STATE OF CONNECTICUT.

ANNUAL REPORT

OF

The Connecticut Agricultural

EXPERIMENT STATION

For 1882.

PRINTED BY ORDER OF THE LEGISLATURE.

NEW HAVEN:
TUTTLE, MOREHOUSE & TAYLOR, PRINTERS.
1883.

OFFICERS

OF

The Connecticut Agricultural Experiment Station,

1882.

STATE BOARD OF CONTROL.

Ex-officio.

His Exc. HOBART B. BIGELOW, *President.*

	Term expires
Appointed by Connecticut State Agricultural Society:	
Hon. E. H. HYDE, Stafford, *Vice-President.*	1885.
Appointed by Board of Trustees of Wesleyan University:	
Prof. W. O. ATWATER, Middletown.	1882.
Appointed by Board of Agriculture:	
T. S. GOLD, West Cornwall.	1883.
Appointed by Governor and Senate:	
EDWIN HOYT, New Canaan.	1883.
JAMES J. WEBB, Hamden.	1884.
Executive Committee. — *Appointed by Governing Board of Sheffield Scientific School:*	
W. H. BREWER, New Haven, *Secretary and Treasurer.*	1884.
Ex-officio.	
S. W. JOHNSON, New Haven, *Director.*	

Chemists.

E. H. JENKINS, Ph.D.
C. A. HUTCHINSON, B.S.
GEO. ARCHER, from April to September

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, waters, milks, and other agricultural materials and products, to identify grasses, weeds, and useful or injurious insects, and to give information on the various subjects of Agricultural Science, for the use and advantage of the Citizens of Connecticut.

The Station makes analyses of Fertilizers, Seed-Tests, &c., &c. 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 by *consumers* from stock now in the market, and in accordance with the Station instructions for sampling.
3. That the samples are fully described 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. 15.

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 Legislature.

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. Farmers' Clubs and like Associations can efficiently work with the Station for this purpose, by sending in 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 agriculture, 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 individual officers, but simply to the

AGRICULTURAL EXPERIMENT STATION,
NEW HAVEN, CONN.

☞ Station Grounds, Laboratory and Office are on Suburban St., between Whitney Avenue and Prospect St., 1⅝ miles North of City Hall. Suburban St. may be reached by Whitney Lake Horse Cars, which leave corner of Chapel and Church Sts. each hour and half hour.

☞ 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.

CONTENTS.

ERRATA.

Page 14, 3d line from top, read *ingredients* instead of *ingredient.*
Page 16, 10th line from top, read *nor* instead of *or.*
Page 17, 14th line from top, read *samples* instead of *same.*
Page 32, 1st line from top, read *phates, 8, superphosphates.*
Page 65, 5th line from bottom, read *Our* instead of *One.*
Page 88, 17th line from top, read *the specific gravity* instead of *it.*

REPORT OF THE BOARD OF CONTROL.

To the General Assembly of the State of Connecticut:

GENTLEMEN:—The Board of Control of THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION herewith submits to your Honorable Body the Annual Reports of the Director and Treasurer made to this Board at its Annual Meeting held at the State House in Hartford, January 16th, 1883.

We beg leave to say that at a special meeting of this Board held May 9th, various parcels of ground were visited and one chosen for purchase for the use of the Station, and a special committee was appointed to carry out the objects of the act passed by the Legislature at its last session, appropriating twenty-five thousand dollars "for the purpose of buying a suitable lot and erecting thereon buildings and equipping the same for the permanent use of said Station." (See p. 108.)

The special committee was made up of His Excellency Hobart B. Bigelow, chairman, J. J. Webb, vice-chairman, William H. Brewer, secretary, S. W. Johnson and T. S. Gold. This committee reports that the property recommended by the Board of Control for purchase was bought May 9th, 1882; it consists of about five acres of land situated on Suburban St., nearly one mile and five-eighths in air line from the City Hall of New Haven, having on it a commodious dwelling house, a barn and well. A substantial brick building has been erected for a chemical laboratory. Water and gas have been laid on. The fixtures of the laboratory are nearly complete. Most of the needed repairs on the house and barn have been made, and the further equipment is in progress and well advanced. The original property cost $12,000.00, and $8,809.04 have thus far been paid out on the new building and for repairs and equipment.

The usual work of the Station went on in the rooms of the Sheffield Scientific School until September 1st, when the Station office was opened at its new and permanent quarters.

The last Annual Report was bound and distributed as heretofore with the Report of the Board of Agriculture. By Special Resolution the Legislature ordered the printing of 2000 extra copies, a large share of which were distributed in advance of the regular edition. These extra copies cost less than 10 cents each, and the demand for them makes similar action desirable this year.

THOMAS M. WALLER,
President.

WM. H. BREWER,
Secretary.

REPORT OF THE TREASURER.

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

RECEIPTS.

Balance from account of 1881,	$611.09	
Licenses for sale of Fertilizers,	315.00	
Miscellaneous Receipts,	705.67	
State Treasurer—Annual Appropriation,	7,000.00	
		$8,631.76

PAYMENTS.

Salaries,	$4,411.67	
Laboratory Expenses,	763.87	
Printing, Postage and Stationery,	369.79	
Traveling Expenses of the Board,	63.33	
Gas and Fuel,	235.50	
General Expenses,	1,113.92	
Cash Balance on hand,	1,673.68	
		$8,631.76

WM. H. BREWER,
Treasurer.

MEMORANDUM.

There is due the Experiment Station one hundred ten $\frac{30}{100}$ dollars for laboratory work and the outstanding bills and liabilities (mostly for apparatus and material) are estimated to amount to seventeen hundred (1700) dollars.

Of the special appropriation "for the purpose of buying a suitable lot and erecting thereon buildings and equipping the same for the permanent use of the Station," twenty thousand eight hundred nine dollars and four cents ($20,809.04) have been paid out for property purchased and for work already done and accepted.

WM. H. BREWER,
Treasurer.

REPORT OF THE DIRECTOR.

The chemical work done at the Station during the year 1882 was necessarily completed for the most part previous to Sept. 1, as on that day the rooms in Sheffield Hall which had been occupied for five years and two months as laboratory and office were vacated, the Station property having been packed up and stored, to await the completion of its new laboratory. Notwithstanding this short period of work nearly the usual number of fertilizer analyses were made, viz: 151, and of these a large proportion were on samples of complex composition.

Two samples of soil and three of swamp muck have been examined. The results are set forth on subsequent pages, with such comments as seem appropriate.

In response to an application from the Wilton Farmer's Club, through the secretary, D. H. Van Hoosear, Esq., five samples of fine salt and one of saltpeter have been submitted to analysis, and their use as antiseptic or preservative material discussed in answering several questions proposed by the Club.

The testing of milk has assumed much prominence, 216 analyses, partial or complete, having been executed. Dr. Jenkins has ably discussed the results of these and of the 56 samples analyzed last year, so far as they have importance for the public, in a paper which follows.

Of fodders six complete analyses and fourteen partial analyses have been undertaken. The results on ensilage will be read with special interest.

Two toxical examinations were made with negative or undecisive results.

Twenty-four seed-tests are reported, made mostly on sweet-corn and onion seed.

The Bulletins of the Station have been only five in number, but they have aggregated 34 carefully printed pages of the style of this Report, and were stitched for convenience of preservation. These have been sent as usual to all of the Agricultural Societies and Farmers' Clubs and to all the newspapers in the State. They have been reprinted in the *Connecticut Farmer* and in agricultural papers in other States. In anticipation of the act requiring the Station after Sept. 1, 1882, to "mail or cause to be mailed two copies, at least," of its bulletins, to each post-office in the State, 6,000 copies of Bulletins 71 and 72 were distributed by post in special envelopes addressed to the postmasters, on which was printed the following:

"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."

Section 10 *of "An Act concerning Commercial Fertilizers," passed by the General Assembly, to take effect Sept.* 1, 1882.

☞ The postmaster will greatly serve the public by distributing the enclosed bulletins to farmers. ☜

Hereafter the Station will dispatch to every Connecticut post-office a package of each of its bulletins, so that they may be universally accessible to the farmers of Connecticut.

Fertilizer Law.

The General Assembly at its last session passed a new Fertilizer Law, which went into effect Sept. 1, and which repeals and takes the place of all previous legislation on this subject in this State.

Since a full understanding of the provisions and penalties of this law is important to all parties who buy or sell commercial fertilizers, attention is specially directed to the following points:

1. In case of fertilizers that retail at ten dollars or more per ton, the law of 1882 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. 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.

Here follows the full text of the law:

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.

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 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.

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 the address of 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.

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.

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.

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.

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.

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 analyses 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.

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.

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.

FORM OF MANUFACTURER'S STATEMENT TO AFFIX TO PACKAGES.

At the request of several manufacturers, the following examples of statement are given for use in complying with Section 1 of the Act.

JOHN DOE'S SUPERPHOSPHATE.

This lot or package (bag or barrel) contains (or is guaranteed to contain) 250 net pounds of JOHN DOE'S SUPERPHOSPHATE, manufactured at New Haven, Ct., and having the following chemical composition, per cent., viz:

Nitrogen in nitrates,	2.1
" ammonia-salts,	1.5
" organic-matter,	1.5
Soluble phosphoric acid,	8.0
Reverted " "	1.5
Insoluble " "	1.0
Potash, as sulphate (or muriate),	4.3

John Doe, Manufacturer, New Haven, Ct.

The above statement of chemical composition will cover SUPERPHOSPHATES and SPECIAL MANURES when it is desired to specify minutely the state of the ingredient. Ingredients that are not present may of course be omitted in the statement, and others may be named if it is desired.

In most cases manufacturers necessarily avail themselves of the cheapest sources of nitrogen, and substitute nitrates for ammonia salt or the reverse according to the state of the market. It is therefore not easy to maintain any exact distinction as to nitrates, ammonia salts and organic nitrogen. Some prefer also to group together soluble and reverted phosphoric acid, and to use low-grade potash-salt which contain both sulphates and muriates.

In such cases the statement of composition may be confined to Nitrogen, Soluble and Reverted Phosphoric acid, Insoluble Phosphoric acid, Potash.

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 the per cent. of Potash (potassium oxide), and of Sulphate of potash or Muriate of potash.

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

The common use of the word "ammonia" in place of nitrogen, as applied to articles really containing no ammonia or ammonia-salts, is not "approved" as it is not "currently employed by the Connecticut Agricultural Experiment Station." The same is true of the use of the terms "available" and "assimilable" as covering soluble and reduced phosphoric acid.

The Station in analyzing the fertilizers sold under this law, as a rule, can take account of those ingredients only which are specified in the Statement that accompanies each package sold.

FORM OF DEALER'S REPORT TO THE STATION.

Section 4 of the Act requires that 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 agent or seller, make a report to the Director of the Experiment Station. The subjoined form may be used for such reports.

I (we), the undersigned, hereby report to the Director of the Connecticut Agricultural Experiment Station, as required by law, that I am agent (we are agents) for the sale of (here give correct full name and brand of fertilizer) manufactured (imported, furnished) by (here give name and address of manufacturer, importer or party from whom the fertilizer was obtained) and hold myself (ourselves) prepared to deliver to said Director a sample of the same on his demand.

Sign with name,
Residence,
Post Office Address,
And Date.

Blanks for making out these Reports will be supplied on application to the Experiment Station.

On receiving Statements and analysis-fees from manufacturers and Reports from dealers, the Station will issue receipts for the same.

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 can work against the public good.

During 1882, one hundred and fifty-one (151) samples of fertilizers have been analyzed. Of these, 34 were examined for private parties, and the remainder, 117, for the general use of the citizens of the State.

The samples analyzed for the public benefit have been sent in from various quarters of the State, in most instances by actual purchasers and consumers, ~~in~~ a few cases by dealers, while the Station itself, through authorized agents, has drawn a considerable number of samples from the stock of dealers and agents.

All the analyses of the first class are made on samples understood to have been taken in accordance with the printed instructions which the Station supplies to all applicants. Here follows a copy of these instructions.

* The matter of this and of several subsequent pages, explanatory of the sampling and valuation of fertilizers, is copied with a few appropriate alterations from the Report for 1881. This repetition appears to be necessary for the use of readers who have not seen former Reports.

THE CONNECTICUT

AGRICULTURAL EXPERIMENT STATION.

Instructions for Sampling Commercial Fertilizers.

The *Commercial Value* of a high-priced Fertilizer can be estimated, if the amounts *per cent.* of its principal fertilizing elements are known. Chemical analysis of a small sample, so taken as to fairly represent a large lot, will show the composition of the lot. The subjoined instructions, if faithfully followed, will insure a fair sample. Especial care should be observed that the sample neither gains or loses *moisture* during the sampling or sending, as may easily happen in extremes of weather, or from even a short exposure to sun and wind, or from keeping in a poorly closed vessel.

1. Provide a tea cup, 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. Weigh separately at least three (3) average packages (barrels or bags) of the fertilizer, and enter these *actual weights* in the "Form for description of Sample."

3. Open the packages that have been weighed, and mix well together the contents of each, down to one-half its depth, emptying out upon a clean floor if needful, and crushing any soft, moist lumps in order to facilitate mixture, but leaving hard, dry lumps unbroken, so that the sample shall exhibit the texture and mechanical condition of the fertilizer.

4. Take out five (5) equal cupfulls from different parts of the mixed portions of each package. Pour them (15 in all) one over another upon a paper, intermix again thoroughly but quickly to avoid loss or gain of moisture, fill a can or box from this mixture, close tightly, *label plainly*, and send, charges prepaid, to

The Conn. Agricultural Experiment Station,
New Haven, Conn.

The foregoing instructions may be over-nice in some cases, but they are not intended to take the place of good sense on the part of those who are interested in learning the true composition of a fertilizer. Any method of operating that will yield a *fair sample* is good enough.

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 a good number of places will give a fair sample with great ease. With dry, coarse articles, such as ground bone, there is likely 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. Otherwise the analysis will certainly misrepresent the article whose value it is intended to fix.

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

It is also 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 will soon decompose and lose ammonia, if bottled and kept in a warm place. Superphosphates containing much 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.

These changes in the composition of a sample not suitably preserved must invalidate any conclusions from its analysis, and work serious injustice either to the manufacturer or to the consumer.

It doubtless often happens that a purchaser on laying in a stock of fertilizers decides that he will not then trouble the Station to analyze the goods he has obtained, but will set aside samples which he can send for examination in case the crops report adversely as to their quality. It is always better to send all samples at once to the Station where they can be directly analyzed or so prepared that they will keep without chemical change.

With the Instructions for Sampling, the Station furnishes a blank Form for Description of Samples, a copy of which is here given.

THE CONNECTICUT

AGRICULTURAL EXPERIMENT STATION,

NEW HAVEN, CONN.

FORM FOR DESCRIPTION OF SAMPLE.

Station No. ---------- Rec'd at Station, ----------18

Each sample of Fertilizers sent for gratuitous analysis must be accompanied by one of these Forms, with the blanks *below* filled out fully and legibly.

The filled out Form, if wrapped up with the sample, will serve as a label.

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

Brand of Fertilizer, ----------

Name and address of Manufacturer, ----------

Name and address of Dealer from whose stock this sample is taken, ----------

Date of taking this sample, ----------

Selling price per ton or hundred, bag or barrel, ----------

Selling weight claimed for each package weighed, ----------

Actual weight of packages opened, ----------

Here write a copy of any analysis or guaranteed composition that is fixed to the packages.

Signature and P. O. address of person taking and sending the sample.

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 estimating, with help of the analysis, the commercial value of its fertilizing elements, and 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* should 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.

When a sample of fertilizer has been analyzed, the results are entered on a printed form, which is filed in the Station Record of Analyses, facing the "Description of Sample" that was received with the fertilizer to which it pertains, and there remains for future reference.

A copy of the analysis is also immediately reported to the party that furnished the sample, the report being entered on one page of another printed form and facing a second 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 OF FERTILIZER-ANALYSIS AND VALUATION.

Nitrogen is commercially the most valuable fertilizing element. It occurs in various forms or states. *Organic nitrogen* is the nitrogen of animal and vegetable matters generally, existing in the albumen and fibrin of meat and blood, in the uric acid of bird dung, in the urea and hippuric acid of urine, and in a number of other substances. Some forms of organic nitrogen, as that of blood and meat, are highly active as fertilizers; others, as that of hair and leather, are comparatively slow in their effect on vegetation unless these matters are reduced to a fine powder or chemically disintegrated. *Ammonia* and *nitric acid* are results of the alteration of *organic nitrogen* in the soil and manure heap, and are the most active forms of Nitrogen. 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.

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 oil of vitriol. It is not only readily taken up by plants, but is distributed through the soil by rains. Once well incorporated with soil it shortly becomes reverted phosphoric acid.

Reverted (reduced or precipitated) Phosphoric acid strictly means phosphoric acid that was once freely soluble in water, but from chemical change has become insoluble in that liquid. It 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, but generally have less value than soluble phosphoric acid, because they do not distribute freely by rain.

Insoluble Phosphoric acid implies various phosphates not freely soluble in water or ammonium citrate. In some cases the phosphoric acid is too insoluble to be rapidly available as plant food. This is true of South Carolina rock phosphate, of Navassa phosphate, and especially of Canada apatite. The phosphate of coarse raw bones is at first nearly insoluble in this sense, because of the animal matter of the bone which envelopes it, but when the latter decays in the soil, the phosphate remains in essentially the "reverted" form.

Potash signifies the substance known in chemistry as potassium oxide, which is the valuable fertilizing ingredient of "potashes" and "potash salts." It is most costly in the form of sulphate, and cheapest in the shape of muriate or chloride.

The Valuation of a Fertilizer signifies estimating its worth in money, or its trade-value; a value which, it should be remembered, is not *necessarily* proportional to its fertilizing effects in any special case.

Plaster, lime, stable manure and nearly all the less expensive fertilizers have variable prices, which bear no close relation to their chemical composition, but guanos, superphosphates and other fertilizers, for which $30 to $80 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 money-value per pound of these ingredients is easily estimated from the market prices of the standard articles which furnish them to commerce.

The average Trade-values, or cost in market per pound, of the ordinarily occurring forms of nitrogen, phosphoric acid and potash, as found in the Connecticut and New York markets, and employed by the Station during the last two years, have been as follows:

TRADE-VALUES FOR 1881 AND 1882.	1881. Cents per lb.	1882. Cents per lb.
Nitrogen in nitrates,	26	26
" in ammonia salts,	22½	29
" in Peruvian Guano, fine steamed bone, dried and fine ground blood, meat and fish, superphosphates and special manures,	20	24
" in coarse or moist blood, meat or tankage, in cotton seed, linseed and Castor Pomace,	16	18
" in fine ground bone, horn and wool dust,	15	17
" in fine medium bone,	14	15
" in medium bone,	13	14
" in coarse medium bone,	12	13
" in coarse bone, horn shavings, hair and fish scrap,	11	11
Phosphoric acid soluble in water,	12½	12½
" " "reverted" and in Peruvian Guano,	9	9
" " insoluble, in fine bone, fish guano and superphosphates,	6	6
" " " in fine medium bone,	5½	5½
" " " in medium bone,	5	5
" " " in coarse medium bone,	4½	4½
" " " in coarse bone, bone ash and bone black,	4	4
" " " in fine ground rock phosphate,	3½	3
Potash in high grade sulphate,	7½	7
" in low grade sulphate and kainite,	5½	5
" in muriate or potassium chloride,	4½	5

These "trade-values" of the elements of fertilizers are not fixed, but vary with the state of the market, and are from time to time subject to revision. They are not exact to the cent or its fraction, because the same article sells cheaper at commercial or manufacturing centers than in country towns, cheaper in large lots than in small, cheaper for cash than on time. These values are high enough to do no injustice to the dealer, and properly interpreted, are accurate enough to serve the object of the consumer.

To Estimate the Value of a Fertilizer we multiply the per cent. of nitrogen, etc., by the trade-value per pound, and that product by 20; we thus get the values per ton of the several ingredients, and adding them together we obtain the total estimated value per ton.

In case of *Ground bone*, the fineness of the sample is graded by sifting, and we separately compute the nitrogen value of each grade of bone which the sample contains, by multiplying the pounds of nitrogen per ton in the sample, by the per cent. of each grade, taking one one-hundredth of that product, multiplying it by the estimated 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 estimated value of the sample of bone. For further particulars, see page 38.

The uses of the "Valuation" are, 1st, 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 no higher than the estimated value, the purchaser may be quite sure that the price is reasonable. If the selling price is but $2 to $3 per ton more than the estimated value, it may still be a fair price; but if the cost per ton is $5 or more over the estimated value, it would be well to look further. 2d, Comparisons of the estimated values and selling prices of a number of fertilizers will generally indicate fairly which is the best for the money. But the "estimated value" 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.

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, plaster, 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.

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 estimated 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. It should be remembered that, in an Annual Report, the fluctuations in trade-value that may occur within the year cannot be accurately followed, and the comparisons of estimated values are mostly in retrospect.

The valuations for 1882 were adopted in consultation with Dr. Goessmann, Inspector of Fertilizers for Massachusetts, and Prof. Cook, Director of, and Dr. Neale, Chemist to, the New Jersey Agricultural Experiment Station, and have been employed by these gentlemen in their official Reports for 1882.

ANALYSES AND VALUATIONS OF FERTILIZERS.

The classification of the Fertilizers analyzed in the Station Laboratory from Nov. 1st, 1881, to Sept. 1st, 1882, is as follows:

13 phosphate rocks and phosphatic (non-nitrogenous) guanos.
4 plain (non-nitrogenous) superphosphates.
49 nitrogenous (ammoniated) superphosphates and guanos.
23 special fertilizers or "formulas."
18 bone manures.
2 fish manures.
6 nitrates.
1 sulphate of ammonia.
6 dried blood and tankage.
1 dried meat.
4 castor pomace and cotton seed meal.
1 fowl manure.
1 compost of tripe refuse.
1 damaged tea.
9 potash salts.
1 plaster.
2 slaked lime.
2 limestones.
2 marls.
1 "Norfolk Fertilizer."
1 marine mud.
3 mucks.

151

Of this number 34 were analyzed for private parties, and are only noticed in the following pages when the results are of general interest and value.

Native Phosphates.

Phosphate Rock, **708.** This sample, sent by H. H. Austin, Suffield, and reported to the Station as for sale by Horatio Lothrop of the same place, was analyzed with the following result:

Phosphoric acid,	37.84
Cost per ton,	$19.00

Cost of phosphoric acid per pound, 2½ cts.

The sample was very fine, all of it passing through a sieve having $\frac{1}{50}$ inch meshes. Prolonged treatment with ammonium citrate dissolved only 4½ per cent. of the phosphoric acid.

The phosphoric acid is therefore mostly "insoluble" but material as finely pulverized as this "Ground Phosphate Rock" might be often used to advantage where phosphates are deficient, especially on soils with abundant humus or decaying vegetable matter, as in case of reclaimed swamps, and where green-crops are plowed in, or on moist grass lands. At the price quoted it would also make a cheap and excellent superphosphate by treatment with oil of vitriol.

It was finally learned that this ground phosphate was not in the market, but was from a sample in the hands of an importer.

783. Phœnix Guano. Sold by W. C. Staples & Son, Westport. Sampled and sent by W. L. Coley, Westport.

Analysis.

"Reverted" phosphoric acid,	16.52
Insoluble phosphoric acid,	6.52
Cost per ton,	$40.00
Estimated value per ton,	33.65

Phœnix Guano from McKean's Island, like the Baker and Jarvis Islands, Curaçao, Orchilla and other guanos from rainy regions, has lost by atmospheric agency all or all but a trace of the nitrogen and potash which it originally contained. The phosphoric acid in them is much more readily soluble than in the rock phosphates, and on that account they are more active as fertilizers when applied to the land without previous treatment with oil of vitriol. Sample **783** was from a small stock remaining in possession of the dealer. The importations of Phœnix Guano are understood to have ceased some years ago.

Plain (Non-Nitrogenous) Superphosphates.

Four articles of this class have been examined within the year. The analyses and valuations of three of them will be found on page 26.

These are superphosphates in the true sense of the term, for essentially all the phosphate of lime which they contain is soluble in water. In such cases it is of little importance to the purchaser

whether the basis of the superphosphate is rock-phosphate or bone, while if, as is generally the case, from one-third to one-half or even more of the phosphoric acid in a superphosphate is insoluble, it will make a very considerable difference in the agricultural value of the article whether the insoluble portion consists of bone or rock. In many cases it is not easy for the chemist to decide with certainty what is the source of the phosphoric acid, and there is therefore wisdom and economy in providing soluble phosphoric acid in these high grade goods.

Plain Superphosphates.

735. Superphosphate of Lime, 19 per cent. From stock of H. J. Baker & Bro., N. Y. Sampled and sent by J. J. Webb, Hamden.

766. Acid Phosphate of Lime, 14 per cent. available phosphoric acid. H. J. Baker & Bro., N. Y., wholesale dealers. Sampled from stock of Wilson & Burr, Middletown, by J. M. Hubbard, Middletown.

779. Dissolved Bone. Made by William L. Bradley, Boston. Sold by H. D. Torrey, Putnam. Sampled and sent by W. I. Bartholomew, Putnam.

	735	766	779
Soluble phos. acid,	19.33	11.50	13.33
Reverted phos. acid,	.31	1.22	1.12
Insoluble phos. acid,	.35	.74	1.75
Cost per ton,	$34.50*	$27.00	$40.00
Cost of soluble phos. acid per 100 lbs.	$ 8.67†	$10.40	$13.46
	$ 8.92‡	$11.74	$15.00

* In New York.

† Reckoning reverted and insoluble at 9 and 6 cents per pound respectively.

‡ Making no allowance for reverted and insoluble.

735 contains a larger percentage of soluble phosphoric acid than any sample previously brought to the Station. Superphosphates are made containing 35 per cent. and over, but these are sold to manufacturers for use in mixed fertilizers, and have not found their way into our retail market.

The cost of soluble phosphoric acid per 100 pounds, making no allowance for the reverted and insoluble phosphoric acid is, in **735,** $8.92, in **766,** $11.74, in **779,** $15.00. If reverted and insoluble phosphoric acid are valued at 9c. and 6c. per pound, the cost of soluble phosphoric acid will be $8.67, $10.40 and $13.46 per 100 pounds respectively. If we add $2.00 to the cost of **735,** to cover freight from New York, the hundred pounds of soluble phosphoric acid in it would cost $9.44 without taking account of the reverted and insoluble, or $9.18 making allowance for these.

It is evident, then, that soluble phosphoric acid can be bought without difficulty at retail for less than the present Station valuation, $12.50 per 100 pounds.

799 is a sample of "Dissolved Bone Black," containing originally not far from 15 per cent. of soluble phosphoric acid, which has been treated with lime to "revert" the phosphoric acid for a particular use. It was sent to the Station for examination by Prof. H. P. Armsby of the Storrs Agricultural School. The analysis is as follows:

Soluble phosphoric acid,	none
Reverted phosphoric acid,	10.14
Insoluble phosphoric acid,	.89

Wood ashes, leached or unleached, will revert superphosphates in the same way and the two should not be mixed if an application of soluble phosphate is desired.

In some sections of the country, purchasers much prefer to buy superphosphates which are dark colored or black. If there is any reason in such a whim it probably lies in the belief that such goods contain bone-black and that a superphosphate made from that material is more apt to be of high grade. The addition of a very little *lampblack* in the manufacture is a not uncommon practice, to gratify this prejudice.

Nitrogenous, (Ammoniated) Superphosphates and Guanos.

This class includes all those commercial fertilizers—excepting the Special Fertilizers or "Formulas" to be noticed further on,—which contain or are claimed to contain any considerable amount of soluble phosphoric acid together with nitrogen. Potash is also found in most of them. Forty-nine samples of these goods have been tested. Sixteen were for private parties. The results of the other thirty-three analyses will be found tabulated on pages 28 to 31. 18 are called by the manufacturers, "Phos-

Nitrogenous Superphosphates.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Sampled and Sent by
752	A. A. Ammoniated Superphosphate of Lime.	H. J. Baker & Bro., New York.	Wilcox & Judd, Bristol.	S. R. Gridley, Bristol.
773	Americus Brand Ammoniated Bone Superphosphate.	Williams, Clark & Co., New York.	O. F. Strunz, Bristol.	" " "
791	Phosphate.	G. H. Harris & Son, Eagleville, Ct.	Manufacturers.	W. H. Barrows, Willimantic.
793	Americus Brand Ammoniated Bone Superphosphate.	Williams, Clark & Co.	F. Ellsworth, Hartford.	L. S. Wells, New Britain.
741	Animal Fertilizer.	L. B. Darling & Co., Pawtucket, R.I.	J. P. Barstow & Co., Norwich.	J. P. Barstow, Norwich.
792	Dry Ground Fish.	Quin. Fertilizer Co., N. London, Ct.	Olds & Whipple, Hartford.	Olin Wheeler, Buckland.
744	Ammoniated Bone Superphosphate.	E. Frank Coe, New York.	J. P. Barstow & Co., Norwich.	J. P. Barstow, Norwich.
720	Superphosphate of Lime.	Bosworth Bros., Putnam, Ct.	Bosworth Bros., Putnam.	James Allen, Putnam.
808	Americus Ammoniated Bone Superphosphate.	Williams, Clark & Co.	O. F. Strunz, Bristol.	Station Agent.
762	Fish and Potash (second grade).	Quinnipiac Fertilizer Co.	S. A. Weldon & Son, Bristol.	S. R. Gridley, Bristol.
726	Phosphate.	" " "	R. B. Bradley & Co., N. Haven.	Station Agent.
805	A. A. Ammoniated Superphosphate.	H. J. Baker & Bro.	Wilcox & Judd, Bristol.	" "
725	Fish and Potash, Crossed Fish Brand.	Quinnipiac Fertilizer Co.	R. B. Bradley & Co., N. Haven.	" "
790	Phosphate.	Lombard & Matthewson, Warrenville, Ct.	Buck, Durkee & Stiles, Willimantic.	N. P. Perkins, Willimantic.
829	Fish and Potash.	Geo. W. Miles Co., Milford, Ct.	Olds & Whipple, Hartford.	Station Agent.

Nitrogenous Superphosphates—continued.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Sampled and Sent by
749	XL. Superphosphate.	Bradley Fertilizer Co., Boston.	H. K. Brainard, Thompsonville.	Station Agent.
729	Pelican Bone Phosphate.	H. J. Baker & Bro.	Dennis Fenn, Milford.	Dennis Fenn, Milford.
747	Fish and Potash (second grade).	Quinnipiac Fertilizer Co.	A. W. Allen, Jr., Thompsonville.	Station Agent.
831	Ammoniated Bone Superphosphate.	Russell Coe, Linden, N. J.	H. A. Stillman & Co., Hartford.	" "
802	Ammoniated Bone Superphosphate.	Preston & Sons, Greenpoint, L. I.	E. N. Pierce & Co., Plainville.	" "
795	Fish and Potash.	Bowker Fertilizer Co., New York and Boston.	W. F. Fuller, Suffield.	W. H. Pomeroy, Suffield.
757	Pelican Bone Phosphate.	H. J. Baker & Bro.	Wilcox & Judd, Coal and Lumber Co., Bristol.	S. R. Gridley.
827	Prepared Dry Fish.	Bowker Fertilizer Co.	Coburn & Gale, Hartford.	Station Agent.
724	Dry Ground Fish Guano.	Quinnipiac Fertilizer Co.	R. B. Bradley & Co., N. Haven.	" "
803	Dried and Ground Fish Guano.	Preston & Sons.	E. N. Pierce & Co., Plainville.	" "
832	Soluble Pacific Guano.	Pacific Guano Co., Boston, Mass.	H. A. Stillman & Co., Hartford.	" "
737	Fish and Potash, Crossed Fish Brand.	Quinnipiac Fertilizer Co.	A. W. Allen, Jr., Thompsonville.	C. T. Remington, Suffield.
730	A. A. Brand Phosphate.	H. J. Baker & Bro.	Dennis Fenn, Milford.	Dennis Fenn.
755	Brighton Phosphate.	Bowker Fertilizer Co.	S. A. Weldon & Son, Bristol.	S. R. Gridley.
750	Pine Island Guano.	Quinnipiac Fertilizer Co.	A. W. Allen, Jr., Thompsonville.	Station Agent.
833	I.X.L. Ammon. Bone Superphos.	Geo. W. Miles Co.	Olds & Whipple, Hartford.	" "
828	Cooke's Blood Guano.	Bowker Fertilizer Co.	A. C. Sternberg, Hartford.	" "
763	Powell's Prepared Chemicals.	Brown Chemical Co., Baltimore.		S. R. Gridley.

Nitrogenous Superphosphates.

Station No.	Name.	Nitrogen of Nitrates.	Nitrogen of Ammonia Salts.	Nitrogen of Organic Matters.	Soluble Phos. Acid.	Reverted Phos. Acid.	Insoluble Phos. Acid.	Potash.	Chlorine.	Estimated value per ton.	Cost per ton.	Valuation exceeds Cost.
752	H. J. Baker & Bro's A. A. Ammoniated Superphosphate of Lime	--	--	3.29	8.44	1.45	.62	3.29	--	$50.23	$42.00	$8.23
773	Williams, Clark & Co's Americus Brand Ammoniated Bone Superphos.	--	--	2.90	10.82	.92	1.05	2.82	1.91	46.71	40.00	6.71
791	Geo. H. Harris & Son's Phosphate	--	--	3.08	4.43	6.26	3.81	.35	4.00	42.81	*37.00	5.81
793	Williams, Clark & Co's Americus Brand Ammoniated Bone Superphos.	--	--	2.81	9.13	1.02	.63	2.95	2.26	41.87	§38.00	3.87
741	Darling's Animal Fertilizer	--	--	4.20	.70	7.46	5.11	5.95	5.76	47.41	‡45.00	2.41
792	Quinnipiac Fertilizer Co's Dry Ground Fish	1.45	--	5.59	1.52	4.58	2.62	2.69	3.19	52.24	50.00	2.24
744	E. Frank Coe's Ammoniated Bone Superphosphate	--	--	2.63	8.11	1.34	2.80	--	--	38.67	37.00	1.67
720	Bosworth Bros' Superphosphate of Lime	--	--	2.10	5.50	4.61	4.17	2.23	--	39.36	*38.00	1.36
808	Williams, Clark & Co's Americus Brand Ammoniated Bone Superphos.	--	--	2.50	9.79	.71	.77	2.42	1.45	41.10	40.00	1.10
762	Quinnipiac Fertilizer Co's Fish and Potash (second grade)	.20	--	2.72	.27	4.83	4.96	4.75	6.60	33.17	33.00	.17
												Cost exceeds Valuation.
726	Quinnipiac Fertilizer Co's Phosphate	1.62	--	1.38	5.43	2.76	2.91	2.35	4.60	39.43	40.00	.57
805	H. J. Baker & Bro's A. A. Ammoniated Superphosphate	--	1.16	1.51	8.30	1.58	.52	3.04	3.03	41.23	42.00	.77
725	Quinnipiac Fertilizer Co's Fish and Potash, Crossed Fish Brand	1.64	--	2.42	.80	3.17	4.13	4.19	8.61	37.00	38.00	1.00
790	Lombard & Matthewson's Phosphate	--	--	2.46	4.34	8.08	.69	.26	4.57	38.43	‖40.00	1.58
829	Geo. W. Miles Co's Fish and Potash	--	.46	3.43	4.08	1.24	1.86	4.31	4.25	38.10	40.00	1.90
749	Bradley Fertilizer Co's XL. Superphosphate	--	--	2.67	8.33	1.38	1.75	1.74	1.77	39.97	42.00	2.03

* In bulk. § In New York. ‡ Figured from cost per bag, viz: $3.75 for 167 lbs. ‖ In bags.

Nitrogenous Superphosphates—continued.

Station No.	Name.	Nitrogen of Nitrates.	Nitrogen of Ammonia Salts.	Nitrogen of Organic Matters.	Soluble Phos. Acid.	Reverted Phos. Acid.	Insoluble Phos. Acid.	Potash.	Chlorine.	Estimated value per ton.	Cost per ton.	Cost exceeds Valuation.
729	H. J. Baker & Bro's Pelican Bone Phosphate	.94	--	1.48	6.35	2.21	.73	2.87	4.51	35.60	38.00	2.40
747	Quinnipiac Fertilizer Co's Fish and Potash (second grade)	--	--	2.84	.15	4.59	5.23	4.93	9.08	33.48	36.00	2.52
831	Russell Coe's Ammoniated Bone Superphosphate	--	--	2.10	8.08	1.88	1.82	1.41	2.48	37.25	40.00	2.75
802	Preston & Sons' Ammoniated Bone Superphosphate	--	--	2.36	7.06	1.79	3.53	--	--	36.44	40.00	3.56
795	Bowker Fertilizer Co's Fish and Potash	--	--	2.18	4.11	1.19	2.16	5.44	10.54	30.91	35.00	4.09
757	H. J. Baker & Bro's Pelican Bone Phosphate	.98	--	1.57	6.46	2.07	.63	2.32	3.93	35.60	40.00	4.40
827	Bowker Fertilizer Co's Prepared Dry Fish	--	--	3.75	1.05	5.85	3.67	--	--	35.56	40.00	4.44
724	Quinhipiac Fertilizer Co's Dry Ground Fish Guano	--	--	5.11	.48	5.18	4.16	2.50	5.15	43.54	48.00	4.46
803	Preston & Sons' Dried and Ground Fish Guano	.39	1.21	1.95	2.23	3.25	.52	--	--	30.46	35.00	4.54
832	Soluble Pacific Guano	.75	--	1.56	6.19	1.91	4.88	3.11	2.62	39.28	45.00	5.72
737	Quinnipiac Fertilizer Co's Fish and Potash, Crossed Fish Brand	.53	--	3.01	.43	4.06	3.58	3.97	8.15	33.87	40.00	6.23
730	H. J. Baker & Bro's A. A. Brand Phosphate	--	--	3.14	6.57	2.45	.55	2.15	2.22	38.71	45.00	6.29
755	Bowker Fertilizer Co's Brighton Phosphate	--	--	2.00	4.88	2.38	4.49	1.63	--	33.10	40.00	6.90
750	Quinnipiac Fertilizer Co's Pine Island Guano	1.80	--	2.72	1.64	3.95	3.90	3.41	--	42.08	50.00	7.92
833	Geo. W. Miles Co's I. X. L. Ammoniated Bone Superphosphate	--	--	1.70	7.71	.90	2.18	1.90	1.68	33.58	42.00	8.42
828	Bowker Fertilizer Co., Cooke's Blood Guano	--	--	1.88	4.11	2.83	4.26	1.54	2.42	31.04	42.50	11.46
763	Brown Chemical Co's Prepared Chemicals	--	--	1.76	3 83	.90	1.62	8.78	6.90	30.37	†46.15	15.78
	Average 32 Samples	--	--	--	--	--	--	--	--	38.69	40.58	----

† Figured from cost per bbl., viz: $6.00 for 260 lbs.

phates or Superphosphates," 6, "Fish and Potash," and 3 "Ground Fish Guano." The other six are "Prepared Dry Fish," "Soluble Pacific Guano," "Pine Island Guano," "Blood Guano," "Animal Fertilizer," and "Prepared Chemicals."

The last named, No. **763,** is advertised as follows:* "For $12 a farmer can buy a formula (520 lbs.) of POWELL'S PREPARED CHEMICALS. This, when mixed at home, makes one ton of SUPERIOR PHOSPHATE, equal in plant-life and as certain of successful crop-production as many high-priced phosphates." A device, resembling a trade mark, bears the words, "Purity." "Quality not quantity."

This is a superphosphate of rather low grade; its cost is $46.15 per ton and its estimated value $30.37. 520 lbs. of it "mixed at home" would require the addition of 1480 lbs. of something better than itself to make "one ton of superior phosphate." It was sampled by Mr. Gridley of Bristol from a lot purchased by a farmer in that place. We do not understand that the goods are at present off red for sale in this State.

It will be observed that during 1882 nitrates have been considerably used as a source of nitrogen both in the superphosphates and special manures. During the last 18 months the nitrogen of Chili saltpeter has ruled cheaper than that of dried blood, azotin, ammonite, fish scrap, etc., so that manufacturers have made use of it more frequently than in past years.

Chlorine has been determined in most cases in order to decide whether the potash in the fertilizer exists as muriate or sulphate. High grade sulphate contains none or only very little chlorine, the double sulphate of potash and magnesia, which has now come into considerable use in this country, has only from one to four per cent. of chlorine while muriate of potash (80 per cent.) has 38 or more per cent.

The table giving a Comparison of Different Fertilizers of the same Brand, p. 33, makes evident the variations which may arise from want of uniformity in the materials employed in the manufacture, accidents or carelessness in the preparation of the fertilizer, the storage of the goods, errors in sampling, etc., etc.

We are informed by the manufacturers that the regular price of the Quinnipiac Fertilizer Co's Fish and Potash No. 1, is $38.00, and that **737** (price $40.00) was from a special lot of which only two tons were made.

* Cover of the American Agriculturist, Jan., 1882.

COMPARISON OF DIFFERENT SUPERPHOSPHATES OF THE SAME BRAND.

Station No.	Name or Brand.	Nitrogen of Nitrates.	Nitrogen of Ammonia Salts.	Nitrogen of Organic Matters.	Soluble Phos. Acid.	Reverted Phos. Acid.	Insoluble Phos. Acid.	Potash.	Chlorine.
752	H. J. Baker & Bro's Ammoniated Superphosphate		1.16	3.29	8.44	1.45	.62	3.29	
805				1.51	8.30	1.58	.52	3.04	3.03
730				3.14	6.57	2.45	.55	2.15	2.22
729	H. J. Baker & Bro's Pelican Bone Phosphate	.94		1.48	6.35	2.21	.73	2.87	4.51
757		.98		1.57	6.46	2.07	.63	2.32	3.93
792	Quinnipiac Fertilizer Co's Dry Ground Fish Guano	1.45		5.59	1.52	4.58	2.62	2.69	3.19
724				5.11	.48	5.18	4.16	2.50	5.15
725	Quin. Fertilizer Co's Fish and Potash, Crossed Fish Brand	1.64		2.42	.80	3.17	4.13	4.19	8.61
737		.53		3.01	.43	4.06	3.58	3.97	8.15
762	Quinnipiac Fertilizer Co's Fish and Potash, Second Grade	.20		2.72	.27	4.83	4.96	4.75	6.60
747				2.84	.15	4.59	5.23	4.93	9.08

Special Fertilizers.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Sampled and Sent by
820	Corn Manure.	Geo. B. Forrester, New York.	----------	S. B. Wakeman, Saugatuck.
821	Onion "	" " "	----------	" " "
789	Corn "	Mapes' F. & P. G. Co., New York.	Mapes' F.& P.G.Co's Br'ch,Hart.	C. H. Pease, South Windsor.
767	Tobacco " (for use with stems).	" " " "	P. M. Augur & Sons, Middlefield.	J. M. Hubbard, Middletown.
787	" " " "	" " " "	Mapes Co's Branch, Hartford.	C. H. Pease.
815	Corn "	" " " "	P. M. Augur & Sons.	P. M. Augur.
822	Potato "	Geo. B. Forrester.	----------	S. B. Wakeman.
816	Orange Tree Manure.	Mapes' F. & P. G. Co.	P. M. Augur & Sons.	P. M. Augur.
788	Tobacco Manure, Connecticut Brand.	" " "	Mapes Co's Branch, Hartford.	C. H. Pease.
760	Corn Manure.	H. J. Baker & Bro., New York.	Wilcox & Judd, Bristol.	S. R. Gridley.
782	Complete Corn Manure.	" " " "	Olds & Whipple, Hartford.	Olin Wheeler, Buckland.
814	Potato Manure.	Mapes' F. & P. G. Co.	P. M. Augur & Sons.	P. M. Augur.
807	" "	H. J. Baker & Bro.	Wilcox & Judd, Bristol.	Station Agent.
806	Corn "	" " "	" " "	" "
761	Stockbridge Manure for Corn & Grain.	Bowker Fertilizer Co.	S. A. Weldon & Son, Bristol.	S. R. Gridley, Bristol.
738	" Grass, Top Dressing.	" " "	J. P. Barstow & Co., Norwich.	J. P. Barstow, Norwich.
756	" Man. for Pot. and Veg.	" " "	S. A. Weldon & Son, Bristol.	S. R. Gridley.
810	" Manure for Grain.	" " "	" " " "	Station Agent.
781	Potato Manure.	H. J. Baker & Bro.	Olds & Whipple, Hartford.	J. F. Phelps, Bloomfield.
780	Complete Tobacco Manure.	" " "	" " "	Olin Wheeler.
740	Stockbridge Man. for Pot. and Veg.	Bowker Fertilizer Co.	J. P. Barstow & Co., Norwich.	J. P. Barstow.
739	" Man. for Corn and Grain.	" " "	" " " "	" "
830	Patent Fertilizer for Tobacco.	Bradley Fertilizer Co., Boston.	A. C. Sternberg, Hartford.	Station Agent.

Special Fertilizers.

Station No.	Name.	Nitrogen of Nitrates.	Nitrog. of Ammonia Salts.	Nitrog. of Organic Matters	Total Nitrogen.	Soluble Phos. Acid.	Reverted Phos. Acid.	Insoluble Phos. Acid.	Potash.	Chlorine.	Estimated value per ton.	Cost per ton.	Valuation exceeds Cost.
820	Corn Manure, Forrester's	----	5.09	.21	5.30	6.94	.84	.78	8.06	6.39	$58.39	*50.00	$8.39
821	Onion " "	----	5.53	----	5.53	5.93	.30	.40	5.69	.66	55.53	*50.00	5.53
789	Corn " Mapes'	1.00	2.36	.17	3.53	7.88	3.78	1.25	7.17	6.29	54.86	50.00	4.86
767	Tobacco " (for use with stems), Mapes'	2.60	2.35	.91	5.86	3.40	4.12	2.30	4.36	1.24	56.30	54.00	2.30
787	" " " " "	2.48	2.46	.66	5.60	4.76	2.77	2.14	4.37	.28	55.92	54.00	1.92
815	Corn " Mapes'	1.44	1.71	.87	4.02	4.93	4.67	2.15	6.91	7.45	51.82	50.00	1.82
822	Potato " Forrester's	----	3.78	----	3.78	5.98	.93	.31	10.27	4.90	50.69	50.00	.69
													Cost exceeds Valuation.
816	Orange Tree Manure, Mapes'	2.22	----	1.18	3.40	2.85	4.60	2.53	3.77	1.14	40.93	42.00	1.07
788	Tobacco Manure, Conn. Brand, Mapes'	1.52	1.68	.42	3.62	5.44	2.33	1.64	9.03	1.72	52.05	54.00	1.95
760	Corn Manure, Baker's	----	----	4.95	4.95	4.54	.89	.19	9.51	----	46.45	50.00	3.55
782	" " "	1.66	1.96	.83	4.45	5.34	.31	.20	7.95	5.61	46.08	50.00	3.92
814	Potato Manure, Mapes'	1.46	1.30	1.18	3.94	3.25	4.61	2.18	6.10	4.88	45.94	51.00	5.06
807	" " Baker's	----	3.00	1.15	4.15	4.88	.14	.10	9.37	12.15	44.86	50.00	5.14
806	Corn " "	1.62	1.93	.61	4.16	4.42	1.34	.43	7.97	9.68	44.49	50.00	5.51
761	Corn and Grain Manure, Stockbridge	1.35	----	2.49	3.84	5.02	1.35	2.76	6.64	6.02	43.90	50.00	6.10
738	Grass Top Dressing, "	1.59	----	2.46	4.05	6.10	.62	2.77	3.69	3.14	43.46	50.00	6.54
756	Potato and Vegetable Manure, Stockbridge	.88	----	2.67	3.55	5.40	1.95	2.65	4.85	5.03	42.44	50.00	7.56
810	Grain Manure, Stockbridge	1.05	.13	2.30	3.48	4.85	1.72	2.57	6.83	6.62	42.39	50.00	7.61
781	Potato " Baker's	----	2.61	.96	3.57	4.66	.22	.05	9.99	11.13	41.87	50.00	8.13
780	Complete Tobacco Manure, Baker's	1.09	3.30	.35	4.76	2.48	.18	.02	8.56	9.98	41.60	50.00	8.40
740	Potato and Vegetable Manure, Stockbridge	.70	----	2.56	3.26	6.02	1.58	2.31	4.95	4.62	41.54	50.00	8.46
739	Corn and Grain " "	.67	----	3.15	3.82	6.29	1.12	1.03	3.87	3.53	41.46	50.00	8.54
830	Patent Fertilizer for Tobacco, Bradley's	.56	----	2.08	2.64	7.00	1.31	1.51	1.90	2.11	36.46	50.00	13.54
	Average 23 Analyses	----	----	----	----	----	----	----	----	----	46.93	50.22	----

* In New York.

Rejecting **763,** the average estimated value of the other 32 nitrogenous superphosphates this year has been $38.69 and the average cost $40.58; a difference in round numbers of $2.00.

In 1881 the average cost, $43.00, exceeded the average estimated value by $4.00, and in 1880 the average cost was $39.00, $3.00 more than the estimated value.

Special Fertilizers or "Formulas."

On pages 34 and 35 will be found the analyses and valuations of 23 samples of these fertilizers. In 10 of the number nitrogen is present in three forms, as nitrates, ammonia, and in animal or vegetable matter ("organic nitrogen.")

In Mapes' Tobacco manures, (Connecticut brand, and for use with stems) Nos. 767, 787, and 788 and in Forrester's Onion Manure No. 821, most of the potash is present as sulphate.

The estimated value of two articles of this class is very considerably higher than their market price, in nine of them estimated value and cost differ less than $5.00, while in the remaining 12 the cost is a good deal higher than the estimated value.

The *average* cost is $50.22; $3.29 more than the average estimated value $46.93. In 1881 the average cost $48.40 exceeded the estimated value by $4.80, and in 1880 the average cost, $48.00, exceeded the estimated value by $3.35.

On the following page is a comparison of the various corn, tobacco and potato manures.

The average composition of these manures is as follows:

	Nitrogen.	Phosphoric Acid.	Potash.
Corn manure,	4.32	8.93	7.34
Tobacco manure,	3.67	7.30	6.49
Potato manure,	3.74	8.06	6.37

The tobacco and potato manures—on the average—agree in composition more closely than separate analyses of the same brand of goods usually do.

An examination of these analyses and those of special fertilizers made in past years, abundantly justifies the conclusion that on the farms of this State it is quite as rational to use a "Corn manure" on potato land or a "potato manure" for the tobacco crop, as in any other way. To attempt to construct a fertilizer specially adapted to growing a particular crop on soils which

differ so widely in composition and have been so differently fertilized and tilled as those of Connecticut is irrational and useless. Objection to these goods only applies to their names and to the theory on which they are made and on which their special claims rest. As *fertilizers* they are of good quality; their higher retail price, compared with that of other superphosphates is in part justified by the larger amounts of nitrogen and potash which they usually contain.

Comparison of Special Manures.

Brand.		Total Nitrogen.	Soluble Phos. Acid.	Reverted Phos. Acid.	Insoluble Phos. Acid.	Potash	Chlorine.
Corn Manure	Forrester's, 1 Analysis	5.30	6.94	.84	.78	8.06	6.39
	Mapes', 2 Analyses	3.77	6.40	4.23	1.70	7.04	6.87
	Baker's, 3 "	4.52	4.77	.85	.27	8.48	7.64
	Stockbridge, 3 "	3.71	5.39	1.43	2.12	5.78	5.39
Tobacco Manure	Mapes', 1 Analysis	3.62	5.44	2.33	1.64	9.03	1.72
	Baker's, 1 "	4.76	2.48	.18	.02	8.56	9.98
	Bradley's, 1 "	2.64	7.00	1.31	1.51	1.90	2.11
Potato Manure	Forrester's, 1 Analysis	3.78	5.98	.93	.31	10.27	4.90
	Mapes', 1 "	3.94	3.25	4.61	2.18	6.10	4.88
	Baker's, 2 Analyses	3.86	4.77	.18	.07	9.68	11.64
	Stockbridge, 2 "	3.40	5.71	1.76	2.48	4.90	4.82

Bone Manures.

Method of Valuation.

For the benefit of those who have not the previous reports of the Station at hand, a detailed account of the method employed for the valuation of bone manures is here given, being in large part reproduced from former Reports.

Experience has led us to distinguish, for the purpose of valuation, five grades of ground bone, the proportions of which are found by a mechanical analysis, *i. e.*, by passing a weighed sample of the bone through a system of four sieves. These five grades have the dimensions, and during 1882, have had the trade-values below specified, viz:

Grade.	Dimensions.	1882. Estimated value per pound. Nitrogen.	Phos. Acid.
Fine,	smaller than one $\frac{1}{60}$ inch,	17 cts.	6 cts.
Fine medium,	between $\frac{1}{60}$ and $\frac{1}{25}$ inch,	15 "	5½ "
Medium,	" $\frac{1}{25}$ and $\frac{1}{12}$ inch,	14 "	5 "
Coarse medium,	" $\frac{1}{12}$ and $\frac{1}{6}$ inch,	13 "	4½ "
Coarse,	larger than $\frac{1}{6}$ inch,	11 "	4 "

The chemical and mechanical analysis of a sample of ground bone being before us, we separately compute the nitrogen value of each grade of bone which the sample contains, by multiplying the pounds of nitrogen per ton in the sample by the per cent. of each grade, taking $\frac{1}{100}$th of that product, multiplying it by the estimated 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 estimated value of the sample of bone.

The following example will serve for illustration. Rogers and Hubbard's Pure Ground Bone, **818,** contains nitrogen 3.94 per cent., or 78.8 pounds per ton; phosphoric acid 22.50 per cent., or 450 pounds per ton. The mechanical analysis showed:

31	per cent.	fine.
25	"	fine medium.
23	"	medium.
21	"	coarse medium.
0	"	coarse.
100		

The calculations are as follows:

$78.8 \times 31 \div 100 \times 17 = \$4.16$
$78.8 \times 25 \div 100 \times 15 = 2.96$
$78.8 \times 23 \div 100 \times 14 = 2.54$
$78.8 \times 21 \div 100 \times 13 = 2.15$

Estimated value of nitrogen, $11.81

$450 \times 31 \div 100 \times 6 = \$8.37$
$450 \times 25 \div 100 \times 5\frac{1}{2} = 6.19$
$450 \times 23 \div 100 \times 5 = 5.18$
$450 \times 21 \div 100 \times 4\frac{1}{2} = 4.25$

Estimated value of phosphoric acid, $23.99

$35.80

The result agrees with the cost ($35.00) within 80 cents.

When the sample of bone contains foreign matters introduced as preservatives, dryers or adulterants, such as salt, salt-cake, niter-cake, ground oyster-shells, spent lime, plaster, or soil, these must be taken account of in the mechanical analysis, especially since they would be likely, on sifting, to pass chiefly or entirely into the finer grades. In such cases, the several grades as obtained by sifting must be separately examined, and the amounts of foreign matter which they contain must be suitably taken into the account if an *exact* valuation is desired.

In some instances a further source of error in valuation may arise from the fact that the proportions of nitrogen and phosphoric acid are not the same in the finer and coarser portions of a sample, which contains no adulterants, properly speaking, but partly consists of meat, tendon, etc.

There is, however, a limit beyond which it is useless to attempt to refine the processes of valuation. When they become too complicated or costly they defeat the object which they should serve. It is sufficient that the errors of valuation are no greater than those which arise from unavoidable variations in different portions of the same lot of fertilizer, or in different lots of the same brand. A difference of two or three dollars between cost and estimated value cannot ordinarily demonstrate that either is out of the way.

Bone Manures.

Analyses.

[See pages 40 and 41.]

Sample **733** was very wet, which accounts for the low percentage of nitrogen and phosphoric acid found in it. At the price asked ($25.00 per ton) it is an excellent article for immediate use, but in its moist state could not be kept long without decomposition and loss.

In five of the samples analyzed this year the valuations fall very considerably below the market price. In **731** and **804** this is caused chiefly by the coarseness of the bone. **770** contains salt-cake in considerable quantity, as this brand of goods usually does. **801** probably contains the same. **751** has 6.9 per cent. of sulphuric acid combined with lime, being equivalent to 13.3 per cent. of hydrated plaster.

Salt-cake is used as a drier and preservative to mix with bone which would otherwise be too wet to handle and transport. No secret is made of it by the manufacturers, nor is the mixture sold as "pure" bone. But bone sold as "pure" which contains 13 per cent. of land plaster has clearly been adulterated.

The average cost of bone this year, $35.29, exceeds the average estimated value, $32.14, by $3.15.

Bone Manures—Analyses and Valuations.

Station No.	Name.	Nitrogen.	Phos. Acid.	Finer than $\frac{1}{50}$ inch.	Finer than $\frac{1}{25}$ inch.	Finer than $\frac{1}{12}$ inch.	Finer than $\frac{1}{6}$ inch.	Coarser than $\frac{1}{6}$ inch.	Estimated value per ton.	Cost per ton.	Valuation exceeds Cost.
711	Bone Sawings	3.86	26.98	97	3	----	----	----	$45.37	*40.00	$5.37
764	Williams, Clark & Co's Bone Meal	3.76	21.22	61	22	15	2	----	36.28	32.00	4.28
733	Rogers & Hubbard Co's Bone Sawings	2.10	16.50	100	----	----	----	----	26.94	25.00	1.94
732	" " " " Meal	3.94	23.66	40	35	25	----	----	38.63	37.50	1.13
771	Mapes' Extra Fine, Strictly Pure Ground Bone	2.49	28.87	52	40	8	----	----	40.98	40.00	.98
818	Rogers & Hubbard Co's Pure Ground Bone, Grade AX	3.94	22.50	31	25	23	21	----	35.80	35.00	.80
§677	Peck Brothers' Ground Bone	4.32	21.89	7	14	17	33	29	31.95	32.00	Cost exceeds Valuation.
824	Geo. B. Forrester's Pure Ground Bone	3.40	21.95	42	19	21	16	2	34.13	†36.00	1.87
794	Williams, Clark & Co's Americus Bone Meal	3.14	22.54	59	18	16	7	----	35.43	†38.00	2.57
743	Rogers & Hubbard Co's "A" Bone	3.94	24.47	10	13	31	46	----	35.16	38.00	2.84
742	Darling's Fine Bone	3.82	22.71	73	21	6	----	----	39.02	42.00	2.98
839	Richards' Pure Bone	4.08	20.55	14	21	24	31	10	31.94	35.00	3.06
753	Peck Brothers' Ground Bone	4.04	21.77	6	9	30	46	9	31.77	35.00	3.23
770	Lister Brothers' Celebrated Ground Bone	3.22	14.48	42	19	14	14	11	25.10	31.00	5.90
731	H. J. Baker & Bro's Pure Ground Bone	3.65	23.83	10	16	35	38	1	33.99	40.00	6.01
804	Richardson's Ground Bone	3.54	16.35	6	20	29	29	16	25.51	33.00	7.49
751	Pure Ground Bone	2.84	14.33	41	23	23	10	3	24.27	34.00	9.73
§670	Rafferty & Williams' Bone Meal	1.68	14.36	52	20	14	14	----	21.19	32.00	----
801	Preston & Sons' Ground Bone	1.94	10.47	43	21	15	12	9	17.12	35.00	17.88
817	Rogers & Hubbard Co's Marine Bone	4.61	22.89	33	55	12	----	----	39.99	‡	----
	Average 19 Analyses	----	----	----	----	----	----	----	32.14	35.29	----

§ The analyses of **670** and **677**, made late in 1881, were in the last Station Report, with valuations reckoned from the trade values adopted for last year. The advance in cost of nitrogenous raw-materials having necessitated changes in the Station scale of trade values, these analyses are here given with valuations calculated by the trade-values of 1882.

* In bbls. net. † In New York. ‡ Price not fixed.

Bone Manures.

Station No.	Name or Brand.	Manufacturer.	Dealer.	Sampled and Sent by
711	Bone Sawings.	----------	Wilder & Puffer, Springfield.	R. E. Pinney, Suffield, Ct.
764	Bone Meal.	Williams, Clark & Co., New York.	S. A. Weldon & Son, Bristol.	S. R. Gridley, Bristol.
733	Bone Sawings.	Rogers & Hubbard Co., Middleto'n	Manufacturers.	P. M. Augur, Middlefield, Ct.
732	Bone Meal.	" " " "	"	" " " "
771	Extra Fine, Strictly Pure Ground Bone.	Mapes' Formula and Peruvian Guano Co., New York.	W. H. Smith, Norwalk, Ct.	D. H. Van Hoosear, Wilton, Ct.
818	Pure Ground Bone, Grade AX.	Rogers & Hubbard Co.	Manufacturers.	Chas. Fairchild, Middletown, Ct.
677	Ground Bone.	Peck Bros., Northfield, Ct.	G. P. Burnett, Bristol.	S. R. Gridley, Nov. 9, 1881.
824	Pure Ground Bone.	Geo. B. Forrester, New York.	----------	S. B. Wakeman, Saugatuck, Ct.
794	Americus Bone Meal.	Williams, Clark & Co.	F. Ellsworth, Hartford, Ct.	L. S. Wells, New Britain, Ct.
743	"A" Bone.	Rogers & Hubbard Co.	----------	J. P. Barstow, Norwich, Ct.
742	Darling's Fine Bone.	L. B. Darling & Co., Pawtucket, R.I.	J. P. Barstow & Co., Norwich.	" " " "
839	Richards' Pure Bone.	Geo. Richards & Co., Unionville.	Manufacturers.	Wm. Porter, Unionville.
753	Ground Bone.	Peck Bros., Northfield.	G. Perry Bennett, Bristol, Ct.	S. R. Gridley.
770	Celebrated Ground Bone.	Lister Bros., Newark, N. J.	Manufacturers.	D. H. Van Hoosear, Wilton.
731	Pure Ground Bone.	H. J. Baker & Bro., New York.	Dennis Fenn, Milford.	Dennis Fenn.
804	Ground Bone.	Geo. Richardson & Son, Unionville	E. N. Pierce & Co., Plainville.	Station Agent.
751	Pure Ground Bone.	----------	H. K. Brainard, Thompsonville.	" "
670	Bone Meal.	Rafferty & Williams, New York.	S. A. Weldon & Son, Bristol.	S. R. Gridley, Oct. 6, 1881.
801	Ground Bone.	Preston & Sons, Greenpoint, L. I.	E. N. Pierce & Co., Plainville.	Station Agent.
817	Marine Bone.	Rogers & Hubbard Co.	Manufacturers.	Chas. Fairchild.

Dry Ground Fish.

During the year no samples of this fertilizer have been sent to the Station by purchasers or dealers. The two examinations made, were partial analyses for private parties.

Nitrates of Potash and Soda.

837. Saltpeter. From stock of E. B. Botchford, New Milford.

838. Nitrate of Soda. From stock of Merritt Beach, New Milford.

837 and **838** were sampled and sent by J. M. Hallock, Gaylordsville.

811. "Saltpeter." Sold by Martin Hungerford, Gaylordsville. Sampled and sent June 19, by G. N. Woodruff, Sherman. No printed analysis or statement of composition was attached to the barrels or accompanied the goods, which were sold under verbal guarantee that they contained 95 per cent. saltpeter.

812. "Saltpeter." Sold by M. L. Hungerford, Gaylord's Bridge. Sampled and sent June 20th, by A. G. Barnes, New Milford. No guarantee upon the barrel. Stated to be pure saltpeter, such as is used in the manufacture of powder.

813. "Saltpeter." Sampled and sent June 19th, by H. T. Haviland, Sherman.

The results of the analyses of **811, 812** and **813** were reported to Messrs. Woodruff, Barnes and Haviland, June 30th. In a few days after came to hand—

819. "Saltpeter." Sold by M. L. Hungerford. Sampled and sent July 3d, by Geo. G. Hungerford, Gaylordsville. "Name and address of manufacturer not known."

This last sample contained besides the rhombohedral crystals of soda-saltpeter with nearly square faces, a number of long prismatic crystals of common or potash saltpeter.

Analyses and Valuations.

	837	838	811	812	813	819
Nitrogen in nitrates	12.98	14.29	6.24	5.53	7.12	10.76
Potash	44.65	----	none	none	none	13.38
Magnesia	----	.86	----	----	----	----
Chlorine	2.06	2.66	38.11	39.47	33.70	17.83
Water	1.12	3.78	----	----	---	----

The composition of these articles, as deduced from the above analytical determinations, may be represented as follows:

	837	838	811	812	813	819
Sodium nitrate (soda-saltpeter)	----	86.76	37.89	33.57	43.23	41.22
Potassium nitrate (potash-saltpeter)	93.78	----	none	none	none	28.72
Sodium chloride (common salt)	2.24	4.38	62.11	65.05	55.51	29.38
Potassium chloride	1.47	----	----	----	----	----
Magnesium sulphate	----	2.59	----	----	----	----
Water	1.12	3.78	----	----	----	----
Other matters, not determined	1.39	2.49	----	1.38	1.26	.68
	100.00	100.00	100.00	100.00	100.00	100.00
Commercial value of nitrogen* per ton	$67.50	74.31	32.45	28.75	37.02	55.95
" " " potash† " "	$62.51	----	----	----	----	18.73
" " " salt‡ "	----	----	$6.70	7.00	6.00	3.25
Estimated value per ton	$130.01	74.31	39.15	35.75	43.02	77.93
	**	**	††	††	not	††
Cost per ton	$600.00	100.00	130.00	130.00	stated	130.00

* Reckoned from the Station price of nitrogen in nitrates, viz: 26 cents per lb.

† Potash is valued at 7 cents per lb.

‡ Assuming agricultural salt, containing 94 per cent. sodium chloride, to cost $10.00 per ton. See Station Report for 1881, p. 53.

** Reckoned from price per cwt.

†† Reckoned from price per pound, 6½ cents.

The term "saltpeter" properly refers to nitrate of potash which in its pure state contains 53.4 per cent. of potash and 46.6 per cent. of nitric acid, the latter equivalent to (containing) 13.84 per cent. of nitrogen. **837** is the commercial article of fair quality. Refined saltpeter is now quoted at from 7 to 9 cts. per lb. and can be bought in New York for that price in 100 lb. packages. At that price saltpeter can be obtained by consumers in New Milford for from $140 to $180 per ton with the cost of freight from New York added. Nitrate of Soda, also called "cubic niter," or "Chili saltpeter" contains in the pure state 36.5 per cent. of soda and 63.5 per cent. of nitric acid, the latter equivalent to 16.46 per cent. of nitrogen. The commercial article usually contains 95 per cent. of pure nitrate of soda, from 1 to 3 per cent. of moisture, besides a little chloride of sodium (salt) and dirt. **838** is nitrate of soda of rather poor quality; containing 2.6 per cent. of Epsom salts and rather more salt and dirt than first rate goods do. 95 per cent. nitrate of soda has retailed in the New York and Philadelphia markets this year at about $76.50 per ton. In some cases as low as $67.50.

The samples sent from Sherman and New Milford, as "pure saltpeter, such as is used in the manufacture of powder," **811, 812** and **813,** are variable mixtures of soda-saltpeter (Chili saltpeter) with common salt, the latter predominating, and contain no potash at all, while as said before such saltpeter as is used in making gunpowder contains 46.6 per cent. of potash. Pure potash-saltpeter by the Station valuation for 1882 has an estimated value of $136.00 per ton. These "saltpeters" are worth commercially but $43, $39 and $35.75 respectively, and not only are destitute of potash, an essential ingredient of that saltpeter which it is claimed they were represented to be, but they contain 56 to 65 per cent. of common salt, which is not, in general, a benefit to land or crops, even when applied cautiously and in small quantity, and is often an injury, especially on tobacco, the burning quality of which it is believed to impair very seriously.

The last sample, **819,** contains a considerable proportion of potash-saltpeter, and has about double the money-worth of the others, yet nearly 30 per cent. of it is common salt and its cost exceeds its value by more than fifty dollars per ton.

Sulphate of Ammonia.

One sample of this article has been examined the past year with the following result:

778. Sulphate of Ammonia from the Bradley Fertilizer Co., Boston, Mass.; sold by H. D. Torrey, Putnam; sampled and sent by W. L. Bartholomew, Putnam.

Analysis.

Nitrogen,	20.56
Equivalent Sulphate of Ammonia,	96.90
Cost per 100 lbs.,	$ 6.00
Cost of nitrogen per 100 lbs.,	$29.11

The quality of this article is unexceptionable. Inferior grades of "Sulphate of Ammonia" sometimes come into the market, which contain a part of their nitrogen in the form of cyanides and sulpho-cyanides of ammonium, and are therefore poisonous and destructive to vegetation.

Dried Blood and Tankage.

Four analyses of these materials have been made for private parties, and the results are here given with the other analyses made for purchasers. **736.** Dried Blood, made by Sperry & Barnes, New Haven; sent by J. J. Webb, Hamden. **768.** Tankage, made by Strong, Barnes, Hart & Co., New Haven; sent by J. M. Hubbard, Middletown. **702, 703** and **704** are samples of comparatively pure dried blood containing very little bone. "Tankage" is a mixture of blood and offal of various sorts with fragments of bone. It contains less nitrogen, more phosphoric acid and usually more moisture than the pure dried blood. **736, 768** and **784** are all articles of this class.

Analyses.

	736	768	784	702	703	704
Nitrogen,	7.43	6.99	6.96	11.08	10.08	10.01
Equivalent ammonia,	9.02	8.49	8.45	13.45	12.24	12.15
Phosphoric acid,	7.46	6.90	4.14			
Moisture,			30.26	9.27	18.99	19.00
Estimated value per ton,	$44.61	41.83				
Cost per ton,	$35.00	35.00				

Allowing 6 cents per pound for the phosphoric acid in **736** and **768,** the nitrogen costs 18 cents in one and 19 in the other. No other fertilizers examined this year furnish nitrogen in so cheap and readily assimilable a form.

Cotton Seed and Castor Pomace.

Analyses and Valuations.

706. Castor Pomace, manufactured by H. Mayhew & Son, Fort Scott, Kansas. Sampled and sent by E. F. Collins, Somers. Not finely ground.

723. I.X.L. Castor Pomace, manufactured by R. B. Brown & Co., St. Louis. Sampled and sent by A. P. Hills, East Hartford.

746. Jersey Castor Pomace, manufacturer not known. Sampled from stock of A. W. Allen, Jr., Thompsonville, by the Station Agent.

748. Cotton Seed Meal. Sampled from stock of H. K. Brainard, Thompsonville, by the Station Agent.

ANALYSES AND VALUATIONS.

	706	723	746	748
Nitrogen,	5.01	5.73	4.95	6.55
Phosphoric acid,	1.89	2.06	1.55	3.52
Potash,	0.94	1.19	1.08	2.05
Cost per ton,	Not given.	$30.00	32.00	29.00
Estimated value per ton,	$21.25	24.29	20.74	29.85

723 appears to contain a large admixture of Cotton Seed Meal, to which its greater content of nitrogen is due.

Some tobacco growers believe that Castor Pomace has a particularly favorable effect on the quality of the tobacco leaf, which cannot be produced by other nitrogenous manures, and therefore prefer to pay a special price for nitrogen in this form. The Station valuations, however, as is abundantly explained elsewhere, do not and are not designed to indicate the *agricultural* value of fertilizers, but represent the average market prices of their different ingredients.

FOWL MANURE.

A sample of this material, **684,** sold by Horatio Lothrop, Suffield, and sent by H. H. Austin, Suffield, has the following composition:

Nitrogen,	3.25
Insoluble in acid (sand and soil),	38.20
Potash,	1.12
Phosphoric acid,	2.83
Estimated value per ton,	$19.43
Cost,	$27.00

The fowl manure was quite dry. It contained a considerable quantity of feathers. In it nitrogen is valued at 20 cents, phosphoric acid at 9 cents, and potash at 6 cents.

TRIPE REFUSE.

701. Refuse from Tripe Factory, composted with earth. Sent by Newton Brothers, 341 Asylum St., Hartford.

ANALYSIS.

Nitrogen,	2.20
Phosphoric acid,	2.91
Sand and soil,	3.49
Estimated value,	$9.51
Cost per ton,	not known.

The Tripe refuse contained about 60 per cent. of moisture, and on burning left 9 per cent. of ash, of which 5.5 per cent. was soluble in dilute acid and consisted chiefly of bone-ash (phosphate of lime). The sample was accordingly nearly free from "earth." Its nitrogen is valued at 15 cents, its phosphoric acid at 5 cents. Its mechanical condition was coarse.

DAMAGED TEA.

705. Sold by H. J. Baker & Bro., New York; sent by Edwin Hoyt, New Canaan.

ANALYSIS.

Nitrogen,	2.04
Ash,	11.99
Water,	54.44

POTASH SALTS.

On pages 48 and 49 are tabulated the analyses and valuations of 9 fertilizers belonging in this class. Five of them are high grade muriates, three double sulphates of potash and magnesia and one kainite.

798 was stated to have been taken from a bag, also sent, on which, besides one word too indistinct to make out, the following was printed:

"Actual Sulphate of Potash. Patented by Dr. F. Dupre and C. H. Hake, Germany and America. Manufactured by the Stassfurter Chemische Fabrik, Stassfurt. J. H. Salmon, New York, Agent.

From the analytical results the following composition is calculated for **775** and **798**:

	775	798
Sulphate of potash,	47.82	45.85
" magnesia,	35.79	39.03
Soda, chlorine, water, &c.,	16.39	15.12
	100.00	100.00

Sulphate of magnesia is now offered for agricultural use in "Kieserite" which contains about 80 per cent. and is quoted at $4.50 to $5.25 per ton wholesale. Adding to the highest of these figures 20 per cent., we have $6.30 as a fair retail price. The samples **775** and **798** which contain 36 to 40 per cent. of sulphate of magnesia have, accordingly, about $3.00 worth of that sub-

Potash Salts.

Station No.	Name.	Importer.	Dealer.	Sampled and Sent by
728	Muriate of Potash, 80–84 per cent.	H. J. Baker & Bro., New York.	Dennis Fenn, Milford.	Dennis Fenn.
734	" " 80 "	" " " "	----------	J. J. Webb, Hamden.
769	" " 80 "	" " " "	Wilson & Burr, Middletown.	J. M. Hubbard, Middletown.
765	" " 80 "	----------	S. J. Hall, Meriden.	Oliver Rice, Meriden.
777	" "	Wm. L. Bradley, Boston, Mass.	H. D. Torrey, Putnam.	W. I. Bartholomew, Putnam.
823	Sulphate of Potash.	----------	Geo. B. Forrester, New York.	S. B. Wakeman, Saugatuck.
809	Acorn Brand German Potash Salts.	Williams, Clark & Co., New York.	O. F. Strunz, Bristol.	Station Agent.
775	Double Sulphate of Potash and Magnesia.	----------	H. J. Lathrop, Suffield.	W. F. Fuller, Suffield.
798	Actual Sulphate of Potash.	----------	----------	J. H. Lathrop, Suffield.

Analyses.

	728	734	769	765	777	823	809	775	798
Potash (potassium oxide)	55.25	50.23	51.21	52.13	54.14	24.20	11.63	25.86	24.80
Equivalent to pure muriate	86.81	79.02	80.56	82.57	85.70	----	----	----	----
" " " sulphate	----	----	----	----	----	44.82	21.50	47.82	45.85
Magnesia	----	----	----	----	----	----	----	11.93	13.01
Chlorine	----	----	----	----	----	2.20	25.07	.90	3.93
Potash guaranteed or implied in brand	50	50	50	50	----	----	----	----	----
Muriate guaranteed	80	80	80	80	----	----	----	----	----
Sulphate guaranteed	----	----	----	----	----	----	22	----	----
Cost per ton	$50.00	*40.00	42.50	45.00	**60.00	†37.57	15.00	38.00	35.00
Estimated value per ton	----	----	----	----	----	33.88	11.63	----	----
Cost per 100 lbs. of potash	$4.53	3.98	4.15	4.31	5.54	7.76	6.44	‡7.34	‡7.05

* In New York. ** Reckoned from price per 100 lbs. † Reckoned from price of bbl., 346 lbs., net.
‡ Making no allowance for sulphate of magnesia.

stance per ton: allowing for it, 100 pounds of potash in **775** cost $6.77 and in **798** cost $6.45.

The analyses show that the two brands "Double Sulphate of Potash and Magnesia," and "Actual Sulphate of Potash," are practically the same thing.

In the high grade muriate, actual potash has cost at retail from 4 to 5½ cents a pound; on the average 4½ cents, or half a cent a pound less than is credited for it in the Station valuation.

Land Plaster.

834. Cayuga Plaster, sent by P. M. Augur & Sons, Middlefield.

Analysis.

Hydrated sulphate of lime or plaster,	68.71
Insoluble in acid,	7.50
Carbonates,	23.79
	100.00
Cost per ton,	$6.00

The Land Plaster from New York State, Onondaga and Cayuga plaster, contains usually from 65 to 75 per cent. of hydrated plaster, 6–8 per cent. of insoluble matter, besides from 18 to 28 per cent. of carbonate of lime.

Nova Scotia plaster has on the average 94 per cent. of hydrated plaster, 2 per cent. of insoluble matter and 4 per cent. of carbonates.

Lime.

796. Fertilizer Lime from Canaan, Ct. Sold by H. K. Brainard, Thompsonville. Sampled and sent by W. F. Fuller, Suffield.

797. Fertilizer Lime (from Pennsylvania?) Sold by W. F. Fuller, Suffield. Sampled and sent by H. H. Austin.

The direct results of the analyses were as follows:—

	796	797
Lime,	70.12	45.08
Magnesia,	.67	31.59
Oxide of iron and alumina,	.20	3.61
Carbonic acid,	7.76	3.48
Water,	20.50	4.77
Silica,		5.56
Insoluble in acid,	.28	5.78
Undetermined matters and loss,	.47	.13
	100.00	100.00
Cost per ton,	$9.00	$8.00

The compounds actually existing in the Canaan lime, **796**, are almost certainly, both in kind and quantity, as given below. The state of combination of the ingredients of **797** cannot be so positively ascertained from the analysis. The statement below is probably correct except that the silica is combined with the iron and a small part of the lime (perhaps also with a little magnesia and alumina). The quantities of lime, etc., that thus chemically unite to silica in the burning of impure limestones, such as yield **797**, depend upon the temperature to which the rock is subjected in the kiln.

	796	797
Calcium hydrate (slacked lime),	79.61	12.62
Calcium carbonate (carbonate of lime),	17.63	7.91
Magnesium hydrate,	.98	
Magnesium oxide (magnesia),		31.59
Calcium oxide (lime),		32.80
Oxide of iron and alumina,	.20	3.61
Matters insoluble in acid,	.28	5.78
Silica (combined with lime and iron as silicates,)		5.56
Moisture, undetermined matters and loss,	1.30	.13
	100.00	100.00

The effect of much silicates (glass- or slag-like compounds formed by strongly heating together silica and lime or iron) in a lime is to "bind" the lime and retard slacking. The effect of magnesia, especially in large proportion, is also to retard or prevent slacking and to diminish the caustic or corroding quality of the lime.

Sample **797** is stated not to have heated when drenched with water, but after standing three weeks it crumbled without killing the grass on which it was heaped.

The question of the comparative value of the two samples is an important one. **797** was bought for application upon tobacco-land. The value of lime applied to land is of two sorts. It may be of service by its caustic or alkaline character in virtue of which it, for example, provokes decomposition of the inert nitrogen-compounds of the soil and thus acts indirectly as a supply of nitrogen. For this use **796** is much superior to **797**. The other mode of action of fertilizer-lime lies in its direct supply of plant-food. On a soil destitute of magnesia, **797** would be better than **796**, but magnesia is commonly abundant enough in our soils, and while an occasional application of a magnesia fertilizer may be advantageous we may conclude that, generally speaking, a nearly pure lime is preferable to one containing a large proportion of magnesia.

Limestone.

709. Limestone, quarried about forty years ago.
710. Limestone, from top of layer.
Both samples were sent by L. Elliot, Durham.

Analyses.

	709	710
Insoluble in acid (sand and soil),	1.84	3.71
Lime,	53.91	52.91
Magnesia,	.63	.52
Phosphoric acid,	.08	.12
Carbonic acid, etc., by difference,	43.54	42.74
	100.00	100.00

The composition may also be stated as follows:—

	709	710
Carbonate of lime,	96.14	94.30
Carbonate of magnesia,	1.32	1.09
Phosphate of lime,	.15	.22
Silica, etc., insoluble in dilute nitric acid,	1.84	3.71
Undetermined matters (carbonate of iron?) and loss,	.55	.68
	100.00	100.00

These limestones are comparatively pure carbonate of lime.

Shell Marl.

698. Shell marl sent by Prof. J. Hoyes Panton, Guelph, Canada.

Analysis.

Moisture,	.24
Insoluble in acid,	.41
Oxide of iron,	.29
Lime,	53.03
Magnesia and other matters,	1.07
Carbonic acid and combined water,	44.96
Phosphoric acid,	trace
	100.00

Norfolk Fertilizer.

772. Norfolk Fertilizer. Made by Styron, Whitehurst & Co., Norfolk, Va. Sampled, sent, and sold by M. B. W. Wheeler, Westport.

The direct results of analysis were as follows:

Lime,	43.43
Magnesia,	1.39
Soda,	5.44
Potash,	.93
Oxide of iron,	.51
Chlorine,	6.55
Phosphoric acid,	.16
Sulphuric acid,	1.78
Carbonic acid,	11.23
Insoluble matters,	2.67
Moisture at 212°,	16.01
Combined water, by difference,	9.90
	100.00

The actual state of combination of the ingredients of the "Norfolk fertilizer" is probably the following:—

Common salt (sodium chloride),	10.26
Muriate of potash (potassium chloride),	.67
Sulphate of potash (potassium sulphate),	.95
Gypsum (hydrated calcium sulphate)	2.88
Carbonate of lime (calcium carbonate),	25.52
Slacked lime (calcium hydrate),	37.26
Slacked magnesia (magnesium hydrate),	2.02
Phosphate of iron,	.67
Sand and insoluble matters,	2.67
Moisture and loss,	17.10
	100.00

The Norfolk Fertilizer is a mixture of ground oyster-shells and slacked lime with some 15 per cent. of "kainite" or similar low-grade "potash-salts" or the equivalent. Its fertilizing and commercial values are about those of leached ashes. The Connecticut farmer can scarcely afford to pay more than $7 to $8 per ton for it. The price quoted to the Station was $30.

Fossil Marl.

786. Fossil Marl. Sampled and sent by Jones Brothers, South Windsor. R. W. Roberts, East Hartford, dealer.

"Fossil Marl" in this instance is the Green Sand Marl of New Jersey. The sample **786** is quite similar to **316** analyzed at this Station in 1879 (see Station Report for that year, p. 46). Below are given the full analysis of **316** and a partial analysis of **786.**

	316	786
Moisture,	16.70	17.64
Combined water,	3.26	
Sand, insoluble silica,	18.33	
Soluble silica,	26.65	
Oxides of iron and alumina,	23.00	
Lime,	.43	
Magnesia,	3.12	
Potash,	5.69	
Soda,	.60	
Phosphoric acid,	.90	.92
Undetermined matters,	.42	
	100.00	
Cost per ton,		$10.00

The analysis given in the pamphlet (issued by Hooper & Co., General Agents) accompanying the sample gives phosphoric acid at 2.8 per cent. and potash at 7.3 per cent. The sample contains but one-third that amount of the former, and as to the latter it exists as a silicate—in the mineral *glauconite*, which gives the green color to the marl—and is insoluble or very slowly soluble, and accordingly the marl has little effect as an active fertilizer when used in small doses, but rather belongs to the class of amendments which often produce striking results on poor soils, when applied in large quantities.

This marl has been extremely useful in New Jersey on lands near to market, and but a little way removed from the marl pits, where its cost is but $3 to $5 per ton. To transport it to Connecticut can hardly be profitable to the farmer here, unless all the circumstances are favorable to laying it on at low cost.

Marine Mud.

685. The sample was sent by Wm. T. Foote, Esq., of Guilford.

Analysis.

Water,	45.68
Organic and volatile,	4.54*
Insoluble in acid (sand and soil),	40.97
Oxide of iron and alumina,	6.14
Lime,	.90
Magnesia,	.05
Potash,	.36
Soda,	.56
Sulphuric acid,	.79
Phosphoric acid,	trace
	100.00

* Containing nitrogen 0.18

This Marine Mud, compared with stable manure is as rich or richer in lime, magnesia, potash, soda and sulphuric acid. It contains but one-third as much nitrogen and is quite deficient in phosphoric acid. It would serve admirably to use in connection with fish manures, which supply little besides nitrogen and phosphates.

Mr. Foote writes as follows regarding this mud :—

"The mud is washed into a small bay between Sachem's Head and Mulberry Point; and is flooded at every tide. I have had fifteen years' experience with it on light-textured though dark-colored loam with a clayish subsoil or underlaid by rock. It should be dug in winter; the action of the frost pulverizes it till it is like ashes. It is then left to dry a month or so. If dug in summer it bakes hard. I cart it to fields from twenty rods to half a mile distant. It costs two cents a bushel dumped on the field ready to spread. I use from 800 to 1000 bushels per acre, in drills and in hills, broadcast on pasture or spread and plowed in. When I used 2000 bush. mud to the acre I raised potatoes at the rate of 400 bush. One cart load was accidentally spread upon a space about 15 feet square and plowed in, and a very large crop was the result; from one hill I took 13 potatoes (all there were) which weighed 6½ lbs. With corn I tried alternate rows of mud and yard-manure; the latter from a yard of twenty cows where 1100 bush. of grain had been fed in the winter. Early in the season the mud rows did not show as well as the other; later they caught up and were equal in results to the other, in size of stalk and amount of grain.

In good corn years I have had 100 bush. of shelled corn to the acre with mud alone; but the general average is 75 bush. This last year of late drouth, the best corn was on the driest land with mud. With wheat this year I used barn-yard, hog-pen, and mud manure with an average crop of 25 bush. per acre to all three. With rye I do not find it successful, though others do who have used it on sandier soil. Of English hay I have 3 tons per acre where nothing but mud has been used for years.

Top-dressing pastures once in three years keeps them in fine grass and apparently would do so forever. I do not find it quick enough for an early vegetable garden, without some other more heating manure. With beets I have raised 900 to 1000 bush. per acre."

Review of the Fertilizer Market.

Organic Nitrogen in Dried Blood, Azotin and Ammonite was quoted in New York at wholesale in November, 1881, at $23.40 to $24.30 per 100 lbs., which are the maximum figures for the year. It fell a little gradually till January, 1882, and from then on quite rapidly till early summer, when nitrogen in blood sold at $19.90, and in azotin and ammonite at $19.50. Since then prices have advanced but very little, and on Nov. 1, 1882, nitrogen in blood was quoted at $19.73, and in azotin and ammonite at $19.73 to $20.49.

Thirteen analyses of blood, ammonite, fish, cotton seed, castor pomace, etc., made at the New Jersey and Connecticut Stations this year, show that the average retail cost of nitrogen in them has been $21.60 per 100 lbs. The highest price paid was $29.35, the lowest $16.80. In most cases these were *manufacturers'* retail prices, and do not include freight and the charges of middle-men.

Two samples of Castor Pomace from the stock of *retail agents* in this State furnished nitrogen at $23 and $29.35 (allowing 6 cts. and 5 cts. respectively for the phosphoric acid and potash in them), though in the cheaper article there was evidently a large admixture of cotton seed.

The single sample of cotton seed meal analyzed, with the allowance mentioned above for phosphoric acid and potash, furnished nitrogen at $17.35 per 100 lbs.

There is no other ingredient in commercial fertilizers which shows such wide differences in retail cost as organic nitrogen, and none which requires as much judgment in its purchase, if the buyer desires to get it at the best advantage to himself.

Nitrogen in Ammonia Salts, on the first of November, 1881, cost $25.60 per 100 lbs. *at wholesale*, and remained stationary in price till March, 1882. Since then it has fallen, and from June on has been quoted at $22.40 per 100 lbs. The average *retail* price of nitrogen in this form in New York and Philadelphia, as shown by analyses made at the New Jersey Agricultural Experiment Station and published in July, has been $23.35. The single sample examined here from a Connecticut retail dealer furnished nitrogen at $29.11. The difference between this and the retail New York prices is caused in part by cost of handling and transportation.

Nitrogen in Nitrate of Soda has cost *at wholesale* through the year less than in any other form. It was quoted in November, 1881, at $20.40 per 100 lbs., which is the highest figure for the year. From then it steadily declined till last September, when it cost $16.80, and on the first of November of this year stood at $17.55 to $18.40. The average price asked by the large retail houses in New York has been about $22 to $23, according to the bulletin of the New Jersey Station. No analyses have been made in this Station of articles of this class which were of average quality or price.

Soluble Phosphoric Acid in the three samples examined here has cost at retail in this State $10.84 on the average. In New York it has retailed at $10.72 when made from South Carolina rock, and a little less when made from bone black.

Insoluble Phosphoric Acid has shown no very marked changes during the year. Charleston rock unground, "free on board," (f. o. b.) at Charleston was quoted at $8.80 per ton in January, and has fallen since, the quotation on Nov. 1st, 1882, being $6 to $6.50. Ground and rough bone have also been quite steady in price, the latter sort ruling highest in November and December, 1881.

Potash as high grade (80 *per cent.*) *muriate* has been very steady, prices ranging from $3.24 to $4.06 per 100 lbs., since May, 1881, and averaging $3.60; small lots purchased in New York have cost on the average $4. In Connecticut it has retailed this year for about $4.50.

Potash as high grade sulphate seems not to be in the retail market in Connecticut to any amount.

Potash in the double sulphate of potash and magnesia has cost, making liberal valuation for sulphate of magnesia, $6.77 and $6.45 per 100 lbs. at retail in the Connecticut market. Only one sample of kainite has been analyzed here. Potash in that article has retailed in New Jersey for $5.06 per 100 lbs. on the average.

From the Review of the Fertilizer Market it appears that the prices of certain fertilizers have varied very considerably during the year. To take a single instance: the nitrogen of dried blood cost at wholesale not far from 23½ cents a pound in November, 1881, but could be got for a little less than 19 cents a pound 7 months later, in June, 1882. Assuming that the blood had 10 per cent. of nitrogen, this would be a difference of over $7 per ton in the cost, an item well worth saving if it can be saved.

Individual purchasers, buying small lots, cannot probably secure any considerable advantage by watching the state of the market, but farmers' clubs and other associations of farmers may find that it pays them well to carefully watch the market and to buy their fertilizers in one lot and at a time when wholesale prices rule low.

The following explanations will be helpful in the examination of market quotations.

Phosphate rock, *kainite*, *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." A "unit of ammonia" is one per cent. or 20 lbs. per ton. To illustrate, if a lot of dried blood 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 $3.75 per unit, a ton of it will cost $8\frac{1}{2} \times 3.75 = \$31.88$.

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 $4.00	per unit	is equivalent to	nitrogen at	24.3	cts.	per	lb.
" 3.90	"	"	"	23.7	"	"	
" 3.80	"	"	"	23.0	"	"	
" 3.70	"	"	"	22.4	"	"	
" 3.60	"	"	"	21.8	"	"	
" 3.50	"	"	"	21.2	"	"	
" 3.40	"	"	"	20.6	"	"	
" 3.30	"	"	"	20.0	"	"	
" 3.20	"	"	"	19.4	"	"	
" 3.10	"	"	"	18.8	"	"	
" 3.00	"	"	"	18.2	"	"	

Commercial sulphate of ammonia contains on the average 20 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 $5\frac{1}{2}$	cents per	lb.	Nitrogen	costs	27.5	cents per	lb.
" $5\frac{3}{8}$	"	"	"	"	26.8	"	
" $5\frac{1}{4}$	"	"	"	"	26.3	"	
" $5\frac{1}{8}$	"	"	"	"	25.6	"	
" 5	"	"	"	"	25.0	"	
" $4\frac{7}{8}$	"	"	"	"	24.4	"	
" $4\frac{6}{8}$	"	"	"	"	23.8	"	
" $4\frac{5}{8}$	"	"	"	"	23.1	"	
" $4\frac{4}{8}$	"	"	"	"	22.5	"	
" $4\frac{1}{2}$	"	"					

Commercial nitrate of soda averages 95 per cent. of the pure salt or 15.6 per cent. of nitrogen.

If quoted at $3\frac{5}{8}$	cents per	lb.	Nitrogen	costs	23.2	cents per	lb.
" $3\frac{1}{2}$	"	"	"	"	22.3	"	
" $3\frac{3}{8}$	"	"	"	"	21.5	"	
" $3\frac{1}{4}$	"	"	"	"	20.8	"	
" $3\frac{1}{8}$	"	"	"	"	19.9	"	
" 3	"	"	"	"	19.2	"	
" $2\frac{7}{8}$	"	"	"	"	18.3	"	
" $2\frac{3}{4}$	"	"	"	"	17.6	"	
" $2\frac{5}{8}$	"	"	"	"	16.9	"	
" $2\frac{1}{2}$	"	"	"	"	16.0	"	

Commercial muriate of potash usually has 80 per cent. of the pure salt, or $50\frac{1}{2}$ per cent. of actual potash.

If quoted at 2.25	cts. per	lb.	Actual potash	costs	4.46	cts. per	lb.
" 2.20	"	"	"	"	4.36	"	
" 2.15	"	"	"	"	4.26	"	
" 2.10	"	"	"	"	4.16	"	
" 2.05	"	"	"	"	4.06	"	
" 2.00	"	"	"	"	3.96	"	
" 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	"	

The accompanying table, prepared by Mr. Hutchinson, shows the fluctuations in the wholesale prices of a number of fertilizing materials in the New York market, during the last 19 months. 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 per cent. and nitrate of soda 15.6 per cent. of nitrogen, and muriate of potash 50½ per cent. of actual potash or 80 per cent. of the pure salt. For three months azotin and ammonite were not quoted at all.

	Cost of Nitrogen at Wholesale in				Cost of Potash at Wholesale in
	Blood. cts. per lb.	Azotin and Ammonite. cts. per lb.	Nitrate of Soda. cts. per lb.	Sulphate of Ammonia. cts. per lb.	Muriate of Potash. cts. per lb.
1881. May	21.3	21.8	21.9	24.7	3.78
June	21.5	21.8	21.1	24.8	3.86
July	22.0	21.8	20.8	25.6	3.92
August	22.4	22.1	20.8	25.2	4.06
September,	23.8	....	20.9	24.7	3.78
October	23.0	24.3	20.8	24.9	3.64
November	23.3	24.3	20.4	25.6	3.62
December	23.1	....	20.3	25.7	3.60
1882. January	23.0	....	19.9	25.6	3.71
February	22.3	22.2	19.8	25.6	3.60
March	19.6	20.1	18.3	25.0	3.36
April	19.7	19.7	18.4	23.8	3.24
May	19.1	19.7	18.3	22.7	3.26
June	18.9	19.7	16.9	22.4	3.28
July	19.8	19.5	16.8	22.4	3.40
August	19.5	19.5	16.8	22.4	3.52
September	19.7	20.3	17.7	22.4	3.60
October	19.7	20.1	17.8	22.3	3.56
November	19.7	20.1	17.5	22.2	3.56

Home-made Superphosphate.

Occasional inquiries are made at the Station with regard to the method of preparing superphosphate of lime on the farm, and as to the economy of its home manufacture. It is perfectly practicable for a farmer to make a high grade and moderately fine article without any considerable outlay for apparatus. The *economy* of the manufacture depends on the prices which he has to pay for the phosphatic raw material and oil of vitriol delivered on his premises. In general it is probably cheaper for him to buy his superphosphate ready made; but it occasionally happens that he can find in his neighborhood small quantities of suitable material offered at a low rate, being a waste product from some manufacturing establishment, which of itself is comparatively inert as a fertilizer, but which can be economically treated with oil of vitriol on the farm and so be made valuable.

An instance of this kind has come to the notice of the Station within the last year. A gentleman living near a factory where iron was extensively worked found that each year a ton or two of bone char was thrown away which he could get for about $8 per ton. Bone char contains no nitrogen, but a high percentage of phosphate of lime in an inert condition. Applied directly to land little or no immediate effect was to be expected.

It was suggested that he try the experiment of treating this char with oil of vitriol, which he could buy for 1½ cts. per lb. by the carboy. The process employed was as follows: A vat was constructed by laying boards closely together on level ground, and putting up sides eight or ten inches high, after the style of a mortar bed. 500 lbs. of bone char were put in the vat, and spread somewhat, with a slight depression in the middle of the pile where the water and acid were afterwards poured. 15 gallons of water were measured into a barrel and 300 lbs. of the acid were weighed off into a crockery vessel. It could have been weighed into wood but would have charred it somewhat.—The greatest care is necessary in pouring the acid from the carboy. The receiving vessel should be held close to the neck of the carboy to prevent spattering as much as possible, and the eyes kept averted; for the acid destroys the clothing and burns the skin very quickly when it falls on it. A drop on the skin should be immediately wiped off with a cloth and the place well washed.—The water was then poured rather slowly over the bone char and mixed with a hoe till the

whole mass was wet. As soon as this was done, the acid was poured on in the same way. The mass became at once very hot, the carbonate of lime, which is always present, was decomposed, and the escape of steam and carbonic acid was attended with much frothing. This must be provided for by making the vat of sufficient size. The materials were worked over and thoroughly mixed with the hoe until the steaming and frothing had about ceased. The mixture then had the consistence of mortar, but within twenty-four hours dried to a crumbly state, and could be pulverized for spreading on the land. In this instance it was mixed with dried blood, which was bought for $35 a ton, and furnished nitrogen at 19 cents a pound. At the end of twenty-four hours samples from different batches of the phosphate were analyzed at the Station. The lowest percentage of soluble phosphoric acid found was 11 per cent., the highest 14.2 per cent., and the average 12.9 per cent. It is believed that the solvent action of the oil of vitriol was not then complete, and that tests made later would have shown a larger percentage of soluble phosphoric acid. The cost of the process was as follows:

2,000 lbs. bone char,	$8.00
1,200 lbs. oil of vitriol,	18.00
Labor,	4.00
	$30.00

Unfortunately no weighing was made of the superphosphate. Of course it could not have been less than 3,200 lbs., the weight of acid and bone, and must have been considerably more, since the sulphate of lime that is formed retains a large quantity of water. But calling its weight 3,200 lbs. and its content of soluble phosphoric acid the lowest found, 11 per cent., we have as a result 352 pounds of soluble phosphoric acid, costing $30, equivalent to $8.52 per 100 lbs., or over $2 per hundred less than the average cost in the retail market during the last year.

Peat or Swamp Muck.

714. Peat from East Haven Peat Swamp, sent by Henry E. Pardee, New Haven. Surface sample containing roots.

715. Peat from East Haven Peat Swamp, sent by Henry E. Pardee. Sample from beneath **714**, free from roots.

745. Muck sent by Philip T. Vibert, Meriden, Ct.

Analyses.	714	715	745
The fresh material contains:—			
Water,	70.51	79.66	80.16
Organic and volatile matters,	24.80	17.85	16.95
Ash,	4.69	2.49	2.89
	100.00	100.00	100.00
The organic and volatile matters contain:—			
Nitrogen,	1.08	0.66	0.59
The ash contains:—			
Silica and insoluble,	1.67	.42	.51
Oxide of Iron, Alumina and Phosphoric acid,	.63	.19	.27
Lime,	1.37	.74	1.14
Undetermined,	1.02	1.14	.97
	4.69	2.49	2.89
The dry mucks contain:—			
Organic and volatile matters,	84.09	87.75	85.43
Nitrogen,	3.66	3.24	2.97
Silica and insoluble,	5.66	2.07	2.55
Oxide of Iron, Alumina, &c.,	2.14	.93	1.36
Lime,	4.64	3.64	5.75

The question of bringing a peat or muck swamp into cultivation, is one that frequently arises. The first essential of course, is drainage sufficient to remove the surface water for a depth of several feet. In small swamps the muck is commonly mixed with enough washed-in soil to admit of cultivation directly. Where the area of the bog is considerable this is commonly not the case. Peat so nearly pure as the samples here reported, contains scarcely enough mineral matters to make a good soil if merely drained. Addition of soil, sand or coal ashes would be needful to amend the texture and prevent the peat from cohering together to a crust and shrinking during dry weather in a degree injurious or fatal to crops, unless indeed frequent shallow tillage were resorted to for the prevention of such disaster. As regards plant-food, there is an ample store of the element most costly, to supply artificially, viz.: nitrogen. The fresh material of these samples contains, on the average, as much of this element as stable or yard manure (0.77 per cent.), and this will become available under suitable cultivation. Lime is also abundant. The analysis is not carried out sufficiently to show how the other mineral elements stand, and probably phosphates and potash salts would be shortly needed. With their help these peats would probably make very productive soils for many years to come.

The Composition of Trap Rock.

"New Britain, Ct., June 13, 1882.

"I enclose a sample of the stones and pulverized matter with which our soil abounds. I desire to know if it contains potash or phosphate of lime. I presume you can tell at a glance, but if an analysis is necessary I hope you will make it. This trap rock abounds in all this region. I had an impression that such rotten stone as I send you is rich in all the mineral elements of plant food. John B. Smith."

It has not been possible hitherto to make an analysis of the sample of decayed trap rock sent by Mr. Smith, and the following answer to his inquiries was based on the general result of such investigations on the subject as have come to the writer's knowledge. By Trap Rock is meant the "blue stone" which forms the material of East and West Rocks at New Haven, of the Hanging Hills of Meriden, and of many similar elevations along the valleys of the Connecticut and Quinnipiac Rivers.

Answer.

The "trap rocks" of this State, so far as they have been analyzed, contain—

$7\frac{1}{2}$	to	$10\frac{1}{2}$	per cent. of	lime,
5	to	$7\frac{1}{2}$	"	magnesia,
$2\frac{1}{2}$	to	$3\frac{1}{2}$	"	soda,
$\frac{4}{10}$	to	$\frac{7}{10}$	"	potash,
trace	to	$\frac{14}{100}$	"	phos. acid.

The rest of the rock consists of silica, alumina, and oxide of iron. The trap rocks are commonly very slow to disintegrate, some that contain much iron decay more rapidly. During the slow decay, the lime, magnesia and alkalies become soluble in water and wash away, so that the decayed rock is less rich in these substances than the original. The rock is a source of these forms of plant food during its decay, more than afterwards. Still the fine clayey matters that result retain small quantities of plant food, such as you will find stated in the various soil-analyses that have been published in the Station Reports. Phosphoric acid remains mostly in the residue of the decay, and potash is washed out much less relatively than soda and lime. The abundance and vigor of the vegetation on such decayed rock, provided sunlight and moisture are suitably supplied, is a better test of the richness of the material in plant food than analysis can be, for the latter cannot always discriminate between the unaltered rock whose elements are insoluble and inaccessible to the plant, and the available plant food in the soil.

Soils.

In December, 1881, two samples of soil were sent to the Station for analysis. The analyses were made in due time, and the results are here given with appropriate extracts from the correspondence.

721. Soil received from Thos. E. Porter, Coventry.

722. Soil sent by A. E. S. Bush, Niantic.

Analyses.

	721	722
Moisture	2.354	.473
Organic and volatile matters *	10.476	6.577
Potash	.056	.047
Soda,	.074	.093
Lime,	.130	.080
Magnesia,	.130	.186
Oxide of iron and alumina,	3.575	4.542
Sulphuric acid,	.059	.041
Phosphoric acid,	.038	.051
Sand, silica and insoluble silicates,	83.108	87.910
	100.000	100.000
* Containing nitrogen,	.334	.140

Mr. Porter wrote in substance regarding **721**:—

"The soil was taken from different parts of a twenty-five acre meadow. The meadow is surrounded on three sides by hills over which brooks and springs descend and overflow it in part during the wet season. There are no visible springs in the meadow.

"It is ditched on each side by ditches 4 feet wide and 15 to 18 inches deep. The black, wet dirt or soil is 12 inches in depth; then, in places, one or two inches of sand and below this is a thin stratum of bluish clay in some parts and below this again a coarse gravel bed. One family have lived there since 1720 and know that the sod has never until now been broken or plowed. The land is for the most part dry enough for tillage, being upland, so-called. It bears what is called June grass. When the frost comes the June grass stubble curls downward and becomes

gray. Cattle will not eat it, and it used to be hard to cut it with scythes. This field is ditched once across which carries the brook mainly by it; it was plowed in the autumn of 1881 for the first time, for the purpose of rotting out the June grass stubble which I want to exterminate and eventually put in Red Top or Fowl Meadow Grass. Wood ashes and barn-yard manure are excellent to bring fertility, but they are scarce. I would like to ascertain what ails this land. It appears to be deficient in plant-food; now what is a restorative? I will also state that this meadow turf peeled up like so many sheepskins, when plowed. I have used bone and muriate of potash, the latter with great success for potatoes."

In reply to Mr. Porter was written as follows:—

"Accompanying this you will find results of the analysis of the sample of soil received from you. All the elements of plant-food are present, and not one of them is deficient in *quantity*. Nitrogen, potash and magnesia are present in as large percentage as in some of the best wheat soils of Illinois. Unfortunately the analysis of a soil gives little information respecting the *state of availability* of the substances found, and experience shows that of the substances present which are indispensable to plant-growth, the one most abundant may be least available! This analysis does not indicate any one ingredient to whose abundance or deficiency the low fertility of the soil is due, and gives, so far as I can see, no clue to a course of treatment for improving it. It leaves us, in fact, in the same state of uncertainty as we were before the analysis was made."

With regard to sample **722** Mr. Bush wrote:—

"I forward to the Station, by express, a sample of our soil. I say 'our' because we, of this neighborhood, have considerable soil of about the same quality apparently, and an analysis of one sample may benefit a good many persons. The sample is taken as fairly as possible from different parts of a plot of about four acres. I have no doubt you will say any fertilizer would be good for it, but, if possible, I would like to know what fruits and vegetables it is best adapted to and what fertilizer is best adapted to make them grow."

To the inquiries of Mr. Bush, answer was made in similar terms as follows:—

"I give herewith the results of the analysis of your soil. I can not find in these figures any satisfactory explanation of its poverty. Everything required by crops is there. Some very productive western soils are no richer in potash. The difficulty with our analyses is that we have no satisfactory means of learning the availability of the substances present. I send you herewith an analysis of a marine mud from Guilford, (No. **685**). (See p. 54). You will observe that it contains no more nitrogen* than your soil, and no weighable amount of phosphoric acid. Its lime, potash, and sulphuric acid are, indeed, 8 to 10 times more abundant than in your soil, but that does not account for the fact that a dressing of 800–1000 bushels of the mud on an acre of Guilford soil renders the latter highly productive. We must infer from the effects of the mud that its elements are in an active, quickly-available form, but the analysis does not reach that point of inquiry, and we are not much wiser in respect to what *special application* may benefit your land or adapt it to fruits, than before the analysis was made."

The application of Mr. Porter for an analysis of his soil was replied to in the following terms: "I regard it as very doubtful if the analysis will be of much service for the desired purpose, having rarely been able to draw very definite conclusions from the analysis of a soil as to what fertilizers were adapted to make it productive."

To this Mr. Porter answered: "I think that if the soil is analyzed we can between us judge what it contains and what it wants—of course there is no certainty—but I have faith that in due time science will discover exactly what any soil is deficient in and what tonic will in any case, promote fertility. The New England farmer, of the present and future, to be successful, must turn to the scientific men for help. The soil is sick and it must be built up the same as animals when sick."

It occasions much regret to be compelled to feel that, for the present, science cannot guarantee to get adequate return for work spent in soil-analysis. Undoubtedly it would be possible to learn more from analyses of the soils here under consideration, than has been learned. No doubt, it would be possible to make much more accurate and refined analyses than those here printed. Doubtless some nearer approach to a knowledge of the availability of the elements might be attained. The Station, probably, has not done as well as might be done in this branch of its work.

* Two analyses of either would usually differ more as regards nitrogen than the results on 685 and 722.

It has, however, done the best it could, under the circumstances, with due regard to its obligations in other directions.

The following extract from the Report of the Conn. Board of Agriculture for 1881, pp. 87, 88, will perhaps throw some light on this subject:—

"QUESTION. To what expense is a farmer to be if he wishes to send samples of earth to the Experiment Station for chemical analysis?

ANSWER. It will cost nothing but the freight. The answer to that question suggests another.—"What is the use of analyzing a sample of earth?" We had the idea extensively promulgated some twenty or thirty years ago, that if a sample of soil were analyzed by a competent chemist, the competent chemist could tell exactly what to put upon the field to make anything grow. Well, the competent chemist can generally tell what to put upon the field without making an analysis. Plenty of good manure will help in almost any case!

A little calculation will readily show what a chemist *cannot* do. You know that it has been frequently a matter of experience that a hundred pounds of Peruvian guano, of the old-fashioned sort that we had twenty years ago, would make the difference between a good crop and a poor crop, when it happened to be applied to the right land, with the right crop and right weather. That hundred pounds of Peruvian guano contained about fifteen per cent. of nitrogen, about fifteen per cent. of phosphoric acid, and about three per cent. of potash, to which 33 pounds of ingredients its fertilizing value was alone due. The soil of an acre of land, taken to the depth of one foot, will weigh about four millions of pounds. Thirty-three pounds of fertilizer, and four millions of pounds of soil, assuming that the crop got all its nutriment from the first foot of ground, are the two quantities which, put one above the other, the smallest at the top and a line between, make the fraction which the chemist must figure down to if he will find out from an analysis of the soil what element of fertility that soil is deficient in, viz: $\frac{33}{4,000,000}$ or $\frac{1}{121,000}$. But, in fact, if the chemist in two analyses of the same sample of soil gets results which agree within $\frac{1}{10,000}$ he is lucky and his luck does more towards that result than his skill, for usually the tenth of one per cent. or $\frac{1}{1000}$ is about the limit of accuracy in chemical analysis. It may thus easily happen that the chemist cannot by analysis distinguish between two soils, one of which has had a dressing

of 1000 lbs. of the best Peruvian guano to the acre, and the other nothing."

Mr. Porter's observation that muriate of potash was used on his land with great success for potatoes, goes to show that potash (soluble in cold hydrochloric acid) while existing in his soil to the extent of 0.056 per cent., or a long ton, (2240 lbs.) per acre, for 1 foot of depth, is not present there in such a state of solubility as that crops can gather it rapidly enough for their necessities.

The fact that a few hundred pounds of active (soluble) fertilizers give good crops, shows that when by external aid plants have been brought to a certain development of root and leaf they are then able to gather a good share of their nourishment from this soil.

The failure of these meadows to give a good crop of good grass may not be altogether due to lack of plant-food. The texture and physical qualities of the soil exercise oftentimes a controlling influence on the kind and amount of vegetation which it supports. Simple drainage and deep tillage which can have no immediate effect on the quantity of the elements that are commonly regarded important to fertilizers or to the soil, often renovate the field by removing too much water and admitting more air, and thus deepening the available tilth.

As Mr. Porter says, "the soil is sick and it must be built up the same as animals when sick." Now the physician when called to a patient will first assure himself that the sanitary conditions are what they should be:—that is, that his patient is warm and dry and his system in a condition to respond to medicine when it is given. If he is not comfortably placed, medicine may do no good and rather aggravate than improve his condition. To carry out the simile, in building up sick land the rule should be, first of all, to make sure that its physical condition is what it should be, and if it is too wet or cold, too compact or too leachy, to remedy these defects by tillage, drainage and the use of amendments. When that is done, we may apply medicine, in the form of fertilizers, if indeed the land does not recuperate without them, but if it is not done little benefit is to be expected from any amount of fertilizers.

This is what Mr. Porter has done with gratifying success. Under date of Nov. 24, 1882, he writes: "We plowed 6 acres in June (1881), harrowed and sowed to buckwheat. The seed did not germinate well, although a neighbor who had some of the

same seed got a good crop. This plowed ground on examination developed the reason why the buckwheat did not respond. It was this: the June grass turf is much like a sheepskin with the wool on, turned over, the moisture could not come up through the tough soil. But the following spring it was plowed and stocked down with oats, red top and clover. The oat crop was good, the grass seed made a good catch and last October the red top was six to eight inches high. There are hundreds of acres of this kind of land in the northeastern portion of the United States, and Connecticut especially has her share. According to your analysis, what is now called the poorest soil, almost worthless, is actually a small mine of wealth if nature is aided in throwing off the water; and the plow will frequently do the important part."

On Reducing Bones with Ashes.

On page 67 of the last report, in discussing this subject it was advised to use gypsum (land plaster) in making a compost heap of bones and ashes. The action of the ashes on the bone is due to the alkaline qualities of their carbonate of potash or of the caustic potash which results from its mixture with quicklime. The use of gypsum was suggested by the fact that this substance is a preservative of animal matter and would tend to prevent waste of nitrogen.

Professor E. W. Hilgard, of San Francisco, Cal., has kindly called my attention to the fact that gypsum (sulphate of lime) destroys the solvent effect of ashes on the bone tissue, as he has found by actual trial, and as must be anticipated from the well-known chemical changes which take place between sulphate of lime and carbonate of potash when they are dissolved together in water. They yield in fact carbonate of lime and sulphate of potash which are quite without effect on the bone.

SALT AND SALTPETRE FOR PRESERVING FOOD.

The following questions were propounded by the Wilton Farmers' Club, through its secretary, D. H. Van Hoosear, Esq.:

"Our Club has had much discussion upon "Butter Salt" and "Saltpeter." I send you to-day samples of both, which please analyze and report upon. Some complain of butter, pork, &c., not keeping; others of brine not being salt enough, yet salt in the barrel.

Could we trouble you to answer the following questions:

1. What is the saving property of salt?
2. What is meant by salt "losing its savor?"
3. Do you find anything detrimental to the keeping of butter, pork, &c., and if so, what, in the samples of salt sent herewith?
4. Is lime in salt injurious to its keeping qualities for butter, pork, &c.?
5. Can salt be *too* fine for salting butter?
6. Which do you think (according to samples) is the best for butter?
7. Is Turk's Island salt as good as rock salt for preserving pork?

(Please give us a standard to go by.)

8. Has saltpeter preserving qualities, and why do we use saltpeter in preserving pork and hams? What effect does it produce on pork and hams?
9. How can we tell an adulterated or impure article of salt or saltpeter?

(One man describes some as "soapsuds," when dissolved in water.)"

Answers.

"1. What is the saving property of salt?"

The putrefaction, or spoiling of meat, and probably also, the rancidity of butter, are caused by microscopic organisms, probably vegetable in their nature, which are latterly known in science as *bacteria*. If the growth and multiplication of these organisms is hindered or prevented, putrefaction and rancidity are correspondingly checked or altogether stopped.

A great variety of substances, such as vinegar, carbolic acid in coal tar, kreosote in wood smoke, camphor, oil of cloves, spirits of turpentine, arsenic, tannin, salicylic acid, sulphurous acid, and

other so-called antiseptics arrest decay, and putrefaction by paralyzing or killing the minute living things whose development appears to stand in the closest relation to these changes.

In the preservation of food we can use only such antiseptics as do not interfere with its proper uses and as are at the same time cheaply and generally obtainable. For common uses, "common salt" is most applicable because of all salts it is the cheapest and has the least injurious effect on the health of man, small quantities of it, as an addition to food, being in fact beneficial to health as well as agreeable to the taste.

The antiseptic effect of salt is only fully manifested by a nearly saturated solution of it in water, *i. e.* by a strong brine. When dry salt is sprinkled over meat it shrinks the fiber of the flesh and expels its juice. A strong brine acts in a similar manner and itself becomes thereby diluted. When pork spoils after salting, it is because there is not salt enough where the spoiling occurs, although surplus of salt exists near by.

Brine in which beef has been corned will taint in warm weather unless it is kept saturated by addition of more salt and frequent stirring. Pure salt and also a brine saturated with salt, will gather moisture rapidly from cool damp air, such as often exists in cellars.

The effect of this "hygroscopic" quality of salt is to make a brine grow weaker at the top, and consequently pork which is but just covered by brine, may, on long standing, become tainted, although there is plenty of salt in the barrel. Either more salt should occasionally be sprinkled over the meat or the access of moist air should be prevented by a close cover.

2. Biblical scholars, I believe, explain the passage "Losing its savor," as follows:

The salt used in the New Testament times was obtained by natural evaporation of salt water, and was a good deal mixed with fine earthy matters, clay, etc. When exposed to rain, the salt was dissolved away and the clay remained, having much of the appearance of the original material, but really containing little or no salt, and having therefore lost its savor or taste. Now that we so universally use a very pure salt, the losing or apparent losing of its savor becomes quite impossible.

3. "Do you find anything detrimental to the keeping of butter, pork, etc., and if so, what—in the samples of salt sent herewith?"

Here follow the results of partial analyses of the samples of salt and a statement of their composition, as calculated from the results of analysis. On dissolving the samples in water, only very minute, scarcely weighable, quantities of foreign matters remained undissolved. They are therefore as clean from dirt and mechanical impurity as could be desired.

Chemical Analyses of Samples of Salt

Sent by D. H. Van Hoosear.

	1	2	3	4	5
	Deakens Salt. Finney & Benedict, Norwalk.	Ashton Salt. Selleck Bros. Norwalk.	Higgins Salt. H. K. & F. B. Thurber & Co. New York.	Phœnix Fact'y-filled Holmes & Keeler. Norwalk.	Holmes Salt. J. C. Rockwell. Wilton.
Results of partial Analysis.					
Water at 100°	0.69	0.71	0.48	0.77	0.37
Lime	0.67	0.65	0.62	0.66	0.55
Magnesia	0.10	0.09	0.11	0.09	0.07
Sulphuric Acid	0.92	0.82	0.83	0.85	0.84
Composition calculated from the above Analytical Results.					
Water at 100°	0.69	0.71	0.48	0.77	0.37
Sulphate of Lime	1.56	1.40	1.41	1.45	1.33
Chloride of Calcium	0.06	0.14	0.08	0.12	---
Sulphate of Magnesium	---	---	---	---	0.09
Chloride of Magnesium	0.24	0.21	0.26	0.21	0.10
Chloride of Sodium—Salt	97.45	97.54	97.77	97.45	98.11
	100.00	100.00	100.00	100.00	100.00

The composition given is calculated in the manner believed to express most truly the real state of combination of the elements present. *Sulphate of lime* exists in all the samples to the extent of 1.33 to 1.56 per cent. These quantities are practically the same, for the sulphate of lime is tasteless and, in these amounts, without any sensible effect on the quality of the salt.

The three compounds chloride of calcium, chloride of magnesium and sulphate of magnesia, may be classed together, as they are highly soluble bodies with a bitter taste, and so far as I know, are essentially alike in their influence upon the quality of the salt. Of these we observe that the first four samples contain almost identically the same amounts, 30 to 35 ten-thousandths. In the 5th sample they are present in smaller proportion. The latter sample also contains less moisture and from one-third to two-thirds of one per cent. more pure salt than the other samples.

It would be too much to say that these analyses of single small samples establish any even slight superiority of the brand represented by 5 over the others. Several analyses of samples manufactured at different times would need to be made in order to give a fair exhibit of the composition of the various brands. Two analyses of Ashton salt, which I am able to refer to, made by Prof. Cook and Prof. Gœssman, in 1861, give but 11 and 6 ten-thousandths of magnesium chloride and sulphate, without any calcium chloride. The manufacturing process scarcely admits of entire uniformity in the result.

The sulphates and chlorides of calcium and magnesium are all, in themselves considered, objectionable ingredients of salt, because they are foreign matters and not salt. With exception of sulphate of lime they are objectionable on account of their unpleasant taste. The chlorides of magnesium and calcium are further objectionable in table salt, because they greedily attract moisture from the air and make the salt damper than pure salt would become.

A salt containing several per cent. of these bodies would be regarded as quite unfit for dairy use. The presence of a few thousandths of them in salt has, however, no appreciable effect on the taste of salt or on the articles it is used to preserve or to flavor. Just to what point they may be increased in quantity without real detriment to the salt, *i. e.* without noticeably injuring it for its common uses is a nice point to determine. Doubtless each of the samples under consideration is, so far as chemical composition goes, a good salt suited for butter-making, for pork or beef packing or for any domestic purpose, and a tenth of one per cent. of all or any of the sulphates or chlorides of magnesium or calcium added to or taken from them would not be recognizable by any of the results of their use. This opinion is not based on any careful comparative trials of various salts of slightly differing purity, but upon the facts that the kinds of salt generally used rarely contain less and often contain more impurities than these analyses reveal, and that these impurities in these quantities are not recognizable by the taste.

4. "Is lime in salt injurious to its keeping qualities for butter, pork, etc. ?"

Lime, as quick lime or slacked lime, I suppose, does not impair the *keeping quality* of the salt, but injures the taste or flavor of the articles salted, and, in case of butter, the appearance. Lime

is sometimes employed in salt manufacture, to purify the brine, and some years ago, I believe, salt containing slacked lime, got into market and damaged or was thought to damage a large quantity of butter. The mistake is of so serious a kind to the salt-makers that it will not be likely to occur again.

5. "Can salt be *too fine* for salting butter ?"

Yes; salt may be too fine or too coarse, for such use. Fresh churned butter contains a quantity of the milk-serum (butter-milk) which it is one object of salting to remove. When salt is worked into butter each grain of salt gradually dissolves in the butter-milk and withdraws it from the butter, probably shrinking the bulky, jelly-like casein just as salt mixed with a jelly of soap shrinks the soap into a small, firm cake, and unites with the water to make a brine. If the salt be very fine the result is to fill the mass of butter with a multitude of very small drops of brine which are difficult to work out of the butter. On the other hand, if the salt be very coarse the butter-milk will gather in large drops, easy to work out, but the salt grains will not be entirely dissolved and will make the butter too salt and gritty to the taste. The proper fineness, therefore, is that which comes just short of occasioning the last-named difficulty, so that by its use we remove the butter-milk thoroughly, without leaving any unpleasant surplus of salt in the butter.

The Ashton butter-salt, and the Syracuse factory-filled dairy-salt, are commonly reputed to have the degree of fineness suitable for dairy use. According to Alexander Müller, the grains of a good dairy salt should have dimensions lying for the most part between $\frac{1}{25}$ and $\frac{1}{50}$ of an inch in diameter ($\frac{1}{2}$ and 1 millimeter).

6. "Which of the kinds of salt sent do you think (according to the samples) the best for butter ?"

The mechanical analysis of these salts is as follows:

	Deakens. 1	Ashton. 2	Higgins. 3	Phœnix. 4	Holmes. 5
Coarser than 2 millimeters,	0.0	0.0	0.0	0.8	0.0
Between 2 and 1.5 "	6.0	4.4	0.0	3.6	0.0
" 1.5 " 1.0 "	11.9	10.9	1.0	10.8	2.2
" 1.0 " 0.5 "	16.9	20.8	13.0	17.5	6.0
Less than 0.5,	65.2	63.9	86.0	67.3	91.8
	100.00	100.00	100.00	100.00	100.00

It will be seen that the Deakens, Ashton and Phœnix salt are quite alike as to mechanical condition. Higgins' and Holmes' salt are very considerably finer.

Alex. Müller (Landwirthsch. Versuchs-Stationen, 1863, Bd. V, S. 187) proposes to test the value of salt by sifting it as above, and values it according to the amount *held on the sieves*. By this test **1, 2** and **4** would be considered better than **3** and **5**, the chemical composition of all five kinds being essentially the same; but it is evident that much depends on the way in which the butter and salt are worked together; and while a moderately coarse salt may answer best for the first object of salting, viz: to withdraw the buttermilk, a finer grade may be better suited to the other object, the preservation and seasoning of the butter. What is considered the best dairy salt in Germany is mostly coarser than 0.5 millimeter.

7. "Is Turk's Island salt as good as rock salt for preserving pork?"

The two kinds of salt are essentially the same. The Turk's Island has a good reputation, and though commonly containing some "dirt," its impurities are not of the kind to impair its preserving quality or to injure pork or beef.

8. "Has Saltpeter preserving qualities, and why do we use it in preserving pork and hams?"

Saltpeter has similar preserving qualities to common salt. Being much more expensive, it is not used for preserving simply, but because it gives a red color to lean meat. Saltpeter in much quantity is very injurious to man, and but little should be used in preserving meat intended for human food.

9. "How can we tell an impure or adulterated article of salt or saltpeter?"

Good salt for dairy use should dissolve in water, making a clear or very nearly clear brine. The coarse Turk's Island salt is sometimes very dirty and makes a brine that might be said to look like soap-suds. The same is often true of cheap unrefined saltpeter. Such a brine when strained through a fine cloth or let settle, may be used for preserving meat. It is better, however, to use salt and saltpeter refined from such impurities. The objectionable chlorides of calcium and magnesium if present in much quantity, may be recognized by the bitterness which they give to the salt, but if their amount is small they can only be detected by the chemist's tests.

POISONS.

Case of Suspected Poisoning.

"Hartford, May 24th.

"Dear Sir: I have sent you by express a sample of the intestines of a cow that died under very suspicious circumstances, May 2d, after a week's illness, where all the symptoms pointed to an enteric difficulty. The heifer had been injured on the side just back of the forelegs, while it was being shipped from Massachusetts, and the internal result was apparent on post-mortem examination by way of exudations, adhesions, etc. Yet the reddened, softened, and excoriated condition of the mucous membrane of the stomach and bowels could hardly be accounted for by the injury. I called attention to this point at the examination and inquired if she could have eaten any poisonous substance, paint, etc. Blood in large clots, a pint or more, was found in the first stomach or paunch. There was a peculiar appearance about the food, which was of a greenish aspect.

"There being no clue to poison and a great paucity of active symptoms, I was nearly persuaded to believe that she died from the effects of the injury. But Col. Rathbone, of Lenox, Mass., from whose herd this animal came, has since lost six head, with similar symptoms, and clots of blood in stomach, so reports say: and it is claimed they were all poisoned. This at once strengthened my suspicion and we exhumed the carcass last Thursday and obtained the specimens sent you. The odor is somewhat subdued by carbolic acid. These are the facts, and I should like to have you test the question and report at an early date.

N. Cressy."

The material sent by Dr. Cressy was submitted to a careful examination by Dr. Herbert Smith of the Yale Medical School. Special attention was directed towards poisonous metals such as might exist in paint, to oxalic acid and to vegetable poisons; but no indication of any poisonous substance was obtained.

Galvanized Iron as a Source of Poison.

Galvanized iron is sheet iron coated with zinc. The latter metal dissolves with great ease in all acids, so that when the juices of fruits or vinegar are put in contact with it the zinc disappears and the juices become impregnated with soluble zinc compounds. Several instances have been reported to the Station where cider has been boiled down in galvanized iron pans with the effect above stated, and the question has arisen whether the cider has thereby become poisonous.

The soluble salts of zinc are certainly not wholesome and are properly ranked among poisons. They are not however an active poison when taken in small doses; and a little zinc dissolved in cider may produce no noticeable ill effects on a vigorous person. Large doses cause disturbance, more or less serious, of the digestive apparatus. Sulphate of zinc, for example, is sometimes used as an emetic. Persons of delicate constitution or in feeble health may be seriously injured by quantities of zinc or other poison which would not perceptibly harm strong and healthy people; and cider or other acid liquids containing zinc should always be looked upon as probably dangerous and their use for domestic purposes should be carefully avoided.

Tinned Copper, so-called, a Source of Lead Poison.

The Station having occasion to use a vessel of tinned copper for the storage of distilled water ordered one made of a tinsmith in New Haven. The vessel proved totally unfit for its use as the copper was lined not with tin but with an alloy containing so much lead that pure water dissolved it rapidly and carbonate of lead in minute brilliant crystals formed a film on the surface of the water and coated the sides of the vessel.

The tinsmith was unaware of the dangerous nature of the copper, and explained that it was a regular article of manufacture coming from Ansonia in this State. Such metal may be useful for many purposes but is totally unfit for cooking utensils, teakettles, etc., and very serious or even fatal consequences may result from its use in the household.

MILK.

By Dr. E. H. Jenkins.

During the last two years the Station has been called upon to make a large number of milk-examinations, partly for retail buyers and sellers, and partly in the interest of the creameries in the State. Between 200 and 300 complete or partial analyses have been made, but only those are referred to here which are believed to be of general interest.*

Before entering into the details of the Station work on the subject of milk, we give a brief outline of the composition of that liquid and of the two methods which serve as tests of its quality.

Chemical Composition of Milk.

An "average" analysis of milk is as follows:—

Water,		87.5
Fat,	3.5	
Casein and albumin,	4.1	
Milk sugar,	4.3	
Ash,	0.6	
Solids,		12.5
		100.0

* *Method of Analysis.*—As the methods of milk analysis used by chemists, differ somewhat, a brief description of the process employed at this Station is given. *Specific gravity* is determined in all cases by the Jolly spring balance. *Water* is determined by drying a weighed quantity of milk, about 1.8 grams, in a weighed capsule containing 10 or 15 grams of washed and ignited sand, till the weight is constant. The contents of the capsule remaining from this determination are transferred to an extractor and the *fat* extracted with absolute ether. The fat is finally dried in a steam bath at 100° C. and weighed. Another weighed portion of milk is dried over the water bath in a capsule of thin glass, capsule and milk residue are pulverized and mixed with soda lime and the nitrogen determined in the usual way. "*Casein*" is reckoned from the amount of nitrogen found, by multiplying by the factor 6.25. This of course includes the albumin and all other nitrogenous matters of the milk. It is only approximately correct, but the results serve for comparing different samples of milk and the method is in general use. The factor 6.4 would no doubt give a closer approximation to the actual amount of nitrogenous matter.

Milk sugar is determined in 8–10 grams of milk, after removing fat and nitrogenous matters by means of copper sulphate and sodium hydrate—(Fresenius' Zeitschrift, 1878, p. 242) by Tollens' method—(Fres. Zeitschrift, 1879, p. 605.) *Ash* is estimated by difference only in those cases where all the other ingredients have been determined.

Water is the most abundant and a necessary, though of itself a worthless ingredient. It constitutes on the average seven-eighths of the total milk, but varies several per cent. from that mean. The valuable ingredients are included in the 12.5 per cent. more or less of matters which remain in the solid state when the water is evaporated off.

All these solids are valuable as food.

Butter is the fat of milk mixed with some 10 or 15 per cent. of water and 1–2 per cent. of the other solids of the milk, together with 2–5 per cent. of salt added in the making.

Butter-milk is the water of milk, with most of the casein and sugar and a small amount of fat.

Cheese is the casein and albumin of milk, with more or less of the fat and other solids and a variable amount of water.

Whey is mostly the water of milk, with the larger share of the sugar and small portions of the other solids.

The worth of milk for common use as food depends on the quantity of solids it contains. It is well established that genuine milk is somewhat variable in composition as respects the proportions of water and solids. It is found that differences of breed, characteristics of the individual animals, period of lactation, quantity and kind of food, climate or weather, state of health and other conditions, which largely affect the quantity or yield of milk, also, though to a much less degree, influence its composition or the proportion of its ingredients.

Milk is also made to depart from the average composition given above, by willful falsification, either by skimming off part of the cream, by adding water directly to the milk or by both operations together. It is difficult to distinguish by simple inspection or ordinary tests, between rich and poor milk, between genuine and moderately adulterated. On the one hand two samples of milk which appear to be different in richness as judged by the color and the rapidity with which the cream rises, may be essentially alike in composition and equally good for cheese-making or for immediate consumption as food. On the other hand, a small amount of watering, and the removal of a part of the cream may escape suspicion and defy detection by the ordinary means.

It is very important therefore to know what are the natural and ordinary limits of the variations in the composition of milk, and how to distinguish such variations from those which result from intentional watering or skimming.

Tests of the quality of milk.—Various methods have been proposed for testing the quality of milk. Of them all, there are but two which are to be depended upon; one of these is the specific gravity (or density) test, the other, chemical analysis.

The specific gravity test is the one commonly employed in the control of market milk, by Boards of Health and police authorities. Milk is, bulk for bulk, slightly heavier than water. A vessel that will contain 1000 grains of water will hold 1029 to 1034 grains of milk. The lactodensimeter, commonly called the lactometer, is a glass spindle with a slender stem marked off into degrees which sinks in milk to different depths according to the specific gravity of the liquid, which can be read from the scale. This instrument, properly constructed and skillfully used, gives the specific gravity, with great accuracy, by a single observation.

Milk is made heavier than water by those of its ingredients, which are heavier than water, namely: casein, albumin, sugar and ash. The fat of milk is lighter than water, and tends to reduce its specific gravity, so that the specific gravity of milk is diminished by adding water and increased by removing fat. Unless, therefore, milk is falsified both by watering and skimming, the specific gravity serves to indicate very exactly its genuineness and its richness.

If milk is watered to any considerable extent, its specific gravity is brought below 1.029 and the lactodensimeter promptly detects the addition. If, however, the milk first be skimmed or the top poured away after some hours' standing, the skimmed or bottom milk will show a high specific gravity and a considerable addition of water may be made without reducing the specific gravity below that of pure milk. Such double falsification of milk requires for its detection that the sample shall be let stand for cream or that chemical analysis shall be resorted to.

The test by chemical analysis is the only absolutely conclusive means of ascertaining the quality of milk. A determination of the solids of milk by evaporating off the water from a known quantity and weighing the residue, will decide whether milk has been watered or the cream removed, and combining both of these frauds only makes the detection of them more certain. If we separate and weigh the fat, the casein and the sugar of a sample of milk, we get an accurate notion of its composition. Ordinarily the determination of the solids and fat suffice for all practical purposes.

The only embarrassment which these tests do not relieve us from, is that occasioned by the natural variations in the composition of milk. The limit of such variation is discussed in the pages that follow.

Analyses of Guernsey Milk.

In the table on page 82 are given analyses of the milk of single Guernsey cows of pure breed, owned by Mr. E. Norton of Farmington, Secretary of the American Guernsey Cattle Club. The samples were drawn from the morning's milk. The cows were milked twice daily, morning and evening, between five and six o'clock.

For comparison, the average of these analyses is given below, with the averages of some milk analyses made at the New Jersey Experiment Station in 1880, by the same method which has been employed here. (See the New Jersey Station Report for 1880, p. 59). In the case of each New Jersey herd, 13 analyses were made on as many consecutive days.

		Made at the New Jersey Station.		
	Guernsey. 6 Cows.	Jersey. 6 Cows.	Ayrshire. 5 Cows.	Native. 6 Cows.
Water,	85.20	85.28	87.15	86.43
Solids,	14.80	14.72	12.85	13.57
Casein,	4.08*	3.67	3.20	3.34
Fat,	5.23	5.21	4.33	4.49
Sugar,	4.50*	4.93	4.60	4.82
Ash,	1.17*	.91	.72	.92
Daily yield per head,		21 lbs. 3 oz.	21 lbs. 4 oz.	22 lbs. 9 oz.

* 10 analyses.

The yield of the Guernsey cows is not known.

The cows of the Ayrshire herd had not been quite so long in milk as the natives. The Jerseys had been longer in milk than either of them.

These figures are here given simply as a contribution to our knowledge of the chemical composition of cows' milk, as affected by the breed. A few results like these, *taken by themselves*, prove very little with regard to this point. In the first instance variations in the chemical composition of milk, like differences in the milk yield, are *individual* peculiarities. By breeding, such differences have, to a greater or less degree, been made permanent and constant; but even within the same breed we still find large

Analyses of Milk of Guernsey Cows. Dairy of Mr. E. Norton, Farmington.

Name of cow	Gloriana.			Princess.			Ceres.			Fawn.		Lemon.		Amy.
Date.	Nov. 15.	Dec. 8.	May 16	Nov. 15.	Dec. 8.	May 16	Nov. 15.	Dec. 8.	May 16	Nov. 15.	Dec. 8.	Nov. 15.	Dec. 8.	May 16
Sp. Gr.	1.0326	1.0354	----	1.0334	1.0354	----	1.0340	1.0368	----	1.0340	1.0340	1.0353	1.0368	----
Water	85.02	84.98	86.36	86.63	85.90	87.19	82.85	82.94	84.86	84.96	86.05	84.82	85.52	84.66
Solids	14.98	15.02	13.64	13.37	14.10	12.81	17.15	17.06	15.14	15.04	13.95	15.18	14.48	15.34
Casein	4.22	4.13	----	4.16	3.69	----	4.51	4.60	----	4.14	3.77	4.00	3.55	----
Fat	5.00	5.47	4.39	4.00	4.77	4.05	6.62	6.74	6.04	5.23	4.73	5.06	5.06	6.22
Sugar	4.47	4.42	----	4.18	4.39	----	4.57	4.52	----	4.62	4.35	4.69	4.76	----
Ash	1.29	.79	----	1.03	1.25	----	1.45	1.20	----	1.05	1.10	1.43	1.11	----
Date of dropping last calf	March 8, 1882.			April 21, 1882.			March 23, 1882.			Slipped her calf last spring.		April 26, 1882.		Nov. 7, 1881.

variations in yield and quality of milk due to individual differences in cows. For example, the Guernseys have been isolated more completely and bred under more uniform conditions perhaps, than almost any other class of cattle. Yet the milk of Ceres in the table here given, differs as widely from that of the other Guernseys in percentage amount of fat as the average Guernsey milk differs from the Ayrshire in the foregoing comparison.

Analyses of the Mixed Milk of Herds.

During the last year over 200 partial analyses of this kind have been made for creameries in this State. The object has been partly to detect any adulteration but more particularly to furnish some guide for fixing the price to be paid by the creameries to their different patrons for milk. As was to be expected, the managers of creameries everywhere find very great differences in the butter-producing quality of milk from different herds, and both abroad and in this country an effort is being made to scale the prices paid according to the quality of the milk. Two methods are in use for testing the butter yield of milk, namely:—1. churning trials on a small scale, and 2. determinations of the fat by chemical examination. Churning tests require considerable time of the workmen in the creamery, and are not absolutely reliable, because it is not easy to work all samples exactly alike and some of the butters may contain more water and butter-milk than others, which would make the apparent yield larger.

The objections to chemical examination are that it requires a special skill not always at command, and that its results are not perfectly conclusive because the butter yield does not depend alone on the amount of fat in the milk, but also on the size of the fat globules, the quality of the milk serum, and perhaps on still other factors. Creamometer tests and optical tests are quite unreliable, and are not taken into account here.

It was objected by some of the creamery patrons that in their own dairies they got a larger butter yield from their milk than was got in the churning tests at the creamery, and it was this objection partly which led to the carrying out of the milk analyses at the Station. It then appeared that in some cases dairymen got a good deal more butter from their milk than there was of actual fat in it, which clearly indicates that their home-made butter contained considerable water or buttermilk, and probably

more than creamery butter.* Perhaps this would be no disadvantage if the butter was used at once, but it would seriously damage its keeping quality.

It is quite evident that quality as well as quantity should be regarded in the sale of milk, and a scale of prices regulated somewhat by the quality will no doubt operate beneficially on all parties. It will then be the aim of all owners of cows to get the richest milk, and not simply the largest yield, without regard to its richness, which latter aim is the chief incentive to adulteration.

Further investigation will be needed before the Station can render the most efficient aid to creameries, milk-producers and milk consumers, but much valuable preliminary work has been already done.

A brief summary of the analyses so far made will be of interest as bearing on the matter of the milk supply of our cities and the tests of the purity and genuineness of milk.

30 analyses of the milk of 12 herds, about 180 head of cows, made in October, 1881, gave:

	Solids.	Fat.
Average,	12.89	4.02
Maximum,	14.28	5.14
Minimum,	12.00	2.68

27 analyses of the milk of the *same herds*, made in July and August, 1882, gave:

	Solids.	Fat.
Average,	12.21	4.23
Maximum,	13.32	5.63
Minimum,	11.02	3.47

77 analyses of the milk of 60 herds made in May, 1882, gave:

	Solids.	Fat.
Average,	12.81	4.05
Maximum,	14.44	5.23
Minimum,	10.93	3.24

* The variations in the composition of genuine well-worked and unsalted butter are, according to Fleischmann, as follows:—

Water,	from 8 to 18,	average 14 per cent.
Fat,	from 80 to 90,	average 84 per cent.
Other solids,	from 0.8 to 2.4,	average 1.5 per cent.

In the creameries it is usual to set the milk for a fixed time only, say 24 hours, while in domestic practice the milk is skimmed during 36 or 48 hours. In case of Jersey and Guernsey milk and generally milk with large fat-globules whose cream rises quickly, the creamery and home tests should agree; but with milk of those breeds which are characterized by small fat-globules, there might be from this cause a considerable discrepancy.

103 analyses of 55 herds made in July and August, 1882, gave:

	Solids.	Fat.
Average,	12.08	4.03
Maximum,	13.83	5.63
Minimum,	9.79	2.60

The average of 208 analyses of herd milk is:

Solids,	12.40
Fat,	4.02

The results just given show that in the herd-milk examined at this Station, solids varied between 14.4 and 9.8 per cent., and fat between 5.6 and 2.6 per cent. In only one case were the solids below 10 per cent. and in that instance the fat was 3.1 per cent. In 5 cases solids were between 10.0 and 10.5, the fat ranging from 3.1 to 3.5. (Two of these cases represent milk of the same herd.) In 6 cases solids were between 10.5 and 11.0, the fat ranging from 2.8 to 3.9. (One case is the same herd that gave solids below 10 per cent.) In 19 cases the solids fell between 11.0 and 11.5, the fat between 2.6 and 4.5. In 27 cases solids ranged between 11.5 and 12.0, fat between 3.3 and 4.7 per cent. In the other 150 cases the solids were above 12.0 per cent., and the fat ranged from 3.4 per cent. upwards.

	Cases.
Solids below 10 per cent.	1
Solids between 10 and 10.5 per cent.,	5
Solids between 10.5 and 11.0 per cent.,	6
Solids between 11.0 and 11.5 per cent.,	19
Solids between 11.5 and 12.0 per cent.,	27
Solids above 12.0 per cent.,	150
	207

Unfortunately it was not possible to make determinations of specific gravity in the samples here examined. In no case was there any apparent sickness among the cows. The larger number of the cows in these herds were grade Jerseys; but there was also a considerable number of natives, Jersey thoroughbreds and Guernseys.

There is no *absolute certainty* that some of these samples were not either watered or diluted with skimmed milk. It is hard to believe that a milk with only 9.8 per cent. of solids has not been tampered with; on the other hand, it is not reasonable to suspect that the milk of between 50 and 60 herds of cows has been systematically "doctored," to reduce the solids below 12 per cent., the minimum figure below which it has been assumed by some

that pure milk never falls,* without this being in any case so clumsily done as to reveal the cheat at once by analysis, or to disclose the knowledge of it to some one in the neighborhood who would bring it to the notice of interested parties.

Considering too, that self-interest as well as common honesty would tend to prevent such fraud in dealings with a company that watched its patrons closely, we cannot do otherwise than accept the majority of these samples as being pure milk.

In a considerable number of these cases we have seen that the per centage of fat and more especially of solids varies widely from the average per centage in milk as given on page 79. Others have found similar variations.

W. Fleischmann (Jahresbericht über Ag. Chem., 1880, 487), found as the annual average in the morning milk of 4 herds of cows, 4 head in each herd, 11.67, 11.89, 11.97 and 11.41 per cent. of solids with 3.2, 3.4, 3.4, 3.2 per cent. of fat respectively. The specific gravities were 1.032, 1.031, 1.0318 and 1.0304. In the evening milk of the same cows he found 11.76, 12.2, 11.97, 11.39 per cent. solids, with 3.0, 3.4, 3.3, 3.0 per cent. fat, and specific gravities 1.0323, 1.0318, 1.0322, 1.0309. In these cases one analysis each of morning and evening milk was made every three weeks; and the cows being under the personal superintendence of the experimenter, the results are perfectly trustworthy.

Dr. Schmœger (Milch-Zeitung, 1881, 787), gives the results of extended observations on the yield and quality of milk from a herd of 45 Dutch cattle in Proskau, from October 15, 1878, to March 31, 1881. The average yield per head from October, 1878, to October, 1879, was 2864 quarts, from October, 1879, to April, 1880, (a half-year) was 1418 quarts, and from April, 1880, to April, 1881, was 2973 quarts. The cows were milked 3 times daily: at 4 and 11 A. M. and 6 P. M. The observations on the *quality* of the milk were as follows:

* For example, the New Jersey State Law declares that milk which contains less than 12 per cent. of solids shall be considered as adulterated. The British Society of Public Analysts have adopted as the minimum proportions of constituents in unadulterated milk 11.5 per cent. of solid and 2.5 per cent. of fat. By the New Jersey law, 28 per cent. of the samples of herd milk here analyzed during the year would have been condemned, by the British Society's standard nearly 15 per cent.

	Morning Milking.			Noon Milking.			Evening Milking.		
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.
Specific gravity	29.2*	34.0	32.0	29.1	34.0	31.2	29.9	34.5	31.9
Solids			11.31			11.85			11.77
Fat			2.79			3.41			3.26

* Read 1.0292—1.0340, etc.

During one period of six months the average percentage of solids was 11.19 in morning milk, in another period, noon milk had 11.75, and in a third, evening milk had 11.75.

Variations in Milk Solids.—An inspection of all the results above given leads to the conclusion that in pure herd milk the solids may in some cases and at certain seasons sink as low as 10.0 or 10.5 per cent. and the fat to 2.6 per cent.: and that very frequently, (in 28 per cent. of the samples examined at this Station), the solids are less than 12.0 per cent.

In more than 6000 recorded observations on the mixed milk of herds, Bouchardat and Quevenne found that it was always between 1.029 and 1.033. Müller in Bern, from many hundred observations in Switzerland, France, Belgium, England and other places, found the same limits. Fleischmann, in 833 samples of milk sold in Lindau, found only 4 per cent. which had a specific gravity of less than 1.029, and all of these, as he proved, were either from single cows or had been watered. In the reports of examinations made by the police of European cities of herd milk taken in the stables, it is possible to find specific gravities under 1.029, but in these cases there is no certainty or even probability that the determinations were made with sufficient care to avoid sources of error.

It is a matter of great importance to know, not simply what is the average composition of herd-milk, but what composition it may have; what are the limits within which all pure herd-milk comes; and whether it is practicable to establish by law, or by regulation among dealers in milk, a standard of composition which shall distinguish pure milk from that which is watered or skimmed, or at least which shall distinguish between that which is marketable and that which is of too poor a quality to be offered for sale. A consideration of the observations noticed above brings us to the following conclusions with regard to the value of *total solids*, and of *specific gravity*, as criteria for judging of the quality of milk.

We have seen that pure herd-milk shows very wide variations

in its content of solids and fat, and variations less striking in its specific gravity. No instance appears to be on record where a competent observer has found for the mixed milk of a number of healthy cows a specific gravity less than 1.029, and we may conclude with certainty, that milk which falls below that density has been watered.

As evidence of watering simply, specific gravity furnishes by far the most satisfactory test, and if 1.029 is adopted as a minimum, no pure milk will be condemned. In some cases moderately watered milk may escape detection.

If we will establish a minimum limit for the percentage of solids and fat which shall in no case condemn pure milk in any locality, we shall have to make it absurdly low, and thus offer a premium on watering milk of good quality.

As between producers and creameries, or wholesale dealers, in any given locality, it is, we believe, perfectly practicable and fair to establish a standard of chemical composition and require that no milk shall be sold which falls below it. In order to establish such a standard, numerous analyses of herd-milk must be made at different times through the year, the samples to be taken from a considerable number of herds; so as to have a clear idea of those variations which are to be expected in that locality, with the changes of the seasons and the feeding. If fairness and accuracy are aimed at, dependence cannot certainly be placed on the results of analyses made in other places, where the popular breeds of cows, the climate, food, and management of cattle are, or may be all different. In such an arrangement it will be seen that "adulteration" will never have to be claimed or proved. The question is simply one of chemical composition and is easily settled.

Of late *skimmed milk* has come to be sold extensively in the cities of this State, being bought at low rates, wholesale, from the creameries by milk dealers, and is too often sold as "whole milk" to the disadvantage of purchasers and the serious embarrassment of milk producers; for it is impossible for an honest milk-man to compete with a dishonest one as long as buyers regard the price of milk as of more account than the quality. This kind of fraud is readily detected by finding the specific gravity and percentage of fat in the milk; but when skimmed milk instead of water has been added to whole milk, it is often impossible to prove the fact by any kind of examination, because the change of composition thus introduced may be less than the

natural variations. In the city of New York it is made illegal to offer for sale or even to bring into the city skimmed milk, on the ground that if it once comes into the city it is entirely impossible to exercise such a control as to prevent its sale as whole milk.

Skimmed milk itself is a legitimate article of trade, and a healthful article of food for adults. It is unsuitable for the exclusive food of infants, and its sale with the express or tacit understanding that it is whole milk, is both fraudulent and dangerous to the public health. It has been shown in Berlin and other cities, that infant mortality decreases as the milk control on the part of the authorities becomes more efficient.

In view of the fact that by a law* passed at the last session of the Legislature, the Station may be called upon to decide as to the purity of suspected samples of milk, it was deemed advisable to gather some statistics with regard to the composition of milk found in our market, and in connection with the present discussion these detailed results will be of interest. (See p. 91.) Of these samples 29 were bought of grocers and bakers, 4 direct from milk carts, and 5 represent what was delivered to private families by milk peddlers.

Nos. 5, 8, 15, 19, 24, 29, have undoubtedly been watered, as is indicated by their specific gravity, taken in connection with the high content of water and low content of fat. The lactometer so far as tried, indicated the same thing except in No. 29.

Nos. 6 and 32 are of doubtful purity, though 32 is cleared by the lactometer test. Nos. 18, 31 and 33 have a high specific gravity, while the solids and fat are quite low, which strongly indicates a mixture of skimmed milk with whole milk.† No. 37 has probably been both skimmed (imperfectly) and watered. If it had been skimmed only, the specific gravity would have been much higher; if watered only the fat would have been higher and the specific gravity lower. No. 3 is wholly anomalous on account of its high percentage of fat, accompanied with low percentages of solids and casein and its low specific gravity.

All the samples taken from milk carts and from what was delivered to private families were of fair quality. 13 out of 29 samples obtained from groceries were of poor quality, and in 7 cases the milk had certainly been watered or skimmed or both.

* See p. 92.

† These *samples* may have been unintentionally skimmed by the removal of the top milk from the can before they were taken.

In every case but one, the price paid was that of whole milk, namely, 4 cents a pint; No. 24 only, was sold for 3 cents.

ANALYSES OF MILK SOLD IN NEW HAVEN.

Station No.	Specific Gravity.	Water.	Solids.	Casein.	Fat.	Degrees New York Board of Health Lactometer.
1	1.030	87.63	12.37	2.61	4.11	---
2	1.032	86.93	13.07	3.62	----	---
3	1.027	88.09	11.91	2.66	4.56	---
4	1.034	87.16	12.84	3.51	3.47	---
5	1.024	92.05	7.95	2.11	2.04	---
6	1.029	88.63	11.37	2.89	3.60	---
7	1.032	87.17	12.83	----	3.95	---
8	----	91.20	8.80	----	2.83	---
9	1.031	87.17	12.83	3.32	4.06	---
10	1.034	87.66	12.34	3.58	3.22	---
11	1.035	86.79	13.21	3.38	3.09	---
12	1.034	86.58	13.42	3.29	4.45	---
13	1.034	87.44	12.56	3.29	3.83	---
14	1.032	87.44	12.56	----	3.97	109
15	1.0256	90.26	9.74	----	2.83	91
16	1.0310	86.97	13.03	----	4.27	113
17	1.0322	86.67	13.33	----	4.54	115
18	1.0337	88.32	11.68	----	2.93	122
19	1.0267	89.79	10.21	----	2.40	94
20	1.0306	87.08	12.92	----	4.29	113
21	1.0322	87.91	12.09	2.88	3.35	---
22	1.0329	86.92	13.08	3.31	4.21	---
23	1.0339	86.94	13.06	----	3.97	---
24	1.0239	89.82	10.18	----	3.52	85
25	1.0340	87.25	12.75	----	3.49	119
26	1.0348	86.80	13.20	----	4.08	120
27	1.0300	88.81	11.19	----	3.62	109
28	1.0313	88.80	11.20	---	3.16	108
29	1.0286	89.83	10.17	----	2.51	102
30	1.0327	88.20	11.80	----	3.06	116
31	1.0356	88.33	11.67	---	2.36	125
32	1.0290	88.42	11.58	----	3.16	110
33	1.0332	88.59	11.41	----	2.37	122
34	1.0301	88.35	11.65	----	3.46	112
35	1.0309	86.19	13.81	----	4.56	119
36	1.0312	87.14	12.86	----	3.99	119
37	1.0297	90.38	9.62	----	1.80	115
38	----	87.08	12.92	----	4.19	---

Control of Market Milk.—The following method of exercising control over the quality of market milk, reported in the Milch Zeitung (1879, p. 205), is worth noticing here. In Brunswick, difficulty was met with in securing convictions for milk adulteration. The wording of the law was such that watering milk could be punished, but skimming could not be; and in many cases where there was very little doubt that milk had been watered, the sus-

pected parties had the benefit of the doubt, and were acquitted. In this dilemma, the authorities had the milk examinations continued as before, and from time to time a record of them was published. The report first stated that in Brunswick 11.1 was regarded as the minimum per cent. of solids in pure milk and 2.2 per cent. as the minimum of fat. Then followed the names and residences of the sellers and the results of analyses of the milk bought of them, giving specific gravity, solids and fat. While in cases of skimming no prosecutions were attempted, the moral effect of the arrangement was salutary, and the result on the quality of the milk supply, satisfactory.

This method, similar to that which, applied to Commercial Fertilizers has worked well in Connecticut, might probably be adopted to advantage in our large towns.

The present State law with regard to the sale of milk is as follows:

An Act to Prevent the Adulteration of Milk.

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

Section 1. Whoever shall knowingly sell, supply, or bring to be manufactured to any butter or cheese manufactory in this State any milk diluted with water, or adulterated by the addition of any foreign substance, or from which any cream or milk commonly known as strippings has been taken; or whoever shall knowingly bring or supply milk to any butter or cheese manufactory that is tainted or partly sour, shall, for each offense, forfeit and pay a sum not less than twenty-five dollars nor more than one hundred dollars with cost of suit, to be sued for in a court of competent jurisdiction, for the benefit of the person or persons, firm or association, or corporation, or their assigns, upon whom such fraud shall be committed.

Sec. 2. The usual test for quality and the certificate of analysis of the director of the Connecticut Agricultural Experiment Station shall be deemed *prima facie* proof of adulteration.

Sec. 3. No person shall sell, or expose for sale any milk from which the cream or any part thereof has been removed, without distinctly and durably affixing a label, tag, or mark of metal in a conspicuous place upon the outside, and not more than six inches from the top of every can, vessel, or package containing such milk, and such metal label, tag, or mark shall have the words "Skimmed Milk" stamped, printed, or indented thereon in letters not less than one inch in height, and such milk shall only be sold or retailed out of a can, vessel or package so marked.

Sec. 4. No person shall sell or offer for sale, or shall have in possession with intent to sell or offer for sale, any impure or adulterated milk.

Sec. 5. Every person who shall violate the provisions of sections three and four of this act shall be deemed guilty of a misdemeanor, and on conviction thereof shall be fined not more than seven dollars, or be imprisoned not more than thirty days or both.

Sec. 6. A printed notice of this law shall be conspicuously posted in all public places, creameries, or factories where milk is received or sold.

Approved, April 25, 1882.

SEED TESTS.

By Dr. E. H. Jenkins.

In the following table are given the results of twenty-four seed tests, some of them made in the interest of dealers and some for private parties.

The percentage of seed which germinates in these laboratory tests does not, and is not claimed to represent exactly the amount which will actually grow to produce healthy plants in farm practice. A seed is counted as good when the rootlet has burst the seed coat and grown to the length of a millimeter, ($\frac{1}{25}$ inch), in an apparently healthy manner. It may not, however, have strength enough left to push its way to the surface of the ground and develop normally. On the farm the success of a planting depends on many things besides the vitality of the seed, viz: on depth of planting, temperature, moisture, etc., and when complaint is made of a poor "catch," the seedsman is slow to acknowledge that the trouble was in the seed rather than in the manner of planting, or the unfavorable weather prevailing at the time. Since in a carefully conducted laboratory test the access of air and light to the seed, the supply of moisture and the temperature can all be very perfectly regulated, the results will in all

cases do full justice to the dealer, while they furnish to the purchaser a very fair idea of the quality of the stock. It should be remembered that while seed is too often put on the market which is known by the seller to be old and poor, there may be great differences in the quality of new seed, occasioned by the weather, and other less obvious causes, differences which may not be appreciated by the seed grower himself until the next planting. Cases have come to our notice repeatedly, where fresh seed was sold by one dealer to another which was almost worthless.

Variety.	Station No.	Seed sprouted. Per cent.	Seed remained sound. Per cent.	Seed rotted. Per cent.	One-half sprouted seed germinated in days.
CLOVER:					
Red Clover	158	75.8	7.5	16.7	5
TIMOTHY	159	90.5	5.5	4.0	6
OATS	146	94.5	1.0	4.5	3
	147	95.0	1.0	4.0	3
MAIZE:					
Mammoth Sweet	140	14.0	0.0	86.0	5
Moore's Concord Sweet	141	38.0	0.0	62.0	5
Minnesota Sweet	142	94.0	0.0	6.0	3
Evergreen Sweet	143	43.0	0.0	57.0	3
" "	145	92.0	0.0	8.0	3
Crosby's Sweet	144	90.5	0.0	9.5	3
CABBAGE:					
Jersey Wakefield	137	12.7	0.0	87.3	4
" "	157	71.8	4.5	23.7	5
Flat Dutch	150	75.8	0.0	24.2	2
	149	46.3	4.5	49.2	4
SAGE	152	39.8	?	?	9
	153	26.7	?	?	14
ONION:					
Red	138	44.3	34.7	21.0	3
Wethersfield large red	139	82.7	0.0	17.3	1
	151	59.5	12.0	28.5	6
Yellow Danvers	155	47.8	9.5	42.7	5
" "	156	86.8	1.0	12.2	5
" "	118	88.5	0.5	11.0	3
" "	148	44.0	?	?	5
LEEK	154	48.5	18.5	33.0	7

The sample of Oats No. 147, was from a lot purchased in this State, and was sent to the Station for examination, because, so it was asserted, horses refused to eat it. The oats were very musty

and were probably unpalatable only on that account. They contained a very small percentage by weight, of seed of foxtail grass, (*Setaria viridis*, and a little *S. glauca*,) and a few seeds of weeds (*Polygonum* and *Chenopodium*.) They weighed 36 lbs. to the bushel and were of average vitality.

The samples of maize seed were all grown in Rochester, N. Y., purported to be of the crop of 1880, and were examined four months after harvest.

Nos. 140, 141 and 143 are of very poor quality and worthless for seed, though the kernels are of average size and weight. The samples named, however, had a yellow dull look instead of being bright and translucent, which made the purchaser, a seedsman, doubtful of their value.

That year the corn was late, bad weather set in, and it heated in the crib. The proper curing of sweet corn is a rather delicate matter. We understand that some growers now cure it in kilns with perfect success.

Of the samples of Onion Seed, No. 138 purported to be of the last crop, and was tested March 1. The large percentage of seed remaining hard at the end after trial (34.7 per cent.), makes it appear very probable that it was in part or altogether old seed.

Numerous trials made at this Station with onion seed, whose age was certainly known, gave an average of 6 per cent. of hard seed at the end of the trial (in only one case as high as 19 per cent.), when the seed was less than one year old; 23 per cent. when between one and two years old; 52 per cent. when between two and three years old; 68 per cent. when between three and four years old; and 88 per cent. when five years old.*

No. 148 is a sample of the small, light seed, which is winnowed off before the seed is put on the market. It is one-third lighter than that which is marketable and its vitality is small.

No. 118 represents the marketable portion of the same crop as No. 148.

The average amount of seed capable of germination, as found in tests reported in North Carolina, and in this State is, in case of—

Red clover (8 tests), ... 78.2 per cent.
Timothy (6 tests), ... 86.3 per cent.
Cabbage (6 tests), ... 79.5 per cent.
Onion (40 tests), ... 83.3 per cent.

* Report of this Station for 1880, p. 98.

The Station's instructions for sampling seeds, are as follows:

THE CONNECTICUT

AGRICULTURAL EXPERIMENT STATION,

NEW HAVEN, CONN.

INSTRUCTIONS FOR SAMPLING SEEDS.

The *Purity and Germinating Power* of Seeds intended for Farm and Garden use are learned by examining a small average sample. A weighed amount of seed is taken, the pure seeds are culled out and weighed, foreign matters and especially noxious seeds are identified, the vitality of the pure seed is tested by careful sprouting trials, and a report is drawn up of the results.

As the test of germinating power requires some time for its completion, a report on samples sent in cannot be ordinarily expected in less than two weeks.

The examination of *grass-mixtures* can only be undertaken in special cases. It requires a large outlay of time and labor which is not often justified by the results.

In selecting a sample for examination the greatest care should be used to have it represent accurately the whole amount from which it was taken. This result will be secured by proceeding as follows:

1. Mix well together with the hand and arm the contents of the package (bag or barrel) or packages of seed.

2. Take out five or six small handfuls or cupfuls* from various parts of the package, mix these together and take a part of this mixture for the sample.

3. Send of the smaller seeds—red top, white clover, timothy, etc., two (2) ounces; of beets, turnips, red clover, etc., four (4) ounces; of wheat and cereals, and of peas and other legumes, eight (8) ounces.

4. Samples may be sent by mail, or otherwise, prepaid, and should be *plainly labeled* and addressed to

CONN. AGRICULTURAL EXPERIMENT STATION,
New Haven, Conn.

* A small cup may be closed with the palm of the hand, forced down to the desired place, then filled and withdrawn.

Seeds sent in for gratuitous examination must be described on the subjoined form.

THE CONNECTICUT

AGRICULTURAL EXPERIMENT STATION,

NEW HAVEN, CONN.

FORM FOR DESCRIPTION OF SAMPLE.

Station No.----------Received at Station, ----------188 .

Each sample of seed sent for gratuitous examination must be accompanied by one of these Forms, with the blanks *below* filled out as fully as practicable.

This Form, filled out and sent with the sample, will serve as a label; but it should be returned *in good order* for filing in the Station Records.

Send with each sample a specimen of any printed circular, or statement that accompanies the seed or is used in its sale.

Name or label of seed,----------

Name and address of Producer or Importer,----------

Name and address of Dealer from whose stock this sample is taken,

---

Date of taking this Sample,----------

Selling price per pound or bushel,----------

Known or reputed age of seed, ----------

Number of packages from which sample is taken,----------

Signature and P. O. address of person taking and sending the sample.

The results of the examination are reported to the party sending, on a form of which the following is an example:

REPORT OF SEED TEST.

THE CONNECTICUT

AGRICULTURAL EXPERIMENT STATION.

NEW HAVEN, CONN., 188

Examination of

Rec'd 188 Station No.

From

Pure seed, per cent. by weight.

Impurities, per cent. by weight.

Pure seed sprouted during days, per cent. by number.

Pure seed decayed during days, per cent. by number.

Pure seed sound (unsprouted)

after days, per cent. by number.

Of sprouted seed, ½ germinated in days.

1000 seeds weighed grams.

Per cent. value,

The "per cent. value" of a sample of seed is obtained by multiplying its per cent. (by weight) of pure seed into the per cent. (by number) found, or able, to germinate, and dividing by 100. It refers the number of seeds found, or able, to germinate, from "pure seed" back upon the sample itself, in terms of per cent. In case of *perennials only* it takes account of ⅓ of the unsprouted sound seeds, the proportion which, on an average of many observations, has been found to germinate under favorable conditions.

Director.

FEEDING STUFFS.

Twenty samples of Feeding Stuffs have been under examination during 1882, viz:

4 of Maize Fodder.
4 of Maize Ensilage.
8 of Hay.
1 of Rice Feed.
1 of Cotton Seed Meal.
1 of Corn Meal.
1 of Wheat Bran.

MAIZE FODDER AND ENSILAGE.

About September 1, 1881, Dr. M. Miles, recently in charge of the Experimental Department of Houghton Farm, sent to the Station samples of Maize Fodder both from "Field Corn" i. e., Maize planted in hills as usual for the crop of grain, and from "Fodder Corn" or Maize sown more thickly in drills, for the crop of stalks and leaves. These samples were selected with especial care, in duplicate, and dispatched at once to the Station in close boxes. At the same time weighed quantities of the same material were put in a silo where they remained until about the middle of January, 1882, when they were taken out and sent to the Station.

Analyses (more or less complete) of all these samples were made with the prime object of learning something of the kind and degree of chemical change which occurs in the silo. As a control on the results, each of the duplicate samples of the fresh maize stalks were separately examined in order to ascertain what amount of variation in the analyses is attributable to imperfect sampling, it being evidently no easy matter to take from a mass of maize stalks two small portions that exactly correspond in composition to each other or to the mass. The results of the analyses are tabulated on p. 100.

Comparing the analyses of the duplicate samples of Field Corn CXXV and CXXVI we notice that the water content of the fresh material as received at this Station, differs 0.85 per cent. This difference is no doubt partly due to unavoidable errors in the sub-sampling, drying and weighing, in part also no doubt to original and necessary inequality in the samples. The fat and wax (ether extracts) determined on the dry substance are identical. The albuminoids are reckoned from the amounts of nitrogen found in the dry substance by multiplying them by 6¼. Two nitrogen

	Field Corn.			Fodder Corn.		
	Fresh (Duplicates).		Ensilaged.	Fresh (Duplicates).		Ensilaged.
Station No.	CXXV.	CXXVI.	CXLIV.	CXXVII.	CXXVIII.	CXLV.
Weight when sent	13 lbs. 0 oz.	13 lbs. 0 oz.	13 lbs. 0 oz.	11 lbs. 2½ oz.		11 lbs. 2½ oz.
Weight when received	12 lbs. 10 oz.	13 lbs. 1½ oz.	12 lbs. 11¼ oz.	10 lbs. 14 oz.	9 lbs. 11 oz.	11 lbs. 6¾ oz.
When received	Aug. 29, '81.	Aug. 29, '81.	Jan. 12, '82.	Sept. 1, '81.	Sept. 1, '81.	Jan. 12, '82.
Water	79.72	80.57	82.38	87.15	86.45	87.68
Ash	1.07		1.05	.87		.91
Albuminoids*	1.78	1.87	1.39	1.54	1.16	1.38
Crude Fiber	4.73		4.80	4.19		4.04
N. fr. Extract†	12.46		9.96	6.06		5.62
Ether Extract (fat, etc.)	.24	.23	.42	.19	.19	.37
	100.00		100.00	100.00		100.00
Water Free.						
Ash	5.26		5.98	6.77		7.42
Albuminoids*	8.79	9.64	7.87	11.95	8.56	11.25
Crude Fiber	23.33		27.24	32.62		32.83
N. fr. Extract†	61.43		56.56	47.20		45.50
Ether Extract (fat, etc.)	1.19	1.19	2.35	1.46	1.40	3.00
	100.00		100.00	100.00		100.00

* Reckoned as total nitrogen × 6.25. † Nitrogen-free extract includes carbhydrates (sugar, gum, etc.).

determinations on each sample gave practically the same result. The discrepancy in albuminoids of 0.85 per cent. therefore lies mainly in the sampling.

Turning now to the duplicate Fodder Corn samples we find 0.7 per cent. in the water content. The ether extracts are not essentially discrepant, but the albuminoids differ by 3.39 per cent. This large difference is unquestionably for the most part due to inequality of the original samples as the two nitrogen estimations on each sample agreed perfectly.

Comparing now, on water-free substance, the composition of the ensilage with that of the corn itself, we get no satisfactory evidence of any change in the albuminoids, for the amount found in the field corn ensilage is but 1.34 per cent. less than the average result on the field corn itself, while in case of fodder corn the albuminoids found in the ensilage are 1 per cent. more than the average obtained in the fresh corn. As regards the "Ether Extracts" we observe that in both cases the ensilage contains very nearly double what was got from the fresh corn. In ordinary fodder-analyses the ether extract consists for the most part of oil, fat or wax, and is usually termed fat or crude fat. In the process of ensilage it is not so likely that fat is produced as that lactic acid is formed, perhaps mainly during the sampling and sending (by transformation of sugar), which dissolves freely in ether.

That sugar and perhaps other carbhydrates are to some degree destroyed and lost by fermentation in the silo, is proved by the appearance of fermentation-products, especially carbonic acid gas. Such loss would tend to diminish notably the percentage of nitrogen-free extract and to increase that of the crude fiber. At first glance the analyses of the Field Corn and its ensilage would seem to indicate a considerable loss in this way, for the fiber of the ensilage is nearly 4 per cent. greater than that of the corn, and its carbhydrates, etc. (N. fr. Extract), nearly 5 per cent. less. But the results for Fodder Corn, though pointing in the same direction give much smaller differences (0.2 per cent. less fiber and 1.7 per cent. more N. fr. Extract), differences that bear no proper relation to each other to be accounted for by loss in fermentation, and that are easily attributable to errors of analysis and uneven sampling. Even the larger differences of 4 and 5 per cent. found in case of the Field Corn might be due to differences in the original samples, for if in the albuminoids there could be in two samples a difference of 3.4 per cent., twice that variation should be anticipated on the three times more abundant fiber and carbhydrates.

We conclude then that these analyses demonstrate that this method of working is incompetent to give any clear notions as to the quantity or even as to the kind of changes that go on in the silo. This result was not unexpected, nevertheless, we regarded the questions involved worthy of careful experimental study.

The antiseptic quality of acids, especially of carbonic acid gas, which has lately been demonstrated by Kolbe, is such as to lead to the conclusion that no considerable amount of chemical change or of loss of nutritive matters can go on in the well constructed silo. Dr. Neale has, we believe, found further experimental evidence of that conclusion in recent investigations at the New Jersey Experiment Station.

Broad Rock Farm Ensilage.

A valuable contribution to the literature of Ensilage has been recently made by Mr. Rowland Hazard, of Peace Dale, R. I., President of the Washington County (R. I.) Agricultural Society.

A sample of Mr. Hazard's ensilage was analyzed at the Station, and the results are here given, together with Mr. Hazard's comments, taken from a memorandum printed by him.

The ensilage was made from corn "cut in September, after the ears were well advanced," on the principle that "the first condition of success with a silo, is to have a good crop to put into it."

"Analysis of Ensilage from Broad Rock Farm made at the Connecticut Agricultural Experiment Station. March, 1882. Six months after storage.

	R. Hazard's Sample.		Seventeen other Samples. Minimum in any case of the seventeen.	Maximum in any case of the seventeen.
Water,	77.648	----	74.2	84.9
Ash,	1.779	----	0.8	1.8
Protein,	2.005	----	0.9	1.9
Crude Fibre,	6.018	----	4.7	7.9
Sugar (Glucose),	0.255			
Acetic Acid,*	.103	12.003	7.0	13.0
Alcohol,*	.396			
Other Carbhydrates,	11.249			
Fat (Ether extract),	.547	----	0.3	0.9
	100.000			

* Alcohol was not positively proven to be present to the extent given, but the figures are probably not far from correct. The amounts of both alcohol and acetic acid may easily increase (or change) after the sample leaves the silo, during its transportation or while it awaits the operations of analysis. There is no probability that the ensilage as fed was so sour or so alcoholic as when analyzed. In fact, the odor of ensilage fresh from the silo is, so far as the writer has had opportunity to observe, much less acid than that which has been received at the station for analysis.

"From this analysis the Broad Rock Farm sample is seen to be nearly 40 per cent. better than the best of seventeen* other samples analyzed. It is nearly equal to good grass, and has an apparent nutritive value of about 2½ lbs. of ensilage to 1 of good hay.

"The cost of 2½ tons ensilage = $7.50. A fair estimate for 1 ton of hay = $12."

"Cost of Ensilage at Broad Rock Farm. September, 1881.

Ploughing 9 acres, 9 days, 1 man and pair of oxen at $2.50 per day,	$ 22.50
Seed (part at $4 per bushel, which is useless expense),	9.50
Manure, including ⅔ of value and hauling and spreading,	135.00
Planting, 5 days, 2 men and 1 horse at $3.50,	17.50
Cultivating, 4 days, 1 man and 1 horse,	9.00
Cutting, 13 men and 2 teams for 6 days,	120.00
Coal for steam engine,	14.00
	$327.50
Add for repairs on machinery, salt and extras,	32.50
	$360.00

"The quantity of ensilage was 120 tons; cost, excluding the interest on land and on silos, $3 per ton.

"The cost per ton on hay for interest and storage is of course much larger than for ensilage."

"Experiment in feeding Ensilage at Broad Rock Farm. Experiment began Feb. 16, 1882, with ten average cows. The Ensilage had been stored fully five months.

"Taste of ensilage decidedly sour, and subsequent analysis as above showed $\frac{103}{1000}$ of 1 per cent. acetic acid. This is equal to about a quart of strong vinegar per 100 pounds. From Feb. 16 fed the ten cows thus, per day: Ensilage at two feeds, 17 lbs. each feed = 34 lbs. per cow. Hay at one feed, 7 lbs. each feed = 7 lbs. per cow. Meal 2 quarts and bran 4 quarts per cow per day. Fed for 7 days, yield of milk was 68 quarts per day. Then changed the feed of the same cows and gave them no ensilage, but instead gave 14 lbs. of hay, making total hay 21 lbs. per day per cow, with meal and bran same as before, and fed for 7 days. Yield of milk was 59 quarts per day. Then changed back to feed same as in the first 7 days, and fed for 7 days. Yield of milk was 66 quarts per day.

* In Mr. Hazard's original memorandum eleven other samples were compared.

"From this it appears that 34 lbs. of ensilage is 12 per cent. better than 14 lbs. of hay. The hay, at $12 per ton, cost 8.4; ensilage, at $3 per ton, cost 5.1. Making allowance for the 12 per cent. better result, we have 9.4 cents hay = 5.1 cents ensilage.

"This shows also that 2½ lbs. of ensilage will more than replace 1 lb. of hay; for, reduce 34 lbs. by 12 per cent. = 30 lbs. and 30 lbs. then would equal 14 lbs. hay, or 1 lb. hay = 2⅓ ensilage."

Analyses of Hay and Stover.

The subjoined partial analyses made for Prof. Armsby on samples sent by him from the Storrs Agricultural School are here put on record. They confirm the formerly published results of similar analyses. The low content of albuminoids in the timothy and red-top is especially noticeable.

Station No.	Kind of Hay.	When Cut.	Analysis. Water.	Albminoids.	Fiber.
CXXXIII,	Clover,	July 10,	16.07	9.36	29.41
CXXXIV,	Clover Rowen,*	Sept. 1,	16.62	13.00	25.10
CXXXII,		Middle of July,	12.96	4.68	28.39
CXL,	Timothy and Red-top,	Middle of July,	14.30	4.54	31.39
CXXXI,		Last of July,	13.45	6.44	26.49
CXLI,	Mixed Grasses,	Aug. 1,	14.00	7.10	27.80
CXXXIX,	Hungarian and some Red-top,	Last of Aug.,	15.37	6.81	36.00
CXXXV,	Swale,	August,	14.64	5.88	25.44
CXXXVI,	Stover,	Sept. 12,	28.71	3.00	24.53

* From the same field as No. CXXXIII.

CXXXVII. Rice Feed. From stock of Holmes and Keeler, Norwalk. Sampled and sent by D. H. Van Hoosear, Wilton.

	Analysis.	Water-free.
Water,	10.33	----
Ash,	9.62	10.70
Albuminoids,	11.43	12.74
Crude Fiber,	9.93	11.03
N. fr. Extract (carbhydrates),	47.20	52.72
Fat,	11.49	12.81
	100.000	100.00

The composition of this Rice Feed is very near that of average oats or the best maize in respect to albuminoids. It has three times the ash of oats, twice the fat, the same amount of fiber, and fourteen per cent. less carbhydrate. The less carbhydrates are about compensated by the more fat.

OBSERVANCE OF THE FERTILIZER LAW.

Manufacturers *who up to Jan.* 16, 1883, *have complied with Sections* 2 *and* 3 *of the Act concerning Commercial Fertilizers, which went into effect Sept.* 1, *see page* 11, *and have sent samples to the Station and paid Analysis Fees to the Director:*

Firm.	Article.
Glidden & Curtis, Boston, Mass.,	Soluble Pacific Guano.
G. W. Dickenson, Essex, Ct.,	Ivory and Bone Dust.

The two fertilizers above-named are accordingly the only ones selling at $10 or over per ton, whose sale in Connecticut has been legal, from Sept. 1, 1882, to Jan. 16, 1883.

Dealers *who up to Jan.* 16, 1883, *have complied with Section* 4 *of the Act concerning Commercial Fertilizers, see page* 11, *and reported to the Director of this Station their names, residences and post-office addresses, and the names and brands of fertilizers sold, with the name and address of the manufacturers, importers or parties from whom such fertilizers were obtained:*

Dealers.	Article.	Manufacturer.
J. P. Barstow, Nor'ch,	Americus Bone Meal,	Rafferty & Williams.
J. P. Barstow, Nor'ch,	Crescent (?) Ground Bone,	Lister Bros.
J. P. Barstow, Nor'ch,	Amm. Bone Superphosphate,	E. F. Coe.
J. S. Benton, Guilford,	Pure Ground Bone, extra fine,	Mapes F. & P. G. Co.
J. S. Benton, Guilford,	Mapes Comp. Man. for light soils,	Mapes F. & P. G. Co.
J. S. Benton, Guilford,	Mapes Comp. Man. A. Brand,	Mapes F. & P. G. Co.
J. S. Benton, Guilford,	Mapes Corn Manure,	Mapes F. & P. G. Co.
J. S. Benton, Guilford,	Mapes Potato Manure,	Mapes F. & P. G. Co.
G. S. Clark, Washington Depot, Ct.,	A. Brand Complete Manure,	Mapes F. & P. G. Co.
Geo. W. Denison, Old Saybrook,	Lister Bros. Ground Bone,	Lister Bros.
Geo. W. Denison,	Lister Bros. Phosphate,	Lister Bros.
W. H. Scott & Co., Pequabuck, Litchfield Co., Ct.,	Ground Bone,	Peck Bros.
W. H. Scott & Co., Pequabuck, Litchfield Co., Ct.,	Bradley's Superphosph. of Lime,	Bradley Fertilizing Co.
Wilson & Burr, Middletown,	Stockbridge Manure for Grain,	Bowker Fertilizer Co.
Wilson & Burr,	Pure Ground Bone,	Rogers & Hubbard Co.
Wilson & Burr,	Stockbridge Man. for Potatoes,	Bowker Fertilizer Co.
Wilson & Burr,	Quinn. Fish and Potash, No. 1,	Quinn. Fertilizer Co.
Wilson & Burr,	Quinn. Phosphate,	Quinn. Fertilizer Co.
Wilson & Burr,	Ground Land Plaster,	G. W. Miller, Middlefield
Wilson & Burr,	Stockbridge Manures,	Bowker Fertilizer Co.

LEGISLATIVE ACTS RELATING TO THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

An Act Establishing the Connecticut Agricultural Experiment Station.

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

Section 1. That for the purpose of promoting agriculture by scientific investigation and experiments, an institution is hereby established, to be called and known as The Connecticut Agricultural Experiment Station.

Sec. 2. The management of this institution shall be committed to a Board of Control, to consist of eight members, one member to be selected by the State Board of Agriculture, one member by the State Agricultural Society, one member by the Governing Board of the Sheffield Scientific School at New Haven, and one member by the Board of Trustees of the Wesleyan University at Middletown, and two members to be appointed by the Governor of this State, with the advice and consent of the Senate. The Governor of the State, and the person appointed as hereinafter provided to be the Director of the Station, shall also be *ex officio* members of the Board of Control.

Sec. 3. After the appointment of the members of the Board of Control as aforesaid, said members shall meet and organize by the choice from among their number of a President, a Secretary, and a Treasurer, who shall be elected annually, and shall hold their respective offices one year, and until the choice of their successors. Five members of said Board shall constitute a quorum thereof for the transaction of business.

Sec. 4. Said Board shall meet annually after the first meeting thereof, on the third Tuesday in January in each year, at such place in the city of Hartford as may be designated by the President of said Board, and at such other times and places, upon the call of the President, as may be deemed necessary, and may fill vacancies which may occur in the officers of said Board.

Sec. 5. Said Board of Control shall locate and have the general management of the institution hereby established, and shall appoint a Director, who shall have the general management and oversight of the experiments and investigations which shall be necessary to accomplish the objects of said institution, and shall

employ competent and suitable chemists and other persons necessary to the carrying on of the work of the Station. It shall have power to own such real and personal estate as may be necessary for carrying on its work, and to receive title to the same by deed, devise, or bequest. It shall expend all moneys appropriated by the State in the prosecution of the work for which said institution is established, and shall use for the same purpose the income from all funds and endowments which it may hereafter receive from other sources, and may sue and be sued, plead and be impleaded, in all courts, by the name of The Connecticut Agricultural Experiment Station. It shall make an annual report to the Legislature which shall not exceed two hundred printed pages, of which not exceeding three thousand copies shall be printed.

Sec. 6. The sum of five thousand dollars annually is hereby appropriated to said Connecticut Agricultural Experiment Station, which shall be paid in equal quarterly installments to the Treasurer of said Board of Control, upon the order of the Comptroller, who is hereby directed to draw his order for the same; and the Treasurer of said Board of Control shall be required, before entering upon the duties of his office, to give bond with surety to the Treasurer of the State of Connecticut in the sum of ten thousand dollars, for the faithful discharge of his duties as such Treasurer.

Sec. 7. Upon the death or resignation of any of the members of the Board of Control, the authority or institution by which such deceased member was originally appointed shall fill the vacancy so occasioned.

Sec. 8. Professor Samuel W. Johnson, of New Haven, is hereby empowered to appoint and call the first meeting of said Board of Control as soon as may be practicable after the appointment of the members thereof, and he shall notify all said members of the time and place of said meeting. Two of said members shall hold office for one year, two of them for two years, and two of them for three years; and at said first meeting they shall determine by lot which of said members shall hold office for one year, which for two years, and which for three years. All members of said Board thereafter chosen or appointed, except such as are appointed or chosen to fill vacancies in said Board, shall continue in office for the term of three years from the first day of July next succeeding such appointment.

Sec. 9. This act shall take effect from its passage.

Approved March 21, 1877.

AN ACT RELATING TO THE PRINTING OF THE REPORT OF THE STATE BOARD OF AGRICULTURE AND OF THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

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

SEC. 1. The Comptroller shall annually cause to be printed, at the expense of the State, five thousand copies each of the report of the State Board of Agriculture and of the Connecticut Agricultural Experiment Station.

SEC. 2. All acts and parts of acts inconsistent herewith are hereby repealed.

Approved, March 19, 1879.

AN ACT CONCERNING THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

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

SECTION 1. The sum of twenty-five thousand dollars is hereby appropriated to the Connecticut Agricultural Experiment Station for the purpose of buying a suitable lot and erecting thereon buildings, and equipping the same for the permanent use of said Station, but the title to such lot and to all buildings, and other improvements placed thereon shall be vested in the State of Connecticut.

SEC. 2. The Board of Control of said Connecticut Agricultural Experiment Station, or a duly authorized committee consisting of members of said Board of Control, shall have and exercise exclusive management, control, and expenditure of the sum appropriated by this act for the purposes aforesaid, shall select and determine the site, and the purchase thereof, the plans of said buildings, and the cost, construction, and equipment thereof, and shall pay for the same out of said sum; *provided always*, that the sum or sums so expended shall not exceed in the aggregate the sum hereby appropriated.

SEC. 3. The Comptroller is hereby authorized and directed to draw his order on the Treasurer of the State in favor of said Board of Control, in such amounts as from time to time said Board of

Control, or its duly authorized committee may require for the purposes aforesaid, not exceeding in the aggregate said sum of twenty-five thousand dollars, and a full and particular account shall be kept by said Board of Control of all moneys expended under this act, which account shall be audited by the Comptroller.

Approved, April 26, 1882.

AN ACT CONCERNING THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

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

Section six of chapter one hundred and fifty-eight of the Public Acts of 1877, being an act entitled An Act establishing the Connecticut Agricultural Experiment Station, is hereby amended so as to make the sum annually appropriated to said Station eight thousand dollars.

Approved, April 25, 1882.

AN ACT CONCERNING FERTILIZERS.

(See pages 11–13.)

AN ACT TO PREVENT THE ADULTERATION OF MILK.

(See page 94.)

INDEX.

For Errata see page 6.