STATE OF CONNECTICUT.

ANNUAL REPORT

OF

The Connecticut Agricultural

EXPERIMENT STATION

For 1888.

PRINTED BY ORDER OF THE GENERAL ASSEMBLY.

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1889.

REPORT OF THE BOARD OF CONTROL.

To His Excellency, Phineas C. Lounsbury, Governor of Connecticut:

In accordance with the law establishing THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION, the Board of Control herewith submits its Annual Report.

The Congress of the United States in 1887, passed an Act popularly known as the Hatch Bill, appropriating the sum of $15,000 to each of the States and Territories for the support of Experiment Stations. This Act is as follows:

[PUBLIC—NO. 112.]

An act to establish agricultural experiment stations in connection with the colleges established in the several States under the provisions of an act approved July second, eighteen hundred and sixty-two, and of the acts supplementary thereto.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

SECTION 1. That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established, under direction of the college or colleges or agricultural department of colleges in each State or Territory established, or which may hereafter be established, in accordance with the provisions of an act approved July second, eighteen hundred and sixty-two, entitled "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts," or any of the supplements to said act, a department to be known and designated as an "agricultural experiment station:" *Provided*, That in any State or Territory in which two such colleges have been or may be so

established the appropriation hereinafter made to such State or Territory shall be equally divided between such colleges, unless the legislature of such State or Territory shall otherwise direct.

SEC 2. That it shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other reseaches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories.

SEC 3. That in order to secure, as far as practicable, uniformity of methods and results in the work of said stations, it shall be the duty of the United States Commissioner of Agriculture to furnish forms, as far as practicable, for the tabulation of results of investigation or experiments; to indicate, from time to time, such lines of inquiry as to him shall seem most important; and, in general, to furnish such advice and assistance as will best promote the purposes of this act. It shall be the duty of each of said stations, annually, on or before the first day of February, to make to the governor of the State or Territory in which it is located a full and detailed report of its operations, including a statement of receipts and expenditures, a copy of which report shall be sent to each of said stations, to the said Commissioner of Agriculture, and to the Secretary of the Treasury of the United States.

SEC. 4. That bulletins or reports of progress shall be published at said stations at least once in three months, one copy of which shall be sent to each newspaper in the States or Territories in which they are respectively located, and to such individuals actually engaged in farming as may request the same, and as far

as the means of the station will permit. Such bulletins or reports and the annual reports of said stations shall be transmitted in the mails of the United States free of charge for postage, under such regulations as the Postmaster-General may from time to time prescribe.

SEC. 5. That for the purpose of paying the necessary expenses of conducting investigations and experiments and printing and distributing the results as hereinbefore prescribed, the sum of fifteen thousand dollars per annum is hereby appropriated to each State, to be specially provided for by Congress in the appropriations from year to year, and to each Territory entitled under the provisions of section eight of this act, out of any money in the Treasury proceeding from the sales of public lands, to be paid in equal quarterly payments, on the first day of January, April, July, and October in each year, to the treasurer or other officer duly appointed by the governing boards of said colleges to receive the same, the first payment to be made on the first day of October, eighteen hundred and eighty-seven; *Provided however*, That out of the first annual appropriation so received by any station an amount not exceeding one-fifth may be expended in the erection, enlargement, or repair of a building or buildings necessary for carrying on the work of such station; and thereafter an amount not exceeding five per centum of such annual appropriation may be so expended.

SEC. 6. That whenever it shall appear to the Secretary of the Treasury from the annual statement of receipts and expenditures of any of said stations that a portion of the preceding annual appropriation remains unexpended, such amount shall be deducted from the next succeeding annual appropriation to such station, in order that the amount of money appropriated to any station shall not exceed the amount actually and necessarily required for its maintenance and support.

SEC. 7. That nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States or Territories in which they are respectively located.

SEC. 8. That in States having colleges entitled under this section to the benefits of this act and having also agricultural experiment stations established by law separate from said colleges, such States shall be authorized to apply such benefits to experiments at stations so established by such States; and in case any

State shall have established under the provisions of said act of July second aforesaid, an agricultural department or experimental station, in connection with any university, college or institution not distinctively an agricultural college or school, and such State shall have established or shall hereafter establish a separate agricultural college or school, which shall have connected therewith an experimental farm or station, the legislature of such State may apply in whole or in part the appropriation by this act made, to such separate agricultural college or school, and no legislature shall by contract express or implied disable itself from so doing.

SEC. 9. That the grants of money authorized by this act are made subject to the legislative assent of the several States and Territories to the purposes of said grants: *Provided*, That payment of such installments of the appropriation herein made as shall become due to any State before the adjournment of the regular session of its legislative meeting next after the passage of this act shall be made upon the assent of the governor thereof duly certified to the Secretary of the Treasury.

SEC. 10. Nothing in this act shall be held or construed as binding the United States to continue any payments from the Treasury to any or all the States or institutions mentioned in this act, but Congress may at any time amend, suspend or repeal any or all the provisions of this act.

Approved, March 2, 1887.

On March 9th, 1887, the Governing Board of the Sheffield Scientific School, the institution which by a Legislative enactment dating back to 1863, was constituted "The College for the benefit of Agriculture and Mechanic Arts," for the State of Connecticut, voted to waive all claims to participation in the avails of the Hatch Bill in favor of The Connecticut Agricultural Experiment Station.

On May 18th, 1887, the General Assembly accepted the offer of Congress and voted to divide the money received equally between The Connecticut Agricultural Experiment Station and a new Experiment Station, which was established in connection with the Storrs Agricultural School at Mansfield. Here follows the act of the General Assembly:

CONCERNING CONGRESSIONAL APPROPRIATIONS TO AGRICULTURAL EXPERIMENT STATIONS.

Resolved by this Assembly: SECTION 1. That this state accepts and assents to the provisions of the act of congress, approved March second, 1887, entitled "An act to establish agricultural experiment stations in connection with the colleges established in the several states, under the provisions of an act approved July second, 1862, and of the acts supplementary thereto."

SEC. 2. The farm attached to the Storrs Agricultural School may be used as an experimental farm for the purposes specified in the act first mentioned; and the trustees of that school and their successors in office are hereby appointed to receive and expend one-half of such moneys as may come to this state, under the provisions of said act first mentioned.

SEC. 3. The board of control of the Connecticut agricultural experiment station and its successors in office is hereby appointed to receive and expend one-half of such moneys as may come to this state under the provisions of said act first mentioned.

Approved, May 18, 1887.

When, after adjournment of Congress in 1887, the "Hatch Bill" was brought to the consideration of the Comptroller of the U. S. Treasury, he decided that the money appropriated had not been "specially provided for by Congress," as required by Sec. 5, and that accordingly further legislation was requisite to enable him to make the intended disbursements.

Early in 1888 Congress passed an act specially providing for the payment of the appropriations for the fiscal year beginning July 1, 1887, and this act was approved by the President on the first day of February. This act also amended Sec. 5 of the Act of 1887 by removing the restriction of payments to money "proceeding from the sales of public lands," and decreeing their payment "out of any money in the Treasury not otherwise appropriated."

The fiscal year of this State, which closed June 30, 1888, was more than two-thirds passed before any portion of the National Appropriation was realized. This unexpected delay, and the uncertainties incident to it made it necessary to modify the work of the station during the early part of 1888. Special meetings of the Board were held in New Haven, Feb. 17th, and April 2d,

to discuss the new conditions brought about by the action of Congress.

It has been a matter of no little solicitude to develop satisfactory plans for the proper expenditure of this addition to the resources of the Station. Various proposals were presented to the Board of Control, and it was decided to establish a new Department for the investigation of the Fungous Diseases of plants, more especially those diseases which affect the crops of this State. The desirability of taking up this line of investigation, with perhaps that of injurious insects, has been frequently discussed by the Board for several years, but the lack of means has heretofore prevented. The National Appropriation now makes it possible, and work has accordingly been undertaken. A new laboratory building for this Department was begun, the walls were up and the building enclosed before the termination of the fiscal year, and it is now nearly complete.

The Station was fortunate in securing the services of Dr. Roland Thaxter, a graduate of Harvard University, and late instructor in Mycology at that institution. Dr. Thaxter began his connection with the Station in July, put himself directly in communication with some of our fruit growers and market gardeners, who are suffering from the ravages of fungi, and is engaged in the needful preliminary work of this department. Books and apparatus, including a Zeiss microscope of approved construction have been provided, and as soon as the heating arrangements, now making, are finished, Dr. Thaxter will begin the culture of various injurious fungi, and make systematic observations and experiments on their growth and habits, and on the methods of controling them.

Dr. Thaxter is now prepared to receive communications on the subject of his department from citizens of the State, who are hereby invited to make inquiries with regard to fungous diseases, including all varieties of rust, smut, mildew, mould, blight, and the like, and to forward to him specimens, concerning which any information may be desired.

At the annual meeting of the Board, in January, the methods of collecting fertilizers were fully discussed. That the farmers and gardeners should know just what commercial fertilizers are offered for sale in the State is evident, and justice to the reputable dealers demands that the collection should be as complete and thorough as possible. The method pursued in 1887 was considered better than any before tried, and it was recommended to

continue the same. It is believed that the collection has been more successfully done this year than ever before.

The Report of the Treasurer is herewith appended. It exhibits the financial affairs of the Station for the fiscal year ending June 30th, and shows the amounts received from the several sources, the amounts spent for various purposes, what part of each has been paid from the National appropriation and what part from Home receipts.

The Report of the Director, which follows, in two parts, describes in classified detail the work of the station for the year ending Dec. 1, 1888.

All of which is respectfully submitted.

WILLIAM H. BREWER,
Secretary.

REPORT OF THE TREASURER.

WM. H. BREWER, *in account with the Connecticut Agricultural Experiment Station.*

FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

RECEIPTS.

Balance from old account	$ 3.39	
From State Comptroller	8,000.00	
" U. S. Treasurer	7,500.00	
Analysis Fees	3,081.50	
Various other receipts	21.26	
		$18,606.15

EXPENDITURES.

	State Ac't.	U. S. Ac't.	Total.
Salaries	$6,081.83	$3,427.50	$9,509.33
General Laboratory Expenses	783.02	858.37	1,641.39
The Establishment, Grounds, Buildings, Repairs, etc.	470.72	------	470.72
Gas	74.12	141.78	215.90
Water	66.00	66.00	132.00
Coal	650.75	------	650.75
Telephone	100.15	------	100.15
Printing	370.67	------	370.67
Stationery	116.54	65.00	181.54
Postage	156.39	------	156.39
Library	248.37	------	248.37
Mycological Library	------	639.48	639.48
Mycological Laboratory	------	348.13	348.13
Grass and Forage Investigation	304.64	------	304.64
Field Experiments	52.41	454.20	506.61
Collecting Fertilizers	575.69	------	575.69
Traveling Expenses of the Board	57.16	------	57.16
New Building	568.46	1,499.54	2,068.00
Miscellaneous Sundries	422.99	------	422.99
	$11,099.91	$7,500.00	$18,599.91
Balance to new account			6.24
			$18,606.15

MEMORANDUM.—*The year's accounts were audited Sept. 13, 1888, by the Auditors of the State Public Accounts. Certain analysis fees due the Station at the close of the previous fiscal year ending June 30th, 1887, known at the time or discovered later, have since been collected and the sums are placed in this year's receipts.*

The analysis fees of some of the fertilizers known or believed to have been on sale (in the State) since May 1st, are not yet received by the Treasurer, and others will probably be reported. As heretofore, any collections that may come from such sources will go into the new account.

WM. H. BREWER, Treasurer.

REPORT OF THE DIRECTOR.

Under the requirements of the fertilizer law, as well as in answer to the requests of purchasers of commercial fertilizers, a large share of the time and labor of the working force of this Station has been employed during the year in the collection and analysis of fertilizers and fertilizing materials.

The whole number of brands of commercial fertilizers legally sold in Connecticut during the year has been 140. The law requires this Station to make and publish annually, at least one analysis of each of these. Examination of home-mixed fertilizers and waste products has brought the whole number of fertilizer-analyses up to 244. Each analysis has been made in duplicate and in almost all cases the duplicates have been executed by different chemists.

During April and May, special agents of the Station, Messrs. E. C. Ellwood, of Green's Farms, and C. L. Gold, of West Cornwall, visited 144 cities, towns and villages in the State and drew 887 samples of fertilizers, reporting also all cases where the requirements of the fertilizer law appeared not to be fully met.

About 130 samples of feeding-stuffs have been or are now being analyzed, and the results of all accessible American analyses of this kind which have been published during the year have also been tabulated and averaged.

Fourteen samples of potatoes have been analyzed in connection with field experiments.

At request of the State Cattle Commission a portion of the stomach of a cow was minutely examined, for both organic and inorganic poisons, with negative results. This examination was made for the Station by Professor Herbert E. Smith, of New Haven.

All the chemical work required by the Dairy Commissioner during the year has been done at this Station, including examinations of 11 samples of suspected butter and 50 samples of molasses.

About 30 partial analyses of milk have been made, chiefly in testing methods of milk-analysis.

The work done and observations made in connection with the Forage Garden are described on subsequent pages (Part 2).

About 150 specimens of grasses and sedges have been sent in from all parts of the State, to be named and for information regarding their value, etc.

Ten field experiments have been carried out, to test the relative value of various phosphates applied as a fertilizer to Indian corn and potatoes, with the coöperation of the following gentlemen:

Robert Aitken	Shaker Station.
C. S. Andrews, Jr.	New Britain.
W. I. Bartholomew	Putnam.
W. R. Fish	Mystic Bridge.
Edwin Hoyt	New Canaan.
G. F. Platt	Milford.
E. A. Russell	Suffield.
C. A. Sill	Saybrook.
W. H. Yeomans	Columbia.

A single experiment on the growth of sorghum was conducted by J. H. Dickerman, Esq., of Mt. Carmel.

An elaborate investigation on the effect of distance of planting on the quality and quantity of the maize crop has been made with the coöperation of J. J. Webb, Esq., of Hamden.

The chemical and field work pertaining to these experiments is described in detail in Part 2.

The Station has published and distributed in editions of 5000 copies, two printed Bulletins aggregating 25 pages. The object of these Bulletins is to place in the hands of those concerned the results of the Station work as promptly as possible.

As required by law, a package of each Bulletin is mailed to every post-office in the State. The package is directed to the postmaster, with a request to distribute to farmers. The number sent will be increased, in any case, on application. The distribution of these Bulletins is of course optional with the postmaster.

The Bulletins are also regularly sent to every Newspaper in the State, and to the Secretary of each Agricultural Society, Farmers' Club and Grange whose address is known to the Station.

The Bulletins are sent, also, to any citizen of Connecticut who applies for them. Such application, as a rule, must be renewed annually early in the year.

The Publications of the Station will be furnished freely to applicants not citizens of Connecticut, so far as the limited editions will permit.

In lieu of other Bulletins, it has been decided to issue in December a complete account of the fertilizer analyses made during the fiscal year, as Part 1 of the Annual Report. Part 2 of the Report will go to press at a little later date, because its printing will necessarily be delayed till the results of the farm experiments can be obtained and tabulated.

The Station has also issued five Weekly Statements printed in a very limited edition by the hektograph process and supplied as far as possible to the agricultural press, and to Secretaries of farmers' clubs and agricultural societies.

The necessary Station correspondence increases from year to year and during the last eleven months has involved the sending of some 1800 manuscript letters and reports of analyses.

During the year the Station has been visited by a larger number of Connecticut farmers and citizens than ever before. On Oct. 10 a field meeting of the Board of Agriculture was held at the Station at which about one hundred people were present.

Early in July, Mr. E. H. Farrington, who had served the Station most acceptably for 5½ years, left to accept a position in the New Hampshire Experiment Station. Mr. R. S. Curtiss, Ph.B. (Yale Univ.), joined the Station as chemist in August. During the summer, Dr. D. N. Harper, now chemist to the Minnesota Experiment Station, Prof. H. B. Patton, of Rutgers College, N. J., and Mr. W. M. Saunders, of Rhode Island, spent some time in our laboratory, to familiarize themselves with our methods of work.

The steam-heating arrangement in use at the Station having proved inadequate during extreme cold weather, and being of a kind not adapted for maintaining uniform temperature in the Laboratories, a new heating apparatus has been put in which it is anticipated will not only prove much more powerful, but also much more convenient and economical than that hitherto employed.

For use in the Chemical Laboratory, a very effective mill to pulverize fodders for analysis, of the kind recommended by Prof. Märcker, of the Saxon Experiment Station at Halle, has been procured through the kind offices of Dr. A. T. Neale, of the New Jersey Station. The address of the manufacturer of this mill is

Grusonwerk, Magdeburg-Buckau, Prussia. To operate this mill an Otto gas-engine has been set up, which also takes the place of hand labor in pulverizing samples of fertilizers and performing various other work.

The Chemical Laboratory is in pressing need of enlargement and improvement. The small fund available for its construction six years ago, necessitated building it in the simplest manner and on a too restricted scale of dimensions. It was foreseen that it must soon become inadequate and was planned with a view to extension. The table-room has been too small already for several years, so that much time is lost in putting together and taking down combinations of apparatus that are almost constantly required for various processes of analysis and which could be placed permanently in position for use if the space were available for that purpose. A large table with sink is needed for the exclusive use of the Laboratory Assistant in cleaning apparatus. Cases for containing and classifying Laboratory supplies, which now must be hunted for in the sampling rooms, the attic, or the cellar, and two rooms—one for storing costly instruments that are but occasionally used, and another as a shop and repair room, are urgently demanded. Some improvements in our present laboratory are also requisite. A small steam boiler, to supply distilled water and heat for evaporations and drying baths, would advantageously and economically replace our present arrangements, which were make-shifts at the outset, are on too small a scale, inconvenient, and from long wear must soon be replaced by something new. The mortar of the ventilating flues is so corroded by acid fumes that sand is constantly falling and endangering our analyses. These flues should be lined with glazed tiles or pipes, both to save the work of the chemists and to protect the chimneys themselves from ruin. I recommend that the Legislature be asked to appropriate $10,000 to increase the capacity of the Laboratory and to make the needed changes. Such enlargement and improvement would enable our chemists to accomplish a much greater amount of work and be a great gain to all concerned.

THE CONNECTICUT FERTILIZER LAW.

The General Assembly at its session in 1882 passed a Fertilizer Law which went into effect September 1, 1882, and which repealed and took the place of all previous legislation on this subject. The law is still in force without any amendment. Since a full understanding of the provisions and penalties of this law is important to all who buy or sell commercial fertilizers the law is here reprinted and attention is specially directed to the following points :

1. In case of fertilizers that retail at ten dollars or more per ton, the law holds the SELLER responsible for *affixing a correct label or statement* to every package or lot sold or offered, as well as for the *payment of an analysis fee* of ten dollars for each fertilizing ingredient which the fertilizer contains or is claimed to contain, *unless* the MANUFACTURER OR IMPORTER shall have provided labels or statements and shall have paid the fee. Sections 1 and 3.

2. The law also requires, in case of any fertilizer selling at ten dollars or more per ton, that a *certified statement* of composition, net weight in package, etc., shall be filed with the Director of the Experiment Station, and that a *sealed sample* shall be deposited with him by the MANUFACTURER OR IMPORTER. Section 2.

3. It is also provided that EVERY PERSON in the State, who sells *any commercial fertilizer of whatever kind or price* shall annually report certain facts to the Director of the Experiment Station, and on demand of the latter shall deliver a sample for analysis. Section 4.

4. All "CHEMICALS" that are applied to land, such as : Muriate of Potash, Kainite, Sulphate of Potash and Magnesia, Sulphate of Lime (Gypsum or Land Plaster), Sulphate of Ammonia, Nitrate of Potash, Nitrate of Soda, etc.—are considered to come under the law as "Commercial Fertilizers." Dealers in these chemicals must see that packages are suitably labeled. They must also report them to the Station, and see that the analysis fees are duly paid, in order that the Director may be able to discharge his duty as prescribed in Section 9 of the Act.

Here follows the full text of the law, with explanatory footnotes.

AN ACT CONCERNING COMMERCIAL FERTILIZERS.

GENERAL ASSEMBLY,
January Session, A. D. 1882.

***Be it** enacted by the Senate and House of Representatives in General Assembly convened:*

SECTION 1. Every person or company who shall sell, offer, or expose for sale, in this State, any commercial fertilizer or manure, the retail price of which is ten dollars, or more than ten dollars per ton, shall affix conspicuously to every package thereof a plainly printed statement, clearly and truly certifying the number of net pounds of fertilizer in the package, the name, brand, or trade-mark under which the fertilizer is sold, the name and address of the manufacturer, the place of manufacture and the chemical composition of the fertilizer, expressed in the terms and manner approved and currently employed by the Connecticut Agricultural Experiment Station.*

Printed statement to be affixed to all packages and to go with all lots.

If any such fertilizer be sold in bulk, such printed statement shall accompany and go with every lot and parcel sold, offered, or exposed for sale.

SEC. 2. Before any commercial fertilizer, the retail price of which is ten dollars, or more than ten dollars per ton, is sold, offered, or exposed for sale, the manufacturer, importer, or party who causes it to be sold, or offered for sale, within the State of Connecticut, shall file with the Director of the Connecticut Agricultural Experiment Station two certified copies of the statement named in section one of this act, and shall deposit with said

Before sale *certified copies* of statement, and *Sealed Sample* to be deposited with Director.

* A statement of the per cents. 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 per cent. of *nitrogen* must be stated. Ammonia may also be given when actually present in ammonia salts, and "ammonia equivalent to nitrogen" may likewise be stated.

The per cent. of soluble and reverted phosphoric acid may be given separately or together, and the term "available" may be used in addition to, but not instead of soluble and reverted.

Insoluble phosphoric acid may be stated or omitted.

In case of Bone, Fish, Tankage, Dried Meat, Dried Blood, etc., the chemical composition may take account of the two ingredients: Nitrogen, Phosphoric Acid.

For Potash Salts give always the per cent. of Potash (potassium oxide); that of Sulphate of Potash or Muriate of Potash may also be stated.

The chemical composition of other fertilizers may be given as found in the Station Reports.

director a sealed glass jar or bottle containing not less than one pound of the fertilizer, accompanied by an affidavit that it is a fair average sample thereof.*

SEC. 3. The manufacturer, importer, agent, or seller of any commercial fertilizer, the retail price of which is ten dollars or more than ten dollars per ton, shall pay on or before the first of May, annually, to the Director of the Connecticut Agricultural Experiment Station, an analysis fee of ten dollars for each of the fertilizing ingredients† contained or claimed to exist in said fertilizer: *provided*, that whenever the manufacturer or importer shall have paid the fee herein required for any persons acting as agents or sellers for such manufacturer or importer, such agents or sellers shall not be required to pay the fee named in this section.

Analysis Fee to be paid annually on or before May 1st.

SEC. 4. Every person in this State who sells, or acts as local agent for the sale of any commercial fertilizer of whatever kind or price, shall annually, or at the time of becoming such seller or agent, report to the Director of the Connecticut Agricultural Experiment Station his name, residence, and post-office address, and the name and brand of said fertilizer, with the name and address of the manufacturer, importer, or party from whom such fertilizer was obtained, and shall, on demand of the Director of the Connecticut Agricultural Experiment Station, deliver to said director a sample suitable for analysis of any such fertilizer or manure then and there sold or offered for sale by said seller or agent.‡

Yearly Report to Station of Dealers‡ or Agents.

SEC. 5. No person or party shall sell, offer, or expose for sale, in the State of Connecticut, any pulverized leather, raw, steamed, roasted, or in any form, as a fertilizer or as an ingredient of any fertilizer or manure, without explicit printed certificate of the fact, such certificate to be conspicuously affixed to every package of such fertilizer or manure, and to accompany and go with every parcel or lot of the same.

Leather.

* The analysis of samples sent in accordance with section two is discretionary with the Station. Such samples are intended for preservation as manufacturers' standards.

† The Station understands "the fertilizing ingredients" to be those whose determination in an analysis is necessary for a valuation, viz: Nitrogen, Phosphoric acid and Potash. The analysis-fees in case of any fertilizer will therefore be ten, twenty or thirty dollars, according as one, two or three of these ingredients are contained or claimed to exist in the fertilizer.

On receipt of statements, samples and analysis-fees, the Station will issue Certificates of Compliance with the law.

‡ Blanks for Dealers' Reports will be mailed to applicants.

Fish-guano, &c

SEC. 6. Every manufacturer of fish guano, or fertilizers of which the principal ingredient is fish or fish-mass from which the oil has been extracted, shall, before manufacturing or heating the same, and within thirty-six hours from the time such fish or mass has been delivered to him, treat the same with sulphuric acid or other chemical, approved by the director of said experiment station, in such quantity as to arrest decomposition: *provided, however*, that in lieu of such treatment such manufacturers may provide a means for consuming all smoke and vapors arising from such fertilizers during the process of manufacture.

Fines.

SEC. 7. Any person violating any provision of the foregoing sections of this act shall be fined one hundred dollars for the first offense, and two hundred dollars for each subsequent violation.

Fertilizers for private use.

SEC. 8. This act shall not affect parties manufacturing, importing, or purchasing fertilizers for their own private use, and not to sell in this State.

Director's duties and authority.

SEC. 9. The director of the Connecticut Agricultural Experiment Station shall pay the analysis-fees received by him into the treasury of the station, and shall cause one or more analysis of each fertilizer to be made and published annually. Said director is hereby authorized, in person or by deputy, to take samples for analysis from any lot or package of manure or fertilizer which may be in the possession of any dealer.

Bulletins.

SEC. 10. The director of the Connecticut Agricultural Station shall, from time to time, as bulletins of said station may be issued, mail or cause to be mailed two copies, at least, of such bulletins to each post-office in the State.

Repeal of former acts.

SEC. 11. Title sixteen, chapter fifteen, sections fifteen and sixteen, and title twenty, chapter twelve, section five of the general statutes, and chapter one hundred and twenty of the public acts of 1881, being an act concerning commercial fertilizers, are hereby repealed.

SEC. 12. This act shall take effect on the first day of September, 1882.

It will be noticed that the State exacts no license tax either for making or dealing in fertilizers. For the safety of consumers and the benefit of honest manufacturers and dealers, the State requires that it be known what is offered for sale, and whether fertilizers are what they purport to be. With this object in view the law provides, in section 9, that all fertilizers be analyzed and it requires the parties making or selling them to pay for these analyses in part; the State itself paying in part by maintaining the Experiment Station.

OBSERVANCE OF THE FERTILIZER LAW.

MANUFACTURERS who have paid Analysis Fees as required by the Fertilizer Law, and Fertilizers for which the fees have been thus paid for the year ending May, 1889.

Firm.	*Brand of Fertilizer.*
Adams, Wm. P., 248 Front St., N. Y.	High Grade Ammoniated Bone Superphosphate. Lion Brand Fish and Potash. Pure Raw Bone.
Apothecaries Hall Co., Waterbury, Conn.	Victor Phosphate.
H. J. Baker & Bro., 215 Pearl St., N. Y.	A. A. Ammoniated Superphosphate. Potato Fertilizer. Corn Fertilizer. Strictly Pure Ground Bone. Castor Pomace.
Bowker Fertilizer Co., 43 Chatham St., Boston, Mass.	Stockbridge Grain Manure. " Forage Crop Manure. " Vegetable Manure. Bowker's Hill and Drill Phosphate. " Ammoniated Dissolved Bone. " Fish and Potash. " Pure Dry Fish.
Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	Bradley's Complete Manure for Potatoes and Vegetables. Bradley's Complete Manure for Corn and Grain. Bradley's Complete Manure for Top Dressing Grass and Grain. Bradley's Superphosphate. B. D. Sea Fowl Guano. Original Coe's Superphosphate. Circle Brand Ground Bone and Potash. Bradley's Potato Manure. Farmer's New Method Fertilizer. Pure Fine Ground Bone. Fish and Potash, Anchor Brand. " " " Triangle A Brand.
Clark's Cove Guano Co., New Bedford, Mass.	Bay State Fertilizer. Unicorn Ammoniated Superphosphate. King Philip Alkaline Guano. Great Planet A Fertilizer. " " B "
Coe, E. Frank, 16 Burling Slip, N. Y.	Potato Fertilizer. Excelsior Red Brand Fertilizer. Alkaline Bone. High Grade Ammoniated Bone Superphosphate. Ground Bone. Fish and Potash.

Firm.	*Brand of Fertilizer.*
Coe, Russell, Tremley, N. J.	Ammoniated Superphosphate.
Cooper's, Peter, Glue Factory, 17 Burling Slip, N. Y.	Peter Cooper's Bone Dust.
Crocker Fertilizer & Chemical Co., Buffalo, N. Y.	Ammoniated Bone Superphosphate. Potato, Hop and Tobacco Phosphate. Queen City Phosphate. Pure Ground Bone. Superphosphate No. 2.
Cumberland Bone Co., Portland, Me.	Cumberland Superphosphate. Seeding Down Fertilizer.
L. B. Darling Fertilizer Co., Pawtucket, R. I.	Darling's Animal Fertilizer. " Extra Bone Phosphate. " Pure Fine Bone.
Davidge Fertilizer Co., 121 Front St., N. Y.	Davidge's Potato Manure. " Special Favorite.
Dawley, T. R., Griswold, Conn.	Baugh's Twenty five Dollar Phosphate.
Dickenson, D. B., Middle Haddam, Conn.	Ammoniated Bone Phosphate.
Downs & Griffin, Derby, Conn.	Ground Bone.
Great Eastern Fertilizer Co., Rutland, Vt.	Great Eastern General Fertilizer. Vegetable, Vine and Tobacco Fertilizer.
Kelsey, E. R., Branford, Conn.	Fish and Potash.
Lister's Agricultural Chemical Works, Newark, N. J.	Lister's Standard Phosphate. Ammoniated Dissolved Bone. Special Potato Manure. Special Corn Manure. Ground Bone.
Luce Brothers, Niantic, Conn.	Dry Ground Fish Guano.
Mapes' Formula and Peruvian Guano Co., 158 Front St., N. Y.	Potato Manure. Corn Manure. Complete Manure for light soils. " " "A" Brand. " " for general use. Fine Bone Dissolved. Tobacco Manure, Conn. Brand. " " Wrapper Brand. Fruit and Vine Manure. Peruvian Guano. Grass and Grain Spring Top Dressing.
C. Meyer, Jr., Maspeth, Long Island.	Acme Fertilizer No. 1. " " No. 2. " Potato Fertilizer.
Miles, G. W., Agent for John Guyer, Milford, Conn.	Fish and Potash, Fish Brand. I. X. L. Ammoniated Bone Superphosphate.
Miller, G. W., Middlefield, Conn.	Flour of Bone Phosphate. Pure Ground Bone.

Firm.	*Brand of Fertilizer.*
Miller, H. S., & Co., Newark, N. J.	Standard Phosphate. Ammoniated Dissolved Bone. Pure Bone Meal.
Mitchell, A., Tremley, N. J.	Standard Superphosphate.
National Fertilizer Co., Bridgeport, Ct.	Chittenden's Complete Fertilizer. " Ammon'd Bone Phosphate " Fish and Potash. " Ground Bone.
Newton & Ludlam, 182 Front St., N. Y.	Cereal Fertilizer. Cecrops Fertilizer.
Orient Guano M'f'g Co., 16 and 18 Exchange Place, N. Y.	Fish and Potash. Orient Complete Manure.
Peck Bros., Northfield, Conn.	Pure Ground Bone.
Prentice, Charles, Putnam, Conn.	Phosphate. Ground Bone.
Preston Fertilizer Co., Greenpoint, L. I.	Ammoniated Bone Superphosphate. Potato Fertilizer. Ground Bone.
Quinnipiac Co., New London, Conn.	Quinnipiac Phosphate. Pine Island Phosphate. Potato Manure. Fish and Potash No. 1. " " " No. 2. Pequot Fish and Potash. Dry Ground Fish. Ground Bone. Muriate of Potash.
Rogers & Hubbard Co., Middletown, Conn.	Raw Knuckle Bone Flour. Strictly Pure Fine Bone. Pure Ground AX Bone. Fairchild's Formula for Corn. " " Bone and Potash. Rogers & Hubbard Co's Complete Potato and Tobacco Manure.
Sanderson, L., 119 Long Wharf, New Haven, Conn.	Sanderson's Mixed Formula. Blood, Bone and Meat. Fine Ground Bone. Dissolved Bone Black. Sulphate of Potash. Muriate of Potash. Sulphate of Ammonia. Nitrate of Soda.
Shoemaker, M. L., & Co., Philadelphia, Pa., by F. Ellsworth, Hartford, Conn.	Swift Sure Superphosphate. " " Bone Meal.
Soluble Pacific Guano Co., Glidden & Curtis, agents, Boston, Mass.	Soluble Pacific Guano. Fish and Potash.
Spencer, Chas. L., Suffield, Conn.	Cotton Hull Ashes.

Firm.	*Brand of Fertilizer.*
Sperry & Barnes, New Haven, Conn.	Dried Blood and Meat.
Standard Fertilizer Co., 118½ Milk St., Boston, Mass.	Standard Superphosphate.
St. Louis Lead & Oil Co., St. Louis, Mo., by Olds & Whipple, Hartford, Conn.	St. Louis Lead & Oil Co's Castor Pomace.
Thompson & Edwards Fertilizer Co., Union Stock Yards, Chicago, Ill.	Pure Fine Ground Bone.
Wilkinson & Co., 52 and 54 William St., N. Y.	Economical Bone Fertilizer.
Williams & Clark Co., Cotton Exchange Building, Hanover Square, N. Y.	Americus Pure Bone Meal. Royal Bone Phosphate. Americus Brand Tobacco and Onion Fertilizer. Americus Brand Potato Fertilizer. Americus Ammoniated Bone Superphosphate. Williams & Clark Co's Potato Phosphate

ANALYSES OF FERTILIZERS.*

In respect to its terms, the Station makes *two classes* of analyses of fertilizers and fertilizing materials: the first for the benefit of farmers, gardeners, and the public generally; the second for the private use of manufacturers and dealers. Analyses of the *first class* are made gratuitously, and the results are published as speedily and widely as possible for the guidance of purchasers and consumers. Those of the *second class* are charged for at moderate rates, and their results are not published in a way to interfere with their legitimate private use. The Station however, distinctly reserves the liberty to use at discretion, for the public benefit, all results obtained in its laboratory, and in no case will enter into any privacy that will work against the public good.

During 1888, 244 samples of fertilizers have been analyzed. Of these, a small number were examined for private parties and for testing methods in connection with other Experiment Stations, and the remainder for the general use of the citizens of the State.

During April and May last Messrs. E. C. Ellwood, of Green's Farms, and C. L. Gold, of West Cornwall, agents of this Station, have collected samples of Commercial Fertilizers in all parts of Connecticut. 144 towns and villages have been visited, distributed as follows:

Hartford Co.	18
Tolland Co.	11
Windham Co.	14
New London Co.	26
Middlesex Co.	20
New Haven Co.	22
Fairfield Co.	20
Litchfield Co.	13
	144

887 samples were taken by these gentlemen, who employed the method of sampling which is described on page 91 of the Report of this Station for 1884.

* The matter of this and several subsequent pages, explanatory of the sampling and valuation of fertilizers, is copied, with a few appropriate alterations, from the Report for 1887. This repetition appears to be necessary for the use of readers who have not seen former Reports.

In this way one or more samples were secured of nearly every brand of fertilizer which is offered for sale within the State. When several samples of a single brand were drawn in different parts of the State the analysis was performed, not on any single sample, but on a mixture made of an equal weight of each 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 agents are instructed when drawing samples, in every case to open at least three packages of each brand, 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 through the entire length of the bag or barrel.

The greatest care is necessary in sampling fertilizers so that the small sample taken shall accurately represent the whole stock from which it is drawn.

As a rule the Station will not analyze samples—

1. From dealer's stock of less than one ton.
2. From stock which has lain over from last season.
3. From stock which evidently is improperly stored, as in bags lying on wet ground or exposed to the weather, etc.

The Station desires the coöperation of farmers, farmers' clubs and granges in calling attention to new brands of fertilizers and in securing samples of all goods offered for sale. All samples drawn by other than Station agents are understood to be taken in accordance with the printed instructions which the Station supplies to all applicants. Here follows a copy of these instructions.

Gratuitous Analysis of Commercial Fertilizers.

To insure justice to manufacturers, dealers and consumers alike, the Station will make gratuitous analyses of Commercial Fertilizers *only* on samples taken by the Agents of the Station, or on such other samples as are *fully* described on the Station Forms for Description and taken in accordance with the Station Instructions for sampling, and furthermore are properly authenticated by the certificate of the person drawing the sample, *and in addition* the witness, either

1. Of a Selectman;
2. Of an Officer of a farmer's club, grange or local agricultural society; or

3. Of the Dealer from whose stock the sample is taken.

In case a Dealer takes samples of his own stock, the witness of one of the Officers aforesaid will be required.

In special cases of importance the Station may send its Agent to draw samples.

Instructions for Sampling Commercial Fertilizers.

1. Provide a teacup, some large papers, and for each sample a glass fruit-can or tin box holding about one quart that can be tightly closed, all to be clean and dry.

2. Open at least three full and unbroken packages, or if there are more than thirty, every tenth package, and mix well together the contents of each for a foot in depth; take out two cupfuls from different parts of the mixed portions of each package, pour them [six in all] one over another upon a paper, intermix thoroughly but quickly to avoid gain or loss of moisture, fill the can or box from this mixture, close tightly, fix securely on the outside of the can a label with some distinguishing letter or mark (which is to be copied in the "Description of Sample" as *sampler's mark*), and send prepaid to the Agricultural Experiment Station, New Haven, Conn.

3. If convenient weigh separately at least three packages and enter these *actual weights* in the "Description of Sample."

4. When a sample has been taken it should *always* be bottled, labeled and the form for its description filled out completely *before* beginning to sample another fertilizer.

Further Remarks on Sampling.

In case of a fine, uniform and moist or coherent article, a butter tryer or a tin tube, like a dipper handle, put well down into the packages in several places, will give a fair sample with great ease.

With dry, coarse articles, such as ground bone, there is liable to be a separation of coarse and fine parts on handling. Moist articles put up in bags or common barrels may become dry on the outside. It is in these cases absolutely necessary to mix thoroughly the coarse and fine, the dry and the moist portions, before sampling.

The quantity sent should not be too small. When the material is fine and uniform, a pint is enough, but otherwise and especially in the case of ground bone, which must be mechanically analyzed, the sample should not be *less than one quart.*

It is important that samples for analysis should be taken at the time when the fertilizer is purchased, and *immediately dispatched* to the Station. Moist fish, blood or cotton seed meal will soon decompose and lose ammonia, if bottled and kept in a warm place. Superphosphates containing much organic nitrogen will suffer reversion of their soluble phosphoric acid under similar circumstances. Most of the moist fertilizers will lose water unless tightly bottled, but some of the grades of potash salts will gather moisture from the air and become a slumpy mass if not thoroughly protected.

Samples as to whose authenticity or fairly representative character there is any reasonable doubt, the Station will not analyze. The Station reserves the right to reject samples taken from less than half a ton of stock or those drawn from goods that have been wintered over from last year.

Send with each sample any printed circular, pamphlet, analysis or statement that accompanies the fertilizer or is used in its sale.

Description of Sample.

Station No. ..... Rec'd at Station, ..., 188

Each sample of Commercial Fertilizer sent for gratuitous analysis *must* be accompanied by a Description made by filling out legibly and as fully as possible, the blanks that follow:

Sampler's Mark .....
Brand of Fertilizer .....
Name and address of Manufacturer .....
.....
Name and address of Dealer from whom this sample was taken,
.....
Date of taking this sample .....
Is it stated to be fresh stock? .....
Dealer's cash price per ton or hundred, bag or barrel .....
Selling weight claimed for each package weighed .....
Actual weights of the several packages opened .....
Number of packages from which the sample was taken .....

Here write the per cents of valuable ingredients which the fertilizer is guaranteed to contain.

Soluble Phosphoric Acid ..... Nitrogen .....
Reverted Phosphoric Acid ..... (Ammonia .....)
(Available Phosphoric Acid .....) Potash .....
Insoluble Phosphoric Acid .....

Certificate of Person taking the Sample.

I, the undersigned, certify that the accompanying sample marked ..... was taken by me from full packages, and in accordance with the Station's Instructions for Sampling and to the best of my knowledge and belief fairly represents the stock from which it was drawn, and that said stock when sampled was properly housed and in good condition. I also certify that the foregoing description is correct.

Signature .....
Post Office address .....

Witness of Officer or Dealer.

The above described sample was drawn in my presence.

Signature .....
Title .....
Township .....
Post Office Address .....

On receipt of any sample of fertilizer from the open market, the filled out "Form for Description" which accompanies it is filed in the Station's Record of Analyses, and remains there as a voucher for the authenticity of the sample and for the fact that it has been taken fairly, or, at least, under suitable instructions. It is thus sought to insure that manufacturers and dealers shall not suffer from the publication of analyses made on material that does not correctly represent what they have put upon the market.

The "Form for Description," when properly filled out, also, contains all the data of cost, weight, etc., of a fertilizer which are necessary for making, with help of the analysis, a valuation of its fertilizing elements, and estimating the fairness of its selling price. Neglect to give full particulars occasions the Station much trouble, and it is evident that want of accuracy in writing up the description may work injustice to the manufacturers or dealers, as well as mislead consumers. It is especially important that the *brand* of a fertilizer and its *selling price* shall be correctly given. The price should be that actually charged by the dealer of whom it is bought, and if the article be purchased in New York or other distant market, that fact should be stated, and the cost at the nearest point to the consumer, on rail or boat, should be reported also.

In all cases, when possible, *ton prices* should be given, and if the sale of an article is only by smaller quantities, that fact should be distinctly mentioned.

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 explanation or protest, if desirable, before the results are published in the Bulletin.

With the analysis there is sent to the party furnishing the sample a printed page of "Explanations," intended to embody the principles and data upon which the valuation of fertilizers is based.

These Explanations are essential to a correct understanding of the analyses that are given on subsequent pages, and are, therefore, reproduced here, as follows:

Explanations Concerning the Analysis of Fertilizers and the Valuation of their Active Ingredients.

Revised.

Nitrogen is the most rare, and commercially, the most valuable fertilizing element.

Free Nitrogen is indeed universally abundant in the common air, but in this form its effects in nourishing vegetation are as yet obscure, or even doubtful.

Organic Nitrogen is the nitrogen of animal and vegetable matters, where it is chemically united to carbon, hydrogen and oxygen. Some forms of organic nitrogen, as those of blood, flesh and seeds, are highly active as fertilizers; others, as found in leather and peat, are comparatively slow in their effect on vegetation, unless these matters are chemically disintegrated.

Ammonia (NH_3) *and nitric acid* (N_2O_5) are results of the decay of *organic nitrogen* in the soil and manure heap, and contain Nitrogen in its most active forms. They occur in commerce —the former in sulphate of ammonia, the latter in nitrate of soda. 17 parts of ammonia or 66 parts of pure sulphate of ammonia contain 14 parts of nitrogen. 85 parts of pure nitrate of soda also contain 14 parts of nitrogen.

Phosphorus is, next to nitrogen, the least abundant and most costly ingredient of Fertilizers, in which it always exists in the form of phosphates, usually those of calcium, iron, and aluminum, or in case of "superphosphates" in the form of phosphoric acid.

Soluble Phosphoric acid implies phosphoric acid or phosphates that are freely soluble in water. It is the characteristic ingredient of Superphosphates, in which it is produced, by acting on "insoluble" or "reverted" phosphates, with diluted sulphuric acid (oil of vitriol). Once well incorporated with the soil it gradually becomes reverted phosphoric acid.

Reverted (reduced or precipitated) Phosphoric acid means strictly, phosphoric acid that was once easily soluble in water, but from chemical change has become insoluble in that liquid. In present usage the term signifies the phosphoric acid (of various phosphates) that is freely taken up by a strong solution of ammonium citrate, which is therefore used in analysis to determine its quantity. "Reverted phosphoric acid" implies phosphates that are readily assimilated by crops.

Recent investigation tends to show that soluble and reverted phosphoric acid are on the whole about equally valuable as plant-food and of nearly equal commercial value. In some cases, indeed, the soluble gives better results on crops, in others the reverted is superior. In most instances there is probably little to choose between them.

Insoluble Phosphoric acid implies various phosphates not soluble in water or ammonium citrate. In some cases the phosphoric acid is too insoluble to be readily available as plant food. This is especially true of the crystallized green Canada Apatite. Bone-black, bone-ash, South Carolina Rock and Navassa Phosphate when in coarse powder are commonly of little repute as fertilizers though good results are occasionally reported from their use. When *very finely pulverized* ("floats") they more often act well, especially in connection with abundance of decaying vegetable matters. The phosphate of calcium in raw bones is nearly insoluble, because of the animal matter of the bones, which envelopes it; but when the latter decays in the soil, the phosphate remains in essentially the "reverted" form. The phosphoric acid of "Thomas-Slag" and of "Grand Cayman's Phosphate" is freely taken up by crops.

Phosphoric acid in all the Station Analyses is reckoned as "Anhydrous phosphoric acid" (P_2O_5) also termed among chemists, phosphoric anhydride, phosphoric oxide, and phosphorus pentoxide.

Potassium is the constituent of Fertilizers, which ranks third in costliness. In plants, soils and fertilizers, it exists in the form of various salts, such as chloride (muriate), sulphate, carbonate, nitrate, silicate, etc. Potassium itself is scarcely known except as a chemical curiosity.

Potash signifies the substance known in chemistry as potassium oxide (K_2O), which is reckoned as the valuable fertilizing ingredient of "potashes" and "potash salts." In these it should be freely soluble in water and is most costly in the form of sulphate, and cheapest in the shape of muriate (potassium chloride).

The Valuation of a Fertilizer, as practised at this Station, consists in calculating the *retail Trade-value* or *cash-cost* (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.

Plaster, lime, stable manure and nearly all of the less expensive fertilizers have variable prices, which bear no close relation to

their chemical composition, but guanos, superphosphates and similar articles, for which $30 to $60 per ton are paid, depend chiefly for their trade-value on the three substances, *nitrogen, phosphoric acid* and *potash*, which are comparatively costly and steady in price. 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 consumer, in estimating the reasonable price to pay for high-grade fertilizers, should add to the *Trade-value of the above-named Ingredients*, a suitable margin for the expenses of manufacture, etc., and for the convenience or other advantage incidental to their use.

The average Trade-values or retail cost in market, per pound, of the ordinarily occurring forms of nitrogen, phosphoric acid and potash, as found in the New England, New York and New Jersey markets, are as follows:—

Trade Values of Fertilizing Ingredients in Raw Materials and Chemicals for 1888.

	Cts. per lb.
Nitrogen in ammonia salts	17½
nitrates	16
Organic nitrogen in dry and fine ground fish, meat, blood, cotton-seed meal and castor pomace	16½
in fine bone and tankage	16½
in fine medium bone and tankage	13
in medium bone and tankage	10½
in coarse bone and tankage	8½
in hair, horn shavings and coarse fish scrap	8
Phosphoric acid, soluble in water	8
soluble in ammonium citrate*	7½
in dry ground fish, fine bone and tankage	7
in fine-medium bone and tankage	6
in medium bone and tankage	5
in coarse bone and tankage	4
in fine ground rock phosphate	2
Potash as high-grade Sulphate and in forms free from Muriate (or Chlorides)	5½
as kainit	4¼
as muriate	4¼

* Dissolved from 2 grams of the unground phosphate previously extracted with pure water, by 100 c. c. neutral solution of Ammonium Citrate, sp. gr. 1.09, in 30 minutes, at 65° C., with agitation once in five minutes. Commonly called "reverted" or "backgone" Phosphoric Acid.

These Trade-values were agreed upon by the Experiment stations of New Jersey, Massachusetts and Connecticut, for use in their respective States during 1888. They are the average 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. They also correspond to the average wholesale prices for the six months ending March 1st, plus about 20 per cent. in case of goods for which we have wholesale quotations. 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, such as:

Sulphate of Ammonia,	Dry Ground Fish,
Nitrate of Soda,	Bone and Tankage,
Dried Blood,	Ground So. Carolina Rock,
Azotin,	Plain Superphosphate,
Ammonite,	Muriate of Potash,
	Sulphate of Potash.

Trade Values in Superphosphates, Special Manures and Mixed Fertilizers of High Grade.

The organic nitrogen in these classes of goods is reckoned at the price of nitrogen in raw materials of the best quality.

Insoluble Phosphoric Acid is reckoned at 3 cents, unless found to be from rock phosphate. In this latter form Insoluble Phosphoric Acid costs but 2 cents per pound. Potash is rated at $4\frac{1}{4}$ 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 $5\frac{1}{2}$ cents.

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

The majority of manufacturers agree that the average cost of mixing, bagging, handling and cartage ranges from $3.00 to $4.50 per ton.

In 1888 the average selling price of Ammoniated Superphosphates and Guanos was $34.55, the average valuation was $28.70, and the difference, $5.85—an advance of 20.3 per cent. on the valuation and on the wholesale cost of the fertilizing elements in the raw materials.

In case of Special Manures the average cost was $39.47, the average valuation $33.99, and the difference $5.48, or 16.1 per cent. advance on the valuation.

To obtain the Valuation of a Fertilizer we multiply the pounds per ton of Nitrogen, etc., by the trade-value per pound. We thus get the values per ton of the several ingredients, and adding them together we obtain the total valuation per ton.

In case of *Ground Bone*, the sample is sifted into four grades and we separately compute the nitrogen-value of each grade by multiplying the pounds of nitrogen per ton, by the per cent. of each grade, taking $\frac{1}{100}$th of that product, multiplying it 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 for phosphoric acid, similarly computed, the total is the Valuation of the sample of bone.

The uses of the "Valuation" are twofold:

1, To show whether a given lot or brand of fertilizer is worth, as a commodity of trade, what it costs. If the selling price is not higher than the valuation, the purchaser may be tolerably sure that the price is reasonable. If the selling price is twenty to twenty-five per cent. higher than the valuation, it may still be a fair price; but in proportion as the cost per ton exceeds the valuation there is reason to doubt the economy of its purchase.

2, Comparisons of the valuations and selling prices of a number of similar fertilizers will generally indicate fairly which is the best for the money.

But the valuation is not to be too literally construed, for analysis cannot always decide accurately what is the *form* of nitrogen, etc., while the mechanical condition of a fertilizer is an item whose influence cannot always be rightly expressed or appreciated.

For the above first-named purpose of valuation, the trade-values of the fertilizing elements which are employed in the computations should be as exact as possible, and should be frequently corrected to follow the changes of the market.

For the second-named use of valuation frequent changes of the trade-values are disadvantageous, because two fertilizers cannot be compared as to their relative money-worth, when their valuations are deduced from different data.

Experience leads to the conclusion that the trade-values adopted at the beginning of a year should be adhered to as nearly as possible throughout the year, notice being taken of considerable changes in the market, in order that due allowance may be made therefor.

The Agricultural value of a fertilizer is measured by the benefit received from its use, and depends upon its fertilizing effect, or crop-producing power. As a broad, general rule, it is true that Peruvian guano, superphosphates, fish-scraps, dried blood, potash salts, etc., have a high agricultural value which is related to their trade-value, and to a degree determines the latter value. But the rule has many exceptions, and in particular instances the trade-value cannot always be expected to fix or even to indicate the agricultural value. Fertilizing effect depends largely upon soil, crop and weather, and as these vary from place to place, and from year to year, it cannot be foretold or estimated except by the results of past experience, and then only in a general and probable manner.

CLASSIFICATION OF FERTILIZERS ANALYZED.

The fertilizers and manurial waste products analyzed at the Station laboratory from November 1st, 1887, to November 1st, 1888, were as follows:

RAW MATERIALS COMMONLY USED IN MIXED FERTILIZERS.

1. *Containing Nitrogen as the Chief Valuable Ingredient.*	
Nitrate of Soda	3
Sulphate of Ammonia	4
Cotton Seed Meal	9
Castor Pomace	2

2. *Containing Phosphoric Acid.*	
Thomas Slag	1
Native Phosphates	6
Dissolved Bone Black	4
3. *Containing Potash.*	
Sulphate of Potash	4
Muriate of Potash	8
Kainit	1
4. *Containing Nitrogen and Potash.*	
Bone Manures	36
Bone and Potash	1
Tankage	7
Dry Ground Fish	2
MIXED FERTILIZERS.	
Nitrogenous Superphosphates and Guanos	93
Special Manures	33
Home-Mixed Fertilizers	12
MISCELLANEOUS FERTILIZERS AND MANURES.	
Cotton Hull Ashes	7
Hardwood, Unleached Canada Ashes	2
Hardwood Ashes from a Brick Kiln	1
Tobacco Stems and Tobacco Dust	3
Hen Manure	1
Slaughter-house Refuse	1
Plaster	3
Total	244

These analyses are discussed in the order above given on subsequent pages.

I. RAW MATERIALS OF HIGH-GRADE CONTAINING NITROGEN AS THE CHIEF VALUABLE INGREDIENT.

NITRATE OF SODA.

Nitrate of Soda is mined in Chili and purified there before shipment. It usually contains about 16 per cent. of nitrogen, equivalent to 97 per cent. of pure nitrate of soda. It contains besides, a little salt and some moisture. The usual guarantee is "96 per cent." of nitrate of soda equivalent to 15.8 per cent. of nitrogen.

2190. Sold by the Rogers & Hubbard Co., Middletown, guarantee 98.75 pure nitrate of soda.

2176. Sold by L. Sanderson, New Haven, guarantee 19–20 ammonia.

ANALYSES.

	2190	2176
Moisture	.35	.85
Salt (sodium chloride)	.23	.33
Sulphate of soda	.21	.16
Pure nitrate of soda	99.21	98.66
	100.00	100.00
Contains nitrogen	16.37	16.28
Cost per ton	$52.00	50.00
Nitrogen costs per pound	15.9 cts.	15.4 cts.

SULPHATE OF AMMONIA.

This article, now manufactured on a large scale as a by-product of gas-works, usually contains over 20 per cent. of nitrogen, the equivalent of from 94 to 97 per cent. of sulphate of ammonia. The rest is chiefly moisture. The usual guarantee is 25 per cent. of ammonia which is equivalent to 20.6 per cent. of nitrogen, but commercial sulphate of ammonia commonly contains less than that quantity.

2170. Sold by L. Sanderson, New Haven. Sampled and sent by J. J. Webb, Hamden.

2213. Made by C. Meyer, Jr., Maspeth. From stock bought by G. F. Platt, Milford, for home mixtures.

2217. Made by C. Meyer, Jr. From stock bought and sampled by C. T. Merwin & Son, Milford.

2230. Made by C. Meyer, Jr. From stock bought and sampled by Dennis Fenn, Milford.

ANALYSES.

	2170	2213	2217	2230
Nitrogen	20.02	20.15	20.12	20.02
Equivalent ammonia	24.30	24.46	24.42	24.30
Cost per ton	$70.00	71.60*	71.60*	71.60*
Nitrogen costs per pound,	17.5 cts.	17.8 cts.	17.9 cts.	17.7 cts.

* Ton lots in Milford.

COTTON SEED MEAL.

The seed of the cotton plant, after ginning to remove the cotton fibre, passes through a mill which hulls or decorticates it. The hulled seed is ground and the oil is expressed by hydraulic pressure. The ground cake from the presses is used as a cattle food and fertilizer. The hulls are burned for fuel in the oil factory and the ashes, which contain from 20 to 30 per cent. of potash, are also used as a fertilizer.

2172. Sold by F. S. Harmon, Suffield. Sampled and sent by H. K. Wright, Suffield.

2173. Sold by W. W. Cooper, Suffield. Sampled and sent by H. K. Wright, Suffield.

2201. Sold by J. E. Soper & Co., Boston. Sampled and sent by C. W. Austin, Suffield, from stock bought by him.

2202. Light colored, from stock of R. H. Ensign, Simsbury. Sampled and sent by J. C. Eddy, Simsbury.

2203. Dark colored, from stock of J. & H. Woodford, Avon. Sampled and sent by J. C. Eddy, Simsbury.

2235. Sold by Olds & Whipple, Hartford.

2244. Sold by F. S. Harmon, Suffield.

2253. Dark colored. Sold by J. E. Soper & Co., Boston. Sampled and sent by H. S. Frye, Poquonock.

ANALYSES.

	2172	2173	2201	2202	2203	2235	2244	2253
Nitrogen	7.38	7.13	6.95	7.65	6.97	7.23	7.42	7.20
Phosphoric acid	3.06	3.40	3.11	2.81	3.60	2.85	3.69	....
Potash	1.91	1.91	1.96	1.81	2.09	1.73	2.08	....
Cost per ton	$25.00	26.00	25.00	25.00	25.00	25.00	25.00	
Nitrogen costs per pound, in cents*	12.6	13.4	13.3	12.5	12.7	13.2	11.9	

* Reckoning phosphoric acid at 7 cents and potash at 5½ cents per pound.

The analyses show that this material has been the cheapest source of available nitrogen during the last season.

CASTOR POMACE.

This is the ground residue or cake of castor beans from which castor oil has been extracted by pressure.

2236. Made by the St. Louis Lead and Oil Co. Sold by Olds & Whipple, Hartford.

2247. Made by H. J. Baker & Bro., 215 Pearl St., N. Y.

ANALYSES.

	2236	2247
Nitrogen	5.78	5.76
Phosphoric acid	1.87	1.71
Potash	1.22	.91
Cost per ton	$20.00	20.00
Nitrogen costs per pound*	**13.9 cts.**	**14.4 cts.**

* Reckoning the phosphoric acid at 7 cents per pound and the potash at 5½ cents.

Castor pomace, like cotton seed meal, has been one of the cheapest sources of available nitrogen this season.

II. Raw Materials of High Grade Containing Phosphoric Acid.

Thomas Slag and Native Phosphates.

The following were used in the field experiments carried out in various parts of the state for this Station and which are described in the latter part of the present report.

2194. Thomas Slag or Thomas Phosphate Meal, a by-product of the manufacture of steel from ores containing phosphorus. Bought of Paul Weidinger, 76 Pine St., New York City.

2193. Ground South Carolina Rock. Purchased for the Station by the Mapes Formula and Peruvian Guano Co., New York City.

2195. Grand Cayman's Phosphate. A phosphatic deposit from Grand Cayman's Island. Bought of N. P. Powter, New York City.

2397. Bolivian Guano. A phosphatic guano from the West Indies, sold by the Quinnipiac Fertilizer Co., and bought from their agent, R. B. Bradley & Co., New Haven.

ANALYSES.

	2194	2193	2195	2397
Phosphoric acid	19.62	25.53	26.22	17.15
Cost per ton	$15.00	14.50	15.00	15.00
Phosphoric acid, costs per pound	**3.8 cts.**	**2.8 cts.**	**2.9 cts.**	**4.3 cts.**

Dissolved Bone Black.

This material is a superphosphate prepared by treating refuse bone black from sugar refineries with oil of vitriol which renders nearly all of the phosphoric acid soluble in water.

Phosphoric acid in dissolved bone black is considerably more expensive than in dissolved South Carolina rock, but the latter material does not get into the retail market in this state for some reason, perhaps for a lack of a demand for it. Phosphoric acid in dissolved rock was bought in New Jersey for about 6 cents a pound the last year, and granges or farmers' clubs that buy in considerable quantity would do well to inquire for it.

2182. Sold by L. Sanderson, New Haven, guaranteed 16–18 per cent. available.

2214. Sold by C. Meyer, Jr., Maspeth, L. I., guaranteed 16–18 per cent. available. From stock bought by G. F. Platt, Milford.

2223. Sold by C. Meyer, Jr. Sampled and sent by C. T. Merwin & Son, Milford.

2228. Sold by C. Meyer, Jr. Sampled and sent by Dennis Fenn, Milford.

ANALYSES.

	2182	2214	2223	2228
Soluble phosphoric acid	15.68	14.55	14.38	15.78
Reverted phosphoric acid	.85	2.39	3.66	1.35
Insoluble phosphoric acid	none	.20	.60	.37
Cost	$26.00	27.60*	27.60*	27.60*
Soluble phosphoric acid costs per pound†	**7.9 cts.**	**8.2 cts.**	**8 cts.**	**8.1 cts.**

* Ton lots in Milford.

† Reckoning the reverted acid at 7½ cents and insoluble at 2 cents per pound.

III. Raw Materials of High Grade Containing Potash.

Sulphate of Potash.

The double sulphate of potash and magnesia is usually sold as "sulphate of potash" on a guarantee of "48–50 per cent. sulphate" which is equivalent to 25.9–27 per cent. of actual potash. It contains, besides some 46–50 per cent. of sulphate of potash, over 30 per cent. of sulphate of magnesia, chlorine equivalent to 3 per cent. of common salt, besides sulphates of soda and lime, with varying quantities of moisture.

Attention is called to the high grade sulphate containing about 94–95 per cent. of pure sulphate of potash. The cost of actual potash is somewhat higher in this than in the double sulphate of potash and magnesia.

2178. Double sulphate of potash and magnesia. Stock of L. Sanderson, New Haven.

2209. High grade sulphate of potash, guarantee 95 per cent. sulphate. Sold by C. Meyer, Jr., Maspeth, L. I. From stock bought by G. F. Platt, Milford.

2225. High grade sulphate of potash. Sold by C. Meyer, Jr. Sampled and sent by Dennis Fenn, Milford.

ANALYSES.

	2178	2209	2225
Actual potash	27.76	51.28	50.68
Equivalent sulphate of potash	51.3	94.8	93.7
Cost per ton	$30.00	61.60*	61.60*
Potash costs per pound	**5.4 cts.**	**6 cts.**	**6.1 cts.**

* Ton lots in Milford.

MURIATE OF POTASH.

Commercial muriate of potash contains about 80 per cent. of muriate of potash (potassium chloride), 15 per cent. or more of common salt (sodium chloride), and 4 per cent. or more of water. It is generally retailed on a guarantee of 80 per cent. muriate, which is equivalent to 50.5 per cent. of actual potash.

2168. From stock bought of L. Sanderson, New Haven. Sampled and sent by J. J. Webb, Hamden.

2177. Stock of L. Sanderson, guarantee, 80–85 per cent. muriate.

2188. Stock of the Rogers & Hubbard Co., Middletown, guarantee, 80 per cent. muriate.

2212. From stock bought of C. Meyer, Jr., Maspeth, L. I., by G. F. Platt, Milford. Guarantee 82 per cent. muriate.

2221. From stock bought of C. Meyer, Jr. Sampled and sent by C. T. Merwin & Son, Milford.

2226. From stock bought of C. Meyer, Jr. Sampled and sent by Dennis Fenn, Milford.

ANALYSES.

	2168	2177	2188	2212	2221	2226
Actual potash	50.0	51.17	50.88	52.52	53.30	52.82
Equivalent muriate	79.2	81.0	80.6	83.2	84.4	83.7
Cost per ton	$41.50	41.50	43.00	41.60*	41.60*	41.60*
Cost of potash per pound, in cents	**4.2**	**4.1**	**4.2**	**4.0**	**3.9**	**3.9**

* Ton lots in Milford.

IV. RAW MATERIALS CONTAINING NITROGEN AND PHOSPHORIC ACID.

BONE MANURES.

The terms "Bone Dust," "Ground Bone," "Bone Meal" and "Bone" applied to fertilizers, may in some cases, signify material, made from dry, clean and pure bones such as shank bones used in making knife handles; in other cases these terms refer to the result of crushing fresh or moist bones which have 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 in order to recover grease, and are then dried and sold as "tankage;" or, finally, they apply to bone from which a large share of the nitrogenous substance has been in extracted in the glue manufacture. The nitrogen of all these varieties of bone when they are in the same state of mechanical subdivision has essentially the same fertilizing value.

Since it now rarely happens that ground bone or tankage is to any considerable extent coarser than $\frac{1}{6}$ inch, the valuation this year is made on four grades only, viz:

Fine, smaller than $\frac{1}{60}$ inch.
Fine-medium, between $\frac{1}{60}$ and $\frac{1}{25}$ inch.
Medium, between $\frac{1}{25}$ and $\frac{1}{12}$ inch.
Coarse, larger than $\frac{1}{12}$ inch.

1. *Sampled by Station Agents.*

On pages 40 to 43 will be found the tabulated analyses of 25 different brands of this class.

Bone Manures.—Sampled by the Station.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Cost Per Ton.
2240	Peter Cooper's Pure Bone Dust.	Peter Cooper's Glue Factory, 17 Burling Slip, N. Y.	Chas. Jennings, Southport.	$26.00
2365	Peter Cooper's Pure Bone Dust.	Peter Cooper's Glue Factory, 17 Burling Slip, N. Y.	Apothecaries Hall Co., Waterbury.	32.00
			Wilson & Burr, Middletown.	28.00
			Geo. Beaumont, Wallingford.	27.00
2362	Baker's Strictly Pure Bone.	H. J. Baker & Bro., 215 Pearl St., New York City.	C. O. Jelliff & Co., Southport.	30.00
			Harry Sedgwick, Cornwall Hollow.	32.00
				30.00
			Allen Betts, Norwalk.	35.00
2373	Quinnipiac Bone Meal.	Quinnipiac Co., New London, Ct.	Chandler & Morse, Putnam.	33.00
			E. A. Godfrey, Bridgeport.	36.00
			E. J. Dickerman, Mt. Carmel.	32.00
			Martin Bros., Wallingford.	32.00
			J. E. Hall, Colchester.	33.00
			A. P. Smith, Lebanon.	34.00
			Bought by Comstock, Ferre & Co., for their own use.	36.00
			J. M. Belden, New Britain.	28.00
2191	Pure Ground AX Bone.	Rogers & Hubbard Co., Middletown, Conn.	Manufacturer.	
2211	Ground Bone.	C. Meyer, Jr., Maspeth, L. I.	Geo. F. Platt, Milford.	
2371	Ground Bone.	Chas. Prentice, Putnam, Conn.	Manufacturer.	31.00
2181	Ground Bone.	Unknown.	L. Sanderson, 119 Long Wharf, New Haven.	35.00

Bone Manures.—Sampled by the Station,—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Cost Per Ton.
2367	Darling's Fine Ground Bone.	L. B. Darling Fertz. Co., Pawtucket, R. I.	Dunham & Co., West Cheshire.	$32.00
			W. S. Vinton, Coventry.	35.00
			T. Pease & Sons Co., Windsor Locks.	35.00
			Quinnebaug Store, Danielsonville.	35.00
			J. P. Barstow & Co., Norwich.	35.00
			H. K. Brainard, Thompsonville.	40.00
			J. M. Belden, New Britain.	35.00
			Manufacturer.	36.00
2185	Raw Knuckle Bone Flour.	Rogers & Hubbard Co., Middletown, Ct.	Manufacturer.	32.00
2192	Strictly Pure Fine Bone.	Rogers & Hubbard Co., Middletown, Ct.	Cochrane Bros., West Cornwall.	35.00
2363	Bradley's Pure Fine Ground Bone.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	Raymond Bros., South Norwalk.	35.00
			David Beers, Danbury.	36.00
			Waterbury & June, Greenwich.	35.00
			T. Pease & Sons Co., Windsor Locks.	35.00
			W. F. Andross, East Hartford.	35.00
			M. H. Tanner, Winsted.	36.00
			C. S. Gillette, Cheshire.	34.00
			J. A. Lewis, Williamantic.	33.00
			A. J. Ives, Meriden.	35.00
			Oscar Leach, Durham.	36.00
			E. C. Dennis, Stafford Springs.	33.00
			Strong & Backus, Colchester.	32.00
			G. A. Dickerman, Haddam.	36.00
			Loomis Bros., Granby.	35.00
			E. E. Spicer, Groton.	35.00
2208	Bradley's Pure Fine Ground Bone.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	From stock bought by Greens Farm. Farmers' Club.	34.–35.

Bone Manures.—Sampled by the Station,—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Cost Per Ton.
2179	Ground Bone.	Unknown.	L. Sanderson, Long Wharf, New Haven.	$35.00
2372	Preston's Pure Ground Bone.	Preston Fertilizer Co., Greenpoint, L. I.	J. B. Merrow & Son, Merrow.	30.00
2369	H. S. Miller & Co's Ground Bone.	H. S. Miller & Co., Newark, N. J.	Staples & Raymond, Westport.	25.00
			Southington Lumber and Feed Co., Southington, Conn.	27.00
			L. Sanderson, Long Wharf, New Haven.	35.00
2180	Ground Bone.	Unknown.	C. S. Gillette, Cheshire.	34.00
2375	Americus Pure Bone Meal.	Williams & Clark Co., Hanover Square, N. Y.	J. O. Fox & Co., Putnam.	35.00
			J. A. Paine, Danielsonville.	
			L. F. Ellis, Woodmont.	33.00
			W. E. Payne, Rockville.	35.00
			John Bransfield, Portland.	40.00
			F. Ellsworth, Hartford.	40.00
2234	Swift Sure Bone Meal.	M. L. Shoemaker & Co., Phila., Pa.	Chandler & Morse, Putnam.	37.00
2366	Crocker's Pure Ground Bone.	Crocker Fertilizer Co., Buffalo, N. Y.	J. L. Bragg, Canaan.	38.00
			F. P. Burr & Co., Middletown.	34.00
2395	Chittenden's Ground Bone.	National Fertilizer Co., Bridgeport, Ct.	W. B. Martin, Rockville.	34.00
			I. W. Denison, Mystic River.	33.00
2364	E. F. Coe's Ground Bone.	E. Frank Coe, 16 Burling Slip, N. Y.	Simon Banks, Southport.	28.00
			H. W. Elliott, North Haven.	35.00
			W. S. Ellis, Gilead.	38.00
2361	Adams' Pure Raw Bone.	W. P. Adams, 248 Front St, N. Y.	F. H. Tillinghast, Central Village.	39.00
			Augustus Meeker, Westport.	33.00
2370	Peck Bros. Ground Bone.	Peck Bros., Northfield, Conn.	A. N. Clark, Milford.	28.00
2238	Lister's Ground Bone.	Lister Agricultural Chemical Works, Newark, N. J.		
2368	Lister's Ground Bone.	Lister Agricultural Chemical Works, Newark, N. J.	G. W. Dennison, Saybrook.	29.00

Analyses of Bone Manures.—Sampled by the Station.

Station No.	Name or Brand.	Chemical Analysis.		Mechanical Analysis. Finer than				Coarser than	Cost per ton.	Valuation per ton.	Percentage difference between cost and valuation.
		Nitrogen.	Phos. Acid.	1/50 inch.	1/25 inch.	1/12 inch.	6 inch.	1/6 inch.			Valuation exceeds cost.
2240	Peter Cooper's Pure Bone Dust	1.68	29.96	36	13	26	25	--	$26.00	$37.75	31.1
2365	Peter Cooper's Pure Bone Dust	1.47	31.37	47	17	24	12	--	29.00	41.55	30.2
2362	Baker's Strictly Pure Bone	3 85	23 70	79	21	--	--	--	32.00	44.32	27.8
2373	Quinnipiac Bone Meal	2.87	25.50	75	16	9	--	--	33.00	42.80	22.9
2191	Rogers & Hubbard Co.'s Pure Ground AX Bone	3.52	22.39	42	25	23	10	--	28.00	36.28	22.8
2211	C. Meyer, Jr.'s Ground Bone	3.87	21.16	52	36	12	--	--	29.60*	38.31	22.7
2371	Chas. Prentice's Ground Bone	3 88	23.51	47	26	24	3	--	31.00	39.80	22.1
2181	Sanderson's Ground Bone	2.59	27.19	74	23	3	--	--	35.00	44.51	21.3
2367	Darling's Fine Ground Bone	2.65	26.10	76	18	6	--	--	35.00	43.19	19.0
2185	Rogers & Hubbard Co.'s Raw Knuckle Bone Flour	3.74	24.96	66	27	7	--	--	36.00	44.22	18.6
2192	Rogers & Hubbard Co.'s Strictly Pure Fine Bone	4.00	22.74	42	28	30	--	--	32.00	38.81	17.6
2363	Bradley's Pure Fine Ground Bone	3.88	21.58	63	29	8	--	--	34.00	39.91	15.0
2208	Bradley's Pure Fine Ground Bone	3.91	20.61	74	26	--	--	--	34.00	39.97	14.9
2179	Sanderson's Ground Bone	3.98	22.32	56	41	3	--	--	35.00	41.00	14.6
2372	Preston Fertilizer Co.'s Pure Ground Bone	3.58	21.33	8	8	15	22	47	30.00	26.42	13.6
2369	H. S. Miller & Co.'s Ground Bone	2.22	18.48	57	23	18	2	--	26.00	29.89	13.0
2180	Sanderson's Ground Bone	4.18	21.26	52	33	15	--	--	35.00	39.14	10.5
2375	Americus Pure Bone Meal	2.94	23.86	62	18	15	5	--	35.00	38.96	10.1
2234	Swift Sure Bone Meal	6.23	20.23	58	26	15	1	--	40.00	44.12	9.3
2366	Crocker's Pure Ground Bone	4.14	23.71	44	24	30	2	--	37.50	40.27	6.8
2395	Chittenden's Ground Bone	2.71	22.89	53	21	16	10	--	34.00	35.76	5.0
2364	E. Frank Coe's Pure Ground Bone†	2.42	21.46	49	22	14	8	7	33.00	33.69	2.5
2361	Adams' Pure Raw Bone	3.82	21.16	59	35	6	--	--	38.50	39.02	1.3
											Cost exceeds valuation.
2370	Peck Bro's Pure Ground Bone	4.19	21.07	8	16	33	40	3	30.00	29.43	1.9
2238	Lister's Ground Bone	3.44	14.28	22	17	29	30	2	28.00	23.15	20.9
2368	Lister's Ground Bone	3.34	15.01	18	21	38	21	2	29.00	23.81	21.8

* In Milford.

† Also contains 1.29 per cent. of potash.

Bone Manures.—Manufacturers' Samples and Samples Sent by Purchasers.

Station No.	Name or Brand.	Manufacturer.	Sample drawn by	Cost per ton.
2169	Sanderson's Fine Bone.	----------	J. J. Webb, New Haven.	$35.00
2222	Pure Ground Bone.	C. Meyer, Jr., Maspeth, L. I.	C. T. Merwin & Son, Milford.	29.60*
2227	Ground Bone.	C. Meyer, Jr., Maspeth, L. I.	Dennis Fenn, Milford.	29.60*
2171	Pure Bone Meal.	H. S. Miller & Co., Newark, N. J.	Charles H. Jones, Westport.	33.00
2166	Pure Fine Ground Bone.	Bradley Fertilizer Co., Boston, Mass.	George Ellwood, Southport.	35.00
2300	Ground Bone.	Downs & Griffin, Birmingham, Ct.	Manufacturers.	30.00
2374	Pure Fine Ground Bone.	Thompson & Edwards Fertilizer Co., Chicago, Ill.	Manufacturers.	----
2378	Pure Ground Bone.	Peck Bros., Northfield, Ct.	Manufacturers.	30.00
2382	Animal Dust.	L. B. Darling Fertilizer Co., Pawtucket, R. I.	J. B. Smith, New Britain.	28.00
2387	Ground Bone.	H. C. Hall.	J. O. Ives, Meriden.	30.00

* Ton lots in Milford.

Analyses of Bone Manures.—Sampled by Manufacturers and Purchasers.

Station No.	Name or Brand.	Chemical Analysis.		Mechanical Analysis. Finer than				Coarser than	Cost per ton.	Valuation per ton.	Percentage difference between cost and valuation.
		Nitrogen.	Phos. Acid.	1/50 inch.	1/25 inch.	1/12 inch.	1/6 inch.	1/6 inch.			Valuation exceeds cost
2169	Sanderson's Ground Bone	2.70	27.07	75	21	4	--	--	$35.00	$44.71	21.7
2222	C. Meyer's Pure Ground Bone	4.03	21.57	34	49	17	--	--	29.60	37.69	21.4
2227	C. Meyer's Ground Bone	3.88	20.33	52	34	14	--	--	29.60	37.71	20.3
2171	H. S. Miller & Co's Pure Bone Meal	3.57	23.43	48	24	28	--	--	33.00	39.03	15.4
2166	Bradley's Pure Fine Ground Bone	4.02	21.11	67	33	--	--	--	35.00	40.48	13.5
2300	Downs & Griffin's Ground Bone	4.44	23.24	14	11	35	40	--	30.00	32.77	8.4
2374	Thompson & Edward's Pure Fine Ground Bone	3.86	22.29	59	23	18	--	--	----	39.86	----
2378	Peck Bros. Pure Ground Bone	4.11	20.86	10	16	35	37	2	30.00	29.54	Cost exceeds Valuation. 1.5
2382	Darling's Animal Dust	5.65	10.61	34	18	22	16	10	28.00	25.97	7.8
2387	Hall's Ground Bone	3.93	21.79	--	--	1.5	4.0	94.5	30.00	25.34	18.3

Leaving out of account Lister's and E. F. Coe's bone which are mixtures of bone with potash or soda salts, the average cost of 22 samples is $32.80 and the valuation $39.07. The trade-values used by the Station for the valuation of bone are accordingly still too high and should be further reduced to make them coincide with the market quotations.

2. *Manufacturers' Samples.*

On pages 44 and 45 will be found analyses of three samples of bone furnished by manufacturers in accordance with the terms of the fertilizer law.

3. *Samples Sent by Purchasers.*

Six analyses of this kind are included in the table on pages 44 and 45.

Bone and Potash.

An analysis of Bradley's Circle Brand Bone and Potash is tabulated with the nitrogenous superphosphates because, having been treated with acid, it is properly a superphosphate.

2189. Fairchild's Formula Bone and Potash. Made by the Rogers & Hubbard Co., Middletown. Sampled from manufacturer's stock by Station Agent.

Mechanical Analysis.*

Fine, smaller than $\frac{1}{30}$ inch	37 per cent.
Fine medium, smaller than $\frac{1}{20}$ inch	18 "
Medium, smaller than $\frac{1}{12}$ inch	29 "
Coarse, larger than $\frac{1}{12}$ inch	16 "
	100 "

Chemical Analysis and Valuation.

Nitrogen	2.90
Phosphoric acid	17.74
Potash (as muriate)	14.72
Cost per ton	$40.00
Valuation per ton	$40.41

* Made after removing salts soluble in water.

Tankage.

This material consists of various kinds of offal but chiefly of cooked bone and meat which collects on the bottom of the tanks in which grease is separated from the waste of slaughter-houses and meat markets. It is very variable in composition, some samples being chiefly meat, others largely bone.

2175. Western Tankage. Stock of L. Sanderson, New Haven. Guarantee 6–8 ammonia, 10–12 phosphoric acid.

2183. New York Tankage. Stock of L. Sanderson. Guarantee 6–8 ammonia, 10–12 phosphoric acid.

2210. New York Tankage. Sold by C. Meyer, Jr., Maspeth. From stock bought by G. F. Platt, Milford. Guarantee 9 ammonia, 5 phosphoric acid.

2220. New York Tankage. Sold by C. Meyer, Jr. Sampled and sent by C. T. Merwin, Milford.

2229. New York Tankage. Sold by C. Meyer, Jr. Sampled and sent by Dennis Fenn, Milford.

2243. Tankage. Made by Sperry & Barnes, New Haven. Manufacturers' sample.

Mechanical Analyses.

	2175	2183	2210	2220	2229	2243
Fine, smaller than $\frac{1}{30}$ inch	64	58	21	14	22	68
Fine medium, smaller than $\frac{1}{20}$ inch	21	25	19	14	21	13
Medium, smaller than $\frac{1}{12}$ inch	14	17	17	12	21	10
Coarse, larger than $\frac{1}{12}$ inch	1	--	43	60	36	9
	100	100	100	100	100	100

Chemical Analyses.

	2175	2183	2210	2220	2229	2243
Nitrogen	7.02	5.81	8.37	8.84	8.76	7.85
Phosphoric acid	13.49	17.46	3.98	4.01	3.56	5.60
Cost per ton	$35.00	35.00	29.60*	29.60*	29.60*	
Valuation per ton	$38.32	39.34	22.50	21.16	24.13	30.60

* Ton lots in Milford.

Dry Ground Fish.

In the two brands here specified the manufacturers' guarantees and the Station analyses refer alone to nitrogen. These articles are accordingly not included among the ammoniated superphosphates given on subsequent pages.

2267. Sold by Luce Brothers, Niantic. Manufacturers' sample.

2336. Made by Bowker Fertilizer Co., Boston. Sample from W. F. Andross, East Hartford.

	2267	2336
Nitrogen	8.20	8.46
Equivalent ammonia	9.96	10.27

Mixed Fertilizers.

I. Nitrogenous Superphosphates and Guanos.

Here are included mixed fertilizers containing nitrogen, phosphoric acid and in most cases potash, which are not designed by their manufacturers for use on any special crops. "Special Manures" are noticed further on. Fish scrap is classified with these goods because it is sometimes acidulated with oil of vitriol to preserve it, thus making it a nitrogenous superphosphate.

1. *Samples drawn by Station Agent.*

In the tables on pages 50 to 62 are given sixty-nine analyses of this kind.

After the name of a brand of goods the names of a number of dealers are frequently given. This indicates that a sample of the goods was drawn by our agent from each dealer named and that the corresponding analysis was made on a mixture of equal parts of all these samples.

The Station assumes full responsibility for accuracy of sampling and analysis only on such samples as are drawn by its own agents. On samples drawn by other persons the Station holds itself responsible only for the accuracy of analysis, but requires before making an analysis a formal statement that the person who drew the sample did it in accordance with the Station directions. See page 25.

Early in the year a circular was sent to all manufacturers whose goods were sold in Connecticut, asking them to inform the Station what would be about the average cash price of their goods in this State during the coming season. In the tables with the various *dealers'* quotations is also given for comparison the *manufacturers'* statement of the average retail cash price per ton in the State in cases where the manufacturer supplied such statement. The cash prices are usually about five per cent. lower than the credit or "time" prices.

The retail cash price of the same fertilizer as quoted by different dealers varies in some cases considerably, partly on account of differences in freight-rates, presence or absence of competition, etc. Some manufacturers arrange with their selling agents so that a given brand shall be sold at a uniform price at all points in the State, but usually the price charged is fixed by the dealer.

The last column of the table of analysis is "Percentage Difference between Cost and Valuation." Its significance and the method of calculating it may be seen by noticing the eighth analysis in the table on page 59, No. **2338.** Here the cost is $32, the valuation is $30.03, and the difference between them is $1.97. By multiplying this difference, $1.97, by 100, and dividing it by the valuation, $30.03, we get 6.6, the percentage advance of selling price over valuation, which advance should represent the costs and profits of the manufacturer in converting the raw materials into a mixed fertilizer, selling it and collecting on his sales.

DIFFERENCE BETWEEN COST AND VALUATION.

Leaving out of account the last analysis in the tables in which the cost exceeded valuation by more than 50 per cent. the average cost of 68 nitrogenous Superphosphates was $34.55, and the average valuation $28.70. The difference is $5.85, and the percentage difference 20.3.

That is, the same quantities of nitrogen, phosphoric acid and potash, which were contained in an average ton of Nitrogenous Superphosphate could have been bought in raw materials of standard quality in ton lots in this State for $28.70 cash, in the average Superphosphate they cost $34.55, and hence the manufacturers' and dealers' expenses and profits on a ton of fertilizer averaged $5.85, or 20.3 per cent. of the cost of the materials.

Guarantees.—The analyses of 21 superphosphates out of the 69 show that their composition is below the minimum guarantee in one or more particulars. Fourteen are deficient in one ingredient, six in ten and one in the three ingredients. In most cases the deficiency is due to a misleading, and in this State illegal, method of expressing the guarantee of potash. It is required, under the law, that the quantity of *actual* potash shall be expressly stated. "Potash, Sulphate, 4 per cent." means four per cent. of *actual potash* in the form of sulphate, and not 2.16 per cent. of potash.

Fish and Potash.—The analyses of this material which has been a favorite fertilizer in this State, though tabulated with the nitrogenous superphosphates are also tabulated by themselves on page 63. Most of the brands are not simple mixtures of fish scrap and potash salts, as the name would imply, but contain other phosphates and in one case much *insoluble* phosphate.

Nitrogenous Superphosphates and Guanos, Sampled by the Station.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2355	Pequot Fish and Potash.	Quinnipiac Co., New London, Ct.	Birdsey & Foster, Meriden.	$17.00	$20.00
2276	Kelsey's Fish and Potash.	E. R. Kelsey, Branford, Conn.	E. B. Payne, Cheshire.	25.00	20.00
			J. A. Bishop, N. Haven.	20.00	
			Nelson Hall, Meriden.	20.00	
2360	Quinnipiac Co's. Dry Ground Fish	Quinnipiac Co., New London, Ct.	Olds & Whipple, Hartford.	35.00	33.00–35.00
2359	Pure Fine Bone Dissolved in Sulphuric Acid.	Mapes Formula & Peruvian Guano Co., 158 Front St., N. Y.	Strong & Backus, Colchester.	32.00	
2356	Sanderson's Formula "A."	L. Sanderson, 119 Long Wharf, New Haven, Conn.	W. A. Thomas, Hamden Plains.	35.00	35.00
2233	Swift Sure Superphosphate.	M. L. Shoemaker & Co., Phila., Pa.	W. A. Thomas, Hamden Plains.	35.00	
			F. S. Ellsworth, Hartford.	38.00	
2339	Quinnipiac Fish and Potash, Plain Brand.	Quinnipiac Co., New London, Ct.	R. W. Burchard, Darien.	30.00	
			M. O. Babcock, Branford.	35.00	
2338	Pine Island Phosphate.	Quinnipiac Co., New London, Ct.	Filler & Hooper, Montville.	34.00	30.00–32.00
			M. O. Babcock, Branford.	35.00	
			H. J. Stanclift, New Hartford.	32.00	
2325	Ammoniated Dissolved Bone Phosphate.	Lister Agricultural Chemical Works, Newark, N. J.	A. N. Clark, Milford.	28.00	
			G. F. Fowler, N. Branford.	28.00	
			W. J. Munson, Watertown.	35.00	
2330	Flour of Bone Phosphate.	G. W. Miller, Middlefield, Conn.	M. K. Northam, Stony Creek.	38.00	
2333	Acme Fertilizer, No. 2.	C. Meyer, Jr., Maspeth, L. I.	J. & F. Beach, Branford.	40.00	43.00
			J. H. Ives, Danbury.	42.–45.	
2318	Great Planet A. Manure.	Clark's Cove Guano Co., New Bedford, Mass.	J. W. Boswell, Sterling.	37.–38.	
2316	Great Eastern General Fertilizer.	Great Eastern Fertilizer Co., Rutland, Vt.	C. A. Sharp, Abington.	38.00	
			W. R. Mapes, Putnam.	36.00	
			G. T. Sanger, Canterbury.	35.00	
			B. Seagrave, So. Canterbury.	36.00	
			C. B. Stearns, Andover.		

Nitrogenous Superphosphates and Guanos, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2326	Complete Manure for light soil.	Mapes Formula & Peruvian Guano Co., 158 Front St., N. Y.	Dean & Horton, Stamford.	$44.00	$44.00
			Mapes Branch, Hartford.	44.00	
			Birdsey & Foster, Meriden.	45.00	
2296	A. A. Ammoniated Superphosphate.	H. J. Baker & Bro., 215 Pearl St., N. Y.	Allen Betts, Norwalk.	37.00	----
			D. N. Benton, Guilford.	34.00	
			W. W. Cooper, Suffield.	37.50	
			A. L. Winton, Bridgeport.	37.50	
2327	Complete Manure for General Use.	Mapes Formula & Peruvian Guano Co., 158 Front St., N. Y.	Dean & Horton, Stamford.	39.00	39.00
			Mapes Branch, Hartford.	39.00	
2266	Ammoniated Bone Superphosphate.	Bowker Fertilizer Co., 43 Chatham St., Boston, Mass.	W. H. Anderson, Putnam.	35.00	----
			J. M. Belden, New Britain	31.00	
			W. F. Andross, E. Hartford.	35.00	
			E. B. Clark, Milford.	29.–30.	
			Hubbell & Bradley, Saugatuck.	30.00	
			W. R. McDonald, Cromwell.	31.00	
2261	Chittenden's Ammoniated Bone Superphosphate.	National Fertilizer Co., Bridgeport, Conn.	Andrew Ure, Hamden.	28.00	----
			F. P. Burr & Co., Middletown.	34.00	
			David Fitzgerald, Stratford.	33.00	
			J. H. French, Cheshire.	34.00	
			G. W. Eaton, Plainville.	33.00	
			Clarence Swan, Bridgeport.	35.00	
			E. A. Buck & Co., Willimantic.	30.00	
			Balch & Platt, West Winsted.	35.00	
			M. Kinney, Putnam.	34.00	
2256	Americus Ammoniated Bone Superphosphate.	Williams & Clark Co., Hanover Square, New York.	W. E. Payne, Rockville.	32.00	35.00
			C. S. Gillette, Cheshire.	34.00	
			J. O. Fox, Putnam.	34.00	
			I. W. Beers, Hamden.	36.00	
			J. A. Paine, Danielsonville.	----	
			W. Kyle, Bethel.	36.00	
			D. B. Wilson & Co., Waterbury.	36.00	
			W. G. & F. Comstock, E. Hartford.	36.00	

NITROGENOUS SUPERPHOSPHATES AND GUANOS, SAMPLED BY THE STATION—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2292	Chittenden's Fish and Potash.	National Fertilizer Co., Bridgeport, Conn.	E. A. Buck & Co., Willimantic.	$30.00	
			G. W. Eaton, Plainville.	34.00	
			W. W. Cooper, Suffield.	34.00	
			J. H. French, Cheshire.	35.00	
2332	Fish and Potash.	G. W. Miles, Agent, Milford, Conn.	J. D. Toomey, Fairfield.	30.00	$32.00–34.00
2324	Standard Superphosphate.	Lister Agricultural Chemical Works, Newark, N. J.	W. H. Parmelee, Essex.	35.00	----
			W. J. Munson, Watertown.	35.00	
			G. W. Dennison, Saybrook.	35.00	
			A. N. Clark, Milford.	32.00	
2278	Bay State Fertilizer.	Clark's Cove Guano Co., New Bedford, Mass.	J. B. Cowan, So. Coventry.	36.00	----
			H. F. Standish, Andover.	34.00	
			W. Tillinghast, Plainfield.	37.00	
2314	Quinnipiac Phosphate.	Quinnipiac Co., New London, Ct.	Martin Bros., Wallingford.	35.00	
			Birdsey & Foster, Meriden.	36.00	
			Daniel Moriarty, So. Meriden.	38.00	
			Alden Hill, No. Branford.	38.00	
			M. O. Babcock, Branford.	38.00	
			Southington Lumber and Feed Co., Southington.	36.50	
			J. C. Nettleton, Madison.	37.00	
			P. & G. M. Williams, New London,	32.50	
			D. N. Benton, Guilford.	33.00	
			Chandler & Morse, Putnam.	34.00	
			J. E. Hall, Colchester.	32.00	
			Olds & Whipple, Hartford.	37.00	
			J. M. Belden, New Britian.	36.00	
			D. C. Wood, Stratford.	36.00	
			Staples & Raymond, Westport.	36.00	
			R. W. Burchard, Darien.	37.00	
			Benj. Beers, Redding Center.	36.00	
			E. A. Godfrey, Bridgeport.	35.00	
			J. F. Silliman & Co., New Canaan.	38.00	

NITROGENOUS SUPERPHOSPHATES AND GUANOS, SAMPLED BY THE STATION—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2270	Complete Manure A. Brand.	Mapes Formula & Peruvian Guano Co., 158 Front St., N. Y.	Dean & Horton, Stamford.	$36.00	----
			W. R. Foot, Branford.	37.00	
			Wilson & Burr, Middletown.	36.00	
			Birdsey & Foster, Meriden.	37.00	
			David Beers, Danbury.	38.00	
			D. B. Wilson & Co., Waterbury.	38.00	
			Mapes Branch, Hartford.	36.00	
			Quinnebaug Store, Danielsonville.	37.00	
2331	I. X. L. Ammoniated Bone Superphosphate.	G. W. Miles, Agt., Milford, Ct.	W. E. Wheeler, Mystic River.	33.00	$28.00–32.00
			J. P. Barstow & Co., Norwich.	30.00	
			J. D. Toomey, Fairfield.	30.00	
			A. H. Hinckley, Mystic.	29.00	
2335	Orient Complete Manure.	Orient Guano Mfg. Co., Orient, L. I.	Mrs. F. Shanley, Torrington.	29.00	----
			F. P. Burr & Co., Middletown.	30.00	
			A. B. Morse, Guilford.	29.00	
			G. W. Eaton, Plainfield.	28.00	
2353	Standard Pure Bone Superphosphate.	H. S. Miller & Co., Newark, N. J.	G. W. Dennison, Saybrook.	35.00	----
			R. W. Cowles, Plantsville.	38.00	
2388	Victor Phosphate.	Apothecaries Hall Co., Waterbury, Conn.	Manufacturer.	30.00	
2257	Farmer's New Method Fertilizer.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	A. J. Ives, Meriden.	32.00	32.00
			D. B. Judd & Co., Bristol.	32.00	
			W. F. Andross, E. Hartford.	33.00	
			J. R. Cogswell, Putnam.	32.00	
			I. W. Beers, Hamden.	32.00	
			R. A. Parker, Warehouse Point.	33.00	
			M. Beach & Son, New Milford.	35.00	
			C. S. Gillette, Cheshire.	32.00	
			T. Pease & Sons Co., Windsor Locks.	35.00	
			W. B. Martin, Rockville.	35.00	

Nitrogenous Superphosphates and Guanos, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2259	Bowker's Hill and Drill Phosphate.	Bowker Fertilizer Co., 43 Chatham St., Boston, Mass.	E. J. Dickerman, Mt. Carmel.	$40.00	----
			W. F. Andross, E. Hartford.	37.00	
			J. A. Paine, Danielsonville.	----	
			Dunham & Co., W. Cheshire.	38.00	
			F. Hallock & Co., Birmingham.	36.00	
			T. Pease & Sons Co., Windsor Locks.	37.00	
			Hubbell & Bradley, Saugatuck.	35.00	
			W. H. Anderson, Putnam.	38.00	
			J. M. Belden, New Britain.	35.00	
2294	Cumberland Superphosphate.	Cumberland Bone Co., Portland, Me.	J. M. Williams, Manchester.	35.00	$36–38
			W. Tillinghast, Plainfield.	37.00	
			E. E. Salisbury, Moosup.	38.00	
2273	Quinnipiac Fish and Potash "Crossed Fishes."	Quinnipiac Co., New London, Ct.	E. J. Dickerman, Mt. Carmel.	37.00	----
			Daniel Moriarty, So. Meriden.	36.00	
			Olds & Whipple, Hartford.	36.00	
			J. F. Silliman & Co., New Canaan.	38.00	
			Wilson & Burr, Middletown.	35.00	
			M. O. Babcock, Branford.	36.00	
2279	Ammoniated Bone Superphosphate.	Russell Coe, Tremley, N. J.	W. Tillinghast, Plainfield.	32.00	----
			S. J. Hall, Meriden.	30.00	
			Wilson & Burr, Middletown.	30.00	
2248	Chittenden's Complete Fertilizer.	National Fertilizer Co., Bridgeport, Conn.	David Fitzgerald, Stratford.	41.40	----
			J. H. French, Cheshire.	43–44	
			Balch & Platt, West Winsted.	45.00	
			W. B. Martin, Rockville.	45.00	
			W. W. Cooper, Suffield.	40.00	
			L. W. Currier, Bridgeport.	45.00	
2207	Bradley's Superphosphate.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	From stock bought by Green's Farms Farmer's Club.	35.00	35.00

Nitrogenous Superphosphates and Guanos, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's average cash price per ton.
2246	Bradley's Superphosphate.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	M. H. Tanner & Co., Winsted.	$37.00	$35.00
			W. F. Andross, East Hartford.	37.50	
			Raymond Bros., So. Norwalk.	36.00	
			W. W. Cooper, Suffield.	38.00	
			T. Pease & Sons Co., Windsor Locks.	36.00	
			R. A. Parker, Warehouse Point.	35.00	
			M. Beach & Son, New Milford.	38.00	
			W. B. Martin, Rockville.	38.00	
			A. A. Hubbard, Canaan.	37.00	
			Ruggles & Clark, Shelton.	37.00	
			E. E. Scofield, Stamford.	38.00	
			Warner & Clark, Sandy Hook.	36.00	
2312	Fish & Potash, "Anchor Brand."	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	Sanford & Hawley, Unionville.	35.00	32.00
			Strong & Backus, Colchester.	30.00	
			D. B. Judd & Co., Bristol.	32.00	
			A. J. Ives, Tracy.	32.00	
			C. S. Gillette, Cheshire.	30.00	
2271	High Grade Ammoniated Bone Superphosphate.	E. Frank Coe, 16 Burling Slip, N. Y.	H. W. Elliott, No. Haven.	36.00	36–37
			F. P. Burr & Co., Middletown.	34.00	
			Cochrane Bros., W. Cornwall.	34.00	
			Simon Banks, Southport.	34.00	
			Ruggles & Clark, Shelton.	35.00	
2310	Original Coe's Superphosphate.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	Cochrane Bros., W. Cornwall,	32.00	----
			S. E. Rose, Quarryville.	36.00	
2281	Bosworth Bone Superphosphate.	Chas. Prentice, Putnam, Conn.	Manufacturer.	34.00	----
2272	Darling's Animal Fertilizer.	L. B. Darling Fertilizer Co., Pawtucket, R. I.	R. P. Hubbard, Middletown.	34–35	36.00
			W. S. Vinton, Coventry.	36.00	
			T. Pease & Sons Co., Windsor Locks.	37.00	
			J. M. Belden, New Britain.	35.00	
			W. W. Cooper, Suffield.	37.50	
			H. K. Brainard, Thompsonville.	36.00	
			Dunham & Co., W. Cheshire.	36.00	

Nitrogenous Superphosphates and Guanos, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2260	Soluble Pacific Guano.	Soluble Pacific Guano Co., Boston, Mass.	Dunham & Co., W. Cheshire.	$35.00	----
			J. M. Belden, New Britain.	35.00	
			E. A. Buck & Co., Willimantic.	33.00	
			R. W. Burchard, Darien.	38.00	
2311	Extra Fine Ground Bone with Potash.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	J. L. Butler, Torrington.	40.00	$32.00
			E. E. Spicer, Groton.	34.00	
2334	Peruvian Guano, Cargo Strathorne.	Mapes' Formula and Peruvian Guano Co., 158 Front St., N. Y.	Mapes Branch, Hartford.	60.00	60.00
2269	Ammoniated Bone Superphosphate.	Crocker Fertilizer Co., Buffalo, N. Y.	A. H. Dimond, Bethel.	----	37–38
			H. K. Brainard, Thompsonville.	36.00	
			E. Hill, Moosup.	----	
			L. D. Post, Andover.	35.00	
			W. Tillinghast, Plainfield.	37.00	
			J. M. Belden, New Britain.	37.00	
2293	Darling's Extra Bone Phosphate.	L. B. Darling Fertilizer Co., Pawtucket, R. I.	T. Pease & Sons' Co., Windsor Locks.	37.00	----
			W. S Vinton, Coventry.	36.00	
			Quinnebaug Store, Danielsonville.	35.00	
2313	Fish & Potash—A Brand.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	Raymond Bros., South Norwalk.	31.00	32.00
			C. B. Dokin, Sharon.	32.00	
2290	Cecrops Fertilizer.	Newton & Ludlam, 182 Front St., N. Y.	Young & Vaughn, Danielsonville.	43.00	----
			H. B. Todd & Son, Wallingford.	43.00	
2309	Sea Fowl Guano.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	W. W. Cooper, Suffield.	38.00	----
2265	Bowker's Fish and Potash.	Bowker Fertilizer Co., 43 Chatham St., Boston, Mass.	E. J. Dickerman, Mt. Carmel.	35.00	----
			W. R. McDonald, Cromwell.	31.00	
			C. W. Michaels, Yalesville.	34. & 35.	
			A. S. Russell & Co., Meriden.	30.00	
			J. M. Belden, New Britain.	32.00	
			T. Pease & Sons' Co., Windsor Locks.	32.00	
			Durham & Co., West Cheshire.	35.00	

Nitrogenous Superphosphates and Guanos, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2317	King Philip Alkaline Guano.	Clark's Cove Guano Co., New Bedford, Mass.	W. F. Bailey, Bozrahville.	$28.00	
			T. Pease & Sons' Co., Windsor Locks.	32.00	
2358	Ammoniated Bone Phosphate.	David Dickinson, Middle Haddam.	S. H. Emmons, Moodus.	38.00	$36.00
2343	Standard Superphosphate.	A. Mitchell, Tremley, N. J.	S. E. Brown, Pawcatuck Bridge.	38.00	----
			Edward Fly, Putnam.	36.00	
2303	High Grade Ammoniated Bone Superphosphate.	William P. Adams, 248 Front St., N. Y.	G. Thompson, Essex.	35.00	----
			C. E. Chapman, Westbrook.	36.00	
			J. E. Leonard, Jewett City.	37.00	
			F. H. Tillinghast, Central Village.	38.00	
2289	Standard Superphosphate.	Standard Fertilizer Co., Boston, Mass.	Allen Wilson, Suffield.	38.00	----
2277	Fish and Potash.	Soluble Pacific Guano Co., Boston, Mass.	W. B. Martin, Rockville.	32.00	----
			Dunham & Co., West Cheshire.	33.00	
			B. Curtis & Son, Stepney Depot.	33.00	
2337	Ammoniated Bone Superphosphate.	H. Preston & Sons, Greenpoint, L. I.	J. B. Merrow & Son, Merrow.	34.00	----
			A. L. Hodge & Son, Roxbury Station.	32.00	
2291	Cereal Fertilizer.	Newton & Ludlam, 182 Front St., New York.	E. Fly, Putnam.	36.00	----
			Young & Vaughn, Danielsonville.	33.00	
			H. B. Todd & Son, Wallingford.	33.00	
2342	Royal Bone Phosphate.	Williams & Clark Co., Hanover Square, N. Y.	B. E. Johnson, Higganum.	27.00	----
			Dimmock & Brown, New London.	26.00	
			H. K. Brainard, Thompsonville.	25.00	
2319	Alkaline Bone.	E. Frank Coe, 16 Burling Slip, N. Y.	H. W. Elliott, North Haven.	33.00	32–34
			H. L. Hall, Jr., Wallingford.	35.00	
2320	Red Brand, Excelsior Guano.	E. Frank Coe, 16 Burling Slip, N.Y.	F. P. Burr & Co., Middletown.	44.00	43–45

Nitrogenous Superphosphates and Guanos, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2357	The $25.00 Phosphate.	Baugh & Sons' Co., Philadelphia, Penn.	T. R. Dawley, Griswold.	$30.00	----
2390	Davidge's Special Favorite.	Davidge Fertilizer Co., New York.	Prentice & Young, Norwich.	35.00	----
			Young & Vaughn, Danielsonville.	35.00	
			N. C. Barker & Co., Lebanon.	33.00	
			H. J. Stanclift, New Hartford.	34.00	
			Smith & Caulkins, New Lebanon.	32.00	
			E. E. Hill, Moosup.	----	
2321	High Grade Fish Guano and Potash.	E. Frank Coe, 16 Burling Slip, N. Y.	Ruggles & Clark, Shelton.	35.00	----
			F. P. Burr & Co., Middletown.	34.00	
2302	Adams' Lion Brand Fish and Potash.	William P. Adams, 248 Front St., N. Y.	W. S. Ellis, Gilead.	33.00	----
			G. Thompson, Essex.	35.00	
			L. M. Clark, Monroe.	38.00	
2322	Queen City Phosphate.	Crocker Fertilizer and Chemical Works, Buffalo, N. Y.	G. H. Clark, Salisbury.	35.00	$37.00
2340	Economical Bone Fertilizer.	Wilkinson & Co., 239 Center St., N. Y.	W. A. Smith, Groton.	32.00	32.00
			A. L. Anderson & Son, Tolland.	32.00	
			Southington Lumber and Feed Co., Southington.	30.40	

Analyses of Nitrogenous Superphosphates, Sampled by the Station.

Station No.	Name or Brand.	Nitrogen					Phosphoric Acid.							Potash.		Chlorine.	Cost per Ton.	Valuation per Ton.	Percentage Difference between Cost and Valuation.
		Nitrogen as Nitrates.	Nitrogen as Ammonia.	Nitrogen, Organic.	Total Nitrogen Found.	Nitrogen Guaranteed.	Soluble.	Reverted.	Insoluble.	Total Found	Total Guaranteed.	Available. Found	Available. Guaranteed	Found.	Guaranteed.				
2355	Quinnipiac Co's Pequot Fish and Potash	----	.75	2.32	3.07	*2.5*	.26	4.85	2.88	7.99	----	5.11	*3.0*	4.65	*4.0*	---	$17.00	$23.65	28.1*
2276	Kelsey's Fish and Potash	----	.60	3.73	4.33	*2.5*	.89	1.83	.36	3.08	*3.0*	2.72	----	3.29	*3.0*	3.24	20.00	21.60	7.1*
2360	Quinnipiac Co's Dry Ground Fish	----	.26	8.56	8.82	*7.5*	.97	4.10	1.83	6.90	----	5.07	*4.0*	----	----	----	35.00	37.96	7.7*
2359	Mapes' Pure Fine Bone, Dissolved	----	.46	2.55	3.01	*2.0*	4.79	11.45	1.56	17.80	----	16.24	*12.0*	----	----	----	32.00	35.80	1.6*
2356	Sanderson's Formula "A"	.54	.24	2.62	3.40	*3.2*	6.04	3.83	1.80	11.67	*10.0*	9.87	*6.0*	7.37	*6.0*	----	35.00	34.26	2.1
2233	Shoemaker's Swift-Sure Superphosphate	.90	----	2.67	3.57	*2.5*	7.56	3.83	2.72	14.11	----	11.39	*9.0*	4.65	*4.0*	tr'ce	38.00	36.26	4.7
2339	Quinnipiac Fish and Potash, Plain Brand	----	.26	2.88	3.14	*2.0*	----	7.54	3.40	10.94	*6.0*	7.54	*4.0*	5.17	*4.0*	7.71	30.00	28.15	6.6
2338	Quinnipiac Co's Pine Island Phosphate	.24	.28	2.04	2.56	*2.0*	2.47	10.07	2.03	14.57	----	12.54	*9.0*	1.51	*1.0*	3.41	32.00	30.03	6.6
2325	Lister's Ammoniated Dissolved Bone Phosphate	----	.44	1.52	1.96	*1.8*	7.74	3.11	1.36	12.21	----	10.85	*9.0*	1.67	*1.5*	.94	28.00	25.95	7.9
2330	G. W. Miller's Flour of Bone Phosphate	.63	.23	3.02	3.88	*2.4*	----	10.25	.14	10.39	*12.0*	10.25	*11.0*	7.29	*4.8*	9.23	38.00	34.50	10.1
2333	Meyer's Acme Fertilizer, No. 2	.63	3.32	1.33	5.28	*5.0*	3.88	4.44	1.56	9.88	----	8.32	*8.0*	6.52	*5.0*	.26	43.00	38.93	10.4
2318	Great Planet A Manure	1.10	1.41	.57	3.08	*3.0*	6.88	2.07	1.09	10.04	*8.3*	8.95	*7.3*	9.31	*9.5*	7.61	37.00	33.02	12.
2316	Great Eastern General Fertilizer	.71	.13	2.58	3.42	*3.0*	5.33	5.71	2.91	13.95	----	11.04	*8.0*	2.21	*2.0*	2.35	36.00	31.97	12.6
2326	Mapes' Complete Manure for light soil	.83	2.46	2.40	5.69	*5.0*	3.43	5.04	1.66	10.13	*8.0*	8.47	*6.0*	6.84	*6.0*	6.48	44.00	39.05	12.7
2296	Baker's "AA" Ammoniated Superphosphate	----	2.22	1.05	3.27	*2.5*	11.35	.27	.02	11.64	----	11.62	*10.0*	2.95	*2.0*	2.05	36.50	32.21	13.3

* Valuation exceeds cost.

Analyses of Nitrogenous Superphosphates, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Nitrogen.					Phosphoric Acid.							Potash.		Chlorine.	Cost per Ton.	Valuation per Ton.	Percentage Difference between Cost and Valuation.
		Nitrogen as Nitrates.	Nitrogen as Ammonia.	Nitrogen, Organic.	Total Nitrogen Found.	Nitrogen Guaranteed.	Soluble.	Reverted.	Insoluble.	Total Found	Total Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.				
2327	Mapes' Complete Manure for general use	.72	.84	2.17	3.73	*3.3*	5.10	5.09	2.28	12.47	*10.0*	10.19	----	4.95	*4.0*	3.36	$39.00	$33.78	15.4
2266	Bowker's Ammoniated Bone Superphosphate	----	.09	1.98	2.07	*1.5*	8.66	2.26	2.64	13.56	*11.0*	10.92	*10.0*	1.13	*1.0*	1.95	31.00	26.64	16.4
2261	Chittenden's Ammoniated Bone Superphosphate	----	.12	2.14	2.26	*1.6*	5.04	5.63	3.57	14.24	*9.0*	10.67	*7.0*	2.59	*2.0*	2.79	33.00	28.33	16.4
2256	Americus Ammoniated Bone Superphosphate	----	.98	1.83	2.81	*2.0*	9.79	.96	.32	11.07	*11.0*	10.75	----	3.07	*2.0*	.29	35.00	30.04	16.5
2292	Chittenden's Fish and Potash	----	----	3.52	3.52	*3.3*	.98	4.64	5.72	11.34	*6.0*	5.62	----	5.43	*5.0*	5.49	33.00	28.20	17.
2332	Miles' Fish and Potash	----	.18	2.12	2.30	*2.5*	6.65	2.41	.64	9.70	----	9.06	*5.0*	3.94	*3.0*	4.65	30.00	25.61	17.1
2324	Lister's Standard Superphosphate	----	.66	1.96	2.62	*2.0*	8.07	3.09	1.47	12.63	----	11.16	*10.0*	1.84	*1.5*	1.96	34.00	28.77	18.2
2278	Bay State Fertilizer	----	1.10	1.64	2.74	*2.1*	8.58	1.72	1.96	12.26	*9.5*	10.30	*8.0*	3.00	*2.0*	1.32	35.00	29.61	18.2
2314	Quinnipiac Phosphate	.44	----	2.74	3.18	*2.8*	8.44	1.92	.90	11.26	----	10.36	*9.0*	2.60	*2.0*	2.35	35.00	29.56	18.4
2270	Mapes' Complete Manure, "A" Brand	.34	.77	1.74	2.85	*2.5*	5.16	4.78	3.92	13.86	----	9.94	*10.0*	3.20	*2.5*	4.40	36.00	30.03	19.8
2331	Miles' I. X. L. Ammoniated Bone Superposphate	----	.24	1.74	1.98	*2.0*	8.07	2.04	.72	10.83	----	10.11	*8.0*	2.31	*1.0*	2.20	30.00	24.94	20.3
2335	Orient Complete Manure	----	----	2.10	2.10	*1.7*	8.98	.59	.41	9.98	----	9.57	*8.0*	1.95	*2.0*	1.52	29.00	24.09	20.3
2353	H. S. Miller's Standard Bone Superphosphate	----	.18	2.50	2.68	*2.4*	11.35	.21	.07	11.63	----	11.56	*10.0*	3.30	*1.5*	----	36.50	30.19	20.9
2388	Victor Phosphate	----	----	----	2.62	----	7.55	1.13	.33	9.01	----	8.68	----	2.43	----	2.25	30.00	24.69	21.5
2257	Bradley's Farmers' New Method Fertilizer	----	.12	2.08	2.20	*1.7*	8.47	1.58	1.29	11.34	*10.0*	10.05	*8.0*	2.77	*3.0*	2.86	32.00	26.32	21.6
2259	Bowker'sHill and Drill Phos.	.36	.29	2.01	2.66	*2.5*	8.47	2.64	2.53	13.64	*11.0*	11.11	*10.0*	1.99	*2.0*	1.75	36.00	29.53	21.8
2294	Cumberland Superphosphate	.42	.44	1.66	2.52	*2.0*	7.03	3.97	3.40	14.40	*11.0*	11.00	*8.0*	2.69	*2.0*	.96	37.00	30.25	22.3
2273	Quinnipiac Fish and Potash, Crossed Brand	----	.48	3.53	4.01	*3.3*	.36	5.04	4.37	9.77	*5.0*	5.40	*3.0*	5.13	*3.0*	7.10	35.00	28.46	22.9

Analyses of Nitrogenous Superphosphates, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Nitrogen.					Phosphoric Acid.							Potash.		Chlorine.	Cost per Ton.	Valuation per Ton.	Percentage Difference between Cost and Valuation.
		Nitrogen as Nitrates.	Nitrogen as Ammonia.	Nitrogen, Organic.	Total Nitrogen Found.	Nitrogen Guaranteed.	Soluble.	Reverted.	Insoluble.	Total Found	Total Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.				
2279	Russell Coe's Ammoniated Bone Superphosphate	----	1.32	1.19	2.51	*2.0*	6.36	2.25	1.24	9.85	*9.0*	8.61	*8.0*	2.80	*1.0*	5.02	$31.00	$25.22	22.9
2248	Chittenden's Complete Fertilizer	.58	----	3.03	3.61	*3.3*	3.41	6.68	4.13	14.22	*8.0*	10.09	*6.0*	5.65	*6.0*	5.64	43.00	34.62	24.2
2207	Bradley's Superphosphate	.33	.17	2.24	2.74	*2.3*	8.19	2.16	1.73	12.08	----	10.35	*9.0*	2.06	*1.5*	2.05	35.00	28.16	24.3
2246	Bradley's Superphosphate	.31	---	2.47	2.78	*2.3*	8.32	1.92	1.70	11.94	----	10.24	*9.0*	2.11	*1.5*	2.20	35.00	28.14	24.3
2312	Bradley's Fish and Potash, Anchor Brand	----	.22	3.34	3.56	*3.3*	3.84	1.73	1.46	7.03	*5.0*	5.57	*3.0*	4.08	*3.0*	8.68	31.00	24.88	24.6
2271	Coe's High Grade Ammoniated Bone Superphosphate	----	.60	1.77	2.37	*2.0*	8.49	1.68	1.88	12.05	*10.0*	10.17	*9.0*	2.54	*3.0*	.31	35.00	27.86	25.6
2310	Original Coe's Superphosphate	----	----	2.16	2.16	*2.1*	8.71	2.03	1.18	11.92	*10.0*	10.74	*8.0*	2.52	*1.0*	2.64	34.00	26.97	26.
2281	Bosworth Bone Superphosphate	----	1.34	1.01	2.35	*2.0*	3.57	3.65	7.41	14.63	----	7.22	*11.0*	3.72	*2.0*	3.58	34.00	26.81	26.4
2272	Darling's Animal Fertilizer	----	.48	2.96	3.44	*3.3*	2.35	4.04	4.49	10.88	*10.0*	6.39	----	5.24	*4.0*	5.54	36.00	28.41	26.7
2260	Soluble Pacific Guano	----	.30	2.29	2.59	*2.0*	6.76	2.81	2.67	12.24	----	9.57	*8.0*	2.72	*2.0*	3.11	35.00	27.56	26.9
2311	Bradley's Extra Fine Ground Bone with Potash	----	----	2.09	2.09	*1.8*	3.67	6.00	2.75	12.42	*8.0*	9.67	----	2.07	*2.0*	2.28	32.00	25.18	27.
2334	Mapes' Peruvian Guano	.06	5.72	1.18	6.96	*7.8*	7.56	4.67	1.97	14.20	*14.0*	12.23	----	3.13	*2.6*	4.35	60.00	47.14	27.3
2269	Crocker's Ammoniated Bone Superphosphate	----	----	3.16	3.16	*2.9*	7.76	2.08	1.16	11.00	*8.0*	9.84	----	1.62	*1.0*	1.26	36.00	28.04	28.3
2293	Darling's Extra Bone Phosphate	.20	.48	2.39	3.07	*2.5*	3.92	3.45	3.50	10.87	*10.0*	7.37	----	5.03	*3.0*	4.50	36.00	28.01	28.5
2313	Bradley's Fish and Potash "A" Brand	----	.42	2.89	3.31	*2.0*	3.02	2.65	2.26	7.93	*6.0*	5.67	*4.0*	3.90	*4.0*	6.21	31.50	24.50	28.5
2290	Cecrops Fertilizer	.58	.22	2.42	3.22	*3.2*	7.02	3.17	3.18	13.37	----	10.19	*7.0*	5.48	*7.0*	5.37	43.00	33.18	29.5
2309	Bradley's Sea Fowl Guano	----	----	2.48	2.48	*2.5*	8.92	2.73	1.24	12.89	*11.0*	11.65	*9.0*	2.23	*2.0*	1.91	38.00	29.28	29.8
2265	Bowker's Fish and Potash	----	.09	1.95	2.04	*2.2*	3.56	3.21	6.79	13.56	*8.0*	6.77	----	3.54	*4.0*	3.82	32.00	24.35	31.4

Analyses of Nitrogenous Superphosphates, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Nitrogen.					Phosphoric Acid.							Potash.		Chlorine.	Cost per Ton.	Valuation per Ton.	Percentage Difference between Cost and Valuation.
		Nitrogen as Nitrates.	Nitrogen as Ammonia.	Nitrogen, Organic.	Total Nitrogen Found.	Nitrogen Guaranteed.	Soluble.	Reverted.	Insoluble.	Total Found	Total Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.				
2317	King Philip Alkaline Guano	.17	.35	1.26	1.78	*1.2*	4.65	2.98	3.32	10.95	*7.5*	7.63	*6.5*	2.61	*3.0*	1.04	$30.00	$22.35	34.2
2358	Dickinson's Ammoniated Bone Superphosphate	----	.06	3.21	3.27	*4.0*	5.84	4.34	2.68	12.86	*13.0*	10.18	----	----	----	----	38.00	28.26	34.4
2343	Mitchell's Standard Superphosphate	.12	.23	2.06	2.41	*2.0*	8.12	2.17	.26	10.55	*11.5*	10.29	*9.0*	2.86	*2.5*	----	37.00	27.41	35.
2303	Adams' High Grade Ammoniated Bone Superphosphate	----	.33	1.84	2.17	*2.5*	4.77	4.72	1.54	11.03	----	9.49	*10.0*	4.18	*7.0*	1.41	36.50	26.99	35.2
2289	Standard Superphosphate	----	.48	2.29	2.77	*2.5*	7.38	2.52	2.29	12.19	*11.0*	9.90	*9.0*	2.18	*2.0*	3.12	38.00	28.04	35.5
2277	Soluble Pacific Guano Co's. Fish and Potash	----	----	2.43	2.43	*2.5*	4.87	1.66	2.63	9.16	*6.0*	6.53	*4.0*	4.78	*4.0*	7.71	32.50	23.94	35.7
2337	Preston's Ammoniated Bone Superphosphate	----	.37	1.72	2.09	*2.5*	4.69	2.64	2.99	10.32	----	7.33	*9.0*	3.66	*2.0*	.31	33.00	24.16	36.6
2291	Cereal Fertilizer	----	----	1.28	1.28	*1.3*	8.41	2.37	4.60	15.38	*11.0*	10.78	*10.0*	1.02	*4.0*	1.43	34.00	24.88	36.6
2342	Williams & Clark Co's Royal Bone Phosphate	----	----	1.49	1.49	*0.5*	5.19	2.61	1.14	8.94	*8.0*	7.80	----	2.28	*2.0*	----	28.00	20.19	38.6
2319	Coe's Alkaline Bone	----	.07	1.33	1.40	*.8*	8.57	2.05	1.74	12.36	*10.0*	10.62	*9.0*	1 85	*3.0*	.23	34.00	24.41	39.3
2320	Coe's Excelsior Guano. Red Brand	----	.79	2.49	3.28	*3.3*	7.77	1.22	.69	9.68	*10.0*	8.99	----	5.18	*11.0*	.50	44.00	31.18	41.2
2357	Baugh&Son's $25 Phosphate	----	----	1.97	1.97	*2.0*	6.63	1.44	3.10	11.17	----	8.07	*7.0*	----	----	----	30.00	21.13	41.9
2390	Davidge's Special Favorite	----	.12	1.49	1.61	*1.2*	9.08	1.55	.38	11.01	*12.0*	10.63	*10.0*	1.71	*1.5*	1.48	34.00	23.87	42.4
2321	Coe's High Grade Fish Guano and Potash	----	.20	2.30	2.50	*3.3*	3.59	3.97	2.49	10.05	----	7.56	*6.0*	3.01	*4.0*	6.19	34.50	24.04	43.5
2302	Adams' Lion Brand Fish and Potash	----	----	2.38	2.38	*2.5*	4.06	3.58	.96	8.60	*6.0*	7.64	*3.0*	4.57	*8.0*	4.30	35.00	24.18	44.7
2322	Queen City Phosphate	----	----	1.94	1.94	*1.7*	7.64	2.17	.93	10.74	----	9.81	*8.0*	1 40	*2.0*	*1.46*	*35.00*	*23.63*	*48.1*
2340	Wilkinson's Economical Bone Fertilizer	.19	.76	.42	1.37	*1.2*	5.60	1.46	1.13	8.19	*6.0*	7.06	----	2.84	*2.0*	.58	*32.00*	*19.40*	*64.9*

Fish and Potash.—Sampled by the Station.

	Quinnipiac Pequot.	Kelsey's.	Quinnipiac Plain Brand.	Chittenden's.	Miles'.	Quinnipiac Crossed Brand.	Bradley's Anchor Brand.	Bradley's A Brand.	Bowker's.	Soluble Pacific Guano Co's.	Coe's.	Adams' Lion Brand.
	2355	**2276**	**2339**	**2292**	**2332**	**2273**	**2312**	**2313**	**2265**	**2277**	**2321**	**2302**
Nitrogen as Ammonia	.75	.60	.26	----	.18	.48	.22	.42	.09	----	.20	----
Nitrogen, Organic	2.32	3.73	2.88	3.52	2.12	3.53	3.34	2.89	1.95	2.43	2.30	2.38
Soluble Phosphoric Acid	.26	.89	----	.98	6.65	.36	3.84	3.02	3.56	4.87	3.59	4.06
Reverted Phosphoric Acid	4.85	1.83	7.54	4.64	2.41	5.04	1.73	2.65	3.21	1.66	3.97	3.58
Insoluble Phosphoric Acid	2.88	.36	3.40	5.72	.64	4.37	1.46	2.26	6.79	2.63	2.49	.96
Potash	4 65	3.29	5.17	5.43	3.94	5.13	4.08	3.90	3.54	4.78	3.01	4.57
Cost	$17.00	$20.00	$30.00	$33.00	$30.00	$35.00	$31.00	$31.50	$32.00	$32.50	$34.50	$35.00
Valuation	23.65	21.60	28.15	28.20	25.61	28.46	24.88	24.50	24.35	23.94	24.04	24.18
Nitrogen found	3.07	4.33	3.14	3.52	2.30	4.01	3.56	3.31	2.04	2.43	2.50	2.38
Nitrogen guaranteed	2.5	2.5	2.0	3.3	2.5	3.3	3.3	2.0	2.2	2.5	3.3	2.5
Phosphoric Acid found	7.99	3.08	10.94	11.34	9.70	9.77	7.03	7.93	13.56	9.16	10.05	8·60
Phosphoric Acid guaranteed	----	3.0	6.0	6.0	----	5.0	5.0	6.0	8.0	6.0	----	6.0
Potash found	4.65	3.29	5.17	5.43	3.94	5.13	4.08	3.90	3.54	4.78	3.01	4.57
Potash guaranteed	4.0	3.0	4.0	5.0	3.0	3.0	3.0	4.0	4.0	4.0	4.0	8.0

2. *Manufacturers' Samples.*

The fertilizers named below were not found by the Station agents in any stocks which they inspected, and accordingly the analyses were made on samples deposited at the Station by manufacturers.

2344. Unicorn Fertilizer and **2345** Great Planet B. Fertilizer are made by the Clark's Cove Guano Co., New Bedford.

2348. Crocker's Superphosphate, No. 2, made by the Crocker Fertilizer and Chemical Works, Buffalo, N. Y.

2394. Ammoniated Dissolved Bone Phosphate, made by H. S. Miller & Co., Newark, New Jersey.

Analyses and Valuations.

	2344	2345	2348	2394
Nitrogen as nitrates	----	1.86	----	----
Nitrogen as ammonia	.17	2.00	----	.85
Organic nitrogen	2.42	1.11	.38	1.58
Total Nitrogen found	2.59	4.97	.38	2.43
Nitrogen guaranteed	1.8	4.9	----	1.7
Soluble phosphoric acid	6.70	5.54	9.90	8.61
Reverted phosphoric acid	2.33	1.09	2.70	1.19
Insoluble phosphoric acid	3.62	.60	1.77	.67
Total phosphoric acid found	12.65	7.23	14.37	10.47
Phosphoric acid guaranteed	10.0	6.0	13.00	----
Available phosphoric acid found	9.03	7.23	12.60	9.80
Available phosphoric acid guaranteed	8.05	5.0	11.00	8.0
Potash	2.55	7.32	1.43	3.04
Potash, guaranteed	2.25	7.0	1.36	1.5
Chlorine	1.24	2.04	1.52	.78
Valuation per ton	$27.34	34.83	23.41	27.23

3. *Sampled by private individuals.*

2284. Chittenden's Ammoniated Bone Superphosphate.*

2285. Chittenden's Fish and Potash.†

2286. Chittenden's Complete Fertilizer.‡ All made by the National Fertilizer Co., Bridgeport. Sampled and sent by Thos. R. Atwood, Newington.

* See also analysis of same brand, p. 60, No. 2261.

† See also analysis of same brand, p. 60, No. 2292.

‡ See also analysis of same brand, p. 61, No. 2248.

Analyses and Valuations.

	2284	2285	2286
Nitrogen as nitrates	.41	----	2.07
Nitrogen as ammonia	.13	.13	none
Organic nitrogen	2.58	3.93	2.50
Soluble phosphoric acid	5.04	3.92	5.01
Reverted phosphoric acid	4.46	3.45	3.80
Insoluble phosphoric acid	3.54	3.25	3.41
Potash	4.18	6.19	6.64
Chlorine	4.28	6.38	6.73
Cost per ton	$30.00	30.00	39.00
Valuation per ton	30.70	32.08	36.28

II. Special Manures, sampled by Station Agents.

[For tables of analyses, etc., see pages 66–72.]

Here are included such nitrogenous superphosphates as are claimed by their manufacturers to be specially adapted to the needs of particular crops. In previous reports the justice of such claims has been discussed.

Guarantees.—Nine samples are below guarantee on one ingredient and two samples on two ingredients, making a third of the whole number which fail to come up to their minimum guarantee.

COST AND VALUATION. The average cost of the Special Manures has been $39.47, and the average valuation $33.99. The difference between cost and valuation is $5.48 and the percentage difference 16.1. The corresponding difference in case of the superphosphates (see page 49) was 20.3 per cent. This year, as heretofore, the Special Manures as a class have been higher-priced than the other nitrogenous superphosphates, more concentrated, and if the quality of the raw materials composing them is equally good, more economical to purchase.

Special notice of certain analyses.—In Bulletin No. 95 the valuation of the Rogers & Hubbard Co.'s Complete Potato and Tobacco Manure, and Fairchild's Formula for Corn and General Crops was lower than in the following tables. The valuation was first made as on superphosphates. These brands, however, contain no soluble phosphoric acid, and as the source of the phosphoric acid was evidently raw bone and was so claimed by the manufacturer, the samples were mechanically analyzed after removing salts and the phosphoric acid valued as in bone. This raised the total valuation about two dollars in each case.

These two brands are mixtures of finely ground raw bone, nitrate of soda and sulphate of potash.

Special Manures, Sampled by the Station.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2186	The Rogers & Hubbard Co.'s Complete Manure for Potatoes and Tobacco.	The Rogers & Hubbard Co., Middletown, Conn.	Manufacturer.	$46.00	$46.00
2187	Fairchild's Formula for Corn and General Crops.	The Rogers & Hubbard Co., Middletown, Conn.	Manufacturer.	44.00	44.00
2349	Seeding Down Fertilizer.	Cumberland Bone Co., Portland, Me.	E. E. Salisbury, Moosup.	30.00	----
2315	Vegetable, Vine, and Tobacco Fertilizer.	Great Eastern Fertilizer Co., Rutland, Vt.	Clifton Peck, Lebanon.	34.00	----
			C. B. Stearns, Andover.		
			G. T. Sanger, Canterbury.	35.00	
			B. S. Gallup, Baltic.	34.00	
2308	Complete Manure for Top Dressing Grass and Grain.	Bradley Fertilizer Co , 27 Kilby St., Boston, Mass.	Burtis & Mead, New Canaan.	35.–36.	
2350	Tobacco Manure. Wrapper Brand.	Mapes' Formula and Peruvian Guano Co., New York.	Mapes Branch, Hartford.	46.00	46.00
2351	Fruit and Vine Manure.	Mapes' Formula and Peruvian Guano Co., New York.	Mapes Branch, Hartford.	38.00	38.00
2268	Complete Manure for Potatoes and Vegetables.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	J. O. Lewis, Willimantic.	40.00	40.00
			M. H. Tanner & Co., Winsted.	41.00	
			Raymond Bros., South Norwalk.	40.00	
			W. F. Andross, East Hartford.	42.00	
			S. E. Rose, Quarryville.	40.00	
			David Beers, Danbury.	44.00	

Special Manures, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2329	Quinnipiac Potato Manure.	Quinnipiac Co., New London, Ct.	J. E. Leonard, Jewett City.	$38.00	
			Mrs. F. Shanley, Torrington.	35.00	
			Alden Hill, North Branford.	38.00	
			Filer & Hooper, Montville.	35.00	
			A. Williams, Collinsville.	36.00	
			D. N. Benton, Guilford.	35.00	
			H. J. Stanclift, New Hartford.	38.00	
			Chandler & Morse, Putnam.	36.00	
			Staples & Raymond, Westport.	37.00	
			D. C. Wood, Stratford.	37.00	
			Birdsey & Foster, Meriden.	38.00	
			J. M. Belden, New Britain.	38.00	
			R. W. Burchard, Darien.	38.00	
			Benj. Beers, Redding Center.	36.00	
			J. F. Silliman & Co., New Canaan.	38.00	
			E. J. Dickerman, Mt. Carmel.	40.00	
			E. A. Godfrey, Bridgeport.	37.00	
2275	Grass and Grain Top Dressing.	Mapes' Formula and Peruvian Guano Co., New York.	Dean & Horton, Stamford.	41.00	$41.00
			David Beers, Danbury.	43.00	
			Birdsey & Foster, Meriden.	42.00	
			Mapes Branch, Hartford.	41.00	
2205	Complete Manure for Potatoes and Vegetables.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	Bought by Green's Farms Farmers' Club.	*	40.00
2328	Tobacco Manure. Conn. Brand.	Mapes' Formula and Peruvian Guano Co., New York.	Wilson & Burr, Middletown.	44.00	44.00
			Mapes Branch, Hartford.	44.00	
2323	Potato Fertilizer.	Lister Agricultural Chemical W'ks, Newark, N. J.	W. H. Parmelee, Essex.	35.00	----
2377	Acme Potato Fertilizer.	C. Meyer, Jr., Maspeth, L. I.	J. H. Ives, Danbury.	45.00	
			A. S. Russell & Co., Meriden.	38.00	

* Bought at special rate.

Special Manures, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
			A. Williams, Collinsville.	40.00	$40.00
			W. F. Andross, E. Hartford.	42.00	
2307	Complete Manure for Corn and Grain.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	David Beers, Danbury.	45.00	43.00
			Mapes Branch, Hartford.	43.00	
2264	Potato Manure.	Mapes' Formula and Peruvian Guano Co., New York.	Quinnebaug Store, Danielsonville.	46.00	
			D. B. Wilson & Co., Waterbury.	45.00	
			Abbott & Co., Birmingham.	45.00	
			Birdsey & Foster, Meriden.	44.00	
			Dean & Horton, Stamford.	43.00	
			W. R. Foote, Branford.	42.–43.	41.00
			Dean & Horton Stamford.	41.00	
2280	Corn Manure.	Mapes' Formula and Peruvian Guano Co., 158 Front St., N. Y.	Mapes Branch, Hartford.	41.00	
			David Beers, Danbury.	43.00	
			W. W. Cooper, Suffield.	42.50	----
			Allen Betts, Norwalk.	42.00	
2295	Complete Potato Manure.	H. J. Baker & Bro., 215 Pearl St., New York.	Smith & Sons, West Cornwall.	42.50	
			D. N. Benton, Guilford.	39.00	
			M. H. Tanner & Co., Winsted.	41.00	
			Dunham & Co., W. Cheshire.	43.00	
2306	Stockbridge Grass Top Dressing, and Forage Crop Manure.	Bowker Fertilizer Co., 43 Chatham St., Boston, Mass.	W. G. & F. Comstock, E. Hartford.	35.00	36.00
2283	Potato Phosphate.	Williams & Clark Co., Hanover Square, N. Y.	F. C. Spaulding, So. Coventry.	34.00	
			J. H. Ray, Greenwich.	34.00	
			D. N. Benton, Guilford.	34.00	
			W. Kyle, Bethel.	40.00	
			C. H. Northrop, Ridgefield.	38.00	
			J. P. Kingsley & Sons, Plainfield.	35.00	
			E. M. Jennings, Southport.	35.00	
			L. F. Ellis, Woodmont.	33.00	

Special Manures, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
			D. C. Wood, Stratford.	$42.00	$42.00
			M. H. Tanner & Co., Winsted.	41.00	
			W. H. Anderson, Putnam.	44.00	
2258	Stockbridge Corn and Grain Manure.	Bowker Fertilizer Co., 43 Chatham St., Boston, Mass.	J. A. Lewis, Willimantic.	40.00	
			T. Pease & Sons Co., Windsor Locks.	42.00	
			F. Hallock & Co., Birmingham.	40.00	
			E. J. Dickerman, Mt. Carmel.	43.00	
			Dunham & Co., W. Cheshire.	45.00	
			Bought by Green's Farms Farmers' Club.	*	36.00
2206	Potato Manure.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	Cochrane Bros., West Cornwall.	35.00	36.00
			E. C. Barnum, Naugatuck.	38.00	
2250	Potato Manure.	Bradley Fertilizer Co., 27 Kilby St., Boston, Mass.	Mather & Grumman, Darien.	38.00	
			J. W. Beach, Stratford.	37.00	
			Waterbury & June, Greenwich.	38.00	
			W. F. Andross, E. Hartford.	38.00	
			M. Beach & Son, New Milford.	38.00	
			A. A. Hubbard, Canaan.	38.00	
			M. H. Tanner & Co., Winsted.	38.00	
			Raymond Bros., So. Norwalk.	37.00	
			W. F. Andross, E. Hartford.	42.00	----
			J. M. Belden, New Britain.	41.00	
2247	Stockbridge Vegetable Manure.	Bowker Fertilizer Co., 43 Chatham St., Boston, Mass.	Hubbell & Bradley, Saugatuck.	40.00	
			F. Hallock & Co., Birmingham.	40.00	
			T. Pease & Sons Co., Windsor Locks.	42.00	
			M. H. Tanner & Co., Winsted.	41.00	
			D. C. Wood, Stratford.	44.00	

* Bought at special rate.

Special Manures, Sampled by the Station—*Continued.*

Station No.	Name or Brand.	Manufacturer.	Dealer.	Dealer's cash price per ton.	Manufacturer's statement of average cash price per ton.
2282	Americus Brand Potato Fertilizer.	Williams & Clark Co., Hanover Square, N. Y.	W. G. & F. Comstock, E. Hartford.	$42.00	
			J. H. Ray, Greenwich.	38.00	
			E. M. Jennings, Southport.	42.00	
			W. W. Cooper, Suffield.	42.50	----
2305	Complete Manure for Corn.	H. J. Baker & Bro., 215 Pearl St., New York.	H. A. Stillman & Co., Hartford.	35.00	$37.00–38.00
2274	Potato, Hop, and Tobacco Phosphate.	Crocker Fertilizer and Chemical Works, Buffalo, N. Y.	Chandler & Morse, Putnam.	36.00	
			H. K. Brainard, Thompsonville.	36.00	
			E. Hill, Moosup.	----	
			W. Tillinghast, Plainfield.	37.00	
			J. M. Belden, New Britain.	37.00	
			L. D. Post, Andover.	35.00	
			J. B. Merrow & Son, Merrow.	41.00	
2354	Potato Fertilizer.	Preston Fertilizer Co., Green Point, L. I.	J. I. Worthington, Portland.	40.00	40.00
2346	Potato Fertilizer.	E. Frank Coe, 16 Burling Slip, N. Y.	W. C. Reynolds, East Haddam.	35.00	
			D. N. Benton, Guilford.	35.00	
2392	Davidge's Potato Manure.	Davidge Fertilizer Co., New York.	H. J. Stanclift, New Hartford.	38.00	
			Dunham & Co., West Cheshire.	42.00	
			G. W. Eaton, Plainville.	43.00	
			Young & Vaughn, Danielsonville.	43.00	
			Prentice & Young, Norwich.	42.00	
			E. E. Hill, Moosup.	----	

Analyses of Special Manures, Sampled by the Station.

Station No.	Name or Brand	Nitrogen					Phosphoric Acid.							Potash.		Chlorine.	Cost per Ton.	Valuation per Ton.	Percentage Difference between Cost and Valuation.
		Nitrogen as Nitrates.	Nitrogen as Ammonia.	Nitrogen, Organic.	Total Nitrogen Found.	Nitrogen Guaranteed.	Soluble.	Reverted.	Insoluble.	Total Found	Total Guaranteed.	Available. Found.	Available. Guaranteed.	Found.	Guaranteed.				
2186	Rogers & Hubbard Co's Complete Potato and Tobacco Manure	2.76	----	3.09	5.85	*5.0*	----	8.47	5.24	13.71	*14.5*	8.47	----	11.47	*10.0*	----	$46.00	$49.61	*7.3
2187	Fairchild's Formula for Corn and General Crops	4.17	--	1.32	5.49	*5.5*	----	7.31	4.50	11.81	*12.0*	7.31	----	14.95	*12.0*	----	44.00	46.20	*4.7
2349	Cumberland Bone Co's Seeding Down Fertilizer	.35	.40	1.81	1.86	*1.7*	2.29	4.69	15.85	22.83	*18.0*	6.98	----	.27	*1.0*	----	30.00	30.98	*3.1
2315	Great Eastern Fertilizer Co's Vegetable, Vine and Tobacco Fertilizer	----	.18	2.61	2.79	*2.1*	5.12	6.44	2.67	14.23	----	11.56	*8.0*	5.60	*6.0*	5.71	34.50	33.45	3.10
2308	Bradley's Complete Manure for Top Dressing Grass and Grain	3.87	----	.34	4.21	*4.1*	7.21	1.80	1.08	10.09	*7.0*	9.01	*6.0*	5.81	*5.0*	5.52	35.00	33.33	5.0
2350	Mapes' Tobacco Manure	.82	4.27	1.93	7.02	*6.2*	1.96	2.79	.67	5.42	*4.5*	4.75	----	11.45	*10.5*	----	46.00	43.50	5.7
2351	Mapes' Fruit and Vine Manure	.39	.62	1.72	2.73	*1.7*	2.63	4.76	2.43	9.82	*7.0*	7.39	----	11.92	*11.0*	----	38.00	34.78	9.2
2268	Bradley's Complete Manure for Potatoes and Vegetables	.76	.84	2.46	4.06	*3.7*	7.25	3.41	1.15	11.81	*9.0*	10.66	*8.0*	6.00	*6.0*	4.60	40.00	36.00	11.1
2329	Quinnipiac Potato Manure	.66	.18	2.77	3.61	*3.3*	4.00	3.77	1.18	8.95	----	7.77	*5.0*	6.38	*6.0*	.72	35.00	31.44	11.3
2275	Mapes' Grass and Grain Top Dressing	.68	2.11	1.88	4.67	*4.1*	5.44	3.57	3.22	12.23	*7.0*	9.01	----	5.93	*5.0*	5.14	41.00	36.80	11.4
2205	Bradley's Complete Manure for Potatoes and Vegetables	.70	1.05	2.54	4.29	*3.7*	6.31	3.71	1.47	11.49	*9.0*	10.02	*8.0*	5.69	*6.0*	----	40.00	35.67	12.1
2328	Mapes' Tobacco Manure, Conn. Brand	----	.67	4.08	4.75	*4.7*	5.20	3.70	2.23	11.13	*7.8*	8.90	----	7.73	*7.7*	.87	44.00	39.24	12.1
2323	Lister's Potato Fertilizer	----	.20	1.68	1.88	*1.7*	7.71	5.33	.50	13.54	----	13.04	*8.0*	4.89	*4.0*	4.72	35.00	31.03	12.8

* Valuation exceeds cost.

ANALYSES OF SPECIAL MANURES, SAMPLED BY THE STATION—*Continued.*

Station No.	Name or Brand.	Nitrogen.					Phosphoric Acid.							Potash.		Chlorine.	Cost per Ton.	Valuation per Ton.	Percentage Difference between Cost and Valuation.
		Nitrogen as Nitrates.	Nitrogen as Ammonia.	Nitrogen, Organic.	Total Nitrogen Found.	Nitrogen Guaranteed.	Soluble.	Reverted.	Insoluble.	Total Found	Total Guaranteed.	Available. Found.	Available. Guaranteed	Found.	Guaranteed.				
2377	Acme Potato Fertilizer	....	1.92	1.08	3.00	2.9	4.36	3.33	2.29	9.98	8.0	7.69	....	9.08	9.0	1.90	$38.00	$32.99	15.2
2307	Bradley's Complete Manure for Corn and Grain	.46	1.05	2.21	3.72	3.7	9.69	.97	.39	11.05	10.0	10.66	9.0	5.61	5.5	4.75	40.00	34.39	16.3
2264	Mapes' Potato Manure	.78	1.51	1.71	4.00	3.7	4.82	4.09	3.91	12.82	8.0	8.91	....	6.78	6.0	.70	43.00	36.85	16.6
2280	Mapes' Corn Manure	.74	1.61	1.52	3.87	3.7	5.88	3.58	3.46	12.92	10.0	9.46	....	6.08	6.0	5.56	41.00	35.06	16.9
2295	Baker's Complete Potato Manure	....	3.01	.87	3.88	3.3	6.79	.14	.04	6.97	....	6.93	5.8	10.17	10.0	4.28	41.50	34.27	21.0
2306	Stockbridge Grass Dressing and Forage Crop Manure	3.49	....	2.32	5.81	5.5	6.48	1.18	2.00	9.66	6.0	7.66	5.0	2.98	2.5	2.33	42.00	34.70	21.0
2283	Williams & Clark Co's Potato Phosphate	....	1.10	1.61	2.71	2.0	7.00	.86	.36	8.22	8.0	7.86	....	6.47	6.0	.19	36.00	28.93	21.0
2258	Stockbridge Corn and Grain Manure	.39	.62	2.55	3.56	3.3	7.82	3.58	1.94	13.34	7.0	11.40	6.0	3.42	4.0	3.31	42.00	33.78	24.3
2206	Bradley's Potato Manure	.20	.11	2.44	2.75	2.5	7.53	1.73	1.36	10.62	8.0	9.26	6.0	5.12	6.0	4.45	36.00	28.90	24.6
2250	Bradley's Potato Manure	.24	.09	2.46	2.79	2.5	7.11	1.68	1.58	10.37	8.0	8 79	6.0	5.45	6.0	4.80	36.00	28.69	25.4
2247	Stockbridge Vegetable Manure	.69	.44	2.35	3.48	3.3	7.82	2.44	2.90	13.16	9.0	10.26	7.0	3.69	5.0	3.34	41.00	32.56	25.9
2282	Americus Brand Potato Fertilizer	....	1.76	1.80	3.56	3.0	5.69	1.22	.60	7.51	7.0	6.91	....	8.32	8.0	1.67	41.00	32.00	28.1
2305	Baker's Complete Manure for Corn	....	3.60	.90	4.50	5.0	6.36	.18	trace	6.54	....	6.54	6.0	7.94	7.0	7.81	42.50	32.76	29.7
2274	Crocker's Potato, Hop and Tobacco Phosphate	....	....	2.41	2.41	2.0	7.91	1.39	1.19	10.49	....	9.30	8.0	4.24	3.5	3.92	36.00	27.01	33.2
2354	Preston Fertilizer Co's Potato Fertilizer	....	.97	1.95	2.92	3.3	6.04	2.71	1.23	9.98	....	8.75	8.0	6.47	7.0	....	41.00	30.40	34.8
2346	Coe's Potato Fertilizer	....	.09	1.75	1.84	2.1	8.01	1.30	1.19	10.50	10.0	8.31	....	5.13	9.0	....	37.00	26.54	39.4
2392	Davidge Potato Manure	....	.24	2.94	3.18	2.9	7.58	.93	.12	8.63	10.0	8.51	9.0	4.48	8.0	4.06	41.00	27.95	46.7

III. HOME-MIXED FERTILIZERS.

[For table of analyses, see page 77.]

Ten samples of these mixtures have been analyzed the past year. The formulas by which they were made are first given, followed by the table of analyses and certain conclusions drawn from it.

2262. A mixture made by a number of members of Advance Grange, Simsbury, from chemicals bought of L. Sanderson, New Haven. Sample drawn by J. C. Eddy, Secretary of the Grange.

100	pounds of Nitrate of Soda @ $50. per ton cost	$ 2.50
100	" Sulphate of Ammonia @ $70. per ton cost	3.50
640	" Tankage (N. Y.) @ $35. per ton cost	11.20
700	" Dissolved Bone Black @ $26. per ton cost	9.10
360	" Double Sulphate of Potash and Magnesia @ $30. per ton cost	5.40
100	" Muriate of Potash @ $41.50 per ton cost	2.07
2000	" Mixture cost	$33.77
	Add freight to Simsbury	1.80
		$35.57

2245. Mixture for Potatoes, made by W. F. Andross, East Hartford.

400	pounds of Sulphate of Potash.
400	" Acid Phosphate.
400	" Dissolved Bone Black.
600	" Baker's Castor Pomace.
200	" Dry Ground Fish.

This mixture has been used by Mr. Andross for four years and has proved very satisfactory.

2241. Mixture for Corn. Made by Dennis Fenn, Milford, from chemicals bought of C. Meyer, Jr., Maspeth, L. I. Sample drawn by Mr. Fenn.

300	pounds Sulphate of Ammonia,	@ $71.60 per ton cost	$10.74
1000	" Bone	@ 29.60 " "	14.80
250	" Tankage,	@ 29.60 " "	3.70
250	" Dissolved Bone Black,	@ 27.60 " "	3.45
400	" Muriate of Potash,	@ 41.60 " "	8.32
2200	" of the mixture,	cost	$41.01
	Or $37.38 per ton unmixed at Milford.		

2231. Mixture for Potatoes. Made by Dennis Fenn from chemicals bought of C. Meyer, Jr. Sample drawn by Mr. Fenn.

200	pounds	Sulphate of Ammonia,	@	$71.60	per ton	cost	$ 7.16
1000	"	Bone,	@	29.60	"	"	14.80
250	"	Tankage,	@	29.60	"	"	3.70
250	"	Dissolved Bone Black,	@	27.60	"	"	3.45
275	"	Muriate of Potash,	@	41.60	"	"	5.72
275	"	High grade Sulphate of Potash,	@	61.60	"	"	8.47
2250	"	of the mixture,	cost				$43.30

Or $38.49 per ton unmixed at Milford.

2239. Mixture made by G. F. Platt, Milford, from chemicals bought of C. Meyer, Jr. Sample drawn by Station Agent.

1000	pounds	Sulphate of Ammonia,	@	$71.60	per ton	cost	$35.80
5000	"	Tankage,	@	29.60	"	"	74.00
5000	"	Dissolved Bone Black,	@	27.60	"	"	69.00
1500	"	Muriate of Potash,	@	41.60	"	"	31.20
1100	"	High Grade Sulphate of Potash,	@	61.60	"	"	33.88
4800	"	Bone,	@	29.60	"	"	71.04
18,400	"	of the mixture,	cost,				$314.92

Or $34.22 per ton unmixed at Milford.

2215. Home Mixture No. 1, made by C. T. Merwin & Son, Milford. From chemicals purchased of C. Meyer, Jr. Sample drawn by Mr. Merwin.

833 pounds Dissolved Bone Black.
667 pounds Tankage.
334 pounds Muriate of Potash.
166 pounds Sulphate of Ammonia.

2000 pounds of the mixture cost $33.41 unmixed.

2216. Home Mixture No. 2, like the above except that 170 pounds of bone were used, replacing the same weight of Tankage. Sample drawn by Mr. Merwin.

2219. Home Mixture No. 3, like No. 1 except that the tankage was from another manufacturer. Sample drawn by Mr. Merwin.

2218. Home Mixture No. 4. Made by Mr. Merwin.

260 pounds Tankage.
710 pounds Dissolved Bone Black.
330 pounds Muriate of Potash.
100 pounds Sulphate of Ammonia.
600 pounds Bone.

2000 pounds of the mixture cost $32.51.

2288. Mixture for Potatoes, made by Peck Brothers, Northfield.

600 pounds Dissolved Bone Black.
600 pounds Blood, Bone and Meat.
600 pounds Sulphate of Potash.
200 pounds Sulphate of Ammonia.
300 pounds Plaster.

2300 pounds of the mixture.

The chemicals used in the mixtures made in Simsbury and Milford were analyzed here and from the composition of the chemicals and the quantity used is calculated what the analysis would have been in each case if the weighings had been exact, the materials and mixture uniform and no loss or gain of moisture had happened in handling. This is entered in the table in the column headed "Calculated," p. 77. In general the agreement of the calculated and actual composition of the mixtures is fair, though there are some wide variations.

The prices given are regular retail quotations. In most cases the actual costs were considerably less on account of special rates obtained from the dealers.

Examination of the samples and of the table of analyses shows:

1st. That these home mixtures compare favorably in composition with the best commercial fertilizers. In all cases but one the valuation is higher than the average valuation of factory-made superphosphates or specials analyzed last year.

2d. The home-mixtures are not as finely ground as the *best* factory-made fertilizers, yet their mechanical condition is satisfactory.

3d. In only one case does cost of materials exceed valuation. If we add $3.00 per ton for cost of mixing, the valuation and the cost will be about the same. The cost of factory-made fertilizers usually exceeds valuation by 20–25 per cent.

These analyses justify the statement made in our last report that while it is often cheaper to buy the best commercial mixtures,—ammoniated superphosphates and special manures,—than to buy and mix the chemicals, yet the experience of a yearly increasing number of farmers shows that money may be saved by the seasonable purchase of raw materials and their use in home-mixtures.

We call the attention of those who intend to purchase raw materials the coming season and do their own mixing to the following suggestions:

1st. As has already been noted, soluble phosphoric acid should cost considerably less in the form of dissolved South Carolina rock than in dissolved bone black. Thus in New Jersey soluble phosphoric acid has cost about 6.2 cents per pound the present season in dissolved South Carolina Rock, while it has cost 7½ cents in dissolved bone black. The Carolina Rock yields a lower grade article than bone black, averaging in composition about as follows:

Dissolved South Carolina Rock.

Soluble phosphoric acid	9.9
Reverted phosphoric acid	1.7
Insoluble phosphoric acid	3.6
Total phosphoric acid	15.2

Besides superphosphates, there are other sources of phosphoric acid which are well worth the attention of buyers of raw materials. Thomas-Slag has been used with success abroad, and field experiments made for this Station in this State have in certain cases at least given very satisfactory results. [The outcome of this year's experiments will be found in the latter part of this report.] Fine ground bone containing from 24–30 per cent. of phosphoric acid from 1.5–4.0 per cent. of nitrogen can be got for from $26–32 per ton; while bone black superphosphate, containing 17 per cent. of phosphoric acid and a small fraction of 1 per cent. of nitrogen costs $26.

2d. This year the cheapest sources of organic nitrogen have been caster pomace at $20 per ton and cotton seed meal at $25. While Nitrogen in Blood, Tankage and Fish costs from 16 to 17 cents per pound, in Castor Pomace and Cotton Seed Meal it costs only 12 to 14 cents. Occasionally car lots of Cotton Seed Meal are offered at even lower rates because damaged and "off color." If the dark meal is not mouldy or damp its value *as a fertilizer* is probably not less than that of the prime quality meal. Of course it is unsafe to use as a *cattle food* any but the best quality of meal. There is good reason to believe that the nitrogen of these vegetable products is equally efficacious as plant food with that of animal matter and therefore it would be well to consider these materials in purchasing nitrogen. Their composition is given on page 35.

3d. There should always be a clear understanding between the purchasers and sellers of fertilizing chemicals as to their guaranteed quality. We reprint for the information of those interested a form taken with slight alterations from a circular sent to dealers in fertilizing chemicals by a New Jersey grange, which may be convenient for use by granges and farmers' clubs in this State:

"Wanted: to buy the materials to make —— tons *or more* of fertilizer. The materials to consist of nitrate of soda, sulphate of ammonia, acid phosphate, dissolved bone or bone black, fine ground bone, fine ground fish scrap, muriate of potash and sulphate of potash.

HOME-MADE FERTILIZERS, ANALYSES AND VALUATIONS.*

Station No.	Name.	Nitrogen.				Phosphoric Acid.				Potash.		Chlorine.	Valuation per Ton.	Cost of Chemicals [unmixed].
		As Nitrates.	As Ammonia.	Organic.	Total.		Soluble.	Reverted.	Insoluble.	Total.		Found.	Calculated.			
					Found.	Calculated.				Found.	Calculated.					
2262	Advance Grange Mixture	.71	1.04	1.73	3.48	3.7	6.15	3.85	2.24	12.24	11.4	7.65	7.6	2.36	$36.20	$35.57
2245	W. F. Andross, Potato Mixture	----	----	2.85	2.85	2.7	5.54	1.47	1.21	8.22	7.4	4.92	4.5	.26	26.53	28.00
2241	Dennis Fenn, Corn Mixture	----	2.41	3.08	5.49	5.5	1.82	6.12	5.32	13.26	12.0	8.06	9.5	----	40.73	37.38
2231	Dennis Fenn, Potato Mixture	----	1.76	2.42	4.18	4.5	1.73	6.09	4.13	11.95	11.3	13.40	12.7	6.18	41.22	38.49
2239	G. F. Platt, Mixture	----	1.33	3.45	4.78	4.4	3.44	4.10	2.92	10.46	11.3	8.49	7.3	4.95	37.12	34.22
2215	C. T. Merwin & Son, Mixture No. 1	----	1.72	3.06	4.78	4.3	5.96	2.14	.88	8.98	9.0	9.00	9.2	8.24	37.04	33.41
2216	" " 2	----	1.76	2.47	4.23	4.2	5.96	3.03	1.75	10.74	10.6	8.71	9.2	8.01	36.84	33 41
2219	" " 3	----	1.76	2.94	4.70	4.6	6.39	1.51	.45	8.35	9.1	8.93	8.9	8.39	36.21	33.41
2218	" " 4	----	1.03	2.51	3.54	3.5	5.58	5.33	2.44	13.35	13.6	8.58	8.8	7.93	37.55	32.51
2288	Peck Brothers, Potato Mixture	----	1.65	1.42	3.07	----	4.74	2.35	1.87	8.96	----	6.16	----	.56	29.27	----

* For description of samples, see page 73.

All materials to be in good mechanical condition; in good bags; to run even weights or be plainly marked what each bag contains *net*, and to be delivered at ——— early in March next. All materials to be guaranteed to contain certain percentages of nitrogen, potash, or available phosphoric acid, as the case may be; one-half of the bill to be paid within ten days after receipt of goods; on the other half a credit of sixty days to be allowed, within which time samples will be sent to the Connecticut Experiment Station for analysis, and if there found to contain as large percentages as guaranteed the balance of bill will be paid within the sixty days, but if any are found to contain a *less* percentage than guaranteed, then a discount is to be allowed on the bill equal to the loss in money value caused by such deficiency for the first one per cent. or fraction thereof, and *twice* the loss in money value for all deficiencies in excess of one per cent., and balance of bill within the sixty days. Samples to be taken by a station agent or other disinterested party."

Miscellaneous Fertilizers and Manures.

Cotton Hull Ashes.

2184. Sold by Charles L. Spencer, Suffield. Sampled and sent by C. M. Owen, Suffield.

2376. Sold by Charles L. Spencer, Suffield. Sampled and sent by Edmund Halladay, Suffield.

2198. Sold by J. E. Soper & Co., Boston. Sampled and sent by J. A. DuBon, Suffield.

2204. Sold by J. E. Soper & Co., Boston. Sampled and sent by H. W. Alford, Poquonock.

Analyses.

	2184	2376	2198	2204
Soluble phosphoric acid	.32	1.44	2.56	1.64
Reverted phosphoric acid	6.98	6.53	7.24	7.08
Insoluble phosphoric acid	.91	.46	.67	1.36
Potash	22.67	25.11	25.56	23.78
Cost per ton	$35.00	35.00	*	*
Valuation per ton	$36.28	39.90	43.35	39.94
Potash costs per pound†	**5.2 cts.**	**4.5 cts.**	----	----

* $30 in car lots.

† Reckoning soluble and reverted phosphoric acid as in mixed fertilizers and insoluble phosphoric acid at 2 cents per pound.

Hardwood, Unleached Canada Ashes.

2242. A sample sent by Austin Jennings, Green's Farms, from stock purchased of E. Jennings, Southport, contained 8.21 per cent. of potash and 1.96 per cent. of phosphoric acid. This is of excellent quality. It sold for 28 cents per bushel.

2393. Sent by T. A. Stanley, New Britain. Bought of Monroe, Judson & Stroup, Oswego, N. Y. Cost $14.00 per ton by the car load. The sample contained 1.43 per cent. of phosphoric acid, 5.69 per cent. of potash, and 17.12 per cent. of water. This sample is of about average quality.

Hardwood Ashes from a Brick-Kiln.

2391. Sent by T. A. Stanley, New Britain. Cost nothing but the cartage, which was about $2.50 per ton.

Analysis.

Phosphoric acid	1.87
Potash, soluble in water	1.94
Sand and earth	27.85

When such ashes cost no more than this lot they may be worth a trial. They contain twice as much potash as leached ashes and are much drier.

Tobacco Stems and Tobacco Dust.

2232. St. Louis Tobacco Stems. Stock bought by Comstock, Ferre & Co., Wethersfield.

2298. Tobacco Stems and Bone Black. From Olds & Whipple, Hartford. This is a fine powder, having bone black added probably to prevent its use in smoking tobacco or snuff.

2237. Tobacco Dust. Stock bought by Comstock, Ferre & Co., of A. D. Cowan & Co., New York.

Analyses.

	2232	2298	2237
Nitrogen	1.92	2.16	2.35
Phosphoric acid	.81	1.69	.61
Potash	8.71	7.84	2.59
Cost per ton	$11.00		30.00

The sample of Tobacco Stems is of average quality. The Tobacco Dust contains 25.7 per cent. of sand and is of less value as a fertilizer than Tobacco Stems, while the price is almost three times as great. It is used by the purchaser rather as an insecticide than as a fertilizer.

Hen Manure.

2252. Hen Manure. Sampled and sent by F. H. Stadtmueller from farm of Beach & Co., West Hartford. Cost $15.00 per ton delivered.

Analysis.

Water	51.84
Organic and volatile matter*	24.27
Ash†	23.89
	100.00
* Containing nitrogen as ammonia	.61
Organic nitrogen	.60
† Containing phosphoric acid	.97
Potash	.59

The phosphoric acid, potash and nitrogen contained in a ton of this "Hen Manure" could be bought in the form of chemical fertilizers for about $6.00. Numerous analyses have been made at this Station of "Hen Manure" but the material has always been a mixture of hen dung with variable quantities of feathers, straw and earth scraped from the floor of the hennery. We have no analyses of the unmixed hen dung. The difference between the excrement of fowls and that of cattle of all sorts is that the former contains in *solid form* all the fertilizing material of the food except what is retained in the body for growth or goes into the eggs; while a very considerable portion of the fertilizing value of the food of cattle is excreted in liquid form and is easily lost even in the stalls or barnyard. It is easy to see then why the "dung" of fowls is a richer manure than that of cattle. That of the former contains both the urinary and bowel excretions, that of the latter consists largely of the undigested food, with what of the urine may have been absorbed and retained by it.

Slaughter-House Refuse.

2396. Tankage which had been accumulating in a pit at a slaughter-house for some years. It had passed the first stages of putrefaction, was a wet, black, stinking mass, but contained no tough pieces of animal tissue or bone. Sent by C. E. Lyman, Middlefield. It contained about 72 per cent. of water.

Analysis.

Nitrogen as ammonia	.39
Organic nitrogen	.96
Phosphoric acid	.86

The "valuation," made as for a commercial fertilizer, is $5.74, but on account of its wetness it is doubtful if it would be really worth more than half that sum delivered on the farm.

Land Plaster or Gypsum.

2379. Nova Scotia Plaster. Stock of Nathan Couch, Branchville. Sampled and sent by D. H. VanHoosear, Wilton.

2380. From Smith & Sons, West Cornwall. Sampled by Station Agent.

2381. Nova Scotia Plaster. Stock of Cochrane Brothers, West Cornwall. Sampled by Station Agent.

Analyses.

	2379	2380	2381
Hydrated Sulphate of Lime	74.88	72.77	86.65
Matters insoluble in acid	1.28	7.44	2.93
Moisture	1.18	1.50	1.21
Other matters, chiefly Carbonate of Lime	22.66	18.29	9.11
	100.00	100.00	100.00
Cost per ton	$6.00	6.50	8.50

REVIEW OF THE FERTILIZER MARKET

For the Year ending November 1, 1888.

Nitrogen.

Nitric Nitrogen.

The *wholesale* price of nitric nitrogen in nitrate of soda was 12.7 cents per pound in November of last year. It rose to 13.8 cents in January, fell gradually to 12.8 cents in May, and rose again to 14.1 cents in October.

Its *retail* price in Connecticut this season has been a little under 16 cents ($50 to $52 per ton for nitrate of soda).

Ammonic Nitrogen.

The *wholesale* price for nitrogen in sulphate of ammonia was 14.7 cents per pound in November of last year. It rose to 14.9 cents in December and kept there pretty steadily till September, when it stood at 15.3 and rose in October to 15.8 cents.

Its *retail* price in Connecticut during the year has been from 17½ to 18 cents per pound.

Organic Nitrogen.

The nitrogen of high grade Dried Blood was quoted *at wholesale* in the New York market in November, 1887, at about 11.8 cents per pound. Since that time it has risen in price, as is shown in detail on page 87. The average cost in January was 12.2 cents, in March 13.9, and this figure held till June, when it began to rise again. The average quotation for October was 15 cents per pound.

The nitrogen in *Azotin* has ruled a trifle lower than in dried blood. The wholesale cost of nitrogen in these materials has been about twenty per cent. higher during the last three months of the year than during the first three.

Organic nitrogen *at retail* cost in this State last spring from 11.9 cents to 13.4 cents per pound in cotton seed meal and in two brands of castor pomace 13.9 and 14.4 cents. No stock of dried blood was found by our agents. In a single sample of dry ground fish nitrogen cost 18 cents.

Phosphatic Materials.

Refuse Bone Black at Wholesale fell from $17.75 in November of last year to $16.75 in March, where it remained till September, when it was quoted at $18.25 and in October at $19.20.

Rough and Ground Bone have been steady through the year at $18.00 and $22.50 respectively.

Ground Charleston Rock, f. o. b. N. Y., fell from $9.85 in November of last year to $9.25 in February, began rising in May, and in October stood at $10.25. The quotations for superphosphates have not fluctuated through the year. "Available" phosphoric acid in dissolved S. C. Rock has cost *at wholesale* in N. Y. 3.7 cents, in dissolved bone it has cost 4.05 cents.

Sulphuric Acid 66° B. ruled at 1.07½ cents per pound till September, when it rose to 1.10.

Potash.

In Muriate of Potash.

Potash in this form was quoted at *wholesale* in N. Y. at 3.46 cents per pound in November of last year. It stood at 3.48 in January and February, fell again in March and April to 3.46, rose again and stood at 3.50–3.52 till September, when it went up again to 3.71, where it now stands. It has *retailed* in Connecticut during the season at from 3.9 to 4.2 cents per pound ($41.50–$43.00 per ton of muriate of potash).

Double Sulphate of Potash and Magnesia.

Potash in this article shows frequent and considerable fluctuations. It has been quoted *at wholesale* in New York from 3.86–4.47 cents per pound. It has sold in this State at *retail* for about 5½ cents during the season.

High grade Sulphate of Potash.

This is a high grade sulphate (guaranteed 90–98 per cent. actual sulphate of potash) containing about as much potash, pound for pound, as muriate (50–51 per cent.). It is quoted in N. Y. *wholesale* for 2.3 cents per pound, or 4.5 cents for actual potash. It has cost a trifle over 6 cents at *retail* in Connecticut the past year.

Kainit.

Kainit has risen steadily from $8.00 per ton at the opening of the year to $10.00 in October. Assuming that kainit averages 12.4 per cent. of potash, the *wholesale* cost of potash in kainit in the N. Y. market has been from 3.2 to 4 cents per pound.

In general there has been a decided advance during the year in the prices of nitrogen in nitrates, ammonia salts and high grade organic matters.

There has been no very marked change in the quotations of dissolved phosphate, though the raw materials rule higher.

Potash salts are now considerably higher than in the early months of the year.

The market quotations given above are taken from the "Oil, Paint and Drug Reporter," published in New York. The weekly quotations for each month are averaged, and this average is taken as the quotation for the month.

The following explanations will be helpful in the examination of the market quotations, and will also serve to show the basis on which they have been interpreted in this review :

Phosphate rock, kainit, bone, fish-scrap, tankage, and some other articles are quoted and sold by the ton. The seller usually has an analysis of his stock and purchasers often control this by an analysis at the time of purchase.

Sulphate of ammonia, nitrate of soda and muriate of potash are quoted and sold by the pound, and generally their wholesale and retail rates do not differ very widely.

Blood, azotin and ammonite are quoted at so much "per unit of ammonia." To reduce ammonia to nitrogen, multiply the per cent. of ammonia by the decimal .824 (or multiply the percentage of ammonia by 14 and divide that product by 17). A "unit of

ammonia" is one per cent., or 20 pounds per ton. To illustrate: if a lot of tankage has 7.0 per cent. of nitrogen, equivalent to 8.5 per cent. of ammonia, it is said to contain $8\frac{1}{2}$ units of ammonia, and if it is quoted at $2.25 per unit, a ton of it will cost $8\frac{1}{2} \times 2.25 = \$19.13$.

The term "ammonia" is *properly* used only in those cases where the nitrogen actually exists in the form of ammonia, but it is a usage of the trade to reckon all nitrogen, in whatever form it occurs, as ammonia.

To facilitate finding the actual cost of nitrogen per pound from the cost per unit of ammonia in the market reports, the following table is given.

Ammonia at	$3.00	per unit is equivalent to nitrogen at			18.2	cts. per lb.
"	2.90	"	"	"	17.6	"
"	2.80	"	"	"	17.0	"
"	2.70	"	"	"	16.4	"
"	2.60	"	"	"	15.8	"
"	2.50	"	"	"	15.2	"
"	2.40	"	"	"	14.6	"
"	2.30	"	"	"	14.0	"
"	2.20	"	"	"	13.4	"
"	2.10	"	"	"	12.8	"
"	2.00	"	"	"	12.2	"
"	1.90	"	"	"	11.6	"
"	1.80	"	"	"	11.0	"

Commercial Sulphate of Ammonia contains on the average 20.5 per cent. of nitrogen, though it is found to vary considerably in quality. When it has that amount of nitrogen (equivalent to 24.3 per cent. of ammonia),

At 4	cents per lb.	Nitrogen costs		19.5	cents per lb.
" $3\frac{7}{8}$	"	"	"	18.9	"
" $3\frac{3}{4}$	"	"	"	18.3	"
" $3\frac{5}{8}$	"	"	"	17.6	"
" $3\frac{1}{2}$	"	"	"	17.0	"
" $3\frac{3}{8}$	"	"	"	16.4	"
" $3\frac{1}{4}$	"	"	"	15.8	"
" $3\frac{1}{8}$	"	"	"	15.2	"
" 3	"	"	"	14.6	"
" $2\frac{7}{8}$	"	"	"	14.0	"
" $2\frac{3}{4}$	"	"	"	13.4	"

Commercial Nitrate of Soda averages 95 per cent. of the pure salt or 15.6 per cent. of nitrogen.

If quoted at	3	cents per lb.	Nitrogen	costs	19.2	cents per lb.
"	2⅞	"	"	"	18.3	"
"	2¾	"	"	"	17.6	"
"	2⅝	"	"	"	16.9	"
"	2½	"	"	"	16.0	"
"	2⅜	"	"	"	15.2	"
"	2¼	"	"	"	14.4	"
"	2⅛	"	"	"	13.6	"
"	2	"	"	"	12.8	"
"	1⅞	"	"	"	12.0	"
"	1¾	"	"	"	11.2	"

Commercial Muriate of Potash usually has 80 per cent. of the pure salt, or 50½ per cent. of actual potash.

If quoted at	2.00	cents per lb.	Actual Potash	costs	3.96	cents per lb.
"	1.95	"	"	"	3.86	"
"	1.90	"	"	"	3.76	"
"	1.85	"	"	"	3.66	"
"	1.80	"	"	"	3.56	"
"	1.75	"	"	"	3.46	"
"	1.70	"	"	"	3.36	"
"	1.65	"	"	"	3.26	"
"	1.60	"	"	"	3.16	"
"	1.55	"	"	"	3.06	"
"	1.50	"	"	"	2.96	"

The Double Sulphate of Potash and Magnesia usually has about 26½ per cent. of actual potash.

If quoted at	1.00	cent per lb.	Actual Potash	costs	3.77	cents per lb.
"	1.05	"	"	"	3.96	"
"	1.10	"	"	"	4.15	"
"	1.15	"	"	"	4.34	"
"	1.20	"	"	"	4.53	"

The following table shows the fluctuations in the wholesale prices of a number of fertilizing materials in the New York market, since April, 1885. The price given for each month is the average of the four weekly quotations in that month. Sulphate of ammonia is assumed to contain 20.5 per cent. and nitrate of soda 15.6 per cent. nitrogen, and muriate of potash 50½ per cent. of actual potash or 80 per cent. of the pure salt.

		COST OF NITROGEN AT WHOLESALE IN				COST OF POTASH AT WHOLESALE IN	
		Blood. cts. per lb.	Azotin or Ammonite. cts. per lb.	Nitrate of Soda. cts. per lb.	Sulphate of Ammonia. cts. per lb.	Muriate of Potash. cts. per lb.	Double Manure Salt. cts. per lb.
1885.	April	13.6	13.7	13.2	15.2	3.51	---
	May	14.3	13.7	14.1	15.2	3.54	---
	June	13.9	13.7	14.0	15.2	3.36	---
	July	13.6	13.6	14.0	15.0	3.31	---
	August	13.6	13.6	15.0	14.9	3.34	---
	September	13.8	13.5	15.6	14.8	3.36	---
	October	13.4	13.5	16.0	14.8	3.36	---
	November	13.4	13.5	15.6	14.8	3.38	---
	December	13.8	13.9	16.0	14.9	3.39	---
1886.	January	14.1	14.2	15.6	15.1	3.38	---
	February	14.0	14.3	15.2	15.2	3.46	---
	March	14.2	14.7	16.0	15.8	3.64	---
	April	14.9	15.7	16.1	16.4	3.56	---
	May	14.9	15.4	16.4	15.8	3.41	---
	June	14.6	14.7	15.6	14.6	3.32	---
	July	13.9	14.4	14.9	14.6	3.31	---
	August	14.2	14.4	14.0	14.5	3.31	---
	September	14.1	14.4	13.7	14.4	3.40	---
	October	14.1	14.4	13.2	14.6	3.41	---
	November	14.4	14.4	12.7	14.7	3.41	---
	December	14.0	14.5	13.1	14.7	3.41	---
1887.	January	13.3	14.5	13.0	14.6	3.41	---
	February	13.5	14.5	13.6	14.6	3.41	---
	March	13.4	14.5	14.3	14.5	3.51	---
	April	13.6	14.1	14.9	14.5	3.56	---
	May	13.4	14.0	14.7	14.5	3.48	---
	June	13.1	14.0	14.9	14.5	3.41	---
	July	13.1	14.0	12.0	14.5	3.41	---
	August	12.6	13.4	11.8	14.5	3.40	---
	September	12.1	12.5	12.2	14.7	3.36	---
	October	12.1	12.3	13.0	14.9	3.36	---
	November	11.8	12.2	12.7	14.7	3.41	---
	December	12.1	12.3	13.8	14.9	3.46	4.08
1888.	January	12.2	12.3	13.8	14.9	3.48	4.24
	February	12.6	12.6	13.3	14.9	3.48	4.49
	March	13.9	13.6	13.1	14.9	3.46	4.15
	April	13.9	13.6	12.9	14.9	3.46	4.11
	May	13.9	13.6	12.8	15.2	3.52	4.24
	June	14.0	13.6	13.1	14.9	3.50	3.86
	July	14.2	13.9	13.1	14.9	3.50	3.86
	August	14.5	14.2	13.2	14.9	3.50	3.86
	September	14.6	14.2	13.9	15.3	3.71	4.38
	October	15.0	15.0	14.1	15.8	3.71	4.47

OFFICERS FOR 1888.

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Ex-officio.

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	Term expires
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HON. E. H. HYDE, Stafford, *Vice-President.*	July 1, 1891.
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PROF. W. O. ATWATER, Middletown.	1888.
Appointed by Governor and Senate:	
EDWIN HOYT, New Canaan.	1889.
H. L. DUDLEY, New London.	1890.

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T. S. GOLD, West Cornwall.	1889.
Appointed by Governing Board of Sheffield Scientific School:	
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E. H. JENKINS, PH.D., *Vice-Director.*
E. H. FARRINGTON, B.S., till July 1.
A. L. WINTON, JR., PH.B.
T. B. OSBORNE, PH.D.
R. S. CURTISS, PH.B.

Mycologist.

ROLAND THAXTER, PH.D.

Stenographer and Clerk.

MISS F. M. BIGELOW.

In charge of Buildings and Grounds.

CHARLES J. RICE.

ANNOUNCEMENT.

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION was established in accordance with an Act of the General Assembly, approved March 21, 1877, "for the purpose of promoting Agriculture by scientific investigation and experiment."

The Station is prepared to analyze and test fertilizers, cattle-food, seeds, soils, milk, and other agricultural materials and products, to identify grasses, weeds, and useful or injurious insects, moulds, blights, mildews, etc., and to give information on various subjects of Agricultural Science, for the use and advantage of the citizens of Connecticut.

The Station makes analyses of Fertilizers, Seed-Tests, etc., etc., for the citizens of Connecticut, without charge, provided—

1. That the results are of use to the public and are free to publish.
2. That the samples are taken from stock now in the market, and in accordance with the Station instructions for sampling.
3. That the samples are fully described and retail prices given on the Station "Forms for Description."

All other work proper to the Experiment Station that can be used for the public benefit will be made without charge. Work done for the use of individuals will be charged for at moderate rates. The Station will undertake no work, the results of which are not at its disposal to use or publish, if deemed advisable for the public good. See p. 22.

Results of analysis or investigation that are of general interest will be published in Bulletins, of which copies are sent to each Post Office in this State, and will be summed up in the Annual Reports made to the Governor.

The officers of the Station will take pains to obtain for analysis samples of all the commercial fertilizers sold in Connecticut; but the organized coöperation of the farmers is essential for the full and timely protection of their interests. Granges, Farmers' Clubs and like Associations can efficiently work with the Station for this purpose, by sending in duly authenticated samples early during each season of trade.

It is the wish of the Board of Control to make the Station as widely useful as its resources will admit. Every Connecticut citizen who is concerned in agricul-

ture, whether farmer, manufacturer, or dealer, has the right to apply to the Station for any assistance that comes within its province to render, and the Station will respond to all applications as far as lies in its power.

☞ Instructions and Forms for taking samples, and Terms for testing Fertilizers, Seeds, etc., for private parties, sent on application.

☞ Parcels by Express, to receive attention, should be *prepaid*, and all communications should be directed, *not to any individual officer*, but simply to the

AGRICULTURAL EXPERIMENT STATION,
NEW HAVEN, CONN.

☞ Station Grounds, Laboratories and Office are on Suburban st., between Whitney avenue and Prospect st., 1⅝ miles North of City Hall. Suburban st. may be reached by the Whitney ave. Horse Cars, which leave the corner of Chapel and Church sts. three times hourly, viz: on the striking of the clock and at intervals of twenty minutes thereafter.

☞ The Station has Telephone connection and may be spoken from the Central Telephone Office, 346 State st., or from Peck and Bishop's Office in Union R. R. Depot.

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REPORT OF THE DIRECTOR.

PART II.

[There remains a large amount of field and laboratory work the results of which it has been impossible to prepare for the printer in season for this Report.]

THE COMPOSITION OF AMERICAN FEEDING STUFFS.

By Dr. E. H. Jenkins.

On subsequent pages is given in tabular form the average composition of the feeding stuffs commonly used in this country, compiled exclusively from American analyses. In the first column of these tables is stated the total number of analyses from which the average was obtained. The probable accuracy of the average increases with the number of analyses on which it is based.

As it is very desirable to know within what limits the composition of each fodder is likely to vary, the maximum and minimum amounts of each ingredient have also been inserted in the table.

The wide differences of composition which appear in some cases are no doubt largely due to differences in the methods of analysis followed. It is extremely important that there should be uniformity in this respect and it is hoped that the methods recommended by the Association of Official Agricultural Chemists may be adopted by all who engage in agricultural chemical analysis.

Analyses of feeding stuffs made at this Station during the present year will be found further on in the Report.

Composition of American Feeding Stuffs.

Name.	Analyses.	Total Dry Matter.			Albuminoids or Protein.			Crude Fat.			Nitrogen-free Extract.			Fiber.			Ash.
		Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	
Green Fodder.																	
Maize fodder	75	7.1	48.5	*21.26*	.5	3.0	*1.80*	.1	.9	*.45*	3.2	22.1	*12.94*	1.9	11.4	*4.99*	1.08
Maize fodder, ensilaged	59	13.0	35.6	*19.72*	.7	2.8	*1.52*	.2	1.8	*.70*	5.1	22.2	*10.49*	3.0	10.0	*5.70*	1.31
Sorghum	7	13.6	28.4	*21.66*	.9	1.4	*1.10*	.2	.5	*.31*	5.3	27.0	*13.08*	4.7	8.5	*6.25*	.87
Sorghum, ensilaged	5	22.0	28.1	*24.17*	.6	.9	*.75*	.1	.4	*.28*	13.8	19.0	*15.82*	5.9	6.8	*6.28*	1.04
Rye fodder	6	21.9	25.3	*24.72*	2.3	3.0	*2.61*	.2	.7	*.56*	4.9	12.4	*6.94*	4.9	14.9	*12.73*	1.88
Rye fodder, ensilaged	1	----	----	*19.25*	----	----	*2.42*	----	----	*.27*	----	----	*9.18*	----	----	*5.76*	1.62
Oat fodder	2	21.4	28.8	*25.10*	1.5	2.0	*1.77*	.4	.7	*.57*	10.8	14.6	*12.70*	7.1	9.5	*8.27*	1.79
Clover	1	----	----	*26.67*	----	----	*4.09*	----	----	*.69*	----	----	*11.61*	----	----	*8.12*	2.16
Clover, ensilaged	3	21.5	27.4	*23.73*	3.0	3.8	*3.34*	.9	1.1	*1.02*	8.1	11.4	*10.21*	5.1	8.6	*6.66*	2.50
Lucerne or Alfalfa	6	18.0	28.5	*22.83*	3.6	4.9	*4.09*	.7	1.0	*.83*	7.9	11.8	*9.60*	4.9	8.7	*6.26*	2.05
Serradella	3	15 4	19.9	*18.23*	2.3	2.7	*2.49*	.4	.4	*.41*	6.4	7.0	*6.80*	4.0	7.7	*6.42*	2.11
Cow-pea vines, green and succulent	5	13.9	27.2	*19.93*	1.7	3.3	*2.30*	.2	.6	*.43*	5.3	12.9	*9.27*	2.9	15.3	*6.31*	1.62
Beet leaves	1	----	----	*11.16*	----	----	*2.74*	----	----	*.60*	----	----	*2.49*	----	----	*2.50*	2.83
Carrot leaves	1	----	----	*16.70*	----	----	*4.26*	----	----	*.86*	----	----	*5.99*	----	----	*2.25*	3.34
Cabbage ensilage	1	----	----	*12.39*	----	----	*1.19*	----	----	*.93*	----	----	*4.52*	----	----	*1.59*	4.16
Hay and Dry Coarse Fodder.																	
Clover hay	33	78.2	93.9	*88.62*	8.9	20.8	*12.55*	1.5	4.3	*2.44*	35.0	49.0	*40.55*	15.6	35.7	*26.85*	6.23
Hay containing much clover	10	85.5	89.8	*86.68*	6.3	14.4	*10.33*	1.5	3.1	*2.52*	31.8	45.2	*40.46*	19.7	35.1	*28.07*	5.30
White clover hay	2	91 4	92.9	*92.12*	14.1	20.0	*17.03*	2.1	5.8	*3.95*	38.2	40.6	*39.38*	20.3	27.3	*23.75*	8.00
Alsike clover hay	5	91.4	94.7	*92.38*	11.4	16.1	*13.53*	1.6	4.2	*2.41*	36.5	43.5	*40.91*	24.0	29.5	*27.68*	7.85
Lucerne hay	4	91.6	94.3	*93.05*	10.2	18.6	*15.33*	1.4	2 4	*1.89*	35.4	47.3	*39.66*	26.2	33.0	*29.20*	6.97
Serradella hay	3	88.3	93.8	*90.80*	13.9	16.6	*15.24*	2.2	2.7	*2.74*	40.5	46.0	*43.95*	19.4	23.0	*21.64*	7.23
Timothy hay (*Phleum pratense*)	55	84.5	92.9	*89.79*	4.2	9.6	*6.15*	1.0	3.4	*2.12*	39.2	58.5	*46.98*	22.7	38.5	*30.35*	4.19
Red top hay (*Agrostis vulgaris*)	2	90.2	93.2	*91.68*	7.3	7.8	*7.50*	1.5	2.0	*1.70*	46.5	46.9	*46.72*	27.5	31.8	*29.62*	6.14
Timothy and Red top	10	85.7	91.8	*87.64*	4.8	9.0	*6.52*	1.5	2.7	*2.00*	38.5	48.9	*44.15*	24.7	38.4	*30.17*	4.80

Composition of American Feeding Stuffs—*Continued.*

Name.	Analyses.	Total Dry Matter.			Albuminoids or Protein.			Crude Fat.			Nitrogen-free Extract.			Fiber.			Ash.
		Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	
Hay—*continued.*																	
Orchard grass hay (*Dactylis glomerata*)	5	88.2	93.5	*91.68*	3.6	8.2	*6.69*	1.4	2.4	*1.98*	33.5	48.6	*44.04*	29.7	38.3	*44.04*	5.72
Hungarian grass hay	13	91.0	95.2	*92.85*	5.0	12.3	*7.22*	1.5	3.5	*2.14*	44.4	53.0	*49.41*	23.6	31.3	*28.25*	5.83
Barley hay (seed in milk)	1	----	----	*89.75*	----	----	*9.21*	----	----	*2.47*	----	----	*47.49*	----	----	*26.14*	4.44
Oat hay	3	86.3	91.3	*89.32*	7.8	9.9	*8.53*	2.1	3.1	*2.52*	36.2	48.0	*41.93*	25.1	33.6	*29.92*	6.42
High meadow hay	2	88.7	89.4	*89.02*	6.8	8.3	*7.57*	2.0	2.5	*2.25*	46.9	47.5	*47.19*	24.3	25.2	*25.78*	6.23
Hay from mixed meadow grasses	11	79.7	87.0	*84.04*	4.8	9.2	*6.38*	1.4	2.7	*2.09*	34.4	47.3	*41.05*	22.9	35.9	*29.90*	4.62
Low meadow hay	10	85.5	93.6	*89.50*	4.6	10.4	*7.70*	.7	3.6	*2.20*	39.8	55.2	*43.60*	21.4	40.0	*30.20*	5.80
Hay from salt marsh grasses	13	81.4	92.8	*89.89*	4.0	7.8	*5.69*	1.6	3.1	*2.31*	34.1	54.3	*44.10*	25.1	37.9	*30.51*	7.28
Baled hay, "extra fine"	1	----	----	*84.05*	----	----	*6.20*	----	----	*2.19*	----	----	*45.13*	----	----	*26.60*	3.93
Maize fodder, field cured	7	60.6	77.1	*69.40*	3.8	6.8	*5.14*	.6	2.0	*1.40*	30.5	47.8	*39.08*	14.4	24.7	*19.61*	4.17
Maize stover, field cured	13	51.3	84.6	*75.56*	3.0	8.3	*5.29*	1.1	2.2	*1.48*	26.4	46.2	*40.09*	17.7	29.5	*24.17*	4.53
Buckwheat straw	3	89.6	91.0	*90.09*	3.3	7.8	*5.15*	.7	1.7	*1.26*	32.1	38.9	*35.16*	37.2	46.8	*42.98*	5.54
Oat straw	12	87.5	93.5	*91.26*	2.3	6.9	*3.82*	1.0	3.2	*2.22*	26.4	51.4	*38.89*	29.5	56.0	*41.52*	4.81
Rye straw	8	87.5	93.7	*92.24*	2.2	6.9	*3.46*	1.0	2.7	*1.40*	35.7	52.9	*38.35*	34.2	43.3	*45.25*	3.78
Wheat straw	6	82.1	93.5	*91.22*	2.9	5 0	*3.45*	.8	1.8	*1.29*	31.0	50.6	*37.33*	34.3	42.7	*44.99*	4.16
Cow-pea vines	6	86.0	90.7	*85.95*	13.6	19.8	*15.68*	1.1	4.1	*2.87*	34.9	46.4	*42.17*	17.2	23.7	*19.80*	8.41
Roots, Bulbs, Tubers and other Vegetables and Fruit.																	
Beets, red	5	10.5	14.5	*12.93*	1.1	1.7	*1.52*	.1	.2	*.16*	7.2	11.3	*9.20*	.6	1.7	*.92*	1.03
Beets, sugar	9	9.3	16.7	*13.44*	1.2	2.9	*1.92*	.05	.1	*.09*	7.0	13.6	*9.65*	.7	1.1	*.88*	.90
Mangolds	8	5.6	13.1	*9.60*	1.0	1.9	*1.44*	.03	.5	*.15*	2.4	9.6	*6.06*	.8	1.3	*.90*	1.05
Ruta bagas	3	11.6	13.0	*12.43*	1.2	1.3	*1.26*	.1	.3	*.17*	7.6	9.1	*8.50*	1.2	1.4	*1.30*	1.20
Turnips	3	7.6	12.8	*9.55*	.8	1.4	*1.14*	.1	.2	*.18*	4.2	8.8	*6.28*	.8	1.4	*1.15*	.80
Carrots	6	8.9	13.5	*11.70*	.9	2.0	*1.16*	.2	.7	*.42*	5.1	10.4	*7.68*	1.0	2.3	*1.38*	1.06
Onions	6	6.5	18.4	*12.45*	.8	2.3	*1.41*	.2	.4	*.26*	3.8	14.1	*9.53*	.6	.8	*.69*	.56

Composition of American Feeding Stuffs—*Continued.*

Name.	Analyses.	Total Dry Matter.			Albuminoids or Protein.			Crude Fat.			Nitrogen-free Extract.			Fiber.			Ash.
		Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	
Roots, Bulbs, Etc.—*continued.*																	
Potatoes	7	19 4	24.1	*21.90*	1.1	3.0	*2.19*	----	.2	*.10*	15.3	20.0	*18.19*	.3	.9	*.54*	.88
Sweet potatoes	5	26.6	34.0	*29.37*	.5	3.6	*1.55*	.3	·6	*.38*	18.0	29.7	*25.09*	.6	2.5	*1.36*	.99
Cabbage	2	6.5	10.2	*8.28*	1.8	2.0	*1.95*	.2	·5	*.33*	2.0	3.5	*2.75*	1.4	3.0	*2.21*	1.04
Squash	2	4.8	5.4	*5.12*	.6	.6	*·66*	.2	·3	*.28*	2.9	3.5	*3.24*	.5	.5	*.54*	.40
Pumpkin	1	----	----	*7.73*	----	----	*1.11*	----	----	*.16*	----	----	*4.34*	----	----	*1.49*	.63
Apples	5	15.9	22.7	*18.22*	.2	1.2	*.69*	.3	.6	*.41*	12.6	20.0	*15.31*	.9	2.9	*1.49*	.32
Grains and other Seeds.																	
Barley	9	87.4	92.7	*89.08*	8.6	15.7	*12.39*	1.5	3.1	*1.86*	66.7	73.9	*69.88*	1.2	4.1	*2.57*	2.38
Buckwheat	8	85.1	89.1	*87.40*	8.6	11.1	*10.00*	2.2	2.4	*2.25*	62.6	65.4	*64.50*	7.8	9.4	*8.70*	2.00
Oats (raised in Conn.)	7	86.5	90.7	*89.06*	8.0	10.1	*9.32*	4.7	5.8	*5.29*	59.0	63.2	*61.55*	8.9	12.9	*9.95*	2.95
Oats	25	86.5	91.1	*89.06*	8.0	14.4	*11.38*	3.4	5.8	*4.81*	50.8	66.9	*60.05*	1.5	19.4	*9.85*	2.97
Rye	6	86.8	91.3	*88.40*	9.5	12.1	*10.60*	1.4	2.1	*1.70*	70.7	73.9	*72 60*	1.4	2.1	*1.60*	1.90
Wheat, winter	242	83.8	92.9	*89.48*	8.3	16.6	*11.73*	1.3	3.9	*2.11*	68.1	76.6	*72.01*	.4	2.9	*1.77*	1.86
" spring	13	86.6	91.9	*89.63*	8.1	15.4	*12.51*	1.8	2.5	*2.20*	66.1	78.6	*71.19*	1 3	2.3	*1.82*	1.91
" unclassified	55	87.6	90.9	*89.31*	9.8	14.7	*11.96*	1.6	2.8	*2.10*	68.5	74.7	*71.50*	1.2	3.1	*1.92*	1.83
" Average of all Analyses	310	83.8	92.9	*89.46*	8.1	16.6	*11.80*	1.3	3.9	*2.11*	66.1	73.6	*71.89*	.4	3.1	*1.80*	1.86
Maize, dent	80	85.9	93.7	*89.91*	7.5	12.1	*10.33*	3.8	6.9	*5.10*	66.2	75.7	*70.66*	1.2	4.8	*2.28*	1.54
" dent, raised in New England	12	84.8	91.2	*89.24*	8.3	11.6	*10.12*	3.8	5.1	*4.43*	66.6	74.2	*71.39*	1.3	2.4	*1.78*	1.52
" flint	71	80.4	93.4	*88.82*	7.0	13.7	*10.57*	3.4	7.1	*4.97*	65.0	74.6	*70.18*	.7	2.9	*1.64*	1.44
" flint, raised in New England	36	80.4	91.7	*87.77*	7.9	13.7	*10.91*	3.4	7.1	*4.91*	65.1	77.0	*69.16*	.8	2.5	*2.37*	1.42
" sweet	30	89.0	94.0	*91.04*	8.8	15.3	*11.33*	3.8	11.9	*7.68*	61.8	74.2	*67.48*	1.5	5.2	*2.69*	1.86
" "Western Corn"	3	79.3	83.6	*80.90*	7.8	8.6	*8.30*	3.6	3.9	*3.70*	64.9	68.2	*66.00*	1.7	1.8	*1.75*	1.20
" Average of all Analyses	184	79.3	94.0	*89.54*	7.0	15.3	*10.56*	3.4	11.9	*5.45*	61.8	77.0	*69.90*	.7	5.2	*2.09*	1.54
Sorghum Seed	9	83.2	90.7	*87.48*	7.6	11.2	*8.88*	2.1	4.6	*3.65*	68.6	73.6	*71.26*	1.4	3.2	*1.88*	1.80
Cotton Seed, hulls and kernels	1	----	----	*92.28*	----	----	*15.72*	----	----	*18.56*	----	----	*29.09*	----	----	*25.73*	3.16

Composition of American Feeding Stuffs—*Continued.*

Name.	Analyses.	Total Dry Matter.			Albuminoids or Protein.			Crude Fat.			Nitrogen-free Extract.			Fiber.			Ash.
		Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	
Grains.—*continued.*																	
Flax Seed	1	----	----	*93.75*	----	----	*25.50*	----	----	*37.92*	----	----	*15.37*	----	----	*10.34*	4.63
Cow Pea	5	79.2	89.9	*85.21*	19.3	23.0	*20.77*	1.3	1.6	*1.43*	48.1	61.9	*55.75*	3.3	5.0	*4.06*	3.20
Bush beans	1	----	----	*85.00*	----	----	*20.37*	----	----	*1.62*	----	----	*56.71*	----	----	*3.20*	3.10
Soy Bean	4	86.9	93.9	*91.53*	34.6	40.2	*37.22*	12.3	19.0	*16.52*	26.2	30.5	*28.21*	3.7	5 0	*5.12*	4.46
Flour and Meal.																	
Barley Meal	3	83.8	86.0	*84.90*	8.8	13.9	*11.80*	.7	2.2	*1.70*	----	----	*70.90*	----	----	*.10*	.50
Buckwheat Flour	4	82.4	87.2	*85.46*	4.2	8.1	*6.89*	.7	1.8	*1.44*	71.1	79.4	*75.79*	.2	.5	*.34*	1.00
Oat Meal	6	91.1	93.8	*92.15*	12.9	16.2	*14.66*	6.1	8.8	*7.06*	66.6	68.9	*67.57*	.6	1.2	*.86*	2.00
Rye Flour	4	86.4	87.7	*86.90*	6.0	7.1	*6.65*	.8	.9	*.84*	77.6	79.1	*78.28*	.4	.5	*.41*	.72
Wheat Flour from winter wheat	1	----	----	*87.04*	----	----	*8.56*	----	----	*1.19*	----	----	*76.59*	----	----	*.17*	.53
" from spring wheat	6	86.5	89.7	*87.68*	8.6	14.1	*10.68*	.6	2.0	*1.11*	68.3	78.1	*75.00*	----	1.2	*.22*	.64
" Unclassified	21	86.4	88.8	*87.52*	9.7	13.3	*11.25*	.8	1.9	*1.16*	69.5	76.9	*74.33*	.1	1.0	*.25*	.53
" Average of all varieties	25	86.4	89.7	*87.44*	8.6	14.1	*11.28*	.6	2.0	*1.20*	68.3	78.1	*74.13*	.0	1.2	*.27*	.56
Graham Flour	3	86.3	87.9	*86.90*	11.3	12.4	*11.70*	1.5	1.9	*1.70*	69.8	70.0	*69.80*	1.8	2.1	*1.90*	1.80
Maize Meal	60	74.5	92.0	*84.40*	7.1	10.3	*9.15*	2.2	5.1	*3.84*	57.0	74.0	*67.96*	.5	3.1	*1.98*	14.5
Hominy	2	86.4	86.6	*86.50*	8.1	8.4	*8.25*	.4	.5	*.44*	77.1	77.2	*77.12*	.3	.3	*.32*	.38
Sorghum Meal, mostly decorticated	1	----	----	*86.84*	----	----	*8.25*	----	----	*3.85*	----	----	*71.27*	----	----	*1.88*	1.59
Pea Meal	2	87.0	91.2	*89.54*	19.1	21.4	*10.23*	.9	1.5	*1.19*	50.2	52 0	*51.09*	11.1	17.7	*14.33*	2.64
By Products and Refuse.																	
Apple Pomace	7	22.1	27.4	*22.94*	1.0	1.7	*1.40*	.6	2.0	*1.36*	12.6	17.6	*15.63*	2.0	5.9	*4.01*	.54
Brewers' Grains, wet from brewery	15	20.6	31.4	*24.99*	4.3	7.7	*5.57*	.8	2.9	*1.68*	10.1	15.7	*12.86*	3.0	5.6	*3.87*	1.01
" " "dried"	3	88.1	93.8	*91.81*	19 2	20.2	*19.89*	4.2	6.5	*5.56*	46.1	56.8	*51.75*	10.2	11.6	*11.01*	3.58
" " kiln-dried	1	----	----	*97.43*	----	----	*20.30*	----	----	*6.40*	----	----	*54.89*	----	----	*11.79*	3.97
" " from Silo	3	26.1	33.2	*30.18*	5.8	7.1	*6.64*	1.8	2.5	*2.11*	13.6	16.8	*15.58*	3 9	5.4	*4.64*	1.21

Composition of American Feeding Stuffs—*Continued.*

Name.	Analyses.	Total Dry Matter. Min.	Max.	Aver.	Albuminoids or Protein. Min.	Max.	Aver.	Crude Fat. Min.	Max.	Aver.	Nitrogen-free Extract. Min.	Max.	Aver.	Fiber. Min.	Max.	Aver.	Ash.
By Products and Refuse—*continued.*																	
Brewer's Swill	1	----	----	*5.70*	----	----	*1.90*	----	----	*.80*	----	----	*2.00*	----	----	*.70*	.30
Malt Sprouts	3	88.0	92.7	*89.72*	21.0	25.9	*22.95*	1.1	2.9	*1.79*	45.4	50.3	*48.60*	9.3	11.9	*10.72*	5.67
Cotton Seed Meal	29	81.5	94.2	*91.68*	23.3	50.8	*42.39*	10.2	18.0	*13.37*	12.7	38.6	*22.97*	2.7	11.7	*5.69*	7.26
Linseed Meal, Old Process	14	87.4	93.9	*90.79*	27.7	39.2	*32.26*	5.1	11.6	*8.35*	30.8	41.9	*35.26*	4.7	13.3	*9.13*	5.79
" New Process	12	86.6	93.2	*89.25*	27.1	37.1	*32.85*	1.3	4.4	*3.08*	35.2	48.0	*38.29*	7.6	14.0	*9.46*	5.57
" Oil not removed	1	----	----	*91.67*	----	----	*22.97*	----	----	*30.26*	----	----	*25.48*	----	----	*9.60*	3.36
Palm Nut Meal	3	89.1	93.8	*91.71*	13.5	16.0	*14.39*	6.4	18.7	*13.30*	33.8	41.6	*38.88*	18.7	23.9	*21.40*	3.74
Oat Feed	1	----	----	*91.81*	----	----	*12.64*	----	----	*6.14*	----	----	*56.31*	----	----	*12.48*	4.24
Rye Bran	6	86.3	91.8	*88.51*	11.5	16.8	*15.28*	1.8	4.9	*2.46*	59.8	67.6	*63.66*	2.5	4.1	*3.52*	3.59
Wheat Bran	68	84.2	91.8	*87.62*	7.5	17.5	*15.36*	1.5	5.9	*3.83*	50.0	67.6	*53.50*	2.4	17.8	*9.34*	5.59
" Middlings	27	84.0	91.5	*88.00*	10.1	19.2	*15.17*	1.3	12.7	*4.01*	53.0	70.9	*60.99*	2.1	5.9	*4.57*	3.26
" Shorts	8	84.5	89.0	*87.26*	11.1	16.1	*13.83*	2.5	5.3	*4.14*	53.3	67.0	*57.59*	5.8	10.5	*7.45*	4.25
"Hominy Chops," "Hominy Feed," "Baltimore Meal," "White Meal."	11	86.5	91.9	*88.86*	7.9	11.2	*9.85*	4.6	11.2	*8.43*	61.0	71.1	*64.49*	2.5	4.8	*3.59*	2.40
Gluten Meal	14	88.3	92.7	*90.72*	25.0	35.0	*29.73*	4.2	8.7	*6.58*	44.7	58.5	*52.08*	.7	3.8	*1.56*	.77
Maize Cob	17	75.2	92.8	*89.15*	1.2	3.7	*2.35*	.1	.9	*.45*	43.4	66.4	*54.65*	25.4	38.2	*30.36*	1.34
"Starch Feed," refuse from starch manufacture	9	27.8	42.9	*35.29*	3.6	9.6	*6.17*	1.3	4.4	*3.18*	18.7	28.9	*22.52*	1.6	4.3	*3.19*	.23
"Sugar Feed," kiln-dried, refuse from glucose manufacture	2	89.6	93.4	*91.50*	13.1	13.5	*13.30*	5.9	11.2	*8.60*	54.9	61.4	*58.10*	8.4	10.7	*9.50*	2.00
Sorghum Bagasse	4	11.3	16.6	*14.50*	.6	.7	*.65*		----	----	----	----	*10.20*	2.8	3.3	*3.10*	.60

CONNECTICUT GRASSES.

In the last Report the improvement of our meadows and pastures was spoken of as one great need of our agriculture. A better knowledge of our pasture and meadow grasses, their habits and uses, is a first step towards supplying this need. Questions as to the adaptation of different grasses to particular kinds of soil, the necessary water supply, their rooting habits, how they stand treading and close pasturing by cattle, causes of running out, etc., are still unsettled and show how much must be learned before we can manage grass land to the best advantage. Near our cities the hay crop is sometimes the most profitable one we have, and might often be made much more so by proper management. Our common grasses ought to be known, so that they can be readily told apart by farmers generally at all seasons of the year and rightly named, for till this is done it is clear that no one can speak or write about grasses with any chance of being understood. In the last Report were some explanations of the classification and naming of grasses and an explanatory list of the scientific and popular names of our commonest Connecticut grasses. There was also some account of the Station Forage Garden, in which are to be seen all our common grasses growing, correctly named, and where their habits can be studied to some extent and where pure seed can be got. Extra copies of this part of the Report can be supplied to any who want them.

During the present year there has been shown a greatly increased interest in this subject throughout the State. More than a hundred and fifty specimens have been sent in to be named or for other information from all parts of the State. Named specimens of fresh grasses have also been sent out by the Station in answer to requests for them. The Station is prepared to identify specimens of grass sent here, and so far as possible will supply collections of small samples of seed to any schools, granges, or farmers' clubs that would like to have a collection of named grasses growing near them.

Should sufficient interest be awakened, we could perhaps arrange to send by mail whole plants for inspection and study as they come into bloom through the season.

The Station is also always prepared to examine for farmers seeds of grasses or of vegetables with reference to their purity and vitality.

It is especially desired that any prevalent disease on grasses, such as mildew, rust, etc., and particularly ergot, which has sometimes done great injury at the west in wet seasons, may be brought to the attention of the Station.

Grasses in the Garden of the Station.

Considerable additions have been made to the garden, which now contains one hundred and fifty-seven species and varieties of grasses and forage plants.

The following list includes all grasses which have grown in the Station Forage Garden during the present season. The annual grasses of course, at this time, are dead, and have been sown again for next year. A dagger (†) before the name of a grass denotes that we have at our disposal, for exchange, a small quantity of its seed. The quantity which we propose to exchange will be quite small, in most cases only sufficient for a drill seven or eight feet long; enough, however, to show the characters of the grass, and to yield seed next year for a larger sowing, if that is desired. The seed we believe to be sound, strictly pure and true to name, most of it gathered in this garden and by our own hands.

†Agropyrum glaucum.
† repens. [*Triticum repens of Gray's Botany.*]
tenerum.
violaceum?
Agrostis canina?
† exarata.
† perennans.
† scabra.
† stolonifera?
† vulgaris, var. major.
† vulgaris, var. minor.
vulgaris, var. alba?
†Alopecurus agrestis.
geniculatus.
† pratensis.
Andropogon dissitiflorus. [*A. Virginicus of Gray's Botany.*]
macrourus.
† provincialis. [*A. furcatus of Gray's Botany.*]
scoparius.
Anthoxanthum odoratum.
var. Puelii.
†Apera spica-venti.
Aristida gracilis.
purpurascens.
†Arrhenatherum avenaceum.
†Asprella hystrix. [*Gymnostichum hystrix of Gray's Botany.*]
Avena flavescens.
† sterilis.
†Boutiloua olygostachya.
Briza maxima.
†Bromus brizæformis.
ciliatus.
giganteus.
† inermis.
pinnatus.
† pratensis.
† Schræderi.
† secalinus.
segetum.
sylvaticus.
† tectorum.
†Cenchrus tribuloides.
Chloris submutica.
Chrysopogon nutans. [*Sorghum nutans of Gray's Botany.*]
†Cinna arundinacea.

Cynodon dactylon.
Cynosurus cristatus.
Dactylis glomerata.
†Danthonia spicata.
Deschampsia caespitosa.
flexuosa.
pulchella.
Deyeuxia Canadensis. [*Calamagrostis Canadensis of Gray's Botany.*]
Diplachne fascicularis. [*Leptochloa fascicularis of Gray's Botany.*]
Eatonia obtusata.
†Eleusine Coracana, var. stricta.
Indica.
Elymus Canadensis.
† Virginicus.
†Eragrostis capillaris.
† elegans.
pectinacea.
pilosa.
poeoides, var. megastachya.
Erianthus Ravennæ.
Eulalia Japonica.
var. variegata.
†Festuca duriuscula.
elatior.
† pratensis.
† heterophylla.
† nutans.
ovina.
† var. tenuifolia.
† var. rubra.
† pratensis.
† tenella.
Glyceria aquatica, var. Americana.
† Canadensis.
† fluitans.
nervata.
Holcus lanatus.
mollis.
Hordeum jubatum.
Leersia oryzoides.
Virginicus.
†Lolium perenne.
var. Italicum.
var. tenue.
Melica cærulea.
ciliata.
Muhlenbergia capillaris.
† diffusa.
Mexicana.
Willdenovii.
Oryzopsis melanocarpa.
Panicum agrostoides.
† capillare.
† clandestinum.
crus-galli.
† var. hispidum.
dichotomum.
Germanicum.
glabrum.
latifolium.
† miliaceum.
sanguinale.
† virgatum.
Paspalum paniculatum.
† setaceum.
†Phalaris arundinacea.
cærulescens.
Canariensis.
Phleum pratense.
Phragmites communis.
Poa Abyssinica.
annua.
† arachnifera.
† compressa.
† nemoralis.
Nevadensis.
pratensis.
serotina.
sudetica.
† trivialis.
Reana luxurians.
†Setaria glauca.
verticillata.
† viridis.
Sorghum halapense.
vulgare.
Sporobolus depauperatus.
† heterolepis.
Stipa pennata.
† spartea.
Triodia seslerioides. [*Tricuspis seslerioides of Gray's Botany.*]
Vilfa vaginæflora.
† aspera.

OTHER FORAGE PLANTS IN THE GARDEN OF THE STATION.

Dolichos	Cow pea.
†Lathyrus sativus	Small pea.
Lotus corniculatus	Bird's-foot clover.
†Medicago turbinata	Snail Clover.
sativa	Alfalfa.
Melilotus albus	Bokhara Clover.
Ornithopus sativus	Seradella.
Onobrychis sativa	Esparsette.
Spergula maxima	Giant Spurrey.
Trifolium pratense	Red Clover, Bordeaux, Brittany, German, Hungarian, Mammoth, and Sapling varieties.
Alexandrinum	Egyptian Clover.
hybridum	Alsike Clover.
incarnatum	Crimson Clover.

We give below brief notes regarding some grasses grown in the garden which are not common in Connecticut, but which are valuable elsewhere and so receive very favorable notices from correspondents in our agricultural press and find a place in our seedsmen's catalogues.

Some of these grasses highly valued at the South and West are quite worthless here and some others having value are yet inferior to our common meadow grasses.

Texas Blue-Joint, Poa arachnifera. A year and a half ago both seed and roots were received from dealers at the south. The seed did not come up. The roots were very slow in starting but during the fall of 1887 and the present year have done well. This year the grass seeded. It spreads like June-grass by underground stems, but has not been as thrifty here, and the herbage is coarser.

Teosinte, Reana luxurians, here grows to a height of 4 or 5 feet, but does not blossom. The leaves are narrower, longer, and more tender than the leaves of maize. It makes scarcely any growth before the second week in July and the lightest frost kills it. We have little use for *teosinte* as long as we have maize, except possibly as a substitute for Hungarian grass.

Schräder's Brome-grass, or Rescue-grass, Bromus Schraederi or unioloides. Highly prized at the South and West. Does well on dry soils and is said to be very nutritious. Sowed in the fall of 1886 it completely winter-killed while the other Brome grasses were not injured. Sown in the spring it made good growth, producing abundance of herbage and seeding freely. Here it is an annual, and can hardly be of any value as a farm crop.

Hungarian Brome-grass, Bromus inermis. This is one of the most promising new grasses in the garden. It produces an abundance of tender foliage, spreads quite rapidly by stolons, comes up quickly after cutting and last winter was perfectly hardy. It is said to grow on very dry soil. Hard frosts do not kill the foliage.

Meadow Brome-grass, Bromus pratensis, has made very satisfactory growth, its foliage is abundant and tender. It spreads much less rapidly than the last named grass and makes less fodder.

The Rye-grasses, Lolium perenne and Lolium Italicum. These were planted in September, 1886. They were perfectly hardy the first winter, grew luxuriantly the following summer, and seeded freely. But the following winter they died out largely or completely. The feeble growth of this year appears to be from seed dropped last season. These grasses are often used in lawn "Mixtures." They make a fine show the first season and then disappear. This may be an effect of competition with other grasses, but in our garden trials the Rye-grasses were protected from all interference of other plants. A grass which will make a great show the first season and then die out, should have no place in a mixture for permanent lawns.

Some *Sedges*, notably *Carex vulgaris*, have thrived in the comparatively dry soil of the garden.

The *Glycerias*, especially *Canadensis* and *aquatica*, have not grown satisfactorily in the garden. The *Leersias* just keep alive and *oryzoides* seeded this year. Another marsh grass, *Phalaris arundinacea*, or Red Canary Grass, has grown very vigorously. The Striped Grass of gardens is only a variety of this. On low swampy land this may be a very valuable grass. It is rather coarse but is relished by cattle, comes up quickly after cutting and is not killed down by frost. It is easily propagated from the stout under-ground stems. On cultivated land it might become a pest.

We have had difficulty in raising from seed the Conn. River bents;—blue bent, *Andropogon provincialis*, black bent, *Panicum virgatum* and Indian-grass, *Chrysopogon nutans.* These are

all very valuable native grasses, which deserve more attention than they receive; deep rooted and permanent, with proper treatment. We have ourselves collected the seed for two years when it was apparently ripe, but it has been slow in germinating and the catch was poor. Thus Panicum virgatum planted in Sept., 1887, came up in June, 1888, scattering. Blue-bent planted Sept., 1886, did not come up in the fall, and was replanted April 4, 1887. It came up June 1, scattering but strong and made a good growth that season without blossoming much. This year the stand is thicker by reason of shouldering from the parent stalks, the grass grew from $4\frac{1}{2}$–$5\frac{1}{2}$ feet high and blossomed fully.

Observations on the Chemical Composition of Certain Grasses.

The garden now contains a number of our common meadow grasses growing each by itself in a small plot entirely clear of weeds and all other grasses. The crop from each of these plots is to be annually weighed and analyzed to determine whether under the same treatment, these grasses show decided and constant differences in composition and how great the variations in yield and composition may be from year to year. The results for the first year are here recorded. The soil of the garden is a light sandy loam, with gravelly subsoil overlying disintegrating red sandstone, which is from four to six feet below the surface. For four years before the plots were seeded the land had been fairly well manured with barn-yard manure, and planted to corn, with some ammoniated superphosphate in the hill.

On September 27, 1886, plots were staked off six feet by eight and seeded. During the season of 1887, the grass was not cut, but any bare spots were re-seeded and each plot was kept entirely free from all foreign plants. In the early spring of 1888, the dead grass was burned off and a fertilizer made up of 150 pounds of nitrate of soda, 250 pounds tankage, 30 pounds muriate of potash and 125 pounds dissolved bone black was sown over the whole garden, at the rate of 555 pounds to the acre.

The grass on each plot was cut but once and when not otherwise stated, at the time of full bloom. The crop after weighing was dried in the sun for several hours, then in a dry room for some days and afterwards was thoroughly dried in hot air and prepared for analysis. The results are given in the following tables, but discussion is reserved till further data are collected.

Analyses of Grasses.

Name of Grass.	Plot.	When cut.	Average height of flower stalks in inches.	Weight of crop in ounces.	Composition of the Crop.					
					Water.	Ash.	Albuminoids, etc.‡	Fiber.	Nitrogen-free extract.	Crude fat.
Tall Red-Top, Agrostis vulgaris, major	E	June 30		Fresh 542	76.15	1.66	1.97	7.96	11.65	.61
				Water-free 129		6.96	8.28	33.38	48.83	2.55
Fine Bent, Rhode Island Bent, Agrostis vulgaris, minor	D	" 30*		Fresh 270	71.56	1.93	2.77	9.34	13.64	.76
				Water-free 77		6.78	9.74	32.84	47.97	2.67
June-grass, Poa pratensis	A	" 11	30	Fresh 265	75.70	1.57	2.75	8.05	11.18	.75
				Water-free 64		6.50	11.30	23.11	46.10	3.07
Rough-stalked Meadow-grass, Poa trivialis	J	" 11	24	Fresh 165	72.79	1.73	2.67	8.24	13.74	.83
				Water-free 45		6.34	9.81	30.30	50.51	3.04
Wood Meadow Grass, Poa nemoralis	C	" 16	24	Fresh 177	64.33	1.91	3.66	12.04	16.98	1.08
				Water-free 63		5.36	10.27	33.75	47.60	3.02
Orchard-grass, Dactylis glomerata	I	" 11	41	Fresh 542	77.74	1.56	2.24	7.81	9.92	.73
				Water-free 120		6.96	10.07	35.12	44.62	3.23
Tall Oat-grass, Arrhenatherum avenaceum	Z	" 16	55	Fresh 306	73.46	1.56	2.11	9.24	12.97	.65
				Water-free 81		5.85	7.94	34.84	48.88	2.44
Yellow Oat-grass, Avena flavescens	Q	" 16	38	Fresh 209	66.70	1.38	2.55	11.39	16.72	.78
				Water-free 69		5.58	7.64	34.21	50.23	2.34
Meadow Fescue, Festuca pratensis	Y	" 20	39	Fresh 307	67.62	1.86	2.69	11.34	15.72	.77
				Water-free 99		5.74	8.30	35.02	48.57	2.37
Meadow Fescue, Festuca pratensis	G	" 20	39	Fresh 369	69.89	1.81	2.73	10.53	14.24	.80
				Water-free 111		6.04	9.06	34.96	47.29	2.65
Sweet Vernal grass, Anthoxanthum odoratum	S	" 11†	39	Fresh 125	75.13	1.46	2.89	7.73	11.95	.84
				Water-free 31		5.88	11.61	31.07	48.07	3.37

* Rather past full bloom. † Past bloom, but cut at the same time with June-grass. ‡ Nitrogen × 6.25.

Name of Grass.		Per cent. Nitrogen. Total.	Albuminoid.*	Per cent. of Phosphoric Acid.	Per cent. of Potash.
Coarse Red-top	Fresh	.32	.26	.11	.58
	Water-free	1.32	1.09	.47	2.43
Rhode Island Bent	Fresh	.44	.40	.17	.71
	Water-free	1.50	1.40	.56	2.49
June-grass	Fresh	.44	.38	.16	.72
	Water-free	1.80	1.56	.66	2.99
Rough-stalked Meadow-Grass	Fresh	.43	.39	.19	.85
	Water-free	1.57	1.45	.70	3.11
Poa nemoralis	Fresh	.59	.53	.18	.88
	Water-free	1.65	1.50	.50	2.48
Orchard grass	Fresh	.36	.31	.13	.83
	Water-free	1.61	1.38	.60	3.76
Tall Oat-grass	Fresh	.34	.30	.13	.84
	Water-free	1.27	1.11	.48	3.14
Yellow Oat-grass	Fresh	.41	.37	.18	.97
	Water-free	1.22	1.11	.58	2.91
Meadow Fescue (Y)	Fresh	.43	.36	.18	.89
	Water-free	1.32	1.11	.55	2.78
Meadow Fescue (G)	Fresh	.44	.40	.16	.84
	Water-free	1.45	1.32	.52	2.79
Sweet Vernal	Fresh	.46	.43	.16	.69
	Water-free	1.87	1.75	.66	2.80

* Determined by Stutzer's method described in the Station Report for 1885, p. 40.

Notes on Grass in answer to Correspondents.

The following abstracts from answers to letters of inquiry addressed to the Station, in regard to grasses have sufficient general interest to justify publishing them here:—

The grass sent is Annual Spear Grass, *Poa annua.* It blossoms earlier than any other grass in the spring, and may be found in blossom at almost any time in the year when it is not cold enough for heavy frosts. It makes a beautiful turf where it is not too shady, and where there is enough treading to keep other grasses from running it out. Nothing stands being trodden under foot so well. It is a rich nutritious grass, but the yield of course is very small. It seeds freely and perpetuates itself so, as well as by rooting from joints of the stem.

The grass betrays itself even before opening the package. It is Sweet Vernal, *Anthoxanthum odoratum.* Only one other Connecticut grass has this odor; that is Holy Grass, *Hierochloa borealis,*—so called because it was considered sacred to the Virgin Mary—and that is very different in appearance.

You can pick out Sweet Vernal as soon as it greens in the spring. It grows in quite light green tufts, the leaves and stalks are short and stubbed like pin feathers, and when crushed give out this strong and agreeable odor. A little of it gives a mow of hay a sweet odor, but its green foliage is bitter and not relished by cattle. It is a perennial though an annual variety of it is sold here sometimes as "true perennial."

The annual is much smaller and comparatively worthless.

The specimen which you send is variously called "June-Grass," "Blue-Grass," or "Kentucky Blue-Grass," *Poa pratensis.* There is no botanical difference between our June-Grass or Blue-Grass, and the Kentucky Blue-Grass. In portions of Kentucky, June-Grass grows very lustily to the exclusion of most other forage grasses. This is the famous "blue-grass" region, but its product only differs from our June-Grass in its ranker growth. Many farmers use the name Blue-grass for *Poa compressa,* a very different thing, often called Wire-grass.

"Blue" is more applicable to *P. compressa* than *P. pratensis,* for the foliage of the former is a bluish green. This illustrates the confusion there is in the common names of grasses.

This Wire-grass is easily distinguished from June-grass by its color and its stalks which are flattened while those of June-grass are round.

You ask how to distinguish Blue or June-grass from Red-top. The leaf tips of June-grass are boat-shaped or awl-shaped, those of Red-top are flat and pointed. June-grass has very strong underground stems like Quack. Red-top has few or none. The stem of June-grass is less leafy than Red-top. It blossoms earlier. The seeds of June-grass are bunched, three to five of them together, and they are somewhat webby at the base. Those of Red-top are not bunched. Each is by itself and not webby.

June grass is not the best lawn grass. It is rather coarse and needs constant cutting. It does not make a good hay crop with us, for its foliage is at the bottom, the stalks are not leafy. It is best in pastures which are not too dry. It stands close feeding though not so close as Rhode Island Bent. When a pasture is overstocked, it will mostly disappear while the bent remains, but when the cattle are taken off it appears again.

The grass is Velvet-grass or Soft-grass, called in some parts of England "Yorkshire Mist," *Holcus lanatus*. It is not a native of this country. With us it is of very little or no value and is not worth a trial, I think, unless it covers ground where nothing else seems to do well. It has been raised at the south and is well spoken of in some quarters.

"What grass seed can I sow on rather wet land plowed occasionally to keep down bushes?"

You can probably get in Hartford or New York, seed of rough-stalked meadow-grass, *Poa trivialis*, and of "creeping bent." You might have success with them if the land is too wet for June grass. Nerved Meadow-grass, *Glyceria nervata*, would stand a good chance of staying on the land and doing well; so would Blue-joint, *Deyeuxia Canadensis*, but you cannot get the seed in market. An experiment in seeding with these would be very valuable. They are strong native grasses, inclined to be permanent; perhaps that is a reason why they are not popular in the seed trade!

This is Quack, *Agropyrum repens*, which varies so much in its appearance that it is not always recognized unless caught in its celebrated act of growing through a potato! It is a curse on cultivated land, but I have seen meadows full of it in this State which gave a heavy crop of excellent hay. It spreads rapidly, and puts up with almost any kind of soil. There is nothing better for covering unsightly *road or railroad* embankments to prevent washing.

WORK FOR THE STATE DAIRY COMMISSIONER.

The chemical work required by the Dairy Commissioner during the current year has been done at this Station and expert testimony furnished in court whenever necessary.

Examination of Butter.

On page 133 of our Report for 1886 the chemical methods of examination are given in detail. The method of determining volatile fatty acids has been somewhat modified in view of recent investigations made abroad.

The fat is saponified in a closed flask, with potassium hydrate solution (free from carbonates) without the addition of alcohol. Barium hydrate is used for the subsequent titration. Otherwise, the method now used by us is the same as there described.

Since that report, forty-five samples of suspected butter have been examined for the commissioner, of which thirty-five were imitation butter. The specific gravity of the imitation butter, determined as described in our report for 1886,—varied between .8583 and .862. The volatile fatty acids in 2.5 grams of filtered fat expressed in cubic centimeters of $\frac{1}{10}$ normal potassium hydrate solution varied between 0.5 and 6.4. A single sample of genuine butter had the exceptionally low specific gravity of .8625. The others varied between .8644 and .8666. The volatile acids varied between 12.82 and 16.81.

Examination of Molasses.

Fifty samples of molasses have been examined for the Dairy Commissioner. Of the first twenty-two samples collected by him after the passage of the law regarding the adulteration of molasses, nine were found to be mixed with glucose; one also contained salts of tin. After giving public notice that after a fixed date, all sellers of such molasses would be prosecuted, further samples were drawn and sent here for examination, but they all proved to be pure molasses. Apparently molasses mixed with glucose is no longer sold in the State.

Method of Examination of Molasses.

The method followed has been to polarize the molasses directly, after clearing with basic lead acetate, polarize after inversion according to Clerget's method at ordinary temperature, and polarize a third time at a temperature of about 88°.

No attempt has been made to calculate the sugar on account of the difficulty and uncertainty of the work, and also because it is not necessary to a correct judgment of the genuineness of the molasses. Genuine molasses will show from about 38 to 55 per cent. of "polarization sugar" by direct polarization, after inversion with an acid a polarization of from 10 to 18 or 20 scale degrees to the left in the Scheibler instrument at ordinary temperatures and from 0 to +5 or 6 degrees at 88° C.

Molasses adulterated with glucose almost always shows over 75 per cent. "polarization sugar" by direct polarization, which at once proves the adulteration, for molasses does not contain more than that quantity of solids altogether.

After inversion the rotation is still right-handed, though less than before. The rotatory power of dextrose ("glucose") is not changed by the acid used for inversion, dextrine and maltose (?) however, which are in the glucose syrup, have their right handed polarization somewhat lessened by the action of the acid and of course the cane sugar present is changed to invert sugar, which polarizes to the left. Nevertheless, the polarization of the whole mixture is still strongly to the right.

Next, when the temperature is raised to about 86° the polarization of molasses mixed with glucose syrup instead of sinking to within a few degrees of zero remains about where it was before, rising or falling slightly according to the relative amounts of dextrine and of invert sugar in it.

A glance at the following results will make these differences clear. The polarizations were made with Schmidt and Haensch's double compensation, half shade instrument. [26.048 grams sugar in 100 cc. 200^{mm} tube = 100 scale degrees]. The readings after inversion are corrected for dilution. In the table of analyses of pure molasses the samples marked with letters were kindly furnished by an importer as pure Cuba molasses. The lettered samples of adulterated molasses were also furnished by him but came from sellers of adulterated molasses. J is from a firm which it is said claims that the adulteration is so skillfully done under direction of their chemist that detection is impossible!

GENUINE MOLASSES.

	"Polarization sugar."	After inversion, at ordinary temperatures.		Scale degrees at about 86° C.
	+55.2	−12.6	at 27° C.	+2.2
D	55.2	13.0	27°	2.9
E	55.0	13.6	27°	1.8
B	53.2	12.3	27°	1.8
F	49.2	10.4	27°	4.4
C	49.0	13.4	27°	2.0
A	48.8	13.9	26°	.4
I	47.6	12.8	27°	.9
H	45.4	16.9	26½°	1.3
G				
No. 3	45.8	12.1	22°	
" 4	48.6	13.2	23½°	
" 6	49.4	10.5	19½°	
" 7	48.4	——	——	
" 8	39.4	18.9	21°	2.4
" 14	47.6	14.7	18°	3.1
" 23	50.2	13.4	23°	
" 24	46.4	15.8	18½°	5.1
" 25	50.4	14.7	20°	4.6
" 26	48.0	16.7	22°	4.2
" 27	51.4	18.3	9°	4.6
" 28	42.9	17.8	23°	

ADULTERATED MOLASSES.

	"Polarization Sugar."	After inversion, at ordinary temperatures.		Scale degrees at about 86° C.
J	+107	+91.5	at 26°	+85.8
L	89	57.9	25°	59.4
K	45	−2.2	26°	11.0
No. 2	85.2	+58.1	16°	58.5
" 5	102.4	80.1	19°	78.5
" 9	47.8	5.0	14½°	18.9
" 10	118.0	95.0	14½°	94.2
" 11	106.0	77.9	14½°	78.3
" 12	101.0	70.6	14½°	70.2
" 13	87.2	59.0	17½°	62.4
" 19	90.4			
" 1	37.8	4.9	19°	6.2

The following table gives additional data for certain samples. In some of them the reducing action with copper solution was determined by Allihn's method* and the result was figured as dex-

* Jour. für Prak. Chem. **22.** 52. Fres. Zeits. für Anal. Chem. **22.** 448.

trose. [The reduction equivalent of invert sugar, however, is somewhat different from that of dextrose]. The sugar was then inverted and its reduction equivalent again determined and from the results of these two determinations cane sugar was reckoned. The results have value chiefly for comparison of these samples.

SUGAR BY ALLIHN'S METHOD.

	Dry Matter.	Sp. gr.	Cane Sugar.	Dextrose.
D	73.9			
B	72.8			
I	71.4			
H	75.8			
No. 3		1.368	45.09	18.50
" 4		1.375	45.61	19.34
" 7			44.39	16.30
J	76.9			
L	83.6			
K	77.9			
No. 2		1.385	18.01	34.12
" 5		1.385	11.05	36.08
" 1	75.7	1.383	32.93	26.11

EXAMINATION OF HONEY.

Several samples of genuine honey have been sent to the Station by H. L. Jeffreys, Esq., of New Preston, and J. R. Bostwick, Esq., of New Milford, for examination and comparison with "strained honey," found in market. The question was also asked whether the Station could detect adulterations of honey. Honey, like milk, butter, molasses and many other articles of food may be slightly adulterated in such a way as to escape detection. Generally, however, such slight adulteration is not financially successful. To make adulteration "pay" it must be so considerable that its detection by chemical examination is made almost certain. Only five brands of strained honey could be found in the New Haven market and all of these were largely adulterated with glucose. A single sample of honey in the comb was found to be perfectly pure as was to have been expected. The analytical data are here given though chiefly of interest to those who are called on to make examinations of this kind.

Methods of Examination.

Specific gravity.—Owing to the viscosity of honey, the method of Lenz was used. One part of honey and two of distilled water are accurately weighed and mixed and the specific gravity of the mixture is observed at 17° C. For this we have made use of the Westphal balance.

Copper-reducing power.—A solution of five grams of honey in water is made up to 500 cc. and in 25 cc. of the solution the reducing power determined by Allihn's method and expressed as dextrose. It is well understood that a considerable part of the sugar of honey is invert sugar which consists of equal parts of dextrose and lævulose which have towards Fehling's solution a somewhat different reducing power. But there is at present no satisfactory method of separately determining the two sugars, so the above purely arbitrary method of expressing the reducing power was adopted.

Copper-reducing power after inversion.—A solution of five grams of honey in water is made up to 200 cc., 20 cc. of pure concentrated hydrochloric acid are added and thoroughly mixed, and the whole is kept at a temperature of 68°–70° C. for 15 minutes. After cooling, the free acid is nearly neutralized with sodium hydrate, the solution is made up to 500 cc., and in 25 cc. the copper-reducing power is determined as above.

The difference between the copper reduced after inversion and that reduced before inversion is expressed as cane sugar.

Method of Polarization.—13.024 grams of honey (or one-half the normal quantity, for the polariscope used) are dissolved in water, 3 cc. of basic lead acetate are added, then 2 cc. of a saturated solution sodium carbonate and water to make exactly 100 cc.

The solution passed through a dry filter is examined in a 200^{mm} tube in the polariscope. The reading is multiplied by two to represent the polarization of the normal quantity of honey.

To 50 cc. of the above solution are added 5 cc. of pure concentrated hydrochloric acid, and the mixture is heated at 68°–70° in a corked flask for 15 minutes. After cooling, the temperature and the rotation in a 220^{mm} tube are observed, and the reading multiplied by two as before. The tube without being removed from the polariscope is now heated to about 86° C., and the rotation is again observed and corrected as before.

Ash.—Five grams of honey are dried and ignited at a low heat in a weighed platinum dish.

The following table, page 111, gives the results obtained on samples of pure and adulterated honey:

Dilution with water may be detected by the specific gravity. According to Lenz, no pure honey falls belows 1.111. The last five samples in the table, all of which are adulterated, have a somewhat lower specific gravity than the others, except comb-honey, No. 4, but none are below the limit named. Four of the spurious honeys have less copper-reducing power than the genuine samples but one, No. 10, has not.

The ash also gives no marked indication with regard to the nature of the honey. The polarization however, leaves not the slightest doubt in regard to the quality of the samples and in our opinion furnishes the only reliable means of detecting adulteration with glucose. All the samples here examined which were known to be genuine polarized to the left, and as a rule, genuine honeys are lævorotatory. Cases are on record of genuine honey with right-handed polarization. The hives were close to sugar refineries, and according to the theory of the observer, the bees had failed to completely invert the sugar gathered in the refineries. Such honey however, after inversion in the laboratory would have become lævorotatory.

All the genuine samples here examined, polarize further to the left after inversion than before, in consequence of the inversion of some cane sugar, which is almost always present in honey in small quantity. But the last five samples have a strong right-handed direct polarization, which could not be explained by the presence of cane sugar, for it remains only slightly reduced after inverting with an acid whereas cane sugar would have caused after inversion, a strong left-handed polarization. Therefore they contain some foreign substance, which polarizes strongly to the right, and is not greatly altered in its polarizing power by acids. This substance is undoubtedly glucose syrup.

A further confirmatory test was sought in the polarization of the samples after inversion at 86° C. At this temperature invert sugar becomes optically inactive and if honey consists, as it is stated generally to consist, of invert and cane sugar, it should not affect the polarized ray to any considerable extent at 86° C. But we have found a strong right-handed polarization in genuine honey on raising the temperature of the solution to 86°. This phenomenon, at present unexplained, will be further studied.

HONEY ANALYSES.

	Sp. gr. at 17° C. 1 part honey, 2 parts water.	Copper-reducing power. Direct calculated as Dextrose.	Copper-reducing power. Inv'rt'd calculated as cane sugar.	Polarization. Direct. Reading.	Polarization. Direct. Temp.	Polarization. After inversion. Reading.	Polarization. After inversion. Temp.	Polarization. After inversion. At 86° C.	Ash.
From flowers and fruits, sent in the comb.	1.115	61.72	6.91	— 2.2	15°	— 4.2	17°	+ 18.7	.61
From basswood bloom, liquid, strained	1.115	67.00	3.04	— 7.0	17°	— 11.4	13°	+ 14.1	.40
Same as last, but granulated	1.114	66.64	3.61	— 6.4	20°	— 9.9	20°	+ 13.0	.51
Comb honey	1.113	67.30	1.77	— 8.8	15°	— 13.0	15°	+ 13.4	.38
Strained honey from the Station	1.114	67.40	2.20	— 6.4	20°	— 12.1	16°	+ 12.8	.40
Market Honey in the comb	1.1165	72.84	2.58	— 9.6	24°	— 18.0	18°	+ 9.0	.29
"Choice Clover Honey"	1.112	56.48	2.85	+ 61.4	23°	+ 55.0	20°	+ 51.7	.24
"Superior New Honey"	1.112	50.84	2.62	+ 72.0	24°	+ 64.4	18°	+ 68.6	.08
"Pure Northern Honey"	1.113	45.48	2.04	+112.8	22°	+110.2	14°	+103.4	.27
"Pure Orange Blossom Honey"	1.1125	65.44	1.56	+ 24.0	22°	+ 29.0	14°	+ 34.1	.18
"Pure Honey"	1.1117	53.52	.68	+122.6	26°	+122.1	17°	+113.3	.29

FIELD EXPERIMENTS WITH PHOSPHATES.

The cost of phosphoric acid in fertilizers varies greatly according to the material in which it is purchased. Thus in superphosphates prepared from bone black it costs at present about 8 cents a pound, in dissolved South Carolina Rock between 5 and 6 cents, in Bolivian Guano a little over 4 cents and in Grand Cayman's Phosphate and ground South Carolina Rock about 3 cents. Without doubt the more expensive superphosphates applied in moderate quantity will generally make a larger yield on land deficient in phosphoric acid, than the same quantity of the cheaper raw phosphates or natural phosphates as they are called. But since almost three times as much phosphoric acid can be bought for the same money in raw phosphates as in superphosphates it becomes a very practical question whether their prices stand in close relation to their agricultural value; whether for some crops instead of using a small quantity of superphosphate it may not pay to use a larger quantity of some other less soluble phosphate which costs less per pound. Last year a single experiment on this point was carried out with the assistance of Mr. W. I. Bartholomew of Putnam. The same experiment substantially has been repeated this year with the coöperation of the following gentlemen:

Mr. W. I. Bartholomew, Putnam.
Mr. W. H. Yeomans, Columbia.
Mr. W. R. Fish, Mystic Bridge.
Mr. C. A. Sill, Saybrook.
Mr. C. S. Andrews, Jr., New Britain.
Mr. E. A. Russell, Suffield.
Mr. Robert Aitken, Shaker Station.
Mr. G. F. Platt, Milford.
Mr. Edwin Hoyt, New Canaan.

The results are given in detail on the following pages. The general plan of experiment was as follows:

Land was in all cases selected which in the judgment of its owner was uniform in quality, which had all been cultivated alike and which had not been manured for some years. Only on such land could it be expected that one plot would give the same yield as another plot similarly treated and that a fertilizer would considerably increase the yield.

Over the whole experimental field was broadcast a liberal quantity of nitrogenous matter and potash salts—more than sufficient for a maximum crop. This was essential in order that the yield should be limited by the quantity of phosphoric acid in the soil and not by either nitrogen or potash.

The field was then divided into 7 or more plots which were designated by letters A, B, C, etc., and on which the different phosphates were applied.

The phosphates chosen for comparison were: 1. Dissolved Bone Black, containing 16.53 per cent. of phosphoric acid; 2. A finely pulverized phosphatic rock, from Grand Cayman Island in the Caribbean Sea, containing considerable iron and alumina with 26.22 per cent. of phosphoric acid, placed at our disposal by N. B. Powter, Esq., 181 Pearl street, N. Y.; 3. Thomas-Slag, a bye-product of the steel manufacture, furnished by Paul Weidinger, Esq., No. 76 Pine street, N. Y., and containing 19.6 per cent. of phosphoric acid. 4. Ground South Carolina Rock, containing 25.5 per cent. of phosphoric acid. 5. Bolivian Guano. A phosphatic guano from the West Indies, furnished by the Quinnipiac Co. of New London, containing 17.2 per cent. of phosphoric acid. The analyses are given on pages 36 and 37 of this Report (Part I).

On the first plot a quantity of Dissolved Bone Black was used which it was believed would insure a fair yield and yet would not be in excess of the needs of a full crop but rather slightly deficient.

A single plot was given to each of the other phosphates and they were used in such quantity that the cost of each was just equal to the cost of the dissolved bone black on the first plot. Two or more plots received no phosphate and thus served to show the natural capacity of the soil itself to supply phosphoric acid to the crop.

The land was planted and cultivated as usual and the weight of the crop at harvest was taken in almost all cases by a representative of the Station. A fuller discussion of the reasons for the particulars of the experiment may be found in the last Report of this Station.

Experiments carried out by Mr. W. I. Bartholomew, Putnam.

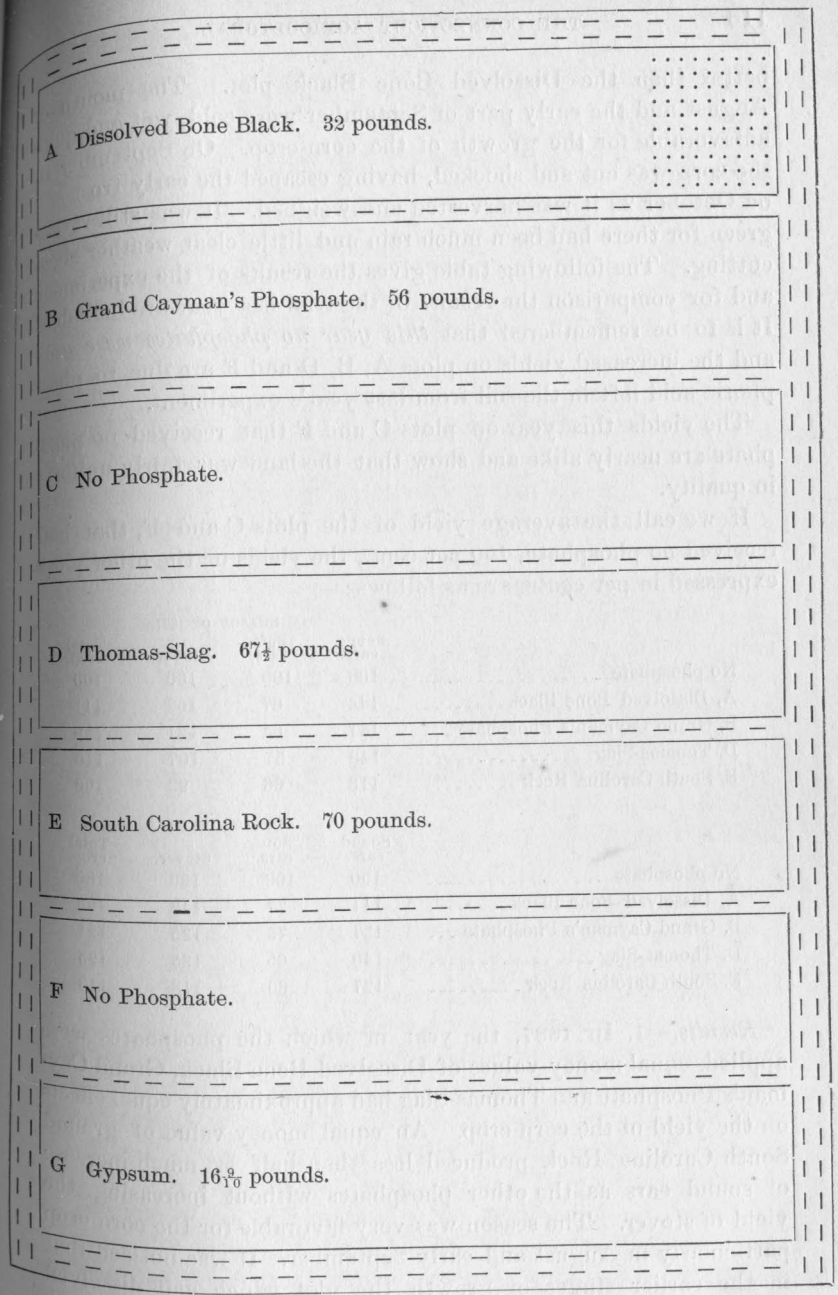
Experiment No. 1.—With Indian Corn.

The first experiment is a repetition of the trial made last year and described in our last Report, page 110. The land used for the experiment is high, gently sloping to the southwest. The soil is a dark loam, moist, with clayey sub-soil. In the fall of 1886 the land had been sown to rye, which was badly winter-killed. In 1887 it was used for an experiment like the present one. The details of that experiment are as follows. After plowing, 200 pounds of muriate of potash and 100 pounds of sulphate of ammonia were broadcast on the acre, the soil was well pulverized with a Thomas smoothing harrow and laid out in seven plots, each 10 rods long and 2 rods wide, containing one-eighth of an acre. On these plots a small variety of flint corn, Rhode Island White Cap, was planted in hills about 3 feet and 3 inches apart each way making 10 rows containing 500 hills in each plot. The phosphates were put in the hill. The general arrangement and the quantities of the phosphates used are shown in the diagram. The cost of the phosphatic material used on each plot was the same. At hoeing time the corn was thinned to five stalks to a hill. The year was uncommonly favorable for the corn crop. It was cut Sept. 20, and husked and weighed Oct. 14th. The yields will be spoken of presently.

This year the land was plowed again. 320 pounds of muriate of potash and 160 pounds of sulphate of ammonia were broadcast on the same field, but no phosphates were used. The same variety of maize was planted, the date and the method of planting and cultivation were precisely the same as last year. This experiment then should show whether the phosphates used last year and not then removed by the crop were still available for corn and how the different phosphates compared in this regard.

The crop grew without accident. A short but violent rain-fall on the evening of June 15 (nearly an inch of water fell in about half an hour) washed the surface somewhat, running off between the rows, but could not have very seriously interfered as the fertilizers had been pretty well worked in previously.

During the summer it was evident that the plot on which Thomas-Slag had been used the year before was doing best and the one which had Grand Cayman's stood next, both decidedly



The plots are 2 rods wide and 10 rods long and contain one-eighth of an acre each. The hills of corn are one-fifth of a rod apart each way and the outside hills are one-tenth of a rod from the edge of the plot. Between the plots are spaces one-fifth of a rod wide and in the middle of each space is a single row of potatoes. The whole ground under experiment is surrounded by a double row of potatoes.

better than the Dissolved Bone Black plot. The month of August and the early part of September were cold, wet and quite unfavorable for the growth of the corn crop. On September 14 the corn was cut and shocked, having escaped the early frost and on October 22 it was harvested and weighed. It was still rather green for there had been much rain and little clear weather since cutting. The following table gives the results of the experiment and for comparison the results of the trial last year are included. It is to be remembered that *this year no phosphates were used* and the increased yields on plots A, B, D and E are due to phosphoric acid left in the soil from last year's experiment.

The yields this year on plots C and F that received no phosphate are nearly alike and show that the land was fairly uniform in quality.

If we call the average yield of the plots C and F, that had received no phosphate, 100 per cent., the yields of the other plots expressed in per cents, are as follows:—

	Season of 1887. Sound ears.	Soft ears.	Stover.	Total crop.
No phosphate	100	100	100	100
A, Dissolved Bone Black	144	67	102	111
B, Grand Cayman's Phosphate	141	64	121	119
D, Thomas-Slag	140	57	107	110
E, South Carolina Rock	118	66	99	100

	Season of 1888. Sound ears.	Soft ears.	Stover.	Total crop.
No phosphate	100	100	100	100
A, Dissolved Bone Black	111	77	112	106
B, Grand Cayman's Phosphate	137	73	125	121
D, Thomas-Slag	140	65	135	125
E, South Carolina Rock	127	80	118	115

Results.—1. In 1887, the year in which the phosphates were applied, equal money values of Dissolved Bone Black, Grand Cayman's Phosphate and Thomas-Slag had approximately equal effects on the yield of the corn crop. An equal money value of ground South Carolina Rock produced less than half as much increase of sound ears as the other phosphates without increasing the yield of stover. The season was very favorable for the corn crop particularly in August and early September. It was noticed that in the earlier stages of growth the plot which had dissolved Bone Black showed better development of the corn than the other plots but this difference disappeared before harvest.

Weights in Pounds of Field-cured Crops.

[Mr. Bartholomew's Experiment of 1888 with Indian Corn.]

Phosphates applied in 1887.	Sound Corn and Cob.		Soft Immature Corn and Cob.		Total Weight of Ears.		Stalks, Leaves and Husks.		Total Weight.	
	1887	1888	1887	1888	1887	1888	1887	1888	1887	1888
A, Dissolved Bone Black	479	345	108	108	587	453	472	434	1059	887
B, Grand Cayman's Phosphate	469	427	102	102	571	529	559	485	1130	1014
C, No Phosphate	319½	334	178	121	497½	455	465½	392	963	847
D, Thomas-Slag	463½	434	90½	91	554	525	494	526	1048	1051
E, South Carolina Rock	394	396	105½	112	499½	508	459½	459	959	967
F, No Phosphate	343½	289	140	159	483½	448	459½	386	943	834
G, Plaster	376	266	113	161	489	427	456	---	945	---

2. In 1888, no phosphates were applied. The plot which received Dissolved Bone Black the year before, produced only 11 per cent. more sound corn than the no-phosphate plots and only 6 per cent. more of total crop; while the plots which had Grand Cayman's Phosphate and Thomas-Slag produced nearly 40 per cent. more of sound ears and 25 per cent. more total crop than the no-phosphate plots and South Carolina rock 27 per cent. more of sound ears and 15 per cent. more of total crop.

An explanation of these facts may be found in the following statement which shows the quantity of phosphoric acid which was applied to the plots last year, the amount of phosphoric acid removed by the crop of last year and that of the present year, and besides the amount of phosphoric acid left in the soil. It will be seen that where dissolved bone black was applied last year there was not quite sufficient phosphoric acid left in the soil from this application to meet the requirements of the crop this year; therefore, it is not surprising that the yield this year on plot A is little larger than on the plot which had received no phosphate either last year or this.

	Phosphoric acid applied in 1887.	Phosphoric acid removed by crop in		Phosphoric acid remaining in the soil after the crop of 1888.
		1887.	1888.	
Plot A	40.6 lbs.	23.9	20.1	— 3.4
B	132.2	24.5	22.0	86.7
D	105.3	23.0	23.0	59.3
E	140.0	21.1	21.1	97.8

3. It will be seen that the effects of Grand Cayman's Phosphate and Thomas-Slag are as great this year as they were last year immediately after being applied. The percentage increase in crop in the case of Grand Cayman's Phosphate is exactly the same as last year, namely, 17 per cent., while the increase percentage of Thomas-Slag is a trifle larger, namely, 16 per cent. as against 13 per cent. last year. The Ground So. Carolina Rock made larger percentage increase this year than last, showing that it is slowly becoming available in the soil. These results need to be verified by other experiments on different soils but are instructive in themselves.

On this particular piece of land and in these two seasons Thomas-Slag and Grand Cayman's Phosphate have been more profitable than the Dissolved Bone Black.

Experiments Nos. 2 and 3.—With Potatoes.

Mr. Bartholomew carried out two other experiments of the same kind as the one described above, but with potatoes instead of corn. Both were in the same field with the first experiment. One was on land where rye grew in 1887, the other on land which was mowed in that year. In each there were seven plots, 5 rods long and 2 rods wide, making one-sixteenth of an acre in each plot. The spaces between the plots were the same as described on page 115.

Over each half acre were broadcast 240 pounds double sulphate of potash and magnesia and 80 pounds of sulphate of ammonia.

At planting the following quantities of phosphates were applied to the plots in *each* experiment.

A, 20 pounds Dissolved Bone Black.
B, 29 pounds Grand Cayman's Phosphate.
C, no phosphate.
D, 34.6 pounds Thomas-Slag.
E, 43.3 pounds ground South Carolina Rock.
F, no phosphate.
G, 34.7 pounds Bolivian Guano.

The following table gives the results of the experiments.

WEIGHT OF POTATOES IN MR. BARTHOLOMEW'S EXPERIMENT WITH PHOSPHATES.

	Experiment II. Planted after Rye.			Experiment III. Planted on Meadow Land.		
Phosphates applied.	Large.	Small.	Total.	Large.	Small.	Total.
A, Dissolved Bone Black	620	125	745	665	130	795
B, Grand Cayman's Phosphate	618	120	738	557	144	701
C, No Phosphate	475	120	595	550	88	638
D, Thomas-Slag	585	165	750	559	150	709
E, South Carolina Rock	462	130	592	570	120	690
F, No Phosphate	480	105	585	495	150	645
G, Bolivian Guano	540	136	676	491	105	596

The agreement between the plots C and F, which received no phosphate, in respect to yield is close enough to make it probable that the land was fairly uniform in quality.

If the average total yield of plots C and F is taken as 100 per cent., the comparative yield on the other plots is as follows:

	On Rye Land.	On Meadow Land.
C and F, No Phosphate	100	100
A, Dissolved Bone Black	126	124
B, Grand Cayman's Phosphate	125	109
D, Thomas-Slag	127	110
E, Ground South Carolina Rock	100	108
G, Bolivian Guano	114	93

Results.—The striking result of these experiments is that on the rye land both Grand Cayman's Phosphate and Thomas-Slag produced as large an increase over the no-phosphate plots as did Dissolved Bone Black. Bolivian Guano gave only half as much increase and Ground South Carolina Rock produced no increase at all.

But on inverted sod, while Dissolved Bone Black gave the same increase as on the rye land, Grand Cayman's Phosphate and Thomas-Slag gave very much less. South Carolina Rock gave as large an increase as these, while the Bolivian Guano yielded actually less than the plots to which no phosphate was applied.

Experiment No. 4.—With Indian Corn.

Mr. Bartholomew made for the Station a fourth experiment with the phosphates named, which was very nearly like the one made by him last year. An acre of land in the same field with the experiments just described was marked off to the north of and immediately adjoining the land on which the corn experiment was made last year and this. The plots were arranged and fertilized precisely as is described on page 115, except that Bolivian Guano was substituted for gypsum. The land had been in meadow, broken up last spring, and had received no manure for years. It was thought to be of uniform quality when planted, but great unevenness in the growth of the crop was noticed in the field as the season advanced. Many years ago—the precise number could not be determined—some manure heaps had stood on the west ends of the several plots and their effects could be plainly seen in the larger yields of sound ears and of stover on the west ends of the plots. The results of the experiment are given in the following table. In the columns headed E and W are given the weights of crop grown on the east and west ends of each plot.

WEIGHTS IN POUNDS OF FIELD-CURED CROPS.

[Mr. Bartholomew's Experiment No. 4 with Corn on Meadow Land.]

	Sound Ears.			Soft Ears.			Stalks, Leaves and Husks.			Total Weight of Crop.
	E.	W.	Total.	E.	W.	Total.	E.	W.	Total.	
A, Dissolved Bone Black	182	225	407	63	78	141	374	303	677	1225
B, Grand Cayman's Phosphate	164	204	368	56	47	103	232	262	494	965
C, No Phosphate	154	211	365	65	58	123	240	311	351	1039
D, Thomas-Slag	190	207	397	64	58	122	300	295	595	1114
E, South Carolina Rock	130	201	331	81	56	137	232	292	524	992
F, No Phosphate	74	112	186	80	82	162	173	191	364	712
G, Bolivian Guano	156	208	364	69	62	131	226	295	521	1016
	1050	1368		478	441		1777	1949		

It will be seen that on one of the no-phosphate plots the yield of sound ears was twice as large as on the other, and the yield of soft ears, and stover were also very different. The only conclusion justified by the results is that the land was not uniform in quality and not suited to the experiment.

This is the unsatisfactory issue of very many such experiments, an issue which cannot be foreseen or fully guarded against. The laying out of the land, the care of the crop and the weighing and recording of results were faultless.

Experiment carried out by Mr. W. H. Yeomans, Columbia.

The general arrangement of the experiment was the same as has already been described on pages 112 and 113. Muriate of potash was applied at the rate of 320 pounds and sulphate of ammonia at the rate of 200 pounds per acre. The separate plots contained each one-sixteenth of an acre. The quantities of phosphate applied are given in the following table,—the money value of the phosphate applied to each plot was the same.

Mr. Yeomans' notes supply all other details and are as follows:

"May 8th. Plowed the ground—a yellow, gravelly loam, with a clayey subsoil—that had been cropped with buckwheat the season before, being dressed with a superphosphate at the rate of 150 pounds per acre; previous to that had been in pasturage for a good number of years. At the time of plowing the soil was in good condition, but the next day it came on wet, continuing until the 10th, when after raining through the night the weather improved.

May 22d. The sulphate of ammonia and muriate of potash were sown on and harrowed in. The phosphates were put in the hill. Commenced planting the corn in the afternoon and finished on the 23d, with warm and pleasant weather and the ground in fine condition. From the 24th the weather continued cloudy and misty, with showers of rain until June 1st; with the exception of May 30th when there was some sun.

June 1st. The corn commenced to come up; that planted on the Thomas-Slag presenting the best appearance.

June 13th. Commenced hoeing the first time in the afternoon, finishing the forenoon of the 14th. At this time A and H presented an appearance of superiority, the other plots showing no distinctive difference.

June 21st. A and H making rapid growth with H leading. G but little better, if any, than C and F.

June 26th. Commenced hoeing the second time in the afternoon finishing in the forenoon of the 27th. A and H looking finely, showing less difference, while all the other plots continue backward.

During July the plots B, D, E and G showed quite a little improvement, and on August 1st, when A and H had commenced the development of ears, these exhibited no tendency to earing, but as the season advanced ear-formation commenced.

Sept. 19th. A and H well advanced in ripening. B appears quite fair in earing. D, E, G, have made some ears while C and F are very light. At the time of planting each plot consisted of five rows of fifty-five hills in each row, or two hundred and seventy-five hills in each plot; and to provide against loss from failure to germinate and from worms or usual depredations and have a stand of four stalks in each hill, six kernels were planted in each hill. It germinated unusually well, but cut worms made considerable havoc with it during the early growth. By the six kernels each plot should have had 1650 stalks, and allowing for a reduction of four in each hill upon an average, there should have been 1100 stalks.

The stalks in the several plots were counted carefully, giving the following result:

	Number of stalks.	More (+) or less (—) than a full stand.
A	991	—109
B	1073	— 27
C	919	—181
D	1122	+ 22
E	1008	— 92
F	985	—115
G	852	—248
H	979	—121

Sept. 25th. The corn was cut and placed in stacks, had not been affected by frost and was in good condition.

Nov. 15th. Corn husked and stalks weighed. The stalks on A and H were much the largest, those on H being larger than those on A, a feature which was marked during a considerable period of

the growth. On husking, the corn on A had more sound, smaller and compact ears than was the case with H, where the ears grew somewhat longer but only one upon a stalk, while many of the stalks of A had two ears each."

The results of the experiment are given in the following tables:

Actual Weights of Crops as Harvested.

(Mr. Yeomans' Experiment.)

	Stover.	Sound Ears.	Soft Ears.	Total Ears.
A, 16 pounds dissolved Bone Black	211	198	21¾	219¾
B, 23 pounds Grand Cayman's Phosphate	133	76½	54½	131
C, No Phosphate	78	2	34½	36½
D, 27½ pounds Thomas-Slag	118	34¾	58	92¾
E, 34½ pounds ground South Carolina Rock	106	18½	57	75½
F, No Phosphate	69	5¼	32½	37¾
G, 27½ pounds Bolivian Guano	102	23¾	41	64¾
H, 32 pounds dissolved Bone Black	293	179	31¾	210¾

These results have been re-calculated in the next table to a full stand of corn in this way. Plot A had 991 stalks on it which yielded 211 pounds of stover. A full stand would have been 1100 stalks. If 991 stalks yielded 211 pounds of stover, 1100 stalks would have yielded $\frac{211 \times 1100}{991} = 234.1$ pounds.

Weights of Crops, Making Allowance for Missing Stalks.

(Mr. Yeomans' Experiment.)

	Stover.	Sound Ears.	Soft Ears.	Total Ears.	Total Crop.
A, Dissolved Bone Black	234.1	219.8	24.1	243.9	478.0
B, Grand Cayman's Phosphate	136.3	78.4	55.8	134.2	270.5
C, No Phosphate	93.3	2.4	41.3	43.7	137.0
D, Thomas-Slag	115.6	34.0	56.8	90.8	206.4
E, Ground South Carolina Rock	115.6	20.2	62.0	82.2	197.8
F, No Phosphate	76.9	5.9	36.5	42.4	119.3
G, Bolivian Guano	131.6	30.7	52.9	83.6	215.2
H, Double quality dissolved Bone Black	329.2	201.1	35.6	236.7	565.9

It appears in the first place that Mr. Yeomans' field was naturally poor in assimilable phosphoric acid and in this regard was suitable for the experiment. A moderate application of Dissolved Bone Black produced a three-fold increase of total crop and a five-fold increase of ears.

It also appears that the land was tolerably uniform in quality so that it is fair to assume that the differences in the yield of the plots were mainly due to differences in the effect of the phosphates, not largely to differences of soil.

Thus the two plots which received no phosphates produced 43.7 and 42.4 pounds of ears and 93.3 and 76.9 pounds of stover, respectively. Again the quantity of Dissolved Bone Black applied to A was not excessive, for while double the quantity, on plot H, gave 7 pounds less of ears it increased the yield of stover by 95 pounds. Mr. Yeomans' observation is noteworthy in this connection that the ears on A were rather smaller, but more compact and sounder than on H, where a double quantity of Dissolved Bone Black was used, and many stalks had two ears while on H there were no stalks with two ears.

If we call the average yield of the two plots which received no phosphate, C and F, one hundred per cent. then the yields on the plots will compare as follows:

	Ears.	Stover.	Total Crop.
C and F, No Phosphate	100	100	100
A, Dissolved Bone Black	567	275	373
B, Grand Cayman's Phosphate	312	160	211
D, Thomas-Slag	211	136	161
E, South Carolina Rock	191	136	155
G, Bolivian Guano	194	155	168
H, Double quantity Bone Black	550	387	442

Looking first at the yield of ears; where Dissolved Bone Black was used only a small portion of the ears were soft or immature, but everywhere else the proportion was large and except on B, Grand Cayman's Phosphate, much more than half. Dissolved Bone Black produced nearly three times the weight of sound ears that the Grand Cayman's Phosphate produced and about seven times as much as any other phosphate.

Of stover, Dissolved Bone Black yielded 1¾ times as much as Grand Cayman's Phosphate or Bolivian Guano and twice as much as Thomas-Slag or ground South Carolina Rock.

Results.—In general it may be fairly said that in this experiment, this year, Dissolved Bone Black yielded twice the return that an equal money value of any other phosphate yielded, that Grand Cayman's Phosphate came next, though greatly inferior in effect and that Bolivian Guano, Thomas-Slag and ground South Caro-

lina Rock did not differ greatly in crop-producing power and the plots which receive them gave about 1½ times as much crop as those which received no phosphates.

Experiment carried out by Mr. W. R. Fish, Mystic, Conn.

The land for this experiment was high but moist and had been in grass and pasture for some years without top-dressing. It was laid off in plots each containing one-eighth of an acre. Between the plots a row of beans was planted as a marker.

The whole acre received 320 pounds of muriate of potash and 200 pounds of sulphate of ammonia, broadcast and harrowed in.

The phosphates were also broadcast and harrowed in. The land was planted the last week in May. The crop was cultivated as usual and suffered no accident. When harvested, Nov. 5, it was very green and had moulded slightly on account of the weather which was everywhere extremely unfavorable.

The results are as follows:—

Weights of Crops as Harvested.

(Experiment of Mr. Fish.)

	Sound Ears.	Soft Ears.	Stover.	Total Crop.
A, 32 pounds Dissolved Bone Black	437½	66½	473	977
B, 46.4 pounds Grand Cayman's Phosphate	455½	68	419	942½
C, No Phosphate	479	52	438	969
D, 55½ pounds Thomas-Slag	473½	73½	485	1032
E, 69½ pounds ground So. Carolina Rock	504	57	477	1038
F, No Phosphate	447	92½	475	1014½
G, 55½ pounds Bolivian Guano	431½	77½	464	973
H, 64 pounds Dissolved Bone Black	478½	54½	527	1060
I, About 7 cords stable manure per acre	384	73	392	849

The average yields on the two plots which received no phosphates and the percentage differences between the average and the yield of each plot are as follows:—

	Average yield.	Percentage difference.
Sound Ears	463	3.4
Stover	456½	4.0
Total crop	991¾	2.3

The percentage increase, (+), or decrease, (—), on the several plots over the average of the no-phosphate plots is as follows:—

	Sound Ears.	Stover.	Total Crop.
A, Dissolved Bone Black	— 5.5	+ 3.6	— 1.5
B, Grand Cayman's Phosphate	— 1.6	— 8.2	— 5.0
D, Thomas-Slag	+ 2.2	+ 6.3	+ 4.0
E, Ground So. Carolina Rock	+ 8.8	+ 4.5	+ 4.6
G, Bolivian Guano	— 6.8	+ 1.6	— 1.9
H, Double quantity Dissolved Bone Black	+ 3.3	+15.5	+ 6.9
I, 7 cords stable manure to the acre	—17.1	—14.2	—14.4

Results.—Study of these results shows that the experiment, though carried out by Mr. Fish with all care and accuracy, throws no light on the question of the relative value of the phosphates. The reason is that the yield was not in any case strikingly increased by the application of phosphate so that probably the soil itself contained sufficient phosphate for the crop. In that case no difference could be looked for in the effects of the different phosphates.

Experiment carried out by Mr. C. A. Sill, Saybrook.

Six years ago the land under experiment had potash salts and dissolved bone black and grew a good crop of corn. The following spring oats were sowed with a complete fertilizer. Since then the land has been in grass and has had no manure or fertilizer of any kind. It was plowed May 17 and the plots laid out, each containing one-tenth of an acre and running north and south.

On the south half of each plot muriate of potash was sowed at the rate of 160 pounds per acre and on the north half double sulphate of potash and magnesia at the rate of 320 pounds per acre. May 23d sulphate of ammonia was applied broadcast over all the plots at the rate of 200 pounds per acre and well harrowed with a wheel harrow.

The phosphates were broadcast on the several plots as indicated below and harrowed lengthwise.

May 24. Planted 296 hills of medium yellow flint corn on each plot. The seed was all shelled together and coated with coal tar.

June 2. Corn coming up. June 9, cultivated and hoed. June 20, cultivated. June 26, hoed and thinned to 3 plants in a hill. July 7, cultivated. July 30, hoed.

On the 22d and 23d of October the crop was harvested and weighed. The results follow:—

Weights in Pounds of Field-Cured Crops.

(Mr. Sill's Experiment.)

	Sound Ears. lbs.	Nubbins and Soft Corn. lbs.	Stover. lbs.	Total Crops. lbs.
A, 26 pounds Dissolved Bone Black	571½	33¼	954¼	1559
B, 37 pounds Grand Cayman's Phosphate	520½	37	789½	1347
C, No Phosphate	490¾	35	696	1221
D, 45 pounds Thomas-Slag	552	20	755	1327
E, 56 pounds S. Carolina Rock	580½	24¾	867¾	1473
F, No Phosphate	533½	37½	800	1371
G, 45 pounds Bolivian Guano	532¼	29¼	776½	1338
H, 26 pounds Dissolved Bone Black	515¼	27	737¾	1280
I, 52 pounds Dissolved Bone Black	528¾	23¾	830½	1383

The yield of sound ears on the two plots which had no phosphate differed by 42¾ pounds or 8 per cent. of the average yield. Hence no effect on the yield of sound ears can be ascribed with certainty to a phosphate if the plot on which it was applied did not yield over 8 per cent. more than the plots which received no phosphate. The per cent. increase of yield of sound ears on the plots which had phosphate over the average yield of the plots which had none, is as follows:—

A, Dissolved Bone Black	11.5
B, Grand Cayman's Phosphate	1.6
D, Thomas-Slag	7.8
E, South Carolina Rock	13.3
G, Bolivian Guano	4.0
H, Dissolved Bone Black	.6
I, Double quality Dissolved Bone Black	3.0

It appears that an increase of more than 8 per cent. over the average yield on the plot which had no phosphate was obtained on only two plots A and E; that there was a difference of 11 per cent. in the yield of plots A and H which received the same quantity of Dissolved Bone Black. Moreover the yield of sound ears on one of the no-phosphate plots, F was greater than on any which received phosphates, except A and D.

Result.—These facts indicate that the land which appeared to be quite uniform in quality and which we had anticipated would be much benefited by phosphates was not uniform in quality nor deficient in assimilable phosphoric acid and for these reasons was unsuited for this special experiment. The experiment was carried out by Mr. Sill with great exactness and was noted by an officer of the Station who examined it in the summer, as one of the most promising experiments of the series.

Experiment carried out by Mr. E. A. Russell, Suffield.

The soil of the field used for this experiment was a rather light loam and had been in grass with no manure for a considerable number of years. The field sloped to the west and the plots and rows ran from east to west. Muriate of potash at the rate of 320 pounds and sulphate of ammonia at the rate of 200 pounds per acre were broadcast over the whole piece. Each plot contained one-tenth of an acre. The phosphates were used in the hill, "Angel-of-Midnight" corn was planted on the 21st and 22d of May, in hills 3¼ feet apart each way, 4 stalks in a hill. Wire worms destroyed considerable of the corn before it came up and as the seed gave out, some Canada corn was used for planting over (on June 9) which matures a little earlier than the other. At the second hoeing a few hills had to be planted again. It was noticed August 1st when an officer of the Station examined the field that from plots A to G, the stand on the upper end of the plots was considerably lighter than on the lower end. The crop was cultivated in the usual way and the corn cut and stacked on the 18th and 19th of September. On Oct. 19th, the stacks were weighed ready for husking. Rain came on and the husking could not be finished and the ears weighed till the 25th. Following are the results:—

Weights of Field-cured Crops.

(Mr. Russell's Experiment).

	Sound ears.	Soft ears.	Stover.	Total crop.
A, 26 pounds Dissolved Black	527½	9¾	1037¾	1575
B, 37 pounds Grand Caymen's Phosphate	477	12¼	807¾	1297
C, no phosphate	439	24¼	828¾	1292
D, 45 pounds Thomas-Slag	377	95¾	754¼	1227
E, 56 pounds Ground So. Carolina Rock	349	98¾	728¼	1176
F, no phosphate	345	108¾	770¼	1224
G, 45 pounds Bolivian Guano	415	78¼	921¾	1415
H, 52 pounds Dissolved Bone Black	450½	74	930½	1455
I, no phosphate	364½	68	798	1230½
J, 50 pounds Swift Sure Superphosphate	448½	52½	996	1497

The average weights of crops on the three plots which received no phosphates, and the largest percentage difference between this average and the yield on any single one of the three plots are as follows:—

	Average yield.	Percentage difference.
Sound ears	382.8	14.7
Stover	799	3.6
Total crop	1248⅚	3.5

Since the differences in the natural capacity of the soil of different plots are equivalent to 14.7 per cent. of the total yield of sound ears at least, it follows that unless an increase of yield of sound ears on a plot which received phosphate amounts to more than 15 per cent. of the average yield on the no-phosphate plots, the increase cannot fairly be attributed to anything other than the inequalities of the soil. For the same reason differences of 4 per cent. in the yield of stover or total crop are not significant.

The percentage increase (+), or decrease (—), of yield on the plots which received phosphate over the average of the unmanured plots is as follows:—

	Sound ears.	Stover.	Total crop.
A, Dissolved Bone Black	+37.7	+30.0	+26.1
B, Grand Cayman's Phosphate	+24.6	+ 1.0	+ 3.9
D, Thomas-Slag	— 1.5	— 5.7	— 1.8
E, South Carolina Rock	— 8.9	— 8.9	— 5.8
G, Bolivian Guano	+ 8.4	+15.4	+13.3
H, Double quantity Dissolved Bone Black	+17.7	+16.4	+16.5
J, Swift Sure Superphosphate	+17.2	+25.0	+20.0

Result.—It appears that Thomas-Slag and South Carolina Rock had no effect on the yield, and that Bolivian Guano had only very little, if any effect. Dissolved Bone Black increased the yield both of sound ears and stover noticeably, and Grand Cayman's Phosphate increased the yield of sound ears, but not of stover or of total crop.

Experiment Carried Out by Mr. C. S. Andrews, Jr., New Britain.

The soil of the experiment field was a light sandy loam. It had not been manured for 10 years, had been in grass for some years and was believed to be in an exhausted condition. It would not yield half a ton of hay to the acre. The plots each

contained one-eighth of an acre (2 rods wide and 10 rods long) and were separated by a strip of turf 3 feet wide. The plots and rows ran north and south. On the acre and one-eighth were broadcast 320 pounds of muriate of potash and 200 pounds of sulphate of ammonia. The phosphates were put in the hill. The corn was a variety called Top-over. The rows were about 3½ feet apart, hills 3½ feet in the row. Five kernels were planted in a hill and thinned to 4. The blackbirds pulled a very little of it, necessitating some replanting.

The planting was done May 21. The crop was carefully cultivated, cut and stacked without suffering from frost, husked Oct. 16th, and weighed shortly after. Severe and frequent rains made it difficult to weigh the stover when it was in good condition.

Following are the results:

Weights of Field-cured Crops.

(Mr. Andrews' Experiment.)

	Sound Ears.	Soft Ears.	Stover.	Total Crop.
A, 32 pounds dissolved Bone Black	372¾	69½	704	1146¼
B, 46 pounds Grand Cayman's Phosphate	338½	58	641	1037½
C, No Phosphate	337	64½	628	1019½
D, 56 pounds Thomas-Slag	334	62	707	1103
E, 69 pounds So. Carolina Rock	275	81¾	550	906¾
F, No Phosphate	259½	70½	497	827
G, 55 pounds Bolivian Guano	309	68	602	979
H, No Phosphate	320½	60½	614	995
I, 64 pounds dissolved Bone Black	278	58½	629	965½

The average weights of crop on the three plots which received no phosphates and the largest percentage difference between the *average* yield and that of any one plot are as follows:

	Average yield.	Percentage difference.
Sound Ears	306	15.2
Stover	579	14.2
Total Crop	947	12.7

The percentage increase, or decrease, (—), of yield on the several plots calling the average yield on the unmanured plots 100 per cent. is as follows:

	Sound Ears.	Stover.	Total Crop.
A, Dissolved Bone Black	21.8	21.6	21.0
B, Grand Cayman's Phosphate	10.6	10.8	9.5
D, Thomas-Slag	9.1	22.1	16.5
E, South Carolina Rock	−10.0	− 5.0	− 4.3
G, Bolivian Guano	.9	3.9	3.4
I, Double quantity Dissolved Bone Black	9.2	8.6	2.0

Result.—It appears that in this experiment there was only a single plot [A, Dissolved Bone Black], where the increase of crop over the average of the no-phosphate plots was decidedly larger than the variation of the no-phosphate plots among themselves. The land, therefore, was not uniform in character and not strikingly deficient in assimilable phosphoric acid; for these reasons alone the results do not help to solve the special point under experiment, viz: the relative value of the phosphates named.

Experiment carried out by Mr. Robert Aitken, Shaker Station.

The soil of the experiment field was a light, sandy loam. It had not been cropped or manured for four years. Over an acre of the field, after plowing, were broadcast 320 pounds of muriate of potash and 200 pounds of sulphate of ammonia. Nine plots were laid off, each containing one-tenth of an acre, with a four foot space between the plots. On these plots the phosphates named below were broadcast with great care. The seed was "Brainard Corn," a flint variety. The hills stood $3\frac{2}{3}$ feet apart each way, with four stalks to a hill. The piece was planted May 25th, and cultivated as usual. When visited in August by an officer of the Station no missing hills were found, but all through the piece were spots where the corn was weak and poor. The plots ran from east to west and the east side of each plot seemed to have the heaviest stand. No reason could be given for these defects, as there was every reason to believe that the whole piece was uniform in quality.

The corn was cut about the 15th of September. It was husked and harvested Oct. 16. The weather was extremely unfavorable, as there was rain almost every day for two weeks. The crops on plots A to F inclusive were weighed that day, but continuous rain prevented harvesting the others till the 22d. This in itself made the experiment less satisfactory. Following are the results:

Weights in Pounds of Field-Cured Crops.

(Mr. Aitken's Experiment.)

Phosphates Applied.	Sound Ears. lbs.	Stover. lbs.	Total Crop. lbs.
A, 26 pounds Dissolved Bone Black	486½	630	1116½
B, 37 pounds Grand Cayman's Phosphate	538	750	1288
C, No phosphate	504	694	1198
D, 45 pounds Thomas-Slag	552	806	1358
E, 56 pounds So. Carolina Rock	492	798	1290
F, No phosphate	432	548	980
G, 45 pounds Bolivian Guano	461	748	1209
H, No phosphate	478	524	1002
I, 52 pounds Dissolved Bone Black	491	644	1135
K, No Fertilizer of any kind	252	318	570
L, 30 pounds Muriate of Potash	279	364	643

The average yields on the three plots which received no phosphate and the largest percentage difference between the *average* yield and that of any one plot are as follows:

	Average Yield.	Percentage Difference.
Sound Ears	471	8.2
Stover	589	17.8
Total Crop	1060	13.0

The percentage increase or decrease (—) on each plot over the no-phosphate plots is as follows:

	Sound Ears.	Stover.	Total Crop.
A, Dissolved Bone Black	3.3	7.0	5.3
B, Grand Cayman's Phosphate	11.4	27.3	21.5
D, Thomas-Slag	11.7	36.9	28.1
E, South Carolina Rock	4.4	35.5	21.7
G, Bolivian Guano	−2.2	27.0	14.0
I, Double quantity Dissolved Bone Black	4.3	9.3	7.0
K, No fertilizer of any kind	−46.5	−46.0	−46.2
L, Muriate of Potash	−40.8	−38.2	−39.3

Result.—This experiment furnishes some interesting observations.

1. Plots C, F and H received nitrogen and potash alone; plot K received no fertilizer of any kind; and plot L received 30 pounds of muriate of potash only. The yields are as follows:

	Ears.	Stover.	Total.
C, F and H, (Potash and Nitrogen)	471	589	1060
L, (Potash)	279	364	643
K, (no fertilizer)	252	318	570

It appears that potash alone only slightly increased the yield, but that potash and nitrogen together almost doubled it. It seems very likely, then, that nitrogenous fertilizers, rather than potash fertilizers will give the largest returns on this land.

2. The double quantity of bone black on plot I made a slight increase of crop over plot A which had half the quantity of Dissolved Bone Black.

3. All the phosphates increased the total yield somewhat. The increase in ears is very slight for it must be borne in mind that of the 12 per cent. increase noticed on B and C, 8 per cent. could fairly be attributed to differences in the quality of the land.

The increase in stover is rather more and is approximately the same on plots B, D and E.

Experiment Carried out by Mr. George F. Platt, Milford.

This experiment was on high land, sloping to the west lengthwise of the plots. The land is set with peach trees which are at present about 4½ feet high. The plots contained one-tenth of an acre each. Muriate of Potash at the rate of 320 pounds and Sulphate of Ammonia at the rate of 200 pounds per acre were broadcast over the whole, and the phosphates were broadcast on the separate plots with great care.

The corn was Hickox Improved Sugar Corn, and was planted May 26th, and cultivated in the usual way.

The crop was raised for seed and therefore was topped in September and the ears gathered Nov. 23, much later than usual on account of the extremely unfavorable weather. It was impossible to gather the stalks and weigh them accurately, both on account of the wet and of the method of harvesting the seed corn. In August there appeared to be a spot on plots A, B and C where the corn was smaller and poorer than elsewhere. No reason could be assigned for this. The stand of corn was otherwise quite even, with very few missing stalks.

Following are the results:

	Weight of Ears.
A, 26 Pounds Dissolved Bone Black	231
B, 37 Pounds Grand Cayman's Phosphate	219½
C, No Phosphate	206
D, 45 Pounds Thomas-Slag	232½
E, 56 Pounds Ground South Carolina Rock	229½
F, No Phosphate	215½
G, 45 Pounds Bolivian Guano	235½
H, No Phosphate	199½
I, 52 Pounds Dissolved Bone Black	281½
K, 80 Pounds Home-mixed Complete Fertilizer	339½

Plot K did not have the muriate of potash and sulphate of ammonia that the other plots received, being outside the experimental field though close to it.

The average yield on the three plots which received no phosphates is 207 pounds and the largest percentage difference between the average yield and that of any one of the three plots is 4.1.—The percentage increase of crops on the several plots over the no-phosphate plots is as follows:

	Percentage Increase over No Phosphate Plots.
A, Dissolved Bone Black	11.6
B, Grand Cayman's Phosphate	6.0
D, Thomas-Slag	12.3
E, South Carolina Rock	10.9
G, Bolivian Guano	13.7
I, Double Quantity Dissolved Bone Black	36.0
K, Home-mixed Complete Fertilizer	64.0

Result.—It appears that Grand Cayman's Phosphate had very little effect on the crop, but remembering that plots A, B and C had each a spot where for some reason the stand of corn was weak, this result is not surprising. The double quantity of Dissolved Bone Black gave a three-fold increase; and the results generally indicate that phosphates rather than potash salts or nitrogenous matters will raise the productiveness of this land. The same increase practically is secured by Dissolved Bone Black, Bolivian Guano, Thomas-Slag and South Carolina Phosphate when applied in quantities proportional to their market price.

The Home-mixed Fertilizer on K produced five times as much increase of crop as any other application, excepting the double quantity of dissolved Bone Black.

This was put on at the rate of 800 pounds per acre, and one fifth of it was put *in the hill* instead of being all sowed broadcast like the other fertilizers.

EXPERIMENT CARRIED OUT BY STEPHEN HOYT'S SONS, NEW CANAAN.

The experiment field had an area of 200 square rods and was perfectly level. For the last seven years nursery stock had been grown on it without any manure. It had not been in grass for 40 years. It was plowed and harrowed on the 22d and 23d of May and on it were broadcast and harrowed in 1000 pounds double sulphate of potash and magnesia and 375 pounds sulphate of ammonia. It was divided into 8 equal plots of 25 square rods each on which the phosphates were sowed as described below.

A flint corn was planted in rows 3 feet apart, hills 2 feet apart in the row and two stalks were left to a hill. The crop was cultivated in the usual way and met with no accidents. When visited by an officer of the Station in August the several plots showed a remarkably uniform stand throughout with no missing hills. The crop was cut at the usual time but could not be husked and weighed till the first week in December. Following are the results :—

WEIGHTS IN POUNDS OF FIELD-CURED CROPS.

(Mr. Hoyt's Experiment.)

	Sound Ears. lbs.	Soft Ears. lbs.	Stover. lbs.	Total Crop. lbs.
A, 40 pounds Dissolved Bone Black	730	200	1052½	1982½
B, 58 pounds Grand Cayman's Phosphate	840	205	1132½	2177½
C, No Phosphate	725	215	1080	2020
D, 69 pounds Thomas-Slag	750	185	1050	1985
E, 86 pounds So. Carolina Rock	590	245	1017½	1852½
F, No Phosphate	652½	185	993½	1831
G, 68 pounds Bolivian Guano	705	240	1085	2030
H, 80 pounds Dissolved Bone Black	585	236½	973½	1795

The average yields on the two plots which received no phosphates and the percentage differences between them and the average are as follows :—

	Average yield.	Percentage difference.
Sound Ears	688.7	5.3
Stover	1036.7	4.2
Total crop	1925.0	5.0

The percentage increase, or decrease [marked —] of crop on the several plots over the average of the no-phosphate plots is as follows:—

	Sound Ears.	Stover.	Total Crop.
A, Dissolved Bone Black	6.0	1.5	3.0
B, Grand Cayman's Phosphate	21.9	9.2	13.1
D, Thomas-Slag	8.9	1.2	3.1
E, So. Carolina Rock	—14.3	—1.9	—3.8
G, Bolivian Guano	2.4	4.6	5.4
H, Double quantity Dissolved Bone Black	—15.0	—6.1	—6.8

Result.—There is not a single case where an increase of yield could fairly be attributed to the phosphate except the yield of sound ears on plot B. In all other cases the slight increase observed is clearly within the limits of error and can be attributed to differences in the quality of the soil on the different plots.

The apparent *decrease* of yields on plots E and H are largely to be explained in the same way. It is evident that the soil was not relatively deficient in phosphates and for that reason could not answer the purpose of this experiment.

Summary.

The experiment made by Mr. Bartholomew with corn in 1887, the repetition of that experiment in 1888, his experiment with potatoes in 1888, Mr. Yeomans' experiment with corn in 1888 and perhaps Mr. Platt's experiment are the only ones which can fairly be regarded as contributions to the question of the relative practical value of the phosphates under experiment.

In Mr. Bartholomew's experiment of 1887 Grand Cayman's Phosphate and Thomas-Slag produced as large a crop of ears, more stover and as large a total crop as the same money value of Dissolved Bone Black produced, while ground So. Carolina Rock produced less than half as much increase of crop over land which had no phosphates.

In 1888 ***with no further addition of phosphates***, the plot which the season before had received Grand Cayman's Phosphate gave three times as much increase of sound ears, over the no-phosphate plots, as the plot which had received Dissolved Bone Black, more than twice as much increase of stover and more than three times as much increase of total crop. The plot which had received Thomas-Slag gave still larger increase of crop. The plot which had ground South Carolina Rock the year before, produced in 1888 more than twice as much increase of ears and two and a half times as much increase of total crop as the Dissolved Bone Black.

These results are differently expressed in this statement of total yield of ears and total crop for the two years.

	Yield of Ears.	Total Crop.
A, Dissolved Bone Black	1040	1946
B, Grand Cayman's Phosphate	1100	2144
D, Thomas-Slag	1079	2099
E, Ground South Carolina Rock	1007½	1926
C and F, No phosphate (average)	942	1793

There was profit in dollars and cents in the use of either Dissolved Bone Black or the raw phosphates Grand Cayman's and Thomas-Slag. But *on this land, in these two years* raw phosphates paid better than superphosphates.

There was no loss perhaps in the use of South Carolina Rock. These conclusions are confirmed by the following statement of yield per acre for the two years:

	Total yield of ears for two years.	Bushels of shelled corn (80 lbs. ears to bu.)	Gain in bushels.	Cost of phosphate.
A, Dissolved Bone Black	8320	104	10	$3.36
B, Grand Cayman's Phosphate	8800	110	16	3.36
D, Thomas-Slag	8632	107	13	3.36
E, South Carolina Rock	8060	101	7	3.36
No phosphate	7536	94		

There now remains on the plots B, D, and E not removed by the crops, the following quantities of phosphoric acid which were applied two years ago.

Plot B	86.7 pounds
" D	59.3 "
" E	97.8 "

All of the phosphoric acid applied to plot A has been removed in the two crops and more beside.

Next we may consider Mr. Bartholomew's potato experiment. First on the rye land. Here the yield of potatoes both large and small was about the same on the separate plots which received equal money values of Dissolved Bone Black, Grand Cayman's Phosphate and Thomas-Slag, though the last named produced a larger proportion of small potatoes than the others. Each of these phosphates increased the yield about one quarter over that of the no-phosphate plots. Bolivian Guano increased the yield half as much and South Carolina Rock did not increase it at all. Each plot contained one-sixteenth of an acre. If we figure the crops of large potatoes to the acre and call 60 pounds of potatoes a bushel, the yields are as follows:—

	Bushels per acre of large potatoes.	Gain in bushels.	Cash value of gain.*	Cost of phosphate.
No phosphate	127	--	-----	----
Dissolved Bone Black	165	38	$19.00	$4.16
Grand Cayman's Phosphate	164	37	18.50	4.16
Thomas-Slag	156	29	14.50	4.16
South Carolina Rock	123	--	-----	4.16
Bolivian Guano	144	17	8.50	4.16

*Reckoning the potatoes at the low price of fifty cents a bushel.

The experiment on meadow land gave very different results. Here Dissolved Bone Black produced 25 per cent. of increase in total crop while neither of the other phosphates produced half as much, and the plot to which Bolivian Guano was applied, for some reason produced less than the no-phosphate plots. The yield in bushels per acre, the gains over the no-phosphate plots and the cash values of the gains are as follows:—

	Bushels per acre of large potatoes.	Gain in bushels.	Cash value of gain.	Cost of phosphate.
No phosphate	139	--	-----	----
Dissolved Bone Black	177	38	$19.00	$4.16
Grand Cayman's Phosphate	148	9	4.50	4.16
Thomas-Slag	149	10	5.00	4.16
South Carolina Rock	152	13	6.50	4.16
Bolivian Guano	131	--	-----	4.16

It appears that there was three to four times as much profit from the use of Dissolved Bone Black as from the use of the raw phosphate, *in this first crop.* It remains to see what the after effect of the different phosphates will be. At present we have no explanation to advance for the very different effects of the phosphates on two pieces of ground in the same field with the same exposure, the only difference between them being that one was inverted sod, while the other had been plowed a year and a half before and had grown rye.

We come now to consider Mr. Yeomans' experiment.

Mr. Yeomans' land like Mr. Bartholomew's is strikingly benefitted by phosphates. Any phosphate, raw or dissolved, put on in moderate quantity will pay well. It is even more strikingly benefited than Mr. Bartholomew's land. The results here are however very different from Mr. Bartholomew's. Dissolved Bone Black yielded from nearly three to ten times as much sound ears as any other phosphate. Where no phosphate was used there was scarcely any sound corn. It yielded from one and three-quarters to twice as much stover also as any raw phosphate. It is fair to say that Dissolved Bone Black on this land, this year, yielded twice the money return of any other phosphate.

At present no explanation can be given of this difference in the comparative effects of the same phosphates on different land. It is hoped that further experiments by these gentlemen may make the matter clearer. We believe that the difference will be found to be partly if not largely due to difference in season. August and early September of 1887, when Mr. Bartholomew's first experiment was tried, were months particularly favorable for the growth of corn, and during those months the raw phosphate plots which earlier in the season were noticeably backward, advanced rapidly and overtook the Dissolved Bone Black plot which had been leading them in growth. On the other hand, August and September of 1888 when Mr. Yeomans' experiment was tried were unfavorable to the growth of corn, being cold and wet and the raw phosphates which are presumably slower in affecting the crop could not be so well utilized. A repetition of Mr. Yeomans' experiment, such as

Mr. Bartholomew made in 1888, on the land used in 1887 is extremely desirable.

In Mr. Platt's experiment only the sound ears were weighed but Thomas-Slag, South Carolina Rock and Bolivian guano gave practically as large a *crop as Dissolved Bone Black.*

In general it has been shown that in some cases the raw phosphates may be more profitable to use than dissolved phosphate, that their effects are more lasting and that the immediate effect in some cases may be as great as that of the same money value of dissolved phosphate. This is a matter of great importance to users of commercial fertilizers and will receive further study on the part of the Station.

To any in the State who may wish to test the effect of raw phosphates on their land for themselves and will engage to follow the Station's directions for making the test and will report the results to the Station for general use, the Station will supply these phosphates so far as it is possible.

It is worth noting that the largest yield of sound ears per acre in the single experiments has run from 2980 pounds to 5860 pounds, or allowing 80 pounds of ears to the bushel, from 37 to 73 bushels per acre.

In conclusion it is a pleasure to acknowledge the readiness with which all those engaged in carrying out the experiments here described have accepted the plan suggested by the Station, and the care and accuracy with which the experiments have been conducted. In every case where there has been partial or complete failure, this has been due to circumstances of weather or to peculiarities of soil which could not be foreseen, not to any neglect on the part of the experimenter. Of the twelve experiments, four have value in connection with the special point which was studied, viz: the relative practical value of the different phosphates, while eight experiments have little or no value of this kind. Some of them however, show incidentally what fertilizing elements have special value for the soil under experiment. This general result is about what was anticipated and is not discouraging.

The question, which pays best, plain superphosphate or an equal money value of raw phosphate is an important one to the farmers of this State who are spending yearly more than $200,000 for phosphoric acid.

If this question can be settled at all it will be by such experiments as we have described carried out in all parts of the State by farmers with the coöperation of the Stations. Even if this question shall not be answered in a perfectly satisfactory way its study will nevertheless diffuse information and may in other ways richly repay for the labor and expense.

FEEDING STUFFS.

[For tabulated statement of Composition of American Feeding Stuffs, see page 90.]

About 200 samples of feeding stuffs have been analyzed during the last twelve months. A large number of the analyses were made in connection with the Experiment on the Effect of the Rate of Planting on the Quality and Quantity of the Maize Crop and will be given in the discussion of that experiment either in this Report or the next. Analyses of grasses will be found on page 101 in the account of the forage garden.

Analyses of potatoes are given in the account of the field experiments with potatoes made by Mr. Fenn, and Mr. Platt of Milford and Mr. Webb of Hamden. The remaining analyses follow. Some of them have already been published in Bulletin No. 96, but are reproduced here to meet the legal requirement that the Report of the Station shall contain "a full and detailed report of its operations."

Full explanations regarding feeding stuffs and their ingredients, feeding standards and the compounding of rations, etc., have been given in previous reports, copies of which can be obtained by those who wish them.

ON THE VALUATION OF FEEDING STUFFS.

It is not possible to accurately express in figures the actual feeding value or nutritive effect of a feeding stuff any more than it is possible to give a figure which shall represent the *agricultural* value of a commercial fertilizer. The reasons are alike in both cases and are evident without explanation. But some way of comparing feeds like that used for comparing fertilizers in which both their chemical composition and cost prices shall be taken account of is very desirable. A large number of mill-products are now offered for sale in this State to feeders of dairy stock. Most of them, like wheat feed, rye feed, oat feed and buckwheat middlings are residues left from the preparation of flour or meal for table use. Some are evidently worth a good deal more than is charged for them; while others are of quite inferior value. Neither buyers nor sellers know their composition nor whether the prices charged are high or low as compared with other feeds, *when their composition is taken into account.*

An attempt has been made by this Station to find out and analyze all the mill-products now in the Connecticut market whose

average composition is not already known, and also to offer some method of comparison or "valuation" for them.

The method here to be described is not a new one. It has been used abroad, where feeds as well as fertilizers are sold under guarantee as to composition and the seller is obliged to make good any deficiency. The method is perfectly logical only when the price of each feeding stuff is governed strictly by its composition. In England and Germany this appears to be much more nearly the case than in this country, where prices at present are regulated scarcely at all by the chemical composition of the feeds. Notwithstanding this the valuations obtained by the method as below described have in general agreed well with the market prices of the standard mill feeds.

An outline of the method is as follows:

The average market prices of the feeds which form the basis of calculation can be obtained from the market reports just as the market prices of nitrogen, phosphoric acid and potash are obtained from the weekly quotations of fertilizer chemicals. The chemical composition of the feeds can be determined by analysis as the composition of fertilizer chemicals is determined.

The next step is to calculate from the chemical composition of all the feeds and their retail prices, the most probable or average retail price of a pound of albuminoids or fat or carbhydrates (fiber and nitrogen-free extract together.) This problem is by no means so simple as that of determining the cost of nitrogen, phosphoric acid or potash. Each of the last-named can be bought by itself; potash for instance in muriate of potash or nitrogen in dried blood, and from the price of the muriate or the blood the cost per pound of potash or nitrogen can be directly deduced. But there are no feeds which contain only one or even only two food-ingredients. All of them contain at least three. Under these circumstances to calculate the cost of each food-ingredient can only be done algebraically by an application of the "method of least squares" so-called. The tedious details of the calculation would be out of place here. The data used for solving this problem are as follows:

By correspondence with dealers throughout the State as well as with purchasers, the average retail prices of fine feed (as distinguished from coarse feed, hay, stalks, straw, etc.) have been obtained as accurately as possible. The average composition of these feeds is known from the tables of analyses which are annually revised and published by this Station. A considerable number of analyses have also been made within the last two months of feeds new to our market, so that we have a tolerably complete statement of their composition.

The feeds used in calculating the average cost of albuminoids, fat and carbhydrates are those in the subjoined list.

The selling prices per ton are believed to represent the average for December, 1888. The explanation of the column headed "Valuation" is given further on.

FINE FEEDS, COST AND VALUATION.

	Selling Price per ton.	"Valuation."
Cotton seed meal	$27.75	$30.37
Linseed meal, old process	32.25	25.92
Wheat bran	20.50	20.22
Wheat middlings	22.00	21.20
Rye bran	21.00	19.89
Corn meal	21.50	19.59
Gluten meal	23.00	25.38
Hominy chops	21.00	23.31
Malt sprouts	17.00	20.27
Oat middlings	25.00	24.31
Rye feed	20.00	19.62
	$251.00	$250.08

The calculation based on these foods and their average composition and prices at the date named shows that the average retail cost of a pound each of albuminoids, fat and carbhydrates is as follows:

COST OF FOOD INGREDIENTS.

Albuminoids (N. × 6.25)	1.6 cents.
Fat	4.2 "
Carbhydrates	.96 "

To test the accuracy of these figures they have been applied to the feeds from which they were derived and the results are given above in the column headed "Valuation." It appears that the total calculated cost and the total actual cost agree within one dollar. It may be noted in passing that these figures differ radically from those used in Germany, which were derived in a similar way from German market quotations and which in absence of any other data have been previously applied to American feeding stuffs.

To explain their use they are here applied to the sample of Malt Sprouts, No. CCCXXXII, the analysis of which is given on page 152.

	The sample contains in 100 pounds.	The sample contains per ton.		Cost per pound.	Ton Value.
Albuminoids	23.87	477.4	@	1.6 cents.	$7.64
Fat	1.38	27.6	@	4.2 "	1.16
Carbhydrates*	58.81	1176.2	@	.96 "	11.29
					$20.09

Cost	$15.00
"Valuation"	20.09

The meaning of this statement must be clearly borne in mind. It does *not* mean that this feed is certainly worth for feeding purposes $5.09 more per ton than it costs. It does *not* mean that malt sprouts are certainly worth more than another feed which has a lower valuation. It does not mean that it is a palatable and easily digestible feed. What this numerical statement does mean is this; that in malt sprouts of this quality and price the purchaser gets the food ingredients named, for less than their average market price by $5.09. This leaves a great deal to be known about the feed, to be sure, but it nevertheless is a very useful piece of information. To illustrate: To know that potash in muriate costs 4¼ cents a pound while in sulphate it costs 5½ cents, leaves much still to be known about the agricultural uses of these two salts, and spite of the difference in cost there will be much use wisely made of the more costly one, but a knowledge of this difference is of great value to purchasers of potash salts. Just so to know that albuminoids, fat and carbhydrates cost very much less in malt sprouts or cotton-seed meal than in wheat bran, will not induce an intelligent dairyman to give up bran and feed malt sprouts or cotton seed meal wholly in its place, but it may induce him to try substituting one of these for a part of the bran or other feed which he uses, and when he finds a new feed offered he will be disposed to look not only on its gross cost but on the cost of the food ingredients in it as compared with the usual market rates. These figures are provisional and will change somewhat with the state of the market. They apply *only to one class of feeds*, namely, dry fine mill-products or brewery refuse like malt sprouts and dried brewers' grains.

* The sum of nitrogen-free extract and fiber.

ANALYSES OF FEEDING STUFFS.

Cotton Seed Bran.

CCCIII. Sold by J. E. Soper & Co., Boston, Mass. Sampled and sent by R. E. Pinney, Suffield. Cost $22 per ton in 100 lb. sacks.

Analysis.	
Water	11.99
Ash	2.18
Albuminoids	6.37
Fiber	30.83
Nitrogen-free extract	47.33
Fat	1.30
	100.00

This material contains less fat (ether extract) and no more albuminoids than hay of fair quality. The fiber probably comes from cotton seed hulls. The Cotton Seed Bran costs as much as wheat bran and is far less valuable as feed.

The "Valuation" by the method just explained is $18.13 per ton, or $4.00 less than the cost. Even this is too high an estimate because more than a third of the carbhydrates consists of fiber which is the least valuable and least digestible part of the carbhydrates.

The Columbia Cured Feed for Horses and Cattle.

CCXC. This feed claims to be made "with oats and corn as a basis, reinforced by barley, wheat, rice and rye, and embodies putting into practice a theory generally held by thoughtful horse and dairy-men, that a greater variety in feed than is usually convenient would be of advantage to the animal." "It contains no tonic or medicine of any description to create a false appetite." "We claim it to be the strongest and most nutritious feed ever offered to the public."

The analysis of this article follows. The composition of wheat bran of average quality is also given for comparison.

	"Concentrated Feed."	Wheat Bran.
Water	11.41	12.38
Ash	5.54	5.59
Albuminoids	15.06	15.36
Fiber	7.44	9.34
Nitrogen-free extract	54.83	53.50
Fat	5.72	3.83
	100.00	100.00

The claim that the feed is composed of a variety of grains is a just one. Corn, rice, oats and barley were identified with the microscope. Rye and wheat may also have been present. In chemical composition the most striking difference between the "Concentrated Feed" and wheat bran is that the feed contains about two per cent. more fat and two per cent. less fiber. Its price is $25.00 per ton and its "valuation" $21.57. Whether a desirable variety of food can more economically be provided by such ready-made mixtures as this or by purchase of the different grains singly and home-mixture must be determined by the purchaser.

"The Concentrated Feed for Horses, Cattle, Sheep, Swine, Poultry, etc."

Manufactured at Pearl Mills. For sale by the Concentrated Feed Co., 33 Wendell St., Boston, Mass.

"There has been nothing invented for years," says the manufacturer's circular, "which has proved such a blessing to all classes of domestic animals as the above feed."

The directions which accompany the feed, show that it is offered as a medicinal or condimental food. Thus we read, "For an ordinary working or driving horse feed one single handful of the feed with one-fourth less his usual allowance of grain at each feed, wet or dry. For worms, twice the quantity for five days." For cows, "feed one half-pint or single handful of the feed with the usual amount of grain, wet or dry. For Garget, feed twice the quantity until it entirely disappears." Still more startling is the announcement, "this disease," hog cholera, "in its most malignant form yields readily to the free use of the Concentrated Feed."

Following the claims of the seller and the directions for use are the usual number of testimonials from those who have used the feed with satisfaction.

This material, or a similar one under the same name, has been sold more or less in the State since 1882, and in the report for 1884, page 111, its merits were fully discussed. During the present year a sample was received from W. H. Hammond, Hampton, Conn., who says in regard to it: "The cost price is 6 cents per pound and is in 12 pound bags to be sold for $1.00 or 8 cents per pound." "The above price" (6 cents per pound),

"is as given me at ton lots, or 3 tons for $300." "I have tried it and think it not up to the mark as advertised in their circular." The sample sent by Mr. Hammond was analyzed and reported to him and was also published in our weekly statement No. 41, of Sept. 15. The analysis is as follows:

	Concentrated Feed. CCLXXXVIII.	Wheat Bran.
Water	11.39	12.38
Salt	13.20	....
Other mineral matters	4.11	5.59
Albuminoids	14.87	15.36
Fiber	4.48	9.34
Nitrogen-free extract	47.42	53.50
Fat	4.42	3.83
	100.00	100.00

This "invention" which has proved "a blessing to all classes of domestic animals," apparently consists of a mixture of wheat and corn with 13 per cent. of salt and perhaps a little of some more concentrated feed. Disregarding the salt, an equal weight of wheat bran would supply as much nutriment and would cost perhaps $20.50 per ton. The "invention" costs $100 per ton in 3 ton lots or at the rate of $160 per ton in small quantities.

The Concentrated Egg Producer.

Made by the Concentrated Feed Co., No. 14 Wendell St., Boston, Mass. A sample of this material furnished by Mr. Hammond of Elliott, had the following composition.

	CCLXXXIX.
Water	10.15
Salt	17.20
Other mineral matters	6.40
Albuminoids	14.19
Fiber	3.37
Nitrogen-free extract	44.94
Fat	3.75
	100.00

The mineral matter contains a quite insoluble oxide of iron. The Egg producer has a somewhat lower feeding value probably

than the Concentrated Food for Cattle. It contains both corn and wheat and some more concentrated feed. Wheat bran contains, pound for pound, as much nutriment. The cost of the Concentrated Egg Producer is 50 cents a pound or a dozen pounds for $4.00. This latter price is equivalent to $660 per ton.

As food, neither the Concentrated Feed for Cattle or the Egg Producer are worth more than a small fraction [about one-fifth in the case of the Feed for Cattle and one-thirtieth in the case of the Egg Producer] of what they cost. As condiments they are worthless. It has been abundantly proved that condimental foods have no advantage over others by reason of the condiments in them.

As medicines, they may well be distrusted in view of the absurd claims made by the seller.

Wheat Feeds.

CCCXLVI. Spring Wheat Bran. Sold by A. Arnold & Co., Willimantic.

CCCL. Choice Bran. Sold by Paine Bros., Milwaukee.

CCCXLIII. Fine Spring Wheat Bran. Sold by E. A. Buck & Co., Willimantic.

CCCXLIV. Fine Spring Wheat Bran. "Fine Feed No. 1," or "Middlings." Sold by A. Arnold & Co., Willimantic.

CCCXLV. Fine Spring Wheat Bran. "Fine Feed No. 2," or "Middlings." Sold by A. Arnold & Co., Willimantic.

CCCXLIX. Fine Middlings. Sold by Paine Bros., Milwaukee.

CCCLI. Flour Middlings. Sold by Paine Bros., Milwaukee.

CCCXLVIII. Special Middlings. Sold by Paine Bros., Milwaukee.

The Willimantic samples were sent by N. P. Perkins, Esq., the Milwaukee samples by C. M. Ely, Esq., Harwinton.

The quotations given by Mr. Perkins were for ton lots. Those by Mr. Ely were for mixed car lots at Boston points. In the statement of costs which follows one dollar per ton has therefore been added to the quotations of Mr. Ely which is about the difference between car lots and ton lots.

Analyses.

	Spring Bran. CCCXLVI.	Choice Bran. CCCL.	Fine Spring Bran. CCCXLIII.	Fine Spring Bran Fine Feed No. 1. CCCXLIV.	Fine Spring Bran, Fine Feed No. 2. CCCXLV.	Fine Middlings. CCCXLIX.	Flour Middlings. CCCLI.	Special Middlings. CCCXLVIII.
Water	10.77	10.89	12.22	11.64	12.20	12.10	12.75	12.45
Ash	6.03	6.05	5.07	3.99	4.32	3.78	2.41	3.87
Albuminoids	17.12	16.69	16.06	18.06	17.75	18.12	18.81	18.50
Fiber	9.35	8.74	6.67	5.39	5.48	5.76	1.40	5.08
Nitrogen-free extract	51.68	53.15	56.36	56.13	55.40	55.34	60.31	56.60
Fat	5.05	4.48	3.62	4.79	4.85	4.90	4.32	3.50
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Cost per ton	$20.00	$20.25	$21.00	$21.00	$21.00	$20.75	$25.25	$23.50
"Valuation" per ton	21.43	20.98	22.20	21.61	21.44	21.65	21.50	20.70

It appears that cost and valuation agree very closely, and that the valuation is slightly higher than cost except in flour middlings and special middlings where the cost is considerably above valuation, probably because these brands can be used to some extent for human food.

Maize Kernel and Meal.

Old and New Crop compared.

CCCXLI. No. 2 New York Corn. *Old Crop.* Sold by Bradley & Davis, New Haven. Cost, 56 cents per bushel.

CCCXXVI. No. 2 High Mixed Corn. *Old Crop.* Sent by C. L. Gold, West Cornwall. Cost, 56 cents per bushel. A struck bushel weighs 58 pounds.

CCCXXIX. No. 2 High Mixed Corn. *New Crop.* Sent by C. L. Gold. Cost, 46 cents per bushel. A struck bushel weighs 50 pounds.

CCCXXXIX. Good Western Corn. *New Crop.* Sent by C. E. Lyman, Middlefield. Cost, 46 cents per bushel *in car lots.*

CCCXL. Mason Co. Yellow Corn of best quality. *New Crop.* Sold by Bradley & Davis, New Haven. Cost, 53 cents per bushel.

CCCXLII. New Corn Meal. Sold by E. A. Buck & Co., and sent by N. P. Perkins, Willimantic.

CCCXLVII. Old Corn Meal. Sold by A. Arnold & Co., and sent by N. P. Perkins, Willimantic.

ANALYSES AND VALUATIONS.

	Maize Kernel.					Maize Meal.	
	CCCXLI. No. 2. Old Crop.	CCCXXVI. High Mixed. Old Crop.	CCCXXIX. High Mixed. New Crop.	CCCXXXIX. West'n Corn. New Crop.	CCCXL. Best Yellow. New Crop.	CCCXLII. From New Corn.	CCCXLVII. From Old Corn.
Water	14.64	13.09	20.00	19.73	20.30	17.42	14.61
Ash	1.12	1.20	1.25	1.06	1.10	1.26	1.18
Albuminoids	9.30	9.40	8.06	8.68	8.40	8.00	8.87
Fiber	1.42	1.53	1.54	1.61	1.38	1.38	1.35
Nitrogen-free extract	69.57	70.67	65.38	64.87	65.20	68.65	69.96
Fat	3.95	4.11	3.77	4.05	3.62	3.29	4.03
	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Cost per ton	$20.00	20.00	16.42*	16.42*	18.92	19.00	19.00
"Valuation" per ton	$19.93	20.32	18.60	18.93	18.51	18.50	19.65

The new crop corn contains over six per cent. more of water than old crop corn, and correspondingly less of food-ingredients. This additional water makes the corn, and especially the meal ground from it, more liable to spoil by heating. It also makes the kernels plumper and considerably lighter, bulk for bulk, than old corn. Repeated trials have shown that old corn of the best quality weighs from 58 to 59 pounds per struck bushel, while a bushel of the best new corn weighs only 50 to 52 pounds.

The valuation of the new corn is about $1.45 per ton less than that of old corn, which represents a difference of 4 cents per bushel; and this seems to be about the difference made in dealers' quotations.

OATS AND OAT MIDDLINGS.

CCCXXIV. Mixed Oats, No. 2. 34 pounds in the bushel. Cost 33 cents per bushel of 32 pounds.

CCCXXV. White Oats, No. 2. 32 pounds to the bushel. Cost 34¾ cents per bushel.

Both samples were sent by C. L. Gold, West Cornwall.

CCCXXI. Oat Middlings. From Betts & Alling, New Haven, cost $25.00 per ton. This is the residue from mills where oat meal is prepared. It is claimed that only the brightest and heaviest oats can be used for the purpose. The quality of the middlings of course depends both on the oats and also on the way they are ground and screened. To illustrate this an analysis is given below, made in 1886, of oat middlings from a different source.

* In car lots. Probably about $17.80 to $18.00 by the ton.

ANALYSES.

	Oats.		Oat Middlings.	
	CCCXXXIV.	CCCXXV.	CCCXXI. Betts & Alling.	CCXVII. B. F. Case.
Water	11.59	11.28	9.19	8.19
Ash	3.15	3.59	3.24	4.24
Albuminoids	14.25	12.43	20.00	12.64
Fiber	7.78	9.77	3.80	12.48
Nitrogen-free extract	58.12	57.69	56.19	56.31
Fat	5.11	5.24	7.58	6.14
	100.00	100.00	100.00	100.00
Cost per ton	$20.62*	21.71*	25.00	
"Valuation" per ton	21.50	21.34	24.29	

The analyses of the oats show nothing to warrant a difference of $1.00 in the price of the two samples. The White Oats are brighter, though not as heavy as the Mixed Oats. Mixed Oats ground with corn make the meal dark-colored and so lessen its market-value if not its feeding-value.

RYE FEED AND BARLEY SCREENINGS.

CCCXX. Rye Feed. The residue from the manufacture of rye flour. From Betts & Alling, New Haven. Cost $20.00 per ton.

CCCXXII and CCCXXVII. Barley Screenings. Sent by C. L. Gold, West Cornwall. The two samples differ in price by $2.00 per ton, which represents the cost of grinding. CCCXXVII is fine ground.

ANALYSES.

	Rye Feed.	Barley Screenings.	
	CCCXX.	CCCXXII.	CCCXXVII.
Water	12.77	12.42	12.02
Ash	2.62	3.60	3.51
Albuminoids	13.56	12.12	12.50
Fiber	2.75	7.62	7.00
Nitrogen-free extract	65.80	61.60	62.03
Fat	2.60	2.64	2.94
	100.00	100.00	100.00
Cost per ton	$20.00	15.00†	17.00
"Valuation" per ton	19.59	19.39	19.72

* In car lots.

† In car lots. By the single ton the prices would probably be from $1.00 to $1.50 higher.

Buckwheat Middlings.

A mill-product obtained in making buckwheat flour. Made by the Quinnebaug Store, Danielsonville.

CCCXXXVII. Made in December, 1888. CCXIII. Made in 1886.

Analyses.

	CCCXXXVII.	CCXIII.
Water	13.71	16.33
Ash	4.35	5.50
Albuminoids	31.25	30.31
Fiber	5.70	4.02
Nitrogen-free extract	36.93	36.29
Fat	8.06	7.55
	100.00	100.00
Cost per ton	$21.00	
"Valuation" per ton	24.95	

This is one of the cheapest and richest feeds in market and in the opinion of some who are using it is unsurpassed in favorable effect on the quality and quantity of the milk-yield.

Various Feeds.

CCCXXVIII. Old Process Linseed Meal. Price, $27.00 per ton in car lots. Sent by C. L. Gold, West Cornwall.

CCCXXXI. "Gluten No. 1 Feed," also called Dry Sugar Feed. Price, $19.70 per ton in Middlefield in car lots.

CCCXXXII. Malt Sprouts from a Meriden brewery. Price, $15.00 per ton.

The last two samples were sent by C. E. Lyman, Middlefield.

CCCXXXIII. Apple Pomace from J. H. Dickerman, Mt. Carmel.

	Old Process Linseed Meal. CCCXXVIII.	Gluten No. 1 Feed. CCCXXXI.	Malt Sprouts. CCCXXXII.	Apple Pomace. CCCXXXIII.
Water	10.27	11.66	10.10	69.90
Ash	5.12	.56	5.84	.71
Albuminoids	36.06	17.81	23.87	1.58
Fiber	7.36	3.08	10.76	4.86
Nitrogen-free extract	34.53	59.56	48.05	21.24
Fat	6.66	7.33	1.38	1.71
	100.00	100.00	100.00	100.00
Cost per ton	$27.00	19.70	15.00	?
"Valuation" per ton	$25.16	23.88	20.02	

In Linseed Meal, albuminoids, fat and carbhydrates cost more than in any other concentrated feed which is in common use.

Gluten No. 1 Feed is made in Buffalo, N. Y., and is a waste product from the manufacture of glucose. Its digestibility has not been determined, but it is probably not greatly inferior to corn meal in this regard, and at the price named is a cheap feed, considered simply from the point of view of composition as shown by the analysis. By the single ton it would cost from $1.00 to $2.00 more than by car load. It has been used by a few farmers in Wallingford and is thought to be excellent for producing milk and butter.

Apple Pomace is prized by those who have it as a food for cattle and horses. This sample, which is free from straw and consists wholly of the apple "cheese" from the cider press, contains about as much albuminoids, ten per cent. more carbhydrates and four times as much fat (ether extract) as green fodder maize. It has a faint vinous smell and contains about a quarter of one per cent. of free acetic acid. Ensilaged like maize fodder it would be a valuable winter feed.

Starch Feed and Sugar Feed.

CCCXXXVIII. Glen Cove Starch Feed. Sold by Bradley & Davis, New Haven. Cost, 20 cents per bushel. (A bushel should weigh, on the average, 60 pounds.) Sampled by a Station Agent.

CCCLII. Buffalo Sugar Meal. Made by The American Glucose Co., Buffalo, N. Y. Sampled and sent by C. L. Davis, New Haven. Cost, 13 cents per bushel *in car lots.* A bushel is stated to weigh 50 pounds.

	CCCXXXVIII. Starch Feed.	CCCLII. Sugar Meal.
Water	66.53	62.91
Ash	.25	.15
Albuminoids	6.01	3.27
Fiber	2.00	2.00
Nitrogen-free extract	22.47	27.60
Fat	2.74	4.07
	100.00	100.00
Cost	$6.66*	5.20†
"Valuation"	8.92	10.15

The Glen Cove Starch Feed has a slightly sour smell; the Buffalo Sugar Meal has a much more pronounced smell, reminding

* By the single bushel. † By the car lot.

one of cheese, but it is said to be greatly relished by cattle. Both feeds are wet and pasty. Nearly two-thirds of their total weight is water.

Meat.

CCCXXX. This sample consists of refuse meat, thoroughly cooked, probably to remove grease, and packed in barrels. It is sold for $1.00 per 100 pounds in Worcester, Mass., and is fed to poultry. It keeps in cold weather for a good while without developing a particularly disagreeable odor. Sampled and sent by Andrew Kingsbury, Coventry.

Analysis.

Water	55.44
Ash	2.20
Albuminoids	35.36
Nitrogen-free extract	1.34
Fat	5.66
	100.00

FURTHER OBSERVATIONS ON THE MECHANICAL ANALYSIS OF SOILS.

By Thomas B. Osborne, Ph.D.

In continuation of this subject, some experiments have been made on boiling clayey soils with water. The boiling was carried on gently in a platinum retort connected by ground joints with a platinum condenser and heated by a lamp flame.

In describing these experiments the word *clay* will be used exclusively to designate that material which, after stirring up with a large volume of water, 200 mm. in depth, remains 24 hours in suspension, and which has been determined by precipitation by ammonium nitrate, ignition and weighing.

The first trials were made on North Haven "Brick Clay" from the same source but of a different sampling and different composition to those employed in former work.

Ten grams of this North Haven clayey soil were boiled in platinum with 100 c.c. of pure water for 3 days (72 hours) continuously with but slight diminution of the volume of water. At the end of this time the soil settled readily, the clay having become flocculent, leaving the water nearly clear. The boiling

was resumed and continued for 6 days longer. On then pouring off the contents of the retort into a beaker, the clay settled promptly with much the appearance of dense ferric hydroxide, leaving the water but slightly turbid. There remained, however, a considerable portion adhering to the walls of the retort which had a pasty character and could only be removed by rubbing. This was detached with as little disturbance as possible and the entire sample was then suspended in about one gallon of distilled water having a depth of 200 mm., and let stand for 24 hours. The turbid liquid was then decanted from the sediment and the suspended clay thrown down by ammonium nitrate.

The sediment was again stirred up with distilled water as before, again left to settle for 24 hours, and a second portion of clay thus obtained in suspension was determined.

The sediment thus obtained was thoroughly pestled as described in report of this Station for 1886, pp. 148 and 153, stirred up with water and clay determined as before.

The results of this treatment were as follows:

		Per cent.
Clay obtained by boiling,	1st sedimentation	6.96
	2d "	2.73
Clay obtained by pestling		9.78
Total		19.47

Ten grams of the same sample were passed through a $\frac{1}{4}$ mm. sieve and without further treatment stirred up with 1 gallon of water 200 mm. deep. After 24 hours' subsidence 3.88% of clay were found in suspension.

Ten grams of the same sample were thoroughly pestled and mixed with 1 gallon of water as before, when 17.74% of clay remained in suspension.

Ten grams of the same sample were boiled for 23 hours in platinum with 100 c.c. water. On opening the retort it was found that only about 30 c.c. water remained. When transferred to a beaker with 150 c.c. water the sand settled promptly, and afterwards a layer of coagulated clay about $\frac{3}{8}$ inch thick was deposited. The entire sample was then transferred to a large jar holding 1 gallon of water 200 mm. deep and allowed to settle 24 hours. There remained in suspension 6.25% clay.

Ten grams were boiled with 150 c. c. water in platinum for 96 hours without appreciable loss of liquid. The clay did not

adhere to the vessel and was densely flocculent. Nine-tenths of the slightly alkaline liquid were filtered off and left on evaporation a residue of .0163 grm., which contained .0056 grm. silica and .0057 calcium carbonate, besides traces of phosphoric and sulphuric acids and magnesia.

Summary of results on North Haven clayey Soil.

	Per cent.
Clay obtained without boiling or pestling	3.88
" " after boiling 23 hours	6.25
" " " " 216 " 1st sedimentation	6.96
" " " " 216 " 2d "	2.73
" " " " 216 " and subsequent pestling	19.47
" " " simply pestling	17.74

Ten grams of a sample of Red Clay from Dakota were boiled in platinum retort with 150 c. c. distilled water for 7 days (168 hours) and the clay capable of remaining in suspension was determined as before and amounted to 27.76%. The same sample after thorough pestling gave 33.36%. In this case the clay showed no signs of flocculating.

The foregoing results agree in general with those previously obtained by boiling in glass. Here we have eliminated the effect of any soluble matter extracted from the glass. No advantage to be derived from boiling is indicated, the difference of 1.73% between the last two items in the above summary being probably within the limits of experimental error.

No evidence is, however, obtained to show that the clay in these samples is made granular from dehydration, or is by prolonged boiling otherwise rendered less susceptible of suspension in water.

The coagulation of the North Haven clay is doubtless due to soluble matter extracted by water from the clay itself.

The superiority of pestling over boiling for the disintegration of clay is made very evident.

The determination of clay by precipitating either with ammonium chloride or by non-volatile salts presents some difficulties. In the latter case the clay must be filtered and washed in order to remove the precipitant, which is a difficult and tedious matter, and then involves the removal of the clay from the paper and the complete incineration of the latter. This is by no means easy. With ammonium chloride the greater part of the solution

can be removed by decantation and the remainder evaporated to dryness and the clay ignited. In such case iron will be lost from the clay through volatilization, as ferric chloride. These difficulties are avoided by using ammonium nitrate which is an excellent precipitant and occasions no loss of iron during ignition. A large part of the ammonium nitrate may be removed before ignition by bringing the clay to dryness in a platinum dish and then filling the dish with hot water. The clay will all remain at the bottom of the vessel and the clear solution can be removed with a pipette. If this process is repeated two or three times there will be but little ammonium nitrate to remove on ignition, and consequently but little trouble will be occasioned by snapping which is otherwise liable to occur.

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