo.	*Bethel:* Johnston & Morrison	10.85	5.66	17.44	7.38	54.40	4.27	30.00
23524	Wildfire. Hunter, Robinson, Wenz Mill. Co., St. Louis, Mo.	*Hartford:* L. C. Daniels Grain Co.	10.62	5.78	16.50	7.21	54.98	4.91	31.00
23526	Illmo. Hunter, Robinson, Wenz Mill. Co., St. Louis, Mo.	*Hartford:* Smith, Northam & Co.	10.68	5.30	16.69	7.29	55.44	4.60	31.00
23497	Snowflake. Lawrenceburg Mill Co., Lawrenceburg, Ind.	*Bristol:* Geo. W. Eaton Est.	10.77	4.90	17.25	6.33	56.85	3.90	31.00
23564	Millbourne. Millbourne Mills, Philadelphia, Pa.	*Norwich:* Norwich Grain Co.	9.39	4.99	15.88	5.49	59.79	4.46	31.00
23616	Star and Crescent. Star and Crescent Mill. Co., Chicago, Ill.	*Torrington:* F. U. Wadhams & Son	8.89	4.97	16.38	6.03	59.61	4.12	29.00
23504	Vimco. Valley City Mill. Co., Grand Rapids, Mich.	*Waterbury:* The Spencer Grain Co.	10.62	5.37	16.00	7.27	55.79	4.95	31.00
23492	Wagoner-Gates Mill Co., Independence, Mo.	*Plainville:* Geo. W. Eaton Est.	10.41	5.74	17.00	6.98	55.37	4.50	33.00
23481	Kent. Williams Bros. Co., Kent, O.	*Meriden:* Meriden Grain and Feed Co.	11.41	5.04	16.37	6.54	56.04	4.60	31.00
		Average of these 18 analyses	**10.60**	**5.47**	**16.72**	**7.03**	**55.68**	**4.50**	**30.11**
		Average digestible	----	----	**13.0**	**4.4**	**4.29**	**3.9**	
	Mixed Feed from Spring Wheat.								
23618	Winona. Bay State Mill. Co., Winona, Minn.	*Torrington:* D. L. Talcott	11.17	6.04	17.00	9.31	51.23	5.25	29.00
23536	Vermont. Chapin & Co., Milwaukee, Wis.	*Suffield:* Spencer Bros.	10.20	4.88	17.38	6.50	55.88	5.16	31.00
23540	Rutland. " " " "	*Rockville:* Edward White	10.63	5.05	15.94	8.30	54.59	5.49	30.00
23415	Boston. Duluth Superior Mill. Co., Duluth, Minn.	*Guilford:* Morse & Landon	10.89	5.10	16.19	7.07	56.02	4.73	29.00
23626	Lucky. Federal Milling Co., Lockport, N. Y.	*New Milford:* F. R. Green	10.08	5.94	17.19	7.87	53.97	4.95	30.00
23588	Faylor's. Northwestern Elevator and Mill. Co., Toledo, O.	*Willimantic:* E. A. Buck & Co.	9.92	5.28	17.00	6.82	56.80	4.18	29.00

* See note on page 286.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1909—*Continued.*

Station No.	Brand.	Retail Dealer.	Analyses. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	Price per ton.
	WHEAT PRODUCTS—*Concluded.* *Mixed Feed from Spring Wheat.*								
23440	Fancy. Pillsbury, Minneapolis, Minn.	*Danbury:* Keeler Grain Co.	10.48	4.57	17.81	5.79	56.39	4.96	$32.00
23455	Occident. Russell Miller Mill. Co., Minneapolis, Minn.	*New Haven:* R. G. Davis	11.77	4.99	17.12	7.60	53.27	5.25	29.00
23624	Regular. Russell Flour Co., Minneapolis, Minn.	*Canaan:* Ives & Pierce	10.94	5.61	16.44	7.17	54.69	5.15	30.00
23420	Gold Mine. Sheffield King Mill. Co., Minneapolis, Minn.	*Ansonia:* Ansonia Flour and Grain Co.	9.94	5.21	17.37	6.99	55.54	4.95	30.00
23599	Superior. Washburn-Crosby Co., Minneapolis, Minn.	*Colchester:* Colchester Grain and Coal Co.	10.79	5.06	16.63	7.16	55.17	5.19	27.00
		Average of these 11 analyses	**10.62**	**5.25**	**16.92**	**7.33**	**54.86**	**5.02**	**29.64**
		Average digestible	----	----	**13.2**	**4.5**	**42.2**	**4.4**	
	Mixed Feed, unclassified.								
23518	Huron. Chapin & Co.	*E. Hartford:* G. M. White & Co.	11.37	4.85	17.38	6.05	55.29	5.06	32.00
23499	*Columbia. C. M. Cox Co., Boston, Mass.	*New Britain:* C. W. Lines Co.	10.24	5.03	15.19	7.88	56.31	5.35	31.00
23617	Newton. C. M. Cox Co., Boston, Mass.	*Torrington:* D. L. Talcott	10.07	5.31	16.75	6.60	56.61	4.66	29.00
	Red Dog Flour.								
23517	*Fancy. Meech & Stoddard, Middletown	*Middletown:* Meech & Stoddard	11.81	2.43	17.88	1.44	62.06	4.38	34.00
	MAIZE PRODUCTS. *Gluten Feed.*								
23732	Atlantic. Atlantic Starch Works, Westport	Manufacturer	5.21	1.13	32.81	1.40	58.38	1.07	30.00
		Guaranty	----	----	**28.00**	----	----	**1.00**	
		Digestible	----	----	**27.9**	**1.1**	**52.0**	**0.9**	
23411	*†Buffalo. Corn Products Refining Co., Chicago, Ill.	*Guilford:* G. F. Walter	10.47	6.18	27.00	6.38	46.17	3.80	30.00
23441	†Buffalo. Corn Products Refining Co., Chicago, Ill.	*Danbury:* Keeler Grain Co.	10.59	3.86	28.37	6.85	47.98	2.35	32.00
23467	†Buffalo. Corn Products Refining Co., Chicago, Ill.	*Branford:* S. V. Osborn	9.35	3.93	24.81	7.04	51.31	3.56	31.00
23525	†Buffalo. Corn Products Refining Co., Chicago, Ill.	*Hartford:* Smith, Northam & Co.	9.09	5.26	28.25	6.73	48.61	2.06	34.00
		Average guaranty	----	----	**23.75**	----	----	**2.50**	
		Average of these 4 analyses	**9.88**	**4.81**	**27.11**	**6.75**	**48.51**	**2.94**	**31.75**
		Average digestible	----	----	**23.0**	**5.1**	**43.2**	**2.4**	
23502	†Cream of Corn. American Maize Products Co., New York	*New Britain:* Stanley-Svea Coal and Wood Co.	9.33	1.98	29.31	6.44	50.44	2.50	32.00
23544	Cream of Corn. American Maize Products Co., New York	*Manchester:* E. W. McKuhney	7.81	2.77	26.19	8.00	51.81	3.42	32.00
		Average guaranty	----	----	**22.50**	----	----	**3.00**	
		Average of these 2 analyses	**8.57**	**2.38**	**27.75**	**7.22**	**51.12**	**2.96**	**32.00**
		Average digestible	----	----	**23.6**	**5.5**	**45.5**	**2.5**	
23556	†Crescent. Corn Products Refining Co., New York	*Westerly:* C. W. Campbell & Co.	9.44	5.12	27.63	6.75	49.55	1.51	31.40
		Guaranty	----	----	**24.00**	**8.50**	----	**2.50**	
		Digestible	----	----	**23.5**	**5.1**	**44.1**	**1.3**	

*Statement of Dealer. † Labeled "Colored."

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1909—*Continued.*

Station No.	Brand.	Retail Dealer.	Analyses. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	Price per ton.
	MAIZE PRODUCTS—*Continued.* *Gluten Feed.*								
23407	Clinton. Clinton Sugar Refining Co., Clinton, Ia.	*Bridgeport:* Standard Feed Co.	10.19	1.02	22.37	6.96	54.53	4.93	$33.00
23559	" " " " " "	*Mystic:* Mystic Grain Co.	9.81	0.87	22.88	6.35	56.75	3.34	32.00
		Average guaranty	----	----	23.00	----	----	3.00	
		Average of these 2 analyses	10.00	0.95	22.63	6.65	55.63	4.14	32.00
		Average digestible	----	----	19.2	5.1	49.5	3.4	
23424	†Globe. Corn Products Refining Co., New York and Chicago, Ill.	*Norwalk:* Holmes, Keeler, Selleck Co.	9.79	4.69	26.81	7.58	49.21	1.92	33.00
23468	†Globe. Corn Products Refining Co., New York and Chicago, Ill.	*New Haven:* Abner Hendee	9.58	3.81	27.75	7.71	47.90	3.25	32.00
23730	†Globe. Corn Products Refining Co., New York and Chicago, Ill.	*Middlefield:* A. E. Miller	9.46	2.87	27.19	7.60	50.39	2.49	31.00
		Average guaranty	----	----	24.00	----	----	2.50	
		Average of these 3 analyses	9.61	3.79	27.25	7.63	49.17	2.55	32.00
		Average digestible	----	----	23.2	5.8	43.8	2.1	
23601	*Jenks. Huron Milling Co., Harbor Beach, Mich.	*Winsted:* Platt & Coe	8.61	0.80	26.50	6.12	48.85	9.12	34.00
		Guaranty.	----	----	27.00	4.50	----	7.50	
		Digestible.	----	----	22.5	4.7	43.5	7.6	
23545	K. K. K. J. C. Hubinger Bros. Co., Keokuk, Ia.	*Manchester:* E. W. McKuhney	7.55	1.53	24.81	7.98	53.72	4.41	32.00
		Guaranty	----	----	23.00	----	----	2.30	
		Digestible	----	----	21.1	6.1	47.8	3.7	
23405	New England. J. E. Soper & Co., Boston, Mass.	*Bridgeport:* Berkshire Mills	9.00	1.00	24.94	7.39	54.16	3.51	34.00
		Guaranty	----	----	24.00	----	----	3.00	
		Digestible	----	----	21.2	5.6	48.2	2.9	
		Average guaranty of all gluten feeds	----	----	24.00	----	----	2.86	
		Average of all (16) analyses	9.08	2.93	26.73	6.70	51.23	3.33	32.02
		Average digestible	----	----	22.7	5.1	45.6	2.8	
	Hominy Feed.								
23438	Purity. American Rice and Cereal Co., Keokuk, Ia.	*Danbury:* Keeler Grain Co.	8.39	2.90	10.87	4.02	65.13	8.69	32.00
		Guaranty	----	----	10.00	----	----	7.34	
23729	‡M. F. Baringer, Philadelphia, Pa.	*Middlefield:* A. E. Miller	6.19	2.71	10.94	4.43	67.41	8.32	28.00
		Guaranty	----	----	10.00	----	----	7.00	
23409	Buffalo Cereal Co., Buffalo, N. Y.	*Stamford:* W. L. Crabb	11.75	2.47	10.37	3.68	63.87	7.86	33.00
23425	" " " " "	*Norwalk:* Holmes Keeler & Selleck Co.	11.28	2.72	10.31	4.29	62.74	8.66	33.00
23482	" " " " "	*Meriden:* Meriden Grain and Feed Co.	10.95	2.35	10.19	3.57	65.20	7.74	33.00
		Average guaranty	----	----	10.25	----	----	8.00	
		Average of these 3 analyses	11.33	2.51	10.29	3.85	63.93	8.09	33.00
23553	‡Niagara. Chapin & Co., Boston, Mass.	*New London:* E. Calkins	10.24	3.07	10.56	4.10	63.67	8.36	29.00
23574	" " " " "	*Plainfield:* J. P. Kingsley & Co.	10.86	2.65	10.81	4.34	63.73	7.61	29.00
		Average guaranty	----	----	10.00	----	----	7.00	
		Average of these 2 analyses	10.55	2.86	10.69	4.22	63.69	7.99	29.00
23490	‡Wirthmore. C. M. Cox, Boston, Mass.	*Plainville:* F. B. Newton	10.63	2.65	10.63	4.47	63.55	8.07	33.00
		Guaranty	----	----	9.00	----	----	7.00	
23577	Lenox. R. J. Hardy & Sons, Boston, Mass.	*Moosup:* T. E. Main & Son	10.51	2.59	11.00	4.34	63.31	8.25	31.00
		Guaranty	----	----	10.00	----	----	7.50	
23539	Hunter Bros. Mill Co., St. Louis, Mo.	*Rockville:* Rockville Milling Co.	10.93	3.00	10.75	6.16	60.07	9.09	32.00
23546	" " " " " " "	*So. Manchester:* Geo. W. Straut	9.42	3.14	10.50	6.85	60.91	9.18	33.00
		Average guaranty	----	----	8.50	10.00	----	7.00	
		Average of these 2 analyses	10.17	3.07	10.63	6.50	60.49	9.14	32.50

* Old stock. † Labeled "Colored." ‡ Statement of Dealer.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1909—*Continued.*

Station No.	Brand.	Retail Dealer.	Analyses. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	Price per ton.
	MAIZE PRODUCTS—*Concluded.* *Hominy Feed.*								
23472	*Husted Milling Co., Buffalo, N. Y.	*New Haven:* Abner Hendee	9.30	2.77	10.31	3.82	64.86	8.94	$33.00
		Guaranty	----	----	**10.14**	----	----	**7.02**	----
23434	Steam-Cooked. Miner-Hilliard Mill. Co., Wilkes-barre, Pa.	*So. Norwalk:* Manuel T. Hatch	9.72	2.69	10.87	3.30	64.86	8.56	33.00
23450	Steam-Cooked. Miner-Hilliard Mill. Co., Wilkes-barre, Pa.	*Wallingford:* E. E. Hall	9.67	2.81	10.94	4.51	62.99	9.08	29.00
23498	Steam-Cooked. Miner-Hilliard Mill. Co., Wilkes-barre, Pa.	*Bristol:* Geo. W. Eaton Est.	9.20	2.77	11.13	4.89	62.99	9.02	33.00
23554	Steam-Cooked. Miner-Hilliard Mill. Co., Wilkes-barre, Pa.	*Westerly:* C. W. Campbell & Co.	9.65	2.58	10.75	4.25	64.19	8.58	29.40
		Average guaranty	----	----	**10.00**	**3.00**	----	**7.50**	----
		Average of these 4 analyses	**9.56**	**2.71**	**10.92**	**4.24**	**63.76**	**8.81**	**31.10**
23460	Wm. H. Payne & Son, New York	*New Haven:* R. G. Davis	10.02	2.51	10.81	3.80	64.86	8.00	31.00
23485	" " " "	*Meriden:* August Grulich	9.91	2.63	11.06	3.82	64.22	8.36	31.00
		Average guaranty	----	----	**11.49**	----	----	**8.00**	----
		Average of these 2 analyses	**9.96**	**2.57**	**10.94**	**3.81**	**64.54**	**8.18**	**31.00**
23520	Blue Ribbon. J. E. Soper & Co., Boston, Mass.	*E. Hartford:* G. M. White & Co.	10.74	2,89	10.50	4.25	63.35	8.27	32.00
		Guaranty	----	----	**10.00**	----	----	**8.00**	----
		Average guaranty of all hominy feeds	----	----	**9.99**	----	- --	**7.47**	----
		Average of all (19) analyses	**9.97**	**2.73**	**10.70**	**4.36**	**63.78**	**8.46**	**31.42**
		Average digestible	----	----	**7.0**	**2.9**	**56.8**	**7.8**	----
23566	Star Feed. Toledo Elevator Co., Toledo, O.	*Norwich:* Chas. Slosberg	10.22	2.90	8.75	9.83	61.24	7.06	31.00
23583	" " " " " " "	*Danielson:* Young Bros. Co.	9.35	3.15	8.88	10.68	60.78	7.16	29.00
23731	" " A. B. Porter & Co., Philadelphia, Pa.	*Middlefield:* C. N. Burnham	9.64	2.97	8.75	9.93	61.68	7.03	27.00
		Average guaranty	----	----	**7.00**	**10.00**	----	**5.50**	----
		Average of these 3 analyses	**9.74**	**3.01**	**8.79**	**10.15**	**61.23**	**7.08**	**29.00**
		Average digestible	----	----	**5.7**	**6.8**	**54.5**	**6.5**	----
23443	Corn Feed Meal. Quaker Oats Co., Chicago, Ill.	*Danbury:* F. C. Benjamin & Co.	10.38	2.55	11.19	3.65	63.68	8.55	32.00
		Guaranty	----	----	**9.00**	----	----	**4.00**	----
		Digestible	----	----	**7.27**	**2.48**	**56.78**	**8.47**	----
23493	Corn Screenings	*Bristol:* W. O. Goodsell	9.83	1.37	9.56	10.09	66.23	2.92	20.00
	RYE PRODUCTS.								
23515	Rye Feed. Boutwell Mill. & Grain Co., Troy, N. Y.	*Middletown:* Meech & Stoddard	11.56	3.24	14.38	3.12	64.65	3.05	28.00
23529	Rye Feed. *H. D. Stone Mill. Co., Rochester, N. Y.	*Unionville:* F. D. Lawton & Son	11.83	3.00	14.50	2.86	64.86	2.95	32.00
23423	Rye Middlings. Miner-Hilliard Mill. Co., Wilkes-barre, Pa.	*Ansonia:* Ansonia Flour & Grain Co.	11.99	3.15	15.37	3.34	63.16	2.99	32.00
23451	Rye Middlings. Miner-Hilliard Mill. Co., Wilkes-barre, Pa.	*Wallingford:* E. E. Hall	11.92	2.97	15.31	3.52	63.34	2.94	29.00
	BUCKWHEAT PRODUCTS.								
23483	Buckwheat Feed. Dayton Milling Co., Towanda, Pa.	*Meriden:* Meriden Grain and Feed Co.	10.09	3.58	16.31	25.07	40.79	4.16	26.00
23581	Buckwheat Middlings. Quinebaug Grist Mill, Danielson	*Danielson:* Quinebaug Grist Mill	12.21	4.83	32.13	8.88	33.59	8.36	32.00

* Statement of Dealer.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1909—*Continued.*

Station No.	Brand.	Retail Dealer.	Analyses. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	Price per ton.
	BARLEY PRODUCTS. *Malt Sprouts.*								
23570	Wm. Rahr & Sons, Manitowoc, Wis.	*Yantic:* A. R. Manning	9.69	5.33	28.69	8.10	46.41	1.78	$30.00
		Guaranty	----	----	25.00	11.00	----	2.00	----
23474	Jersey. M. G. Rankin & Co., Milwaukee, Wis.	*New Haven:* Abner Hendee	10.14	5.93	25.50	12.67	44.38	1.38	25.00
		Guaranty	----	----	25.00	----	----	2.00	----
		Average of these 2 analyses	**9.91**	**5.63**	**27.10**	**10.38**	**45.40**	**1.58**	**27.50**
		Average digestible	----	----	**21.7**	**3.5**	**31.3**	**1.6**	----
	Dried Distillers' Grains.								
23523	Ajax Flakes. Ajax Mill. & Feed Co., Buffalo, N. Y.	*Hartford:* L. C. Daniels Grain Co.	5.39	3.75	29.94	9.83	38.44	12.65	34.00
23532	Ajax Flakes. Ajax Mill. & Feed Co., Buffalo, N. Y.	*Thompsonville:* H. K. Brainard	5.63	1.64	30.56	11.90	36.61	13.66	34.00
		Average guaranty	----	----	31.00	----	----	12.00	----
		Average of these 2 analyses	**5.51**	**2.70**	**30.25**	**10.86**	**37.52**	**13.16**	**34.00**
		Average digestible	----	----	**22.1**	**10.3**	**30.4**	**12.5**	----
23516	*Connecticut Gluten	*Middletown:* Meech & Stoddard	8.16	4.01	26.25	8.58	41.23	11.77	32.00
		Guaranty	----	----	30.00	----	----	15.00	----
		Digestible	----	---	**19.7**	**8.2**	**33.4**	**11.2**	----
23605	*Corn Distillers' Grains. A. B. Porter, Philadelphia, Pa.	*Winsted:* E. Manchester & Son	6.47	1.80	27.63	14.70	36.11	13.29	30.40
		Guaranty	----	----	24.00	----	----	----	----
		Digestible	----	----	**20.2**	**14.00**	**29.2**	**12.6**	----
	Dried Brewers' Grains.								
23538	Anheuser-Busch Brew. Asso., St. Louis, Mo.	*Suffield:* Arthur Sikes	9.00	3.20	26.88	14.14	39.29	7.49	30.00
		Guaranty	----	----	24.00	----	----	7.50	----
23428	Farmer's Feed Co., New York	*Norwalk:* Holmes, Keeler & Selleck Co.	7.48	3.21	28.06	11.98	41.71	7.56	28.00
		Guaranty	----	----	26.30	----	----	7.60	----
23571	Schlitz Brewing Co., Milwaukee, Wis.	*Yantic:* A. R. Manning	8.05	3.26	28.19	13.84	40.95	5.71	30.00
		Guaranty	----	----	24.50	----	----	6.50	----
		Average guaranty of all samples	----	----	24.93	----	----	7.20	----
		Average of these 3 analyses	**8.18**	**3.22**	**27.71**	**13.32**	**40.65**	**6.92**	**29.33**
		Average digestible	----	----	**22.4**	**6.5**	**23.2**	**6.1**	----
	MIXED FEEDS. *Corn and Oat Feeds and Oat Feeds.*								
23614	Corn and Oats. Buffalo Cereal Co., Buffalo, N.Y.	*Torrington:* F. U. Wadhams & Son	10.97	2.09	10.38	5.44	66.03	5.09	34.00
		Guaranty	----	----	10.00	----	----	5.00	----
23558	Provender	*Westerly:* C. W. Campbell & Co.	11.35	2.04	9.56	3.75	69.50	3.80	33.00
		Guaranty	----	----	11.00	----	----	4.00	----
23598	Oat Feed. Chas. M. Cox Co., Boston, Mass.	*Colchester:* Colchester Grain & Coal Co.	7.26	6.21	5.06	25.92	52.89	2.66	26.00
		Guaranty	----	----	6.00	----	----	2.00	----
23461	Boss Chop Feed. Great Western Cereal Co., Chicago, Ill.	*New Haven:* R. G. Davis	9.09	5.21	9.69	7.68	62.62	5.71	28.00
		Guaranty	----	----	8.00	11.00	----	3.50	----
23478	De-Fi Corn and Oat Feed. The H. O. Co., Buffalo, N. Y.	*Meriden:* A. H. Cashen	8.34	4.56	7.50	16.72	59.64	3.24	32.00
		Guaranty	----	----	8.00	21.00	---	3.00	----

* Statement of Dealer.

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1909—*Continued.*

Station No.	Brand.	Retail Dealer.	Analyses. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	Price per ton.
	MIXED FEEDS—*Continued.* *Corn and Oat Feeds and Oat Feeds.*								
23414	Jim Dandy Feed. The H. O. Co., Buffalo, N. Y.	*Guilford:* Morse & Landon	7.31	5.64	7.56	23.08	53.84	2.57	$24.00
		Guaranty	----	----	**7.50**	----	----	**2.75**	----
23625	Corn and Oats. Husted Milling Co., Buffalo, N. Y.	*New Milford:* Ackley, Hatch & Marsh	10.97	2.53	10.38	5.58	65.79	4.75	34.00
		Guaranty	----	----	**9.00**	----	----	**3.00**	----
23512	Korn-Oato. Meech & Stoddard, Middletown	*Middletown:* Meech & Stoddard	9.19	3.45	7.31	13.71	63.87	2.47	29.00
23563	* " " " "	*Groton:* Groton Grain Co.	8.51	3.61	7.06	12.86	65.67	2.29	33.00
		Guaranty	----	----	**7.00**	----	----	**3.00**	----
		Average of these 2 analyses	**8.85**	**3.53**	**7.19**	**13.28**	**64.77**	**2.38**	**31.00**
23470	Victor Feed. Quaker Oats Co., Chicago, Ill.	*New Haven:* Abner Hendee	9.83	3.67	8.75	11.63	61.01	5.11	29.00
		Guaranty	----	----	**7.50**	**12.00**	----	**3.00**	----
		Average of all Corn and Oat Feeds (10)	**9.28**	**3.90**	**8.53**	**12.44**	**62.08**	**3.77**	**30.20**
		Average digestible	----	----	**6.1**	**6.0**	**51.5**	**3.3**	----
	Wheat and Corn Cob Feeds.								
23486	Jersey Mixed Feed. Indiana Mill. Co., Terre Haute, Ind.	*Meriden:* August Grulich	9.89	4.32	11.62	15.32	56.02	2.83	25.00
		Guaranty	----	----	**10.00**	----	----	**2.50**	----
23458	Blue Grass Mixed Feed. A. Waller & Co., Henderson, Ky.	*New Haven:* R. G. Davis	10.53	4.02	11.31	14.51	56.28	3.35	25.00
23567	Blue Grass Mixed Feed. A. Waller & Co., Henderson, Ky.	*Norwich:* Chas. Slosberg	9.86	4.20	11.25	16.17	55.50	3.02	30.00
		Guaranty	----	----	**9.00**	----	----	**2.00**	----
		Average of these 2 analyses	**10.19**	**4.11**	**11.28**	**15.34**	**55.89**	**3.19**	**27.50**
		Average of all (3) Wheat and Corn Cob Feeds	**10.09**	**4.18**	**11.39**	**15.33**	**55.94**	**3.07**	**26.67**
		Average digestible	----	----	**7.2**	**4.3**	**39.7**	**2.8**	----
	Proprietary Horse Feeds.								
23550	Molac Molasses Horse Feed. American Cereal Co., Chicago, Ill.	*New London:* P. Schwartz Co.	10.09	5.73	10.88	11.69	59.24	2.37	25.00
		Guaranty	----	----	----	----	----	----	----
23521	Hexagon for Horses. American Hominy Co., New York	*Hartford:* L. C. Daniels Grain Co.	9.18	4.34	8.50	13.76	58.73	5.49	32.00
		Guaranty	----	----	**6.00**	**10.00**	----	**5.00**	----
23622	Sucrena Horse and Mule Feed. American Milling Co., Chicago, Ill.	*Thomaston:* L. E. Blackmer	10.80	6.11	9.13	8.55	62.41	3.00	29.00
		Guaranty	----	----	**10.00**	----	----	**3.50**	----
23513	"Ubiko" Horse Feed. The J. W. Biles Co., Cincinnati, O.	*Middletown:* Meech & Stoddard	8.45	3.64	20.38	9.34	51.04	7.15	34.00
		Guaranty	----	----	**16.00**	----	----	**6.00**	----
23410	Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Stamford:* W. L. Crabb	10.05	3.46	11.50	8.75	61.71	4.53	33.00
		Guaranty	----	----	**10.00**	----	----	**4.00**	----
23430	Bonnie Horse Feed	*So. Norwalk:* Manuel T. Hatch	10.34	2.83	11.44	8.45	63.39	3.55	33.00
		Guaranty	----	----	**14.12**	**5.53**	----	**4.15**	----
23475	Algrane Horse Feed. The H. O. Co., Buffalo, N. Y.	*New Haven:* Abner Hendee	10.73	4.13	11.94	10.08	59.02	4.10	34.00
		Guaranty	----	----	**12.00**	----	----	**4.50**	----
23514	Sugaroto Horse Feed. North West Mills Co., Winona, Minn.	*Middletown:* Meech & Stoddard	10.14	8.06	15.44	19.71	40.97	5.68	29.00
		Guaranty	----	----	**12.00**	----	----	**2.50**	----

* Statement of Dealer.

Table III.—Analyses of Commercial Feeds Sampled in 1909—*Continued.*

Station No.	Brand.	Retail Dealer.	Analyses. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	Price per ton.
	MIXED FEED—*Continued.* *Proprietary Dairy and Stock Feeds.*								
23615	Sucrene Dairy Feed. American Milling Co., Chicago, Ill.	*Torrington:* F. U. Wadhams & Son	9.17	8.21	16.75	10.26	50.88	4.73	$28.00
		Guaranty	----	----	**16.50**	----	----	**3.50**	
23448	Unicorn Dairy Ration. Ajax Mill and Feed Co., Buffalo, N. Y.	*Bethel:* Johnson & Morrison	8.52	3.12	26.50	8.60	45.59	7.67	33.00
23454	Unicorn Dairy Ration. Ajax Mill and Feed Co., Buffalo, N. Y.	*New Haven:* R. G. Davis	9.59	2.79	25.37	9.11	45.89	7.25	33.00
		Guaranty	----	----	**26.00**	**9.00**	----	**6.00**	
		Average of these 2 analyses	**9.05**	**2.96**	**25.94**	**8.86**	**45.73**	**7.46**	**33.00**
23487	Union Grains, Ready Ration. The J. W. Biles Co., Cincinnati, O.	*Southington:* Southington Lumber & Feed Co.	9.71	4.78	24.31	9.50	43.84	7.86	33.00
23507	Union Grains, Ready Ration. The J. W. Biles Co., Buffalo, N. Y.	*Waterbury:* D. L. Dickinson & Son	8.71	4.97	23.94	9.61	44.69	8.08	34.00
23569	Union Grains, Ready Ration. The J. W. Biles Co., Buffalo, N. Y.	*Yantic:* A. R. Manning	9.17	5.64	24.25	8.78	44.13	8.03	33.00
		Guaranty	----	----	**24.00**	**7.00**	----	**7.00**	
		Average of these 3 analyses	**9.20**	**5.13**	**24.17**	**9.30**	**44.21**	**7.99**	**33.33**
23453	Calf Meal. Blatchford's Calf Meal Fact., Waukegan, Ill.	*Wallingford:* E. E. Hall	9.91	4.82	27.75	5.92	46.40	5.20	70.00
		Guaranty	----	----	**25.00**	----	----	**5.00**	
23479	Creamery Feed. Buffalo Cereal Co, Buffalo, N. Y.	*Meriden:* Meriden Grain & Feed Co.	9.35	4.34	20.50	9.62	50.05	6.14	32.00
		Guaranty	----	----	**18.00**	----	----	**4.00**	
23613	Buf-Ce-Co. Stock Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Torrington:* F. U. Wadhams & Son	9.53	2.74	8.75	8.41	65.37	5.20	31.00
		Guaranty	----	----	**8.00**	----	----	**4.00**	
23551	Wirthmore Stock Feed. C. M. Cox Co., Boston, Mass.	*New London:* Beebee & Bragaw	7.86	4.09	10.50	8.91	61.24	7.40	32.00
		Guaranty	----	----	**9.00**	----	----	**4.00**	
23445	Daisy Dairy Feed. Great Western Cereal Co., Chicago, Ill.	*Danbury:* F. C. Benjamin & Co.	8.35	7.68	15.69	12.55	52.67	3.06	28.00
		Guaranty	----		**14.00**	----	----	**3.00**	
23408	Sterling Stock Feed. Great Western Cereal Co., Chicago, Ill.	*Stamford:* Scofield & Miller	9.57	4.82	11.25	8.00	61.12	5.24	30.00
		Guaranty	----	----	**10.00**	**9.00**	----	**4.00**	
23568	Stock Feed. W. H. Haskell, Toledo, O.	*Norwich:* Chas. Slosberg	8.47	3.03	9.94	6.02	64.38	8.16	32.00
		Guaranty	----	----	**8.00**	**6.00**	----	**4.00**	
23431	Bonnie Dairy Feed	*So. Norwalk:* Manuel T. Hatch	10.80	3.35	21.06	7.05	53.16	4.58	33.00
		Guaranty	----	----	**15.87**	----	----	**5.53**	
23489	New England Stock Feed. The H. O. Co., Buffalo, N. Y.	*Southington:* Southington Lumber & Feed Co.	10.05	4.20	8.13	14.52	57.41	5.69	34.00
		Guaranty	----	----	**9.00**	**12.00**	----	**4.00**	
23462	Badger Dairy Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*New Haven:* R. G. Davis	9.77	7.58	19.00	12.01	47.49	4.15	27.00
		Guaranty	----	----	**16.00**	**12.00**	----	**3.50**	
23537	Badger Stock Feed. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Suffield:* Arthur Sikes	10.54	6.58	13.31	14.89	51.38	3.30	32.00
		Guaranty	----	----	**10.00**	**12.00**	----	**4.00**	
23610	Electric Stock Food. Milwaukee Grains and Feed Co., Milwaukee, Wis.	*Winsted:* E. Manchester & Sons	9.78	6.78	15.31	9.55	56.20	2.38	27.00
		Guaranty	----	----	**12.00**	**10.00**	----	**2.00**	
23484	Sugarota Dairy Feed. North West Mills Co., Winona, Minn.	*Meriden:* August Grulich	9.46	8.00	16.87	18.67	42.13	4.87	28.00

TABLE III.—ANALYSES OF COMMERCIAL FEEDS SAMPLED IN 1909—*Concluded.*

Station No.	Brand.	Retail Dealer.	Analyses.						Price per ton.
			Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Fat.)	
	MIXED FEED—*Concluded.*								
	Proprietary Dairy and Stock Feeds.								
23555	Sugarota Dairy Feed. North West Mills Co., Winona, Minn.	*Westerly:* C. W. Campbell & Co.	9.21	7.94	15.00	17.82	43.29	6.74	$27.40
		Average guaranty	----	----	18.00	----	----	4.75	
		Average of these 2 analyses	9.33	7.97	15.94	18.24	42.71	5.81	27.70
23494	Quaker Molasses Dairy Feed. Quaker Oats Co., Chicago, Ill.	*Bristol:* W. O. Goodsell	8.98	6.02	16.25	12.75	53.02	2.98	28.00
		Guaranty	----	----	----	----	----	----	
23406	Schumacher's Stock Feed. Quaker Oats Co., Chicago, Ill.	*Bridgeport:* Berkshire Mills	9.42	4.15	11.50	10.96	59.15	4.82	33.00
		Guaranty	----	----	10.00	----	----	4.00	
23503	Schumacher's Calf Meal. Quaker Oats Co., Chicago, Ill.	*New Britain:* Stanley Svea Coal and Wood Co.	9.31	3.11	18.13	3.49	57.57	8.39	65.00
		Guaranty	----	----	19.00		----	8.00	
23603	Derby Stock Feed. Tioga Mill. and Elev. Co., Waverly, N. Y.	*Winsted:* Theo. Wachter	8.65	3.61	12.00	10.79	58.46	6.49	32.00
		Guaranty	----	----	10.50	13.00	----	7.00	
23508	Economy Feed. Tioga Mill. and Elev. Co., Waverly, N. Y.	*Waterbury:* D. L. Dickinson & Son	8.53	3.24	11.25	14.08	56.77	6.13	30.00
		Guaranty	----	----	10.00	----	----	5.00	
23435	Alfalfa Stock Feed. Otto Weiss, Wichita, Kans.	*New Canaan:* C. H. Fairty	10.94	5.31	12.12	11.68	57.13	2.82	34.00
		Guaranty	----	----	12.00	----	----	3.00	
	Proprietary Poultry Feeds.								
23421	Poultry Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Ansonia:* Ansonia Flour & Grain Co.	10.79	2.89	16.12	4.82	59.82	5.56	38.00
		Guaranty	----	----	15.00	----	----	4.00	
23477	Queen Poultry Mash. The Albert Dickinson Co., Chicago, Ill.	*Meriden:* A. H. Cashen	11.84	4.48	13.62	8.46	57.96	3.64	38.00
		Guaranty	----	----	10.00	----	----	3.00	
23429	G. W. Alfalfa Meal. Great Western Cereal Co., Chicago, Ill.	*Norwalk:* Holmes, Keeler & Selleck Co.	8.68	8.78	14.87	29.09	36.48	2.10	38.00
		Guaranty	----	----	14.00	----	----	2.00	
23432	Bonnie Poultry Feed	*So. Norwalk:* Manuel T. Hatch	10.35	3.65	19.06	5.45	57.01	4.48	37.00
		Guaranty	----	----	14.75	----	----	4.64	
23469	Poultry Feed. The H. O. Co., Buffalo, N. Y.	*New Haven:* Abner Hendee	11.26	3.54	17.62	5.62	57.14	4.82	36.00
		Guaranty	----	---	17.00	----	----	5.50	
23505	Dry Mash Feed. Park & Pollard Co., Boston, Mass.	*Waterbury:* The Spencer Grain Co.	9.86	13.05	19.81	6.15	47.96	3.17	45.00
		Guaranty	----	----	20.00	----	----	3.00	
23519	Growing Feed. Park & Pollard Co., Boston, Mass.	*E. Hartford:* G. M. White & Co.	12.16	3.59	14.56	3.07	62.73	3.89	44.00
		Guaranty	----	----	14.00	----	----	3.00	
23463	Lucerne Pure Ground Alfalfa. M. C. Peters Mill. Co., Omaha, Neb.	*New Haven:* R. G. Davis	10.51	10.10	15.12	26.74	35.58	1.95	39.00
		Guaranty	----	----	12.00	----	----	----	
23600	Purina Mill Feed Mash. Purina Mills, St. Louis, Mo.	*New Haven:* J. T. Benham Est.	10.35	4.87	16.31	8.69	57.50	2.28	40.00
		Guaranty	----	----	17.00	----	----	5.00	
23496	American Poultry Feed. Quaker Oats Co., Chicago, Ill.	*Bristol:* W. O. Goodsell	9.79	3.20	13.69	5.07	62.16	6.09	37.00
		Guaranty	----	----	14.50	----	----	4.50	
23585	Every Morning Mash Feed. Ross Bros. Co., Worcester	*Putnam:* F. M. Cole	9.92	8.91	19.63	10.29	45.80	5.45	40.00
		Guaranty	----	----	12.00	----	----	3.50	

Nutrients Purchasable for One Dollar.

		Protein.	Fiber and Nitrogen-free Extract.	Fat.
1.	Feeds containing over 30 per cent. protein...	16.4	22.4	3.6
2.	" " 25 to 30 " "	14.3	28.1	3.4
3.	" " 20 to 25 " "	12.6	33.1	2.0
4.	" " 15 to 20 " "	8.9	30.7	2.6
5.	" " 10 to 15 " "	5.8	36.4	3.0
6.	" " less than 10 per cent. protein	4.0	40.2	3.4

The variations in the amounts of digestible fat supplied in the different groups are comparatively small. The differences in the other two ingredients, however, are marked. Protein is by far the more expensive of these two, more than one-sixth of it being nitrogen, the element most generally lacking in our soils, most expensive to buy in fertilizers, and most necessary to "balance" the feed of our stock.

If the feeder is mainly concerned in getting protein for his grain feed, he certainly cannot afford to buy feeds of the last three groups containing less than 20 per cent. of protein. But even if he wishes to buy starchy food he can get more for the same money in group three than in four, and considering that he gets more than twice as much protein together with nearly the same amount of carbohydrates in group three as in groups five and six, the economy of buying these very low protein foods even for the starchy matter in them is more than doubtful.

PART IV.

NINTH REPORT

OF THE

STATE ENTOMOLOGIST OF CONNECTICUT

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

In the transmission of this my ninth annual report as state entomologist of Connecticut I have followed the custom of preceding years. The report covers the calendar year of 1909, except the financial statements, which are for the fiscal year ending September 30th, 1909.

Respectfully submitted,

W. E. Britton,

State Entomologist.

Report of the Receipts and Expenditures of the State Entomologist from October 1st, 1908, to September 30th, 1909.

Insect Pest Account.

Receipts.

From E. H. Jenkins, Treasurer	$3,000.00
Account of 1907, balance	779.47
Sale of duplicate pamphlet	.50
	$3,779.97

Expenditures.

For field, office and laboratory assistance	$1,740.76
Printing and illustrations	55.15
Postage	53.62
Stationery	12.15
Telegraph and telephone	1.09
Express, freight and cartage	16.36

Library	$89.13	
Laboratory, apparatus and supplies	393.15	
Office supplies	15.26	
Traveling expenses	251.44	
Balance, cash on hand	1,151.86	
		$3,779.97

Gypsy Moth Control Account.

RECEIPTS.

From E. H. Jenkins, Treasurer	$1,500.00
Account of 1908, balance	3.22
	$1,503.22

EXPENDITURES.

For salary of superintendent, and labor	$802.60	
Printing	1.60	
Tools and supplies	111.55	
Express, freight and cartage	30.61	
Traveling expenses	146.64	
Balance, cash on hand	410.22	
		$1,503.22

Memorandum:—This account of the state entomologist has been duly audited by the State Auditors of Public Accounts.

OFFICE FORCE AND FIELD ORGANIZATION.

Mr. B. H. Walden has continued as general assistant and Miss E. B. Whittlesey as stenographer, as in former years. Mr. G. H. Hollister, who has been in charge of the gypsy moth work at Stonington, on account of the success of that work in reducing the number of the insects was not needed for the whole season. After the scouting Mr. Hollister was employed by the H. L. Frost & Bartlett Company from February 1st until July 1st, when he worked at Stonington until August 20th, and then helped in the nursery inspection. On October 16th Mr. Hollister began his duties as forester of Keney Park, Hartford, where he has charge of pruning, planting, spraying and removing trees. We were, however, able to secure his services at Stonington in scouting work during the week ending December 18th. Mr. Hollister was also able to assist us at Wallingford the following week in destroying egg-masses of the gypsy moth, which had just been discovered there.

Mr. Arthur I. Bourne, A.B., a graduate of Dartmouth College, and a graduate student in entomology at the Massachuetts Agricultural College at Amherst, was employed from June 23d to November 1st, most of the time working on aphids, but helping with the nursery inspection work when needed.

LECTURES, CORRESPONDENCE AND SUMMARY OF INSPECTION WORK.

During the calendar year of 1909, twenty-two lectures have been given before granges and other agricultural meetings and scientific societies. Fifteen of these were illustrated with lantern slides. Of inspections, forty-nine nurseries have been examined, forty-eight certificates granted, and thirty orchards, gardens and greenhouses have been examined for pests; 224 boxes and packages of imported nursery stock were inspected at their points of destination and fifty-two winter nests of the brown-tail moth found and destroyed; 249 samples of insects and their work received for identification; 1,514 letters and thirty-three packages relating to the work of this office have been sent out.

EXHIBITS.

The entomological department has taken part in five exhibits during the year. During the week ending September 18th the Station had an exhibit of its work at the State Fair at Berlin. Many cases of pinned insects were shown, as well as life history sets and Riker mounts of species which are especially injurious in Connecticut. Photographs and charts were also a part of the display, but what attracted the most attention and excited the most interest was about twenty jars and cages of living insects. These included mosquitoes (both *Anopheles,* the malarial kind, and *Culex,* the non-malarial ones) and several kinds of good-sized larvæ like tobacco worms, cecropia, io and tussock caterpillars, which could be obtained at that season of the year.

Several dozen Riker mounts of insects were shown in New York City early in October in connection with the general Station exhibit at the Jewish Farmers' Fair.

Special exhibits in Riker mounts were made in connection with the entomologists of the other New England States at the New England Fruit Show, held in Boston the middle of October, and at the meetings of the Entomological Society of America, also held in Boston the last week in December.

At the meeting of the State Board of Agriculture in New Haven the second week in December, a large exhibit was made by the Station, considerable material being furnished by the entomological department.

Publications from the Entomological Department, 1909.

Eighth Report of the State Entomologist (Part XI of the Station Report for 1907-08); 86 pages, 20 text figures, xviii plates. 9,000 copies, distributed in March, 1909.

Report of Committee on Injurious Insects, W. E. Britton, Chairman, read at the annual meeting, February 3, 1909. Report of the Connecticut Pomological Society, 1909, p. 24; 4 pages.

The San José Scale. *Connecticut Farmer,* April 10, 1909.

The Peach Sawfly. Correspondence slip, illustrated, reprinted in *Connecticut Farmer,* June 26, 1909.

Spraying Potatoes. Correspondence slip, illustrated, June, 1909.

Book Review, "Our Insect Friends and Enemies," by John B. Smith, Sc.D., Professor of Entomology in Rutgers College and Entomologist of the New Jersey Agricultural Experiment Station. *Science,* Vol. XXX, p. 283, Aug. 27, 1909.

Connecticut Laws Relating to the Suppression of Insect Pests, Plant Diseases, and Contagious Diseases of Bees. September, 1909.

Canker Worms. Correspondence slip, illustrated, October, 1909.

Bulletin 165. The San José Scale and Methods of Controlling It, by W. E. Britton. 24 pages, 13 figures. 11,000 copies. November, 1909.

The San José Scale. Correspondence slip, illustrated, November, 1909.

The Cocoons on the Sassafras Tree. *Guide to Nature,* December, 1909.

Gypsy Moth at Wallingford. *Connecticut Farmer,* December 25, 1909.

Inspection of Nurseries.

This work was commenced August 30th, and was nearly all finished before November 1st. It was done by Messrs. Walden, Hollister, Bourne and Britton.

The accompanying list of nurserymen contains forty-seven names as against forty last year. One nursery was inspected in the spring and forty-eight in the fall. One of these nurseries being attached, the owner could not carry out the treatment prescribed by the state entomologist, which was necessary in order to obtain the certificate. One firm had no stock to inspect, and was dropped from the list, and nine new

firms have started in the business. Two of these were started especially for growing seedlings for forest planting, but plainly must be inspected under the law. Some of the others make a specialty of ornamental stock with a view to supplying the local trade. The condition of the nurseries was on the whole rather better than last year, as many of the nurserymen now understand how to keep their stock free from scale and are giving this feature of the business much more attention than a few years ago. The list of firms receiving certificates in 1909 follows:

List of Nursery Firms in Connecticut Receiving Certificates in 1909.

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Atwater, C. W.	Collinsville	Oct. 6,	334
Barnes Bros. Nursery Co.	Yalesville	Sept. 22,	329
Beattie, Wm. H.	New Haven	Oct. 20,	355
Bowditch, J. H.	Pomfret Center	Oct. 8,	339
Brainard, D. Wm. & C. F.	Thompsonville	Oct. 12,	344
Braley & Co., S. A.	Burnside	Nov. 1,	364
Burroughs, Thos. E.	Deep River	Oct. 18,	350
Burr & Co., C. R.	Manchester, Buckland, Durham,	Sept. 14,	328
Chapman, C. E.	North Stonington	Oct. 13,	347
Comstock & Lyon	Norwalk	Oct. 27,	360
Conine Nursery Co., The F. E.	Stratford	Oct. 7,	336
Conn. Agricultural College	Storrs	Dec. 7,	369
Conn. Agr. Experiment Station, Forest Nursery (S. N. Spring, State Forester, New Haven)	Rainbow (Windsor)	Oct. 13,	346
Conway, W. B.	New Haven	Oct. 20,	356
Dehn & Bertolf	Greenwich	Oct. 9,	342
Dwyer, John E.	Manchester	Sept. 24,	330
East Rock Park Nursery (G. X. Amrhyn, Supt.)	New Haven	Sept. 7,	325
Elm City Nursery Co.	New Haven	Sept. 11,	326
Fernwood Nursery	Stamford	Nov. 16,	367
Gardner's Nurseries	Cromwell	Oct. 27,	359
Gurney & Co., H. H.	New Canaan	Oct. 5,	332
Hale, J. H.	So. Glastonbury	Nov 23,	368
Holcomb, Irving	Granby	Oct. 2,	331
Houston & Sons, J. R.	Mansfield Depot	Nov. 15,	366
Hoyt's Sons Co., Stephen	New Canaan	Oct. 5,	333
Hubbard & Co., Paul M.	Bristol	Oct. 18,	351
Hunt & Co., W. W.	Hartford	Oct. 8,	338
Kelsey & Sons, David S.	West Hartford	Oct. 7,	337

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Keney Park Nursery (G. A. Parker, Supt.)	Hartford	Nov. 1,	365
Malone, Geo. W.	Highwood	Dec. 31,	371
Mitchell & Co.	Manchester	Oct. 22,	357
Mount Carmel Forest and Nursery Co.	Mt. Carmel	Oct. 11,	343
North-Eastern Forestry Co.	Hamden and East Haven	Oct. 8,	340
New Haven Nursery Co.	New Haven	Oct. 29,	363
Phelps, J. Wesson	Bolton	Oct. 29,	362
Pierson, A. N.	Cromwell	Sept. 14,	327
Platt Co., The Frank S.	New Haven	Oct. 27,	361
Purinton, C. O.	Hartford	Oct. 18,	352
Rosemore Nursery Co.	Litchfield (2)	Oct. 20,	354
Ryther, O. E.	Norwich	Oct. 25,	358
Schleichert, F. C.	Bridgeport	Oct. 15,	349
Schoonman, W. J.	Danielson	Dec. 17,	370
Scott, J. W.	Hartford	Oct. 12,	345
Sierman, C. H.	Hartford	Oct. 7,	335
Stannard, Mrs. E. P.	Westbrook	Oct. 13,	348
Vidbourne & Co., J.	Hartford	Oct. 9,	341
Woodruff, C. V.	Orange	Oct. 18,	353

INSPECTION OF IMPORTED NURSERY STOCK.

By W. E. Britton and B. H. Walden.

On January 10th, 1909, we received notice from Mr. George G. Atwood, Chief of the Division of Horticulture of the State Department of Agriculture, Albany, N. Y., that nests of the brown-tail moth, *Euproctis chrysorrhœa*, Linn., had been found on nursery stock brought into this country from France, and Mr. Atwood instructed us regarding the measures planned for handling such stock in New York City.

Though we are expecting each year to find the brown-tail moth in this State because of its natural spread from Massachusetts or Rhode Island, we cannot run the risk of its being brought into the State on nursery stock through lack of thorough inspection. An attempt was made, therefore, to inspect all importations so far as we could learn about them. On February 4th, Mr. Walden examined some stock at the nursery of C. R. Burr & Co., of Manchester, Conn., which had been grown by Louis Leroy, Angers, France. Some of the fruit

tree seedlings were found infested by nests of the brown-tail moth which were usually on the extreme tops of the shoots and were therefore rather conspicuous. The following notice was at once issued and sent to all nurserymen of the state:—

New Haven, February 5, 1909.

Dear Sir:—Several winter nests of the brown-tail moth *Euproctis chrysorrhoea* have just been found on nursery stock imported from France into Connecticut. The dangerously injurious nature of this pest is well known from its ravages in Massachusetts, New Hampshire and Maine, and, if possible, its further distribution and spread in this country must be prevented. I therefore request you to notify me at once of any importations received during the fall or winter and of any shipments expected this spring, so that inspection can be made. Please hold boxes until an inspector can reach your nursery before unpacking them. This is an important matter.

Very truly yours,

W. E. BRITTON,

State Entomologist.

The accompanying table shows the details of the examination of this imported stock.

In all 224 boxes and packages were examined, and the work necessitated 51 trips and the equivalent of 48 days' work for one man. Most of this inspecting was done by Mr. Walden, but Messrs. Hubbell and Britton also examined some of the stock. This work, though involving considerable time and expense which was needed for investigation, was deemed so important that it was not safe to neglect it.

Of all the stock inspected, only one lot, containing thirteen large boxes from the nursery of Louis Leroy, Angers, France, imported through the agency of H. Frank Darrow, 26 Barclay Street, New York City, was found infested. The boxes on arrival were all placed together in a barn, where they were kept for some time before being unpacked and before we knew of their arrival. Fifty-two winter nests of the brown-tail moth were found on fruit seedlings, a few on pear and quince, but most of them were on apple and dwarf apple stock. These nests contained living caterpillars. Some of the caterpillars leave their nests when in a warm place, and for this reason it was thought unsafe to allow the stock to go untreated. The nests were clipped off and destroyed, and all seedling stocks dipped root and branch in a mixture of "Scalecide," one part in 20 parts of water. Moreover, the boxes, the interior of the storage house and the packing material, were all drenched with another kind of miscible oil, "Target Brand Scale Destroyer," used in the proportions of one part to about 12 parts of water. An attempt was made to burn the sphagnum packing material, but as it was wet, it was not a satisfactory treatment, and this material was then soaked with the oil preparation.

The dipped stock was pruned root and top, and some of it grafted and planted out. Though some of it failed to grow, the percentage was no greater than with some other lots of imported nursery stock not so treated.

In caterpillar time Mr. Walden made an inspection of the trees and other vegetation growing in the vicinity of the nursery and packing houses, and another examination was made in the fall, but no evidences of infestation by the brown-tail moth were found.

Some nests were found in Port Chester, N. Y., on nursery stock from Massachusetts, which was planted out on an estate only a few rods from the Connecticut line. The case was reported to us by Mr. C. T. Hotaling of Greenwich, and we at once communicated with the New York authorities. They investigated, found several caterpillars, and burned all vegetation over quite a large area. Subsequent inspections showed no traces of the presence of the insect in that locality.

The imported nursery stock was sent to nearly every state in the Union, and in some states thousands of brown-tail nests were found. It is extremely difficult for state inspectors to get track of importations except as notified by the nurserymen purchasing the stock. When asked for notice of the arrival of such stock, the customhouse officials have, in some cases, refused to give it, remarking that they were United States officials and were not obliged to take orders from state inspectors. Much of the stock, however, arrives at the port of New York, and New York state inspectors watched carefully and notified us and the inspectors of other states on the arrival of stock consigned to our respective states. In a few cases the Bureau of Entomology of the U. S. Department of Agriculture at Washington notified us of the

arrival of stock for Connecticut from foreign countries. Undoubtedly there were a number of importations entering through the port of New York of which we received no notice, as well as many shipments entering the state through other ports. This experience and the great danger of bringing serious pests into the country emphasize strongly the need of some adequate system of Government inspection, and it is hoped that some legislation along this line may be enacted by the present Congress. Most nations have systems of inspection of similar imports at the points of entry, but there has never been any provision for the Federal inspection of such stock in this country, and the only inspection that it receives is made by state officials. Some nations would have at once issued an embargo against all nursery stock entering the country from France, or even from Europe, after receiving infested shipments; but nothing of this kind was done by our Federal government.

SOURCES OF IMPORTED NURSERY STOCK.

Country.	No. of Boxes or Bales.
Belgium	2
England	16
France	71*
Germany	93†
Holland	109
Japan	6
Unknown	9
Total	306

PROVISION FOR THE INSPECTION OF APIARIES TO SUPPRESS CONTAGIOUS DISEASES OF BEES.

A bill providing for the inspection of apiaries in Connecticut was introduced into the legislature of 1907 by the Connecticut Beekeepers' Association. Owing to the form of this bill and to the fact that the members were not united in their opinions regarding the requirements of such a law, the matter was reported unfavorably by the committee. The members of the association agitated the question, and it was suggested that the

* One shipment contained 52 nests of brown-tail moth.

† All small pine seedlings for forest planting. Only a small portion examined.

work be placed in charge of the station; a bill to that effect was therefore drawn up and introduced into the legislature of 1909. After the usual number of hearings and changes in the bill made by the committee, the following bill was passed:

An Act Concerning the Suppression of Contagious Diseases Among Bees.

Chapter 185 Public Acts of 1909.

Section 1. *Duty of state entomologist to act on complaint.* For the purpose of suppressing contagious or infectious diseases of the honey bee, it shall be the duty of the state entomologist, when complaint is duly made, to examine and verify, and treat or destroy cases of foul brood among honey bees.

Sec. 2. *Authority to appoint inspectors and to examine apiaries.* In pursuance of the provisions of this act, the state entomologist or any person whom he may appoint for that purpose shall have access at reasonable times to such apiaries or places where bees are kept and where honeycomb and appliances are stored as may be designated in any such complaint.

Sec. 3. *Authority to make regulations.* The state entomologist is authorized and empowered to prescribe suitable forms for and make regulations regarding such complaints, and shall keep the same on file and open to public inspection; and he is further authorized and empowered to make, in his discretion, reasonable rules to govern, and reasonable payments for the services of agents whom he may appoint to carry out the provisions of this act.

Sec. 4. *Obstruction illegal. Penalty.* Any person who impedes, resists or hinders the state entomologist or any agent whom he may appoint in the performance of the duties imposed by this act shall be fined not more than twenty-five dollars.

Sec. 5. *Provision for defraying expenses.* To carry out the provisions of this act the necessary expenses, to an amount not exceeding five hundred dollars, shall be paid by the comptroller on duly accredited vouchers.

Approved August 2, 1909.

This law did not go into effect until October 1st, 1909, too late to do any work this season. On October 20th the following inspectors were appointed:

H. W. Coley, Westport—Inspector for Fairfield, New Haven, Middlesex, and New London counties.

A. W. Yates, Hartford—Inspector for Litchfield, Hartford, Tolland and Windham counties.

The appropriation for the work is very small, being only $500 for two years. It will be impossible to cover the entire State on this amount of money, but a start can be made. As inspections can be made only on complaint, it is necessary to have complaint blanks filled out and signed. These can be sent to the office of the state entomologist or to the inspector named above under whose jurisdiction the locality may be.

Blanks for these complaints have been printed and two of them with a circular letter have been sent to each member of the Connecticut Beekeepers' Association. The form of the blank and a copy of the letter are given below:

Application for Apiary Inspection.

———————19

W. E. Britton, State Entomologist,
Agr. Expt. Station, New Haven, Conn.

Dear Sir:

The apiary of Mr. ——————— of ———————, Conn., is suspected of being infested with either American or European foul brood, and I therefore respectfully request that you have it examined under the authority given you by the Public Acts of 1909, Chapter 185.

Yours truly,

———————————

Address———————————

Complainant.

OFFICE OF STATE ENTOMOLOGIST.

Agricultural Experiment Station.

NEW HAVEN, CONN.

February 15, 1910.

To the Beekeepers of Connecticut:

Dear Sir:

I am mailing you in this letter some blank applications for apiary inspection. After being filled out, they can be sent either to me or to the inspector of your district named below:

H. W. Coley, Westport, Conn., inspector for Fairfield, New Haven, Middlesex and New London counties.

A. W. Yates, Hartford, Conn., inspector for Litchfield, Hartford, Tolland and Windham counties.

Each blank must be filled out in detail, if possible giving definite directions about the location of the apiary. It must also be signed. A man may sign an application for the inspection of his own apiary.

Please send to this office the names of all beekeepers in your locality, together with any other information, such as number of colonies in each apiary, for permanent filing to aid us in this work.

Very truly yours,

W. E. BRITTON,

State Entomologist.

Card records of the apiaries of the State (as far as the information can be secured) and all inspections of them will be kept on file in the office of the state entomologist and open to the public during office hours.

Beekeepers and others interested can aid by sending information regarding their apiaries or the names of other beekeepers.

MUNICIPAL SPRAYING OF ELM TREES IN CONNECTICUT IN 1909.

Serious injury to elm trees by the elm leaf beetle for the two seasons of 1907 and 1908 led us to expect in Connecticut an attack of extraordinary severity in 1909. The danger was further indicated by the drought of July and August, when usually many of the pupæ are killed by the white mold fungus which is prevalent in a moist season, and later by the unusually large number of adults which appeared in the spring.

Warning was therefore given in the last report and in the various lectures given by the state entomologist. Several towns and cities through their selectmen, directors of public works, park superintendents, and tree wardens, conferred with the state entomologist, who gave advice and in a number of cases visited the locality and examined the trees. There was quite a demand for illustrated lectures on the "Care and Protection of Shade Trees," and the state entomologist gave thirteen such lectures on this subject before granges, schools, village improvement and civic associations. At a town meeting in Clinton, May 19th, it was voted to appropriate $1,000 for spraying the elm trees, there being about 800 trees of this kind along the street and highways of the town. Several other towns raised money by taxation to care for their shade trees. In some cases the town authorities purchased spraying apparatus and hired local help to do the work, while in other towns the spraying was done by contracting firms who make a specialty of such work. Where town or city funds could not be obtained for the purpose, improvement associations raised money and hired the work done, or provided for having it done at the owner's expense where authorized to do so.

The city of New Haven let a contract to spray 7,500 elm trees in the original twelve wards, giving two sprayings at the rate of about $1.49 per tree.

The statistics collected by this office show that over 20,000 elm street trees in the State were sprayed in 1909 and at least nearly half of these were sprayed twice. No doubt there were many others of which we received no record. In addition there were also hundreds of elm trees on private grounds that were sprayed to forestall the attacks of the beetle.

The following is a list of persons and firms known to have done commercial spraying in Connecticut in 1909 and is given here merely for the convenience of those who desire to communicate with such persons and firms for estimates and bids. It should be understood that in publishing this list the station in no way endorses or guarantees the work done by these firms. Much of it, however, is known to us and must be considered satisfactory.

LIST OF FIRMS ENGAGED IN COMMERCIAL TREE SPRAYING IN CONNECTICUT IN 1909.

Allen, Geo. G.	New Haven, Conn.
Arnold, A. S.	Danbury, Conn.
Cornell, Joseph	Norwalk, Conn.
Dehn & Bertolf	Greenwich, Conn.
Frost & Bartlett Co., H. L.	Stamford, Conn.
Hazard, James O.	Westerly, R. I.
Hotaling, Chas. T.	Greenwich, Conn.
Kimball, F. L.	Norwich, Conn.
Lindeman, C. T.	R. F. D. 2, Putnam, Conn.
Mount Carmel Forest and Nursery Co.	Mount Carmel, Conn.
Munson & Whittaker Co.	Boston, Mass., and New York, N. Y.
New Haven Forestry Co.	966 Grand Ave., New Haven, Conn.
Providence Forestry Co.	840 Chapel St., New Haven, Conn.
Purinton, C. O.	Hartford, Conn.
Shattuck & Co., Frederick B.	Tremont Bldg., Boston, Mass.
Schoonman, W. J.	Danielson, Conn.
Schults & Co., W. F.	Hartford, Conn.
Sierman, Chas. H.	Hartford, Conn.
Smith, M. H.	Natick, Mass.

Stevens, Jr., F. V.	Stamford, Conn.
Taylor, James	Wallingford, Conn.
Withers, J. T.	1 Montgomery St., Jersey City, N. J.
Woundy, B. S.	New Canaan, Conn.

COMBATING THE GYPSY MOTH IN CONNECTICUT.

Stonington Infestation.

For previous accounts of the discovery of this pest and efforts to exterminate it at Stonington, the reader should consult the reports of this station (1905, p. 246; 1906, p. 235; 1907-08, pp. 300 and 772).

The scouting was done in the winter of 1908-09 by Mr. G. H. Hollister, who has had immediate charge of the work as local superintendent for three years, and Mr. Miller, a scout furnished by Mr. D. M. Rogers, special field agent in charge of the gypsy moth work for the Bureau of Entomology.

Only six egg-clusters were found.

Early in February, 1909, Mr. Hollister began work for H. L. Frost & Bartlett Co., pruning and spraying trees, and returned to the gypsy moth work at Stonington about July 1st. He was also able to help there for about a week early in May, while the trees were being banded with burlap. During the remainder of the time through May and June Mr. Fred Hoadley was in charge of the force.

As the result of our efforts during the three preceding years the infested area had been reduced so it was not considered necessary to band as many trees as heretofore. About 6,000 trees were banded and though a careful search was made only ninety-eight caterpillars were found. Considerable scouting was done during the caterpillar season, especially around the outside edges of the infested area. No caterpillars were found this season at Walnut Grove, though the trees were banded as usual and were faithfully watched.

Messrs. Dennis and Casey, government scouts, were sent to Stonington by Mr. Rogers, and in company with Mr. Hollister, they scouted the infested territory again during the second week in December. Only one egg-mass was found. The government scouts afterward examined the territory northeast of Stonington toward Westerly, R. I., but nothing was found.

The following figures show the results of our work at Stonington:

Date.	Egg-masses destroyed.	Caterpillars destroyed.	Cocoons destroyed.
1906	73	10,000	47
1907	188	2,936	200
1908	76	2,560	44
1909	6	98	0

It seems therefore that the gypsy moth is well under control at Stonington. Probably a few caterpillars will be found there the coming summer, and it will be necessary to repeat the work of banding the trees for at least two more seasons, and even after it is thought to be exterminated, the locality will require careful examinations annually for several years.

Mr. Hollister scouted for about two weeks in the northeastern part of the State and furnished the following notes:

"The following towns and villages were visited and sections looked over in search for any evidences of the gypsy and brown-tail moths: Putnam, Danielson, Plainfield, Dayville, Moosup, Sterling, East Killingly, Thompson and East Thompson.

The trees and bushes, and in some cases fences and buildings in the vicinity of the railroad stations, were looked over and also those near the garages.

The trees and bushes along the trolley road from Danielson to East Killingly were also scouted and those along the highway leading from Putnam north to the state line.

This scouting was done during the latter part of January, 1909. No evidence of either species of moths were found in the above-mentioned places."

Wallingford Infestation.

Discovery of the Gypsy Moth at Wallingford. The following clipping was taken from the Wallingford news in one of the New Haven daily papers of Monday evening, December 13th, 1909:

"Warden Becroft yesterday discovered cocoons containing eggs of what he is informed are gypsy moths. They are on maple trees on North and South Colony Streets, Meadow Street and North Whittlesey Avenue. The street department will get busy to-day with a wash of creosote, and it is requested by the warden that residents throughout the borough investigate and ascertain, if possible, if cocoons of a similar nature are to be found elsewhere. The warden claims the moths were brought here by autos passing along Colony Street."

This item was noticed by Mr. Walden, who brought it to the office the next morning and who was sent to Wallingford during the day to investigate the report. Before he could find Warden Becroft to learn the source of the report or the locality infested, Mr. Walden noticed two egg-masses on the trunks of trees on Whittlesey Avenue, and at once telephoned the news to the office, and the entomologist visited the place in the afternoon. By this time Mr. Walden had found a spot on Union Street where egg-clusters were abundant and counted nearly 300 on one tree. A large number were found on some of the maple trees along this street and on several backyard apple trees.

The presence of this pest in Wallingford was discovered by Mr. Leslie A. Brown, a designer of silverware in the factory of the R. Wallace & Sons Mfg. Co. Mr. Brown lives at 179 Christian Street, near the corner of Main, and in traveling to his work takes a diagonal route toward the factory, crossing Whittlesey Avenue, Orchard and William streets, through Meadow to Church and Colony and thence down Quinnipiac Street to the factory. It was on Meadow Street near Church where Mr. Brown noticed a cluster of eggs on the trunks of a maple tree one morning on his way to work. The next morning he saw several other egg-clusters in the vicinity and informed Mr. William E. Becroft, the warden of the borough.

Mr. Brown formerly lived in Newburyport, Mass., and moved to Wallingford in October, 1908. He had seen the gypsy moth at his old home in Waltham, Mass., and was thus able to recognize the egg-clusters when he saw them in Wallingford, though he had passed the trees a great many times without noticing them.

Mr. Becroft then looked about and saw a few egg-clusters on each of the several streets in that vicinity and noticed some not far from his own house on North Whittlesey Avenue. The worst infested spots, however, had escaped notice until discovered by Mr. Walden.

Destroying Egg-Masses. The next day (December 15th) we had men at work soaking these egg-clusters with creosote oil

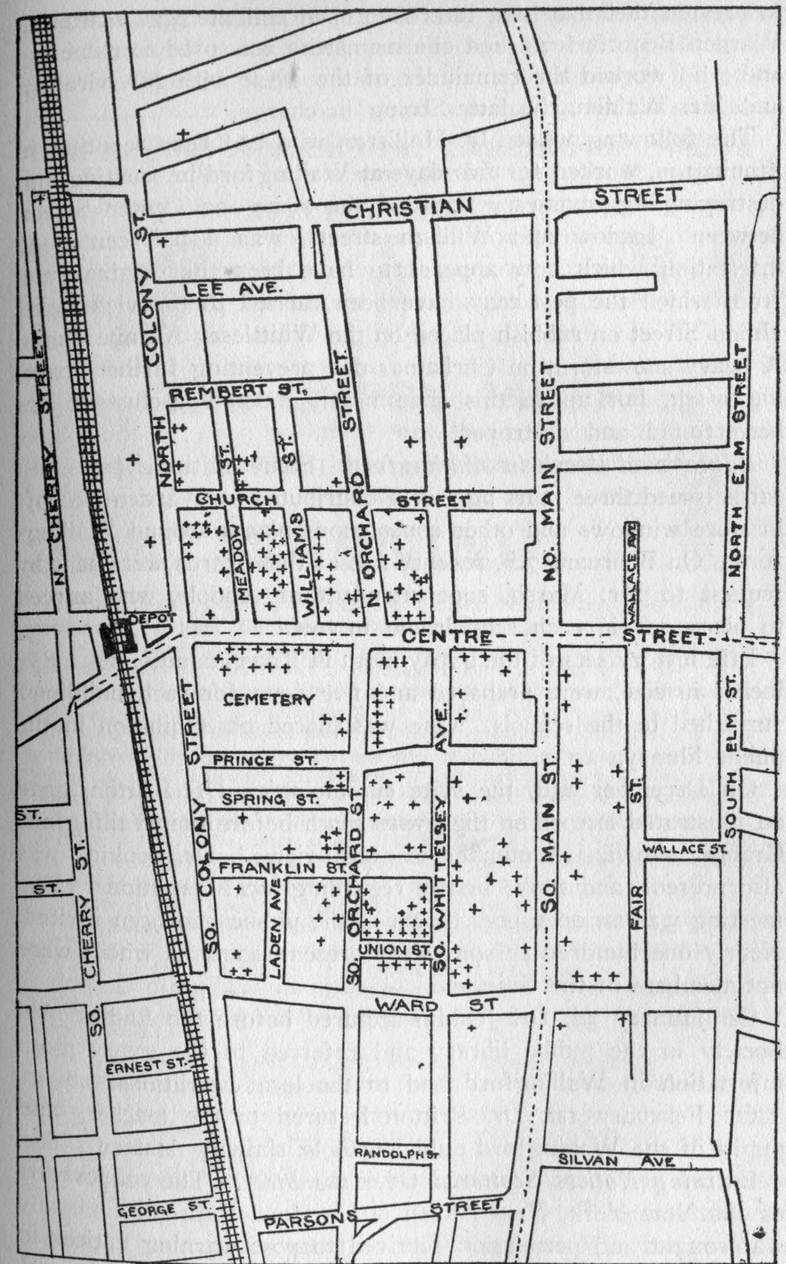


Fig. 1. Map of Wallingford, showing the region infested by the Gypsy Moth. The check marks show where egg-clusters were found during the winter of 1909-10.

to prevent their hatching if broken open and the eggs scattered. Warden Becroft furnished one man, who was used to climbing, and who worked the remainder of the week with Mr. Graham and Mr. Walden, the latter being in charge.

The following week Mr. Hollister, who had been scouting in Stonington, worked for five days at Wallingford in scouting and destroying egg-masses. Back of the stores on Center Street, between Meadow and William streets, was a bad center of infestation which now appears to have been the original one, from which the pest may have been carried to the vicinity of Union Street on rubbish placed on the Whittlesey Avenue dump. A heavy snowstorm on Christmas day preventing further scouting work, but up to this time nearly 6,000 egg-clusters had been found and destroyed.

Educational Work in Wallingford. Some of the gypsy moth cards issued three years ago were distributed by Warden Becroft in store windows and other conspicuous places around Wallingford. On February 7th, seventy-five of these cards were sent by request to Mr. Marsh, superintendent of schools, who agreed to place one in each schoolroom in town.

Life history sets of the gypsy moth in Riker mounts, 6½ x 8½ inches in size, were prepared and five (one for each building) furnished to the schools. One was placed on exhibition in the public library.

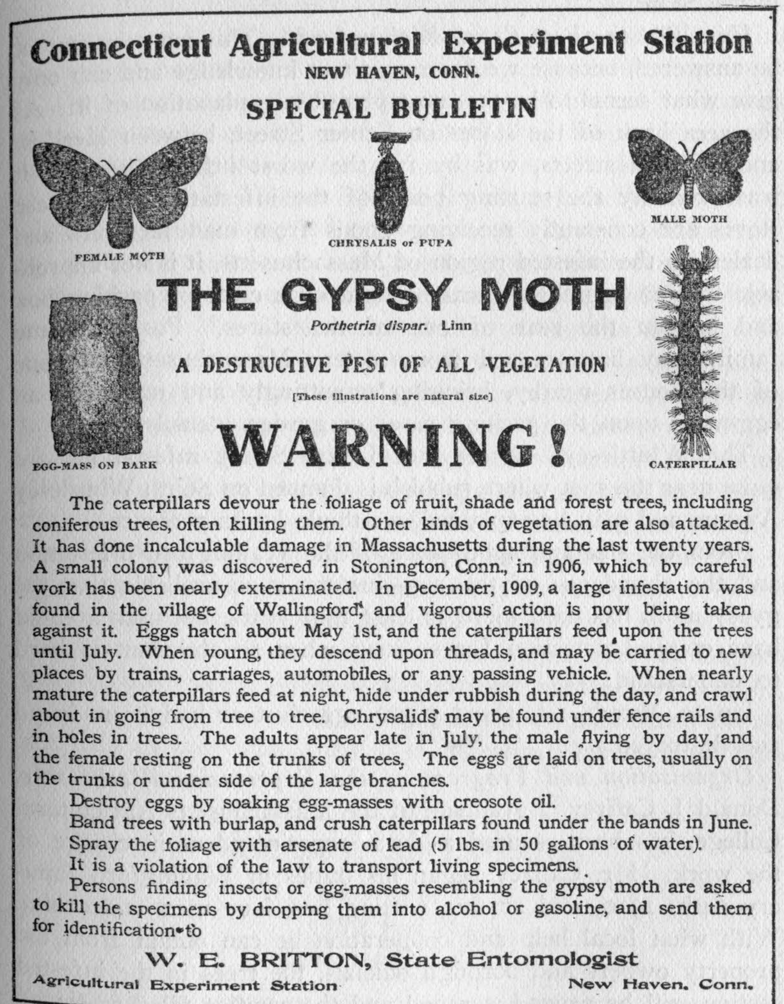
On December 23d, the state entomologist, Dr. Britton, gave an illustrated lecture on the gypsy moth before the Wallingford Grange, showing a number of local views. Dr. Jenkins was also present, and spoke briefly regarding local conditions. The meeting was an open one, to which the public had been invited. Nearly one hundred persons were present, some of whom were not members of the Grange.

On January 3d, Dr. Jenkins lectured before the Ladies' Aid Society in the public library and referred to the gypsy moth infestation in Wallingford and to the local conditions.

On February 1st, Dr. Britton lectured to the teachers and pupils of the Wallingford public schools, showing lantern slides.

Warning Notices Scattered Over the State. The coöperation of the New York, New Haven & Hartford Railroad Company was sought and permission received to post warning notices in the waiting-rooms of the railroad stations throughout the State.

A new and revised edition was printed of the cards issued three years ago and a copy was sent January 13th to each station agent of the road in Connecticut. The railroad company kindly



Connecticut Agricultural Experiment Station
NEW HAVEN, CONN.

SPECIAL BULLETIN

FEMALE MOTH

CHRYSALIS or PUPA

MALE MOTH

THE GYPSY MOTH

Porthetria dispar. Linn

A DESTRUCTIVE PEST OF ALL VEGETATION

[These illustrations are natural size]

EGG-MASS ON BARK

WARNING!

CATERPILLAR

The caterpillars devour the foliage of fruit, shade and forest trees, including coniferous trees, often killing them. Other kinds of vegetation are also attacked. It has done incalculable damage in Massachusetts during the last twenty years. A small colony was discovered in Stonington, Conn., in 1906, which by careful work has been nearly exterminated. In December, 1909, a large infestation was found in the village of Wallingford, and vigorous action is now being taken against it. Eggs hatch about May 1st, and the caterpillars feed upon the trees until July. When young, they descend upon threads, and may be carried to new places by trains, carriages, automobiles, or any passing vehicle. When nearly mature the caterpillars feed at night, hide under rubbish during the day, and crawl about in going from tree to tree. Chrysalids may be found under fence rails and in holes in trees. The adults appear late in July, the male flying by day, and the female resting on the trunks of trees. The eggs are laid on trees, usually on the trunks or under side of the large branches.

Destroy eggs by soaking egg-masses with creosote oil.

Band trees with burlap, and crush caterpillars found under the bands in June.

Spray the foliage with arsenate of lead (5 lbs. in 50 gallons of water).

It is a violation of the law to transport living specimens.

Persons finding insects or egg-masses resembling the gypsy moth are asked to kill the specimens by dropping them into alcohol or gasoline, and send them for identification to

W. E. BRITTON, State Entomologist

Agricultural Experiment Station New Haven, Conn.

Fig. 2. Facsimile of warning notice posted throughout the State.

furnished a list of the addresses of the station agents, and also issued orders to them that the cards be posted in the stations. Similar arrangements were made by the Central Vermont Railroad Company, and cards have now been posted in all railroad stations in Connecticut. Cards were also mailed to all postmasters in the State, with a request that each card be put in a conspicuous place, and to the secretaries of all granges in the State.

How Did the Pest Reach Wallingford? This question cannot be answered, because we have no direct knowledge and can only give what seems to be the most plausible explanation of it. As the area back of the stores on Center Street, between Meadow and William streets, was by far the worst infested section, it was probably the starting point of the infestation. As these stores are constantly receiving goods from manufacturers and dealers in the infested region of Massachusetts, it is not improbable that an egg-cluster was brought on a crate or packing box and left in the rear of one of the stores. Possibly some family may have moved from eastern Massachusetts into one of the houses nearby, bringing unwittingly and unnoticed an egg-mass upon the packing cases or garden utensils.

The Whittlesey Avenue and Union Street infestations are quite near the spot where rubbish is dumped on South Whittlesey Avenue and may be explained, we think, by its presence.

From the size and appearance of the Wallingford infestation and the abundance of the egg-clusters, it is probable that the gypsy moth has been there at least four years, but how it could have escaped detection for so long when so abundant is hard to understand.

Up to March 1st, about 7,500 egg-clusters had been found and destroyed.

Organization and Progress of the Suppression Work. Mr. Donald J. Caffrey, a graduate of the Massachusetts Agricultural College, has been secured as local superintendent in charge of the work. Mr. Caffrey began his duties in Wallingford January 24th, 1910, and at this writing has four men under him. With what local help and coöperation he can obtain from the property owners and borough officials, the trees in the infested section will be pruned, scraped and the cavities filled or tinned over, and some of the fences, outhouses and chicken coops overhauled before the eggs hatch May 1st. In order to do effective work it will be necessary to spray most or all of the trees, shrubs and hedges in this section after the leaves appear. For this purpose a mixture of lead arsenate will be used. The spruce

hedge around the cemetery is infested and will need to be thoroughly treated with lead arsenate and tree tanglefoot. All trees within this infested area will be banded with burlap next season, and in order to care for the work in a proper and effective manner, men must be kept at work until the middle of August or first of September.

The illustrations accompanying this report, Plates II-XI, show much better than any verbal description, the conditions of the infested region.

Mr. Dexter M. Rogers, special field agent of the Bureau of Entomology, in charge of gypsy moth work, with headquarters at Boston, was informed of this newly-discovered infestation, and visited it on December 20th, in company with Drs. Jenkins and Britton. Mr. Rogers expressed a willingness to coöperate in the suppression work, and we requested him to send scouts to help us examine the region around the village. On February 9th he brought three men, who are now at work.

It is too early to make any definite statements regarding the limits of the infestation, but no egg-clusters have been found outside of the village and nearly all of those destroyed were found between the railroad and Main Street and between Ward Street on the south and Christian Street on the north. Several egg-clusters were found east of Main Street near Ward.

Every effort will be made to exterminate the Wallingford gypsy moth colony. This is the farthest west of any existing infestation and if it is not suppressed will be a constant menace not only to the whole State of Connecticut but to New York and New Jersey as well.

THE ROSY APPLE APHIS.

Aphis sorbi Kalt.
Aphis pyri Boyer.
Aphis malifoliæ Fitch.

Though the season of 1909 was especially an aphid year and nearly all kinds of plant lice were abundant, the kind that probably caused more damage than any other is a pinkish or purplish species found on the fruit spurs of apple trees and called the rosy apple aphis. This species has of course been present in Connecticut for a long time, though there are few records. I have observed it in a number of different localities during the past sixteen years; but apparently it did little damage and scant attention was paid to it. In 1908, however, it was brought to my attention in the orchard of Mr. E. M. Ives of Meriden, and it was chiefly there that these studies were made, some of the work being done by Mr. Arthur I. Bourne between June 24th, when he entered the employ of this office, and November 18th.

During 1909 it was much more serious than in the preceding year and caused great damage to apples—not only to the season's crop of fruit but to the trees as well.

Specimens were received from Putnam, Manchester, Wallingford, West Haven and Stratford, and the insect was observed at several other places.

Difference Between the Green and Rosy Apple Aphids.

The most troublesome plant lice on apple in Connecticut are the green apple aphis, *A. pomi* De Geer, and the rosy apple aphis, the identity of which seems not to have been well established. For instance, we find accounts of apparently the same insect as *Aphis sorbi* Kalt., as *Aphis pyri* Boyer., and as *Aphis malifoliæ* Fitch. The green apple aphis was described briefly and figured in the report of this station for 1903, page 259. It attacks the terminal shoots and tender leaves, causing the leaves to curl. It affects the tree chiefly by restricting the growth and is much more serious on young orchard trees and nursery stock than upon old trees. All stages are bright green except the oval egg, which is green when first laid but soon turns to a shining black. Eggs are laid on the terminal twigs late in the season and are conspicuous and often abundant. The rosy apple aphis is pink or purplish in color and seems especially prone to attack the fruit spurs and the inner portions of the tree top rather than the terminal twigs and exterior part. The eggs are smaller and much less conspicuous than those of the green apple aphis, and one often needs to hunt carefully in order to find them at all, as they are hidden around the buds, sometimes partly under the scales.

The attacks of the rosy apple aphis affects seriously the fruit and prevents its growth and development, causes it to be gnarled and irregular in shape. The leaves curl early and often turn yellow and fall late in June if badly infested.

The green apple aphis remains on the apple leaves and shoots throughout the season, but the rosy apple aphis leaves the apple and goes to some other unknown plant host—during the latter part of June—returning to the apple in October and later laying eggs to carry the species through the winter.

Life History.

The eggs of the rosy apple aphis hatch about the middle of April just as the green leaves begin to show at the ends of the buds. On April 16th, in Mr. Ives's orchard at Meriden, the aphids were hatching and the buds had opened just enough to show the green tissue. Many newly-hatched aphids could be seen on the opening buds, though many eggs were still unhatched.

These aphids were abundant through blossoming time and were thick on the young fruit. During the latter part of June, or about the first of July, they disappeared entirely from the trees and did not return again until October.

On November 12th, 1909, the aphids were laying eggs, though but a few could be found.

Description.

The following description and measurements were made by Mr. Bourne:

1st Stage. Color is an almost transparent white when just born, rapidly changing to a cream white as they begin to feed. Eyes are very conspicuous—deep red. Body nearly oval. Posterior end of abdomen bluntly pointed. Antennæ almost equaling length of body, 5-jointed; 3d and 5th joints much the longest. Joints 1 and 2 hardly longer than wide. Antennæ remote at base, no frontal tubercles. Head, broad, flat in front between bases of antennæ. No noticeable lines of division into the three body regions. Legs, long in proportion to size of body. Tarsi and joints of tibiæ, dusky. Beak, long, slender, reaching beyond the 3d coxæ. Cornicles, short, scarcely more than tubercles, not longer than 1st segment of abdomen. Wider at base than tips. Cut off square at ends. Straight. No cauda noticeable in this stage.

2d Stage. Almost twice as large as 1st stage. Color, a deeper yellow. Eyes very deep red. Much more developed than in preceding stage. Body, very convex, almost oval. Head, flat in front. No constriction back of eyes. A very short tubercle, hardly more than a ridge, on each margin of prothorax just back of eyes. Antennæ, 6-jointed. Outer joint the longest and dusky. Do not reach quite to base of cornicles. Tarsi and joints of tibiæ and last joint of beak, dusky. Cornicles equal in length two segments of abdomen. Straight, somewhat tapering and tips flaring a little and quite dark. Legs are not so large in proportion to size of body as in 1st stage. Tibiæ are distinctly hairy, especially toward tip.

3d Stage. (Form that will be wingless.)

Color, brick red. More noticeable along dorsal portion of head, thorax and margin of abdomen. Body, much more convex and considerably larger than preceding stage. Tips of antennæ, joints of tibiæ, whole of tarsi, tips of cornicles and of rostrum, a dusky color. Antennæ, 7-jointed, reaching back beyond the base of cornicles; 3d and 7th joints nearly the same length. Head, narrowed slightly in front, back of eyes broadens considerably. Eyes dark red, almost black, with a prominent ocular tubercle and prominent tubercles on prothorax. Each segment of abdomen with a tubercle on margins. Cornicles, of medium length, straight, tapering slightly, quite slender, ends flaring. Dorsal portion of abdomen, a faint greenish yellow. Can begin to distinguish the embryos forming within. Legs of medium length, with distal ends of tibiæ covered with long bristly hairs, as is the very tip of abdomen. Beak, quite long and slender, reaching a little beyond 3d coxæ.

3d Stage. (Winged form.)

Body, some longer and of about same width as other form. The color is paler somewhat than in wingless form. More of a yellowish tinge, especially near dorsal portion of abdomen. Tips of antennæ, cornicles, tibiæ and beak and whole of tarsi, dusky. Eyes, dark red, as in other form. Antennæ, 7-jointed, not quite reaching base of cornicles. Legs, only moderately long. Cornicles, rather short and thick. Slightly tapering. Ends cut off square on 2d segment of abdomen in front of cauda. Two short blunt tubercles, and on the last two segments of thorax are a pair of wing pads, giving the appearance of shoulders to the insect. Ocular tubercle very prominent. Short blunt tubercle on each segment of abdomen on margins. Beak, slender, reaching to posterior coxæ.

4th Stage. (Winged.) Brick red, most pronounced on head and thorax. End of abdomen, wing cases, antennæ, legs and beak, yellowish. Tips of antennæ and beak, cornicles and tarsi, dusky. Body is somewhat covered with a powdery substance. Is more elongated than oval. Cornicles, straight, wider at base than tips. Tips flaring. Not reaching to the end of the abdomen. Cauda, none or inconspicuous. Abdomen, tipped with a few long hairs. Antennæ, reaching but little beyond middle of abdomen. Eyes, very dark red. Ocular tubercles present, not as prominent as in wingless form. Head constricted somewhat just behind the eyes. Prothorax with two prominent lateral tubercles. Two pairs of wing cases very prominent. Front pair much longer than hind pair. On abdomen, the two segments from end each bear a pair of tubercles. The outer pair small, set nearer together. Tips, dark. Short. A tubercle on each segment of abdomen on outer margin. Embryos can be plainly seen through the dorsal portion of abdomen. Beak, slender, reaches almost to posterior coxæ.

4th Stage. (Wingless.)

Color, same as in winged form. Brick red on head, thorax and margin of abdomen. On dorsal portion of abdomen color is changed from red to orange and yellow, and the embryos can be seen within. Antennæ, tibiæ, cornicles and beak with thin tips, dusky. Cauda, inconspicuous. Two pairs of tubercles on segment before tip of abdomen, as in other forms of the same stage. Each segment of abdomen with a short tubercle on each margin. Abdomen, very convex, almost as broad as long. Prothorax, with two prominent tubercles. Tibiæ, distinctly hairy. Head, narrower in front than back of antennæ. Eyes, very dark red. Ocular tubercle, prominent. Beak, only moderately long, not reaching much beyond 2d coxæ. Antennæ, almost reaching to bases of cornicles, 7th joint longest. Considerably smaller than adult and not nearly so convex even in proportion to length. Body, sometimes covered over with powdery substance.

Adult. (Wingless.)

Color, head, thorax and margin of abdomen dark reddish brown. Quite dark and usually covered with a powdery substance which gives the insect a deep blue color. Along the top

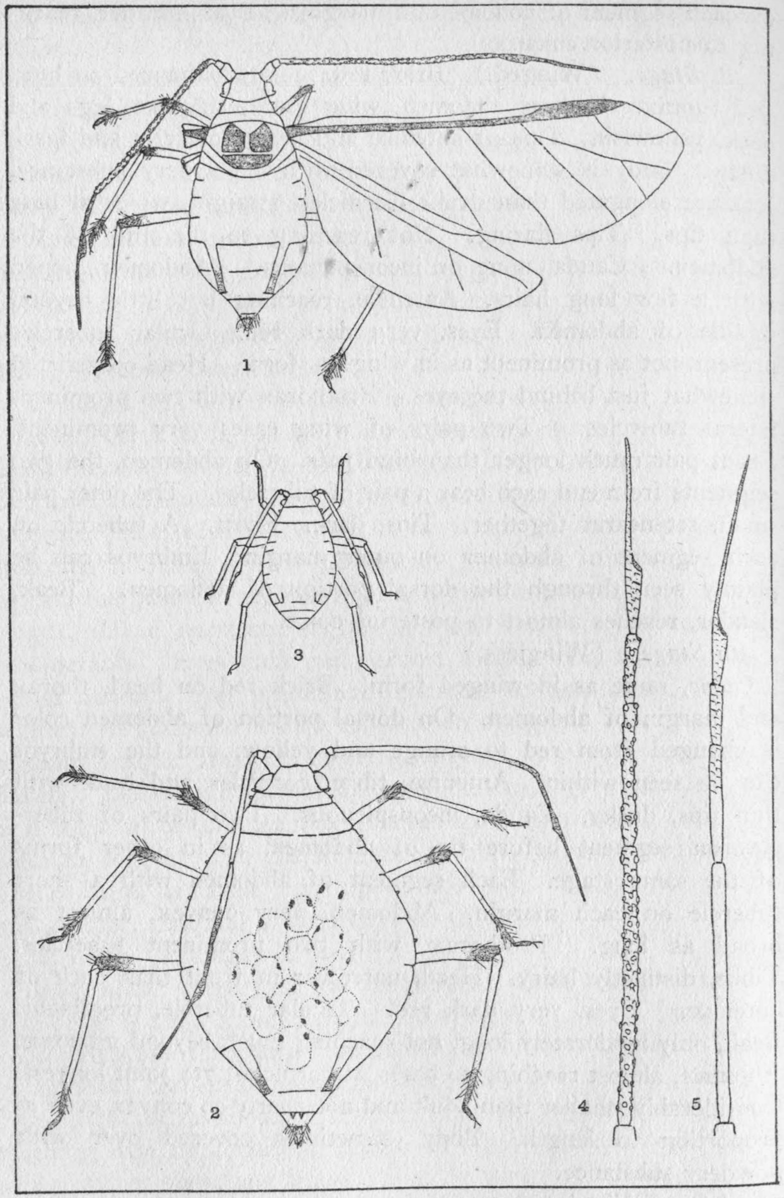


Fig. 3. Rosy Apple Aphis. 1, winged viviparous female; 2, apterous viviparous female; 3, young nymph; 4, antenna of winged viviparous female; 5, antenna of apterous viviparous female. All greatly enlarged.

of abdomen the color fades to a lighter yellow and the embryos within give a greenish tinge to the abdomen. Legs, white, except tips of tarsi and tibiæ, which are dusky. Beak tipped with black. Cornicles, pale greenish yellow tipped with black. Antennæ, almost transparent, except tips, which are dusky. Eyes, reddish black. Head, narrow in proportion to rest of body. Antennæ set wide apart and fixed directly to the head. A short tubercle midway between bases of antennæ in front. Ocelli present. Ocular tubercles, not very conspicuous. Antennæ, 7-jointed. 3d longer than other joints. Reaches a little over half the length of the abdomen to bases of cornicles. Beak, slender, reaching halfway between middle and posterior coxæ. Prothorax, with two prominent tubercles. On other segments there are a pair of blunt tubercles, hardly more than ridges, the 2d pair being the more prominent. Legs, long and to some extent hairy. Abdomen, with short blunt tubercles on outer margins of each segment. Along the dorsal portion the eyes of the embryos within are very conspicuous. Cornicles, moderately long, tapering slightly. Ends flaring, do not reach quite to end of body. Cauda, small, not very conspicuous. Hairy. On the two segments in front of cauda are two pairs of small tubercles, the pair next to cauda being the smaller and closer together.

Adult. (Winged.)

Head, dull black. Eyes, black. Ocular tubercles prominent. Antennæ dusky, except very tips, which are almost transparent. Seven joints; 1st and 2d short and thick; 3d and 4th very thickly set with sensoria. No frontal tubercles. Reach almost the length of body. Beak, rather short, not quite reaching middle coxæ. Thorax, 1st segment, yellowish red with prominent lateral tubercles. Meso and meta thorax, dusky, almost black. Bases of wings a somewhat lighter shade. Legs, distinctly hairy, moderately long. Outer tips of femora, tibiæ and whole of tarsi, dusky. Abdomen, yellowish, almost orange. Lighter along dorsal portion than on margins. Embryos plainly seen. Give a faint greenish tinge to the dorsal portion of abdomen. The margins of each segment with a short blunt tubercle. Cauda, short, not prominent. Tipped with black. Two pairs of tubercles on two segments just in front of cauda, the posterior tubercles being smaller and nearer together. Cornicles, moderately long, tapering somewhat, with their ends flaring. Wings

TABLE I.—ROSY APPLE APHIS. MEASUREMENTS.

Stage.	Body. Length.	Body. Breadth.	Corni-cles.	Antennæ. Total.	Antennæ. 3d joint.	Antennæ. 4th joint.	Antennæ. 5th joint.	Antennæ. 6th joint.	Antennæ. 7th joint.	Tibiæ. 1st joint.	Tibiæ. 2d joint.	Tibiæ. 3d joint.
1st	.968mm	.54 mm	.09 mm	.66 mm	.23 mm	.07 mm	.25 mm	------	------	.268 mm	.306 mm	.36 mm
2d	1.36 "	.738 "	.144 "	.81 "	.23 "	.108 "	.07 "	.27 mm	------	.324 "	.342 "	.432 "
3d (wingless)	1.7 "	1.00 "	.216 "	1.38 "	.324 "	.234 "	.18 "	.108 "	.378 mm	.358 "	.376 "	.756 "
3d (winged)	1.72 "	1.02 "	.216 "	1.17 "	.216 "	.196 "	.104 "	.09 "	.378 "	.432 "	.45 "	.63 "
4th (wingless)	2.07 "	1.18 "	.288 "	1.4 "	.396 "	.27 "	.162 "	.108 "	.432 "	.612 "	.648 "	.811 "
4th (winged)	2.28 "	1.2 "	.36 "	1.5 "	.396 "	.288 "	.180 "	.108 "	.45 "	.63 "	.684 "	.9 "
Adult (wingless)	2.73 "	1.45 "	.36 "	1.78 "	.486 "	.342 "	.198 "	.108 "	.474 "	.738 "	.774 "	1.008 "
Adult (winged)	2.5 "	1.08 "	.33 "	2.37 "	.702 "	.45 "	.27 "	.108 "	.630 "	1.06 "	.974 "	1.27 "

Adult (winged)—Wing expanse 5.4mm.

with 3d discoidal vein having first branch arising at point about half its length; 2d branch nearer apex of wing than base of vein. Stigma quite long, narrow, and pointed sharply at outer end.

PARASITES OF ROSY APPLE APHIS.

The rosy apple aphis was highly parasitized in Connecticut in 1909. The illustration on Plate XIII, b, shows the appearance of the parasitized individuals on a single leaf. They were very much swollen and brown in color. The most important parasite of the rosy apple aphis in Connecticut in 1909 proved to be *Megorismus fletcheri* Cwfd.

Sanderson bred *Lysiphlebus cucurbitaphidis* Ashm. and *L. myzi* Ashm. from parasitized individuals of this aphis in Delaware* and mentions the predaceous insects *Chilocorus bivulnerus* Muls., *Prionidus cristatus* Linn and *Leucospis nigricornis* Egger as feeding upon it.

OTHER HOST PLANT STILL UNKNOWN.

Mr. Bourne spent considerable time searching the wild and cultivated plants of the fields and roadsides during the summer to ascertain the other host-plant of the rosy apple aphis, which had almost entirely disappeared from the apple trees by the middle of July. Several times Mr. Bourne examined all common shrubs, weeds and grasses growing in the vicinity of the orchard, particularly in the direction of the prevailing winds, but could not obtain even a trace of the intermediate host-plant of the aphid.

REMEDIAL TREATMENT.

On April 16th, three apple trees at Mr. Ives's were sprayed with Rex lime and sulphur wash, two with a dilution of one part to nine parts of water and the other at the rate of one to twelve. At the time of this treatment the eggs were hatching and many young aphids could be seen on the opening buds. There were, however, plenty of unhatched eggs.

Nearby trees which Mr. Ives had sprayed with a mixture sold as Cooper's V_1, one part to 100 parts of water, showed hatched aphids.

The practical value of these tests was not demonstrated, probably on account of the few trees treated and the nearness of

* 12th Rept. Del. Agr. Expt. Sta., 1900, p. 190.

the untreated trees. Even if the eggs had all been killed, which was hardly possible, reinfection from adjacent trees would be extremely easy.

Gilette states* that lime and sulphur mixtures are among the substances most effective in destroying eggs of the green apple aphis in Colorado, and Hodgkiss reached similar results with his tests on eggs of various species of aphids in New York.†

Tests were made with kerosene emulsion in different dilutions late in June to determine the proper strength to use. The emulsion standard was prepared after the formula printed on the spray calendar and is as follows:

Kerosene Emulsion.

2 gals. kerosene.
½ lb. common soap.
1 gal. water.

Dissolve the soap in hot water, add the kerosene, and churn together until a white creamy mass is formed which thickens on cooling.

Used this emulsion June 29th at the rate of one part to six parts of water and of one part to nine parts of water. Into the diluted emulsion were dipped typical infested branches. Fourteen trees scattered throughout the orchard were included in this test and both trees and their dipped branches were marked.

The dilute emulsion killed the aphids quickly when brought in direct contact with them. This could be done by dipping the branches, but would not be accomplished so successfully by spraying on account of the curled leaves.

As the winter eggs are so scarce and as the aphids multiply with such rapidity during May and June, it is a question whether any treatment aimed at the destruction of the eggs will prove wholly successful in an aphid season. We expect to make further tests in 1910 to determine this point.

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* Bull. 133, Col. Agr. Expt. Station, p. 27, 1908.
† Bur. Ent. Bull. 67, p. 29, 1907.

THE BUD MOTH.

Tmetocera ocellana Schiff.

For two or three seasons apple trees in certain portions of Connecticut have been seriously injured by a small lepidopterous larva that feeds upon the opening leaves, often curling them and fastening them together. In Stonington, especially, this injury was important and of a serious nature. It was observed in New Haven, Meriden, and in many other places, but in no place was the apparent damage as great as in Stonington.

The insect causing this trouble was not known at first, but was supposed to be the apple leaf-folder *Ancylus nubeculana* Clem., and the injury was mentioned in a brief note in the last report.* Felt records *A. nubeculana*† as being unusually common and causing some injury in New York State in 1907.

From pupæ reared from the curled leaves in 1909 a few small moths emerged and it proved to be the bud moth *Tmetocera ocellana* Schiff., a well-known apple pest.

The appearance of the opening leaves attacked by the bud moth is shown on Plate XIV, and the caterpillar is also shown considerably enlarged. The apple crop is often ruined because these caterpillars attack the cluster buds and eat out the undeveloped flowers where later the fruit sets. The insect also attacks nearly all other kinds of fruit trees, and feeds upon their buds.

ORIGIN, DISTRIBUTION AND PAST RECORD.

The bud-moth was long known in Europe before it was discovered in this country and probably is a European species. In 1840 it caused considerable damage in Europe and in the following year it was first observed in this country in Massachusetts, where by 1869 it had assumed the importance of an apple pest second only to the canker worm. Records show the occurrence of the insect in Pennsylvania in 1870, New York in 1880, and Nova Scotia in 1885.

Considerable damage is recorded at Rochester, N. Y., in 1887, and in Maine in 1888 and 1890. It was exceedingly injurious

* Report of this station for 1907-1908, p. 847.
† Report, New York State Entomologist for 1907, p. 28.

throughout the northeastern states in 1891 and in Michigan in 1892. The species is now found in Oregon and Idaho, and throughout the northeastern and middle Atlantic states and as far south as Washington, D. C.

General Appearance.

Caterpillar.

In June when the caterpillars are full-grown they are nearly half an inch long and a light chestnut brown color, with head, legs and thoracic shields dark brown or black, smooth and shiny. The body is furnished with five pairs of pro-legs and each segment bears several rather long light-colored hairs.

Chrysalis.

This stage follows the caterpillar stage and is the period of greatest change, though quiescent. The mature caterpillar makes a nest in a tube of dead leaves and there transforms to the chysalis or pupa, which is slightly more than a quarter of an inch in length and of a light-brown color.

Moth.

The adult is a small moth having a wing-spread of about five-eighths of an inch, with general color of dark ash-grey, with

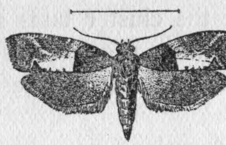

Fig. 4. The Bud Moth. Twice natural size.

broad yellowish cross bands on the front wings and is shown in Figure 4.

Egg.

The egg is disc-like, much flattened, sometimes nearly circular, though usually oval in shape, and is laid upon the underside of a leaf, singly or in small clusters. The eggs are transparent and resemble minute drops of water.

Life History.

In the northern part of its range and probably in Connecticut there is but one brood each season and the insect passes the winter as a half-grown caterpillar hidden in a silken case attached to the twigs. These cases are made early in the fall, sometimes

even in August, though many of the caterpillars continue to feed until October. In the spring the caterpillars appear at the time the buds open, varying with the forwardness of the season, from April 15th to May 15th, and feed on the tender leaves and buds as described above. The leaves are tied together, forming a nest in which the caterpillar lives and feeds. Thus not only are the leaves devoured but the floral organs before developing also are destroyed, thus preventing the tree from fruiting. After feeding for six or seven weeks the caterpillar forms its cocoon and remains in it for about ten days, when the adult moth emerges. Reared specimens emerged in our breeding cages June 10th, and on this date nearly all caterpillars had disappeared. The adults probably live about two or three weeks, during which time they mate and lay eggs for the succeeding generation.

Remedies.

Most writers regard the bud moth as a difficult insect to control and state that the various sprays are unsatisfactory. Our experience at Stonington, however, where many apple trees infested with the bud moth were sprayed with lead arsenate, 1 pound to 10 gallons of water, in the attempt to control the gypsy moth, indicate that this poison will also control the bud moth. Of course the application should be made early—before the blossoms open, and should be repeated after they have fallen. Slingerland advises* two thorough applications before the flowers open. For this purpose lead arsenate is preferable to Paris green.

Where orchards are properly sprayed with arsenical poisons to forestall damage by canker worms, codling moth, tent-caterpillar and other biting insects, there will usually be less trouble from the bud moth, but any efforts in this direction must be thorough and persistent in order to succeed.

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1903, Cooley, Montana Agr. Expt. Sta. Bull. 51, p. 201.

* Cornell Univ. Agr. Expt. Sta. Bull. 107, p. 65.

THE LEOPARD MOTH.

Zeuzera pyrina Linn.

A brief note was printed in the last report of this station (1907-1908, page 847) regarding the occurrence of the leopard moth in Connecticut. Since this note was published considerable evidence has been brought to our attention of serious damage to shade trees, especially elms, by this insect. Pruning of the trees and especially the removal of dead branches reveals the tunnels of the leopard moth larva, which is a borer in the branches and trunks of many species of broad-leaved trees. The illustration on Plate XVI, a, shows one of these galleries, and the infested branch was taken from one of the large elm trees on the New Haven Green. Several specimens of the adult moths have been captured in New Haven, but it was not known until recently that the insect is doing much injury to the trees in Connecticut.

Distribution and Spread in America.

The leopard moth is a European pest, and like many other very injurious insects that we now have to fight, was accidentally introduced into this country, being first noticed in June, 1881, at Hoboken, N. J. Three years later Dr. E. B. Southwick found it injuring trees in Central Park, New York City, and in 1894 pronounced it one of the worst insect pests attacking shade trees. The leopard moth was soon found in other cities near New York and in 1907 Mr. A. H. Kirkland, then superintendent in charge of the work of suppressing the gypsy and browntail moths in Massachusetts, called attention to its presence in Boston. During 1909, the writer was informed of its occurrence in Providence, R. I., and also that many of the fine elms of Cambridge, Mass., were threatened with destruction by this insect. The leopard moth is reported by Professor Smith* as occurring as far south as Long Branch, N. J. As it first appeared in Hoboken, N. J., it will be seen that like many other European insects introduced into this country it has spread northward much more rapidly than in any other direction.

* Report N. J. Agr. Expt. Sta. for 1908, p. 315.

Trees and Shrubs Attacked.

Over eighty species of trees and shrubs have been recorded as being attacked by the leopard moth, and some of them greatly injured. The list includes maples, elms, horse chestnuts, beeches, birches, dogwoods, hickories, oaks and walnuts, their susceptibility being indicated by the order in which they are named. Elms and maples are evidently most commonly attacked from the reports from different cities, but it should be borne in mind that in the Eastern States these trees are far more abundantly planted, both as street trees and as shade trees on private places, than any other kinds of trees. In Central Park, New York City, nearly all deciduous trees and shrubs were to some extent injured by the leopard moth.

Appearance of Infested Trees.

Infested small branches frequently wither and die in mid-summer. Sometimes these will break off, but more often remain, showing as dead twigs above the green foliage. Large scars on the major branches or trunk are caused by the larger caterpillars.

Life History and Habits.

The female is said to lay eggs in the crevices of the bark of the trunk and branches, and as adult moths are taken from early June to late in September this may properly be regarded as the egg-laying season of the insect. In capacity the moths have laid as many as 300 eggs each, and some writers estimate that many more up to 1,000 may be deposited. The young borers often enter the twigs at the base of a bud, then tunnel along the pith, though in some places the burrow curves outward to the bark. Holes through the bark are made here and there for disposing of the chips, which serve to show where the borers are at work.

The early-hatched caterpillars reach a length of about an inch by the end of the season and have the habit of leaving their burrows, crawling about on the branches of the tree to seek another point of attack, perhaps in a larger branch. Such branches are sometimes nearly girdled by the tunnels, and die or break off at the point of injury. The illustration on Plate XVI, a, shows the chamber where two galleries intersected. Most writers state that two years are required for the leopard moth to pass from the egg to the adult stage, and the caterpillar transforms to the pupa inside the burrow at a point where the bark has previously been eaten through. The pupa by wriggling is able to work itself partly out of the branch, when the skin splits open and the moth emerges, leaving the empty pupa case protruding from the orifice of the burrow.

The leopard moth appears to confine its attack to the trees of cities and towns and does not cause much damage to trees growing in country districts.

Appearance of the Insect.

The moths are dirty white and semi-transparent, with a yellow or brownish front margin to the wings, marked as shown in

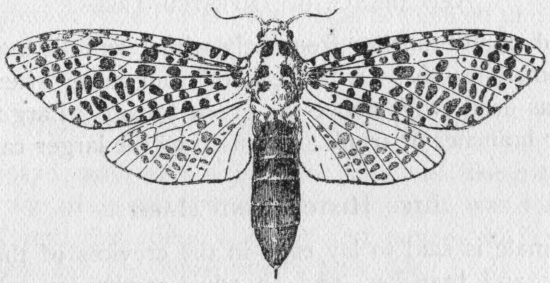

Fig. 5. Female Leopard Moth. Natural size.

the accompanying figure (Fig. 5) with metallic blue dots. The female has a wing-spread of from two and one-half to three inches, and that of the male is about one and three-fourths inches. The markings of the two sexes are similar, except that the dots are more pronounced and the colors brighter in the female.

The eggs are about the size of a pin head and are orange yellow in color.

The caterpillar is pinkish, flesh-colored or dirty white, with a number of dark spots or tubercles, the latter bearing short hairs. Head, thoracic, and anal shields dark brown. Length about two inches.

Remedies.

The position of the caterpillars tunneling in the branches, especially when they are in the tops of large trees, render them exceedingly difficult to reach. If the trees are pruned or other-

wise gone over systematically every year or two the burrows will certainly be detected and can be treated by injecting a few drops of carbon disulphide from an oil can into each and closing the opening with clay, putty, grafting wax or newly-made hard soap. The poisonous fumes penetrate throughout the galleries and will kill the borers therein.

Wilting branches indicate the presence of the borers and should be removed and destroyed. All twigs and limbs that break off during storms should be gathered and burned, thus destroying many of the borers in their tunnels. All female moths should be destroyed wherever found.

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THE PEACH BORER.

Sanninoidea exitiosa Say.

Next to the San José scale the peach borer is probably the most serious insect enemy of the peach in Connecticut. It is found in the United States east of the Rocky Mountains and Canada. It is an American insect and though the peach is not native to America it seems to feed upon it in preference to other hosts.

The Connecticut orchardist therefore is obliged to wage constant and systematic warfare against the peach borer in order to save his trees from destruction, and this brief article is here printed for the benefit of those who are not yet familiar with the work and appearance of the insect and the methods of controlling it.

Effect Upon Trees.

Peach trees infested with borers have a sickly appearance, with light green or yellowish foliage, and the uninitiated often mistake the trouble for an obscure disease of the peach called "Yellows." There is no connection, however, between the two troubles. The borers attack the trunk of the tree at or near the surface of the ground, working in the inner bark and sapwood, usually making a simple chamber just below the surface of the ground, though sometimes running down several inches on a root or working up the trunk above ground for a short distance. The larvæ probably never leave the burrow to go from one tree to another, but keep on enlarging the chamber until they reach maturity, large exudations of a mucilaginous or gummy nature appearing around the trunk. Trees are often entirely girdled and killed, especially where several borers are in them. The peach tree, however, has great ability to recover from the attacks of the borers.

Habits and Life History.

The eggs are laid in midsummer, singly or in groups, on the trunks of the trees near the ground, each female being capable of laying several hundred. About eight days are necessary for the eggs to hatch, and the young larvæ go into the bark sometimes through a crack and sometimes where the bark is smooth, and feed on the inner bark until cold weather, when they suspend operations and hibernate either in the burrow or in a case on the bark. The winter is thus passed as a larva, which goes on feeding in the spring and growing rapidly. As it reaches a large size it makes a larger burrow, and consequently its feeding is much more injurious to the trees than in the fall when it was very small. Great masses of gum exude from the injuries and often the larvæ and particularly the pupæ are enveloped in the masses of gum, which are an indication of the presence of borers in the tree. In June the larvæ become full grown and leave their burrows and pupate in brown cocoons which they make for themselves at the surface of the soil. About three weeks are spent in this stage; then the adult comes forth. The moths are found flying late in June and during July and August. There is but one brood each season.

Food Plants.

Though a native American insect, it did not at first appear to be much of a peach tree pest, but it has been recorded as

attacking the peach for at least one hundred and fifty years. Sargent states* that the wild black cherry is believed to have been the native food plant of this insect. In 1823, Harris reared the peach borer from cultivated cherry in Massachusetts and thirty years later Fitch found it attacking his plum trees in New York. In 1880, Fuller ascribed the cause of death of his dwarf flowering almond shrubs to this borer. In Connecticut the writer has taken what appeared to be the larvæ of the peach borer from the base of the trunk of the wild black cherry. But as the peach is now cultivated extensively in Connecticut it is only as a pest of the peach that this insect is commonly known.

Appearance of Insects.

The adults of the peach borer are wasp-like moths belonging to the family *Sesiidæ,* commonly called "clear-wings." The female is somewhat larger than the male and has a wing-expanse varying from one to one and a quarter inches. The male has a wing-expanse of about an inch, and is of a bright metallic blue color with yellow markings; both front and rear wings are transparent, with a discal cross mark on the fore wing. The female has transparent rear wings, but the fore wings are opaque blue-black, and there is an orange-colored band encircling the fourth segment of the abdomen. Specimens occur having two orange bands instead of one, the fifth abdominal segment also being orange-colored. The appearance of both sexes is shown in Plate XV.

The egg is minute, oval, brown in color, with the whole surface finely reticulated.

The fully grown larva is about an inch long, rather thick, white, with light brown head and is shown on Plate XV. The pupa is also about an inch long, brown in color, and enclosed in a rough cocoon made up of particles of bark and excrement fastened together with gum and lined with silk.

Remedial Treatment.

Many washes and mechanical devices have at various times been originated for preventing the attacks of the peach borer. Some of these devices are not without value; most of them have

* Sylva of North America, vol. 4, p. 11.

long since been discarded by the practical peach grower, who depends upon a careful inspection at least twice a year to destroy the borers. If the trees are examined in September, and again in April or May, and the borers dug out and killed, the expense is probably not greater than any other form of treatment, and is certain to be more effective.

MOSQUITO BREEDING AREAS EXAMINED AT THE REQUEST OF HEALTH OFFICERS.

Early in May the New Haven County health officer, Mr. Carleton E. Hoadley, asked the state entomologist to visit a small pond near Ansonia owned by the Ansonia Water Company, which had been complained about as a source of malarial mosquitoes, malaria having been prevalent the previous season. The visit was made May 12th in company with Mr. Hoadley. A concrete dam had been built, and some ground had been allowed to remain flooded for the purpose of rotting the turf and weeds preparatory to cleaning out. Undoubtedly the pond would breed mosquitoes and probably a great many of them later in the season, but at the time of the visit it was rather early to find wrigglers. The Ansonia Water Company desired to learn about the best treatment to prevent mosquitoes from breeding there. The following brief report was sent to the president of the Water Company:

May 12th, 1909.

"Mr. Theodore Bristol, President,
Ansonia Water Co.,
Ansonia, Conn.

Dear Sir:—

I visited Ansonia this morning in company with Mr. C. E. Hoadley of New Haven, and examined the small lake where you have built a dam on the hill east of the city. On the south side of this flooded area there is considerable brush, and any attempt to use oil on this would probably not be successful until the brush is cleared off, because in applying the oil it would be quite difficult to cover the surface of the water without wasting a good deal of material on the bushes, which would also interfere with thorough work. If the problem was my own, I should draw off the water, or lower it a foot or so, and cut this brush around the edge of the pond back as far as, or perhaps beyond, the present water line. If you expect to leave the water in it, it would be well to see that it is heavily stocked with some kind of carnivorous fishes, preferably those which feed

near the surface of the water,—pike, pickerel, top minnows, and several other kinds which would answer the purpose. They will devour the mosquito larvæ in the water, wherever they can reach them, but in the grass and bushes around the edges, where the water is shallow, it may be impossible for them to reach the mosquito larvæ, and therefore such areas may be prolific breeding places for mosquitoes. From a cursory examination of the place I should feel safe in pronouncing it a place where mosquitoes would breed under ordinary conditions. If the edges could be deepened so that the banks would be abrupt, and kept clean, there would probably be no need of oiling at all, but of course at present the water is shallow and vegetation is apt to grow through it to some extent.

Kerosene can be used for oiling, and should be applied at the rate of one fluid ounce to fifteen square feet of space. It is applied preferably by means of a spray pump, or at least some force pump which will enable one to throw it out for some distance upon the surface of the water. It will spread itself, but it is always well to distribute it as much as possible in applying it. It is always best to put the property in such condition that it will be permanently free from such troubles, because the operation of oiling needs to be repeated once in ten days or so often that in a few years the total expense amounts to even more than the permanent improvement. I shall be glad to answer any further questions in regard to the matter.

Very truly yours,
W. E. Britton,
State Entomologist."

Mr. Bristol replied immediately as follows:

"We are pleased to acknowledge receipt of your letter of May 12th, and will follow your suggestions as to drawing off the pond and clearing off the brush on the Parker pond which you examined, because we can see from your statement that you think it is a practical way to treat this proposition."

Later in the season a similar request came from Mr. Hoadley regarding the meadows near the city of Derby, where the new railroad tracks had cut off the natural drainage, forming pools of water more or less stagnant. The place was visited August 12th, and the state entomologist in company with Mr. Hoadley and Dr. J. H. Townsend, secretary of the State Board of Health, were met in Derby by Dr. F. A. Elmes, health officer, and Dr. A. W. Phillips of the State Board of Health, both of Derby.

A choked ditch and two pools between the old Derby railroad and the present location of the Naugatuck railroad contained many wrigglers or larvæ of malarial mosquitoes. As the health officer wished a statement from this office to submit to the officials of the railroad company the following was sent to him:

Aug. 12, 1909.

"DR. F. A. ELMES,
Derby, Conn.

Dear Sir:—

I herewith submit to you a brief statement of the conditions found on the Derby meadows when examined this morning in company with Dr. J. H. Townsend, secretary State Board of Health, Mr. C. E. Hoadley, County Health Officer, Dr. Phillips, and yourself.

Larvæ or wrigglers of the malarial mosquito (Anopheles), were found in the choked ditch running from the old layout of the Derby railroad towards the present location of tracks of the Naugatuck division; also in two large pools near the present tracks, where the construction work formed a dam cutting off the natural drainage.

In the light of our present knowledge, any pool of stagnant water where these mosquitoes breed must be considered a menace to the health of the people in that vicinity, and should be abated. Permanent treatment, such as filling or draining, is always to be advised rather than the temporary expedient of oiling the surface, which in order to be effective must be repeated every ten days through the mosquito season.

Very truly yours,
W. E. BRITTON,
State Entomologist."

FUMIGATING BUILDINGS WITH HYDROCYANIC ACID GAS.

BY B. H. WALDEN.

In the Sixth Report of the State Entomologist (1906, page 291) is an account of fumigating a dwelling house with hydrocyanic acid gas to kill the bedbug, *Klinophilos lectularia* Linn. This house has been carefully watched for the reappearance of the pest, but not a single specimen of this insect has been found.

Since the publication of the article mentioned above the writer has had charge of fumigating six buildings with hydrocyanic acid gas. Five of the buildings were infested with bedbugs and the sixth, a grain and feed store, was infested with grain insects, principally the saw-toothed grain weevil, *Silvanus surinamensis* Linn. Rats and mice were also doing much damage, especially by gnawing through the bags, allowing the contents to leak out.

As there have been many inquiries received regarding the fumigation of buildings, the operation of fumigating this feed store is herein described.

The building was of brick, 38 x 88½ feet and 4 stories high. Between the first and second story the height was 12½ feet; between the second and third and third and fourth, 11 feet. Between the fourth floor and roof the average was about 5½ feet.

There were comparatively few windows in the building, these being only in the front and back. At the front on the first floor was the office, and on the second floor a room 18 x 20 feet was partitioned off, the remainder of the floor space being used to store the grain; a portion being loose in bins and the remainder stacked in bags.

The fumigating was done on Thursday evening, Friday being a holiday, and the building remained closed until about 8:30 Saturday morning.

The following formula was used, the quantities being for each 100 cubic feet of space:—

Potassium cyanide, 98% C. P.	1 oz. by weight.
Sulphuric acid, commercial	1 oz. by measure.
Water	2 ozs. " "

Below are given the cubic contents of each floor, the amount of cyanide and number of generating dishes used:—

1st floor	42,037 cu. ft.	420 ozs. cyanide.	7 generators.
2d floor	36,992 " "	370 " "	7 "
3d floor	36,992 " "	370 " "	6 "
4th floor	18,498 " "	188 " "	4 "
2 cellars	.....	92 " "	4 "
	134,519 cu. ft.	1,440 ozs., or 90 lbs.	

The cyanide for each generator was weighed and placed in a paper bag, after which a bag was placed near the spot where each generator was to be located. The generating dishes, which were cheap wooden water and candy pails, were charged by putting in each the proper amount of water and then slowly stirring in half as much acid. (The water should always be put in first.) These were then placed in position. The operation was made as simple as possible by using equal amounts in all generators on the same floor, the generators of course being placed so as to diffuse the gas as evenly as possible. When everything was ready two men started at the top to drop the bags of cyanide into the generating dishes. The operator should always start at the top of the building and work down, always leaving the generators nearest the exit until the last. In case the cellar has no door leading out into the open air, the bags should be suspended over the generators with strings and arranged so that they can be lowered from the first floor. It is not safe for the operator to go into the cellar and start the generators going and then go to the first floor to work with gas generating above and below him.

The building was locked and left closed for about 40 hours. The doors and a number of the windows were then opened from the outside and the first floor was soon aired so that the building could be entered. As it was not necessary to use the other floors, these were aired gradually, one at a time.

Many dead mice were found scattered over the floors, and a few dead rats, although many of the rats probably escaped, as it is doubtful if the gas would penetrate their burrows, which may have extended for some distance beneath the foundation of the building.

The owner was satisfied with the treatment, and a subsequent visit showed very little recent damage from mice and rats, and no live grain weevils were found.

In each of the buildings fumigated practically the same method was employed, and the formula mentioned above was used.

One of the principal troubles in the work was to get suitable dishes for generators. Dishes made of the iron stone china are satisfactory and the treatment does not injure them, but the heat generated will destroy the glazing of ordinary glazed earthen ware. In one case where the expense was no object the owners purchased a sufficient number of 2 gallon fruit jars for generators. These were ideal for the purpose but cost about 30 cents apiece, increasing materially the cost of the operation.

In fumigating the feed house above mentioned, and in one of the dwelling houses, cheap wooden pails were used. These were purchased for about 15 cents apiece, and were fairly satisfactory, but would sometimes leak, even though thoroughly soaked with water beforehand. If the pails could be treated so as not to leak, they would make very satisfactory cheap generators.

Two of the dwelling houses were completely furnished when fumigated, and no damage was noted to draperies, gilt picture frames, brass bedsteads, etc. Certain gold and brass alloys showed some tarnish, but this seemed to rub off readily.

Each of the buildings which we have fumigated has been closed over night, and where possible it is advisable to do this, but fumigating for 2-3 hours would probably prove effective.

We consider that fumigating with hydrocyanic acid gas is the most thorough treatment that can be given for household insects. This is one of the most deadly gases known, and great care must be taken throughout the whole operation. The house should be thoroughly aired before entering, and anyone sleeping in a house recently fumigated should see that there is abundant ventilation until all traces of the gas are out of the building.

MISCELLANEOUS INSECT NOTES.

TOBACCO BUD WORM IN CONNECTICUT.

About September 15th some unusual green caterpillars were found feeding upon the experimental tobacco plants, growing on the Station grounds. These were placed in breeding cages and supplied with food. One pupated September 15 and the others a few days later. On October 11th one adult moth emerged from the cocoon, and two appeared October 21st. On obtaining the adults, we were able to identify the species as *Chloridea virescens* Fabr., formerly known as *Heliothis rhexiae* S & A and called the "true bud worm" to distinguish it from *Heliothis obsoleta* Fabr. which is called the "false bud worm."

The adult of *Chloridea virescens* is a greenish moth having a wing expanse of one and one-half inches and is shown in figure 6. Each fore wing is transversed by the lighter bands.

Quaintance mentions* this species as attacking the tobacco crop in Florida but states that it is less troublesome than *Heliothis*

Fig. 6. The Tobacco Bud Worm Moth. Natural size.

obsoleta. Howard† states that it has not been noted in tobacco fields north of Maryland. In Dyar's List of N. A. Lepidoptera the distribution of this species is given as "United States."

CANKER WORMS.

Much damage was done locally to orchard and shade trees throughout Connecticut in 1909, but the warning was given, the danger pointed out and relief measures recommended in the last report of this office (see Report of this Station for 1907-1908, page 777), to which the reader is referred for a full account of this insect. In spite of the warning, however, there were scores of good apple orchards stripped of their leaves in May and looking as if a fire had run through them. However, there were orchards scattered here and there attacked by Canker Worms which were carefully sprayed by the owners and all damage prevented; these served as excellent object lessons to the communities in which they are located.

On account of the great damage caused by Canker Worms in 1909, and the abundance of adults in the late fall and later the

* Florida Agr. Expt. Sta. Bull. 48, p. 184, 1898.
† Year Book U. S. Dept. of Agr. for 1898, p. 132.

eggs on the trees, it is reasonable to expect serious injury again in 1910, and the only treatment that can now be given is to spray the foliage in May, using preferably lead arsenate at the rate of about 3 lbs. in 50 gallons of water.

THE GREENHOUSE LEAF-TYER.

On January 17th Mr. Wm. J. Rowe, gardener to Mr. Joel Sperry of Whalley Avenue, New Haven, Conn., brought to the Station some caterpillars which were injuring greenhouse cinerarias and daisies by devouring the leaves. The following description of the larva and the accompanying drawing (figure 7) were prepared by Mr. Caffrey.

Average length 14mm. Average width 3mm. General color, light green along dorsal surface with a light greenish yellow

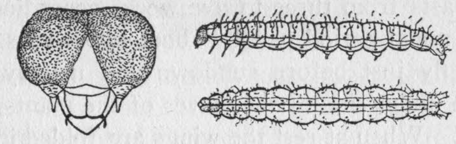


Fig. 7. The greenhouse leaf-tyer. Side and dorsal view of larva two and one-half times natural size. Also front view of head, greatly enlarged.

tinge on lateral and neutral surfaces. A narrow dark green median stripe extends along the dorsal surface from behind the head to the last segment. Four rows of bristles on each side of mid-dorsal line extending length of body with one bristle on each segment except the row next to mid-dorsal line on each side, which has two bristles on each segment. Head has a light brown tinge with darker brown spots.

On January 21st one of the caterpillars spun a cocoon and transformed to the chrysalis or pupa stage and the others soon followed suit. The first moth emerged on Feb. 10th. The insect proved to be *Phlyctœnia ferrugalis* Hubn. (*rubigalis* Guen) and is illustrated on Plate XVI, b.

This species is known as the greenhouse leaf-tyer and according to Chittenden* has caused considerable damage to greenhouse and field plants, including vegetables, during the past few years. The larva works on the under side of the leaves, often fastening

* Bureau of Entomology, Bull. 27, N. S., p. 7.

two together with silken threads or curling the edge of the leaf on which it may be feeding, and enclosing itself in a thin web.

The adult is a slender species with a wing-expanse of about three-fourths of an inch and of a pale reddish brown color, with inconspicuous markings. It is said that there are at least two and perhaps more annual generations out of doors, and more—probably five or six—in greenhouses. There are published records of the occurrence of this insect throughout the eastern states and in California.

The list of food plants includes cabbage, beets, celery and tobacco, rag weed, hedge mustard, and a large number of greenhouse and outdoor ornamental plants.

The whitish translucent eggs are deposited either singly or in masses of eight or ten on the under side of the leaf; they hatch in a period varying from five days to nearly three weeks. The larval period lasts from three to five weeks according to temperature and the pupal period usually about two weeks.

The adults fly just before sundown and usually rest during the day on the under side of the leaves of the plants, upon which the larva feed. When at rest the wings are folded in the manner common to most Pyralid and Deltoid moths.

Wherever much damage is done or the caterpillars are sufficiently abundant to cause apprehension, the plants may be poisoned by spraying them with lead arsenate or by dipping them into the liquid. The poison should be mixed at the rate of about one pound in ten gallons of water.

Where spraying is practiced it is necessary to apply the poison to the under sides of the leaves. Chittenden advises* fumigating the house in serious infestations and gives directions for carrying out the treatment. For general fumigation from one-tenth to fifteen-hundredths of a gram of 98% potassium cyanide for each cubic foot of space should be used.

STRAWBERRY CROWN GIRDLER ATTACKING YOUNG HEMLOCKS.

On June 16th samples of injured hemlock trees were brought to the station from a nursery in New Haven. The trees were between twelve and eighteen inches in height and had been growing in nursery rows for one and two years. They had shown signs of unthriftiness by turning brown and dropping their leaves.

* Idem, p. 20.

Some failed to make any growth. On examining the roots it was found that insects were at work in the bark of the main stem and larger roots. Larvæ pupæ and adults of a small beetle were found in the bark and in the soil near the tree. Of 4,000 young trees about 200 were destroyed by this insect, which proved to be the Strawberry Crown Girdler *Otiorhynchus ovatus* Linn. of the family Otiorhynchidæ and closely allied to the curculios. It usually feeds upon the roots and crowns of strawberry, grass and many other plants. Though I have not found Hemlock mentioned as a food plant, it is known to be a general feeder, and the larvæ of another and much larger species of the same genus *O. sulcatus* Fabr. are known to feed in Hemlock bark. The injured hemlock trees were from western nurseries and were grown in frames a year before setting and were near the spot where strawberries had been growing the preceding year, which possibly may explain the attack.

The Strawberry Crown Girdler is not a native to America but occurs in northern Asia and Europe and probably came to us from Europe. It has also been called the strawberry weevil, the pitchy-legged Otiorhynchus, and in certain localities has acquired the name of "graveyard bug," probably because it was abundantly feeding upon the grass in a cemetery. It occasionally causes serious damage to strawberries in Connecticut by eating the roots and crowns of the plants. Remedial treatment with insecticides is rather unsatisfactory and cultural methods must be relied upon chiefly to control this insect. As the larvæ feed normally upon the roots of grass and various plants, Cooley suggests* that "the remedial measure that seems to promise most is so managing the soil that where it is desired to set out the field to strawberries the beetles will have previously starved out."

Miss Patch reports† this beetle as being abundant in houses in several localities in Maine in 1905. Though housekeepers were alarmed, the Strawberry Crown Girdler does no harm in the house. It simply seeks a hiding place, though not entirely for hibernation, and the houses afford a convenient place.

Miss Patch gathered several hundred adult beetles and confined them to learn something about their feeding habits. She

* Montana Agr. Expt. Sta. Bull. 55, 1904.

† Maine Agr. Expt. Sta. Bull. 123, 1905.

then collected leaves and flowers of various plants and placed before them. In this manner they were observed to feed to a greater or less extent upon about fifty different kinds of trees and plants, not including, however, hemlock.

The adult beetle is nearly one-fourth of an inch long and varies from light reddish brown to nearly black in color. Like some other allied species, the Strawberry Crown Girdler has thick wing covers but no wings. Consequently it is not able to fly and does not spread very rapidly.

Fig. 8. The Strawberry Crown Girdler. Enlarged three times.

This insect is shown in figure 8. The Station collection contains specimens of this beetle from Colebrook, Windsor, Waterbury, Stratford and New Haven.

WHITE GRUBS IN GRASS LANDS.

Reports have been received from different parts of the state of injury to grass land last season by white grubs which eat off the roots. The damage becomes noticeable late in summer, after the hay crop has been harvested, especially if two or more seasons of drought at this time have occurred. The roots are devoured so that the turf can be peeled or scraped from the soil in large areas; in former years I have seen acres in this condition in the State of New Hampshire, and in some fields the ground was literally torn up by skunks which dig to get the grubs for their food. Give the skunks credit for doing a little good. The localities reported in Connecticut are Oxford, Salem and Meriden. One man asks if the grubs will be troublesome next season, and if it will be safe to plant corn, strawberries or other hoed crops on the land next year. Though it is scarcely safe to prophesy regarding the occurrence or absence of insect pests, there are certain general laws and conditions which we may consider. For instance, the white grub is the larva of the "May beetle" or "June beetle," shown in figure 9, of which

there are several species, and three years are required for the insect to pass through its entire period of development from the egg to the adult beetle. Grass lands are seldom injured by the grubs except when they are numerous and nearly full grown. It is fair to assume, therefore, that those grubs doing the damage in the summer of 1909 will not feed another season, but will transform or perhaps have already transformed, and that

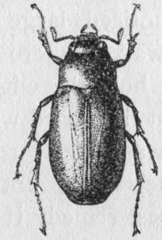


Fig. 9. A common "June Beetle" *Lachnosterna fusca* Froehl. Natural size.

the beetles will emerge in May and June to lay eggs for the succeeding generation. We may expect the beetles to be very abundant. In planting the land to other crops, it is advisable to give it a good plowing and thorough harrowing with a disk or cut-away harrow, and these preparatory operations will kill many of the insects before they emerge.

A word as to remedies. It has often been advised that heavy applications of common salt, lime, kainit or muriate of potash be applied to the grass land as soon as the damage is first noticed to kill the grubs. It is a question whether this practice is worth while, though the application of any good fertilizer is of value as plant food. Usually it is best to plow the ground, and sometimes a crop of Hungarian grass or millet can be grown the same season. In other cases it can be sown to rye. If no crop is put upon the land immediately, it is best to plow the ground late in the fall, as many of the grubs will thus be exposed and devoured by crows or blackbirds or killed by the elements. If the field can be pastured with pigs, they will destroy most of the grubs and beetles.

WHITE ANTS INJURING A HOUSE IN SOUTH NORWALK.

Specimens were received from South Norwalk on April 19th with the report that they were eating through the solid wood of the construction timbers and finish boards of a dwelling house. The specimens were a common insect—known as white ant *Termes flavipes* Kollar, though not an ant at all and not closely related to the ants, but given the popular name of white ant on account of its appearance and habits. There are several species of white ants in the tropics, and some of them do a great amount of damage. *T. flavipes* is rather common in Connecticut, often nesting in old stumps, in fence posts, or in buildings. The writer has noticed large numbers of individuals swarming along the sidewalks, where they had emerged from the strip of board laid to hold the edge of the tar walk. One season they were nesting in the board walks in the Station greenhouse. The greenhouse was afterward fumigated with hydrocyanic acid gas and the white ants disappeared. Carbon bisulphide is perhaps the best remedy if it can be poured into the nest and the opening stopped.

GREEN ROSE CHAFER IN PACKAGE OF NURSERY STOCK IMPORTED FROM EUROPE.

When inspecting some ornamental nursery stock imported from Holland at a nursery in New Haven in April, 1909, a living specimen of *Euphoria* (*Cetonia*) *aurata* Linn. was found in the packing. It is needless to say that the specimen was immediately placed in the cyanide bottle and now reposes in the Station collection. This beetle is a large and handsome species of bright metallic green color marked crosswise with small whitish spots or streaks and is shown on Plate XVI, c.

The green rose chafer is considered a pest in Europe—the grubs feeding upon the roots of strawberries, grass and other plants and the adult beetles attack various flowers, such as strawberry blossoms and roses.

Eggs are laid in the ground where the grubs feed for two or three years. The grubs are nearly an inch and a half long when full grown and are of a dirty white color with the posterior extremity grey and with a yellow head. They make their pupal cases in the soil in the same manner as our white grubs, which they closely resemble.

A brief account of the green rose chafer is contained in "Manual of Injurious Insects and Methods of Prevention" by Eleanor A. Ormerod, London, England, 1890.

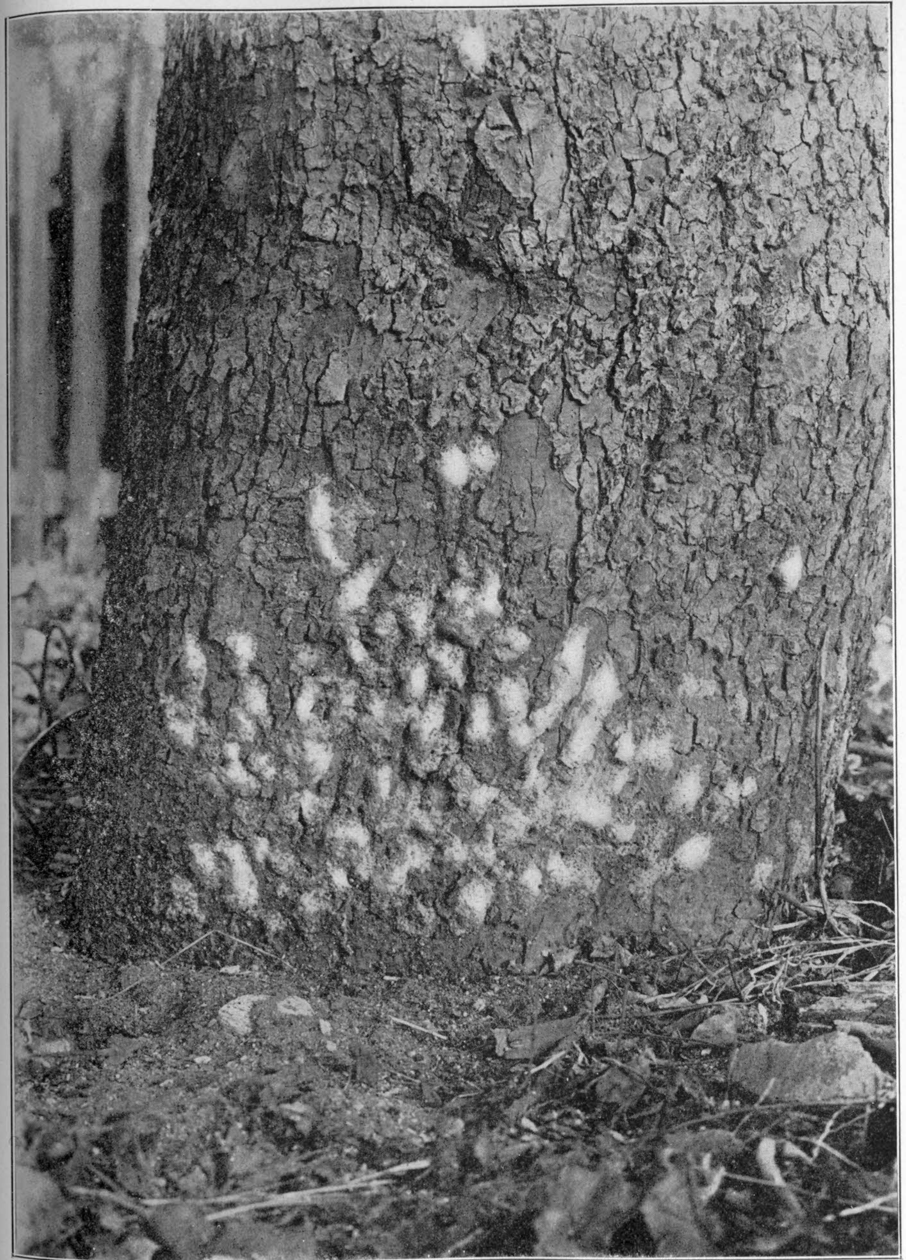
a. Showing boxes of imported stock in packing shed.

b. Inspecting stock at the nursery.

INSPECTION OF IMPORTED NURSERY STOCK.

Egg-clusters on maple street-tree: about 300 were counted on this tree.

GYPSY MOTH AT WALLINGFORD.



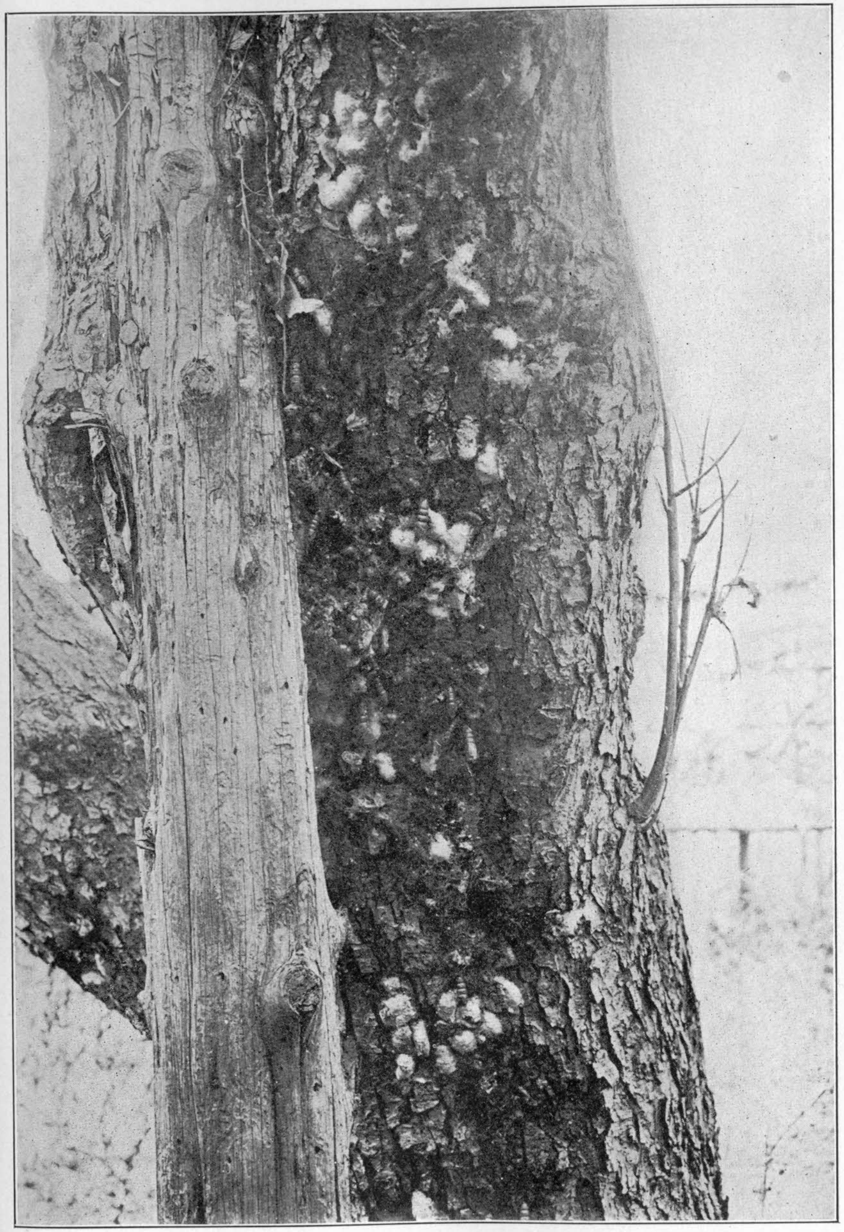
GYPSY MOTH EGG-CLUSTERS ON BASE OF APPLE TREE.

Nearly 300 egg-clusters were found on these trees.

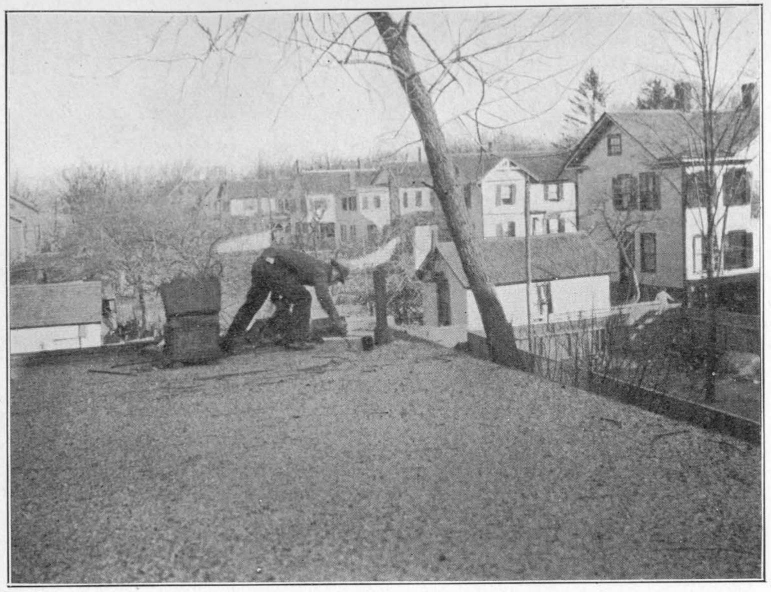
INFESTED WILLOWS AT WALLINGFORD.

Tree, building, fences and tinware were infested with egg-clusters.

CONDITIONS IN AN INFESTED BACKYARD AT WALLINGFORD.



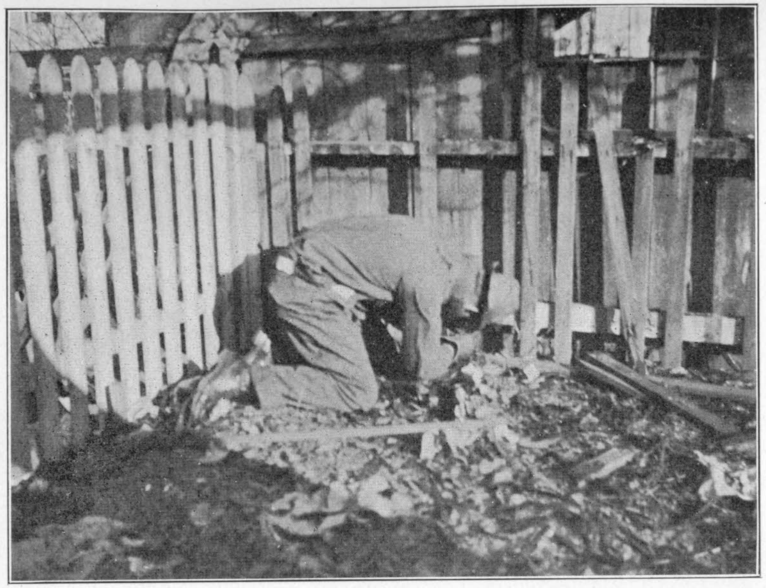
EGG-CLUSTERS AND OLD COCOONS ON APPLE TREE, WALLINGFORD.



a. Nearly fifty egg-clusters were found on this roof.

b. General view of one of the worst-infested backyards.

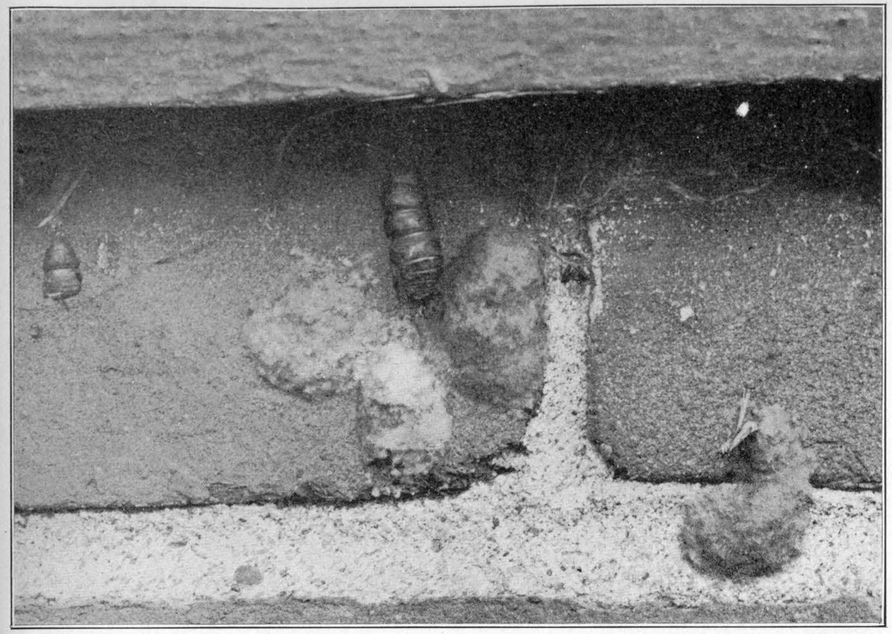
GYPSY MOTH WORK, WALLINGFORD.



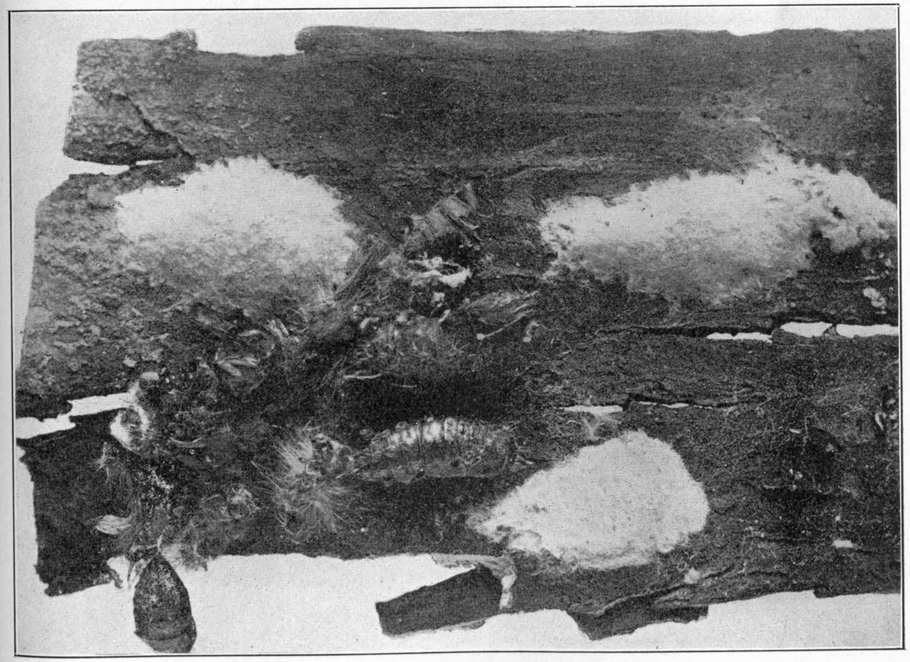
a. Examining the fence and destroying egg-clusters.

b. This pile of kindling wood contained about fifty egg-clusters.

DESTROYING GYPSY MOTH EGGS, WALLINGFORD.



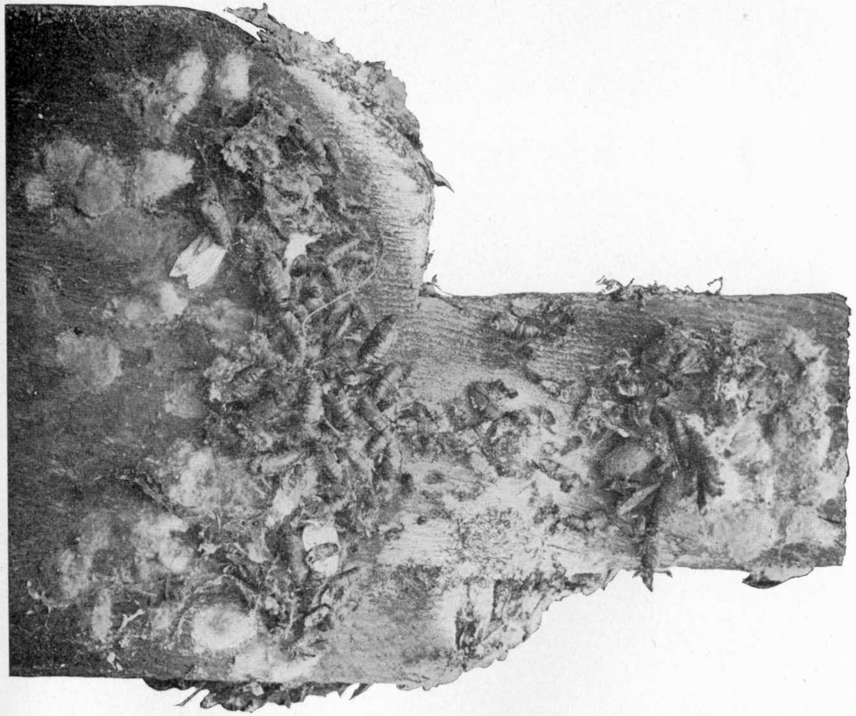
a. Egg-clusters on brick underpinning.



b. Egg-clusters on inside of loose hickory bark.

GYPSY MOTH EGG-CLUSTERS. Natural size.

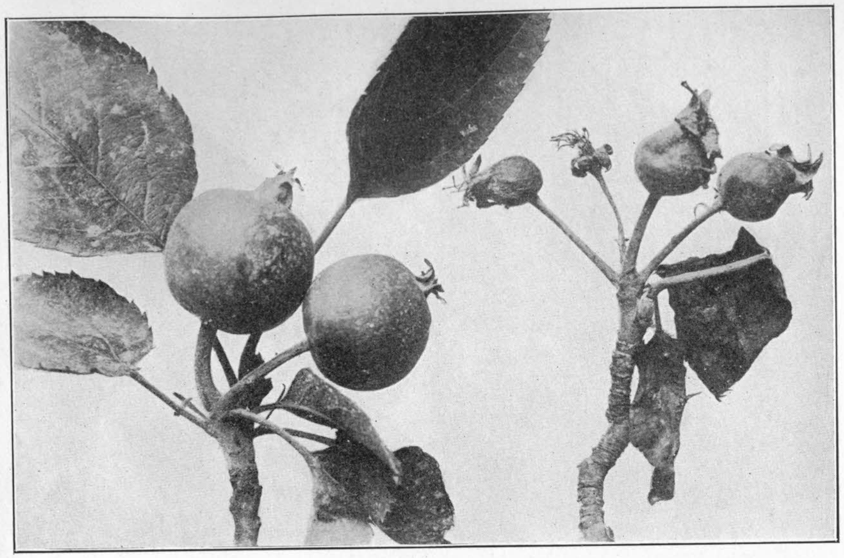
a. This coffee can had 21 egg-clusters on and in it.



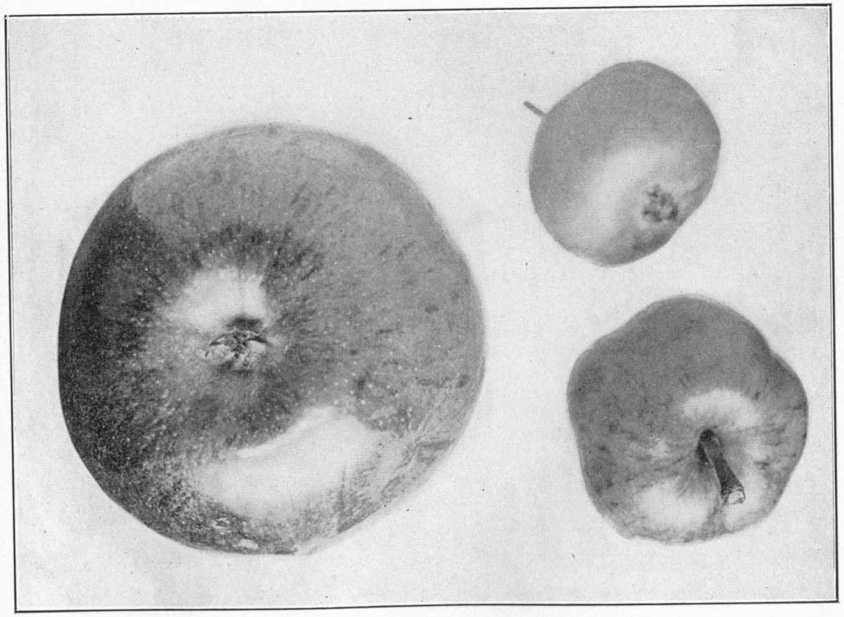
b. Dead moths, egg-masses and old cocoons under board lying upon the ground.

WALLINGFORD GYPSY MOTH INFESTATION.

DESTROYING GYPSY MOTH EGG-CLUSTERS AT WALLINGFORD.

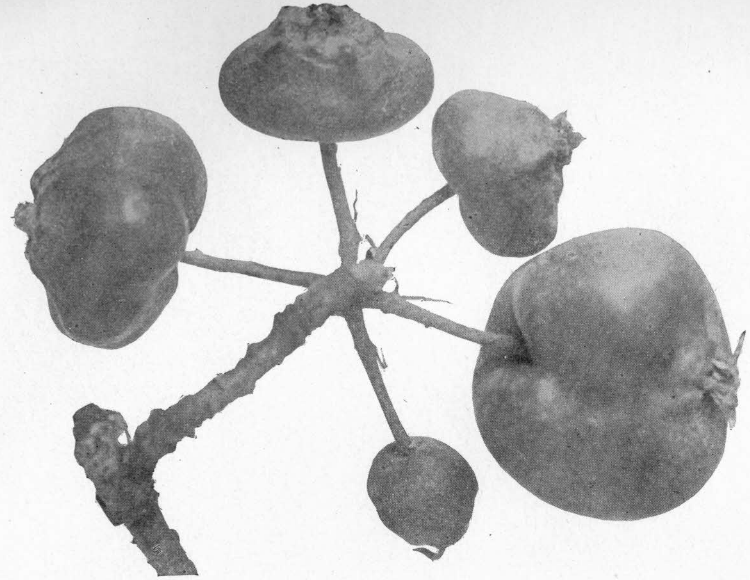


a. Cluster at right badly infested, showing difference in size from normal fruit at left, not infested.

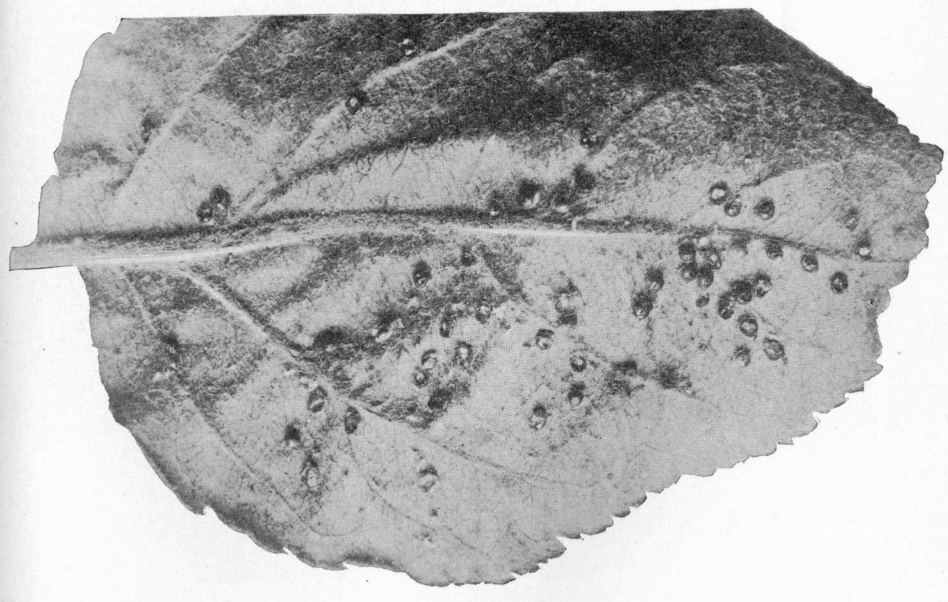


b. Normal size of fruit at left ; those at right checked by attack of aphis.

ROSY APPLE APHIS.



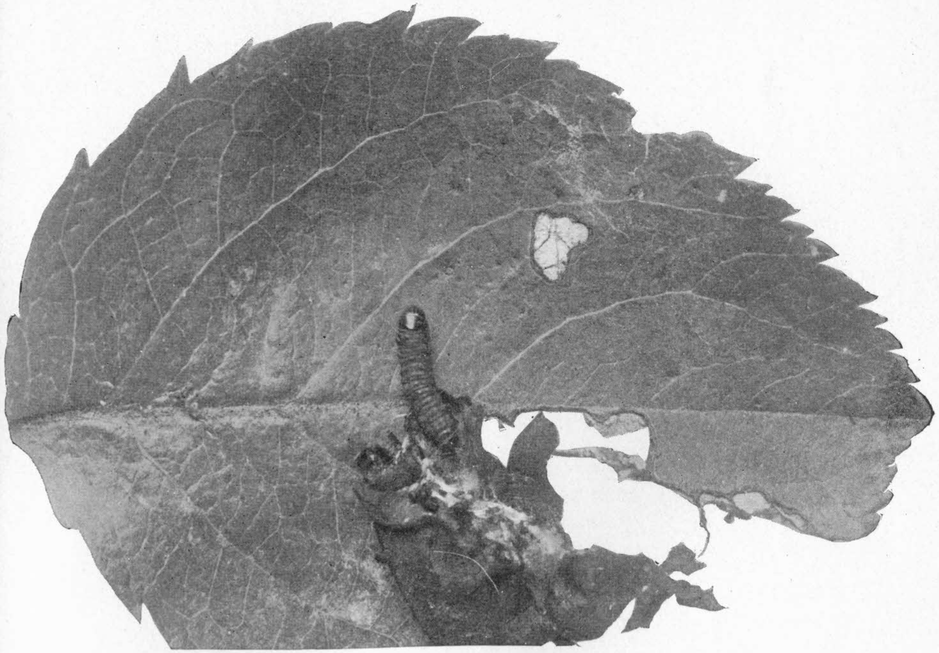
a. Badly infested cluster, causing stunted and irregular fruit.



b. Apple leaf showing parasitized aphids twice natural size.

ROSY APPLE APHIS.

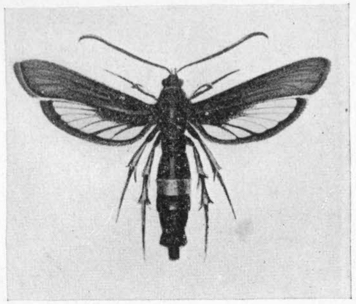
a. Young apple leaves infested by bud moth, natural size.



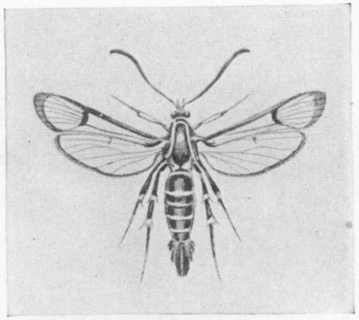
b. Apple leaf and bud moth caterpillar, twice natural size.

BUD MOTH.

a. Larva in its burrow in young peach tree.

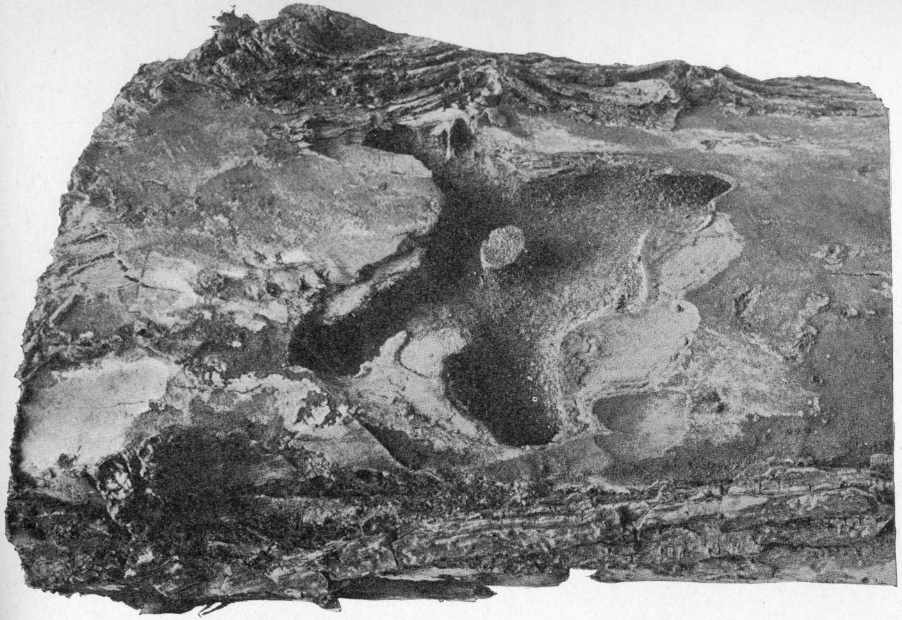


b. Female peach borer moth, twice natural size. (After Beutenmuller.)

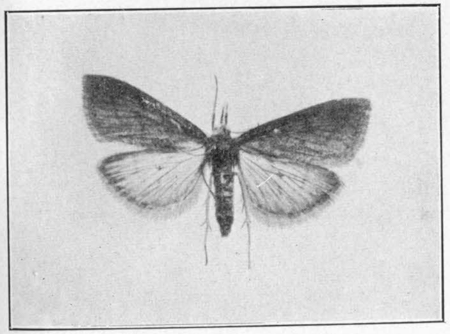


c. Male peach borer moth, twice natural size. (After Beutenmuller.)

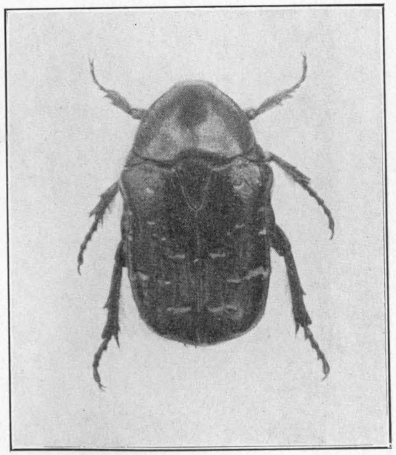
PEACH BORER.



a. Elm branch showing galleries of the Leopard moth larva.



b. Adult of the Greenhouse Leaf-Tyer.
Twice natural size.



c. European Green Rose Chafer.
Twice natural size.

EUROPEAN GREEN ROSE CHAFER, GREENHOUSE LEAF-TYER AND WORK OF LEOPARD MOTH.

PART V.

Report on Commercial Fertilizers, 1910.

By E. H. Jenkins, *Director,* and John Phillips Street,
Chemist in charge of the Analytical Laboratory.

This station is required by statute to analyze yearly at least one sample of every commercial fertilizer which is offered for sale in the State at a price of more than ten dollars per ton.

The Station is also required to publish these analyses yearly.

The duties of manufacturers and dealers in fertilizers have been set forth on pages 1 and 2 of this biennial report.

OBSERVANCE OF THE FERTILIZER LAW.

During 1910, forty-one individuals and firms have entered for sale in this State three hundred and thirty-eight brands of fertilizers, viz:

Special manures for particular crops	153
Other nitrogenous superphosphates	101
Bone manures and "bone and potash"	26
Fish, tankage, castor pomace and chemicals	54
Unclassified	4
	338

SAMPLING AND COLLECTION OF FERTILIZERS.

During April, May and June, Mr. V. L. Churchill, the sampling agent of this station, visited one hundred and seven towns and villages in Connecticut to draw samples of commercial fertilizers for analysis. These places were distributed as follows:

Litchfield County	7
Hartford County	36
Tolland County	8
Windham County	9
New London County	8
Middlesex County	10
New Haven County	16
Fairfield County	13
	107

In these places seven hundred and six samples were taken.

The agent did not find on sale the following brands which had been entered for sale in the State: American Agricultural Chemical Co.'s H. G. Fertilizer with 10 per cent. Potash, Bowker's Highly Nitrogenized Mixture, Special Crop Grower, Essex Grass and Grain, New England Tankage, Parmenter & Polsey's Potato Grower, Swift's Lowell Muriate of Potash. Therefore no analyses of these brands appear in the following pages.

Explanations regarding the method of sampling will be found on page 11 of this report.

ANALYSES OF FERTILIZERS.

A classified list of the samples analyzed is given below and the results are given in detail in the following pages.

DESCRIPTIONS AND ANALYSES OF FERTILIZERS.*

The samples referred to in the following pages were drawn by the Station Agent unless the contrary is stated; the analyses were made by the methods adopted by the Association of Official Agricultural Chemists, and the results are always expressed in percentages, or parts per hundred by weight of the material examined.

CLASSIFICATION OF THE FERTILIZERS ANALYZED.

	Number of Samples.
1. *Containing nitrogen as the chief active ingredient.*	
Nitrate of soda	22
Dried blood	2
Cotton seed meal	157
Castor pomace	6

*The analyses of fertilizers included in this chapter have been made by Mr. Street, chemist in charge, with the assistance of Messrs. Bailey, Morrison, Roe and Shepard, station chemists, and of Mr. Lange. The results have been discussed by the director.

	Number of Samples.
2. *Containing phosphoric acid as the chief active ingredient.*	
Phosphate rock, basic slag, bone ash, etc.	7
Soluble phosphates	17
3. *Containing potash as the chief active ingredient.*	
Muriates and sulphates	24
Kainit	3
Vegetable potash	1
4. *Containing nitrogen and phosphoric acid.*	
Bone manures	32
Tankage	14
Fish	22
5. *Mixed fertilizers.*	
Nitrogenous superphosphates	282
Home mixtures	22
6. *Miscellaneous fertilizers, manures and amendments*	50
Total	661

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA OR SODIUM NITRATE.

Nitrate of soda is mined in Chili and purified there before shipment. As offered in the Connecticut market, it contains about 15.50 per cent. of nitrogen, equivalent to 94.1 per cent. of pure sodium nitrate. The other usual constituents are moisture and small quantities of common salt and Glauber's salt.

Shipments differ somewhat in composition, as is shown by the twenty-two samples which have been analyzed, as follows:

24500. Sold by Coe-Mortimer Co., New York. Sampled by Thos. Griswold & Son, Wethersfield.

24163. Sold by Coe-Mortimer Co. Sampled by L. B. Sperry, New Haven.

24516. Sold by Buffalo Fertilizer Co., Buffalo, N. Y. Sampled by S. L. Tuttle, Wallingford.

24286. Sold by Bowker Fertilizer Co., New York. Sampled by John Gotta, Portland.

24326. Sold by Bowker Fertilizer Co. Sampled from stock of A. Grulich, Meriden.

24429. Sold by E. D. Chittenden, Bridgeport. Sampled from stock of D. L. Clark, Milford.

24485. Sold by Nitrate Agencies, New York. Sampled from stock of Apothecaries Hall Co., Waterbury.

24482. Sold by Atlantic Fertilizer Co., Baltimore. Sampled from stock of L. Harkavy, Leonard's Bridge.

24315. Sold by Nitrate Agencies. Sampled from stock of Apothecaries Hall Co.

24229. Sold by Berkshire Fertilizer Co., Bridgeport. Sampled from stock of T. W. Ryan, Stratford.

24355. Sold by Wilcox Fertilizer Co., Mystic. Sampled from their stock.

24347. Sold by American Agricultural Chemical Co., New York. Sampled from stock of Connecticut Valley Orchard Co., Berlin.

24350. Sold by Swift's Lowell Fertilizer Co., Boston. Sampled from stock of C. W. Lines Co., New Britain.

24310. Sold by Coe-Mortimer Co. Sampled from stocks of F. S. Platt Co., New Haven, and F. S. Bidwell & Co., Windsor Locks.

24664. Sold by Rogers Mfg. Co., Rockfall. Sampled from their stock.

24349. Sold by National Fertilizer Co., New York. Sampled from stock of J. A. Glasnapp, West Cheshire.

24318. Sold by Sanderson Fertilizer Co., New Haven. Sampled from their stock.

24291. Sold by Coe-Mortimer Co. Sampled by J. F. Shepard, New Haven.

24237. Sold by Nitrate Agencies Co. Sampled from stock of S. D. Woodruff & Sons, Orange.

24400. Sold by Patrons' Exchange, Danielson. Sampled from stock of C. R. Treat, Orange.

24392. Sold by American Agricultural Chemical Co. Sampled from stock of Conn. School for Boys, Meriden.

24423. Sold by American Agricultural Chemical Co. Sampled from stock of Andrew Ure, Highwood.

The per cent. of nitrogen in these samples ranges from 15.0 to 15.48 and averages 15.24.

The retail cost of nitrogen ranges from 15.0 to 17.8 cents per pound, the average being 16.1 cents.

The nitrogen of nitrate of soda is unquestionably the most quickly and fully available form which is accessible and this year it has been the cheapest. For quick action, particularly on such crops as grain, grass and potatoes which make a large part of their growth when the soil is still too cold for the active decay and nitrification of organic forms of nitrogen, nitrate of soda is especially valuable.

ANALYSES OF NITRATE OF SODA.

Station No.	24500	24163	24516	24286	24326	24429	24485	24482	24315	24229	24355
Percentage amount of											
Nitrogen found	15.00	15.44	15.36	15.22	15.32	15.48	15.18	15.38	15.00	15.00	15.48
Nitrogen guaranteed	15.0	15.6	....	15.2	15.0	15.0	15.0	15.0	15.0	15.7	15.0
Cost per ton	$45.00	47.00	47.00	47.12	48.00	49.00	48.00	49.00	48.00	48.00	50.00
Nitrogen costs cents per pound	**15.0**	**15.2**	**15.3**	**15.5**	**15.7**	**15.8**	**15.8**	**15.9**	**16.0**	**16.0**	**16.1**

Station No.	24347	24350	24310	24664	24349	24318	24291	24237	24400	24392	24423
Percentage amount of											
Nitrogen found	15.48	15.44	15.36	15.16	15.24	15.00	15.28	15.44	15.34	15.42	15.36
Nitrogen guaranteed	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Cost per ton	$50.00	50.00	50.00	50.00	51.00	52.00	53.00	55.00	....	....	....
Nitrogen costs cents per pound	**16.1**	**16.2**	**16.3**	**16.5**	**16.7**	**17.3**	**17.3**	**17.8**	....	....	....

DRIED BLOOD.

24424. Sold by American Agricultural Chemical Co., New York. Sampled from stock of Andrew Ure, Highwood. Contained 10.44 per cent. nitrogen, 9.87 per cent. guaranteed.

24824. Sold by Rogers Mfg. Co., Rockfall. Sampled from stock of James Hyland, Highwood. Contained 13.00 per cent. nitrogen.

COTTON SEED MEAL.

(ANALYSES ON PAGES 381-386.)

One hundred and fifty-seven samples have been analyzed, representing more than 3100 tons which have cost the buyers nearly $120,000. Most of the meal was used as a fertilizer on tobacco.

Sixty-three of the samples contained notably less nitrogen than was guaranteed. The meal is sold to commission men by a large number of mills at the south, many of them quite small, whose managers do not determine the quality of their output by chemical analysis. Their guaranties, therefore, too often represent little more than a guess. Some mill owners, however, well understand how to adulterate their product with cotton seed hulls, which if ground fine and used in moderate amount, do not sensibly affect the appearance of the meal. The commission merchants who handle this meal do not have it under their inspection and never see the most of it. Hence, without the Station's analysis, the buyer could never be sure of the quality of what he bought under guaranty. Most, if not all, of the meal this year sold in the State was bought under guaranty of a certain percentage of nitrogen from parties who agreed to give a satisfactory rebate for any deficiency in nitrogen. The Connecticut dealer receives this rebate and his customers should and do receive their share of it when they claim it. It is, therefore, the buyer's own fault if he suffers because the meal delivered to him has less than the amount of nitrogen guaranteed to him.

The average cost of cotton seed meal this year has been $37.50 per ton, five dollars more than last year's average.

The average percentage of nitrogen has been 6.79, 0.23 per cent. lower than last year.

The average cost of nitrogen in cotton seed meal has been 24.7 cents per pound, over 4 cents per pound more than has ever been paid before for it.

ANALYSES OF COTTON SEED MEAL, 1910.

Station No.	Dealer, Car No. or Marks.	Purchased, Sampled or Sent by.	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
24450	Humphreys, Godwin & Co., Memphis, Tenn. Spencer Bros., Suffield, 58434×33348	J. Davis, F. W. Brown	7.50	6.5	$37.00	21.9
24469	H. G. & Co., Broad Brook Lumber Co.	E. A. Osborn	7.51	6.5	37.00	21.9
24573	" H. K. Brainard, Thompsonville R. 20586	Mrs. E. Rogers, S. Barron	7.28	6.5	36.50	22.2
24496	" Broad Brook Lumber and Coal Co.	H. W. Mohn	7.38	6.5	37.00	22.3
24581	" " " 12375	Broad Brook Lumber and Coal Co.	7.22	---	36.50	22.4
24515	" H. K. Brainard, R. 17230	H. Russell	6.98	6.5	35.40	22.4
24451	" Spencer Brothers, Suffield, M. P. 15133	C. D. Burbank, W. L. Lovell and others	7.51	6.5	38.00	22.6
24624	" Olds & Whipple, Hartford, 13866	Olds & Whipple	7.05	6.5	36.00	22.6
24625	" " " " 65723	" "	7.02	6.5	36.00	22.7
24546	" " " " 90553	" "	7.20	---	37.00	22.8
24494	" " " " 4413	" "	8.28	7.8	42.00	22.9
24381	" H. K. Brainard, P. 5364	O. E. Pitcher	7.66	7.4	39.25	22.9
24631	" Arthur Sikes, Suffield, B. 3959	E. Perkins, C. S. Fuller and others	6.96	6.5	36.00	22.9
24502	" " " 24168	H. D. Sikes, J. L. Firtion and others	7.04	6.5	36.50	23.0
24187	" Spencer Bros., Suffield, 43789	Bissell-Graves Co.	6.46	6.5	34.00	23.1
24493	" Olds & Whipple, 8857	O. & W.	8.17	7.5	42.00	23.2
23920	" " " 17361	O. & W.	7.45	7.5	39.00	23.4
24354	" " " 8462	H. W. Alford, H. W. Ellsworth	7.67	7.5	40.00	23.4
24765	" " " 31064	O. & W.	7.45	7.4	39.00	23.4
24274	F. W. Brode & Co., Memphis, Tenn. R. H. Ensign Mill, Simsbury, 36178	H. N. Goddard	7.36	6.5	38.50	23.4
23921	H. G. & Co., Olds & Whipple, 79080	O. & W.	7.42	7.5	39.00	23.5
24188	" Spencer Bros., 85865	Bissell-Graves Co.	6.37	6.5	34.00	23.5
24578	" " " 87347	Spencer Bros.	7.00	---	37.00	23.5
24184	" H. K. Brainard, 130992	Geo. Douglass	6.57	6.5	35.10	23.6

ANALYSES OF COTTON SEED MEAL, 1910.—*Continued.*

Station No.	Dealer, Car No. or Marks.	Purchased, Sampled or Sent by.	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
24302	H. G. & Co., Olds & Whipple, 6603	Conn. Tobacco Corporation	6.80	6.6	$36.25	23.6
23992	" " " 7397	O. & W.	7.32	7.5	39.00	23.6
24295	" " " 11954	Conn. Tobacco Corporation	6.77	6.5	36.25	23.7
24299	" " " 47972	" "	6.78	6.5	36.25	23.7
23918	" " " 37698	O. & W.	7.37	7.5	39.00	23.7
24267	" " " 33579 × 26588	"	8.19	8.1	43.00	23.7
24492	" " " 8300	"	8.00	7.9	42.00	23.7
24189	" Spencer Bros., 18324	Bissell-Graves Co.	6.32	6.5	34.00	23.7
24199	" " " 55458	" "	6.31	6.5	34.00	23.7
24212	" Arthur Sikes, 25049	C. F. Whittemore	6.60	---	35.50	23.8
23919	" Olds & Whipple, 85884	O. & W.	7.32	7.5	39.00	23.8
24294	" " " 16464	Conn. Tobacco Corporation	6.74	6.6	36.25	23.8
24296	" " " 47972	" " "	6.74	6.6	36.25	23.8
24297	" " " 6603	" " "	6.73	6.6	36.25	23.8
24298	" " " 11954	" " "	6.77	6.6	36.25	23.8
24711	" " " 124590	O. & W.	7.34	7.5	39.00	23.8
24388	H. E. Bridges & Co., Memphis, Tenn. Olds & Whipple, 11385	"	6.87	6.5	37.00	23.9
23976	Olds & Whipple, 11603	"	7.31	---	39.00	23.9
24708	H. G. & Co., " " 122776	"	7.30	7.5	39.00	23.9
24710	" " " 70012	"	7.40	7.6	39.50	23.9
24194	" Spencer Bros., 17003	Bissell-Graves Co.	6.25	6.5	34.00	23.9
23975	" Olds & Whipple, 15024	O. & W.	7.27	7.5	39.00	24.0
23986	" " " 508896	"	7.28	7.5	39.00	24.0
24626	" " " 17902	"	6.64	6.5	36.00	24.0
24390	H. E. Bridges & Co., Olds & Whipple, 526901	"	6.82	6.5	37.00	24.1
24764	H. G. & Co., " " 123989	"	7.25	7.5	39.00	24.1
24766	" " " 123604	"	7.25	7.5	39.00	24.1

ANALYSES OF COTTON SEED MEAL, 1910.—*Continued.*

Station No.	Dealer, Car No. or Marks.	Purchased, Sampled or Sent by.	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
24767	H. G. & Co., Olds & Whipple, 31128 × 74951	O. & W.	7.24	7.5	$39.00	24.1
24280	" " " 47364	"	7.42	7.5	40.00	24.2
24763	" " " 34454	"	7.10	7.3	38.50	24.2
24888	" " " 124345	"	7.22	7.3	39.00	24.2
24308	" Loomis Bros., Granby, 26440	S. Viets, C. Root and others	6.70	6.5	36.50	24.2
24191	" Spencer Bros., 6767	J. Rose, M. Leahey	6.73	6.5	36.75	24.2
24487	" " " 132440	G. A. Harman, P. Haley and others	6.99	6.5	38.00	24.2
24598	Planters Oil Co., Albany, Ga. G. B. Robinson, N. Y. C., 59371	Ernest Austin	6.35	6.5	35.00	24.3
24468	H. G. & Co., Broad Brook Lumber and Coal Co., 22609	Broad Brook Lumber and Coal Co.	6.67	...	36.50	24.3
24266	H. G. & Co., Olds & Whipple, 61620 × 27207	O. & W.	7.38	7.5	40.00	24.3
24300	" " " 103964 × 56391	"	7.38	7.5	40.00	24.3
24446	" " " 85823 × 17454	"	7.68	7.9	41.50	24.3
24385	H. E. Bridges & Co., Olds & Whipple, 8415	"	6.78	6.5	37.00	24.3
24856	Am. Cotton Oil Co., N. Y. Spencer Bros., 35399	Bissell-Graves Co.	6.63	6.5	36.50	24.4
24713	H. G. & Co., Olds & Whipple, 122385	O. & W.	7.15	7.5	39.00	24.4
24545	" " " 533603	"	6.75	6.5	37.00	24.4
24447	" " " 83454 × 11594	"	7.66	7.9	41.50	24.4
24448	" " " 83723 × 17659	"	7.67	7.9	41.50	24.4
24206	" " " 180656	"	7.30	7.5	40.00	24.5
24198	" Spencer Bros., 64316	D. Barron	6.72	6.5	37.00	24.5
24190	" " " 15267	A. E. Pascoe, O. T. Cone and others	6.71	6.5	37.00	24.5
24479	" Olds & Whipple, 30008	O. & W.	7.30	7.5	40.00	24.6
24301	" " " 74102	"	7.29	7.5	40.00	24.6
24495	" " " 72939 × 9395	"	7.70	7.9	42.00	24.6
24283	H. E. Bridges & Co., Olds & Whipple, 956	"	6.68	6.5	37.00	24.6
24386	" " " " 26690	"	6.68	6.5	37.00	24.6

ANALYSES OF COTTON SEED MEAL, 1910.—*Continued.*

Station No.	Dealer, Car No. or Marks.	Purchased, Sampled or Sent by.	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
24449	H. E. Bridges & Co., Olds & Whipple, 14691	O. & W.	6.68	6.5	$37.00	24.6
24268	“ “ “ “ 67488	“	6.76	6.5	37.50	24.7
24242	H. G. & Co. “ “ 69926	“	7.86	8.1	43.00	24.7
24243	“ “ “ 65068	“	7.87	8.1	43.00	24.7
24253	Arthur Sikes, 6171	D. I. King	6.67	---	37.00	24.7
24221	H. G. & Co., Spencer Bros., 515090	C. Michel and M. Leahey	6.60	6.5	36.75	24.7
24210	Arthur Sikes, 36705	W. C. Knox, H. Fuller, H. A. Henshaw	6.32	---	35.50	24.8
24282	H. E. Bridges & Co., Olds & Whipple, 8520	O. & W.	6.62	6.5	37.00	24.8
24391	“ “ “ “ 12192	“	6.62	6.5	37.00	24.8
24281	H. G. & Co., “ “ 58090	“	7.25	7.5	40.00	24.8
24353	“ “ “	Conn. Tobacco Corporation	6.48	---	36.25	24.8
24491	“ “ “ 105351 × 83655	O. & W.	7.62	7.9	42.00	24.9
24714	“ “ “ 23156	“	6.40	6.5	36.00	24.9
24306	“ Spencer Bros., 140916	J. Cain, J. Riddle and others	6.80	6.5	38.00	24.9
24406	Am. Cotton Oil Co., “ 24604	W. Sikes and A. Organio	6.79	6.5	38.00	25.0
24203	H. G. & Co., “ 45061	G. A. Harmon	6.55	6.5	37.00	25.1
24204	“ “ 94266	M. Leahey and H. Ude	6.50	6.5	36.75	25.1
24223	“ Loomis Bros. Co., 37576	S. F. Holcomb, H. E. Hayden and others	6.55	6.5	37.00	25.1
24254	“ “ “ 7478	F. A. Johnson	6.54	6.5	37.00	25.1
24213	“ Olds & Whipple, 97600	O. & W.	7.76	8.1	43.00	25.1
24741	“ “ “ 36863	“	6.35	6.5	36.00	25.1
24214	“ “ “ 48163	“	7.73	8.1	43.00	25.2
24218	“ Spencer Bros., 7327	G. A. Harmon, A. H. Bridge and others	6.52	6.5	37.00	25.2
24197	“ “ 14883	C. C. Bissell	6.48	6.5	36.75	25.2
24252	Am. Cotton Oil Co., “ 72333	T. Monahan	6.52	6.2	37.00	25.2
24305	H. G. & Co., “ 71282	E. A. Fuller, J. Golin and others	6.73	65	38.00	25.2
24241	“ Loomis Bros. Co., 3403	E. C. Hills	6.52	6.5	37.00	25.2

ANALYSES OF COTTON SEED MEAL, 1910.—*Continued.*

Station No.	Dealer, Car No. or Marks.	Purchased, Sampled or Sent by.	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
24334	H. G. & Co., G. B. Robinson, 18052	E. N. Austin	6.32	6.5	$36.00	25.2
24742	F. W. Brode & Co., R. H. Ensign, Simsbury	H. N. Goddard	6.55	6.5	37.00	25.2
24453	C. C. Johnson & Co., Memphis, Tenn. S. B. Warner, Windsor	A. E. Holcomb	6.33	6.5	36.00	25.2
24182	S. D. Viets, Springfield, Mass.	E. S. Seymour	6.39	6.5	36.45	25.3
24712	H. G. & Co., Olds & Whipple, 122051	O. & W.	6.29	6.5	36.00	25.3
24580	“ Broad Brook L. & C. Co., 5696	Broad Brook L. & C. Co.	6.40	---	36.50	25.3
24577	“ Spencer Bros., 7714	J. Welch, J. Sullivan and others	6.50	6.5	37.00	25.3
24264	“ Arthur Sikes, 3746	R. H. Loomis, G. B. Parks and others	6.50	6.5	37.00	25.3
24272	F. W. Brode & Co., R. H. Ensign, 81764	H. N. Goddard	6.47	6.5	37.00	25.4
24211	Arthur Sikes, 15193	S. H. Graham and E. Perkins	6.33	---	36.25	25.4
24196	H. G. & Co., Spencer Bros, 48345	J. O. Haskins, E. G. Hastings	6.48	6.5	37.00	25.4
24270	H. E. Bridges & Co., Olds & Whipple, 132406	O. & W.	6.58	6.5	37.50	25.4
24383	H. G. & Co., “ “ 11070	Conn. Tobacco Corporation	6.34	---	36.25	25.4
24709	“ “ ‘ 132421	O. & W.	6.25	6.5	36.00	25.5
24384	H. E. Bridges & Co., “ “ 26164	“	6.46	6.5	37.00	25.5
24193	H. G. & Co., Spencer Bros., 5908	G. A. Peckham	6.05	6.2	35.00	25.5
24273	F. W. Brode & Co., R. H. Ensign, 94128	H. N. Goddard	6.46	6.5	37.00	25.5
24382	H. G. & Co., Loomis Bros. Co., 42272	R. B. Chatfield, W. Phelps and others	6.33	6.5	36.50	25.6
24255	“ Olds & Whipple, 22574	O. & W.	6.52	6.5	37.50	25.6
24224	“ “ “ 17762	“	6.60	6.5	38.00	25.7
24761	“ “ “ 81592 × 58149	“	6.20	6.5	36.00	25.7
24743	“ Spencer Bros., 48162	E. C. Holdredge	6.21	6.2	36.00	25.7
24192	“ “ “ 34228	E. A. Fuller and H. Ude	6.36	6.5	36.75	25.7
24209	Arthur Sikes, 11916	D. L. Brockett and J. Orr	6.38	---	37.00	25.8
24389	H. E. Bridges & Co., Olds & W., 559576 × 4248	O. & W.	6.38	6.5	37.00	25.8
24269	“ “ “ 14357	“	6.46	6.5	37.50	25.8

ANALYSES OF COTTON SEED MEAL, 1910.—*Concluded.*

Station No.	Dealer, Car No. or Marks.	Purchased, Sampled or Sent by.	Per cent. of Nitrogen. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
24186	H. G. & Co., Olds & Whipple, 17684	W. S. Pinney	6.92	7.5	$40.00	25.9
24185	" " " 9734	O. & W.	6.89	7.5	40.00	26.0
24762	" " " 38286	"	6.14	6.5	36.00	26.0
24471		Warner Bros.	6.13	---	36.00	26.0
24222	H. G. & Co., Spencer Bros., 62666	A. Anderson, A. Corbin and others	6.48	6.5	38.00	26.1
24623	American Cotton Oil Co.	Thomas Dempsey	6.48	6.5	38.00	26.1
24387	H. E. Bridges & Co., Olds & Whipple, 94805	O. & W.	6.28	6.5	37.00	26.2
24271	" " " " 133382	"	6.35	6.5	37.50	26.3
24195	H. G. & Co., Spencer Bros., 22470	C. O'Brien, S. J. Colter and others	6.07	6.2	36.00	26.3
24200	" " 34772	H. S. Chapman & Co.	5.88	6.2	35.00	26.3
24250	" " 62666	A. Anderson, J. Riddle and others	6.45	6.5	38.00	26.3
24307	" " 69946	E. A. & H. S. Pomeroy	6.25	6.5	37.00	26.3
24201	" " 2718	H. S. Chapman & Co.	5.84	6.2	35.00	26.4
24205	" " 35511	A. Spencer Co., A. Pomeroy	6.10	6.5	36.50	26.5
24277	" H. K. Brainard, A	H. K. B.	6.20	6.5	37.00	26.5
24408	" Broad Brook L. & C. Co., 13819	B. B. L. & C. Co.	6.10	---	36.50	26.5
24579	" Spencer Bros., 4585	E. Halladay, R. Smith and others	5.98	6.5	36.00	26.7
24183	American Cotton Oil Co., H. K. Brainard, 48026	H. K. B.	6.15	6.5	37.00	26.7
24576	H. G. & Co., Spencer Bros., 26989	W. E. Burbank, W. N. Adams and others	5.96	6.5	36.00	26.8
24220	" " 30123	H. S. Chapman & Co. and others	6.12	6.2	37.00	26.9
24470	Olds & Whipple	Manchester Bros., New Hartford	6.44	---	38.80	26.9
24251	F. W. Brode & Co., S. D. Viets, Springfield	Spencer Bros.	6.10	6.5	37.00	27.0
24405	H. G. & Co., Spencer Bros., 38418	Mrs. W. H. Prout and G. N. Thompson	6.28	6.5	38.00	27.0
24202	" " 6102	H. S. Chapman & Co.	5.68	6.2	35.00	27.2
24284	American Cotton Oil Co., " 30071	T. Devine and G. S. Phelps	5.73	6.2	36.00	27.8
24452	" " " "	J. E. Phelps, T. F. Devine and others	5.70	6.2	36.00	28.0
24219	H. G. & Co., " 17544	H. S. Chapman & Co. and others	5.74	6.2	37.00	28.6

This is in our opinion about the limit for it. Tobacco growers should try other forms of nitrogen to replace cotton seed meal, in whole or in part. There is no question that dry ground fish scrap, for instance, could be substituted for a portion at least of the meal. The writer has done it with success. No doubt high grade dried blood could also be used. There is no sound reason for the tradition that tobacco must be raised with vegetable forms of nitrogen only. Whatever form is used, whether animal or vegetable, it must be in fine mechanical condition and quickly available.

We are advised that sample **24183** was bought from Chapin & Co., of Boston, who bought of Fleischmann & Co., of Peekskill, and they in turn from the American Cotton Oil Co., of Memphis, whose tags it bore, with a guaranty of 41 per cent. protein, equivalent to 6.56 per cent. nitrogen. The deficiency in nitrogen was made good to the Connecticut purchaser.

We are also advised that samples **24284** and **24202** sold by H. G. & Co., were bought by them from the American Cotton Oil Co., and came from the Georgia Cotton Oil Mill. They contained much lint and hulls and were of course very inferior. The American Cotton Oil Co., when complaint was made, paid to the dealers and through them to customers who had bought it, a satisfactory rebate and also expenses of the negotiations.

CASTOR POMACE AND CASTOR MEAL.

Castor Pomace, a residue from the manufacture of castor oil and extremely poisonous to stock, which will eat it greedily if they have the chance, is used more or less as a fertilizer for tobacco. The following six samples of ground pomace and castor meal have been examined:

24276. Baker's. Sold by the American Agricultural Chemical Co. Sampled and sent by H. K. Brainard, Thompsonville.

24333. Sold by Olds & Whipple, Hartford. Sampled and sent by E. S. Seymour, Suffield.

24317. Sold by O. & W. and sampled from their stock.

24324. Baker's. Sampled from stock of F. S. Bidwell & Co., Windsor Locks.

24544. Castor Meal. Sold by Sanderson Fertilizer & Chemical Co., New Haven. Sampled and sent by M. L. Gilman, Buckland.

24825. Castor Meal. Sampled from stock of Sanderson F. & C. Co.

ANALYSES.

Station No.	24276	24333	24317	24324	24544	24825
Percentage amounts of						
Nitrogen found	5.34	5.02	4.90	4.65	6.22	6.08
Nitrogen guaranteed	5.0	5.0	5.0	4.2	5.9	6.5
Cost per ton	$25.00	24.00	24.00	24.00	28.50	28.50
Nitrogen costs cents per pound	21.2	21.6	22.1	23.3	21.0	21.5

Castor Pomace also contains about 2.0 per cent. of phosphoric acid and 1.0 per cent. of potash. These are taken into account in computing the cost of nitrogen.

The cost of nitrogen in castor pomace and castor meal ranges from 21.0 to 23.3 cents and averages 21.8 cents per pound, being about 3 cents per pound less than in cotton seed meal.

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

ROCK PHOSPHATE.

25044 is a sample of this material which is used for the manufacture of acid phosphate. In its present condition it is but very slowly available to plants, at least on our Connecticut soils, and cannot be used with profit considering the relative prices of this and other phosphatic materials. This sample contains 32.24 per cent. of phosphoric acid, with 1.55 per cent. of iron oxide and alumina.

BONE ASH.

This is a waste product from copper mills. The sample contains 37.66 per cent. of phosphoric acid in a form which is quite inert as a fertilizer.

BASIC SLAG PHOSPHATE, OR THOMAS SLAG.

This material is a by-product of the steel manufacture, containing from 17 to 19 per cent. of phosphoric acid and 45 to 50 per cent. of lime in finely divided form. The lime is in an efficient form for correcting acidity of the soil. The phosphoric acid is fairly available to plants, though showing small "availability" by the conventional method which is discussed on page 35 of this report. In most cases it will probably be found less quick in its action as a source of phosphoric acid, but more lasting in its effects than acid phosphate.

For top-dressing grass land and for fruit trees it has given very satisfactory results.

All the samples were imported and sold by the Coe-Mortimer Co., of New York.

24248. Sampled and sent by C. L. Gold, West Cornwall.

24292. Sampled and sent by J. F. Shepard, New Haven.

24311. Sampled from stock of Apothecaries Hall Co., Waterbury.

The analysis shows something less than the guaranteed amount and less than the German analysis of the cargo which was represented by our sample. As the goods had been distributed, our agent was unable to draw a second sample of the stock.

24501. Sampled and sent by Thos. Griswold & Sons, Wethersfield.

All these samples are guaranteed to contain from 17 to 19 per cent. of phosphoric acid, of which 15 to 16 per cent. is "available" by Wagner's method of extraction, with 35 to 50 per cent. of lime.

ANALYSES OF THOMAS SLAG.

Station No.	24248	24292	24311	24501
Percentage amounts of				
Phosphoric acid	18.83	17.76	16.95	18.54
Price per ton	.....	$20.00	18.00	19.00

DOMESTIC SLAG.

24207. Sent by T. W. Head, Groton, is stated to be from American Steel Works, not offered for sale in Connecticut, but sent to learn whether it was worth purchasing.

It contained:

Silica and sand	28.94
Oxide of iron and alumina	20.63
Lime	37.77
Magnesia	7.72
Phosphoric acid	4.94
	100.00

Obviously, this material cannot be brought to Connecticut and used to any profit as a fertilizer.

PRECIPITATED BONE PHOSPHATE.

24427. This is a manufacturing waste, bought of Olds & Whipple, Hartford, for experiment. It is a fine white powder, containing phosphoric acid, mostly insoluble in water, but apparently very readily available to plants. It is an excellent form for use as a tobacco fertilizer. It contains:

Water-soluble phosphoric acid	1.72	per cent.
Citrate-soluble phosphoric acid	35.26	
Citrate-insoluble phosphoric acid	4.62	
Total	41.60	

DOUBLE SUPERPHOSPHATE.

24448. Bought by the Station for experiment of Olds & Whipple, Hartford. This is not sold at retail, but is mostly used in the manufacture of mixed fertilizers of high grade. It contains:

Water-soluble phosphoric acid	41.38	per cent.
Citrate-soluble phosphoric acid	2.88	
Citrate-insoluble phosphoric acid	0.90	
Total	45.16	

DISSOLVED ROCK PHOSPHATE OR ACID ROCK AND DISSOLVED BONE BLACK.

(Analyses on page 391.)

These materials are made by treating various mineral phosphates, spent bone black, or bone with oil of vitriol.

24226. Sold by Berkshire Fertilizer Co., Bridgeport. Sampled from stock of T. W. Ryan, Stratford.

24520. Sold by Bowker Fertilizer Co., New York City. Sampled and sent by S. L. Tuttle, Wallingford.

24484. Sold by Atlantic Fertilizer Co., Baltimore. Sampled from stock bought by L. Harkavy, Sec'y, Leonard's Bridge.

24239. Sold by American Agricultural Chemical Co., New York. Sampled from stock of S. D. Woodruff & Sons, Orange.

24622. Sold by National Fertilizer Co., New York. Sampled and sent by A. E. Potwine, E. Windsor.

Analyses of Acid Phosphate.

Station No.	24226	24520	24484	24239	24622	24660	24430	24358
Percentage amount of								
Water-soluble phosphoric acid	13.66	11.92	10.56	12.04	12.78	13.64	12.60	14.54
Citrate-soluble phosphoric acid	2.70	2.43	4.05	2.85	2.61	1.85	2.10	1.83
Citrate-insoluble phosphoric acid	0.19	1.94	1.89	0.87	2.48	0.64	3.73	0.12
Total phosphoric acid	16.55	16.29	16.50	15.76	17.87	16.13	18.43	16.49
Sum of water-soluble and citrate-soluble phosphoric acid found	16.36	14.35	14.61	14.89	15.39	15.49	14.70	16.37
"Available" phosphoric acid guaranteed	16.0	....	14.0	14.0	....	14.0	....	....
Cost per ton	$15.00	13.00	13.85	15.00	15.50	15.50	17.50	17.00
"Available" phosphoric acid costs cents per pound	4.5	4.5	4.7	5.0	5.0	5.0	5.1	5.2

Station No.	24327	24662	24402	24395	24289	24425	24813
Percentage amount of							
Water-soluble phosphoric acid	11.11	11.60	13.68	12.08	11.35	11.62	10.19
Citrate-soluble phosphoric acid	3.52	4.32	0.99	2.88	3.07	3.24	7.09
Citrate-insoluble phosphoric acid	1.55	2.17	0.13	0.74	1.69	1.04	1.01
Total phosphoric acid	16.18	18.09	14.80	15.70	16.11	15.90	18.29
Sum of water-soluble and citrate-soluble phosphoric acid found	14.63	15.92	14.67	14.96	14.42	14.86	17.28
"Available" phosphoric acid guaranteed	....	....	14.0	14.0	....	14.0	....
Cost per ton	$15.50	17.00	....	....	....	....	....
"Available" phosphoric acid costs cents per pound	5.3	5.3	....	....	....	....	....

24660. Sold by Nitrate Agencies Co., New York. Sampled from stock of John Merrill, Suffield.

24430. Sold by E. D. Chittenden Co., Bridgeport. Sampled from stock of D. L. Clark, Milford.

24358. Sold by Wilcox Fertilizer Co., Mystic. Sampled at the factory.

24327. Sold by Bowker Fertilizer Co. Sampled from stock of W. B. Rice, Meriden.

24662. Sold by Rogers Mfg. Co., Rockfall. Sampled from their stock.

24402. Sold by Patrons Exchange, Danielson. Sampled and sent by C. R. Treat, Orange.

24395. Sold by American Agricultural Chemical Co. Sampled from stock bought by Connecticut School for Boys, Meriden.

24289. Sold by Bowker Fertilizer Co. Sampled and sent by John Gotta, Portland.

24425. Sold by American Agricultural Chemical Co. Sampled from stock bought by Andrew Ure, Highwood.

24813. Sold by Rogers Mfg. Co. Sampled from stock of James Hyland, Highwood.

COST AND VALUATION.

The retail cash cost of acid phosphate has ranged from $13.00 to $17.50 per ton and averaged $15.50, making "available" phosphoric acid cost 4.96 cents per pound. In mixed car lots "available" phosphoric acid has been bought by farmers for 4 cents per pound.

III. RAW MATERIALS OF HIGH GRADE CONTAINING POTASH.

HIGH-GRADE SULPHATE OF POTASH.

(ANALYSES ON PAGE 394.)

This chemical should contain about 90 per cent. of pure potassium sulphate (sulphate of potash), equivalent to about 49 per cent. of potassium oxide ("potash"), and it should be nearly free from chlorides. The seven samples analyzed were of good quality, with exception of **24314**, which showed less potash than was guaranteed. A second sample, **24497**, drawn from the same place had a percentage of potash well above what was guaranteed.

The average cost of potash in high grade sulphate has been a little less than 5 cents a pound.

DOUBLE SULPHATE OF POTASH AND MAGNESIA.

(ANALYSES ON PAGE 394.)

This material is usually sold as "sulphate of potash" or "manure salt," on a guaranty of "48-50 per cent. sulphate," which is equivalent to 25.9-27.0 per cent. of potassium oxide. Besides some 46-50 per cent. of potassium sulphate, it contains over 30 per cent. of magnesium sulphate, chlorine equivalent to 3 per cent. of common salt, a little sodium and calcium sulphates, and varying quantities of moisture.

The single sample analyzed was of average composition.

The cost of potash per pound in double sulphate of potash is usually somewhat higher than in high grade sulphate.

MURIATE OF POTASH.

(ANALYSES ON PAGES 394 AND 395.)

Commercial muriate of potash contains about 80 per cent. of muriate of potash (potassium chloride), equivalent to 50.5 per cent. of actual potash, 15 per cent. or more of common salt (sodium chloride) and 4 per cent. or more of water.

Most of the sixteen samples examined were of standard quality. **24499** was drawn from 5 bags and is much below the average composition. Two other samples, **24348** and **24290** from the same firm, show 49.68 and 54.06 per cent. of potash, respectively.

The price per pound of actual potash in the muriate has ranged from 3.8 to 4.8 cents, the average being 4.25 cents.

KAINIT.

(ANALYSES ON PAGE 395.)

Kainit is less uniform in composition than the other potash salts. It contains from 11 to 15 per cent. of potash, more than that quantity of soda, and rather less magnesia. These "bases" are combined with chlorine and sulphuric acid. It usually contains more water than either the sulphate or the muriate of potash and is sold on a guaranty of 12 to 15 per cent. of potash.

A sample, **24658**, drawn from stock bought by August Grulich, Meriden, and taken from a single bag, marked "Kainit," was found to contain 46.21 per cent. of potash, chiefly in form of sul-

POTASH SALTS. PERCENTAGE COMPOSITION AND COST PER POUND OF POTASH.

Station No.	Drawn from Stock in possession of	Sampled and sent by	Potash soluble in water. Found.	Potash soluble in water. Guaranteed.	Cost per ton.	Potash costs cents per pound.
	High Grade Sulphate of Potash.					
24661	John Merrill, Suffield, from Nitrate Agencies Co., N. Y.	Station Agent	50.47	----	$46.00	4.6
24497	Apothecaries Hall Co., Waterbury, from German Kali Works, Baltimore	Station Agent	49.60	48.0	48.00	4.8
24663	Rogers Mfg. Co., Rockfall	Station Agent	49.46	48.0	48.00	4.9
24314	Apothecaries Hall Co., from German Kali Works.	Station Agent	47.56	48.0	48.00	5.0
24357	Wilcox Fertilizer Co., Mystic	Station Agent	48.35	48.0	52.00	5.4
23981	A. A. Young, Jewett City, from C. M. Shay Fertilizer Co., Groton.	A. A. Young	49.00	----	----	----
24432	D. L. Clark, Milford, from Am'n Agric. Chem. Co., N. Y.	Station Agent	50.52	48.0	----	----
	Low Grade Sulphate of Potash.					
24397	Conn. School for Boys, Meriden, from A. A. C. Co., N. Y.	Station Agent	26.59	26.0	----	----
	Muriate of Potash.					
24517	S. L. Tuttle, from Bowker Fertilizer Co., N. Y.	S. L. Tuttle	50.05	49.0	38.00	3.8
24319	Sanderson Fert. & Chem. Co., New Haven.	Station Agent	55.16	50.0	43.00	3.9
24499	Thos. Griswold & Co., S. Wethersfield, from Coe-Mortimer Co., N. Y.	T. Griswold & Co.	47.51	48.0	39.00	4.1
24227	T. W. Ryan, Stratford, from Berkshire Fert. Co., Bridgeport.	Station Agent	48.80	50.5	40.00	4.1
24325	Wm. B. Rice, Meriden, from Bowker Fert. Co.	Station Agent	49.40	49.0	40.50	4.1
24665	Rogers Mfg. Co., Rockfall.	Station Agent	50.27	48.0	42.00	4.2
24313	F. S. Platt Co., New Haven.	Station Agent	51.68	50.0	43.50	4.2

POTASH SALTS. PERCENTAGE COMPOSITION AND COST PER POUND OF POTASH.—*Continued.*

Station No.	Drawn from Stock in possession of	Sampled and sent by	Potash soluble in water. Found.	Potash soluble in water. Guaranteed.	Cost per ton.	Potash costs cents per pound.
	Muriate of Potash, continued.					
24431	D. L. Clark, Milford, from A. A. C. Co.	Station Agent	52.89	49.0	$45.00	4.3
24348	R. H. Morgan, Cheshire, from Coe-Mortimer Co.	Station Agent	54.06	50.0	48.00	4.4
24290	J. F. Shepard, New Haven, from Coe-Mortimer Co.	J. F. Shepard	49.68	48.0	44.40	4.5
24356	Wilcox Fert. Co., Mystic.	Station Agent	48.28	48.0	44.00	4.6
24322	F. S. Bidwell & Co., Windsor Locks, from A. A. C. Co.	Station Agent	52.40	49.0	50.00	4.8
24238	S. D. Woodruff & Sons, from Nitrate Agencies Co.	Station Agent	51.04	50.0	----	----
24287	John Gotta, Portland, from Bowker Fert. Co.	J. Gotta	50.24	49.0	----	----
24394	Conn. School for Boys, Meriden, from A. A. C. Co.	Station Agent	53.45	49.0	----	----
24403	C. R. Treat, Orange.	Station Agent	51.92	49.0	----	----
	Kainit.					
24323	A. D. Bridge's Sons, Hazardville, from A. A. C. Co.	Station Agent	13.32	12.0	14.00	5.3
24393	Conn. School for Boys, Meriden, from A. A. C. Co.	Station Agent	11.75	12.0	----	----

phate. It was apparently sweepings, probably shipped by mistake and contained nearly four times as much potash as kainit, for which it was sold.

VEGETABLE POTASH.

This material, sold by Olds & Whipple, Hartford, is understood to be the ashes of beet residues from the beet sugar manufacture, and is considerably used as a source of potash in tobacco formulas. The single sample examined, **24667**, contained:

Percentage amounts of	
Potash calculated as muriate	1.20
" " " sulphate	1.55
" " " carbonate	23.17
Total water-soluble potash	25.92
Potash costs cents per pound	**8.5**

IV. RAW MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

BONE MANURES.

(ANALYSES ON PAGES 398 AND 399.)

The terms "Bone Dust," "Ground Bone," "Bone Meal" and "Bone" sometimes signify material made from dry, clean and pure bones; in other cases these terms refer to the result of crushing fresh or moist bones which have been cooked in steam tanks to recover grease, and are sometimes sold as "tankage"; or they apply to bone from which a large share of the nitrogenous substance has been extracted in the glue manufacture. When they are equally fine, the nitrogen of all these varieties of bone probably has about the same fertilizing value. But agricultural value of bone depends very largely on its fineness. It is a matter of common observation that a whole bone may lie in the ground for a good while without going to pieces. Fine grinding increases enormously the surface which plant roots and the disintegrating forces of the soil can act upon and by so doing make the nitrogen and phosphoric acid available. Much of the bone now sold is dry and could be easily ground finer than it usually is, and more attention should be paid, both by manufacturers and purchasers, to the fineness of this material. Increased demand for a fine bone dust will soon make it more common in the market.

The table of analyses of bone manures contains a column headed "Valuation per ton."

Full explanation of the meaning of this term, and the method of calculating the "valuation" of fertilizers, is given on pages 40 to 44 of this report and need not here be repeated. The "trade values" used in 1910, however, differ somewhat from those given on page 41 which apply to the previous year. The schedule of trade values in force in 1910 is as follows:

	Cents per pound.
Nitrogen in nitrates	16
ammonia salts	16
Organic nitrogen in dry and fine ground fish, meat and blood, and in mixed fertilizers	20
in fine† bone and tankage	20
in coarse† bone and tankage	15
Phosphoric acid, water-soluble	4½
citrate-soluble‡	4
of fine ground bone and tankage	4
of coarse bone and tankage	3½
of cotton seed meal, castor pomace and ashes	3½
of mixed fertilizers, if insoluble in ammonium citrate‡	2
Potash as high-grade sulphate in forms free from muriate (or chlorides)	5
as muriate	4¼

1. *Bone Manures Sampled by the Station Agent.*

In the tables on pages 398 and 399 are tabulated analyses of twenty-two samples.

GUARANTIES.

Of the samples having a guaranty, six failed in one particular to meet it but the deficiency was met by a corresponding excess of the other ingredient in most cases, so that a full money equivalent was given for the plant food guaranteed.

24842. Rogers & Hubbard's Strictly Pure Fine Bone was found to contain 19.45 per cent. of phosphoric acid. This is

† In this report "fine," as applied to bone and tankage, signifies smaller than $\frac{1}{50}$ inch; and "coarse," larger than $\frac{1}{50}$ inch.

‡ Dissolved from 2 grams of the fertilizer, previously extracted with pure water, by 100 cc. neutral solution of ammonium citrate, sp. gr. 1.09, in thirty minutes, at 65° C., with agitation once in five minutes. Commonly called "reverted" or "backgone" phosphoric acid.

PERCENTAGE COMPOSITION AND VALUATION OF BONE MANURES AND OF TANKAGES.

Station No.	Manufacturer and Name or Brand.	Dealer or Purchaser.	Dealer's cash price per ton.	Valuation per ton.	Percentage difference between cost and valuation.	Chemical Analysis.				Mechanical Analysis.	
						Nitrogen.		Phosphoric Acid.		Finer than 1-50 inch.	Coarser than 1-50 inch.
						Found.	Guar-anteed.	Found.	Guar-anteed.		
	BONE MANURES.										
	Sampled by Station Agent:										
24829	Amer. Agric. Chem. Co., Fine Ground Bone	J. A. Glassnapp; D. L. Clark	$33.00	$27.18	21.4	2.64	2.5	23.52	22.0	56	44
24830	Amer. Agric. Chem. Co., Bone Meal	R. H. Hall, East Hampton	26.00	19.97	30.2	2.15	1.6	16.02	13.7	61	39
24831	Armour Fertilizer Co., Bone Meal	E. A. Buck & Co., Willimantic	34.00	29.08	16.9	1.86	2.0	28.96	24.0	68	32
24483	Atlantic Fertilizer Co., Ground Bone	L. Harkavy, * Leonard's Bridge	29.80	28.02	6.4	1.98	--------	28.38	--------	46	54
24228	Berkshire Fertilizer Co., Fine Ground Bone	T. W. Ryan, Stratford	28.00	27.12	3.2	3.38	3.3	22.02	17.0	28	72
24832	Bohl, Valentine, Self Recommending Fertilizer	Valentine Bohl	28.00	32.04	†12.6	4.06	3.8	22.00	23.0	71	29
24833	Bowker Fert. Co., Bowker's Fresh Ground Bone	Lightbourn & Pond; W. B. Martin	32.50	27.66	17.5	2.70	2.5	23.48	22.9	62	38
24834	Buffalo Fertilizer Co., Bone Meal	L. A. Fenton, Norwich Town	29.00	26.84	8.0	2.40	2.9	24.10	22.0	57	43
24835	Dennis, G. L., Ground Bone	Manufacturer	30.00	27.44	9.3	2.75	3.0	24.86	20.0	34	66
24836	Frisbie Co., The L. T., Frisbie's Fine Bone Meal	"	30.00	31.39	† 4.4	4.05	3.3	22.28	18.0	58	42
24837	Lister Fert. & Chem. W'ks, Lister's Ground Bone	J. A. Foster, Stafford Springs	32.00	19.18	66.8	3.08	2.7	11.59	12.0	43	57
24838	National Fert. Co., Chittenden's Ground Bone	H. A. Bugbee, Willimantic	30.00	20.43	46.8	1.93	1.7	18.06	13.8	53	47
24839	New England Fertilizer Co., Ground Bone	H. S. Pomeroy, Suffield	31.00	27.93	11.0	2.52	2.5	24.97	23.0	57	43
24840	Niantic Menhaden Oil & Guano Co., Ground Bone	W. C. Reynolds, E. Haddam	33.00	25.72	28.3	2.81	2.5	20.52	20.6	60	40
24841	Rogers & Hubbard Co., Hubbard's Raw Knuckle Bone Flour	H. W. Andrews, Wallingford	37.00	32.02	15.6	3.85	3.5	24.72	24.5	50	50
24842	Rogers & Hubbard Co., Hubbard's Strictly Pure Fine Bone	F. S. Platt Co., New Haven	35.00	26.41	32.5	3.70	2.9	19.45	22.0	30	70
24843	Rogers Mfg. Co., Knuckle Bone Flour	Arthur Sikes; W. C. Bulkley	35.50	33.83	4.9	3.85	3.3	25.94	24.0	64	36
24844	Rogers Mfg. Co., Ground Bone	G. W. Eaton, Bristol	32.00	33.42	† 4.2	3.44	2.5	26.28	22.0	77	23
24845	C. M. Shay Fert. Co., Ground Bone	G. M. Williams Co., N. London	35.00	29.79	17.5	2.60	1.7	27.20	22.9	55	45
24846	Shoemaker & Co., M. L., Swift-Sure Pure Bone Meal	Olds & Whipple, Hartford	37.00	37.67	† 1.8	5.38	4.5	23.74	20.0	63	37
24847	Swift's Lowell Fertilizer Co., Swift's Lowell Ground Bone	H. W. Andrews; F. S. Bidwell & Co.	31.00	30.45	1.8	3.07	2.5	26.58	23.0	46	54
24848	Wilcox Fert. Co., Wilcox's Pure Ground Bone	Gallagher Bros., Wallingford	32.00	27.57	1.7	2.72	2.4	24.38	22.0	45	55
	Sampled by Purchasers and others:										
24232	Bowker Fertilizer Co., Bone Meal	W. R. Pierson, Cromwell	24.00	27.39	†12.4	2.48	2.5	25.92	22.3	35	65
24519	Bowker Fertilizer Co., Fresh Ground Bone	S. L. Tuttle, Wallingford	29.00	27.77	4.4	2.35	2.47	24.76	22.88	70	30
25199	Cooper's Glue Factory, Peter, Pure Bone Meal	Fred Lyman, Manchester	27.40	28.67	† 4.4	2.25	2.1	27.06	22.5	60	40
23994	Eastern Chem. Co., Boston, Bone Flour	A. A. Young, Jewett City	28.50	--------	--------	2.00	--------	--------	--------	--------	--------
24572	L. T. Frisbie Co., New Haven, Ground Bone	P. M. Pommeau, Simsbury	30.00	31.15	† 3.7	3.30	3.3	25.36	18.0	60	40
24849	E. L. James, Warrenville, Ground Bone	Sent by Manufacturer	30.00	26.69	12.4	3.90	3.0	20.95	20.0	5	95
23980	C. S. Page, Hyde Park, Vt., Pure Raw Ground Bone	A. A. Young, Jewett City	35.00	29.57	18.4	3.90	4.5	23.74	22.5	20	80
24256	Rogers Mfg. Co., Bone Meal	A. N. Pierson, Cromwell	25.00	28.25	†11.5	0.72	--------	31.82	--------	97	3
24571	Sanderson Fertilizer & Chemical Co., Bone Meal	Noble Bros., Simsbury	28.00	26.13	7.2	3.43	--------	20.64	--------	25	75
25098	C. M. Shay Fert. Co., Bone Meal	T. W. Head, Groton	32.00	--------	--------	2.29	--------	27.10	--------	--------	--------
	TANKAGES.										
	Sampled by Station Agent:										
24236	American Agric. Chem. Co., N. Y.	S. D. Woodruff & Sons, Orange	36.00	33.05	8.9	7.55	7.6	9.39	--------	45	55
24396	" " " " "	Conn. School for Boys, Meriden	--------	28.07	--------	5.84	5.8	10.72	10.0	44	56
24422	" " " " "	Andrew Ure, Highwood	--------	28.90	--------	5.04	4.9	15.26	13.7	47	53
24433	" " " " "	D. L. Clark, Milford	--------	29.32	--------	5.48	4.9	13.52	13.7	50	50
24312	Conn. Fat Rendering & Fert. Corp., New Haven	Manufacturer	25.00	31.72	†21.2	5.60	6.2	16.98	16.5	42	58
24822	Frisbie Co., The L. T., New Haven	"	30.00	26.39	13.7	3.60	4.9	18.38	15.0	50	50
24666	Rogers Manufacturing Co., Rockfall	"	35.00	31.94	9.6	6.45	6.6	13.10	10.5	44	56
24823	" " "	James Hyland, Highwood	--------	35.34	--------	6.66	--------	14.40	--------	65	35
24401	From Chicago	C. R. Treat, Orange	--------	25.02	--------	5.87	--------	6.92	--------	39	61
	Sampled by Purchasers and others:										
24288	Bowker Fertilizer Co., N. Y.	John Gotta, Portland	--------	28.73	--------	4.74	4.9	15.52	13.8	58	42
24518	" " " "	S. L. Tuttle, Wallingford	28.00	28.26	† 0.9	5.35	4.9	12.43	13.7	53	47
24332	Buffalo Fertilizer Co., Buffalo, N. Y.	Tanner & Wilcox, Winsted	30.00	30.92	† 3.0	6.04	6.1	12.65	9.16	54	46
24818	Frisbie Co., The L. T., New Haven	D. W. Meeker, W. Cheshire	30.00	27.49	9.1	4.12	4.7	17.27	15.0	52	48
24584	New Haven Rendering Co.	S. D. Woodruff & Sons	28.00	28.15	† 0.5	4.10	--------	18.45	--------	49	51

* Secretary of a Farmers' Club, not a dealer.

† Valuation exceeds cost.

much less than has been found in this brand in other years, and the manufacturers claim does not represent the average quality of the goods.

COST AND VALUATION.

The average cost per ton of the 22 brands examined was $31.85 and the valuation $28.25. The average cost is half a dollar greater than last year and the average valuation nearly three dollars more.

2. *Sampled by Others than the Station Agent.*

In the tables on pages 398 and 399 are included ten analyses of samples drawn by others than the Station Agent. The Station is responsible only for the analyses: not for the correctness of the sampling of these.

SLAUGHTER-HOUSE TANKAGE.

(ANALYSES ON PAGES 398 AND 399.)

After boiling or steaming various slaughter-house wastes, fat rises to the surface and is removed, the soup is run off and the settlings are dried and sold as tankage. In general, it contains more nitrogen and less phosphoric acid than bone.

1. *Slaughter-House Tankage Sampled by the Station Agent.*

In the table following the bone manures are analyses of nine samples of this material from the Connecticut market.

Tankage has a very wide range of composition, some sorts being quite like bone. This year ground tankage has been on the whole more finely pulverized than bone.

The finer the fertilizer, up to a certain point, the more even will be its distribution in the soil and the quicker will crops get hold of it. There is room for considerable improvement in the mechanical condition of both bone and tankage. Five of the samples had no statement of cost with them. Some were bought in car lots and, therefore, at considerably less than retail market prices, and some no doubt with special discounts which would be of no general interest or value.

2. *Sampled by Others than the Station Agent.*

The table includes analyses of five samples drawn by others than the Station Agent.

DRY GROUND FISH AND ACIDULATED FISH.

(ANALYSES ON PAGE 402.)

This is a by-product from the manufacture of fish oil, a process which removes from the fish little that is of value as a fertilizer.

The fresh fish are cooked by steam, pressed to remove the oil, and dried either in the air or by steam. The scrap is sometimes sprinkled with diluted oil of vitriol, to check putrefaction, whereby the bones are softened and to some extent dissolved. Nineteen samples have been examined, eighteen of which are described in the table. Samples **24814, 24233, 24234** and **24235**, stated to be made by the Wilcox Fertilizer Co., but sold by the Rogers Mfg. Co. to the persons named, have the composition of Wilcox's Dry Ground Acidulated Fish Scrap, which has a guaranty of 7.81 per cent. nitrogen, rather than of their Dry Ground Fish Guano, in which 8.50 per cent. of nitrogen is guaranteed. The tags attached to the goods, however, gave 10 per cent. ammonia as the guaranty. This is equivalent to 8.26 per cent. nitrogen and is not the amount guaranteed in either of the Wilcox brands. In samples drawn by the Station Agent, from two lots of Mr. Graves' purchase, **24455** and **24456**, were found 8.00 and 8.19 per cent. of nitrogen. The manufacturers protested that the analyses of sample **24359** did not represent the average composition of this brand and requested that another sample be drawn elsewhere in this State. This was done and, by its analysis, **24816** shows considerably more nitrogen than was found in the other sample.

COST AND VALUATION.

The seven samples known to be dry ground fish, which were sampled by the Station, have on an average 8.5 per cent. of nitrogen and 8.0 per cent. of phosphoric acid. The average valuation is within one dollar of the average cost.

The six samples of acidulated fish have, on an average, 7.70 per cent. of nitrogen and 5.1 per cent. of phosphoric acid.

Percentage Composition and Valuation of Dry Ground Fish and Acidulated Dry Fish.

Station No.	Manufacturer or Dealer.	Nitrogen. Found.	Nitrogen. Guaranteed.	Phosphoric acid. Water-soluble.	Phosphoric acid. Citrate-soluble.	Phosphoric acid. Citrate-insoluble.	Total phosphoric acid. Found.	Total phosphoric acid. Guaranteed.	Cost per ton.	Valuation per ton	Percentage difference between cost and valuation.
	Dry Ground Fish.										
	Sampled by Station Agent:										
24657	American A. C. Co. Sampled in Suffield, Glastonbury and Granby	8.12	8.2	0.96	4.62	1.24	6.82	-----	$40.00	$37.22	7.5
24225	Berkshire Fertilizer Co. Stock of T. W. Ryan, Stratford	9.33	8.0	0.62	5.35	0.93	6.90	9.0	40.00	42.53	5.9*
24309	Bowker Fertilizer Co. Stock of W. S. Morris, Wethersfield	8.32	8.0	0.82	7.23	0.87	8.92	-----	40.00	39.77	0.6
24328	Essex Fertilizer Co. Stock of Spencer Bros., Suffield	8.30	7.5	0.47	9.59	3.94	14.00	-----	42.00	42.77	1.8*
24426	National Fertilizer Co. Stock of G. A. Williams, Silver Lane	8.64	8.2	0.84	4.62	1.52	6.98	-----	40.00	39.21	2.2
24316	Olds & Whipple, Hartford. Stock of O. & W.	8.06	8.2	0.75	5.20	0.55	6.50	-----	40.00	36.24	10.4
24815	Sanderson Fert. Chem. Co. Sampled at Glastonbury and factory	7.94	8.2	2.07	3.40	0.33	5.80	6.0	40.00	35.80	11.7
24329	Wilcox Fertilizer Co., by Rogers Mfg. Co. Stock of Arthur Sikes, Suffield	8.20	7.8	2.10	4.30	0.41	6.81	-----	40.00	37.22	7.4
24330	Wilcox Fertilizer Co. Stock of Spencer Bros., Suffield	8.82	8.5	0.59	4.12	1.11	5.82	-----	42.00	39.43	6.5
24814	Wilcox Fertilizer Co., by Rogers Mfg. Co. Stock of L. J. Grant, Wapping	7.59	7.8	1.91	3.71	0.38	6.00	5.0	40.00	34.66	15.4
	Sampled by Purchasers and others:										
24720	Bowker Fertilizer Co. Sampled by I. B. Barnard, Bloomfield	8.13	8.2	0.87	6.69	0.86	8.42	-----	40.00	38.64	3.5
24233	Wilcox Fertilizer Co., by Rogers Mfg. Co. Sampled by A. N. Graves, Windsor Locks	8.08	8.2	2.10	3.45	0.27	5.82	5.0	37.00	37.08	0.2*
24234	Wilcox Fertilizer Co., by Rogers Mfg. Co. Sampled by A. N. Graves, Windsor Locks	7.79	8.2	2.05	3.75	0.19	5.99	5.0	37.00	36.09	2.5
24235	Wilcox Fertilizer Co., by Rogers Mfg. Co. Sampled by A. N. Graves, Windsor Locks	7.68	8.2	2.08	3.29	0.26	5.63	5.0	37.00	35.32	4.7
24621	Dealer unknown. Sampled by Michael Donovan, South Windsor	8.44	-----	1.05	6.74	0.59	8.38	-----	38.00	39.59	4.0*
	Acidulated Dry Fish.										
24659	Niantic Menhaden Oil & Guano Co. Sampled in East Haddam and Moodus	5.80	3.3	0.22	3.80	3.50	7.52	3.5	27.00	27.12	0.5*
24359	Wilcox Fertilizer Co. Sampled by Station Agent at factory	7.75	7.8	1.94	3.62	0.30	5.86	5.0	36.50	35.24	3.6
24816	Wilcox Fertilizer Co., by Rogers Mfg. Co. Sampled by Station Agent	8.03	8.2	2.17	3.95	0.29	6.41	5.0	37.00	36.23	2.1

* Valuation exceeds cost.

NITROGENOUS SUPERPHOSPHATES AND GUANOS.

(Analyses on pages 406 to 426.)

Here are included all the commercial mixed fertilizers containing nitrogen, phosphoric acid and potash which have been analyzed in 1910.

We have abandoned the previous practice of tabulating by themselves those mixed fertilizers which were advertised as specially adapted to some special crop, because there were no differences of composition or ingredients distinctive enough to warrant such a separation. The "potato manures," for instance, put out by different manufacturers differ from each other in composition almost as much as the potato manures differ from the corn or market garden manures.

Other changes in the method of tabulation will be noticed. The fertilizer analyses, for instance, are arranged alphabetically, according to the manufacturers' names, so that the analyses of all the brands of each firm appear together. The names of the towns where the samples were drawn are given, but not the names of the particular persons whose stock was sampled. A report of the analysis has been made to each person whose stock was examined, but it does not seem essential to publish all these names in this report.

These various changes are made necessary by the restrictions on the Station printing. The number of pages allowed by the State Board of Control makes it necessary to condense everything into the least possible space. No doubt some will miss the arrangement of the fertilizers in the order of the percentage differences between cost and valuation. These percentage differences are all given in the table and in the case of different fertilizers can readily be compared.

1. *Samples Drawn by the Station Agent.*

In the table pages 406 to 426 are given analyses of two hundred and sixty-four samples. Several of them require explanation or special notice.

Samples Requiring Special Notice.

The American Agricultural Chemical Co.'s Complete Tobacco Manure is of two kinds, the one containing potash as sulphate, and the other as carbonate. **24794**, p. 406, is obviously the former and **24696** the latter kind.

It will be noticed that, in this and other tobacco fertilizers claimed to contain potash in form of carbonate, our analyses show more or less of the potash calculated as sulphate and muriate. In many cases a chemical analysis cannot certainly prove or disprove the statement that potash is present in form of carbonate.

In making valuations for these fertilizers, potash sufficient to combine with the chlorine present is calculated as chloride; potash sufficient to combine with all the sulphuric acid present is calculated as sulphate, and any excess of potash remaining is then calculated as carbonate. We repeat that this does not necessarily conflict with the manufacturer's statement that a part or all of the potash was put into the mixture as high-grade carbonate. The matter has been fully discussed in previous reports.

The American Agricultural Chemical Co. requested that a second sample of their Grass and Lawn Top Dressing be analyzed as **24367** had less nitrogen than was guaranteed, and did not in their opinion represent the general quality of this brand. A second sample, **24533**, had about the same percentage of nitrogen as the other, and a third, **24547**, had the guaranteed amount.

The American Agricultural Chemical Co. made a similar request regarding sample **24634**, p. 408, Great Eastern Northern Corn Special, which contained half a per cent. less nitrogen than was guaranteed. A second sample drawn by our agent from different stock, **24850**, fully met the guaranty.

The above company also asked for a second sample and analysis of their Packer's Union Gardeners' Complete, analysis **24605**, p. 408, having shown a deficiency of about one per cent. of potash. The second sample, **24851**, fully met the guaranty of potash, but was below it in nitrogen.

A similar request was made regarding Wheeler's Havana Tobacco Grower, **24697**, p. 408, the analysis of which showed a deficiency of three-quarters of one per cent. of potash. The second analysis, **24886**, met the guaranty in all respects.

Bowker's Tobacco Ash Elements, **24699**, p. 412, represents a mixture of the three samples drawn respectively from stocks of Seth Viets, West Suffield, W. H. Prout, Suffield, and C. F. Brewer, Silver Lane. The analysis shows 2.8 per cent. more of "available" phosphoric acid and 1.3 per cent. less of potash than

was guaranteed. Separate tests for potash in the three samples gave 13.43, 11.34 and 16.76 per cent. and showed that the three samples were quite unlike in composition. Another sample of the same brand, drawn from the stock of A. D. Bridge's Sons, Hazardville, **25050**, contained 12.91 per cent. of potash, a deficiency of 2.1 per cent. but an overrun of 5 per cent. of "available" phosphoric acid.

Coe-Mortimer Co. protested that analysis **24700** of their Tobacco and Onion Fertilizer (p. 414), which showed a deficiency of about one per cent. of potash, did not represent the quality of this brand. The company submitted affidavits from their factory superintendent, giving the formulas by which the fertilizer had been made and which gave a calculated composition quite different from the Station analysis. The two compare as follows:

	Calculated from Formula.	Station Analysis.	Guaranteed by Manufacturer.
Nitrogen	3.34	3.68	3.0
Total phosphoric acid	6.05	7.96	7.0
Potash	8.00	6.94	8.0

It was not possible to find another sample of this brand on sale after receiving the above protest and making a second analysis. The analysis shows that the overrun in nitrogen and phosphoric acid was more than equivalent in money value to the deficiency in potash.

It is quite possible that in bagging and transit the work of mixing was partially undone and that in the samples taken there was in consequence an undue proportion of the things which contained nitrogen and phosphoric acid (tankage for instance) and a deficiency of potash salts.

Lister's Agricultural Chemical Works advise that in their Complete Tobacco Manure, **24702**, p. 416, carbonate is the only form of potash used, while in the analysis it is all calculated as muriate or sulphate. There is no reason to doubt this statement. Enough sulphuric acid and chlorine were present, however, to combine with all the potash, and carbonate is only used rationally in tobacco manures to avoid the introduction of these acids. See the remarks above, under American Agricultural Chemical Co.'s Tobacco Manure.

The National Fertilizer Co., noting the deficiency of potash in **24789**, p. 418, their Tobacco Special with Carbonate of Potash

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	The American Agricultural Chemical Co., New York City.			
24504	Complete Manure with 10% Potash	Milford, Wilton, Plainville	$39.50	$26.91
24645	Complete Tobacco Manure (from Sulphate)	Windsor Locks, So. Manchester, Glastonbury	36.75	29.30
24794	*Complete Tobacco Manure (from Sulphate)	So. Manchester	35.50	28.48
24696	Complete Tobacco Manure (from Carbonate)	Glastonbury (2)	36.25	28.13
24367	*Grass and Lawn Top Dressing	Meriden, Stafford Springs	36.50	20.99
24533	" " " " "	Wapping	35.00	19.57
24547	" " " " "	So. Manchester	35.00	21.58
24809	Grass and Oats Fertilizer	Wallingford, Milford	19.25	12.55
24747	H. G. Tobacco Manure	Wapping	49.00	35.24
24503	Tobacco Starter and Grower	New Milford, Hazardville	38.50	24.89
	Bradley Branch.			
24369	Complete Manure for Potatoes and Vegetables	Meriden, Norwich Town, Stafford Springs	37.75	26.01
24633	Complete Manure for Top Dressing, Grass and Grain	Hazardville	39.00	23.20
24368	Corn Phosphate	Windsor Locks, Norwich Town, Stafford Springs	32.25	17.99
24600	Eclipse Phosphate	Milford, Putnam	29.00	14.59
24472	Farmers' New Method Fertilizer	Meriden, Stafford Springs, Middletown	30.00	18.29
24599	Niagara Phosphate	Middletown, Putnam	28.50	13.71
24434	Potato Fertilizer	Stafford Springs, Rockville, New Milford	32.00	19.32
24335	Potato Manure	Bristol, Windsor Locks, Suffield	32.75	20.03
24370	Superphosphate	Bristol, Windsor Locks, Norwich Town	32.25	20.28
	Church Branch.			
24505	Fish and Potash	Meriden, Middletown	27.50	17.71
	Crocker Branch.			
24748	Ammoniated Corn Phosphate	So. Coventry	31.00	17.90
24749	Potato, Hop and Tobacco Fertilizer	So. Coventry	31.00	19.27
	Darling Branch.			
24601	Dissolved Bone and Potash	Southington, Wallingford	37.00	24.72
24671	Farm Favorite	Wallingford, Clinton	32.25	18.51
24670	General Fertilizer	Wallingford, Clinton	28.00	15.00
24534	Potato Manure	Wallingford (2), So. Manchester	34.00	19.75

* See note on page 404.

Analyses and Valuations.

Station Number.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Found. As Muriate.	Found. Total.	Guaranteed.
24504	46.8	0.36	2.11	1.07	3.54	3.3	5.28	1.47	0.89	7.64	7.0	6.75	6.0	9.93	9.93	10.0
24645	25.4	----	0.20	4.37	4.57	4.5	0.50	5.33	2.46	8.29	4.0	5.83	3.0	1.50	5.71	5.5
24794	24.6	----	0.18	4.14	4.32	4.5	0.41	5.67	2.70	8.78	4.0	6.08	3.0	1.61	5.59	5.5
24696	28.9	0.14	0.10	4.24	4.48	4.5	0.13	5.01	3.79	8.93	4.0	5.14	3.0	0.41	†3.80	5.5
24367	73.9	2.96	0.18	0.65	3.79	3.9	2.80	3.93	1.25	7.98	6.0	6.73	5.0	2.57	2.57	2.0
24533	78.8	2.18	1.22	0.36	3.76	3.9	5.11	0.79	0.19	6.09	6.0	5.90	5.0	2.28	2.28	2.0
24547	62.2	2.13	1.52	0.25	3.90	3.9	2.98	4.31	0.92	8.21	6.0	7.29	5.0	2.82	2.82	2.0
24809	53.4	----	---	---	----	--	9.31	2.15	1.15	12.61	12.0	11.46	11.0	2.34	2.34	2.0
24747	39.0	----	3.08	2.44	5.52	5.8	4.54	1.74	0.32	6.60	6.0	6.28	5.0	1.49	10.23	10.0
24503	54.7	----	2.14	1.42	3.56	3.3	6.05	3.10	0.93	10.08	9.0	9.15	8.0	0.66	4.16	4.0
24369	45.1	0.90	1.30	1.14	3.34	3.3	6.90	1.76	1.47	10.13	9.0	8.66	8.0	6.50	7.17	7.0
24633	68.1	1.19	3.00	0.55	4.74	4.9	4.57	1.16	0.28	6.01	6.0	5.73	5.0	2.87	2.87	2.5
24368	79.3	0.26	0.80	1.11	2.17	2.1	6.65	2.51	1.50	10.66	9.0	9.16	8.0	1.83	1.83	1.5
24600	98.8	0.15	0.44	0.69	1.28	1.0	6.55	2.23	1.05	9.83	9.0	8.78	8.0	2.17	2.17	2.0
24472	64.0	0.23	0.68	1.05	1.96	1.7	6.96	2.11	1.34	10.41	9.0	9.07	8.0	3.15	3.15	3.0
24599	107.9	0.15	0.42	0.63	1.20	0.8	6.13	2.44	1.19	9.76	8.0	8.57	7.0	1.67	1.67	1.0
24434	65.6	0.42	0.72	1.04	2.18	2.1	7.02	2.53	1.43	10.98	9.0	9.55	8.0	3.07	3.07	3.0
24335	63.5	0.10	1.55	1.03	2.68	2.5	4.94	1.97	0.70	7.61	7.0	6.91	6.0	5.08	5.08	5.0
24370	59.0	0.37	1.20	1.05	2.62	2.5	7.54	2.32	1.10	10.96	10.0	9.86	9.0	2.32	2.32	2.0
24505	55.3	----	0.40	1.98	2.38	2.1	4.33	2.60	1.01	7.94	7.0	6.93	6.0	2.50	2.50	2.0
24748	73.2	0.38	0.90	0.92	2.20	2.1	7.34	2.20	1.22	10.76	9.0	9.54	8.0	1.48	1.48	1.5
24749	60.9	0.69	0.85	0.67	2.21	2.1	7.26	2.37	0.92	10.55	9.0	9.63	8.0	3.36	3.36	3.0
24601	49.7	0.13	1.20	1.23	2.56	2.5	5.29	2.37	0.76	8.42	7.0	7.66	6.0	10.09	10.09	10.0
24671	74.2	0.13	1.10	0.97	2.20	2.1	6.44	2.38	0.90	9.72	9.0	8.82	8.0	3.09	3.09	3.0
24670	86.7	0.21	0.31	0.86	1.38	1.2	4.65	2.00	1.12	7.77	7.0	6.65	6.0	4.31	4.31	3.0
24534	72.2	----	1.68	0.85	2.53	2.5	5.18	1.98	0.55	7.71	7.0	7.16	6.0	5.31	5.31	5.0

† 1.71 per cent. potash as sulphate, 1.68 per cent. as carbonate.

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	East India Branch.			
24602	A. A. Ammoniated Superphosphate	New Haven, So. Manchester	$33.50	$20.51
24750	Potato Manure	So. Manchester	38.00	25.30
	Great Eastern Branch.			
24729	General	Madison	31.00	15.46
24646	H. G. Vegetable, Vine and Tobacco Fertz.	East Hampton, Rocky Hill	34.00	20.54
24634	*Northern Corn Special	East Hampton, Granby	32.00	18.97
24850	" " "	East Lyme	33.00	20.82
	North Western Branch.			
24336	Fish, Bone and Potash	New Haven, Bristol, Suffield	30.50	17.81
24435	Market Garden Phosphate	Southport, New Milford	33.50	22.17
24410	10% Potato Fertilizer	New Haven, Waterbury, Southport, Milford	35.00	24.09
24535	Universal Fertilizer	Suffield, Avon	32.50	21.32
	Packers' Union Branch.			
24604	Animal Corn Fertilizer	Somerville, Waterford	31.00	18.88
24605	*Gardeners' Complete Manure	New Canaan, Granby	37.00	25.19
24851	" " "	Watertown	37.00	25.50
24603	Potato Manure	New Canaan, Somerville	34.00	20.90
24751	Universal Fertilizer	East Hampton	29.00	16.15
	Quinnipiac Branch.			
24768	Climax Phosphate	Plainfield	28.00	16.28
24606	Corn Manure	Westport, Plainfield	30.00	18.09
24412	Market Garden Manure	Southport, Westport, Norwalk	36.50	26.18
24460	Phosphate	New London, Westport	32.50	20.74
24411	Potato Manure	New London, Southport, Westport	31.75	21.48
24769	Potato Phosphate	New London	31.00	20.15
	Read Branch.			
24461	Practical Potato Special	New Canaan, Wilton	31.50	15.19
24673	Standard Superphosphate	W. Hartford, So. Meriden	30.00	16.07
24672	Vegetable and Vine Fertilizer	East Canaan, So. Meriden	33.50	20.33
	Wheeler Branch.			
24607	Corn Fertilizer	Granby, So. Coventry	30.00	16.73
24810	Grass and Oats	New Canaan, Granby	22.50	12.40
24697	*Havana Tobacco Grower	East Granby, Granby	36.00	24.92
24886	" " "	East Granby	35.00	26.46
24608	Potato Manure	New Canaan, Granby	31.50	19.31
	Williams and Clark Branch.			
24770	Americus Ammoniated Bone Superphosphate	Waterbury	35.00	20.52
24536	Americus Corn Phosphate	Milford, Wallingford, Wapping	31.50	16.84

* See note on page 404.

Analyses and Valuations—*Continued.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Guaranteed.	Phosphoric Acid. Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Guaranteed.	So-called "Available." Found.	Guaranteed.	Potash. Found. As Muriate.	Total.	Guaranteed.
24602	63.3	0.29	1.24	1.14	2.67	2.5	7.03	3.05	1.10	11.18	10.0	10.08	9.0	2.17	2.17	2.0
24750	50.2	----	2.05	1.05	3.10	3.3	5.41	1.25	0.38	7.04	7.0	6.66	6.0	7.97	9.72	10.0
24729	100.5	----	0.22	0.88	1.10	0.8	7.21	1.26	1.16	9.63	9.0	8.47	8.0	3.86	3.86	4.0
24646	65.5	0.32	0.80	1.03	2.15	2.1	6.56	1.99	1.11	9.66	9.0	8.55	8.0	5.78	5.78	6.0
24634	68.7	0.58	0.78	0.64	2.00	2.5	7.43	2.77	2.75	12.95	10.0	10.20	9.0	2.40	2.40	2.0
24850	58.5	0.82	0.76	1.18	2.76	2.5	6.92	2.27	1.65	10.84	10.0	9.19	9.0	2.75	2.75	2.0
24336	71.3	----	0.26	2.23	2.49	2.5	2.88	1.79	0.83	5.50	5.0	4.67	4.0	4.37	4.37	4.0
24435	51.1	----	1.07	1.37	2.44	2.5	7.30	1.48	0.47	9.25	9.0	8.78	8.0	6.27	6.27	6.0
24410	45.3	----	0.92	1.02	1.94	1.7	6.33	2.53	1.07	9.93	9.0	8.86	8.0	10.49	10.49	10.0
24535	52.4	----	1.07	1.38	2.45	2.5	7.27	2.46	0.94	10.67	9.0	9.73	8.0	4.10	4.10	4.0
24604	64.2	0.73	1.00	0.78	2.51	2.5	7.30	1.75	1.16	10.21	10.0	9.05	9.0	2.11	2.11	2.0
24605	46.9	----	1.80	0.99	2.79	2.5	5.51	1.81	1.20	8.52	7.0	7.32	6.0	2.67	8.98	10.0
24851	45.1	0.09	1.22	0.73	2.04	2.5	5.80	1.57	3.63	11.00	7.0	7.37	6.0	1.36	10.66	10.0
24603	62.7	0.41	0.99	0.90	2.30	2.1	6.74	1.76	1.07	9.57	9.0	8.50	8.0	5.78	5.78	6.0
24751	79.6	0.08	0.70	0.32	1.10	0.8	6.19	2.78	1.87	10.84	9.0	8.97	8.0	4.51	4.51	4.0
24768	72.0	0.20	0.65	0.89	1.74	1.1	6.80	2.01	1.02	9.83	9.0	8.81	8.0	2.19	2.19	2.0
24606	65.8	0.85	0.77	0.76	2.38	2.1	5.95	2.88	1.39	10.22	9.0	8.83	8.0	1.94	1.94	1.5
24412	39.4	----	2.27	1.11	3.38	3.3	6.91	1.98	1.00	9.89	9.0	8.89	8.0	7.39	7.39	7.0
24460	56.7	0.56	1.10	1.07	2.73	2.5	8.11	1.88	1.24	11.23	10.0	9.99	9.0	2.18	2.18	2.0
24411	47.8	0.70	0.72	1.20	2.62	2.5	5.82	1.88	0.83	8.53	7.0	7.70	6.0	5.97	5.97	5.0
24769	53.8	0.76	0.79	0.80	2.35	2.1	8.07	2.10	1.28	11.45	9.0	10.17	8.0	2.99	2.99	3.0
24461	107.4	----	0.15	0.83	0.98	0.8	3.68	1.33	0.80	5.81	5.0	5.01	4.0	7.88	7.88	8.0
24673	86.7	----	0.40	0.69	1.09	0.8	7.06	2.10	1.82	10.98	9.0	9.16	8.0	3.85	3.85	4.0
24672	64.8	----	1.20	0.78	1.98	2.1	6.84	1.65	1.26	9.75	9.0	8.49	8.0	6.34	6.34	6.0
24607	79.3	0.22	0.73	0.89	1.84	1.7	7.18	1.88	0.94	10.00	9.0	9.06	8.0	2.11	2.11	2.0
24810	81.5	----	---	---	----	---	8.49	2.41	2.70	13.60	12.0	10.90	11.0	2.06	2.06	2.0
24697	44.5	----	1.94	0.74	2.68	2.5	5.62	1.49	1.13	8.24	7.0	7.11	6.0	1.25	9.24	10.0
24886	32.4	0.12	1.24	1.21	2.57	2.5	5.93	1.72	1.22	8.87	7.0	7.65	6.0	1.62	10.30	10.0
24608	63.1	0.09	1.68	0.49	2.26	2.1	7.12	2.05	1.81	10.98	9.0	9.17	8.0	3.42	3.42	3.0
24770	70.6	----	1.31	1.43	2.74	2.5	6.81	2.91	1.24	10.96	10.0	9.72	9.0	1.94	1.94	2.0
24536	87.0	0.54	1.06	0.52	2.12	2.1	7.12	1.72	0.99	9.83	9.0	8.84	8.0	1.71	1.71	1.5

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent: Williams and Clark Branch (Continued).			
24647	Americus H. G. Special Fertilizer	Plainville, Wapping	$38.00	$25.43
24648	Americus Potato Manure	Milford, Collinsville	31.50	18.03
24609	Potato Phosphate	Waterbury, Wallingford	34.50	19.72
	The Armour Fertilizer Works, Baltimore, Md.			
24413	All Soluble	New Haven, Willimantic, Norwalk	33.50	21.65
24462	Ammoniated Bone with Potash	Willimantic, Danbury	30.00	17.69
24506	Bidwell's Formula for all Crops	Windsor Locks	30.00	22.91
24635	Bone, Blood and Potash	Thompsonville, Bridgeport	38.25	28.44
24559	Complete Potato	Branford, Danbury, Putnam	32.00	19.37
24610	Corn King	Danbury, Putnam	29.50	20.21
24473	Fish and Potash	Branford, Norwalk, Meriden	27.25	16.28
24537	Fruit and Root Crop Special	Danbury, Meriden	27.50	19.62
24436	Market Garden	New Haven, Branford, Danbury	36.50	25.16
24414	High Grade Potato	New Haven, Willimantic, Norwalk	33.75	22.13
24852	Wheat, Corn and Oats Special	Colchester	25.00	15.27
	Atlantic Fertilizer Co., Baltimore, Md.			
24475	*Early Truck and Vegetable Manure	Leonard's Bridge	26.00	21.90
24474	*H. G. Truck and Potato Special	Leonard's Bridge	30.00	25.67
	Berkshire Fertilizer Co., Bridgeport, Conn.			
24561	Ammoniated Bone Phosphate	Danbury, Waterbury, Stafford	28.75	15.65
24507	Complete Fertilizer	Southport, Waterbury, Plantsville	34.00	23.76
24611	Grass Special	Stafford, Yantic	36.50	25.66
24538	Long Island Special	Southport, Plantsville	35.00	26.57
24560	Potato and Vegetable Phosphate	Danbury, Waterbury, Stafford	31.25	17.44
24730	Tobacco Special	Glastonbury, Bridgeport	35.50	24.92
	F. E. Boardman, Westfield, Conn. (*Made for*)			
24548	Complete Fertilizer	Westfield	34.00	28.38
	Bowker Fertilizer Co., New York City.			
24772	Bone and Wood Ash Fertilizer	New Haven	30.00	15.77
24649	Complete Alkaline Tobacco Grower	Thompsonville, Silver Lane, Ellington	34.25	27.98

* Bought from manufacturer. Brand not entered for sale in this State.

Analyses and Valuations—*Continued.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen.		Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.		So-called "Available."		Found.		Guaranteed.
					Found.	Guaranteed.				Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	
24647	49.4	0.49	2.24	0.70	3.43	3.3	7.23	1.25	0.58	9.06	9.0	8.48	8.0	7.24	7.24	7.0
24648	74.7	0.52	0.90	0.69	2.11	2.1	6.85	1.96	0.75	9.56	9.0	8.81	8.0	3.16	3.16	3.0
24609	74.9	0.06	1.76	0.82	2.64	2.5	5.28	1.70	0.40	7.38	7.0	6.98	6.0	5.12	5.12	5.0
24413	54.7	1.19	0.72	1.10	3.01	2.9	6.84	2.16	0.56	9.56	8.5	9.00	8.0	3.57	3.57	4.0
24462	69.6	0.93	0.24	1.15	2.32	2.5	5.46	1.89	0.86	8.21	6.5	7.35	6.0	3.03	3.03	2.0
24506	30.9	0.49	0.25	1.79	2.53	2.5	6.92	2.07	0.59	9.58	8.5	8.99	8.0	4.45	5.92	5.0
24635	34.5	1.70	0.19	2.04	3.93	4.1	6.82	1.80	0.54	9.16	8.5	8.62	8.0	7.57	7.57	7.0
24559	65.2	1.10	0.20	0.58	1.88	1.7	7.23	1.35	0.30	8.88	7.5	8.58	7.0	6.09	6.09	6.0
24610	46.0	1.43	0.14	0.43	2.00	2.5	7.79	1.36	0.43	9.58	8.5	9.15	8.0	6.11	6.11	4.0
24473	67.4	0.60	0.16	1.30	2.06	2.1	5.06	1.77	1.11	7.94	6.5	6.83	6.0	2.63	2.63	2.0
24537	40.2	1.02	0.12	0.81	1.95	1.7	7.37	1.64	0.44	9.45	8.5	9.01	8.0	5.43	5.43	5.0
24436	45.1	1.06	0.70	1.48	3.24	3.3	6.65	1.69	0.58	8.92	8.5	8.34	8.0	7.10	7.10	7.0
24414	52.5	0.58	0.15	0.70	1.43	1.7	7.33	1.69	0.63	9.65	8.5	9.02	8.0	10.34	10.34	10.0
24852	63.7	0.28	0.10	1.20	1.58	0.8	6.52	1.97	0.50	8.99	8.5	8.49	8.0	1.88	1.88	1.0
24475	18.7	----	1.58	1.52	3.10	3.3	2.92	3.06	1.34	7.32	---	5.98	6.0	6.05	6.05	5.0
24474	16.9	0.71	0.88	0.93	2.52	3.3	8.68	1.36	0.55	10.59	---	10.04	8.0	9.11	9.11	10.0
24561	83.7	0.19	0.09	1.12	1.40	0.8	6.93	1.91	0.65	9.49	9.0	8.84	8.0	2.63	2.63	2.0
24507	43.1	0.56	0.70	1.48	2.74	2.5	6.49	2.18	0.54	9.21	9.0	8.67	8.0	7.07	7.07	6.0
24611	42.2	2.35	1.03	1.84	5.22	5.0	2.76	2.18	0.54	5.48	5.0	4.94	4.0	3.58	3.58	2.0
24538	31.7	----	1.69	1.88	3.57	3.3	4.89	2.24	0.49	7.62	7.0	7.13	6.0	8.53	8.53	7.0
24560	79.2	0.23	1.00	0.87	2.10	1.7	4.73	1.42	0.35	6.50	7.0	6.15	6.0	5.27	5.27	4.0
24730	42.5	----	1.60	2.32	3.92	4.1	2.94	2.14	0.68	5.76	4.0	5.08	3.0	1.09	6.05	5.0
24548	19.8	0.59	0.48	2.29	3.36	2.9	5.28	2.40	0.47	8.15	---	7.68	7.0	10.51	10.51	10.0
24772	90.2	----	0.15	1.57	1.72	1.7	1.50	5.42	2.74	9.66	7.0	6.92	6.0	2.61	2.61	2.0
24649	22.4	0.40	0.10	3.72	4.22	4.1	1.10	4.18	3.76	9.04	5.0	5.28	4.0	0.73	5.78	5.0

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent: **Bowker Fertilizer Co.** *(Continued).*			
24775	Complete Alkaline Tobacco Grower (with Carbonate)	West Suffield	$35.50	$29.37
24539	Corn Phosphate	Rockville, Sharon	29.00	17.27
24437	Early Potato Manure	Wethersfield, Yalesville, So. Norwalk	37.25	25.90
24540	Farm and Garden Phosphate	Hazardville, Meriden	27.00	16.51
24337	Fisherman's Brand Fish and Potash	Waterbury, Wethersfield, Meriden	27.50	18.71
24415	Gloucester Fish and Potash	New Haven, Yalesville	25.00	14.30
24338	Hill and Drill Phosphate	Waterbury, Hazardville, Yalesville	34.00	20.15
24773	Lawn and Garden Dressing	New Haven	50.00	19.22
24463	Market Garden Fertilizer	Wethersfield, Yalesville, Sharon	36.50	25.61
24373	Potato and Vegetable Fertilizer	Hazardville, Yalesville, Yantic	34.25	21.45
24562	Potato and Vegetable Phosphate	Rockville, Danielson, Norwich	31.75	16.92
24464	Sure Crop Phosphate	Yalesville, Yantic, Sharon	26.75	14.63
24699	*Tobacco Ash Elements	West Suffield, Suffield, Silver Lane	33.00	22.62
25050	" " "	Hazardville	35.00	23.57
24698	Tobacco Starter	Hazardville, Silver Lane	36.50	21.37
24371	Stockbridge Spec. Comp. Manure for Corn and All Grain Crops	Yantic, Meriden, Rockville	38.00	27.09
24339	Stockbridge Spec. Comp. Manure for Potatoes and Vegetables	New Haven, Waterbury, Wethersfield	40.00	27.26
24636	Stockbridge Spec. Comp. Manure for Seeding Down, etc.	Sharon	35.00	24.38
24372	Stockbridge Spec. Comp. Manure for Top Dressing and for Forcing	Wethersfield, Meriden, Rockville	38.00	27.63
24774	Stockbridge Spec. Comp. Manure for Tobacco	Wapping	48.00	32.71
	The Buffalo Fertilizer Co., Buffalo, N. Y.			
24361	Celery and Potato Special	Plainville, West Cheshire, Westville	33.50	21.32
24375	Farmer's Choice	Plainville, Westville, Norwich Town	25.00	17.59
24417	Fish Guano	Westville, Manchester, Branford	24.25	16.01
24416	High Grade Manure	Plainville, West Cheshire, Manchester	36.50	27.52
24542	New England Special	Plainville	29.00	20.51
24731	Tobacco Producer	West Suffield, East Windsor Hill	38.00	25.96

* See note on page 404. † 3.35 per cent. potash as sulphate, 2.52 per cent. as carbonate.

Analyses and Valuations—*Continued.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen.			Total Nitrogen.		Phosphoric Acid.			Total.		So-called "Available."		Potash. Found.		
		As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.
24775	20.9	1.04	0.06	3.07	4.17	4.1	0.68	5.02	3.24	8.94	5.0	5.70	4.0	0.31	†6.18	5.0
24539	67.9	0.30	0.75	0.80	1.85	1.7	6.76	2.73	1.36	10.85	9.0	9.49	8.0	2.25	2.25	2.0
24437	43.8	----	1.47	1.84	3.31	3.3	5.91	2.36	1.20	9.47	8.0	8.27	7.0	7.23	7.23	7.0
24540	63.5	----	0.56	1.06	1.62	1.7	5.43	3.72	1.88	11.03	9.0	9.15	8.0	2.19	2.19	2.0
24337	47.0	0.26	0.58	1.69	2.53	2.5	3.24	2.33	1.22	6.79	5.0	5.57	4.0	4.69	4.69	4.0
24415	74.8	0.10	0.10	0.84	1.04	0.8	6.84	2.92	1.42	11.18	9.0	9.76	8.0	1.45	1.45	1.0
24338	68.7	0.11	1.92	0.55	2.58	2.5	7.44	2.67	1.43	11.54	10.0	10.11	9.0	2.41	2.41	2.0
24773	----	0.83	1.92	0.33	3.08	3.3	2.53	2.44	0.63	5.60	8.0	4.97	4.0	5.43	5.43	5 0
24463	42.5	0.09	1.23	1.48	2.80	2.5	5.37	2.08	1.16	8.61	7.0	7.45	6.0	10.01	10.01	10.0
24373	59.7	0.34	1.12	1.16	2.62	2.5	6.33	2.74	1.38	10.45	9.0	9.07	8.0	4.35	4.35	4.0
24562	87.6	0.34	0.66	0.82	1.82	1.7	6.56	2.78	1.57	10.91	9.0	9.34	8.0	1.99	1.99	2.0
24464	82.8	----	0.10	0.88	0.98	0.8	7.20	2.44	1.50	11.14	10.0	9.64	9.0	2.07	2.07	2.0
24699	45.9	----	---	---	----	--	1.44	7.35	4.67	13.46	----	8.79	6.0	1.06	13.73	15.0
25050	48.5	----	---	---	----	--	1.88	9.15	4.32	15.35	----	11.03	6.0	0.51	12.91	15.0
24698	70.8	0.26	1.26	1.08	2.60	2.5	6.49	2.58	0.92	9.99	9.0	9.07	8.0	0.96	3.05	3.0
24371	40.3	1.07	1.65	0.66	3.38	3.3	8.52	2.01	0.87	11.40	11.0	10.53	10.0	7.20	7.20	7.0
24339	46.7	0.83	0.94	1.63	3.40	3.3	4.17	2.62	1.55	8.34	7.0	6.79	6.0	10.12	10.12	10.0
24636	43.6	0.11	1.40	1.09	2.60	2.5	5.21	2.01	0.92	8.14	9.0	7.22	6.0	10.02	10.02	10.0
24372	37.5	1.21	1.50	2.17	4.88	4.9	2.87	2.81	0.63	6.31	6.0	5.68	4.0	6.12	6.12	6.0
24774	46.7	1.05	3.49	1.01	5.55	5.8	3.14	1.32	0.67	5.13	5.0	4.46	4.0	1.30	10.17	10.0
24361	57.1	0.80	0.40	0.73	1.93	1.6	4.90	3.46	1.16	9.52	9.0	8.36	8.0	8.14	8.14	10.0
24375	42.1	0.10	0.35	0.87	1.32	0.8	5.68	3.46	1.41	10.55	9.0	9.14	8.0	4.72	4.94	5.0
24417	51.5	0.52	0.12	0.63	1.27	0.8	5.60	3.61	1.22	10.43	10.0	9.21	9.0	3.56	3.56	2.0
24416	32.6	1.17	1.15	1.19	3.51	3.3	4.57	2.75	0.83	8.15	8.0	7.32	7.0	10.23	10.23	10.0
24542	41.4	----	0.54	1.44	1.98	1.6	3.20	6.03	2.35	11.58	10.0	9.23	9.0	5.15	5.15	5.0
24731	46.4	0.50	0.74	2.86	4.10	4.5	2.67	2.41	0.88	5.96	6.0	5.08	5.0	6.90	6.90	5.5

NITROGENOUS SUPERPHOSPHATES.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent: **The Buffalo Fertilizer Co.** *(Continued).*			
24541	Top Dresser	West Cheshire, Manchester	$41.00	$30.87
24374	Vegetable and Potato	Plainville, West Cheshire, Norwich Town	33.50	22.97
	The E. D. Chittenden Co., Bridgeport, Conn.			
24732	Connecticut Tobacco Grower	Broad Brook (2)	45.50	32.95
24740	Dissolved Bone Phosphate	Milford, Broad Brook	28.50	17.51
24735	Fish and Potash	Broad Brook (2)	28.00	20.57
24738	Grass and Grain	Broad Brook	36.00	27.68
24739	High Grade Potato	Milford	38.00	27.61
24737	Potato and Grain	Broad Brook	30.00	24.64
24736	Potato Manure	Broad Brook (2)	30.00	21.30
24734	Tobacco Grower	Broad Brook (2)	34.00	25.08
24733	Tobacco Special	Broad Brook (2)	34.50	25.13
	The Everett B. Clark Seed Co., Milford, Conn.			
24418	Special Mixture for General Use	Milford	31.00	26.78
24438	10% Brand	Milford	34.00	28.00
	The Coe-Mortimer Co., New York City.			
24637	Celebrated Special Potato Fertilizer	West Hartford, Torrington	33.50	18.45
24776	Genuine Peruvian Guano, Lobos Grade	So. Norwalk, Wethersfield	36.50	25.78
24543	Gold Brand Excelsior Guano	West Hartford, Southington	32.00	21.67
24563	H. G. Ammoniated Bone Superphosphate	West Hartford, Somerville, Norwich	32.25	17.74
24638	New Englander Corn and Potato Fertilizer	Riverton, Winsted, Torrington	28.00	13.80
24777	Peruvian Vegetable Grower	Cheshire	43.00	29.14
24549	Red Brand Excelsior Guano	Cheshire, Wilton, Somerville	37.50	26.47
24700	*Tobacco and Onion Special	Somerville	37.00	25.95
	Conn. Valley Orchard Co., Berlin, Conn.			
24360	H. G. Complete Fertilizer	Berlin	27.00	21.76
	Peter Cooper's Glue Factory, New York City.			
24650	†Sterling H. G. Potato and Tobacco Fertilizer	East Canaan	23.00	21.38
	T. H. Eldredge, Norwich, Conn. *(Made for)*			
24362	Fish and Potash	Norwich	28.00	18.52
24363	Special Superphosphate	Norwich	27.00	15.48

* See note, page 405. † Bought of manufacturer. Brand not entered for sale in this State.

ANALYSES AND VALUATIONS—*Continued.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
24541	32.8	1.35	2.26	2.19	5.80	5.7	4.34	2.34	0.82	7.50	7.0	6.68	6.0	5.23	5.23	5.0
24374	45.8	0.85	1.15	0.73	2.73	2.4	5.40	2.82	0.52	8.74	9.0	8.22	8.0	7.44	7.44	7.0
24732	38.1	0.34	2.24	2.50	5.08	5.0	1.04	4.43	1.02	6.49	6.0	5.47	4.0	0.80	9.92	8.0
24740	62.8	----	0.92	0.66	1.58	1.7	5.36	3.78	4.01	13.15	10.0	9.14	8.0	2.93	2.93	2.0
24735	36.1	0.13	1.18	1.41	2.72	2.5	6.09	1.06	1.55	8.70	6.0	7.15	--	4.45	4.45	4.0
24738	30.1	0.11	3.50	0.57	4.18	4.1	5.72	1.29	1.66	8.67	8.0	7.01	6.0	8.25	8.25	5.0
24739	37.6	----	2.88	1.00	3.88	4.1	6.22	2.01	1.94	10.17	10.0	8.23	8.0	7.53	7.53	7.0
24737	21.8	----	2.06	1.09	3.15	3.3	7.62	1.73	2.15	11.50	10.0	9.35	8.0	5.40	5.40	6.0
24736	40.8	----	1.27	0.73	2.00	2.0	7.43	1.45	1.70	10.58	10.0	8.88	8.0	6.81	6.81	6.0
24734	35.6	0.17	2.32	0.81	3.30	3.3	8.12	1.62	1.51	11.25	10.0	9.74	8.0	0.44	4.74	5.0
24733	37.3	----	2.47	1.43	3.90	4.5	6.42	1.18	1.25	8.85	3.0	7.60	3.0	2.37	4.65	5.5
24418	15.8	1.40	1.12	1.03	3.55	3.3	6.25	2.97	0.68	9.90	----	9.22	8.0	7.44	7.44	7.0
24438	21.4	1.51	1.12	1.13	3.76	3.3	3.73	3.60	1.00	8.33	----	7.33	6.0	9.92	9.92	10.0
24637	81.6	0.08	0.21	1.50	1.79	1.7	5.83	2.69	1.02	9.54	9.0	8.52	8.0	4.37	4.37	4.0
24776	41.6	0.43	0.42	1.80	2.65	2.9	2.39	9.19	2.93	14.51	14.0	11.58	8.0	1.44	5.41	4.8
24543	47.7	0.06	1.29	1.05	2.40	2.5	5.73	2.42	1.07	9.22	11.0	8.15	8.0	6.61	6.61	6.0
24563	81.8	----	0.18	1.67	1.85	1.9	5.46	3.14	1.16	9.76	9.0	8.60	8.0	3.06	3.06	3.0
24638	102.9	----	0.22	0.73	0.95	0.8	5.26	2.91	1.32	9.49	8.5	8.17	7.5	3.05	3.05	3.0
24777	47.6	0.61	0.79	1.92	3.32	3.3	4.70	3.86	0.52	9.08	10.0	8.56	8.0	1.18	9.63	9.0
24549	41.7	0.46	1.40	1.64	3.50	3.3	5.15	3.27	1.25	9.67	9.0	8.42	8.0	7.29	7.29	7.0
24700	42.6	2.16	0.16	1.36	3.68	3.3	3.53	3.43	1.00	7.96	7.0	6.96	6.0	1.12	6.94	8.0
24360	24.1	0.17	1.60	0.91	2.68	2.5	7.43	2.28	1.29	11.00	10.0	9.71	9.0	4.04	4.04	4.0
24650	7.6	0.11	1.61	0.43	2.15	1.7	6.34	1.88	2.28	10.50	9.0	8.22	8.0	7.11	7.11	8.0
24362	51.2	0.06	0.30	1.92	2.28	1.7	3.01	2.81	1.54	7.36	6.0	5.82	5.0	4.83	4.83	4.0
24363	74.4	0.05	0.10	1.20	1.35	1.0	3.61	4.87	1.70	10.18	10.0	8.48	8.0	2.79	2.79	2.0

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	Essex Fertilizer Co., Boston, Mass.			
24593	Complete Manure for Corn, Grain and Grass	East Hartford, Plainville	$41.00	$27.48
24508	Complete Manure for Potatoes, Roots and Vegetables	East Hartford, Suffield, Plainville	41.00	27.83
24511	Fertilizer for Grass and Top Dressing	East Hartford, So. Manchester, Poquonock	45.75	31.25
24509	Market Garden and Potato Manure	East Hartford, Windsor Locks, Plainville	35.75	21.37
24550	Special Tobacco Manure	So. Manchester, Hazardville, East Hartford	45.75	31.58
24701	Tobacco Starter and Grower	E. Hartford, Broad Brook	38.50	26.78
24510	XXX Fish and Potash	East Hartford, Suffield, Plainville	32.25	18.44
	The L. T. Frisbie Co., New Haven, Conn.			
24341	Corn and Grain Fertilizer	Hartford	29.00	19.84
24340	Potato Manure	Hartford	32.00	27.93
	Germofert Manufacturing Co., Charleston, S. C.			
24674	Patented Potato Manure	Saybrook Pt.	36.00	24.48
24752	Patented Special Cotton Grower	Fairfield	36.00	17.90
	Lister's Agricultural Chemical Works, Newark, N. J.			
24778	Ammoniated Dissolved Bone Phosphate	Stafford Springs	34.00	19.02
24702	*Complete Tobacco Manure	Burnside, Glastonbury	37.00	28.26
24585	Corn and Potato Fertilizer	Stafford Springs, East Canaan, Wallingford	31.75	17.93
24551	Potato Manure	East Canaan, Glastonbury, Burnside	38.75	26.31
24779	Special Grass Mixture	East Canaan, Glastonbury	35.50	26.46
24586	Standard Pure Bone Superphosphate of Lime	Suffield, Wallingford (2)	32.00	20.09
24612	Success Fertilizer	Stafford Springs, E. Canaan	32.00	16.89
24782	3-6-10 for Potatoes	Suffield	35.00	25.01
	E. Manchester & Sons, Winsted, Conn. *(Made for)*			
24565	Formula	Winsted, Gilead (2)	30.00	26.33
24564	Special	Winsted, Gilead (2)	34.00	31.58
	The Mapes Formula and Peruvian Guano Co., New York City.			
24342	Average Soil Complete Manure	Hartford, Windsor Locks, Meriden	38.00	26.77
24552	Cereal Brand	Milford, Hartford	30.00	15.90

* See note, page 405.

Analyses and Valuations—*Continued.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
					Total Nitrogen.					Total.		So-called "Available."		Found.		
		As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.
24593	49.2	----	0.60	2.78	3.38	3.3	4.53	1.87	1.01	7.41	7.0	6.40	6.0	9.95	9.95	10.0
24508	47.3	----	0.50	2.90	3.40	3.3	4.53	2.04	0.90	7.47	7.0	6.57	6.0	10.07	10.07	10.0
24511	46.4	----	0.60	3.76	4.36	4.1	5.39	2.31	0.78	8.48	8.0	7.70	7.0	8.57	8.57	8.0
24509	67.3	----	0.40	1.96	2.36	2.0	6.57	2.42	0.43	9.42	9.0	8.99	8.0	4.98	4.98	5.0
24550	44.9	0.85	0.08	3.17	4.10	4.1	3.88	3.20	1.18	8.26	7.0	7.08	6.0	1.29	9.75	10.0
24701	43.8	0.83	0.08	3.31	4.22	4.1	1.61	3.21	0.63	5.45	5.0	4.82	4.0	0.69	6.39	6.0
24510	74.9	----	0.02	2.06	2.08	2.0	5.40	2.97	0.83	9.20	9.0	8.37	8.0	3.02	3.02	3.0
24341	46.2	----	0.07	2.15	2.22	1.6	2.79	5.44	2.40	10.63	8.0	8.23	5.0	3.76	3.76	3.0
24340	14.6	0.13	0.12	2.99	3.24	2.5	3.96	7.07	4.28	15.31	8.0	11.03	5.0	4.99	4.99	6.0
24674	47.1	1.03	1.15	1.87	4.05	4.1	0.15	3.33	6.49	9.97	10.0	3.48	3.3	0.82	4.74	6.0
24752	101.1	0.74	0.58	1.23	2.55	2.5	0.12	1.52	11.58	13.22	10.0	1.64	3.3	0.51	2.87	3.0
24778	78.8	----	0.26	1.92	2.18	2.1	6.88	2.87	1.29	11.04	9.0	9.75	8.0	1.76	1.76	1.5
24702	30.9	1.64	0.05	2.81	4.50	4.1	0.06	6.70	3.31	10.07	5.0	6.76	4.0	0.72	4.95	5.0
24585	77.1	----	0.20	1.62	1.82	1.7	5.59	2.79	1.47	9.85	9.0	8.38	8.0	3.48	3.48	3.0
24551	47.3	----	1.93	1.39	3.32	3.3	7.40	1.46	0.70	9.56	9.0	8.86	8.0	7.60	7.60	7.0
24779	34.2	0.10	0.77	1.18	2.05	1.7	9.47	1.38	0.36	11.21	----	10.85	10.0	10.82	10.82	10.0
24586	59.3	----	1.10	1.38	2.48	2.5	7.84	1.94	0.93	10.71	10.0	9.78	9.0	2.43	2.43	2.0
24612	89.5	----	0.17	1.38	1.55	1.2	6.83	2.85	1.25	10.93	10.0	9.68	9.0	2.24	2.24	2.0
24782	39.9	----	0.93	1.55	2.48	2.5	3.82	3.40	1.59	8.81	7.0	7.22	6.0	10.62	10.62	10.0
24565	13.9	0.53	0.20	3.01	3.74	3.5	2.17	3.46	1.89	7.52	----	5.63	8.0	7.61	7.61	7.5
24564	7.7	1.67	0.18	3.00	4.85	5.0	2.95	3.85	1.00	7.80	----	6.80	8.0	0.60	7.61	7.5
24342	42.0	2.45	1.28	0.59	4.32	4.1	1.48	6.16	0.64	8.28	8.0	7.64	7.0	0.66	6.05	5.0
24552	88.7	0.69	0.64	0.59	1.92	1.7	0.59	6.69	1.36	8.64	8.0	7.28	6.0	3.37	3.37	3.0

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent: **The Mapes Formula and Peruvian Guano Co.** *(Continued).*			
24465	Complete Manure "A" Brand	Meriden, Southington, Hartford	$37.25	$21.22
24364	Corn Manure	Hartford, Meriden, Norwich	37.00	22.66
24811	Dissolved Bone	Hartford	33.00	26.81
24525	Economical Potato Manure	Hartford, Milford, Forestville	37.75	26.49
24783	Fruit and Vine	Hartford	41.00	24.98
24343	Potato Manure	Hartford, Windsor Locks, Suffield	40.75	27.70
24784	Seeding Down Manure	Forestville	44.00	32.97
24703	Tobacco Ash Constituents	Suffield, Hartford	34.50	26.22
24704	Tobacco Manure, Wrapper Brand	Hazardville, Suffield, Hartford	49.00	38.98
24554	Tobacco Starter, Improved	Hartford, Windsor Locks	37.50	24.35
24553	Top Dresser, Improved, Full Strength	Hartford, Forestville	53.00	41.27
24478	" " " Half Strength	Windsor Locks, Hartford, Middletown	34.50	21.00
24365	Vegetable Manure for Light Soils	Hartford, Meriden, Norwich	44.00	31.46
	The National Fertilizer Co., New York City.			
24555	Chittenden's Ammoniated Bone Phosphate	Willimantic, Silver Lane	30.50	16.58
24753	Chittenden's Complete Corn and Grain Fertilizer	East Windsor Hill	----	23.97
24785	Chittenden's Complete Grass Fertilizer	Greenwich	45.00	24.65
24527	" " Root Fertilizer	So. Manchester, Silver Lane	39.50	24.22
24556	" " Tobacco Fertz.	So. Manchester, New Milford	38.00	25.03
24786	* " Connecticut Valley Tobacco Grower	New Milford	48.45	28.83
24528	Chittenden's Eureka Potato Fertilizer	Willimantic, So. Manchester	36.00	24.77
24439	" Fish and Potash	West Cheshire, So. Manchester, Silver Lane	31.75	21.27
24787	" Formula "A"	Willimantic	33.00	24.60
24788	" Market Garden Fertilizer	Suffield	34.00	22.79
24440	" Potato Phosphate	Willimantic, Silver Lane, Greenwich	32.75	22.38
24812	" Soluble Bone and Potash	Wallingford	20.00	12.47
24705	" Tobacco Special	Suffield, Simsbury	35.00	28.46
24789	‖ " " " with Carbonate	Simsbury	36.50	27.16
24529	Chittenden's Universal Phosphate	Greenwich, Winsted	28.00	13.37
24526	" XXX Fish and Potash	So. Manchester, Winsted, Avon	28.00	18.86

* See note on page 428. † 4.72 per cent. potash as sulphate, 7.70 per cent. as carbonate. ‡ 3.16 per cent. potash as sulphate, 5.25 per cent. as carbonate. § 2.41 per cent. potash as sulphate, 0.59 per cent. as carbonate. ‖ See note on page 405.

Analyses and Valuations—*Continued.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.
24465	75.5	1.22	0.70	0.70	2.62	2.5	0.76	9.28	3.34	13.38	12.0	10.04	10.0	3.34	3.34	2.5
24364	63.3	0.56	1.16	0.82	2.54	2.5	0.92	7.60	2.70	11.22	10.0	8.52	8.0	6.93	6.93	6.0
24811	23.1	----	0.68	2.58	3.26	2.1	2.65	14.35	1.10	18.10	----	17.00	12.0	----	----	----
24525	42.5	1.48	1.30	0.94	3.72	3.3	0.69	4.81	1.11	6.61	6.0	5.50	4.0	1.08	9.08	8.0
24783	64.1	1.61	0.10	0.47	2.18	1.7	0.36	6.33	0.56	7.25	7.0	6.69	5.0	1.00	12.18	10.0
24343	47.1	1.88	1.50	0.50	3.88	3.7	1.52	7.21	1.11	9.84	8.0	8.73	8.0	0.72	7.41	6.0
24784	33.5	2.63	0.08	0.44	3.15	2.5	0.00	13.00	4.08	17.08	18.0	13.00	----	12.35	12.35	10.0
24703	31.6	----	0.02	0.80	0.82	0.5	0.00	4.07	2.77	6.84	5.7	4.07	----	1.82	†14.24	15.0
24704	25.7	4.50	0.04	1.89	6.43	6.2	0.07	4.19	1.59	5.85	4.5	4.26	----	1.50	‡ 9.91	10.5
24554	54.0	3.56	0.12	0.94	4.62	4.1	0.12	7.82	1.30	9.24	8.0	7.94	6.0	0.62	2.02	1.0
24553	28.4	5.51	3.61	0.43	9.55	9.9	0.34	7.03	0.88	8.25	8.0	7.37	----	1.04	4.25	4.0
24478	64.3	3.84	0.72	0.24	4.80	4.9	0.43	2.85	1.08	4.36	4.0	3.28	----	0.74	2.46	2.0
24365	39.9	2.45	2.30	0.57	5.32	4.9	0.81	6.71	1.00	8.52	8.0	7.52	6.0	0.98	7.63	6.0
24555	84.0	----	0.60	0.92	1.52	1.7	6.98	2.07	1.18	10.23	9.0	9.05	8.0	3.02	3.02	2.0
24753	----	----	2.26	0.94	3.20	3.3	5.43	3.12	1.34	9.89	9.0	8.55	8.0	5.94	5.94	6.0
24785	82.6	2.60	0.20	1.18	3.98	4.1	4.54	2.84	0.67	8.05	7.0	7.38	6.0	5.11	5.11	5.0
24527	63.1	----	2.24	0.97	3.21	3.3	5.59	3.22	1.35	10.16	9.0	8.81	8.0	5.91	5.91	6.0
24556	51.8	----	2.58	0.77	3.35	3.3	6.72	2.38	1.25	10.35	9.0	9.10	8.0	0.70	5.34	5.0
24786	68.1	0.29	0.15	4.19	4.63	4.9	0.40	4.16	0.88	5.44	4.0	4.56	1.0	0.60	6.71	8.0
24528	45.3	0.51	1.34	0.93	2.78	2.5	4.44	2.16	0.92	7.52	7.0	6.60	6.0	10.62	10.62	10.0
24439	49.3	0.97	0.24	1.71	2.92	2.9	5.37	2.21	1.09	8.67	7.0	7.58	6.0	4.14	4.14	4.0
24787	34.1	1.43	0.94	0.88	3.25	3.3	6.34	1.72	1.24	9.30	7.0	8.06	6.0	6.94	6.94	6.0
24788	49.2	0.74	0.42	1.38	2.54	2.5	6.62	2.13	1.08	9.83	9.0	8.75	8.0	6.43	6.43	6.0
24440	46.3	0.51	1.08	0.86	2.45	2.1	7.00	2.03	1.03	10.06	9.0	9.03	8.0	6.50	6.50	6.0
24812	60.4	----	---	---	---	--	9.27	1.86	1.82	12.95	12.0	11.13	11.0	2.25	2.25	2.0
24705	23.0	----	0.90	3.85	4.75	4.5	0.34	4.61	2.75	7.70	4.0	4.95	3.0	0.85	5.21	5.5
24789	34.4	0.24	0.12	4.08	4.44	4.5	0.45	5.12	3.30	8.87	4.0	5.57	3.0	0.60	§ 3.60	5.5
24529	109.4	----	0.22	0.80	1.02	0.8	7.18	1.79	1.06	10.03	9.0	8.97	8.0	1.37	1.37	1.0
24526	48.5	0.54	0.32	1.65	2.51	2.5	4.90	1.89	0.98	7.77	6.0	6.79	5.0	3.76	3.76	3.0

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	New England Fertilizer Co., Boston, Mass.			
24613	Corn and Grain Fertilizer	Rockville, Plantsville, Suffield	$29.75	$14.45
24639	Corn Phosphate	Bristol, Collinsville	30.00	17.73
24614	H. G. Potato Fertilizer	Bristol, Plantsville	35.50	22.90
24706	Perfect Tobacco Grower	So. Manchester, Suffield, Collinsville	37.50	25.89
24466	Potato Fertilizer	Bristol, Rockville, Plantsville	31.00	16.18
24675	Potato Grower	Rockfall, Cromwell	35.50	24.12
24615	Superphosphate	Bristol, East Woodstock, So. Manchester	32.50	21.18
	Niantic Menhaden Oil & Guano Co., South Lyme, Conn.			
24791	Bone, Fish and Potash	East Haddam	30.00	19.28
24793	Corn and Grain Fertilizer	East Haddam, Moodus	30.00	19.55
24795	H. G. Tobacco Fertilizer	East Haddam	38.00	27.30
24792	Market Garden Manure	Norwich	35.00	24.67
24616	Potato and Vegetable Manure	Norwich, East Haddam	31.00	22.05
	Olds & Whipple, Hartford, Conn.			
24640	Complete Corn and Potato Fertilizer	Hartford	34.00	28.20
24796	Complete Tobacco Fertilizer	Hartford	37.00	30.61
24344	Fish and Potash	Hartford	30.00	18.09
24512	Grass Fertilizer	Hartford	34.00	26.91
24345	H. G. Potato Fertilizer	Hartford	37.00	30.39
24346	Special Phosphate	Hartford	35.00	25.97
	Parmenter & Polsey Fertilizer Co., Boston, Mass.			
24797	5-4-8	Wallingford, Warehouse Point	37.50	30.35
24479	Plymouth Rock Brand	Plantsville, Wallingford	33.00	20.53
24594	Potato Fertilizer	Wallingford, So. Woodstock	31.00	19.58
24798	Special Potato Fertilizer	Mansfield Depot	39.00	27.18
	The Rogers & Hubbard Co., Middletown, Conn.			
24618	Hubbard's Bone Base Complete Phosphate	Wallingford, Moodus, Suffield	27.25	20.04
24652	Hubbard's Bone Base Grass and Grain Fertilizer	Portland, Middletown	42.00	32.54
24754	Hubbard's Bone Base New Market Garden Phosphate	Middletown, Branford	35.50	24.32
24651	Hubbard's Bone Base Oats and Top Dressing	Wallingford, Clinton	56.00	42.01

* 1.28 per cent. potash as sulphate, 4.23 per cent. as carbonate.

Analyses and Valuations—*Continued.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
		As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Found. As Muriate.	Found. Total.	Guaranteed.
24613	105.9	----	0.08	1.37	1.45	1.2	4.97	2.64	0.78	8.39	8.0	7.61	7.0	2.14	2.14	2.0
24639	69.2	----	0.32	1.53	1.85	1.6	6.24	2.38	1.03	9.65	9.0	8.62	8.0	3.13	3.13	3.0
24614	55.0	----	0.13	2.37	2.50	2.5	5.40	3.15	0.80	9.35	9.0	8.55	8.0	6.24	6.24	6.0
24706	44.8	0.78	0.10	3.12	4.00	4.1	1.84	3.28	0.74	5.86	5.0	5.12	4.0	0.93	6.15	6.0
24466	91.6	----	0.24	1.40	1.64	1.6	5.21	2.14	0.52	7.87	8.0	7.35	7.0	3.76	3.76	4.0
24675	47.2	----	0.06	2.32	2.38	2.5	4.02	2.89	0.65	7.56	7.0	6.91	6.0	9.95	9.95	10.0
24615	53.4	----	0.45	2.08	2.53	2.5	6.16	2.34	0.83	9.33	10.0	8.50	8.0	4.33	4.33	4.0
24791	55.6	----	0.54	2.09	2.63	2.5	2.37	3.10	2.65	8.12	6.0	5.47	5.0	4.14	4.14	3.0
24793	53.5	0.55	0.39	1.54	2.48	2.1	2.72	3.09	3.44	9.25	8.0	5.81	7.0	4.80	4.80	3.5
24795	39.2	0.80	0.50	2.12	3.42	3.3	3.50	3.96	2.85	10.31	8.0	7.46	7.0	0.90	7.33	6.0
24792	41.9	0.68	0.57	2.23	3.48	4.1	3.60	3.51	2.25	9.36	8.0	7.11	7.0	5.65	5.65	6.0
24616	40.6	1.08	0.31	1.31	2.70	2.5	3.11	3.75	3.31	10.17	8.0	6.86	7.0	6.17	6.17	4.0
24640	20.6	----	0.69	3.09	3.78	3.3	0.50	8.21	2.25	10.96	7.0	8.71	6.0	4.32	6.36	6.0
24796	20.9	0.57	0.15	3.98	4.70	4.5	0.12	4.21	0.58	4.91	3.5	4.33	3.0	0.74	*6.25	5.5
24344	65.8	----	0.16	2.34	2.50	2.5	0.08	4.96	3.33	8.37	6.0	5.04	5.0	3.35	3.35	3.0
24512	26.4	----	0.88	3.06	3.94	3.3	0.64	5.55	2.39	8.58	7.0	6.19	6.0	6.91	6.91	6.0
24345	21.7	----	0.56	3.05	3.61	3.3	0.38	6.66	2.66	9.70	7.0	7.04	6.0	6.53	10.65	10.0
24346	34.8	----	0.76	3.44	4.20	4.1	0.03	6.86	2.30	9.19	----	6.89	4.0	1.00	3.49	3.0
24797	23.6	0.85	0.14	3.25	4.24	4.1	2.62	2.96	0.75	6.33	5.0	5.58	4.0	0.97	9.30	8.0
24479	60.7	----	0.60	1.78	2.38	2.5	6.43	2.06	0.82	9.31	9.0	8.49	8.0	4.38	4.38	4.0
24594	58.3	----	0.10	1.78	1.88	1.6	4.26	2.76	0.67	7.69	7.0	7.02	6.0	6.86	6.86	6.0
24798	43.5	----	0.66	2.60	3.26	3.3	6.28	3.07	0.78	10.13	9.0	9.35	8.0	7.35	7.35	7.0
24618	36.0	0.58	0.05	1.00	1.63	1.5	5.56	4.40	0.67	10.63	8.0	9.96	7.0	6.15	6.15	5.0
24652	29.1	0.28	0.06	2.28	2.62	2.2	0.23	10.09	7.19	17.51	16.0	10.32	6.5	13.14	13.14	12.0
24754	46.0	1.01	0.08	1.05	2.14	2.0	3.59	4.76	0.99	9.34	7.0	8.35	6.0	10.81	10.81	10.0
24651	33.3	7.33	0.02	0.86	8.21	8.5	0.08	8.49	1.49	10.06	8.0	8.57	4.5	8.93	8.93	8.0

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent: **The Rogers & Hubbard Co.** *(Continued).*			
24653	Hubbard's Bone Base Potato Phosphate	Wallingford, Glastonbury	$33.00	$22.60
24587	" " " Soluble Corn and General Crops Manure	Wallingford, East Hampton, Moodus	37.25	24.88
24617	Hubbard's Bone Base Soluble Potato Manure	East Hampton, Clinton, Moodus	44.00	32.74
24707	Hubbard's Bone Base Soluble Tobacco Manure	Westbrook, Portland, Suffield	48.00	36.60
	The Rogers Mfg. Co., Rockfall, Conn.			
24655	All Round Fertilizer	Southington, Wallingford	30.50	17.78
24654	Complete Potato and Vegetable Fertz.	Suffield, Cromwell	33.50	23.23
24567	Fish and Potash	Norwalk, Burnside	33.00	21.87
24557	H. G. Complete Corn and Onion	Suffield, Southington, Cromwell	37.50	28.10
24656	H. G. Grass and Grain Fertilizer	Wapping, Wallingford	42.00	35.54
24558	H. G. Oats and Top Dressing	Suffield, Southington, Cromwell	44.50	37.86
24588	H. G. Soluble Tobacco Manure	Suffield, Southington, Glastonbury	44.25	38.38
24566	H. G. Soluble Tobacco and Potato	Suffield, Burnside, Somerville	40.00	33.73
24799	H. G. Tobacco Grower	Suffield, Rockfall	37.50	31.52
24755	Tobacco Starter	Wapping, Somerville	36.00	22.97
	Sanderson Fertilizer & Chemical Co., New Haven, Conn.			
24513	Atlantic Coast Bone, Fish and Potash	Guilford, East Hampton, Plainville	25.75	20.27
24676	Kelsey's Bone, Fish and Potash	Granby	29.00	25.44
24721	Sanderson's Corn Superphosphate	East Hampton, Torrington	28.00	15.98
24568	" Formula A	New Haven, Guilford	35.00	24.83
24722	" " B for Tobacco	Green's Farms, Simsbury	33.50	25.79
24480	" Potato Manure	New Haven, Danbury, East Hampton	30.25	19.12
24514	" Special with 10% Potash	New Haven, East Hampton, Plainville	36.25	23.77
24595	" Top Dressing for Grass and Grain	New Haven, Danbury	38.50	30.16
	The C. M. Shay Fertilizer Co., Groton, Conn.			
24442	*Corn Fertilizer	Norwich, Guilford	29.50	21.29
24596	" "	Putnam, Norwich	29.50	22.06
24530	Grass and Lawn Fertilizer	Norwich, Leonard's Bridge	36.00	29.23
24441	Potato Manure	Norwich, Guilford	34.00	28.26

* See note, page 428.

Analyses and Valuations—*Continued.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen.					Phosphoric Acid.							Potash.		
					Total Nitrogen.					Total.		So-called "Available."		Found.		
		As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.
24653	46.0	1.00	---	1.14	2.14	2.0	5.90	5.06	1.46	12.42	10.0	10.96	9.0	5.77	5.77	5.0
24587	49.7	1.21	0.10	1.43	2.74	2.5	2.90	5.19	1.61	9.70	8.0	8.09	5.5	8.91	8.91	8.0
24617	34.4	2.09	0.26	2.82	5.17	5.0	1.26	7.82	2.20	11.28	10.0	9.08	7.0	1.26	5.86	5.0
24707	31.1	1.99	0.28	2.61	4.88	5.0	0.89	7.91	2.60	11.40	10.0	8.80	7.0	0.98	10.87	10.0
24655	71.5	1.02	---	1.10	2.12	1.7	1.44	6.96	3.13	11.53	10.0	8.40	8.0	2.35	2.35	2.0
24654	44.2	1.07	0.22	1.34	2.63	2.3	5.74	3.73	1.33	10.80	10.0	9.47	8.0	5.96	5.96	5.0
24567	50.9	0.89	0.38	2.23	3.50	3.3	2.41	3.08	1.97	7.46	6.0	5.49	4.0	4.07	4.07	3.8
24557	33.4	1.52	0.33	2.06	3.91	3.8	4.04	4.09	1.93	10.06	8.0	8.13	6.0	7.36	7.36	7.0
24656	18.2	0.31	0.20	2.49	3.00	3.0	0.00	11.93	6.47	18.40	16.0	11.93	----	13.90	13.90	12.5
24558	17.5	4.16	0.20	2.39	6.75	6.3	3.00	5.20	2.23	10.43	9.0	8.20	7.0	7.77	7.77	7.5
24588	15.3	1.22	0.40	3.26	4.88	5.0	1.20	7.38	1.97	10.55	8.0	8.58	6.0	1.34	12.59	11.0
24566	18.6	0.50	0.50	3.07	4.07	3.5	1.30	6.85	2.98	11.13	9.0	8.15	7.0	1.02	10.56	8.8
24799	19.0	1.28	0.70	3.27	5.25	5.0	0.19	5.15	2.28	7.62	5.0	5.34	4.0	0.80	7.02	6.0
24755	56.7	1.08	0.45	2.23	3.76	3.8	1.87	4.01	2.97	8.85	5.0	5.88	4.0	1.59	3.31	3.0
24513	27.0	----	0.46	2.04	2.50	1.7	2.76	3.59	1.22	7.57	6.0	6.35	4.0	0.93	4.94	4.0
24676	14.0	----	0.92	3.01	3.93	2.5	1.29	5.53	1.55	8.37	5.0	6.82	4.0	1.10	4.42	4.0
24721	75.2	0.79	0.50	0.86	2.15	1.7	1.71	4.95	2.03	8.69	9.0	6.66	7.0	2.47	2.47	2.0
24568	41.0	0.90	0.92	1.48	3.30	3.3	2.62	4.35	1.58	8.55	9.0	6.97	6.0	7.79	7.79	6.0
24722	29.9	1.09	0.60	1.80	3.49	3.3	4.61	2.57	1.76	8.94	10.0	7.18	6.0	1.25	6.46	6.0
24480	58.2	0.16	0.62	1.52	2.30	1.7	3.05	4.28	1.55	8.88	7.0	7.33	5.0	5.55	5.55	6.0
24514	52.5	0.30	0.80	1.86	2.96	2.5	3.22	2.86	1.14	7.22	7.0	6.08	5.0	8.42	8.42	10.0
24595	27.6	2.36	0.10	1.86	4.32	4.0	6.38	2.81	0.83	10.02	7.0	9.19	7.0	7.68	7.68	7.0
24442	38.6	----	0.17	2.67	2.84	3.0	2.96	3.61	2.03	8.60	8.0	6.57	----	4.37	4.37	4.0
24596	33.7	----	0.08	2.94	3.02	3.0	2.78	3.93	1.87	8.58	8.0	6.71	----	4.29	4.29	4.0
24530	23.2	0.96	0.20	3.11	4.27	4.0	3.73	4.65	1.05	9.43	10.0	8.38	----	6.57	6.57	6.0
24441	20.3	0.86	0.22	3.01	4.09	4.0	3.72	3.99	1.56	9.27	8.0	7.71	----	6.60	6.60	6.0

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	M. L. Shoemaker & Co., Philadelphia, Pa.			
24443	"Swift-Sure" Superphosphate for General Use	Hartford, Glastonbury, Guilford	$36.00	$27.80
24800	"Swift-Sure" Superphosphate for Potatoes	Guilford	37.00	27.51
24801	"Swift-Sure" Guano for Truck, Corn and Onions	Guilford	31.00	21.06
	Swift's Lowell Fertilizer Co., Boston, Mass.			
24803	Swift's Market Garden Manure	Westport	33.00	27.04
24467	" Perfect Tobacco Grower	Ellington, Rockville, Windsor Locks	39.00	25.36
24804	" Potato Grower	Westport	33.00	27.72
24724	" Special Corn and Vegetable Manure	Southport, Kensington	34.00	26.11
24805	Swift's Special Grass Mixture	Rockville	40.00	28.92
24725	" " Potato Fertilizer	Southport, Wallingford, Kensington	32.75	23.67
24806	" Superior Fertilizer with 10% Potash	Rockville	39.00	29.65
24807	Swift's Tobacco Manure	Warehouse Point	45.00	32.19
24378	" Lowell Animal Brand	New Britain, Norwich, Ellington	33.00	20.36
24376	" " Bone Fertilizer	Norwich, Ellington, Rockville	30.00	16.98
24802	" " Dissolved Bone and Potash	Ellington	29.00	18.65
24569	Swift's Lowell Empress Brand	Wallingford, Putnam, Moosup	27.75	13.46
24377	" " Potato Manure	New Britain, Norwich, Rockville	31.00	16.12
24723	" " Potato Phosphate	Ellington, Rockville	35.50	21.74
	*** Tanner & Wilcox, Winsted, Conn.**			
24677	Reliable Potato and Garden Phosphate	Winsted	34.00	27.61
	The Wilcox Fertilizer Co., Mystic, Conn.			
24570	Complete Bone Superphosphate	Mystic, Woodstock, Norwich	29.00	20.69
24444	Fish and Potash	Mystic, Norwich, Guilford	25.50	19.63
24531	Grass Fertilizer	Suffield, Wallingford	38.00	27.88
24726	H. G. Fish and Potash	Norwich, Woodstock	29.00	22.89
24808	*H. G. Tobacco Special	Ellington	35.00	32.06
24481	Potato Fertilizer	Suffield, Mystic, Wallingford	29.00	20.46

* See note, page 428.

Analyses and Valuations—*Continued.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Found. Total.	Guaranteed.
24443	29.5	1.15	0.03	1.83	3.01	2.9	8.55	3.98	1.36	13.89	12.0	12.53	9.0	0.57	5.37	4.5
24800	34.5	0.90	0.06	1.88	2.84	2.9	8.15	4.29	1.36	13.80	11.0	12.44	8.0	6.60	6.60	7.0
24801	47.2	0.70	0.05	0.97	1.72	1.7	6.96	3.75	1.38	12.09	10.0	10.71	8.0	5.85	5.85	5.0
24803	22.0	----	0.63	3.17	3.80	4.1	5.12	2.76	0.84	8.72	8.0	7.88	7.0	6.09	6.09	6.0
24467	53.8	0.80	0.07	2.81	3.68	4.1	1.36	4.01	1.24	6.61	5.0	5.37	4.0	0.94	6.55	6.0
24804	19.0	----	0.68	2.67	3.35	3.3	4.65	1.76	0.97	7.38	7.0	6.41	6.0	10.43	10.43	10.0
24724	30.2	----	0.70	2.47	3.17	3.3	6.58	2.96	0.58	10.12	9.0	9.54	8.0	6.44	6.44	7.0
24805	38.3	----	0.65	3.60	4.25	4.1	5.38	2.27	0.88	8.53	8.0	7.65	7.0	6.39	6.39	6.0
24725	38.4	----	0.12	2.20	2.32	2.5	4.02	2.53	0.68	7.23	7.0	6.55	6.0	10.09	10.09	10.0
24806	31.5	----	0.58	2.83	3.41	3.7	5.50	2.71	0.49	8.70	8.0	8.21	7.0	10.76	10.76	10.0
24807	39.8	0.92	0.10	3.28	4.30	4.0	3.56	2.90	0.96	7.42	7.0	6.46	6.0	0.70	10.01	10.0
24378	62.1	----	0.44	1.90	2.34	2.5	6.00	2.35	0.95	9.30	10.0	8.35	8.0	4.36	4.36	4.0
24376	76.7	----	0.40	1.34	1.74	1.6	6.22	2.00	0.90	9.12	9.0	8.22	8.0	3.27	3.27	3.0
24802	55.5	----	0.10	1.84	1.94	1.6	6.22	3 62	1.69	11.53	10.0	9.84	9.0	2.11	2.11	2.0
24569	106.2	----	0.06	1.18	1.24	1.3	5.00	2.48	0.78	8.26	8.0	7.48	7.0	2.07	2.07	2.0
24377	92.3	----	0.34	1.31	1.65	1.6	5.30	1.90	0.46	7.66	8.0	7.20	7.0	3.91	3.91	4.0
24723	63.3	----	0.38	1.90	2.28	2.5	5.96	2.63	0.63	9.22	9.0	8.59	8.0	6.13	6.13	6.0
24677	23.1	0.99	0.08	1.86	2.93	3.3	3.53	4.77	3.34	11.64	9.3	8.30	8.0	9.88	9.88	9.0
24570	40.2	0.64	0.20	1.44	2.28	2.1	3.99	5.83	1.68	11.50	9.0	9.82	8.0	3.91	3.91	3.0
24444	29.9	0.05	0.36	2.27	2.68	2.5	2.82	3.20	1.44	7.46	6.0	6.02	5.0	4.19	4.19	3.0
24531	36.3	1.46	1.08	1.83	4.37	4.1	4.20	3.37	1.21	8.78	7.0	7.57	6.0	3.69	6.02	5.0
24726	26.7	----	0.40	2.96	3.36	3.3	3.67	2.23	0.59	6.49	6.0	5.90	5.0	5.24	5.24	4.0
24808	9.2	0.80	0.06	2.76	3.62	3.3	0.00	2.76	0.26	3.02	7.0	2.76	5.0	0.82	16.08	7.0
24481	41.7	0.53	0.18	1.69	2.40	2.1	2.50	4.31	2.02	8.83	7.0	6.81	6.0	1.86	5.19	4.5

Nitrogenous Superphosphates.

Station Number.	Manufacturer and Brand.	Place of Sampling.	Dealers' average cash price per ton.	Valuation per ton.
	Sampled by Station Agent: **The Wilcox Fertilizer Co.** *(Continued).*			
24727	Potato, Onion and Vegetable Phosphate	Guilford, Woodstock	$34.50	$24.47
24728	Special Superphosphate	Mystic, Wallingford, So. Meriden	25.75	14.99
	S. D. Woodruff & Sons, Orange, Conn.			
24240	Home Mixture	Orange	30.00	28.56
	Sampled by Purchasers and others:			
24756	Bowker's Stockbridge Complete Manure for Corn and All Grain Crops	*Guilford:* J. B. Hubbard	40.00	27.29
24590	E. D. Chittenden's Mixture for Grass	*Wapping:* W. Hills	33.00	31.00
24589	" " Potato and Grain	" "	27.50	24.92
24887	Clay's Fertilizer	*Groton:* T. W. Head	140.00	23.20
24592	Conn. Valley Orchard Co. High Grade Fertilizer	*Deep River:* G. W. Spicer	28.00	22.21
24532	Cooper's Sterling Brand for Potatoes	*So. Wethersfield:* T. Griswold & Co.	24.00	21.69
24678	Frisbie's Keeney's Mixture	*Somerville:* M. Keeney	38.50	37.16
24476	Mapes' Tobacco Ash Constituents	*West Suffield:* Bissell-Graves	35.00	27.32
24477	" " " "	" " " "	35.00	28.33
24303	New England Corn Fertilizer	*Newtown:* L. Busker	32.00	15.74
24304	" " Potato Fertilizer	" "	32.00	16.52
24445	Olds & Whipple's Complete Tobacco Fertilizer	*Burnside:* J. M. Hickey	36.00	30.11
24231	Rogers' H. G. Tobacco Grower	*Granby:* E. M. Griffin	37.50	31.37
24642	Sanderson's Special (Formula A with 10% Potash)	*Shelton:* O. G. Beard	38.00	32.40
24619	Sanderson's Special No. 1	*New Haven:* J. I. Webb	29.50	28.74
24620	" " " 2	" " " "	29.50	29.10
24331	Tanner & Wilcox's Reliable Potato and Garden Phosphate	*Winsted:* Manufacturer	34.00	28.30

* 4.45 per cent. potash as sulphate, 8.75 per cent. as carbonate.
† 4.39 " " " " " 9.39 " " " "
‡ 1.39 " " " " " 3.89 " " " "

Analyses and Valuations—*Concluded.*

Station Number.	Percentage difference between cost and valuation.	Nitrogen. As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Guaranteed.	Phosphoric Acid. Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Guaranteed.	So-called "Available." Found.	Guaranteed.	Potash. Found. As Muriate.	Total.	Guaranteed.
24727	41.0	0.96	0.77	1.41	3.14	3.3	5.97	2.24	0.54	8.75	8.0	8.21	7.0	4.21	6.55	6.0
24728	71.8	----	0.15	1.06	1.21	1.0	2.86	5.86	2.03	10.75	9.0	8.72	8.0	2.59	2.59	1.5
24240	5.0	1.06	0.52	2.08	3.66	3.3	4.68	3.52	1.22	9.42	---	8.20	8.0	9.02	9.02	8.0
24756	46.6	----	2.44	0.82	3.26	3.3	7.58	2.82	1.25	11.65	11.0	10.40	10.0	7.79	7.79	7.0
24590	6.5	----	3.20	0.67	3.87	--	4.16	5.86	2.30	12.32	---	10.02	----	10.27	10.27	----
24589	10.4	0.11	1.64	1.07	2.82	3.3	7.08	1.85	2.38	11.31	10.0	8.93	8.0	7.34	7.34	6.0
24887	----	----	2.33	2.89	5.22	--	0.20	1.04	7.46	8.70	----	1.24	----	0.22	0.22	----
24592	26.1	1.53	0.10	1.20	2.83	2.5	7.34	1.38	0.67	9.39	10.0	8.72	9.0	4.95	4.95	4.0
24532	10.7	0.62	0.40	0.94	1.96	1.6	1.70	4.69	2.82	9.21	10.0	6.39	8.0	9.72	9.72	8.0
24678	3.6	4.64	0.35	0.40	5.39	--	0.46	4.87	0.43	5.76	----	5.33	----	2.26	15.45	----
24476	28.1	0.10	0.00	0.75	0.85	0.5	0.02	3.70	2.93	6.65	5.7	3.72	----	1.65	*14.85	15.0
24477	23.5	----	0.02	0.78	0.80	0.5	0.02	3.65	3.11	6.78	5.7	3.67	----	1.83	†15.61	15.0
24303	103.3	----	0.34	1.18	1.52	--	6.08	1.94	1.06	9.08	--	8.02	----	2.93	2.93	----
24304	93.7	----	0.20	1.42	1.62	1.6	5.22	2.13	0.68	8.03	8.0	7.35	7.0	4.15	4.15	4.0
24445	19.6	0.50	0.10	4.19	4.79	4.5	0.09	3.61	0.65	4.35	3.5	3.70	3.0	0.69	‡5.97	5.5
24231	19.5	1.18	0.18	3.40	4.76	5.0	0.98	5.48	2.89	9.35	5.0	6.46	4.0	1.21	7.17	6.0
24642	17.3	2.46	0.72	1.27	4.45	4.0	6.23	2.03	2.24	10.50	10.0	8.26	8.0	0.43	9.08	10.0
24619	2.6	1.65	0.08	2.63	4.36	3.3	4.13	2.33	1.37	7.83	----	6.46	6.0	7.70	7.70	6.0
24620	1.4	1.65	0.10	2.69	4.44	3.3	3.87	2.64	1.36	7.87	----	6.51	6.0	7.78	7.78	6.0
24331	20.1	1.00	0.13	2.20	3.33	3.3	2.89	5.32	2.96	11.17	9.3	8.21	----	9.22	9.22	9.0

and of both nitrogen and potash in their Connecticut Valley Tobacco Grower, **24786**, page 418, requested that other samples be drawn. An attempt was made to comply with the request, but other samples could not at that time be found.

The C. M. Shay Co. protested that analysis **24442**, p. 422, which showed a deficiency of 0.16 per cent. of nitrogen, did not represent the quality of their Corn Fertilizer, and requested that another sample be drawn and examined. This was done, and the analysis, **24596**, shows 0.02 per cent. above guaranty. In both analyses the percentages of potash and phosphoric acid were well above guaranty, and under such conditions a deficiency of 0.16 per cent. of nitrogen is not significant.

Tanner & Wilcox advise that the shortage of nitrogen shown in the sample **24677**, p. 424, of their Reliable Potato and Garden Phosphate, was due to a mistake in the quality of some nitrogenous material sold them, which was ordered as ten per cent. goods, whereas eight per cent. goods were delivered. The shortage was made good in subsequent mixtures.

The sample **24808**, Wilcox High Grade Tobacco Special, p. 424, does not at all represent the quality of this brand. The manufacturers advise that a mistake was discovered in the mixing and all the shipments were ordered returned and the proper correction made, except in the one from which our sample was drawn, which was overlooked. In this mixture the buyer receives a larger money equivalent in plant food than in the regular formula, so that the money loss comes on the manufacturer.

Guaranties.

Of the 264 analyses of nitrogenous superphosphates sampled by the Station Agent, 85 or nearly one-third of the number failed to meet their guaranties in one or more particulars. In many cases the difference was small and in most cases a deficiency of one ingredient was made good in money equivalent by other ingredients which exceeded the guaranty.

In the following brands, however, this deficiency was not thus balanced by excess of other ingredients: Atlantic High-Grade Truck and Potato Special, Germofert Patented Potato Manure, Germofert Special Cotton Manure, Manchester's Special, Mapes' Top Dressing, and Niantic Market Garden Manure.

Cost.

An effort is made to get a statement of cash retail price from each dealer from whom a sample is taken and these statements are

in all cases submitted to the manufacturer for criticism. In general an average of the quoted prices forms the basis of comparison between cost and valuation.

Valuation.

The method and meaning of valuation is explained on page 40.

The schedule of trade-values is given on page 397. The organic nitrogen in mixed fertilizers is reckoned at the price of nitrogen in raw material of the best quality, 20 cents per pound.

Citrate-insoluble phosphoric acid is rated at 2 cents per pound. Potash is rated at 4¼ cents, if sufficient chlorine is present in the fertilizer to combine with it to make muriate. If there is more potash present than will combine with the chlorine, then this excess of potash is reckoned at 5 cents per pound, except in those cases where carbonate of potash has been used in the mixture. In these cases the method is followed which is described on page 404.

In most cases the valuation of the ingredients in superphosphates falls considerably below the retail price. The difference between the two figures represents the manufacturer's charges for converting raw materials into manufactured articles and selling them. The charges are for grinding and mixing, bagging or barreling, storage and transportation, commission to agents and dealers, long credits, interest on investments, bad debts, and, finally, profits.

To obtain the Valuation of a Fertilizer, multiply the pounds per ton of nitrogen, etc., by the trade-value per pound. The several products give the values per ton of the several ingredients and their sum is the total valuation per ton.

Percentage Difference.

Percentage Difference shows the percentage excess of the cost price over the average retail cost, at freight centers, of the nitrogen, phosphoric acid and potash contained in the fertilizer and furnishes the best means we have for expressing the *comparative* commercial (but not *agricultural*) value of the different brands.

This information helps the purchaser to determine whether it is better economy to buy the commercial mixed fertilizers, of which so many are now offered for sale, or to purchase and mix for himself the raw materials. In some cases the prices quoted by dealers differ very widely, in extreme cases by $5.00 per ton.

As the percentage difference varies with the price, any uncertainty or misstatement as to price makes a corresponding uncertainty and inaccuracy in the percentage difference.

The average cost per ton of two hundred and fifty-eight nitrogenous superphosphates, of which the costs and valuations are given in the table, is $34.31, the average valuation $23.36, and the percentage difference 46.9.

The average composition and cost of nitrogenous superphosphates for the last three years have been as follows:

	Nitrogen.	Total Phosphoric Acid.	"Available" Phosphoric Acid.	Potash.	Cost per Ton.	Percentage Difference.
1908.........	2.91	9.55	7.97	5.63	$34.13	38.5
1909.........	2.93	9.52	8.09	5.78	33.96	52.1
1910.........	2.98	9.28	7.83	5.88	34.36	46.9

2. *Sampled by Purchasers and Others.*

In the table pages 426 to 427 are given the analyses of seventeen samples drawn by others than the Station Agent. The Station assumes the responsibility only for the accuracy of analysis of these samples, not for the accuracy of the sampling. The sender, however, provides a certificate, stating that the sample was drawn properly in substantial accordance with the Station's directions.

THE SOLUBILITY OF ORGANIC FORMS OF NITROGEN IN FERTILIZERS.

By John Phillips Street.

Most of the nitrogenous superphosphates sold in this State contain nitrogen in three forms which differ both in their commercial and agricultural value.

First: About two-thirds of these fertilizers contain nitrogen as nitrates, which ranges in amount from a trace to more than 3.00 per cent.; the average for those containing nitrate being 0.92 and for the whole number 0.60 per cent.

Second: With only three exceptions, all contain nitrogen in form of ammonia salts or yield ammonia on distillation with magnesia. Three-fourths of the number contain one per cent. or less. The average amount of ammonia is 0.76 per cent.

Third: Nitrogen in organic forms, ranging from 0.24 to 4.37 per cent. with an average of 1.62 per cent.

Recognizing the wide range of percentages given above, we may say, with sufficient exactness for the purpose of this discussion, that the nitrogenous superphosphates taken together, as a composite, contain:

Nitrogen in form of nitrates	0.60	per cent.
" " " " ammonia	0.76	"
" " organic forms	1.62	"
Total nitrogen	2.98	"

The nitrogen in form of nitrate, generally nitrate of soda but sometimes nitrate of potash, is always the same in its form of combination, it is perfectly soluble in water and its fertilizing effect, compared with other forms of nitrogen, is fairly well known.

The larger part of the nitrogen in form of ammonia which is found in these fertilizers comes from sulphate of ammonia added in the factory mixture. It comes in part, however, from other sources. For example, in the analyses of fish small amounts of ammonia are always obtained by the analytical method used. There is no doubt that this comes from other things than added sulphate of ammonia. While drying, fish decomposes to some extent, yielding ammonia as one of the decomposition products. It is quite likely, too, that ammonia is formed during the process of determination by the decomposition of amines formed in decaying fish, which readily break up with formation of ammonia. The agricultural value of sulphate of ammonia is well known. The value of nitrogen in other matters which yield ammonia on distillation with magnesia has not been determined.

But organic nitrogenous matters are most complex and various and their comparative fertilizing value is not known except in the most general way. They may come from the greatest variety of sources: some are freely soluble in water, others totally insoluble; some quickly decompose and yield their nitrogen to crops, while others are almost inert. It is not possible, in most cases, to certainly identify these organic matters, such as blood, meat, peat, treated leather, bat guano, hoof meal, etc., either by the eye alone or with the microscope and chemical reagents. Were this possible, some crude estimate might be made of the farm value of the mixtures containing them.

Yet some method of estimation is urgently needed. More than half of the nitrogen in the average mixed fertilizer is in organic forms and for this nitrogen the buyer pays more than twenty cents a pound with only little knowledge of its real farm value.

The urgency is becoming greater. It is difficult to meet the ever-increasing demand for fertilizer-nitrogen at prices that the farmer can pay; and various processes have been and are being tried to convert the nitrogen of comparatively inert "ammoniates" such as leather, wool waste, hair and other manufacturing waste into soluble and available forms. If this can be done, it will vastly increase the supply of fertilizer-nitrogen at prices which the farmer can pay. In principle, there is nothing wrong in the plan and theoretically it is possible. It is just as legitimate as the conversion of comparatively inert ground phosphate into quickly available acid phosphate and if it succeeds it will be an even greater help to agriculture.

It is quite likely that from now on mixed fertilizers will contain more or less nitrogenous matter derived from things like leather, hair, etc., agriculturally inert in their crude state, but which have been treated with the object of making them agriculturally valuable. Whether this object has been attained, it is of the first importance to know. The manufacturers themselves are not in position to prove the point.

These considerations make it desirable for the stations to coöperate in devising some method to determine at least in approximate fashion the probable availability of that part of the nitrogen of commercial fertilizers which is in organic forms.

The work to be described here is chiefly preliminary to a study of the actual availability to crops of water-soluble and permanganate-soluble forms of nitrogen and to devising, if possible, a laboratory method which shall be useful in determining the agricultural value of organic forms of nitrogen. The water- and permanganate-solubility of nitrogen has been determined in one hundred and seventeen samples of organic nitrogenous matters known to be used in fertilizer mixtures. These samples include thirty-five kinds of material of all grades of agricultural value. The results appear in the following table on pages 438 to 440.

Ammonia.

We have reckoned all the nitrogen yielded by boiling the fertilizer in the usual way with magnesium oxide, as from ammonia. The high percentages obtained in many cases emphasize the suggestion made on an earlier page, that a considerable portion of this ammonia comes not from ammonia salts but rather from partial putrefaction of the material, or from organic forms that yield ammonia when boiled with magnesia. The agricultural value of these forms has yet to be established.

Materials like blood, hoof meal, cotton seed meal, castor pomace and bone yield but little ammonia, at most only a few tenths of one per cent. The samples of fish yield from 0.12 to 1.40 per cent. and tankage shows about the same variation. "Fillerine" and beet root manures, both generally considered to contain relatively inert forms of nitrogen, have 0.90 and 2.02 per cent. respectively of ammonia. Two samples of alleged tankage examined in 1909 contained 2.38 and 2.29 per cent. of ammonia, and, considering their analyses and appearance, are believed to be forms of beet root manure. The high ammonia content of these materials which are generally assumed to be of inferior value, raises the question, whether their agricultural value is underestimated, or whether the availability and value of all the ammonia set free by magnesium oxide is overestimated. The percentages of nitrogen as ammonia are given in the third column of the table.

Water-Soluble Organic Nitrogen. *

The percentages of water-soluble nitrogen, given in the fourth column of the table, are specially interesting. High-grade dried blood, hide and skin meal, tartar pomace, "fillerine" and peat have only traces. Certain other materials contain large amounts. Ammonite, for instance, contains 6.73 per cent. while a number of samples of fish and tankage have from 2.00 to nearly 4.00 per cent., a sample of bone meal 2.36 per cent., and "solubilized organic nitrogen" and "azote," both of them forms of treated leather, contain respectively 1.45 and 2.02 per cent.

These figures suggest a very important problem; namely, the value of the water-soluble organic nitrogen. If it is readily

* Water-soluble organic nitrogen was determined by extracting one gram of the sample with water at room temperature. The water-soluble organic nitrogen is calculated by subtracting the nitrogen of the residue from the total organic nitrogen in the substance.

available to crops, whatever the source from which it comes, it is clear that certain fertilizer materials, hitherto classed as low grade, are undervalued. On the other hand, if this water-soluble nitrogen is not in all cases readily available, the value of the wet-mixing process for rendering inert forms of nitrogen soluble and available is questionable.

Insoluble Organic Nitrogen.*

The amount of organic nitrogen which is insoluble in water and permanganate solution is given in the fifth column of the table, and in the sixth the percentage insoluble in both water and permanganate solution.

It appears that the nitrogen in all of those materials which are generally regarded as high-grade, is highly soluble in permanganate, while that of the others, like garbage tankage and peat, is very much less soluble. The following table gives the average solubilities of some of the typical organic forms.

Permanganate Solubility of the Organic Nitrogen which is Insoluble in Water.

Dried blood	96 per cent.
Hoof meal	95
Cotton seed meal	93
Ground bone	93
Dried fish	91
Tankage	90
Castor pomace	88
Tartar pomace	54
Garbage tankage	50
Sheep manure	48
Peat	42
Tobacco stems	39
Mora meal	34

Ranging in solubility between castor pomace and tartar pomace are the greater number of articles prepared for use in fertilizers from inert forms by some treatment designed to make them more available. Such are the various treated leather preparations, "fillerine" and beet root manure. Inasmuch as all the materials which experience shows to be quickly available give permanganate solubilities of 85 or over, a solubility much below this minimum suggests, but does not prove, relative inferiority as a source of nitrogen for feeding a growing crop.

The fifty samples of raw materials examined this year in our regular fertilizer inspection were also tested for permanganate solubility. The solubility of thirteen of the tankages ranged from 83 to 94 per cent., while one was only 72 per cent.; that of eighteen samples of fish ranged from 87 to 94; of dried blood from 94 to 97; of castor pomace from 87 to 92; of the single samples of cotton seed and hoof meals, each 96; while the permanganate solubility of garbage tankage, treated leather, tobacco stems, fish and peat and "dissolved animal matter" (leather) were 67, 79, 45, 46, and 17 respectively.

The only solubilities which appear erratic are those of dissolved bone and hair manure. Thus two samples of dissolved bone had permanganate solubilities of 71 and 69 respectively, figures which are so low as to make us question whether the two articles are true to their names. The solubility of hair manure (92 per cent) is much higher than would have been expected, but the particular sample tested was a very fine, soft hair which rapidly disintegrated when rubbed between the fingers. A sample of coarse, more resistant hair was not at our disposal, so that the figure given for hair must not be considered typical for that material, but only as representing this particular sample. The data discussed above indicate that the neutral permanganate method may offer a means of determining the approximate rela-

* NEUTRAL PERMANGANATE METHOD.

Weigh a quantity of the fertilizer, equivalent to 45 mgms. of water-insoluble organic nitrogen, on a moistened 11 cm. filter paper, and wash with successive portions of water at room temperature until the filtrate amounts to 250 cc. Transfer insoluble residue with 25 cc. of tepid water to a 300 cc. low-form Griffin beaker, and add 100 cc. of 2 per cent. permanganate of potash solution. Digest in a steam or hot-water bath for thirty minutes at the temperature of boiling water, covering the beaker with a watch glass and setting well down into the bath so that the level of the liquid in the beaker is below that of the bath. Stir twice at intervals of ten minutes. At the end of the digestion, remove from the bath, add 100 cc. of cold water and filter through a heavy 15 cm. folded filter. Wash with cold water, small quantities at a time, until total filtrate amounts to about 400 cc. Determine nitrogen in residue and filter, correcting for the nitrogen of the filter.

tive value of the organic nitrogen found in commercial fertilizers. At any rate it seems sufficiently promising to warrant pot and perhaps field experiments to determine how far the differences in solubility noted above correspond to differences in actual fertilizing value and how far the approximate relative value of organic nitrogen may be determined by a laboratory method.

Permanganate Solubility of Organic Nitrogen in Mixed Fertilizers.

The solubility of the organic nitrogen of all the mixed fertilizers analyzed in 1910 has been determined by the two reagents: water and neutral solution of potassium permanganate. Only a brief summary of results can here be given. On the average about 23.5 per cent. of the organic nitrogen was soluble in cold water, 63 per cent. was soluble in neutral permanganate and 13.5 per cent. was insoluble in both. In one fertilizer as much as 72 per cent. of the organic nitrogen was water-soluble.

Only a very small percentage of nitrogen insoluble in the above reagents was found in the tobacco specials, the average in thirty-three brands being 9 per cent. and only seven of them having more than that percentage.

If the quality of a fertilizer were to be judged by this method, it would not be fair to consider the actual amount of insoluble organic nitrogen apart from its relation to the total nitrogen. The nitrogen of certain high-grade fertilizers consists almost entirely of soluble inorganic forms, nitrates and ammonia salts, and the total organic nitrogen consists of only a few tenths of one per cent. Now, even granting that this organic nitrogen exists in an inferior form and shows a low permanganate solubility, say 40 to 50 per cent., the smallness of the amount of organic, compared to total, nitrogen gives these figures but little significance in this class of samples. In one sample, for instance, 42 per cent. of the organic nitrogen was insoluble in water or permanganate, yet it amounted to only 0.25 per cent. of actual nitrogen and was only about one-twentieth of the total nitrogen which showed a solubility of 94 per cent.

The following statement shows the range of the solubilities of the *organic* nitrogen in the 250 mixed fertilizers examined.

Number of Brands.	Solubility of Organic Nitrogen in Water and Permanganate of Potash.
96	over 90
50	80 to 89
66	70 79
30	60 69
5	50 59
3	under 50

The relation of permanganate solubility to the amount of total nitrogen present is shown in the following table:

No. of Brands.	Per cent. total Nitrogen.		Permanganate Solubility of Water-insoluble Organic Nitrogen.		
3	under	1.00	56	to 60, average	58
16	1.01 to	1.50	50	85	65
32	1.51	2.00	46	91	71
49	2.01	2.50	48	93	74
43	2.51	3.00	51	92	73
65	3.01	4.00	56	98	81
32	4.01	5.00	37	97	87
8	5.01	6.00	71	94	86
2	6.01	7.00	92	94	93
2	over	8.00	83	89	86

While there are a few individual exceptions, the "high-grade" fertilizers, those that contain most nitrogen, have a higher nitrogen solubility than the "low-grade" goods.

An ocular examination of 48 of the mixed fertilizers showed with reasonable degree of certainty the nature of their organic nitrogen. It is interesting to note how closely their solubilities, shown in the table below, agree with those given for the corresponding raw materials in the table on pages 438-440.

Fish and bone	89-98, average	94	Cotton seed meal	88-92, average	90
Fish	86-97,	91	Tankage	85-92,	89
Castor pomace	94-96,	95	Tankage (?)	65,	65
Blood and bone	89-96,	93	Peruvian guano	89,	89
Tankage & bone	89-94,	92	Sheep manure	50-56,	52
Bone	82-96,	90	Fish and peat	46,	46

Material.	Per cent. of Nitrogen. Total.	As Ammonia.	As Water-soluble Organic.	As Permanganate-soluble Organic.	As Insoluble Organic.	Solubility of Organic Nitrogen. Total.	Water-insoluble Organic.
Dried Blood	14.06	0.10	0.20	13.35	0.41	97	97
"	13.04	0.04	0.00	12.61	0.39	97	97
"	13.32	0.06	0.00	12.73	0.53	96	96
"	8.90	0.06	0.88	7.64	0.32	96	96
"	10.35	0.08	0.21	9.46	0.60	94	94
"	10.34	0.34	0.60	8.84	0.56	94	94
Average	**11.67**	**0.11**	**0.32**	**10.77**	**0.47**	**96**	**96**
Hoof Meal	14.83	0.38	1.25	12.54	0.66	95	95
"	15.16	0.32	1.12	13.03	0.69	95	95
Average	**15.00**	**0.35**	**1.19**	**12.78**	**0.68**	**95**	**95**
Azotine	13.00	0.07	1.73	10.64	0.56	96	95
Cotton Seed Meal	7.09	0.11	0.63	6.10	0.25	96	96
"	8.22	0.10	0.62	7.05	0.45	94	94
"	6.03	0.08	0.61	4.97	0.37	94	93
"	6.80	0.06	0.74	5.52	0.48	93	92
"	7.00	0.06	0.82	5.57	0.55	92	91
Average	**7.03**	**0.08**	**0.68**	**5.85**	**0.42**	**94**	**93**
Bone Knuckle	4.09	0.01	0.22	3.74	0.12	97	97
Bone Dust	2.02	0.00	0.78	1.14	0.10	95	92
Bone Meal	5.40	0.00	2.36	2.77	0.27	95	91
Average	**3.84**	**0.00**	**1.12**	**2.56**	**0.16**	**96**	**93**
Hair Manure	8.06	0.80	1.14	5.65	0.47	94	92*
Dried Fish	9.33	0.40	0.71	7.73	0.49	95	94
"	8.82	0.15	0.71	7.48	0.48	94	94
"	8.30	0.12	0.96	6.71	0.51	94	93
"	9.46	0.18	2.88	5.95	0.45	95	93
"	6.69	0.24	1.99	4.15	0.31	95	93
"	8.68	0.61	2.10	5.49	0.48	94	92
"	8.32	0.47	2.81	4.64	0.40	95	92
"	8.64	0.52	0.92	6.62	0.58	93	92
"	7.75	0.66	1.93	4.70	0.46	94	91
"	8.44	0.94	1.54	5.42	0.54	93	91
"	8.12	0.40	1.68	5.50	0.54	93	91
"	8.13	0.44	2.71	4.53	0.45	94	91
"	7.94	0.84	1.82	4.80	0.48	93	91
"	8.03	1.40	1.49	4.63	0.51	92	90
"	8.08	0.89	1.83	4.77	0.59	92	89
"	7.79	0.88	1.74	4.60	0.57	92	89
"	7.59	0.68	1.97	4.40	0.54	92	89
"	7.68	0.78	1.80	4.49	0.61	91	88
"	8.20	1.34	1.48	4.73	0.65	90	88
"	8.06	1.33	1.64	4.43	0.66	90	87
"	5.80	0.90	1.20	3.21	0.49	90	87
"	4.82	0.65	1.19	2.56	0.42	90	86
Average	**7.94**	**0.67**	**1.69**	**5.07**	**0.51**	**93**	**91**

* See note, page 435.

Material.	Per cent. of Nitrogen. Total.	As Ammonia.	As Water-soluble Organic.	As Permanganate-soluble Organic.	As Insoluble Organic.	Solubility of Organic Nitrogen. Total.	Water-insoluble Organic.
Tankage	7.68	0.10	0.54	6.69	0.35	95	95
"	6.45	0.06	0.53	5.51	0.35	95	94
"	6.66	0.08	0.58	5.64	0.36	95	94
"	4.74	0.18	0.86	3.44	0.26	94	93
"	5.35	0.20	0.93	3.92	0.30	94	93
"	4.62	0.23	0.87	3.27	0.25	94	93
"	5.78	0.15	1.31	4.02	0.30	95	93
"	7.40	0.14	2.44	4.48	0.34	95	93
"	6.00	0.70	0.74	4.24	0.32	94	93
"	5.74	0.15	1.55	3.76	0.28	95	93
"	5.24	0.27	0.77	3.91	0.29	94	93
"	5.48	0.28	0.92	3.94	0.34	93	92
"	5.04	0.18	1.11	3.45	0.30	94	92
"	5.60	0.02	2.50	2.80	0.28	95	91
"	4.88	0.13	1.59	2.88	0.28	94	91
"	6.36	0.10	2.78	3.17	0.31	95	91
"	6.77	0.76	1.31	4.28	0.42	93	91
"	5.74	0.51	1.35	3.49	0.39	93	90
"	5.39	0.60	1.13	3.29	0.37	92	90
"	7.55	1.32	1.51	4.25	0.47	92	90
"	5.84	0.40	1.34	3.65	0.45	92	89
"	7.33	0.36	3.69	2.85	0.43	94	87
"	7.41	0.19	3.18	3.47	0.57	92	86
"	6.04	0.14	1.81	3.48	0.61	90	85
"	4.10	0.08	2.02	1.70	0.30	93	85
"	5.30	0.15	2.63	2.09	0.43	92	83
"	4.12	0.08	2.19	1.53	0.32	92	83
"	3.60	0.13	1.37	1.74	0.36	90	83
"	5.87	0.09	0.45	3.84	1.49	74	72
Average	**5.80**	**0.27**	**1.52**	**3.61**	**0.40**	**93**	**90**
Tankage (alleged)	5.62	2.38	0.62	1.65	0.97	70	63
" "	5.52	2.29	0.67	1.61	0.95	71	63
Average	**5.57**	**2.33**	**0.65**	**1.63**	**0.96**	**70**	**63**
Ammonite	13.66	0.05	6.73	6.12	0.76	94	89
Castor Pomace	6.22	0.06	0.76	4.97	0.43	93	92
"	6.08	0.00	0.56	5.08	0.44	93	92
"	5.34	0.06	0.98	3.83	0.47	91	89
"	4.96	0.06	0.56	3.86	0.48	90	89
"	4.82	0.03	0.81	3.50	0.48	90	88
"	4.90	0.00	0.64	3.71	0.55	89	87
"	4.65	0.01	0.86	3.29	0.49	89	87
"	5.02	0.00	0.53	3.91	0.58	88	87
"	5.18	0.48	0.42	3.38	0.90	81	79
Average	**5.24**	**0.08**	**0.68**	**3.95**	**0.53**	**90**	**88**
Peruvian Guano	2.65	[1]0.42	0.24	1.39	0.17	91	89
"	8.15	3.12	1.97	2.66	0.40	92	87
Average	**5.40**	**[2]1.77**	**1.11**	**2.02**	**0.28**	**92**	**88**

[1] Contains 0.43 nitrates. [2] Contains 0.22 nitrates.

Material.	Per cent. of Nitrogen. Total.	As Ammonia.	As Water-soluble Organic.	As Permanganate-soluble Organic.	As Insoluble Organic.	Solubility of Organic Nitrogen. Total.	Water-insoluble Organic.
Tygert Tankage	9.48	0.14	0.90	7.43	1.01	89	88
Sewage Waste	4.20	0.04	0.28	3.41	0.47	89	88
Nitrogenous Material	8.84	0.17	0.55	6.58	1.54	82	81
Treated Leather	6.35	0.36	0.45	4.38	1.16	81	79
Cocoon Dust	9.20	0.05	1.19	6.21	1.75	81	78
Hide and Skin Meal	8.06	0.12	0.12	5.87	1.95	75	75
Dissolved Bone	3.26	0.68	1.03	1.10	0.45	83	71*
Acidulated Bone	3.40	0.41	0.42	1.77	0.80	73	69
Fillerine	4.80	0.90	0.00	2.69	1.21	69	69
Solubilized Organic Nitrogen	6.47	0.16	1.45	3.16	1.70	73	65
Beet Root Manure	5.75	2.02	0.41	2.09	1.23	67	63
Azote	7.18	0.30	2.02	2.87	1.99	71	59
Tartar Pomace	3.99	0.48	0.03	1.88	1.60	54	54
Garbage Tankage	2.92	0.10	0.10	1.82	0.90	68	67
"	2.51	0.03	0.52	1.00	0.96	61	51
"	2.45	0.07	0.52	0.87	0.99	58	47
"	2.76	0.09	0.29	1.02	1.36	49	43
"	2.07	0.04	0.55	0.61	0.87	57	41
Average	**2.54**	**0.07**	**0.40**	**1.06**	**1.01**	**59**	**50**
Sheep Manure	2.20	0.25	0.43	0.85	0.67	66	56
"	2.35	0.23	0.44	0.86	0.82	61	51
"	2.50	0.49	0.39	0.81	0.81	60	50
"	2.58	[2]0.37	0.41	0.77	0.95	55	45
"	2.50	0.52	0.25	0.67	1.06	46	39
Average	**2.42**	**0.39**	**0.38**	**0.79**	**0.86**	**58**	**48**
Peat	2.80	0.02	0.02	1.38	1.38	50	50
"	2.81	0.10	0.01	1.24	1.46	46	46
"	2.92	0.08	0.00	1.14	1.70	40	40
"	3.04	0.16	0.28	0.78	1.82	37	30
Average	**2.89**	**0.09**	**0.08**	**1.13**	**1.59**	**43**	**42**
Fish and Peat	3.35	----	----	1.17	1.37	--	46
Tobacco Stems	2.43	[3]0.34	0.52	0.44	0.54	64	45
"	2.42	[4]0.10	0.49	0.60	0.84	56	42
"	2.77	[5]0.28	0.53	0.40	0.70	57	36
"	2.40	[6]0.37	0.55	0.30	0.64	57	32
Average	**2.51**	**[8]0.27**	**0.52**	**0.44**	**0.68**	**59**	**39**
Mora Meal	3.02	0.02	0.24	0.94	1.82	39	34
Dissolved Animal Matter	1.48	----	----	0.08	0.37	--	17

[2] Contains 0.08 nitrates. [3] Contains 0.59 nitrates. [4] Contains 0.39 nitrates.
[5] " 0.86 " [6] " 0.54 " [8] " 0.60 "

* See note, page 435.

VEGETATION TESTS.

A series of tests was conducted, in which rye was grown in 8 inch flower pots in the greenhouse by the usual methods of experiment. The yields from tankage, cotton seed meal, dried fish, bone, hoof meal, nitrate of soda, calcium nitrate, and calcium cyanide, showed so little agreement among the individual pots under the same kind of fertilization, that no consideration is given them here. However, where nitrogen was supplied in these high-grade forms, the yields both of dry matter and nitrogen were in every case much larger than where the pots received the same amounts of nitrogen in the other forms named below, and these latter yields were very uniform. The yields from dried blood showed good agreement with each other and are used as the basis of comparison. The organic materials were applied in quantities equivalent to 0.15 and 0.25 gm. of actual nitrogen.

The average yields of dry matter and per cents of the fertilizer nitrogen found in the crops are shown below:

	Added fertilizer contained 0.15 gm. N. Dry matter of crop, gms.	N. recovered in crop, per cent.	Added fertilizer contained 0.25 gm. N. Dry matter of crop, gms.	N. recovered in crop, per cent.
Dried Blood	21.5	47.4	32.9	54.3
Sheep Manure	12.1	20.0	15.2	14.0
Peat	8.9	2.2	9.8	3.1
Fillerine	10.4	9.9	13.1	11.8
Hide and Skin Meal	9.6	8.5	14.2	13.0
Tygert Tankage	14.8	18.5	18.1	18.1
Sol. Organic Nitrogen	11.4	13.3	16.3	11.7
Beet Root Manure	16.1	23.3	20.0	23.0
Azote	13.3	15.3	16.9	14.8
No nitrogen	5.8	....	5.8	....

For the first three weeks of the experiment the differences in growth in the pots were not marked. After that time all the pots fertilized as indicated above, except the blood pots, began to fall behind those fertilized with high-grade ammoniates, and at the end of seven weeks from the beginning of the experiment had practically ceased growing and had turned yellow. The experiment was continued for four months, at the end of which time only small poorly developed heads had been formed in any of the pots showing low nitrogen availability.

By comparing the percentage recovery of the nitrogen with the permanganate solubilities of the same fertilizers given on page 438, it will be seen that all of these materials classed there as inferior, showed a decided inferiority to dried blood in nitrogen assimilation in these vegetation tests.

Peat appears to be almost worthless as a source of nitrogen, while the nitrogen of the other materials is shown to be from about one-fifth to four-tenths as available as that of dried blood.

HOME MIXTURES.

The following table contains analyses of twenty-two samples of fertilizer mixtures sent by those who had prepared and used them. The formulas by which they were prepared are also given, so far as they were reported to the Station.

In some cases there has been some mistake in weighing the raw materials or the sample does not fairly represent the mixture, or possibly the raw materials are of quite abnormal composition. Thus in sample **24591**, 400 lbs. of muriate of potash in a ton mixture should yield about 10 per cent. of potash, while the sample showed only 2.2. Again, the bone and tankage used might be expected to yield 11 or 12 per cent. of phosphoric acid, while analysis shows over 17 per cent.

24679, 900 lbs. of ground bone in a ton mixture should yield between 9 and 12 per cent., not 14.5 of phosphoric acid.

The next sample, **25174**, is stated to contain 400 lbs. of cyanamide, or "lime nitrogen," and no nitrate, yet the analysis shows 1.43 per cent. of nitrate nitrogen, equivalent to nearly 200 lbs. of nitrate of soda, in a ton mixture.

These facts emphasize the need of more care in weighing, mixing and sampling. Without such care the analysis is worthless and the time and labor spent on it are wasted.

Home Mixtures. Formulas.

Station No.	Made by or for	Formulas. Pounds per Ton of Mixture.												
		Nitrate of Soda.	Cyanamide.	Dried Blood.	Cotton Seed Meal.	Bone Black Superphosphate.	Acid Phosphate.	Dry Fish.	Tankage.	Fine Ground Bone.	Sulphate of Potash.	Muriate of Potash.	Kainit.	Lime.
24591	C. R. Burr & Co., Manchester	---	---	---	---	---	---	---	800	800	---	400	---	---
24679	H. E. Clark, Middlebury	400	---	300	---	---	---	---	---	900	400†	---	---	---
25174	" "	---	400	300	---	---	---	---	---	900	400†	---	---	---
24398	Connecticut School for Boys, Meriden	500	---	---	---	---	400	---	500	---	---	250	350	---
24399	Connecticut School for Boys, Meriden	100	---	---	---	---	750	---	750	---	200	200	---	---
24757	Dennis Fenn, Milford	200	---	---	---	600	---	---	800	100	---	300	---	---
24758	" "	100	---	100	---	600	---	---	800	200	---	200	---	---
24644	Andrew Kingsbury, Rockville	300	---	---	---	---	800	---	---	600	---	300	---	---
25197	Fred Lyman, Manchester	---	---	---	---	---	834	333	---	416	---	417	---	---
24643	H. B. Pomeroy, Rockville	325	---	---	---	---	1307	---	---	---	---	368	---	---
23987	H. J. Roche, Suffield	---	---	---	1000	---	---	400	---	---	300†	---	---	300
24404	C. R. Treat, Orange	150	---	---	---	---	650	---	850	---	---	350	---	---
24420	G. A. Cleveland, Windsor Locks	---	---	---	---	---	---	---	---	---	---	---	---	---
24680	E. G. Jones, New Canaan	---	---	---	---	---	---	---	---	---	---	---	---	---
24681	" "	---	---	---	---	---	---	---	---	---	---	---	---	---
24817	D. W. Meeker, West Cheshire	---	---	---	---	---	---	---	---	---	---	---	---	---
24421	T. W. Ryan, Stratford	---	---	---	---	---	---	---	---	---	---	---	---	---
24521	S. L. Tuttle, Wallingford, for Corn and General Crops	---	---	---	---	---	---	---	---	---	---	---	---	---
24522	S. L. Tuttle, for Orchards	---	---	---	---	---	---	---	---	---	---	---	---	---
24523	S. L. Tuttle, for Potatoes and Quick Crops	---		---	---	---	---	---	---	---	---	---	---	---
24524	S. L. Tuttle, for Oats and Top Dressing	---	---	---	---	---	---	---	---	---	---	---	---	---
24419	Andrew Ure, Highwood	100	---	100	---	---	700	---	800	---	---	300	---	---

* Does not include cost of mixing or cartage. † High grade.

Analyses and Valuations.

Station No.	Analyses.									Cost and Valuation.	
	Nitrogen as Nitrate.	Nitrogen as Ammonia.	Nitrogen Organic.	Total Nitrogen.	Water-soluble Phosphoric Acid.	Citrate-soluble Phosphoric Acid.	Citrate-insoluble Phosphoric Acid.	Total Phosphoric Acid	Potash.	Cost per ton.	Valuation per ton.
24591	---	0.12	3.81	3.93	2.26	7.73	7.46	17.45	2.22	$31.20	$28.70
24679	2.84	0.12	2.14	5.10	0.24	10.07	4.18	14.49	9.58	36.25	37.39
25174	1.43	0.25	3.50	5.18	0.02	5.69	7.57	13.28	5.10	36.25	31.79
24398	3.62	0.12	1.34	5.08	2.70	2.55	0.72	5.97	8.92	26.91	29.66
24399	0.84	0.12	1.99	2.95	4.79	3.65	1.46	9.90	8.04	23.47	25.77
24757	1.62	0.12	2.67	4.41	0.85	4.97	2.28	8.10	8.76	34.50	29.35
24758	0.72	0.16	2.78	3.66	4.53	4.79	2.35	11.67	7.16	33.00	28.87
24644	2.29	0.04	1.15	3.48	4.20	7.32	2.42	13.94	8.04	28.80	29.50
25197	----	0.14	1.61	1.75	5.03	6.45	4.46	15.94	9.86	29.05	26.74
24643	2.42	0.02	0.05	2.49	7.81	2.07	0.28	10.16	9.73	25.64	25.07
23987	----	0.04	4.72	4.76	0.05	0.82	0.43	1.30	8.01	33.95	27.84
24404	1.17	0.08	2.30	3.55	4.58	2.90	0.77	8.25	8.59	25.75	27.25
24420	0.24	0.05	3.43	3.72	0.07	0.21	0.09	0.37	12.44	----	27.23
24680	2.87	0.05	0.14	3.06	0.02	7.02	2.11	9.15	10.18	32.50	26.49
24681	1.50	0.12	2.50	4.12	2.44	3.24	1.32	7.00	17.28	32.50	37.58
24817	----	0.10	3.30	3.40	1.65	7.01	5.26	13.92	9.50	32.20	30.80
24421	2.80	0.14	2.96	5.90	4.43	3.85	1.65	9.93	5.93	----	34.02
24521	2.76	0.10	1.52	4.38	2.34	5.67	2.77	10.78	10.36	36.00	31.80
24522	2.18	0.05	0.71	2.94	4.37	7.57	1.57	13.51	9.04	34.50	28.28
24523	6.15	0.06	1.30	7.51	1.85	3.93	1.87	7.65	8.11	36.00	37.52
24524	5.22	----	----	5.22	5.31	1.14	0.70	7.15	12.68	35.50	33.45
24419	1.85	0.18	2.80	4.83	4.08	4.58	2.41	11.07	2.24	----	27.89

LIME IN VARIOUS FORMS.*

The following samples were sent for analysis by purchasers, many of whom did not give the particulars regarding the samples which are necessary to make them of any public interest and value and thus to justify the analyses at the state expense.

24170, sent by W. A. Henry & Son, Wallingford. **24293**, sold by the Vermont Lime Co., Greenfield, Mass.; sent by J. F. Carpenter, Putnam. **24583**, "Lime and Ashes," sold by the Knox Fertz'r Co., Rockland, Me.; sent by L. P. Abbe, Hazardville. **24629**, Caledonia Marl, sold by Caledonia Marl Co.; sent by F. A. Hamilton, Warehouse Point. **24630**, sent by C. M. Jarvis, Berlin. **24682**, Damp Forked Lime, sold by Buffalo Fertilizer Co.; sent by C. B. Treadwell, New Canaan. **24744**, sold by Buffalo Fertilizer Co.; sent by E. H. Nevers, Burnside. **24854**, from a pile of refuse lime in Bethel; **24855**, lime from the Redding Kiln, both sent by I. C. Fanton, Westport. **25173**, sent by H. E. Clark, Middlebury. **25176**, sent by E. E. Burwell, New Haven. **25198**, sold by W. L. Mitchell, New Haven, sent by F. Lyman, Manchester.

24853. Oyster Shell Dust, sold by the Adamant Plaster Co., New Haven, and sent by A. A. Young, Jewett City.

ANALYSES.

	24170	24293	24583	24629	24630	24682	24744
Moisture	----	----	17.29	----	27.80	23.47	----
Lime	60.62	69.91	47.50	47.40	39.87	58.30	49.54
Magnesia	0.77	5.57	2.97	----	4.88	----	2.35
Potash	----	----	0.60	----	----	----	----
Phosphoric acid	----	----	0.36	----	----	----	----
Insoluble in acid	0.65	7.57	3.36	----	----	----	--
Cost per ton	$4.00	7.00†	12.04	----	----	4.00	7.00

	24854	24855	25173	25176	25198	24853	
Moisture	33.18	----	----	----	----	----	----
Lime	27.90	47.00	49.82	34.14	60.70	42.39	----
Magnesia	16.79	32.78	----	----	----	----	----
Potash	----	----	----	----	----	----	----
Phosphoric acid	----	----	----	0.52	----	----	----
Insoluble in acid	----	----	----	----	----	----	----
Cost per ton	----	$5.00†	4.50†	10.00	5.00†	2.50	----

† At kiln.

These figures would have been interesting and instructive if those who sent the samples had given the particulars necessary

* See also page 453.

to give value to the analyses. As it is, most of them are almost worthless for the public.

With the constantly increasing demands on the station's time it will be necessary hereafter to decline to analyze samples until the station has received information about them sufficient to give general value to the analysis, and until the accuracy of the sample and of the information regarding it are vouched for.

COTTON HULL ASHES.

This valuable tobacco fertilizer has almost disappeared from our markets. Only four samples have been examined this year, as follows:

24249, car Erie 72333; **24407**, car C. St. P. M. & O. 24604; and **24857**, car I. C. 35399, all sold by American Cotton Oil Co., N. Y. C., through Spencer Bros., Suffield.

24683. Sold by Olds & Whipple; sampled and sent by F. B. Hathaway, Suffield.

ANALYSES.

Station No.	24249	24407	24857	24683
Percentage amount of				
Water-soluble potash	23.02	20.02	18.34	23.79
Cost per ton	$51.00	40.04	42.66	55.00
Potash costs cents per pound	9.7	10.0	10.0	10.2

WOOD ASHES.

24821. Bowker's Canada Hard Wood Ashes, sold by Bowker Fertilizer Co. and sampled from stock of Lightbourn & Pond Co., New Haven.

24257. Canada Hard Wood Ashes, sold by John Joynt, Lucknow, Can., and claimed to contain 6 per cent. of potash. Sampled and sent by O. S. Olmstead, Hazardville.

24627. Same brand, sampled and sent by Olds & Whipple, Hartford.

24628. Same brand, claimed to contain 4.0 per cent. of potash. Sampled and sent by Frank S. Platt Co., New Haven.

24582. Sold by F. R. Lalor, Dunnville, Can.; sampled and sent by F. B. Miller, Bloomfield.

24488. Sold by Geo. L. Munroe & Co.; sampled and sent by J. A. Sherwood, Long Hill.

ANALYSES.

Station No.	24821	24257	24627	24628	24582	24488
Percentage amounts of						
Total potash	....	4.86	3.95	4.07	5.98	3.43
Water-soluble potash	4.38	4.13	2.90	3.29	....	2.89
Phosphoric acid	1.71	1.47	1.00	1.43	1.68	1.36
Lime	31.58	30.00	24.88	18.82	31.20	27.11
Magnesia	4.85	3.92	5.05	4.73	3.33	4.79
Insoluble in acid	8.60	13.22	34.33	26.65	12.17	29.57
Moisture	15.52	18.23	5.50	24.50	10.63	20.45
Cost per ton	$18.00	13.21	12.00	18.00	11.00	11.00

HORSE MANURE FROM CITY STABLES.

Very large quantities of manure are brought into this state from Boston and New York horse stables and are used chiefly by tobacco farmers and market gardeners.

24574 is a sample carefully taken by Mr. W. M. Hinson of the U. S. Department of Agriculture from a car from Boston stables, bought by W. K. Ackley, East Hartford.

24575 is a sample of New York stable manure sampled like the last, at East Hartford. Their composition is as follows:

	24574	24575
Water	62.95	65.36
Organic matter*	32.99	30.70
Mineral matter†	4.06	3.94
	100.00	100.00
* Containing nitrogen	0.66	0.72
† Containing phosphoric acid	0.38	0.41
potash	0.59	0.64

These analyses show that the manure was rather drier than is usual, 70-75 per cent. of moisture being commonly present. Horse manure commonly contains from 0.50-0.75 per cent. of lime, one-third of that amount of magnesia and about 0.1 per cent. of chlorine.

SHEEP MANURE.

24641. Wizard Brand Manure, sold by the Pulverized Manure Co., Chicago, and sampled from stock of Lightbourn & Pond Co., New Haven.

24771. Pulverized Sheep Manure, sold by the A. A. C. Co. and sampled from stock of Greenwich Hardware Co.

24790. Pulverized Sheep Manure, sold by Natural Guano Co., Aurora, Ill., and sampled from stock of F. S. Bidwell & Co., Windsor Locks.

ANALYSES.

	24641	24771	24790
Nitrogen as ammonia	0.49	0.23	0.25
Nitrogen organic	2.01	2.12	1.95
Total nitrogen	2.50	2.35	2.20
Water-soluble phosphoric acid	1.15	0.77	0.40
Citrate-soluble " "	0.46	0.25	0.70
Citrate-insoluble " "	0.17	0.20	0.28
Total phosphoric acid	1.78	1.22	1.38
Potash calculated as muriate	0.78	0.84	0.70
" " " sulphate	0.91	0.75	1.30
Total potash	1.69	1.59	2.00
Cost per ton	$25.00	33.00	30.00

The analyses show that this material contains moderate amounts of nitrogen, phosphoric acid and potash which could be bought in forms of fertilizer chemicals for about $11 to $12 per ton.

It must also be remembered that 60 per cent. of sheep manure consists of fine vegetable matter which forms humus in the soil and has distinct value in feeding the soil bacteria and in regulating the water content of the soil.

DISSOLVED ANIMAL MATTER.

Stated to be made by the Peter Cooper's Glue Factory, sampled and sent by J. W. Crowell, Hartford, contained:

Nitrogen	1.48 per cent.
Water-soluble phosphoric acid	8.96
Citrate-soluble " "	1.82
Citrate-insoluble " "	1.87
Total phosphoric acid	12.65

The cost per ton is $19.00.

A sample of Hoof Meal, **23996**, contained 14.83 per cent. of nitrogen. Hoof, after thorough steaming, drying and grinding, seems to be a form of nitrogen fairly available to plants.

COCOON DUST.

A sample of this material, **23350**, is understood to consist of the dead bodies of silk worms, being a waste from Cheney's silk mills in South Manchester.

It has been found in practice to be a very strong fertilizer and the following analysis shows a high percentage of nitrogen:

Nitrogen	9.20 per cent.
Phosphoric acid	0.67
Potash	0.75
Matters insoluble in acid	5.31

SEWAGE WASTE.

23974. Sent by H. Kamp, Rockville, is understood to be the sludge which accumulates on the sand beds used for the purification of sewage and was sent to learn if it had value as a fertilizer.

It contains:

Water	68.00 per cent.
Nitrogen	1.34
Phosphoric acid	0.22
Potash	0.03

This material has almost three times as much nitrogen as stable manure, but it is probably much less fully available to crops because the more soluble and valuable part of the nitrogen has been removed by water and microbe action. Nevertheless, if it can be got for the hauling, it might pay for a short haul to plow under.

MISCELLANEOUS FERTILIZERS.

The following analyses do not represent goods offered for sale in this state and therefore have no general interest or value, but are here given in accordance with our rule to publish all analyses.

23979 and **23993,** sent by other stations to check their work, contained 2.99 per cent. of nitrogen and 5.74 per cent. respectively. **23982,** tankage, sent for opinion as to the availability of its nitrogen, contained 1.34 per cent. of nitrogen.

TOBACCO DUST AND TOBACCO STEMS.

23857 is a sample of tobacco dust from a tobacco factory, sampled and sent by J. & H. Woodford, Avon.

24826 is tobacco stems, sold by Olds & Whipple, Hartford; sampled and sent by E. P. Brewer, Silver Lane.

	23857	24826
Nitrogen as nitrate	....	0.59
" " ammonia	0.14	0.34
" organic	1.31	1.50
Total nitrogen	1.45	2.43
Phosphoric acid	0.43	0.49
Potash	1.83	5.80
Cost per ton		$14.00

NEW ENGLAND MINERAL FERTILIZER.

This material is made and sold by the New England Mineral Fertilizer Co. of Boston. It is stated by the manufacturer that this is not a lava but a "natural product," finely ground in water, and is sold from $10.00 per ton upwards, depending on the amount of the order.

It is claimed that with a proper application of this material three-fourths of all the insect life which preys on crops will be destroyed in soil and plant; that the manufacturer of these goods is giving twice the value of the ordinary commercial fertilizer at less than one-third the cost.

The analysis of a sample taken from a bag sent by the manufacturer showed 90.92 per cent. of silica and silicates undecomposed and insoluble in strong boiling hydrochloric acid. The acid dissolved 0.28 per cent. of phosphoric acid and 0.36 per cent. of potash.

No further comment on this material as a fertilizer is necessary. If there are any farmers who believe that finely ground stones can enrich the more finely ground rock dust which is already in our soils and that these ground stones are six times as valuable as commercial fertilizers, to such farmers the claims made for this fertilizer may appeal. To others they will appear so preposterous as to be unworthy of discussion.

MUCK AND SEA MUD.

23983, 23984, and **23985** are samples taken from a swamp at the depths of 4½ feet, 2 feet and a few inches, respectively. The lower sample has the same appearance as the muck down to 12 feet. The samples were sent by E. K. Catlin, Torrington.

24173 is described as "muck from farm," sent by J. C. Wilcoxson, Stratford.

24172 was sent by Hubert D. Goodale, Stamford, with the question whether, with or without lime, it could be used in place of stable manure.

23847, sent by Walter E. Coe, Stamford, is stated to be leaf muck from a bed a half mile long and one-quarter mile wide and at least fifteen feet deep, surrounded by high banks. It is apparently a pond basin. Large hardwood trees are found on it and there is water below.

23893. Peat taken from a swamp on the farm of Thomas L. Brown, Black Hall. The sample is drier than the muck usually is because of the exceptionally dry season. Mr. Brown reports that corn grown on rather poor land dressed with this peat yielded as well as where stable manure was used and twice as much as where nothing was applied.

For comparison, **24668** represents a compost of peat or muck and fresh porgies or menhaden which was made in the summer of 1909 and used last spring on corn land with excellent results. Sent by C. W. Scranton, New Haven.

24174 is sea mud, sent by G. D. Tillinghast, Westerly, R. I., who states that he has an unlimited supply of it at hand and wishes, if it proves suitable, to substitute it for stable manure in market gardening.

The composition of these samples is as follows:

ANALYSIS OF PEAT OR MUCK AND MARINE MUD AS RECEIVED.

	23983	23984	23985	24173	24172	23847	23893	24668	24174
Water	54.71	66.29	61.68	52.73	2.87	85.62	69.54	71.70	53.99
Organic matter	5.65	14.30	20.63	8.88	19.01	11.65	25.25	21.84	3.96
Mineral matter	39.64	19.41	17.69	38.39	78.12	2.73	5.21	6.46	42.05
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	0.20	0.50	0.75	0.34	0.44	0.31	0.85	0.95	0.17
Phosphoric acid	----	----	----	----	----	trace	----	0.77	0.19
Potash	----	----	----	----	----	trace	----	----	trace
Calculated Water-Free.									
Organic matter	12.49	42.42	53.84	18.78	19.54	81.03	82.90	77.09	8.62
Mineral matter	87.51	57.58	46.16	81.22	80.46	18.97	17.10	22.91	91.38
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Nitrogen	0.45	1.50	1.96	0.73	0.45	2.18	2.79	3.35	0.37
Phosphoric acid	----	----	----	----	----	0.09	----	2.72	0.42
Potash	----	----	----	----	----	0.05	----	----	0.03

Marine Mud.

There is little actual plant food in this sample, **24174,** and over 90 per cent. of it is very fine sand, with a little carbonate of lime.

If dug in summer this marine mud is said to bake hard, but if heaped up in winter the frost crumbles it as fine as ashes and, in spite of the facts shown by chemical analysis, farm practice has shown profit, in some cases, from its use *on light soils* where applied at the rate of 800 to 1,000 bushels per acre on corn, potatoes, and as a top-dressing on pastures.

Its good effect probably consists in large part in making the soil finer by filling the spaces between the coarse particles. In this way the water-holding and carrying capacity of a soil is improved.

Fine sifted coal ashes sometimes have a very evident effect on light sandy soils which is to be explained in the same way.

Peat or Muck.

"Muck" originally meant dung or mixtures of dung and vegetable matter, and "peat" meant the dark mass resulting from the slow decay of vegetable matter under water or away from the air. Some now use the word "muck" for the surface layers of a swamp which are loose in texture and not fully rotted down, and designate as "peat" the lower layers which are quite uniform in color and texture. But at present the two words in common farm usage have nearly or quite the same meaning.

The analyses above given show fairly the very various sorts of swamp or pond deposits called "muck" or "peat."

One of the samples, as the analysis shows, was almost perfectly dried before sending; the others contained from 52 to 85 per cent. of water, those having the most water which contained most vegetable matter. These analyses can best be studied by calculating them to a water-free basis, since the water is a very variable constituent, changing constantly with the weather and the seasons.

The water-free analyses show in the first place that these mucks vary greatly in their quality, ranging from samples like that at the left of the table, which is merely soil or sand with enough leaf-mold or other vegetable matter in it to make it dark or black in color, to samples like those at the right of the muck samples, which are mostly vegetable matter, with relatively little sand.

In the next place, it is to be noted that mucks in general contain only small fractions of one per cent. of potash and phosphoric acid. The reason is clear when their origin is considered. Most of them are formed by the decay of leaves and grasses, often under water and always without free access of air. The material from which muck is formed is naturally poor in fertilizing matter and much of this has been leached out by water.

It will be noted once more that dry muck contains much more nitrogen than either phosphoric acid or potash, the percentage of nitrogen in the above samples ranging from 0.37 to 2.79.

These are doubtless higher percentages than were contained in the dry matter of the material from which these mucks were formed. This is because the slow destruction which turns fresh vegetable matter into muck burns out the non-nitrogenous matters, starch, sugar and woody fiber much more quickly and completely than it does the nitrogenous matters. As a consequence, nitrogenous matters form a larger part of the peat than of the vegetable matter from which it came.

This nitrogen, however, can only be slowly soluble and available to crops. Water has leached away the most soluble part of it, decay has doubtless released the more easily decomposed part of what remained and there are left in the muck forms of nitrogen which are insoluble and relatively undecomposable by the processes which go on in soil.

Pot experiments also show little immediate fertilizing effect from this nitrogen.

It is obvious, then, that the direct fertilizer value of peat or muck must be small. Compared with stable manure, mucks contain much less potash and phosphoric acid than manure and much more nitrogen, but the nitrogen of muck is much less available to crops than that of manure.

The value of muck as an absorbent in stables and manure piles and as an amendment on light sandy soils is great, but is little regarded at present.

The attention of farmers has been chiefly centered on the use of commercial fertilizers and too often to the neglect of that "manœuvering" or "tempering" of land by tillage, drainage and amendments which was earlier practiced with profit by our farmers. The great value of peat or muck as an amendment and the methods of its use cannot be discussed in the limits of this report.

The agricultural value of peat depends chiefly on its great power of absorbing and holding water and water vapor, its regulation of the soil temperature and its continual supply to the soil of carbonic acid resulting from its gradual decay.

That is, it tempers the soil.

Fifty years ago, Professor Johnson, formerly director of this station, after citing the experience of successful farmers in this state, gives it as their opinion, "That a well-made compost of two loads of muck and one of stable manure is equal to three loads of the manure itself." He adds: "This opinion is so well substantiated that we need not hesitate to pronounce it a fact, and if a fact, it is one which deserves to be painted in bold letters on every barn door in Connecticut."

The large deposits of swamp muck in this state are one of our "natural resources" which has thus far been "conserved" because its value has been disregarded. There are many sandy farm lands which are hungry for it.

The station will be glad to hear from any farmers who have recently used muck on their land and to learn their experience and opinion, as it contemplates a full discussion of its use at some future time.

24668 is a compost of whole fish and swamp muck which was made in the early summer of 1909 and used on corn land in the spring of 1910. The compost had a disagreeable musty smell, the fish were entirely disintegrated and the effects as a fertilizer and amendment were very satisfactory.

FURTHER ANALYSES OF LIME.

The following samples are additional to those given on page 444, having been overlooked in that tabulation. Samples **25183** to **25186** were sent by B. Betts, Fairfield, to ascertain their relative values.

25204 represents a shipment of lime bought on inspection of the dealer's sample **25205**. A comparison shows the uncertainties of "buying on sample." The goods delivered contained only two-thirds as much lime as the sample which was supposed to represent the shipment.

25636 is refuse lime from a kiln which has been exposed to the weather for some years and costing fifty cents a load. The weight of a "load" would determine, with the analysis, the economy of the purchase.

ANALYSES.

	25183	25184	25185	25186	25204	25205	25636
Lime	56.20	62.20	62.94	35.42	44.84	66.93	36.52
Magnesia	3.45	0.99	1.01	0.72	....	....	24.46
Insoluble in acid	....	....	....	....	....	....	3.17

PART VI.

FIFTEENTH REPORT ON FOOD PRODUCTS AND THIRD REPORT ON DRUG PRODUCTS, 1910.

(Examined during the year ending July 31, 1910.)

BY JOHN PHILLIPS STREET.*

This station is required by law to make examinations of food products and drugs, to publish its findings and to report to the dairy commissioner all cases of adulteration or misbranding which are discovered. Under this law a large number of samples have been bought in various parts of the state and carefully examined, and all cases of adulteration or misbranding reported to the dairy commissioner. Prosecution for infractions of the law rests with this official, the station's duty being to determine the facts and supply expert testimony in case of prosecution.

The dairy commissioner and his deputy have sent a large number of samples of vinegar, molasses and butter, the sale of which is regulated by special statutes, as well as a limited number, about one hundred, of samples of other foods and drugs. These are but briefly noticed here, being discussed in the commissioner's report, where account is also given of the results of prosecution under the law.

Lastly, a number of samples of food and drug products have been examined for individuals, which will likewise receive brief mention.

* The analytical work herein described was done jointly with Messrs. Bailey, Morrison, Roe and Shepard.