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Thirty-seventh Annual Report

OF

The Connecticut Agricultural Experiment Station

Being the annual report for the year ending October 31

1913

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF.

SEPTEMBER 30, 1913

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BUILDINGS AND GROUNDS.
WILLIAM VEITCH, *In Charge.*

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REPORT OF THE BOARD OF CONTROL

OF

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

To His Excellency, Simeon E. Baldwin, Governor of Connecticut:

The Board of Control of The Connecticut Agricultural Experiment Station herewith respectfully submits its report for the year ending November 1, 1913.

The following changes in the Station staff have occurred within the year:

Mr. G. L. Davis was engaged as an assistant chemist in March, taking the place of R. B. Roe, resigned.

Quincy S. Lowry, B.S., was engaged as an assistant in entomology in March in place of Mr. Harry B. Kirk, resigned, and I. W. Davis, B.S., in August in place of Mr. D. J. Caffrey, of the same department, resigned.

All of these resignations were in consequence of higher salaries offered elsewhere.

Mr. A. E. Moss has been appointed Assistant State Forester.

The General Assembly at the January Session, 1913, increased the annual appropriation to the Station by seven thousand five hundred dollars, and the State Entomologist's appropriation by one thousand dollars. The special appropriation for control of the gypsy moth was reduced from ten thousand dollars to eight thousand dollars.

A new law regarding apiaries provides for quarantine, certification of bees to be transported, and authority to inspect without previous complaint.

The act concerning inspection of nursery stock has been amended to give better control over imported stock.

An act concerning woodland taxation which was proposed by a special commission and passed by the General Assembly prescribes additional duties for the State Forester in examining woodlands with reference to their classification for taxation and determining

whether the owners of classified woodland are complying with the legal requirements.

The following summary shows the scope of the Station's work in the year:

Botanical Department.

The botanical department has completed and published an extended study of the chestnut blight.

The results of a study of the calico disease of tobacco will be published in our next report.

Studies on onion smut, peach yellows, fertilization of peach orchards, and miscellaneous spraying experiments have been continued, as well as cultural experiments with various fungi.

The results of varietal tests of muskmelons will be published this year, and an experiment to increase disease resistance, yield and quality is continued in coöperation with the plant breeder.

Two hundred and forty-nine specimens of plant diseases have been identified in answer to inquiries.

Chemical Department.

The fertilizer, cattle feed and food and drug inspection and control work have occupied most of the time of the chemical department, involving the analyses of about 900 samples of fertilizers, 281 of feeds, and 1,862 of foods and drugs, and appearance in court on sixteen cases where the quality of foods or drugs was matter of inquiry. In connection with the food inspection the department has collected and examined all the brands of diabetic foods, both domestic and imported, which could be found and has published the results in a report of 102 pages, which has been in great demand both by physicians and the laity. Laboratory assistance has also been given to police authorities in efforts to check the illicit traffic in cocaine, heroin and morphine.

The department has also coöperated with the Association of Official Agricultural Chemists in studies of analytical methods.

Entomological Department.

The entomological department has carefully watched the districts in Stonington and Wallingford where serious infestations of gypsy moth occurred some years ago, but continued search

resulted in the discovery of only two egg masses and three caterpillars at Wallingford and seven specimens at Stonington. To aid in discovering and trapping the gypsy moth caterpillar, about 5,000 trees were banded with burlap and systematically examined.

The brown-tail moth has been found in twenty-nine towns of the State and 7,600 nests were destroyed by the Station scouts. The federal authorities have liberated brown-tail parasites in ten of these towns. Until local organizations take up very actively the work of fighting this pest it will continue to spread over the State and it is futile for the Station to continue the fight single-handed.

Of imported nursery stock 1,316 cases representing 259 shipments have been inspected, dangerous pests being found in five. Reports of each inspection have been made to the Federal Horticultural Board.

Of apiaries 189, consisting of 1,500 colonies, have been inspected, of which about 24 per cent. were infected with European foul brood.

Twenty private orchards have also been inspected on request.

Control field experiments against the cabbage maggot, onion thrips and pea louse have been made, and studies continued in coöperation with the botanical department on the control of apple insects and fungous diseases.

Sixty nurseries have been officially inspected and certificates issued and 366 specimens identified in answer to inquiries.

Forestry Department.

From the Station nurseries the forestry department has sold at cost over 202,000 seedling pines for foresting Connecticut lands, and about 338,000 seedlings are still on hand. The raising and selling of seedlings will be discontinued when the stock on hand is sold because trees can now be bought at reasonable prices from nursery companies.

At the Station experiment forest about 4,500 trees have been set. Two fires occurred there which, before they could be controlled, destroyed one and a half acres of plantings.

The plantations in the State forests have done well and about 38,000 trees have been added to them. A bad fire starting out-

side the property burned over about one hundred acres of the Portland forest.

The work of the Special Commission on Woodland Taxation, of which the forester was a member, required considerable field work in gathering data for the Commission's use and office work in preparing the report for the use of the General Assembly.

The Forest Survey of the State, begun by a former forester, Mr. Hawes, is now being completed.

About twenty examinations of forest land have been made for private owners and advice given as to their management.

The management of the Forest Fire Warden service and the supervision of bills for fire fighting have required considerable attention, and in some cases the forester has taken personal supervision of the fighting of extensive fires.

Plant Breeding Department.

The chief work of this department has been a study of the mode of inheritance of sizes and shapes of plant parts, mosaic pattern color and protein in corn as well as the effects of inbreeding, a study of the practical value of first generation hybrid seed corn, and a coöperative experiment on a modified ear-to-row method of improving a variety of corn by selection.

Along with studies of the effect of selection of fluctuations within a self-fertilized family of tobacco, a commercial tobacco breeding problem is being continued in coöperation with the Bureau of Plant Industry of the United States Department of Agriculture and the Bussey Institution of Harvard University. A remarkable mutant or sport of Cuban tobacco is being studied with reference to its permanence and economic importance.

Other problems in breeding tomatoes, cucumbers and melons are being studied, and experiments in selection with catalpas and locusts have been undertaken in coöperation with the forestry department and in selection of melons with the botanical department.

Protein Research Department.

Most of the year's work has been devoted to studies of nutrition, viz.:

The nutritive value of the proteins of maize when fed as the sole protein of the diet and in combination with others.

The influence on growth and maintenance of the various amino-acids which proteins yield on decomposition.

The relation of the chemical constitution of the proteins to specificity of the anaphylaxis reaction.

Experiments have shown that some still unknown substance is essential to growth and that this unknown substance is present in milk. Much work is being done in an effort to discover and isolate this substance.

The results of the year's work have been published in five technical papers in scientific journals.

A detailed account of the work thus briefly summarized will be given, so far as space permits, in the annual report now in preparation.

The Station has made a large educational exhibit of its work at the autumn fairs held at Goshen, Washington, Norfolk and Granby. These exhibits are expensive and quite seriously interrupt the regular Station work, but have been highly appreciated in the several communities, and many more invitations to exhibit have been received than could possibly be accepted.

A field meeting was held in August at the Station's experiment field at Mount Carmel. About two hundred were present and most of the day was spent in examining and discussing various features of the work.

This brief summary does not give an adequate picture of the Station work. Very many inquiries come daily to the Station on subjects other than those specially studied in the several departments on which members of the staff can give adequate information.

The Station correspondence has involved the sending of 11,592 letters and manuscript reports. (Administration office 5244, chemical department 871, botanical 671, entomological 2499, forestry 1820, plant breeding 213, protein research 274.)

Members of the staff have also made ninety addresses at granges, farm institutes and other meetings of agricultural organizations, and have published in scientific journals 17 papers relating to their work, besides frequent contributions to magazines and agricultural papers.

The following publications have been issued:

The annual report of 551 pages and 33 plates in an edition of 10,000 copies, five bulletins of the regular series and one special bulletin aggregating 220 pages with 12 plates and 24 figures.

The special bulletin and one which was technical in character were distributed in much smaller editions than the others.

It was found impossible to adequately present the Station's work within the 475 pages authorized by Statute. For the additional 76 pages the Station was obliged to pay $604.20 from its own appropriation.

All of which is respectfully submitted,

GEORGE A. HOPSON, *Secretary.*

NEW HAVEN, CONN., November 1, 1913.

REPORT OF THE TREASURER, 1913.

E. H. JENKINS, in account with THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION for the fiscal year ending September 30, 1913.

RECEIPTS.

Balance on hand, October 1, 1912:			
Analysis Fees	$755.17		
State Agricultural Appropriation	297.67		$ 1,052.84
State Appropriation, Agriculture		$10,000.00	
State Appropriation, Food		2,500.00	
State Appropriation, Insect Pest		3,000.00	
State Appropriation, Gypsy Moth		5,000.00	
United States Appropriation, Hatch		7,500.00	
United States Appropriation, Adams		7,500.00	
Analysis Fees		12,744.55	
Sale of Station Produce		27.85	
Miscellaneous Receipts		58.30	
From the Lockwood Income		9,395.16	
			57,725.86
Total			$58,778.70

DISBURSEMENTS.

E. H. Jenkins, director, salary	$ 2,800.00
E. H. Jenkins, treasurer, "	400.00
G. A. Hopson, salary	100.00
V. E. Cole, "	850.00
L. M. Brautlecht, "	750.00
J. P. Street, "	2,500.00
T. B. Osborne, "	2,400.00
E. M. Bailey, "	1,550.00
C. B. Morison, "	1,200.00
R. B. Roe, "	38.19
C. E. Shepard, "	975.00
G. L. Davis, "	558.15
W. E. Britton, "	2,183.34
G. P. Clinton, "	2,383.33
E. M. Stoddard, "	1,000.00
W. O. Filley, "	2,000.00
A. E. Moss, "	1,181.48
H. K. Hayes, "	1,500.00

Edna L. Ferry, salary	$1,175.00	
H. Lange, "	925.00	
V. L. Churchill, "	825.00	
Wm. Veitch, "	675.00	
E. L. Avery, "	480.00	
E. B. Whittlesey	624.00	
M. H. Jagger	520.00	
C. D. Hubbell	728.00	
H. Kiley	728.00	
Wm. Pokrob	728.00	
Geo. Graham	728.00	
Labor	2,611.12	
Publications	2,570.42	
Postage	432.93	
Stationery	445.96	
Telephone and Telegraph	168.95	
Freight and Express	279.17	
Gas, Kerosene and Electricity	866.39	
Coal	1,474.30	
Water	155.10	
Chemicals and Laboratory Supplies	1,044.61	
Agricultural and Horticultural Supplies	212.54	
Miscellaneous Supplies	555.28	
Fertilizers	560.49	
Feeding Stuffs	305.73	
Library and Periodicals	1,140.54	
Tools and Machinery	456.51	
Furniture and Fixtures	556.35	
Scientific Apparatus	383.93	
Traveling by the Board	112.41	
Traveling by the Staff	1,351.05	
Traveling in connection with Adams Fund Investigations	214.25	
Fertilizer and Food Sampling (included in Traveling by the Staff)		
Insurance	408.24	
Insect Pest Appropriation to State Entomologist	3,000.00	
Contingent	223.15	
Lockwood Expenses	400.00	
Gypsy Moth Appropriation to State Entomologist	5,000.00	
Betterments	78.67	
Repairs	458.03	
Rental of Land	37.50	
Total Disbursements		$58,009.11
Balance on hand, Oct. 1, 1913 (Analysis Fees)		769.59
		$58,778.70

NEW HAVEN, CONN., Oct. 24, 1913.

THIS CERTIFIES that we have examined the accounts of E. H. Jenkins, Treasurer of The Connecticut Agricultural Experiment Station, for the fiscal year ending Sept. 30, 1913, have compared the same with the vouchers therefor and find them correct.

WILLIAM P. BAILEY,
JAMES P. TOBIN,
Auditors of Public Accounts.

ERRATA.

On page 163 of this Report the per cent. of nitrogen guaranteed in M. L. Shoemaker's Swift-Sure Superphosphate for Tobacco is incorrectly given as 2.50. It should be 2.88.

Pages 164 and 165. No. **2669** is not Olds & Whipple's Complete Tobacco Fertilizer, but a Special Mixture made for Mr. Kamp, containing extra potash. The guaranty given is *not* the guaranty of this Special Mixture. Of the total potash 0.66 per cent. should be calculated as muriate, 1.78 per cent. as sulphate and 5.05 as carbonate, making the valuation $30.45 and not $27.67, as given in the table.

PART I.

Eighteenth Report on Food Products and Sixth Report on Drug Products, 1913.

SECTION 1.

DIABETIC FOODS.*

By JOHN PHILLIPS STREET,
Chemist of the Station.

With the coöperation of LAFAYETTE B. MENDEL,
Professor of Physiological Chemistry, Sheffield Scientific School of Yale University.

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*Mr. Street is responsible for the analytical work herein reported, which was carried out in the Station laboratory.

INTRODUCTION.

In carrying out the requirements of the law regarding food products this Station has for many years devoted attention to the composition of foods for human consumption, with special reference to the improvement of the market and the encouragement of high standards of food production and distribution. From time to time renewed examination has been made of special groups of products and among these certain foods recommended for the use of persons suffering from diabetes. In the report for 1906, pp. 153-165, Dr. A. L. Winton published the analyses of a number of brands of so-called gluten flours and related products, and noted that the various preparations offered for sale at that time were far from satisfactory in respect to the content of carbohydrates (starch and sugars) with which the special value of the foods is particularly connected. Subsequently other analyses have been reported from time to time by this laboratory.*

The demand for these publications, the frequent inquiries directed to this Station, and the comments of those who are competent in the field, have led us to believe that a more extensive review of the situation and the collection of first-hand information regarding so-called "diabetic" foods would be welcomed in many quarters. The highly unsatisfactory state of the market and the inferiority of many of the products at present offered for sale are generally conceded by those familiar with them. Meanwhile the unsuspecting patient purchases foods which are not only misrepresented but which may be positively harmful to him. The fraud and deception to which an unfortunate portion of the public is subjected in the purchase of so-called foods for diabetics is at last receiving deserved attention from the medical profession. A leading American journal remarks:

"In some cases the manufacturers of these preparations are plainly to blame. They know that the stuff they sell is dangerous for the diabetic, and when national or state laws have forced them to modify their claims, they have done so in such a way as to continue to violate the spirit of the law while grudgingly obeying the letter. Other manufacturers, we believe, have been misled by those who should know better,—the physicians."*

* Report 1907, p. 138; 1908, p. 711; 1910, p. 549; 1911, p. 134; and 1912, pp. 107-112.

Diabetes is primarily a disturbance of nutrition in which the ability of the organism to utilize carbohydrates (starch, sugars, etc.), as it normally does, is more or less impaired. In the more severe cases there is added to this a disturbance in the utilization of fats (and possibly also of proteins) by the body.

"Because the diabetic can use only a portion, if any, of the carbohydrate of his food, he loses this amount of potential energy through the urine. From this comes the loss of flesh and strength. A gradual increase in the sugar content of the blood is a constant accompaniment of human diabetes. It is the probable source of many of the complications of the disease, especially of the lowered resistance to bacterial infections. . . . The problem of the management of the diabetic, therefore, is the problem of nourishing the organism with little or no carbohydrate, and, at the same time, avoiding the danger of acid intoxication when no carbohydrate is being consumed."†

The treatment of diabetes may be hygienic, dietetic and medicinal, as well as symptomatic in relation to the complications. All recent authorities, however, agree in placing the first emphasis upon the rôle of diet in the management of this disease. A few quotations in evidence of this must suffice to justify the special consideration which has been given to the dietary problems of the diabetic in this report.

Professor Janeway of Columbia University writes:

"Dietetic treatment is our mainstay. Does it actually influence the progress of the disease? I prefer to turn to the reverse side of that question first. Does neglect of proper dietetic treatment hasten the course of diabetes? Emphatically it does in a large proportion of cases. The evidence of this seems clear, although absolute proof from controlled experiments is out of the question. If this be true, then our first question is answered affirmatively, since the diabetic must eat, and, therefore, must have either proper or improper diabetic treatment. If his physician does not prescribe the former, he will the latter. Furthermore, it is a commonplace of therapeutics that a weakened function should not be overtaxed. It is, therefore, rational to shield the organs concerned in carbohydrate metabolism from constant demand beyond their damaged powers."†

* Editorial in the Jour. Med. Asso., March 22, 1913, p. 909.

† Janeway, T. C.: The Dietetic Treatment of Diabetes, Amer. Jour. of the Medical Sciences, March, 1909.

Professors Benedict and Joslin of Boston write:

"It is acknowledged by all clinicians that the most satisfactory treatment of *Diabetes mellitus* is obtained by a careful and intelligent regulation of the diet. The use of drugs has invariably met with but transitory success; modern clinicians are therefore relying less and less upon such remedies and are turning their attention more definitely toward a careful dietetic régime. Accordingly it is of fundamental importance that all the knowledge possible should be carefully accumulated regarding the uses made by the diabetic patient of the diet, the demands of the body for nutriment, and the best kinds of food to be ingested."*

Professor Futcher of Johns Hopkins University writes:

"The symptoms of diabetes are directly or indirectly dependent upon the hyperglycæmia, the grade of which is pretty accurately indicated by the amount of glucose excreted. Our object, therefore, should be to eliminate the hyperglycæmia if possible. This will be most quickly effected by cutting out of the dietary those constituents that are most readily converted by the digestive processes into grape sugar—namely the carbohydrates. When a diabetic patient comes under observation it should be the physician's first duty to ascertain the patient's capacity to warehouse carbohydrates or, in other words, to determine his tolerance for carbohydrates. This is done by placing the individual for at least five days on a diet absolutely free from starches and sugar, that is, on a proteid-fat diet."†

Professor Falta of Vienna writes:

"Symptomatic therapy seeks in the first instance to combat the most prominent symptom, the excretion of sugar and its results. Theoretically two possibilities exist: 1. To increase the efficiency of carbohydrate metabolism. . . . Unhappily such successes have been slight. 2. To diminish the amount of carbohydrate metabolism, thereby giving the diseased organ or organs the opportunity of recovering. This may be brought about by diminishing the amount of food, especially of the most effective sugar-formers. This is the theoretical foundation of the dietetic therapy of *Diabetes mellitus,* which has thus far been regarded as the sovereign means of treatment."‡

Professor Strauss of Berlin writes:

"The dietetic treatment of *Diabetes mellitus* is by all means the most potent therapeutic factor in the management of diabetics. It aims not only to diminish the sugar that makes its appearance in the urine, but

* Benedict, F. G., and Joslin, E. P.: A Study of Metabolism in Severe Diabetes. Carnegie Institution of Washington, Publ. 176, 1912, p. 3.
† Futcher, T. B.: Osler's Modern Medicine, 1907, i, p. 790.
‡ Falta, W.: The Therapy of Diabetes Mellitus. The Harvey Lectures for 1908-1909, Philadelphia, 1910, p. 97.

also the excess of sugar in the blood, the hyperglycæmia, which is a familiar cause of damage to the tissues."*

Professor von Noorden of Vienna writes:

"The treatment of diabetes has been restricted to certain definite lines since the days of Rollo, and this limitation is but now being extended. Rollo was the first to discover that urinary sugar decreased or disappeared from the urine when sugar and mealstuffs were excluded from the dietary; he found also that the general condition of the patients then got better. In those days the chemical constitution of foodstuffs was quite unknown, and many decades passed before the various articles of diet were analyzed. To-day we have a more precise knowledge of the composition of foods. But we cannot say that certain foodstuffs are suitable for diabetics simply because of their chemical composition. Such hard and fast chemical figures would mislead us. Further investigations on the influence of the individual foodstuffs revealed new and special peculiarities and it has not been possible to explain them from our knowledge of their chemistry, or our experience of their digestion and assimilation. There was also the remarkable fact, that diabetics could often assimiliate a food well when it is given singly, but badly when it is mixed with others. In spite of such special considerations the general direction that the intake of carbohydrates should be restricted or excluded stands to-day in the foreground of diabetic therapy, just as it did in the previous century. It is perhaps more emphasized than heretofore."†

The consensus of opinion in respect to the importance of a restriction of the carbohydrates—the starches and sugars—in certain cases and certain aspects of diabetes is apparent from these quotations from competent authorities, which might easily be multiplied. It is not our function to review or criticize the therapy of diabetes or the details of the dietetic regulation proposed or practiced; this is foremost the province of the physician. The desirability of prescribing a starch- or sugar-free dietary at times or of knowing accurately the actual amounts of these carbohydrates that are being consumed in familiar available foods calls for the coöperation of the chemist to furnish the requisite information regarding food composition.

The number of articles of food not containing starch, or having only small amounts of carbohydrates, from which the

* Strauss, H.: Diätbehandlung innerer Krankheiten, 3te Auflage, Berlin, 1912, p. 183.
† von Noorden, C.: New Aspects of Diabetes, New York, 1912, p. 73.

diabetic may choose when carbohydrates are ordered to be excluded from his regimen, is not inconsiderable and permits him to vary his dietary from time to time. (See the tabulation on page 9.) The common foods which the diabetic should be warned against taking except with the permission or advice of his physician, include particularly bread of all sorts and other bakery products; farinaceous preparations such as rice, sago, tapioca, hominy, semolina, arrowroot, macaroni and other cereal pastes; starchy vegetables like the potato, corn, peas, etc.; sweet fruits; sweet beverages; and sugar or products containing it.

Inasmuch as bread is the one article of diet which enters most familiarly and extensively into the daily regimen of people in all walks of life, the exclusion of it from the dietary is perhaps the most irksome of all the restrictions to which the diabetic may be subjected in the effort to reduce his intake of carbohydrates. The craving for the "staff of life" is the result of a widespread habit which makes bread one of the mainstays of human nutrition. Accordingly substitutes for bread—baked products which resemble it in texture and flavor—have been introduced from time to time. The oldest of these and the ones most extensively used are gluten bread and similar products prepared from gluten flour. The latter, introduced by Bouchardat in 1841, is made by washing away the starch from wheat flour. The processes of removing this carbohydrate so as to leave the protein-rich gluten residue is a laborious and expensive one. For this reason few of the so-called gluten flours on the market are satisfactory from the standpoint of low starch content. Owing to the expense and unreliability of most gluten flours now sold, many physicians have given up their use. White bread ordinarily contains about 53 per cent. of carbohydrates and the flour from which it is prepared about 75 per cent. When it is noted that many of the brands of gluten flour widely advertised and sold in American markets to-day contain 50 per cent. or more of starch (although as our analyses likewise show, it is possible to prepare a gluten product that is practically starch-free), the seriousness of the situation from the standpoint of the unsuspecting diabetic is apparent. In any event a conscientious manufacturer should certainly state the percentage of starch in his product, to say the least. But when this is done what advantage is it to prescribe or use a flour or

bread or baked product supposedly of unique value to a patient, yet differing at most from the commonest, inexpensive, palatable bread by only a few grams of starch in an entire day's ration?

Not only is it a dangerous error at the present time to assume that a product bearing the label "gluten flour," or some similar designation, is practically free from starch and thus available for those dietaries in which a carbohydrate-free regimen is sought, but by an unfortunate circumstance the provisions of the Federal Food and Drugs Act have served to render the situation worse rather than better. For instance, the government standard for gluten flour requires that it shall contain "not less than five and six-tenths (5.6) per cent. of nitrogen," which is equivalent to 35 per cent. protein. However, in the past the authorities at Washington have ruled that gluten flour, or in fact any food or drug product, which may not be of standard composition, is legally labeled if the amount of deviation from standard is indicated on the label. Thus a gluten flour containing only 20 per cent. protein may be labeled "gluten flour, $\frac{4}{7}$ standard," one containing 17.5 per cent, "gluten flour, $\frac{1}{2}$ standard," and so on down the line until we come to ordinary wheat flour with 10 per cent. protein, which under this ruling might be legally labeled "gluten flour, $\frac{2}{7}$ standard."

Our own recent analyses bear out our earlier experience and the contention of others in respect to the dangerous status of some of the most widely advertised flours and foods for diabetics. Quoting a recent comment by a writer in the Journal of the American Medical Association (March 22, 1913, p. 922):

> "Gluten flours are as a rule prescribed only for diabetics to whom the starch content is of the utmost importance. A physician tells his patient to use a gluten flour not because that product is rich in protein but because it is (supposedly) poor in carbohydrates. The great majority of so-called gluten flours and gluten foods sold in this country contain dangerously high percentages of carbohydrates, and the manufacturers do their best to keep both physician and patient in ignorance of this fact. In the case of gluten flours of legal standard, the protein-content is emphasized and made the main selling point. The subject of starch-content is studiously avoided, and it becomes necessary to write letters to the manufacturers specifically asking for the carbohydrate-content of their products, which may then be grudgingly—and not always truthfully—given."

Janeway writes, of so-called gluten foods as one of the "great frauds of the age":

"From my experience I say without hesitation that gluten bread is the diabetic's worst enemy. Taught by the dealer, or worse yet, by the physician, not only that it is safe for him to eat, but sometimes even that it is actually a cure for the disease, he eats it in large quantities. . . . The best gluten breads contain over thirty per cent. of starch; the worst . . . much more than ordinary white bread."

In speaking of the better types he adds:

"At best, even these are a very small help in providing something to eat more butter on, and fulfill no real function. It is better to allow the carbohydrate one does give in the form of familiar and longed-for foods, such as white bread, the starch content of which is known."*

We shall have more to say later in this report about the sorts of deception practiced. It is easy, by adding a few drops of Lugol's solution to them, to demonstrate that these gluten products with few exceptions contain starch; a blue, or even black, reaction is obtained according to the amount of starch present. In view of the fact that the purer sorts of gluten preparations require considerable skill in order that they shall become palatable after baking, the prejudice of an inexpert baker or housewife may militate against a good product; for carbohydrate is essential in the ordinary modes of preparing dough with yeast, and in the absence thereof less familiar methods of "raising" the mass must necessarily be employed. This is not generally appreciated; hence the failure to bake "pure" gluten products into a "light" form is often erroneously charged to some suspected unsuitability of the gluten flour, when in reality the shortcoming is on the culinary side.

Other substitutes for bread have been prepared from diverse products. A vegetable protein preparation made from wheat and termed "aleuronat" flour was advocated by Ebstein. The lack of carbohydrate makes it difficult to convert into "bread" by the conventional methods. Flours have been prepared from the soy bean (soya bean, soja bean, *Soja hispida*), almonds, Iceland moss, casein, etc. Leavening agents like baking powders are essential for success in their use. In addition to many nuts (not, however, the starchy chestnut), nut breads are employed by virtue of their relative poverty in carbohydrates and richness in protein and fat. Patients frequently tire of

* Janeway, T. C., loc. cit.

all of these, especially as they are liable to overeat when some novelty in the way of bread substitutes is offered to them. Very porous and light products, introduced in Germany under the name of "Luftbrot," are employed, not so much as complete substitutes as to act in the rôle of vehicles for other food materials, like butter. Their form and flavor furnish a grateful deception to those deprived of ordinary bread.

There are certain foods which, owing to their relative freedom from starches and sugar, may be taken freely by diabetics. The following list is based on that of Futcher,* but somewhat enlarged and modified to meet American conditions:

Soups:—Clear soups, such as bouillon and consommé, meat broths; soups with marrow, eggs, cheese and vegetables (listed below).

Fresh Meats:—All the muscular parts of the ox, calf, sheep, pig, deer, wild and domesticated birds, in their own gravy or a mayonnaise sauce.

Preserved Meats:—Dried or smoked meats, smoked or salted tongue, corned beef and other canned meats (in the absence of added starch).

Other Animal Products:—Brains, bone marrow, pig's feet, gelatin, sweetbreads, tongue, tripe, kidneys, eggs, cheese (especially when ripened), beef juice and true meat extract.

Fish:—All common varieties, except scallops, oysters, mussels and clams, cooked without bread crumbs or meal, and served with any kind of non-farinaceous sauce, preferably melted butter.

Oils and Fats:—Butter, lard, suet, tallow, oleomargarine, olive oil, cottonseed oil, cod liver oil, and other edible oils.

Fresh Vegetables:—Lettuce, cucumbers, spinach, asparagus, rhubarb, endive, sorrel, cress, vegetable marrow, beet greens, celery, Brussels sprouts, sea-kale and tomatoes. The following in limited amounts depending upon variety and maturity: cauliflower, cabbage, okra, egg-plant, radishes, salsify, leeks, pumpkins, string beans, kohl-rabi, rutabagas, squash, onions and parsnips.

Canned Vegetables:—French beans, asparagus, Brussels sprouts, okra, tomatoes, string beans, macedoine, artichokes and certain brands of pumpkins, peas and squash; pickles made from the above named vegetables; ripe olives and sauerkraut.

Condiments and Spices:—Vinegar, salt, pepper, cayenne, paprika, curry, cinnamon, cloves, nutmeg, English mustard (if free from added starch), caraway, capers, and the piquant sauces in limited quantities.

Non-alcoholic Beverages:—Sugar-free milk, tea, coffee, cocoa (without milk), natural and carbonated waters, and lemonade. Saccharin may be used as a sweetener, but no sugar.

Alcoholic Beverages:—Brandy, gin, rum, whisky (up to 3 oz. per day); dry wines, such as Moselle, Rhine, claret, Burgundy, hock (up to one pint per day).

* Futcher, T. B.: Osler's Modern Medicine, 1907, p. 792.

Where the diet is to be strict, sugar for sweetening purposes must be omitted. Saccharin is commonly permitted as an artificial sweetener, although glycerin has also been used to some extent. Most of the "substitutes" for sugar on the market are merely saccharin in substance or solution, masked under the guise of an attractive name and sold at a fancy price. These preparations are referred to more fully in a later section of this report. (See page 79.)

There is some evidence that certain forms of starch or certain carbohydrates are more readily utilized by diabetics than are others. Accordingly one hears of the potato diet, the inulin diet, levulose feeding, etc. Certain dietary measures such as the "rice treatment" and "oatmeal treatment" are employed for therapeutic effects, the reason for which is not yet adequately understood. The discussion of these is beyond the sphere of this report and their application demands the attention of a physician or student of nutrition. They aim primarily to increase the tolerance of the patient or to affect favorably the acidosis attendant upon many cases of diabetes.

Alcoholic beverages are included in this report because in the belief of most students of the subject alcohol is a useful, if not indispensable, adjunct to the dietary of the diabetic. Occasionally it serves to diminish the ketonuria in severe cases. Janeway has summarized the consensus of opinions on this subject in these words:

"Fat food which is always abundant in the dietary of diabetes is not agreeable to many persons, and in some cases causes digestive disturbances and diarrhœa. As a help in fat digestion alcohol is of distinct value, and it is next to impossible to give the large amounts of fat necessary in diabetes, without wine or spirits being taken at the same meal. Whisky or brandy, Rhine or Moselle wine, claret or Burgundy, may all be used, but sweet wines are of course prohibited. The amount should not exceed an alcohol content of forty grams in the day. As alcohol has a fuel value of seven Calories per gram, it is in itself not to be despised as an additional source of energy in these cases."*

* Janeway, T. C., loc. cit.

What is a "Diabetic" Food?

Formerly an almost complete absence, or at least a very marked reduction, of carbohydrates was considered an essential characteristic of a true "diabetic" food. While a diminution of the carbohydrates in the diet of the diabetic is still deemed necessary, modern practice allows a somewhat more liberal use of carbohydrates than in the past, and under certain conditions some practitioners of recognized authority even permit, for a limited period, foods of high carbohydrate content, such as oatmeal, potatoes and rice. It is, therefore, very difficult to prescribe the limits for the use of the word "diabetic" as applied to foods.

On the other hand, a food sold specifically as a "diabetic" food is popularly believed to contain considerably less carbohydrates than ordinary products of the same class, and this belief is fostered by the manufacturers on their labels and in their advertising literature, with hardly an exception. Our experience in previous investigations, as well as in the present one, has shown that as a rule little dependence can be placed on the manufacturers' claims. The physician and the patient are utterly at a loss as to the true carbohydrate content of the foods offered to them. In fact so great has this uncertainty become, that many leading practitioners have abandoned the use of all special preparations, preferring greatly reduced allowances of staple products like ordinary bread whose carbohydrate content is known and subject only to relatively slight variations. We believe, however, that there is a future for honest, properly standardized "diabetic" foods. At any rate, it is clearly incumbent upon the manufacturers to make their brands mean something, so that when a diabetic purchases "A's" Gluten Flour or "B's" Diabetic Bread he may be reasonably sure that he has obtained a preparation of definite composition and uniform carbohydrate content. Furthermore, when a manufacturer offers a preparation as particularly suited for the use of diabetics, he removes that product from the category of ordinary foods and assumes new obligations to the consumer. The conditions surrounding its sale must necessarily be more exacting than for an ordinary food sold for ordinary purposes.

With these considerations in mind, and judging from the opinions expressed to us by various authorities on diabetes, and

from the results of the extensive analyses included in this report, it would seem that the following restrictions should apply to any preparation sold specifically as a "diabetic" food:—

1. It should contain very much less carbohydrates than found in a normal food of the same class,—certainly not over half as much.

2. The label should bear a correct statement of the percentages of protein, fat and carbohydrates present.

3. The amounts of the different carbohydrates present should be declared on the label, i. e., starch, sucrose, levulose, lactose, etc.

4. The processes of manufacture should be so standardized that uniformity of composition, within reasonable limits, will be maintained from year to year.

5. No statement should be placed on the label which would give the impression that any food in unlimited quantity is suitable for a diabetic patient.

6. In the advertisements of these foods emphasis should be put on the carbohydrate content rather than on the amount of protein present.

It may be that the above requirements are too ideal for practical application; but until diabetic foods are prepared, advertised and sold under conditions closely approximating the above, this important class of food preparations, which should be so useful to the diabetic, must remain in the limbo of patent medicines, and be subject to the same suspicion, distrust and uncertainty as to results.

Sources of Samples Analyzed.

It has been our purpose to include in this report analyses of all diabetic foods sold in this country. All available American analyses have been tabulated, together with a number of foreign analyses of English, French and German preparations. Many of these latter doubtless may be found in our markets in the near future. (The firms of Brusson, Charrasse, Fromm and Rademann, for instance, which are well represented in our new analyses herewith reported, as far as we know had no agents in this country in 1906, the time of our first investigation.) All advertisements of diabetic preparations have been investigated, and all manufacturers of such preparations, whose names we could

obtain, have been asked for their advertising literature, so that we might have before us the exact claims made for the various foods. We have also personally investigated the market in New York, Boston, Baltimore and this state. In addition to this we have communicated with a number of authorities on diabetes in various parts of the country, asking them what brands they recommended to their patients and what other brands had been brought to their attention. In this connection we wish to acknowledge the valuable suggestions received from Dr. E. P. Joslin of Boston, Dr. A. J. Cramp of Chicago, Dr. T. C. Janeway and Dr. R. W. Wilcox of New York, Dr. S. Solis Cohen and Dr. James Tyson of Philadelphia and Dr. P. A. Shaffer of St. Louis.

By following the methods above noted we believe that we have covered the whole American market in a quite thorough manner, especially for the flours, meals, breads, biscuits, etc. At any rate in this report we present the analyses of nearly 400 brands of diabetic preparations, exclusive of wines. In several instances where the manufacturers put out an extensive line of foods, some differing from others only in shape or some other external characteristic, it seemed unnecessary to analyze all of these brands. Likewise in the case of the Rademann fruits prepared "without sugar" or "in their own juice," we have made no attempt to cover the whole extensive line of this class of preparations.

The following is a summary of the analyses of the various classes of foods published in this report, the "new" analyses referring to our own analyses now published for the first time:—

	Total	New
Flours and Meals	109	41
Protein Preparations	10	1
Soft Breads	40	3
Breads, Biscuits, Cakes, etc.	150	54
Breakfast Foods	14	6
Macaroni, Noodles, etc.	10	3
Nuts, Nut Butters and Pastes, etc.	32	20
Chocolate and Cocoa	16	6
Wines	38	38
Miscellaneous	19	14
Saccharin Preparations	17	17
Other Partial Analyses	87	..
Totals	542	203

A total of 542 analyses are tabulated, 203 of which are our own unpublished analyses and about 110 those made in this laboratory in past years. The sources of the compiled analyses are given below, the numbers referring to those given in the analytical tables. The samples without reference numbers, with date "1913," represent our new analyses.

Sources of Compiled Analyses.

1 California Agr. Expt. Station, Rept. 1895, 161; 2 do., 1902-3, 88; 3 do., 1902-3, 97. 4 Connecticut Agr. Expt. Station, Rept. 1899, 138; 5 do., 1901, 199; 6 do., 1903, 140; 7 do., 1904, 188; 8 do., 1906, 156-8; 9 do., 1906, 165; 10 do., 1907, 139; 11 do., 1908, 604; 12 do., 1908, 711; 13 do., 1910, 550; 14 do., 1911, 135; 15 do., 1911, 161; 16 do., 1912, 108; 17 do., 1912, 197; 18 do., 1912, 206. 19 Fetterolf, Univ. of Penn. Med. Bull., Sept., 1909. 20 Janney, Münch. med. Wochenschr., 1910, No. 40. 21 König, Chem. mensch. Nahr. u. Genussm., 1903, 1, 685; 22 do. (Vers.-Stat. Münster); 23 do. (Kornauth, Oesterr. Centralbl.) 24 do., 1, 686 (Vers.-Stat. Münster); 25 do. (Plagge and Lebbin); 26 do., 1, 687 (Vers.-Stat. Münster); 27 do., 1, 1463-4; 28 do., 1, 1465; 29 do., 1, 1465 (Wintgen); 30 do., 1904, 2, 535; 31 do, 1904, 883. 32 König, Zeit. Nahr. u. Genussm., 1898, 1, 762. 33 Kunz, Wien. klin. Wochenschr., 1899, 12, 509. 34 Magnus-Levy, Berl. klin. Wochenschr., 1910, 47, 236. 35 Maine Agr. Expt. Station, Bull. 55, 1899, 96; 36 do., Bull. 75, 1901, 99-101, 107; 37 do., Bull. 158, 1908, 227, 228; 38 do., Off. Insp., 34, 1911, 123. 39 Michigan Agr. Expt. Station, Bull. 211, 1904, 18. 40 North Dakota Agr. Expt. Station, Rept. 1901, 20; 41 do., Spec. Food Bull. 2, 1912, 184. 42 Sandmeyer, Milch Ztg., 1900, 29, 831. 43 U. S. Dept. Agr., Notice of Judgment, 1507. 44 Wintgen, Zeit. Nahr. u. Genussm., 1902, 5, 289; Zellner, Pharm. Ztg., 1901, 46, 501.

Methods of Analysis.

The methods of the Association of Official Agricultural Chemists have been followed. Inasmuch as in a number of instances a specific guaranty was made by the manufacturer as to the amount of starch present, starch as such was determined in all the samples by the official diastase method, after removal of soluble carbohydrates. The new analyses were made by the assistant chemists of this laboratory, Messrs. E. M. Bailey, C. B. Morison, C. E. Shepard and G. L. Davis, to whom our thanks are due for their efficient coöperation.

Explanation of Tables.

For purposes of comparison the foods of more or less similar nature have been grouped into classes. The first column gives

the date of publication of each analysis, then follows the name of the manufacturer (or jobber) and brand. The next four columns show numerous blanks, due to the failure of the various analysts to report the net weight of the samples and their cost. The cost of diabetic foods is an important factor in their use, and has possibly been insufficiently emphasized in the past. The column headed "No. of Pieces" may be useful as indicating the relative bulk of many of the baked preparations. The next six columns of analytical data require no explanation. Unless otherwise indicated the percentages of "starch" given represent starch as determined by the diastase method after removing soluble carbohydrates. The "starch" figures of the analyses made in this laboratory in 1906 include sugars, dextrin and other soluble carbohydrates. Footnotes indicating these and other instances, where the percentage published does not represent insoluble starch or other insoluble carbohydrates, are given in the various tables.

For the sake of uniformity the protein has been calculated by means of the conventional factor, 6.25; for this reason the protein percentages of the wheat products, as given in the tables, are too high, and those for nitrogen-free extract are correspondingly too low. In certain instances, where a very high percentage of wheat protein is present, this error is sufficient to cause the total nitrogen-free extract, obtained by difference, to exceed the sum of starch, sugar and dextrin as determined. On the other hand, in a preparation like Casoid Flour, consisting in large part of casein, the use of the proper factor, 6.37, instead of 6.25, would increase the protein 1.64 per cent. and correspondingly decrease the nitrogen-free extract. The use of the conventional factor in such a substance as this does it a slight injustice, as it is practically free from carbohydrates. It is also recognized that the "starch" as determined in our analyses may include a certain amount of other insoluble carbohydrates, such as pentosans. However, unless considerable bran were present, cereal flours and breads would contain only negligible amounts of pentosans, and it was not deemed necessary to make separate pentosan determinations in the samples. On the other hand, the starch figures for the soy bean and nut preparations are doubtless somewhat too high. In all our subsequent discussion of these analyses we have used

"nitrogen-free extract" and "carbohydrates" as synonymous terms, keeping the above explanation in mind.

In each table is given the amount of the particular food equivalent in carbohydrate content to 10 grams (about one-third of an oz.) of wheat bread, an average of 53 per cent. of carbohydrates being assumed for the latter. Naturally the higher this equivalent value the more useful is the food in a strict diabetic dietary; foods showing equivalents less than 10 are even less suitable for diabetics than ordinary wheat bread.

The last column gives the number of Calories supplied by 100 grams of the food, based on an average available fuel value of 4 Calories per gram for protein and carbohydrates, and 9 Calories per gram for fat. This column is inserted simply as a convenience to physicians and dietitians who may wish to know the fuel value supplied by any of these foods. A simple calculation—multiplying by 4.5—will convert these values to the pound basis.

With certain brands a number of analyses of unlike date have been included, as it was considered important to note whether or not the preparations showed any constancy in composition from year to year. For instance, von Noorden* found a sample of *Konglutinbrot* to contain 28.5 per cent. carbohydrates, while six months later another sample of the same product from the same bakery contained 42 per cent. Our tables show a very satisfactory uniformity of composition in a number of instances. Furthermore in a few cases products showed a marked improvement over their earlier analyses.

The Palatability of Special Diabetic Foods.

In considering the composition and comparative cost of the special foods recommended for diabetics in the preceding pages the question of the palatability of the various dietary articles has been left entirely out of consideration. It is well known, however, that the flavor and texture of our foods play no inconsiderable part in determining the preferences which the individual may give to different products. Crude animal fat and finely flavored butter may exhibit the same nutritive value

*von Noorden, C.: Die Zuckerkrankheit und ihre Behandlung, Berlin, 1910, p. 365.

from the standpoint of digestibility and energy content; yet the dictates of the palate in no small measure determine the higher price which is paid for the more acceptable product. Not a few of the preparations enumerated in this report, representing products that are from the standpoint of their chemical make-up apparently well suited to the specific nutritive limitations of the diabetic, fail in practice to meet the expectations aroused by their appropriate composition, owing to peculiarities of flavor, or in some cases utter lack of flavor, which speedily renders them dietetically objectionable to the consumer. So long as it is impossible to standardize products by criteria dependent upon our senses of taste or smell, and so long as individual tastes and preferences show the wide range of variation that is familiar to anyone who has experience in culinary matters, it seems unprofitable to attempt any indication in a report of this sort of even the probable merits of the various diabetic products from the standpoint of palatability. The consumer himself must determine in the individual cases to what extent a product, satisfactory from the standpoint of composition and digestibility, will satisfy the preferences of his palate. Herein lies the opportunity for the intelligent manufacturer to introduce improvements. There is room for wide progress in this field. Most of the gluten products, for example, either are bland to the taste or manifest some slight peculiarity of odor or taste too small to detect by chemical means, yet sufficient to render them objectionable to discriminating palates. In view of these facts discrepancies in the relative cost of comparable preparations must not be judged solely from the standpoint primarily emphasized in later pages; for in diabetic products, as in the food materials of every-day life, it is often flavor quite as much as composition which determines the cost to the consumer.

FLOURS AND MEALS.

In this group are included gluten flours, and other flour-like preparations either essentially of a protein nature, such as Aleuronat, Roborat, Casoid Flour, etc., or certain non-cereal flours like soy bean and almond products. The analyses of 109 samples of 68 brands of these flours are given in Table I.

TABLE I.—ANALYSES OF DIABETIC FOODS.

Date of Analysis. (See page 14.)		Manufacturer and Brand.	No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N×6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
		Flours and Meals.		gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
1910	43	Acme Mills Co., Portland, Ore., Acme Diabetic Flour	..	....	...	...	9.4	1.1	9.4	0.8	77.4	1.9	71.4	7	364
....	30	Amthor & Co., Halle, Weizen-Protein	..	....	...	...	8.6	1.1	84.1	...	4.8	1.4	....	110	368
1906	8	Herman Barker, Somerville, Mass., Barker's Gluten Food "A"	..	....	...	...	10.1	0.2	85.4	0.0	3.7	0.6	*4.5	143	362
1912	16	" " " " " " " "	..	363	125	156	7.4	0.4	86.9	0.2	4.6	0.5	Trace	115	370
1906	8	" " " " " " " "B"	..	....	...	...	10.1	0.2	84.4	0.0	4.7	0.6	*6.0	113	362
1913		" " " " " " " "	..	381	100	119	6.3	0.4	85.1	0.4	7.2	0.6	3.7	74	375
1906	8	" " " " " " " "C"	..	....	...	...	9.7	0.2	82.5	0.0	6.8	0.8	*8.3	78	364
1913		" " " " " " " "	..	385	100	118	5.7	0.4	84.1	0.6	8.6	0.6	3.4	62	377
1907	10	Bischof & Co., London, Gluten Flour	..	....	...	...	10.1	1.3	79.8	0.2	5.0	3.6	....	106	372
1906	8	Callard, Stewart & Watt, London, Casoid Flour	..	907	150	75	10.0	2.5	85.6	1.4		0.5	0.0	377+	353
1909	19	" " " " " "	..	907	150	75	10.3	2.5	82.5	3.1		1.6	....	171+	357
1912	16	Cereo Co., Tappan, N. Y., Soy Bean Gruel Flour	..	352	50	65	4.9	4.4	45.7	1.9	22.6	20.5	0.6	23	458
1913		" " " " " " "	..	467	50	49	4.2	4.2	43.1	2.2	24.9	21.4	Trace	21	465
1906	8	Farwell & Rhines, Watertown, N. Y., Cresco Flour	..	....	...	...	12.7	0.5	11.1	0.0	74.8	0.9	....	7	352
1913		" " " " " " "	..	454	9	9	12.7	0.4	18.1	0.4	67.4	1.0	57.2	8	351
1913		" " " " " " "	..	2321	50	10	....	...	20.1	...	....	....	....	?	...
1904	7	" " " " Gluten Flour	..	....	...	...	....	...	9.4	...	....	....	much	?	...
1906	8	" " " " " "	..	....	...	...	12.7	0.4	11.4	0.3	74.3	0.9	*71.5	7	351
1906	8	" " " " " "	..	....	...	...	13.3	0.5	10.8	0.1	74.3	1.0	*72.0	7	349
1909	19	" " " " " "	..	....	...	...	10.7	0.5	12.0	76.3		0.5	....	7+	358
1913		" " " " " "	..	2330	115	22	8.3	0.6	43.1	0.2	46.6	1.2	38.1	11	370
1913		" " " " " "	..	509	15	13	8.6	0.5	46.3	0.6	42.9	1.1	32.8	12	367
1904	7	Farwell & Rhines, Watertown, N. Y., Special Diabetic Food	..	....	...	...	....	...	13.5	...	....	...	much	?	...
1906	8	" " " " " " "	..	....	...	...	12.0	1.9	14.3	1.4	67.4	3.0	*58.3	8	354
1906	8	" " " " " " "	..	....	...	...	10.3	1.6	14.2	1.1	70.0	2.8	*62.1	8	362
1906	8	" " " " " " "	..	....	...	...	12.4	1.3	12.8	0.6	70.3	2.6	....	8	358
1913		" " " " Special Dietetic Food	..	445	10	10	9.6	1.8	27.5	1.7	56.6	2.8	40.0	9	362
1910	34	Gericke, Potsdam, Aleuronat	..	....	...	...	9.3	0.9	83.4	3.1		3.3	....	171+	376
1913		Golden Rod Milling Co., Portland, Ore., Acme Special Flour	..	....	...	...	10.0	0.7	15.8	0.7	71.4	1.4	57.9	7	361
1913		O. B. Gilman, Boston, Mass., Gluten Flour	..	454	11	11	8.7	1.0	47.3	0.6	40.4	2.0	31.4	13	369
1909	19	Karl Goldscheider, Carlsbad, Conalbin-Mehl No. 1	..	....	...	...	9.4	0.5	10.9	78.8		0.4	....	7+	362
1910	34	Gumpert, Berlin, Ultramehl	..	....	...	...	6.6	2.9	36.5	9.4		44.6	....	56+	585
1908	37	Hazard's Wheat Protein	..	....	...	...	7.0	0.6	41.8	0.3	49.1	1.2	....	11	374
1906	8	Health Food Co., New York, Almond Meal	..	....	...	...	8.5	6.4	50.6	2.9	16.0	15.6	*7.2	33	407
1913		" " " " "	..	469	100	97	7.9	6.3	50.3	2.8	17.9	14.8	Trace	30	406
1911	14	" " " C B X Cold Blast Flour, 25% Protein	..	2350	75	15	8.7	0.5	10.1	0.2	79.6	0.9	68.9	7	367
1906	8	" " " Glutosac Gluten Flour	..	...	...	...	10.1	1.1	34.1	1.0	52.1	1.6	*49.3	10	359

*Determined by the diastase method, without previous washing with water, and calculated as starch.

TABLE I.—ANALYSES OF DIABETIC FOODS.—*Continued.*

Date of Analysis. (See page 14.)	Manufacturer and Brand.	No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N x 6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
	Flours and Meals. *(cont.)*		gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
1909 19	Health Food Co., New York, Glutosac Gluten Flour	..	....	...	...	8.0	1.1	35.3	55.0		0.6	....	10+	367
1911 38	" " " " " " "	..	....	...	...	8.7	...	36.6	...	....	....	....	?	...
1913	" " " " " " "	..	847	35	19	8.2	1.4	39.9	0.7	47.5	2.3	36.9	11	370
1913	Health Food Co., New York, Pronireu (Gluten Griddle Cake Flour)	..	855	30	16	8.8	4.9	37.3	0.5	47.3	1.2	37.7	11	349
1906 8	" " " Protosac Gluten Flour	..	....	...	...	10.6	0.7	36.6	0.3	50.9	0.9	*50.0	10	358
1913	" " " " " "	..	839	40	22	8.0	0.9	42.7	0.3	46.4	1.7	36.3	11	372
1913	" " " Protosoy Soy Flour	..	500	50	45	3.0	5.0	42.3	5.4	24.5	19.8	Trace	21	446
1906 8	" " " Pure Washed Gluten Flour	..	....	...	...	6.2	0.8	62.4	0.2	29.5	0.9	*27.5	18	376
1913	" " " " " " " "	..	889	50	26	6.1	0.5	80.3	0.4	11.1	1.6	7.0	48	380
1892–6 30	R. Hundhausen, Hamm, Aleuronat (pure)	..	....	...	...	8.5	0.9	86.1	...	4.0	0.5	....	133	365
1892–6 30	" " " (less pure)	..	....	...	...	9.1	1.2	77.7	0.2	10.6	1.2	....	50	364
1906 8	Jireh Diabetic Food Co., New York, Diabetic Flour	..	....	...	...	9.3	1.3	14.3	1.0	71.9	2.2	*66.6	7	365
1906 8	" " " " " "	..	....	...	...	11.0	1.3	12.1	1.1	72.7	1.8	....	7	355
1913	" " " " Flour	..	1144	30	12	7.6	1.4	14.4	1.4	72.9	2.3	60.9	7	370
1913	" " " " Patent Barley	..	475	25	24	5.0	1.1	11.4	0.7	80.2	1.6	67.8	7	381
1913	" " " " " Cotton Seed Flour	..	495	20	18	7.4	5.5	49.1	4.0	21.3	12.7	6.0	25	396
1913	" " " " " Lentils Flour	..	469	25	24	5.9	2.5	27.3	3.3	59.8	1.2	42.6	9	359
1913	" " " " Protein Flour	..	1124	50	20	7.3	1.7	31.4	0.9	56.7	2.0	48.5	9	370
1913	" " " " Soja Bean Flour	..	457	30	30	4.4	4.6	42.3	4.7	25.8	18.2	0.0	21	435
1906 8	" " " " Wheat and Barley Flour	..	....	...	...	9.7	1.5	11.8	1.6	73.5	1.9	*66.2	7	358
1906 8	" " " " " " " "	..	....	...	...	9.5	1.6	11.3	1.4	74.4	1.8	....	7	359
1906 8	Johnson Educator Food Co., Boston, Mass., Educator Standard Gluten Flour	..	....	...	...	11.3	1.0	26.4	0.4	59.2	1.7	*56.8	9	358
1911 14	" " " " " " " " "	..	1358	38	13	7.3	0.8	40.1	0.2	50.2	1.4	40.9	11	374
1911 38	" " " " " " " " "	..	....	...	...	8.8	...	40.1	...	....	....	....	?	...
1904 39	The Kellogg Food Co., Battle Creek, Mich., 20% Gluten Meal	..	....	...	...	10.5	1.0	15.8	0.4	71.7	0.6	57.4	7	355
1909 19	" " " " " " "	..	....	...	...	8.9	1.1	21.0	68.2		0.8	....	8+	364
1912 16	" " " " " " "	..	428	25	26	9.8	1.4	27.5	0.1	60.7	0.5	49.6	8	357
1906 8	The Kellogg Food Co., Battle Creek, Mich., 40% Gluten Flour	..	....	...	...	10.5	0.5	40.3	0.2	47.3	1.2	*46.9	11	361
1906 8	" " " " " " "	..	....	...	...	8.5	1.4	38.4	0.1	50.4	1.2	*50.0	11	366
1909 19	" " " " " " "	..	....	...	...	7.9	1.2	39.0	50.1		1.8	....	11+	373
1912 16	" " " " " " "	..	320	50	71	9.7	1.4	47.0	0.2	40.8	0.9	31.9	13	359
1913	" " " " " " "	..	414	50	55	8.0	1.2	43.7	0.2	46.0	0.9	40.5	11	367
1909 19	" " " " " " " Self-Raising	..	....	...	...	8.8	1.3	38.7	50.2		1.0	....	11+	365
1909 19	" " " 80% Gluten	..	....	...	...	7.2	0.6	78.8	12.5		0.9	....	42+	373
1912 16	" " " " " "	..	425	60	64	9.1	0.6	81.3	0.2	7.9	0.9	6.2	67	365
1913	Eugene Loeb, New York, Gluten Cracker Meal	..	134	15	51	9.7	1.0	27.8	0.3	53.5	7.7	40.2	10	394
1913	" " " Imported Gluten Flour	..	....	...	40	9.2	1.4	76.3	0.4	11.8	0.9	4.4	45	361

*Determined by the diastase method, without previous washing with water, and calculated as starch.

TABLE I.—ANALYSES OF DIABETIC FOODS.—*Continued.*

Date of Analysis. (See page 14.)	Manufacturer and Brand.	No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N×6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
			gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
	Flours and Meals. *(cont.)*													
1913	Eugene Loeb, New York, Pure Gluten Flour	..	423	20	21	10.1	0.6	40.3	0.3	46.3	2.4	39.6	11	368
1913	" " " Whole Wheat Flour	..	424	10	11	11.1	1.1	14.6	0.5	70.5	2.2	54.6	8	360
1913	E. Loeb & Co., New York, Gluten Flour	..	453	50	50	9.8	0.5	43.9	0.3	44.4	1.1	39.8	12	363
1913	Thos. Martindale & Co., Philadelphia, Special Gluten Flour	..	900	30	15	8.2	0.6	40.3	0.3	49.1	1.5	41.4	11	371
1913	Mayflower Mills, Fort Wayne, Ind., Bond's Diabetic Flour	..	1445	30	9	9.4	0.6	40.2	0.2	48.3	1.3	40.6	11	366
1906 [8]	Theo. Metcalf Co., Boston, Mass., Soja Bean Meal, 5.5% Starch	..	....	...	...	7.8	4.4	39.9	3.9	24.9	19.1	*9.0	21	431
1906 [8]	" " " " " " 7.6% "	..	....	...	...	....	...	36.8	...	....	....	....	?	...
1913	" " " " " " 18.0% "	..	453	50	50	6.5	4.1	41.0	3.4	25.0	20.0	....	21	444
1906 [8]	" " Vegetable Gluten, 20.0% "	..	....	...	...	7.9	0.7	61.4	0.3	28.1	1.6	*26.8	19	372
1913	" " " " 8.1% "	..	453	50	50	7.6	0.5	80.4	0.2	9.8	1.5	5.9	54	374
1901–2 [44]	H. Niemöller, Gütersloh, Roborat	..	....	...	...	9.5	1.4	82.3	0.2	2.9	3.7	....	183	374
1913	Pieser-Livingston Co., Chicago, Gluten Flour	..	....	...	...	8.5	0.6	43.3	0.1	46.2	1.3	38.4	11	370
1913	" " " " " "	..	1358	43	14	8.7	0.6	41.8	0.2	47.3	1.4	36.5	11	369
1904 [7]	Pure Gluten Food Co., New York, Gum Gluten Flour	..	...	...	...	....	...	54.3	...	....	....	....	?	...
1911 [14]	" " " " " " " "	..	464	15	15	8.1	1.0	38.3	0.2	50.8	1.6	42.4	10	371
1902–3 [2]	Pure Gluten Food Co., New York, Gum Gluten Ground	..	....	...	...	11.9	0.9	26.8	59.0		1.4	....	9+	356
1904 [39]	" " " " " " " "	..	....	...	...	10.6	0.8	44.1	0.4	42.8	1.3	30.0	12	359
1906 [8]	" " " " " " " "	..	....	...	...	6.9	1.0	50.1	0.5	39.6	1.9	*38.6	13	376
1901 [2]	" " " " " " Self-Raising	..	....	...	...	9.8	3.8	31.5	0.3	53.2	1.4	....	10	351
1906 [8]	" " " " " " " "	..	....	...	...	10.8	4.5	37.9	0.5	45.3	1.0	*42.9	12	342
1906 [8]	Pure Gluten Food Co., New York, Hoyt's Gum Gluten	..	....	...	...	11.2	1.0	31.8	0.3	54.1	1.6	*52.0	10	358
1901 [36]	" " " " Plain Gluten Flour	..	....	...	...	9.9	0.6	53.6	0.2	34.5	1.2	....	15	363
1911 [38]	" " " " Pure Gluten Flour	..	....	...	...	....	...	37.9	...	....	....	....	?	...
1911 [38]	" " " " " " " "	..	....	...	...	9.1	...	39.3	...	....	....	....	?	...
1913	Rademann's Nährmittelfabrik, Frankfurt, Diabetiker Mehl	..	246	20	37	9.6	0.8	37.9	0.2	50.7	0.8	46.8	11	362
1895 [1]	Ralston Health Food Co., Gluten Flour	..	....	...	...	12.8	0.6	15.0	0.6	69.0	2.0	....	8	354
1902–3 [2]	" " " " " "	..	...	...	...	11.9	0.9	15.8	70.9		0.5	....	7+	351
1913	Sprague, Warner & Co., Chicago, Richelieu Gluten Flour	..	1357	69	23	8.7	0.5	49.7	0.2	39.7	1.2	31.6	13	368
1913	G. Van Abbott & Sons, London, Almond Flour	..	480	48	45	4.0	3.0	24.6	1.9	7.9	58.6	0.0	67	657
1913	" " " Gluten Flour	..	902	144	72	10.2	0.8	75.1	0.4	12.6	0.9	12.4	42	359
1913	" " " Gluten Semola	..	....	60	...	10.1	2.8	51.4	0.4	32.4	2.9	28.2	16	361
1911 [38]	Wilson Bros., Rochester, N. Y., Gluten Flour, ¼ Standard	..	....	...	...	11.1	...	19.9	...	....	....	....	?	...
1911 [38]	" " " " " " "	..	....	...	...	9.7	...	19.5	...	....	....	....	?	...
1913	" " " " " " "	..	....	...	10	11.0	1.2	20.8	0.3	64.6	2.1	54.6	8	361
1913	" " " " " " Self-Raising, ¼ Standard	..	1296	25	9	12.2	4.6	17.4	0.3	63.5	2.0	51.8	8	342
	Protein Preparations.													
1912 [17]	The Bauer Chemical Co., Berlin, Sanatogen	..	200	190	431	10.0	5.6	80.1	4.2		0.1	....	126+	338
1900–1 [27]	Eiweiss–Extrakt Co., Altona, Germany, Soson	..	....	...	...	6.4	1.0	91.2	1.1		0.3	....	482+	372

*Determined by the diastase method, without previous washing with water, and calculated as starch.

TABLE I.—ANALYSES OF DIABETIC FOODS.—*Continued.*

Date of Analysis. (See page 14.)		Manufacturer and Brand.	No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N×6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
		Protein Preparations. *(cont.)*		gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
1902	29	Krecke & Co., Salzuflen, Energin	..	....	...	...	9.1	1.0	83.8	0.3	1.3	4.5	....	408	381
1913		Menley & James, New York, Glidine	..	284	150	240	5.7	0.9	91.4	0.2	1.0	0.8	0	530	377
1899–1900	28	Plasmon Co., London, Plasmon, (average 9 analyses)	..	....	...	...	11.9	7.5	70.2	9.7		0.7	....	55+	326
1901	36	" " "	..	....	...	...	8.5	7.4	75.0	8.9		0.2	....	60+	337
1908	11	" " "	..	128	35	124	12.4	7.7	70.3	9.2		0.4	....	58+	322
1909	19	" " "	..	....	...	...	10.9	7.6	78.7	0.0		2.7	....	....	339
1898–1900	27	Troponwerke, Mülheim, Tropon, (average of many analyses)	..	....	...	...	9.3	1.2	86.6	2.7		0.2	....	196+	359
1901	36	" " "	..	....	...	...	9.2	0.8	88.5	1.2		0.3	....	442+	362
		Soft Breads.													
1913		Ferguson Bakery, Boston, Mass., Gluten Bread	1	476	20	19	37.2	1.7	24.2	0.2	33.6	3.1	25.2	16	259
1892	26	Frank & Co., Bockenheim, Proteïn-Roggenbrot	..	....	...	...	32.0	2.8	23.7	2.3	33.0	6.2	....	16	283
1892	26	" " Proteïn-Weizenbrot	..	....	...	...	31.9	2.7	23.4	2.2	33.5	6.3	....	16	284
....	23	Fritz, Vienna, Aleuronatbrot	..	....	...	...	35.5	1.3	15.6	0.2	46.6	0.8	....	11	256
1910	20	" " Kleberbrot, Schwarz	1	114	...	...	....	...	21.5	...	48.6	....	....	11	...
1910	20	" " Litonbrot	1	229	...	...	....	...	38.6	...	15.4	....	....	34	...
1910	20	Fromm & Co., Dresden, Conglutinbrot	1	273	...	...	....	...	18.3	...	47.3	....	....	11	...
1910	20	" " " Litonbrot	1	355	...	...	....	...	35.8	...	14.3	....	....	37	...
1910	20	Gericke, Potsdam, Doppel-Porterbrot	1	145	...	...	38.6	...	26.9	...	35.1	....	....	15	...
1910	34	" " " "	..	....	...	...	38.9	1.1	21.9	36.7		1.5	....	14+	248
1910	34	" " Dreifach-Porterbrot	..	....	...	...	35.1	1.3	30.7	0.4	26.0	6.5	19.8	20	285
1910	34	" " Einfach-Porterbrot	..	....	...	...	30.5	1.6	17.8	48.2		1.8	....	11+	280
1910	34	" " Sifarbrot	..	....	...	...	39.6	2.2	37.3	0.6	15.0	5.3	12.3	35	257
1910	34	Karl Goldscheider, Carlsbad, Sinamylbrot	..	....	...	...	39.1	3.5	28.2	4.4	20.2	4.6	17.3	26	235
1910	34	Gumpert, Berlin, Diabetiker-Doppel-Schwarzbrot	..	....	...	...	25.6	1.6	18.5	0.5	42.0	11.8	39.4	13	348
1910	34	" " " " "	..	....	...	...	27.9	1.6	15.9	42.0		12.7	....	13+	346
1910	34	" " " " -Weissbrot	..	....	...	...	23.7	2.3	18.8	0.4	39.4	15.4	36.8	13	371
1910	34	" " " Einfach-Schwarzbrot	..	....	...	...	30.1	1.4	15.6	49.5		3.4	....	11+	291
1910	34	" " " " -Weissbrot	..	....	...	...	29.4	1.5	16.2	46.4		6.5	....	11+	309
1910	34	" " Ultrabrot	..	....	...	...	27.9	3.1	28.2	0.8	7.8	32.2	6.8	68	434
1892	22	F. Günther, Frankfurt, Kleberbrot	..	....	...	...	33.7	2.4	17.2	0.7	45.5	0.5	....	12	255
1906	8	Health Food Co., New York, Glutosac Bread	..	....	...	...	31.5	1.9	27.4	0.4	36.1	2.7	*29.9	15	278

*Determined by the diastase method, without previous washing with water, and calculated as starch.

TABLE I.—ANALYSES OF DIABETIC FOODS.—*Continued.*

Date of Analysis. (See page 14.)	Manufacturer and Brand.	No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N×6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
			gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
	Soft Breads. *(cont.)*													
1906 8	Health Food Co., New York, Protosac Bread	..	....	...	...	27.3	1.4	32.5	0.2	37.0	1.6	*33.1	14	292
1892–6 21	R. Hundhausen, Hamm, Aleuronatbrot, low gluten	..	....	...	...	39.6	1.6	17.3	0.6	40.6	0.3	....	13	234
1906 8	Jireh Diabetic Food Co., New York, Whole Wheat Bread	..	....	...	...	39.2	1.8	9.4	0.6	48.6	0.4	*43.8	11	236
1913	" " " " " " " "	..	....	...	10	21.8	2.5	12.4	0.6	62.0	0.7	44.9	9	304
1913	" " " " " " " " (not fresh)	1	....	...	10	21.8	2.5	12.4	0.6	62.0	0.7	44.9	9	304
	Eugene Loeb, New York, P. & L. Genuine Gluten Bread	1	321	10	14	31.4	1.6	10.4	0.3	53.7	2.6	44.2	10	280
1910 34	Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Grahambrot	..	....	...	...	31.7	1.8	9.8	2.1	49.4	5.1	45.6	11	283
1910 20	" " " " Schwarzbrot (dry)	1	196	...	...	....	...	37.8	...	33.3	....	....	16	...
1910 34	" " " " "	..	....	...	...	29.1	1.9	14.5	1.4	50.5	2.5	45.8	10	283
									47.6					
1910 34	" " " " "	..	....	...	...	33.6	1.9	14.9			1.9	....	11+	267
1910 20	" " " " Weissbrot (dry)	1	128	...	...	....	...	43.4	...	28.1	....	....	19	...
1910 34	" " " " "	..	....	...	...	33.8	1.9	23.3	0.4	40.1	0.5	37.0	13	258
1910 20	" " " "D-K" Brot (dry)	1	217	...	...	....	...	12.3	...	58.9	....	....	9	...
1892 26	" " " Erdnuss-Brot	..	....	...	...	24.6	3.8	33.6	5.5	19.7	12.8	....	27	328
1910 34	" " " Litonbrot	..	....	...	...	42.6	2.4	30.2	0.7	21.6	2.5	17.5	25	230
1894 22	Schelte, Münster, Aleuronatbrot	..	....	...	...	38.8	1.3	18.3	0.9	40.1	0.6	....	13	239
1910 20	Seidl, München, Aleuronatbrot	1	164	...	...	28.0	...	21.9	...	47.3	0.3	....	11	280
1910 20	" " Kleberbrot	1	138	...	...	24.2	...	18.6	...	54.4	0.7	....	10	298
1899 33	Troponwerke, Mülheim, Tropon-Brot	..	....	...	...	42.1	...	19.5	...	....	....	....	?	...
	Hard Breads and Bakery Products.													
1907 10	Bischof & Co., London, Diabetic Gluten Bread	..	....	...	...	7.4	4.7	73.1	0.0	14.3	0.5	....	37	354
1907 10	" " " Essentiel Bread for Super Alimentation	..	....	...	...	7.3	4.8	26.6	0.1	59.6	1.6	....	9	359
1910 13	Brusson Jeune, Villemur, France, Gluten Bread	1	30	10	150	7.8	1.1	32.1	0.2	57.0	1.8	49.8	9	373
1912 16	" " " " " "	1	34	10	133	12.7	0.8	37.3	0.3	47.1	1.8	40.1	11	354
1909 19	Callard, Stewart & Watt, London, Almond Biscuit, Plain	..	....	...	...	3.7	3.2	28.3		36.8	28.0	....	14+	512
1909 19	" " " " Almond Shortbreads	..	....	...	...	4.2	3.5	19.5		20.7	52.1	....	26+	630
1906 8	" " " " Casoid Biscuits No. 1	..	....	...	...	7.8	3.9	63.0		8.0	17.3	*8.1	66+	444
1909 19	" " " " " " "	..	....	...	...	7.2	2.5	64.8		8.7	16.8	....	61+	445
1913	" " " " " " "	54	226	150	300	4.8	3.4	66.8	0.4	5.8	18.8	4.0	91	460
1908 12	" " " " " " No. 2	..	....	...	...	....	...	58.1	...	....	....	0.0	?	...
1909 19	" " " " " " "	..	....	150	...	7.5	3.6	57.8		5.6	25.5	....	95+	483
1908 12	Callard, Stewart & Watt, London, Casoid Biscuits No. 3	..	....	...	...	....	...	54.7	...	....	....	Trace	?	...
1909 19	" " " " " " "	..	....	150	...	7.9	5.0	54.3		7.8	25.0	....	68+	473
1908 12	" " " " " Dinner Rolls	..	....	...	...	....	...	80.8	...	....	....	†3.3	?	...
1909 19	" " " " " " "	..	....	150	...	7.0	1.8	78.0		2.1	11.1	....	252+	420
1909 19	" " " " " Lunch Biscuit	..	....	...	...	4.2	3.8	25.5		21.6	44.9	....	25+	593

* Determined by the diastase method, without previous washing with water, and calculated as starch.

† By direct acid hydrolysis, calculated as starch.

TABLE I.—ANALYSES OF DIABETIC FOODS.—*Continued.*

Date of Analysis. (See page 14.)		Manufacturer and Brand.	No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N×6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
		Hard Breads and Bakery Products. *(cont.)*		gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
1909	19	Callard, Stewart & Watt, London, Casoid Rusks	..	....	...	...	5.4	4.5	37.0	20.8		32.3	....	25+	522
1909	19	Callard, Stewart & Watt, London, Cocoanut Biscuit+Saccharin	..	....	...	...	2.6	3.1	16.6	16.4		61.3	....	38+	684
1909	19	" " " " Ginger Biscuit+Saccharin	..	....	...	...	2.5	3.7	17.1	18.1		58.6	....	29+	668
1909	19	" " " " Kalari Batons	..	....	...	...	8.1	4.4	52.9	0.9		33.7	....	(?) 589	519
1913		" " " " " "	30	320	150	213	4.5	5.2	43.2	0.7	7.4	39.0	0	69	553
1909	19	" " " " " Biscuits	..	....	...	...	6.3	3.7	56.9	1.7		31.4	....	312+	517
1909	19	" " " " Prolactic Biscuit	..	....	...	...	6.3	4.0	42.9	19.3		27.5	....	27+	496
1913		Charrasse Biscuits Croquettes au Gluten	97	194	135	316	7.3	0.5	34.3	0.2	52.3	5.4	30.6	10	395
1913		" Biscottes Lucullus	37	530	95	81	7.5	1.8	11.4	0.2	73.4	5.7	59.2	7	391
1913		" Gluten Exquis Biscuits aux Amandes	24	189	150	360	5.3	1.6	18.1	0.6	50.6	23.8	25.5	10	489
1913		" Gluten Fleur de Neige Pain	21	146	115	357	6.1	2.3	35.9	0.4	42.8	12.5	25.1	12	427
1913		" Mignonettes au Gluten	47	116	90	352	8.2	2.1	40.1	0.3	43.6	5.7	27.3	12	386
1913		" Pain de Gluten	15 sliced bread	481	150	141	8.1	2.1	40.8	0.2	43.5	5.3	27.2	12	385
1913		" Tranches Grillées pour Potage		81	60	336	7.7	2.3	40.6	0.3	45.5	3.6	28.8	12	377
1892	26	Frank & Co., Bockenheim, Erdnuss-Kakes	..	....	...	...	6.4	2.7	32.2	3.1	36.5	19.1	....	15	447
1910	20	Fritz, Vienna, Braunes Luftbrot "B"	1	29	...	...	....	...	42.6	...	19.8	....	...	27	...
1910	20	" " Mandelbrot	1	45	...	...	....	...	15.4	...	23.1	....	....	23	...
1913		Fromm & Co., Dresden, Almond-form Wafers with Chocolate	54	125	65	236	2.6	1.0	4.8	0.3	62.3	29.0	14.0	8	529
1913		" " Butterbrezeln	18	123	35	129	6.3	2.0	12.3	0.2	62.7	16.5	43.1	8	449
1913		" " Crackers	23	91	25	125	7.4	3.4	12.9	0.2	68.4	7.7	58.2	8	395
1913		" " Eierbiscuit	8	80	35	198	7.7	1.3	18.8	0.2	60.6	11.4	37.5	9	420
1910	20	" " Eiweissbrot	1	13	...	...	....	...	45.5	...	37.5	....	....	14	...
1913		" " Hazelnuss-Stangen	15	104	35	153	5.2	2.9	13.4	1.7	60.8	16.0	0.0	9	441
1913		Fromm & Co., Dresden, Luft Bread	18	263	135	233	8.3	8.9	50.9	0.2	30.7	1.0	23.4	17	335
1913		" " Makronen	24	159	65	185	6.0	3.0	14.1	1.3	56.2	19.4	0.0	9	456
1913		" " Salz-Stangen	36	156	35	102	6.2	3.6	13.0	0.4	61.2	15.6	39.1	9	437
1913		" " Stangenin	42	161	35	99	6.6	1.6	14.0	0.4	64.4	13.0	51.6	8	431
1910	20	" " Uni Bread	1	12	...	...	....	...	71.3	...	8.6	....	....	62	...
1913		" " " "	18	272	135	225	8.1	5.6	71.7	3.5	9.4	1.7	2.9	56	340
1910	20	Gericke, Potsdam, Doppel-Porterzwieback	13	72	...	...	....	...	19.1	...	41.0	....	....	13	...
1910	34	" " " "	..	....	...	...	4.9	1.7	34.2	39.7		19.5	....	13+	471
1910	20	" " Mandelbrot	12	94	...	...	....	...	16.2	...	43.3	....	....	12	...
1910	20	" " Porterbiskuits	10	31	...	...	....	...	16.1	...	63.0	....	....	8	...
1910	20	" " Porterzwieback	13	69	...	...	....	...	26.4	...	72.0	....	....	7	...
1910	20	" " Sifarbiskuits	6	64	...	...	....	...	20.2	...	35.3	....	....	15	...
1910	34	Groetzsch, Frankfurt, Diabetiker-Salzbrezeln	..	....	...	...	14.0	3.3	36.3	17.1		29.3	....	31+	477

TABLE I.—ANALYSES OF DIABETIC FOODS.—*Continued.*

Date of Analysis. (See page 14.)		Manufacturer and Brand.	No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N x6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
		Hard Breads and Bakery Products. *(cont.)*													
1910	34	Groetzsch, Frankfurt, Diabetiker-Salzbrezeln		gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
			..	....	...	...	5.3	1.6	34.5	0.3	22.9	35.4	....	23	548
1910	34	" " Pfeffernüsse								9.3					
1910	34	" " "	..	....	...	...	25.2	2.8	38.7			24.0	....	57+	408
			..	....	...	...	15.2	2.6	39.2	0.7	10.3	32.0	....	51	486
1910	34	Gumpert, Berlin, Diabetiker-Stangen								11.0					
1910	34	" " Doppel-Diabetiker-Zwieback	..	....	...	...	5.5	2.9	31.1			49.5	....	48+	614
1892	24	F. Günther, Frankfurt, Aleuronat-Kakes	..	....	...	...	4.6	2.5	32.5	0.8	27.6	32.1	27.1	19	529
1892	24	" " " "	..	....	...	...	5.1	0.8	14.9	0.4	69.5	9.3	....	8	421
			..	....	...	...	4.5	1.6	17.8	0.9	67.3	7.9	....	8	412
1897	25	" " " "								70.0					
			..	....	...	...	4.5	1.5	15.3			8.7	....	8+	420
1913		Health Food Co., New York, Alpha Best Diabetic Wafer	17	88	50	258	4.9	3.6	66.1	0.5	11.3	13.6	Trace	47	432
1906	8	" " " Diabetic Biscuit	..	....	...	...	4.7	3.1	28.1	0.3	54.8	9.0	*51.1	10	413
1913		" " " " "	22	321	25	35	8.9	2.5	25.0	0.2	54.2	9.2	46.5	10	400
1913		" " " Gluten Nuggets	77	360	35	44	5.7	2.8	30.2	0.2	48.3	12.8	38.6	11	429
1906	8	" " " Glutona	..	...	...	...	4.8	2.5	22.1	0.3	58.5	11.8	*54.9	9	429
1906	8	Health Food Co., New York, Glutosac Butter Wafers	..	....	...	...	4.7	3.8	27.6	1.6	49.4	12.9	*41.2	11	424
1906	8	" " " " Rusks	..	....	...	...	4.5	2.7	36.5	0.9	51.6	3.8	*42.5	10	387
1906	8	" " " " Wafers, Plain	..	....	...	...	6.1	3.5	29.4	1.5	49.9	9.6	*41.6	11	404
1906	8	" " " " Zwieback	..	....	...	...	7.6	2.5	32.5	1.2	49.3	6.9	*40.9	11	389
1906	8	" " " No, 1 Proto Puffs	..	....	...	...	8.6	1.3	75.9	0.1	13.1	1.0	*9.9	40	365
1913		" " " " " "	10	141	35	113	7.2	2.7	76.3	0.2	10.7	2.9	4.3	50	374
1911	14	Health Food Co., New York, No. 2 Proto Puffs	..	161	25	71	8.2	1.8	52.4	0.2	35.9	1.5	27.2	15	367
1913		" " " " " "	8	119	25	95	7.9	2.5	56.6	0.2	30.7	2.1	19.0	17	368
1906	8	" " " Protosac Rusks	..	....	...	...	5.9	2.0	40.9	0.5	48.7	2.0	*43.9	11	376
1913		" " " Protosoy Diabetic Wafers	43	168	40	108	3.9	5.0	43.1	1.9	21.2	24.9	4.7	25	481
1906	8	" " " Salvia Sticks	..	....	...	...	6.6	7.5	39.2	1.9	24.0	20.8	*18.7	22	440
1912	41	Heintz Food Co., Chicago, Gluten Biscuits	..	....	...	...	....	...	13.1	...	....	....	....	?	...
1913		" " " " "	28	278	25	41	6.4	3.5	12.8	1.3	57.7	18.3	21.4	9	447
1913		" " " Glutin Biscuits	26	259	25	44	7.3	3.0	14.5	1.0	67.0	7.2	45.5	8	391
1892–6	31	R. Hundhausen, Hamm, Aleuronatzwieback, high gluten								17.7					
1892–6	31	" " " low gluten	..	....	...	...	8.5	2.6	66.2			5.0	....	30+	381
1894	22	" " Aleuronat-Biskuits	..	....	...	...	6.5	1.6	22.9	0.8	59.6	8.6	....	9	407
1891	22	" " " -Kakes	..	....	...	...	6.6	4.7	24.8	0.5	52.2	11.2	....	10	409
1912	16	Huntley & Palmer, London, Akoll Biscuits	..	....	...	...	3.4	1.1	20.1	1.2	64.8	9.4	....	8	424
1913		" " " " " "	..	113	22	88	9.3	3.9	53.2	0.4	6.3	26.9	Trace	84	480
1906	8	Jireh Diabetic Food Co., New York, Diabetic Biscuits	58	302	70	105	7.2	3.4	54.5	0.7	6.8	27.4	Trace	78	492
1906	8	" " " " " "	..	....	...	...	6.3	2.0	14.8	0.9	72.3	3.7	*65.4	7	382
1906	8	" " " " Rusks	..	....	...	...	8.9	2.3	13.1	1.2	70.6	3.9	....	7	370
1913		" " " " Diatetic Biscuits	..	....	...	...	8.7	3.1	14.6	0.9	67.7	5.0	....	8	374
1913		" " " " Rusks	42	460	30	30	5.4	2.0	13.2	1.2	70.8	7.4	49.6	7	403
1906	8	" " " " Wheat Nuts	17	231	30	59	5.4	1.9	14.9	1.1	68.0	8.7	47.0	8	410
1906	8	" " " " " "	..	....	...	...	7.6	2.3	19.0	1.0	54.5	15.6	*50.1	10	434
			..	....	...	...	6.0	3.2	21.0	1.2	46.3	22.3	....	11	470

*Determined by the diastase method, without previous washing with water, and calculated as starch.

TABLE I.—ANALYSES

Date of Analysis.	(See page 14.)	Manufacturer and Brand.
		Hard Breads and Bakery Products. *(cont.)*
1906	8	Johnson Educator Food Co., Boston, Almond Biscuits
1906	8	" " " " Diabetic Biscuits
1906	8	" " " " Educator Crackers, Greseni Gluten
1913		" " " " " Gluten Bread Sticks
1911	14	" " " " Gluten Cookies
1906	8	" " " " " Rusk, Greseni Gluten
1906	8	" " " " " Wafers
1906	8	" " " " Glutine, Greseni Gluten
1899	35	" " " " " " "
1912	16	The Kellogg Food Co., Battle Creek, Mich., Avena-Gluten Biscuit
1906	8	" " " " Potato Gluten Biscuit
1909	19	" " " " " " "
1913		" " " " " " "
1906	8	" " " " Pure Gluten Biscuit
1909	19	" " " " " " "
1913		The Kellogg Food Co., Battle Creek, Mich., Taro-Gluten Biscuit
1906	8	" " " " 40% Gluten Biscuit
1909	19	" " " " " " "
1911	14	" " " " " " "
1912	16	" " " " " " "
1913		" " " " " " "
1912	16	" " " " 80% Gluten Biscuit
1895	22	Kirche, Düsseldorf, Aleuronat-Kakes
1910	34	Klopfer Chemische Fabrik, Dresden, Glidinebrot
1913		Eugene Loeb, New York, Gluten Luft Bread
1913		Pure Gluten Food Co., New York, Gum Gluten Biscuit Crisps
1893	26	Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Biskuits
1913		" " " " "
1913		" " " " Bretzel
1910	20	" " " " Cakes
1913		" " " " "
1893	22	Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Chokolade-Biskuits
1913		" " " " Dessert-Gebäck
1910	20	" " " " Makronen
1910	34	" " " " "
1913		" " " " "
1910	20	" " " " Stangen
1910	34	" " " " "
1913		" " " " "

OF DIABETIC FOODS.—*Continued.*

No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (Nx6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
	gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
..	....	...	...	5.3	2.1	29.0	0.5	54.3	8.8	*50.0	10	412
..	....	...	...	5.9	1.9	25.3	0.4	59.0	7.5	*54.9	9	405
..	....	...	...	6.2	2.9	23.0	0.2	63.1	4.6	*57.9	8	386
..	....	...	...	8.4	2.4	35.9	0.3	45.8	7.2	37.5	12	392
12	208	30	65	4.8	2.7	26.4	0.3	49.8	16.0	37.8	11	449
23	259	25	44	6.2	3.0	22.1	0.3	68.1	0.3	*63.3	8	364
..	....	...	...	6.9	0.9	30.3	0.3	61.2	0.4	*57.0	9	370
..	....	...	...	6.4	2.6	21.9	0.6	67.7	0.8	*63.1	8	366
..	....	...	...	10.2	1.1	13.8	74.0		0.9	....	7+	359
..	349	25	33	7.9	2.1	21.4	0.4	55.5	12.7	41.1	10	422
..	....	...	...	8.2	0.8	80.0	0.0	10.6	0.4	*9.8	50	366
..	....	...	...	7.6	0.9	75.6	13.3		2.6	....	40+	379
92	207	30	66	8.8	0.8	41.5	0.4	48.0	0.5	39.5	11	363
..	....	...	...	7.5	1.0	80.3	0.2	10.2	0.8	*9.1	52	369
..	....	...	...	8.2	1.1	48.3	39.1		3.3	....	14+	379
29	106	30	128	9.4	0.7	31.3	0.4	57.7	0.5	48.2	9	361
..	....	...	...	7.5	1.6	35.8	0.1	54.0	1.0	*52.6	10	368
..	....	...	...	7.5	1.4	36.4	51.9		2.8	....	10+	378
..	244	40	74	8.0	1.6	43.3	0.2	45.7	1.2	35.3	12	367
37	89	25	129	10.2	0.5	47.5	0.2	41.1	0.5	35.0	13	359
24	219	50	104	7.2	1.3	37.2	0.3	53.2	0.8	45.0	10	369
70	190	30	72	10.1	2.1	82.4	0.1	4.4	0.9	4.7	118	355
..	....	...	...	5.0	0.9	17.0	1.6	61.8	13.7	....	9	439
..	....	...	...	12.7	2.3	47.6	0.3	34.9	2.2	32.8	15	350
3	135	25	84	7.3	1.0	27.9	0.4	54.2	9.2	44.1	10	411
16	106	25	107	5.3	1.7	42.9	0.9	48.5	0.7	39.3	11	372
..	....	...	...	2.9	3.5	44.1	...	19.7	29.8	10.0	27	523
13	105	35	151	5.0	1.1	29.6	0.2	44.5	19.6	25.9	12	473
16	78	25	145	6.8	3.0	31.4	0.2	50.1	8.5	40.7	11	402
10	64	...	...	....	...	12.6	...	39.8	....	....	13	...
19	96	35	165	6.5	3.0	29.6	0.2	47.2	13.5	39.1	11	429
..	....	...	...	1.8	3.8	44.9	...	21.9	27.6	11.8	24	516
17	117	65	252	4.3	2.5	22.2	1.1	27.5	42.4	5.9	19	580
10	52	...	...	....	...	12.3	...	11.3	....	....	47	...
..	....	...	...	4.5	3.2	22.3	1.1	20.9	48.0	8.8	25	605
14	62	45	329	4.0	3.0	23.2	1.2	20.6	48.0	3.0	26	607
10	112	...	...	....	...	22.7	...	17.0	....	....	31	...
..	....	...	...	10.5	2.1	29.8	24.6		33.0	....	22+	515
13	123	42	155	4.5	3.6	17.7	0.5	29.5	44.2	21.4	18	586

* Determined by the diastase method, without previous washing with water, and calculated as starch.

TABLE I.—ANALYSES OF DIABETIC FOODS.—*Continued.*

Date of Analysis. (See page 14.)		Manufacturer and Brand.	No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N×6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
		Hard Breads and Bakery Products. *(cont.)*		gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
1910	20	Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Zwieback	14	110	...	...	....	...	16.4	...	37.6	....	....	14	...
1910	34	" " " " "	..	....	...	...	9.4	2.2	25.2	51.3		11.9	47.0	10+	413
1893	22	" " " Erdnuss-Biskuits	..	....	...	...	1.9	2.7	34.8	...	39.1	21.5	9.0	14	489
1910	34	" " " Käsestangen	..	....	...	...	6.9	2.2	11.2	50.5		29.3	....	10+	511
1913		" " " "	8	49	35	324	6.7	3.8	9.3	0.1	46.4	33.7	38.0	11	524
1910	20	Rademann's Nährmittelfabrik, Frankfurt, Sanitätszwieback	10	96	...	...	....	...	17.5	...	58.4	....	....	9	...
1897	25	Schelle, Braunschweig, Aleuronat-Kakes	.	....	...	...	4.9	1.3	19.9	63.1		10.8	....	8+	429
1910	20	Seidl, München, Kleberzwieback	11	108	...	...	6.3	...	14.8	...	66.6	7.8	....	8	396
1913		Roman Uhl, Karlsbad, Carlsbad-Water Biscuits, "Sprudel" Brand	8	170	30	80	8.1	1.7	10.0	0.2	74.8	5.2	55.6	7	386
1913		G. Van Abbott & Sons, London, Caraway Biscuits for Diabetics	36	330	72	100	6.7	3.6	35.6	0.7	15.9	37.5	8.6	33	544
1913		" " " Diabetic Rusks for Diabetics	14 slices	60	48	363	10.8	1.2	70.9	0.3	16.0	0.8	12.6	33	355
1913		" " " Euthenia Biscuits	13	256	84	149	5.5	3.4	35.8	1.4	13.2	40.7	6.9	40	562
1913		" " " Gluten Biscottes or Rolls	12	251	72	130	10.5	2.4	51.6	0.2	33.0	2.3	29.8	16	359
1913		" " " Gluten Bread or Slices	12 slices	216	72	151	10.6	2.0	54.1	0.2	30.9	2.2	27.4	17	361
1913		G. Van Abbott & Sons, London, Gluten Butter Biscuits for Diabetics	mostly broken	195	60	140	6.1	3.0	44.1	0.9	12.7	33.2	9.0	40	526
1913		" " " Ginger Biscuits for Diabetics	31	423	72	77	4.1	3.4	34.6	1.8	16.7	39.4	10.9	32	560
1913		" " " Midolia Biscuits	52	517	36	32	6.0	4.3	17.6	4.1	31.6	36.4	13.4	16	524
1913		" " " Walnut Biscuits for Diabetics	29	223	60	122	4.4	2.9	20.9	2.3	12.3	57.2	Trace	41	648
		Breakfast Foods.													
1913		Brusson Jeune, Villemur, France, Farine au Gluten	..	246	25	46	10.9	9.6	33.9	0.2	53.8	0.6	48.8	10	356
1910	13	" " " " Gluten Semolina	..	209	30	65	9.7	0.7	17.2	0.3	71.6	0.5	64.9	7	360
1913		Farwell & Rhines, Watertown, N. Y., Barley Crystals	..	904	25	13	9.9	1.2	11.5	0.9	75.2	1.3	62.7	7	359
1913		" " " " Cresco Grits	..	898	25	13	11.1	0.6	17.8	0.5	68.6	1.4	54.1	8	358
1908	37	Hazard's Wheat Protein Breakfast Food	..	....	...	...	8.5	0.7	40.1	49.7		1.0	....	13+	368
1913		Health Food Co., New York, Manana	..	188	25	60	10.2	2.4	37.6	1.1	46.8	1.9	31.0	11	355
1913		Jireh Diabetic Food Co., New York, Whole Wheat Farina	..	703	15	10	6.2	1.8	12.9	2.2	74.6	2.3	59.5	7	371
1913		" " " " Frumenty	..	674	15	10	6.2	1.4	12.3	1.1	77.3	1.7	65.4	7	374
1911	14	The Kellogg Food Co., Battle Creek, Mich., Granola	..	370	10	12	6.1	2.3	13.9	0.6	76.3	0.8	45.2	7	368
1904	39	Pure Gluten Food Co., New York, Gum Gluten Breakfast Food	..	....	...	...	9.5	0.9	54.4	0.5	33.9	0.8	30.4	16	360
1906	8	" " " " " " " " " "	..	....	...	...	9.1	1.1	53.4	0.3	34.5	1.6	*31.0	15	366
1911	14	" " " " " " " " " "	..	465	20	20	7.5	1.2	37.8	0.4	51.8	1.3	37.9	10	370
1911	14	" " " " " " Granules	..	457	20	20	7.5	1.5	45.5	0.3	43.6	1.6	32.3	12	371
1901	36	" " " " Pure Gluten Breakfast Cereal	..	....	...	...	9.3	0.7	43.7	0.3	44.4	1.6	....	12	367

* Determined by the diastase method, without previous washing with water, and calculated as starch.

TABLE I.—ANALYSES OF DIABETIC FOODS.—*Continued.*

Date of Analysis. (See page 14.)		Manufacturer and Brand.	No. of Pieces	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N x 6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 grms. wheat bread.	Calculated Calories per 100 grms.
		Macaroni, Noodles, etc.		gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
1910	13	Brusson Jeune, Villemur, France, Pâtes aux Oeufs Macaroni	..	220	45	93	8.8	0.7	13.9	Tr.	76.2	0.4	69.2	7	364
1910	13	" " " " " " " Nouillettes	..	231	30	59	8.7	0.7	14.4	Tr.	75.7	0.5	68.9	7	365
1913		" " " " Petites Pâtes au Gluten	..	259	25	44	9.0	0.8	18.6	0.2	70.4	1.0	61.2	8	365
1910	13	" " " " Vermicelle au Gluten	..	449	45	45	8.0	0.8	18.4	Tr.	72.4	0.4	65.8	7	367
1913		Jireh Diabetic Food Co., New York, Macaroni	..	437	25	26	8.8	1.1	16.9	0.9	71.4	0.9	58.8	7	361
1913		Eugene Loeb, New York, Home Made Noodles	..	130	20	70	9.8	1.0	41.8	0.2	41.7	5.5	36.7	13	384
1906	9	Pure Gluten Food Co., New York, Gum Gluten Macaroni	..	....	...	...	10.3	0.7	41.4	0.3	46.3	1.0	*46.2	11	360
1911	14	" " " " " " Noodles	..	118	15	58	8.3	1.1	36.6	0.2	51.4	2.4	42.0	10	374
1901	5	The Marvelli Co., Detroit, Mich., Macaroni	..	....	...	...	13.4	0.5	20.7	64.8		0.6	....	8+	347
1912	18	" " " " " Spaghetti	..	....	...	...	....	...	15.5	...	....	...	....	....	...
		Peanut Butter.													
1899	4	Atlantic Peanut Refinery, Philadelphia	..	....	25	50	2.1	4.0	28.7	2.3	16.5	46.4	6.2	32	598
1913		J. W. Beardsley's Sons, New York, Acme Red Brand	..	416	25	27	2.2	4.4	28.2	1.7	15.2	48.3	4.0	35	608
1913		Beech-Nut Packing Co., Canajoharie, N. Y.	..	109	10	42	2.0	3.5	29.4	1.9	16.6	46.6	4.5	32	613
1913		A. C. Blenner & Co., New Haven (Distributed by)	..	126	10	36	2.9	4.0	29.7	1.2	14.3	47.9	4.6	37	607
1913		D. W. Brooke, Newark, N. J.	..	171	10	27	1.8	3.8	29.5	1.5	14.9	48.5	4.3	36	614
1913		Dillon & Douglass, New Haven (Distributed by), Perfection	..	666	23	16	1.8	4.4	29.1	1.8	20.1	42.8	4.8	26	582
1913		H. J. Heinz Co., Pittsburgh, Pa.	..	90	10	50	3.0	3.9	28.9	1.7	15.2	47.3	4.0	35	592
1913		The Kellogg Food Co., Battle Creek, Mich.	..	92	15	74	3.6	3.3	30.6	1.5	12.2	48.8	3.2	43	610
1913		" " " " "	..	311	30	44	3.1	3.0	28.1	1.4	14.7	49.7	3.4	36	619
1913		Francis H. Leggett & Co., New York, Premier	..	469	23	22	2.1	4.0	29.7	1.7	18.8	43.7	6.5	28	587
1913		MacLaren Imperial Cheese Co., Detroit, Mich., Eagle	..	199	10	23	1.5	3.8	32.1	1.7	16.0	44.9	4.3	33	597
1913		Nut Products Co., New Haven, Penolia	..	218	13	27	2.4	3.9	27.9	1.5	13.0	51.3	3.9	41	625
1899	4	Peanolia Food Co., New Haven, Peanolia	..	....	25	50	2.0	6.0	29.9	2.1	13.3	46.7	5.6	40	593
1913		S. S. Pierce Co., Boston, Acharis Brand	..	231	25	49	1.7	3.7	28.7	3.0	14.6	48.3	5.1	19	608
		Average	..	....	...	...	*2.3*	*4.0*	*29.3*	*1.8*	*15.4*	*47.2*	*4.6*	*34*	*604*
		Almond Paste.													
1902–3	3	Chapman, Chicago	..	....	...	...	23.7	1.4	13.1	36.3		25.5	11.3	15+	427
1902–3	3	Henry Heide, New York	..	....	...	...	22.0	1.6	12.7	43.7		20.0	small	12+	406
1902–3	3	Spencer, New York	..	....	...	...	27.0	1.7	13.5	31.6		26.2	very small	17+	416
		Average	..	....	...	...	*24.2*	*1.6*	*13.1*	*37.2*		*23.9*	....	*15+*	*416*
		Nuts.													
1913		California Paper Shell Almonds, edible portion (Sold by Chas. Lawrence Co., Boston)	..	177	13	35	3.5	3.5	18.4	3.0	16.3	55.3	0	33	637
1913		Jireh Diabetic Food Co., New York, Diatetic Pine Nuts (Pignolias)	..	242	40	75	2.0	4.6	39.7	0.9	3.4	49.4	0	156	617
1913		The Kellogg Food Co., Battle Creek, Mich., Pine Nuts	..	451	75	75	2.6	4.5	38.0	1.1	4.2	49.6	....	126	615
		Malted Nuts.													
1901	36	The Kellogg Food Co., Battle Creek, Mich., Malted Nuts	..	....	...	...	2.6	2.2	23.7	43.9		27.6	....	12+	519
1913		Nashville Sanitarium-Food Co., Nashville, Tenn., Malted Nut Food	..	....	...	25	3.4	1.7	24.7	27.5		42.7	3.4	19	593

*Determined by the diastase method, without previous washing with water, and calculated as starch.

TABLE I.—ANALYSES OF DIABETIC FOODS.—*Concluded.*

Date of Analysis. (See page 14.)		Manufacturer and Brand.	No. of Pieces.	Net weight of package.	Cost per package.	Cost per pound.	Water.	Ash.	Protein (N×6.25). (See page 15.)	Fiber.	Nitrogen-free Extract. (See page 15.)	Fat (Ether Extract).	Starch.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms
				gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
		Other Nut Preparations.													
1906	8	The Kellogg Food Co., Battle Creek, Mich., Almond Butter (Sanitas)	..	....	...	...	0.9	2.9	22.6	3.9	8.2	61.5	*3.7	65	677
1908	37	" " " " " " "	..	....	...	...	2.3	3.0	21.7	11.5		61.5	...	46+	686
1913		" " " " Nut Bromose (Meltose and Nuts)	..	221	30	61	14.0	1.5	17.1	1.2	39.4	26.8	3.2	13	467
1906	8	" " " " Nut Butter (Sanitas)	..	....	...	...	0.2	2.9	28.8	3.7	13.9	50.5	*9.1	38	625
1906	8	" " " " Nut Meal "	..	....	...	...	3.0	2.2	29.0	2.0	12.1	51.7	*8.9	44	630
1906	8	" " " " Nuttolene "	..	....	...	...	55.2	2.2	12.7	1.8	6.3	21.8	....	84	272
1906	8	" " " " Protose "	..	....	...	...	62.2	1.5	22.6	0.9	3.6	9.2	....	147	188
1913		Nashville Sanitarium-Food Co., Nashville, Tenn., Nut Butter	..	473	17	16	1.9	2.9	28.0	1.6	13.0	52.6	3.8	41	637
1913		" " " Nutcysa	..	411	15	17	57.0	1.8	12.9	1.0	6.3	21.0	Trace	84	266
1913		" " " Nutfoda	..	440	15	15	62.3	1.6	20.8	0.5	6.8	8.0	Trace	78	182
		Chocolate.													
1913		Brusson Jeune, Villemur, France, Chocolat with Added Gluten à la Vanille	..	250	90	163	2.6	3.2	15.9	2.2	26.4	49.7	9.2	20	617
1913		Fromm & Co., Dresden, Conglutin-Diabetiker-Schokolade	..	96	40	189	4.0	5.4	17.6	1.2	32.7	39.1	4.3	16	553
1910	34	Groetzsch, Frankfurt, Essschokolade (Orange)	..	....	..	...	4.6	2.3	10.8	4.4	17.2	60.7	12.0	31	658
1910	34	" " Kochschokolade	..	....	...	...	10.9	6.7	25.3	5.9	26.1	25.1	15.9	20	432
1901	40	Plasmon Co., London, Plasmon Chocolate	..	....	...	...	....	...	21.1	...	....	....	....	?	...
1903	6	" " " "	..	....	...	...	3.5	2.5	20.2	0.7	48.0	25.1	Trace	11	499
1910	20	Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Chokolade	..	....	...	...	....	...	16.1	...	9.6	....	....	55	...
1913		" " " " "	..	99	45	206	2.5	3.2	17.5	2.3	16.9	57.6	3.8	31	656
1898	32	Troponwerke, Mülheim, Tropon-Chokolade	..	....	...	...	1.7	1.6	18.2	2.7	49.9	25.9	....	11	506
1899	33	" " " "	..	....	...	...	1.8	...	18.4	...	....	....	....	?	...
		Cocoa.													
1913		Charrasse Gluto-Cacao	..	....	...	...	6.4	6.7	21.5	3.1	40.1	22.2	16.3	13	446
1906	8	Jireh Diabetic Food Co., New York, Diabetic Cocoa	..	....	...	...	3.1	4.3	20.6	3.6	50.6	17.8	*32.6	10	445
1906	8	" " " " " "	..	....	...	...	7.3	3.9	19.1	3.4	47.9	18.4	*29.0	11	434
1903	6	Plasmon Co., London, Plasmon Cocoa	..	....	...	...	8.9	6.6	52.8	20.9		10.8	5.1	25+	392
1913		Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Cacao	..	258	80	141	5.2	5.9	17.6	3.0	44.7	23.6	10.7	12	462
1913		Callard, Stewart & Watt, London, Casoid Chocolate Almonds	..	107	50	212	3.5	3.1	22.3	3.2	16.1	51.8	Trace	33	620
		Miscellaneous Products.													
1913		Gustav Muller & Co., New York, Dr. Bouma Sugar-Free Fat-Milk	(14.5 oz.)		30	...	91.8	0.5	2.4	...	....	5.3	....	....	57
1900	42	Rose's Diabetesmilch, 5%	..	....	...	...	92.5	0.2	1.1	...	1.2	5.0	....	442	54
1900	42	" " 10%	..	....	...	...	86.3	0.2	2.3	...	1.2	10.0	....	442	104
1913		D. Whiting & Sons, Boston, Sugar-Free Milk (ave. 3 analyses)	(8 oz.)		25	...	86.4	0.7	5.7	...	Tr.	7.2	....	....	88
1913		Health Food Co., New York, Kaffeebrod	..	351	15	19	4.5	2.2	12.9	6.4	72.5	1.5	10.1	7	355
1911	15	The Kellogg Food Co., Battle Creek, Mich., Sanitas Meltose	..	....	...	...	26.8	0.5	0.6	72.1		....	....	7	291

*Determined by the diastase method, without previous washing with water, and calculated as starch.

The government standard for gluten flour requires not less than 5.6 per cent. of nitrogen, or, using the conventional factor 6.25, 35 per cent. protein. In judging these preparations we must first consider whether they meet this standard and are thus legally entitled to be sold as gluten flours. Mere legality, however, is no special recommendation for any flour as a food for diabetics. The great majority of the gluten flours examined are totally unfit for such a purpose, and the rather absurd government standard has tended to increase the distrust with which these flours are viewed by careful dietitians. The government has gone even further, allowing substandard gluten flours to be sold if the variation from standard is declared on the label (as explained on page 7). It is evident from the analyses here given that all manufacturers should be obliged to guarantee their products both for protein and carbohydrates; a mere protein guaranty is of little value to the diabetic, as he buys these flours not because they are rich in protein, but because he supposes they are low in carbohydrates.

Sixty-eight samples were sold as gluten flours; these ranged in protein content from 9 to 87 per cent. Thirteen contained over 75 per cent, 10 from 45 to 75, 24 from 35 to 45, 9 from 25 to 35, 8 from 15 to 25, and 4 under 15 per cent. In other words 21, or nearly one-third of the samples, did not even satisfy the government's low standard. It is only fair, however, to state with reference to these samples that eight of them guaranteed only 20 per cent., and these were, therefore, misbranded in but two cases, where only 16 and 17 per cent. were found. Furthermore all but three of the remaining thirteen deficient samples were analyzed prior to the passage of the Federal Pure Food and Drug Act, and before the legal standard for gluten flour was established. These deficient samples are *Farwell and Rhines' Gluten Flour* (1909), *Jireh Protein Flour* (1913) and *Loeb's Gluten Cracker Meal* (1913). A sample of *Farwell and Rhines' Gluten Flour* analyzed this year contained 43 per cent. protein, so that this brand now complies with the legal standard's minimum.

The following tabulation shows the protein and carbohydrate content of the preparations sold specifically as "gluten" flour, arranged in the order of their percentage of carbohydrates, the figures enclosed in parentheses indicating the year of analysis, where variable analyses were shown.

GLUTEN FLOUR.

Gluten Flours	Protein	Carbohydrates
Barker's Gluten Food "A" ('06)	85	4
Barker's Gluten Food "A" ('12)	87	5
Bischof's Gluten Flour	80	5
Barker's Gluten Food "B" ('06)	84	5
Barker's Gluten Food "B" ('13)	85	7
Barker's Gluten Food "C" ('06)	83	7
Kellogg's 80% Gluten ('12)	81	8
Barker's Gluten Food "C" ('13)	84	9
Metcalf's Vegetable Gluten ('13)	80	10
Health Food Pure Washed Gluten ('13)	80	11
Loeb's Imported Gluten Flour	76	12
Van Abbott's Gluten Flour	75	13
Kellogg's 80% Gluten ('09)	79	13
Metcalf's Vegetable Gluten ('06)	61	28
Health Food Pure Washed Gluten ('06)	62	30
Van Abbott's Gluten Semola	51	32
Pure Gl. Food Co. Plain Gluten Flour	54	35
Pure Gl. Food Co. Gum Gluten Ground ('06)	50	40
Richelieu Gluten Flour	50	40
Gilman's Gluten Flour	47	40
Kellogg's 40% Gluten Fl. ('12)	47	41
Pure Gl. Food Co. Gum Gluten Ground ('04)	44	43
Loeb and Co.'s Gluten Flour	44	44
Farwell and Rhines' Glut Fl. ('13)	45	45
Pure Gl. Food Co. Gum Gluten Self-Rais. ('06)	38	45
Kellogg's 40% Gluten Fl. ('13)	44	46
Loeb's Pure Gluten Flour	40	46
Protosac Gluten Flour ('13)	43	46
Pieser-Livingston Gluten Flour	43	47
Pronireu	37	47
Kellogg's 40% Gluten Fl. ('06)	40	47
Glutosac Gluten Flour ('13)	40	48
Martindale's Gluten Flour	40	49
Kellogg's 40% Gluten Fl. ('09)	39	50
" " " " ('06)	38	50
" " Self-Raising	39	50
Educator Gluten Flour ('11)	40	50
Pure Gl. Food Co. Gum Gluten Fl.	38	51
Protosac Gluten Flour ('06)	37	51
Glutosac Gluten Flour ('06)	34	52
Pure Gl. Food Co. Gum Gluten, Self-Raising ('01)	32	53
Loeb's Gluten Cracker Meal	28	54
Hoyt's Gum Gluten ('06)	32	54
Glutosac Gluten Flour ('09)	35	55
Jireh Protein Flour	31	57
Pure Gl. Food Co. Gum Gluten Ground ('02)	27	59
Educator Gluten Flour ('06)	26	59
Kellogg's 20% Gluten Meal ('12)	28	61
Wilson's Gluten Fl., Self-Raising	17	64
Wilson's Gluten Flour	21	65
Kellogg's 20% Gluten Meal ('09)	21	68
Ralston Gluten Flour ('95)	15	69
" " " ('02)	16	71
Kellogg's 20% Gluten Meal ('04)	16	72
Farwell and Rhines' Gluten Flour ('06)	11	74
Farwell and Rhines' Gluten Flour ('09)	12	76

The above table shows at a glance the unsatisfactory condition of the gluten flour market. The purchaser of even a "standard" gluten flour may expect anywhere from 35 to 87 per cent. of protein. The range in carbohydrates is naturally equally wide, from 4 to 55 per cent., while several of the substandard samples contained nearly as much as ordinary wheat flour (75 per cent.).

That it is possible to prepare a gluten flour with a greatly decreased carbohydrate content is apparent from the first thirteen samples in the above tabulation, which contain from 4 to 13 per cent. The six analyses of the three *Barker* brands, covering a period of seven years, show how great uniformity in composition may be secured by exercising due care in manufacture. On the other hand *Kellogg's 20% Gluten Meal* and *Pure Gluten Food Co.'s Gum Gluten Ground* show a continuing improvement in respect to carbohydrates, although both still contain too much for strict diabetic feeding. It is conceivable that a gluten flour containing as much as 40 per cent. of carbohydrates might find some use in the diabetic's dietary in connection with other foods containing little or no starch or sugars. It is, however, open to serious question whether the slight advantage gained is worth the much higher price asked for flours of this kind. Fully half of the flours tabulated above, even though many of them are of "standard" composition, can be used by the diabetic only with uncertainty, if not with grave danger.

Certain other preparations included in Table I, but not sold as gluten flours, are *Aleuronat, Roborat, Amthor's Weizen-Protein,* consisting largely of vegetable protein, and *Casoid Flour,* a ground casein preparation. These contain from 78 to 86 per cent. protein with very small amounts of carbohydrates. Their carbohydrate content was as follows:—

	%
*Casoid Flour ('06)	1.4
Roborat	2.9
*Casoid Flour ('09)	3.1
Gericke's Aleuronat	3.1
Hundhausen's Aleuronat (pure)	4.0
Amthor's Weizen-Protein	4.8
Hundhausen's Aleuronat (less pure)	10.6

* See page 15.

Gumpert's Ultramehl, while not specially high in protein (36.5), contained only 9.4 per cent. carbohydrates, with 45 per cent. of fat. It is said to be a mixture of *Roborat* and almond meal.

Hazard's Wheat Protein had essentially the composition of a "standard" gluten flour, with 39 per cent. carbohydrates.

The seven soy bean flours showed considerable uniformity, containing from 37 to 46 per cent. protein, 23 to 26 carbohydrates and 18 to 21 fat. While soy bean flour contains a by no means negligible amount of carbohydrates, it differs from the cereal flours in containing practically no starch and from 4 to 10 per cent. sucrose, the remaining carbohydrate probably being of a pentosan nature and thus unobjectionable for diabetics. Of the seven samples *Cereo Soy Gruel Flour* showed somewhat more protein and fat and slightly less carbohydrates than the others.

The two samples of *Health Food Almond Meal* showed very uniform composition, containing about 50 per cent. protein, 15 fat and 17 carbohydrates. The low carbohydrate content renders such a meal as this particularly useful as an addition to a true gluten meal to increase the palatability of the resultant product. *Van Abbott's Almond Flour* contained 25 per cent. protein, 59 per cent. fat, and 8 per cent. carbohydrates, with no starch. It differed from the almond meals in that none of the fat had been removed.

There remain to be considered in this group certain preparations not sold as gluten flours, but either by their brand name or by the claims of their manufacturers specially recommended for the use of diabetics. In the absence of any standard, in judging these the percentage of carbohydrates is the main consideration.

Acme Diabetic Flour contained 77 per cent. carbohydrates. After prosecution by the U. S. government the firm changed the name to *Acme Special Flour,* which we find to contain 71 per cent. On the package we found "We do not guarantee it to be free from starch. It contains a large percentage of carbohydrates. This flour has been used for the last fifteen years by diabetic patients." While the name has been changed for the sake of legal conformity, it is seen that it still claims indirectly special merits as a diabetic food, although it possesses practically no advantages over ordinary wheat flour.

Farwell and Rhines' Cresco Flour when analyzed by this station in 1906 contained 75 per cent. carbohydrates and it was then sold as a diabetic food. Our recent analysis showed 67 per cent. carbohydrates with 18 per cent. protein; a second sample showed 20 per cent. protein. It now claims to be $\frac{4}{7}$ standard, or to contain 20 per cent. protein. The following rather guarded claim now appears in the company's literature: "Many people with Diabetes Insipidus (or Glycosuria) claim to find it of great service and all they require. But this flour should not be considered a substitute for our genuine "Gluten Flour" in marked cases of Diabetes." Any physician of course understands the difference between *Diabetes insipidus* and *Diabetes mellitus,* the characteristic of the former being a greatly increased volume of urine *without glycosuria.* To represent *Diabetes insipidus* and *Glycosuria* as synonyms is false and ridiculous.

Farwell and Rhines' Special Diabetic Food, analyzed by this station in 1906, contained from 67 to 70 per cent. carbohydrates, making it totally unfit for diabetics. This product is now sold under the name of *Special Dietetic Food* and is recommended as a "flour for Dyspeptics and cases of Kidney and Liver Troubles, requiring rather strict diet at medium price." This claim appears to be an evasion of the spirit of the food law which requires honest branding. The preparation is an improvement over the old article, as the protein has been increased to about 27 per cent., while the carbohydrates are reduced to 57 per cent.; the latter percentage, however, does not recommend it as a food for diabetics.

Goldscheider's Conalbin-Mehl No. 1 is a preparation analyzed by Fetterolf in 1909, according to whom it was represented as "a special flour, free from starch, and designed for diabetics." It contained about 11 per cent. protein and nearly 79 per cent. carbohydrates, the latter figure being somewhat higher than usually found in ordinary wheat flour. The claims for this product were absolutely dishonest.

Health Food CBX Cold Blast Flour, although claiming 25 per cent. protein, was found by us in 1911 to contain only 10 per cent. The company's literature at present, however, makes no specific claims for this product other than that it is "an unsurpassed cream white flour."

Jireh Diabetic Flour was analyzed by this station in 1906, when it showed from 72 to 73 per cent. carbohydrates. Our present analysis of *Jireh Flour* shows the same result. The manufacturer of these flours, while admitting the presence of starch, claims that

> "the Jireh Flour is an entire whole-wheat-stone-ground-starch-treated-flour, containing all of the starch and cereal salts which nature put into the wheat berry. None of it is extracted in the milling process and none of it is extracted or removed in the special diathermous fermentation to which it is subjected to produce certain changes in the starch-granules. The changes which we produce is brought about by the addition of certain enzymes to the flour, which after thorough trituration is subjected to a certain degree of heat for a specified period of time. This heat causes the moisture on the inside of the minute starch atoms to become steamed, which after a certain point explodes the capsule or envelope of the starch atom."

This somewhat elaborate statement of the Jireh process of "starch-treated" foods, however, is not true, for a microscopic examination of the flour shows a large proportion of the wheat starch grains intact and "unexploded." Apparently the "diathermous fermentation" and the "addition of certain enzymes" have failed to rupture the starch grains. The statement of the company in one of its pamphlets that "ordinary unconverted starch acts as a poison to the diabetic system and is excreted by the kidneys as glucose" has, therefore, special significance, and the preparation is thus condemned as a diabetic food by its own manufacturer. Both the literature and the labels of this company introduce to us a new word "diatetic" whose similarity to "diabetic" is at least suggestive. "Dietetic" is a familiar word, but the variant seems to be the invention of the Jireh company. The requirements of the Federal food law as to honest branding possibly explain the genesis of the word "diatetic." The company continually juggles with the two words, and on several of their packages we find on one side "Jireh *Diatetic* Patent Cotton Seed Flour," "Jireh *Diatetic* Soja Bean Flour," "Jireh *Diatetic* Pine Nuts," etc., while on the other side under the caption "List of Jireh *Diabetic* Foods" is given a list of practically *all* of the company's preparations.

Jireh Patent Barley and *Jireh Wheat and Barley Flour* contained 80 and 74 per cent. carbohydrates, respectively, and are as unfit for the use of the diabetic as the *Jireh Flour. Jireh*

Patent Lentils Flour contained 27 per cent. protein, but nearly 60 per cent. carbohydrates. It is therefore less valuable than even ordinary "standard" gluten flour. *Jireh Patent Cotton Seed Flour,* with its high protein (49) and fat (13) and relatively low carbohydrates (21), is not without merit, as less than one-third of the latter is starch. The company's claim that it "contains five times more proteid and one-third less carbohydrates than wheat flour" is reasonably accurate.

Eugene Loeb's Whole Wheat Flour is apparently true to name, but is not entitled to its distributor's classification as one of "our other diabetic foods."

Bond's Diabetic Flour has about the same composition as ordinary gluten flour (40 per cent. protein and 48 per cent. carbohydrates). In its literature we read

"It is superior to any of the foods prepared specially for Diabetic Patients. It justifies the claims made for it, and is up to the standard of excellence demanded by physician specialists in Diabetic Cases. It is exceedingly rich in Gluten and Albumenoids and contains only a small percentage of Saccharine matter. . . . A marked diminution of sugar invariably occurs after a short period of its use. It is the only safe food for Diabetics. . . . It is the Ideal Food for Persons Afflicted with Chronic Diabetes."

Most of the above statements are dangerously false. The claim that "only a small percentage of Saccharine matter" is present is true, but totally misleading, as the flour contains over 40 per cent. of starch, which while not itself "saccharine matter," is a producer of sugar in the human body.

Rademann's Diabetiker Mehl claims 33 per cent. of protein, and it contained nearly 38 per cent. It is a typical "standard" gluten flour with about 51 per cent. of carbohydrates and 47 per cent. of starch, and is entitled to no special claims as a diabetic food.

The Cost of Diabetic Flours and Meals.

As already explained, we do not possess full data regarding the cost of these preparations. We have obtained this information, however, for twenty-seven brands of gluten flour, which cost from 9 cents to $1.56 per pound, certainly a very wide range. The first thirteen gluten flours listed in the table on page 41, containing from 76 to 87 per cent. protein and from 4 to 13 per cent. carbohydrates, cost from 26 cents to $1.56 per pound. It is realized by the writers that the very nearly complete removal of the starch from a flour is an expensive operation; yet it is a serious question whether for practical purposes a patient is justified in paying from $1.18 to $1.56 per pound for flours containing from 5 to 7 per cent. carbohydrates, when other flours containing only a little more, from 8 to 12 per cent., may be obtained for from 26 to 64 cents per pound. The remaining gluten flours, containing from 28 to 76 per cent. carbohydrates, cost from 9 to 71 cents per pound.

The soy bean flours, containing from 23 to 26 per cent. carbohydrates, cost from 30 to 65 cents per pound. The slight differences in composition of these samples scarcely warrant this wide range in cost.

Certain other flour preparations, containing from 60 to 80 per cent. carbohydrates, cost from 9 to 26 cents per pound. Most of these brands offer no advantage to the diabetic, and do not warrant his paying these greatly increased prices for products little, if any, better for his needs than ordinary wheat flour.

Flours and Meals—Summary.

One hundred and nine samples of sixty-eight brands are reported. Sixty-seven of these were sold as gluten flours, twenty-one of which did not even satisfy the low government standard of 35 per cent. protein. Thirteen samples contained less than 13 per cent. carbohydrates, while the remaining gluten flours ranged from 28 to 76 per cent.

Aleuronat, Roborat, Amthor's Weizen-Protein and Casoid Flour contained from 76 to 86 per cent. protein with very small percentages of carbohydrates.

The soy bean flours contained from 23 to 26 per cent. carbohydrates; the almond meals contained 17 per cent., the almond flour 8 per cent. and the cotton seed flour 21 per cent.

Other diabetic flours, not specifically sold as gluten flours, contained from 67 to 80 per cent. carbohydrates.

Gluten flours containing less than 13 per cent. carbohydrates cost from 26 cents to $1.56 per pound. Other gluten flours, containing from 28 to 76 per cent. carbohydrates, cost from 9 to 71 cents per pound. Soy bean flours of practically the

same composition cost from 30 to 65 cents per pound. The miscellaneous diabetic flours, with from 60 to 80 per cent. carbohydrates, cost from 9 to 26 cents per pound.

The purchaser of so-called gluten flours at the present time may obtain preparations containing from 87 to 11 per cent. protein and from 4 to 76 per cent. carbohydrates, at a cost of from 9 cents to $1.56 per pound.

In view of the government's low standard for gluten flour, and because of the wide variations in composition found in the brands at present on the market, *proper protection of the diabetic demands that the manufacturer of these flours should be required to state on the label the guaranteed percentages of both protein and carbohydrates.*

PROTEIN PREPARATIONS.

The analyses of ten samples of six brands of protein preparations are given, none of which except *Glidine* is specially recommended for diabetics, but which are included in this investigation because of their adaptability to the dietary of the diabetic. They contain from 70 to 91 per cent. protein with trifling amounts of carbohydrates. From their nature they are unsuitable for use as flours, but are valuable as adjuncts to the diabetic's diet. *Sanatogen* and *Plasmon* are casein preparations, *Energin* is prepared from rice, *Glidine* from wheat, and *Soson* and *Tropon* are mixtures of vegetable and animal proteins, the latter being prepared from the residues obtained in the manufacture of meat extract.

Students of diabetes recognize the fact that proteins yield sugar in metabolism and that some of them contain a carbohydrate group. Furthermore the amino acids, which are a very important constituent of the protein molecule, also have an influence upon sugar formation.

C. von Noorden* says in this connection:—

"One of our difficulties is the extraordinary differences manifested by diabetics to vegetable and animal albumins. If in a case of severe diabetes we order a dietary which is poor in carbohydrates and of low albumin content, and at the same time suffices to exclude glycosuria, to

* von Noorden, C.: New Aspects of Diabetes, New York, 1912, pp. 16-18.

which we then add 100 grams of vegetable albumin, . . . the urine remains free from sugar, or almost so. If, however, we add a similar quantity of a meat albumin instead of a vegetable one, then a marked glycosuria appears and persists even after the meat albumin has been stopped. . . . Not all cases of diabetes, however, serve to demonstrate this fact. In the slighter forms, the influence of meat albumins is not great and it is difficult to demonstrate the reaction of the patient to different forms of albumin. It may be necessary to add more albumin than the patient can actually take before the glycosuric indication is reached. On the other hand, it is not always possible to obtain such results in severe cases; these patients are most susceptible to a large quantity of albumin. Once a medium amount of albumin is exceeded, say 70-80 grams, the glycosuria increases, no matter what the type of albumin is. The most favorable cases are those—as I have already mentioned—which are just under the borderline of "severe diabetes." For these, my experience has led me to formulate my views in the following manner:

"Meat is dealt with least well; namely the glycosuria increases to the greatest extent.

"Next comes casein.

"Then follows egg albumin.

"Finally, there is vegetable albumin; of this type *glidin* gives the best results."

SOFT BREADS.

The table includes the analyses of 40 samples of 34 brands of soft breads. A bread of relatively low carbohydrate content can be secured by the use of a gluten flour, or similar material, very rich in protein and correspondingly poor in carbohydrates, or by the use of an ordinary flour to which either protein matter or materials rich in fat, or both, are added. Ordinary wheat bread with a moisture content of about 34 per cent., contains 53 per cent. of carbohydrates, and this figure must always be kept in mind in judging any bread recommended for diabetics. The reduction in carbohydrates must be considerable to give the bread any particular value for this purpose. Magnus-Levy* suggests the following standard for a true diabetic bread: 16-20 per cent. protein, 12-14 per cent. fat, 2-3 per cent. ash, 1-3 per cent. fiber, about 30 per cent. starch and 30-33 per cent. water. To the writers an allowance of 30 per cent. for starch seems excessive.

All but five of the brands listed in the table are European products, and are of interest chiefly as reflecting conditions in

* Magnus-Levy, A.: Berl. klin. Wochenschr., 1910, 47, p. 238.

Europe. The nature of these breads precludes any other than a local use. The analyses show them to be most variable products; omitting three rather dry samples, they range in moisture from 24 to 43, ash from 1 to 4, protein from 9 to 39, fiber from 0.2 to 5.5, carbohydrates from 8 to 49 and fat from 0.3 to 32 per cent. *Gumpert's Ultrabrot* differs from the other samples by its high fat and low carbohydrate content; it is said to be made from a mixture of *Roborat* and almond meal. This bread is a type which might well be imitated in this country; the addition of a material like almond meal, rich in fat and low in starch, to a gluten flour moderately low in carbohydrates would result in a very satisfactory diabetic bread, both from the standpoint of composition and palatability.

Fritz's Litonbrot, Fromm's Litonbrot, Gericke's Dreifach-Porterbrot and *Sifarbrot, Goldscheider's Sinamlybrot* and *Rademann's Erdnuss-Brot* and *Litonbrot,* all contain less than half as much carbohydrates as ordinary wheat bread. The other foreign breads require no detailed comment other than to note that they contain from 33 to 54 per cent. of carbohydrates.

The five American samples are of more particular interest to us. *Ferguson's Gluten Bread* claims 26.9 protein, 28.4 starch and 8 per cent. fat; we find somewhat less protein and starch, possibly due to a higher moisture content, but less than one-half of the claimed amount of fat. Roughly speaking, this bread contains about one-third less carbohydrates than ordinary bread.

Glutosac and *Protosac Bread* are somewhat similar to *Ferguson's,* but contain in one case 3, in the other 8 per cent. more protein, with a trifle more carbohydrates. The manufacturers of these two breads make most reasonable claims for them, recognizing the necessity of establishing each diabetic's tolerance for carbohydrates, and only recommending the use of *Protosac* and *Glutosac* "after the sugar is eliminated by the aid of No. 1 Proto Puff, followed by the No. 2 Proto Puff test."

Eugene Loeb's P. and L. Genuine Gluten Bread differs little from ordinary wheat bread in composition, except for a somewhat higher fat content. It contained only 10.4 per cent. protein with 54 per cent. carbohydrates. This bread purports to be made from *Pieser-Livingston Gluten Flour,* which we found to contain about 43 per cent. protein. Just how the use of such a gluten flour could result in a bread like this we find it difficult

to explain. The wrapper accompanying this sample is rather misleading as on it there is a copy of an analysis of the *P. and L. Gluten Flour,* printed in such a way as to suggest that it applies to the bread itself.

Jireh Whole Wheat Bread was analyzed by this station in 1906 and again this year. The apparent difference in the two analyses is entirely a matter of moisture content, as the later sample, sent to us by a diabetic who was using it, had lost nearly half its moisture before reaching the laboratory. The two samples calculated to a water-free basis show 15.8 and 15.4 per cent. protein, and 79.4 and 80 per cent. carbohydrates, indicating that the bread of to-day is essentially the same as it was in 1906. The label of *Jireh Bread* reads as follows:— "Jireh Bread, guaranteed Pure Whole Wheat and (Starch Treated). Used by everybody but especially by people afflicted with Diabetes, Obesity, Bright's Disease and Indigestion. Send for Booklet on Diabetes." That it is specifically recommended for diabetics is therefore indisputable. In the company's booklet 39.12 per cent. of starch is admitted, but no mention is made of the other carbohydrates, the total carbohydrates according to our analysis showing nearly 49 per cent., only 4 per cent. less than average wheat bread. *Jireh Bread* contained over 39 per cent. of moisture, which of course reduces the percentage of starch. Calculated on the basis of 33.8 per cent. moisture (the average of over 200 samples of bread recently analyzed in this laboratory) this bread would show 53 per cent. of carbohydrates, or almost exactly the same as ordinary bread. The company's claim as to the percentage of starch, therefore, is grossly misleading. Furthermore in the booklet we read ". . . and the Jireh Bread certainly show a greatly decreased amount of starch compared with any others of the kind on the market." An examination of our analyses will show the falsity of this statement also, as with the exception of *Loeb's P. and L. Gluten Bread,* which we have already shown is not entitled to the name, *Jireh Bread* contains *more* starch than any American bread of this class which we have examined, and, with one exception, *more* starch than any European diabetic bread whose analysis we have been able to find. Incidentally it also contains the least protein of any of the forty soft breads listed in our table.

Cost of Soft Breads.

We have prices on only three brands of the soft breads. These brands, containing from 35 to 54 per cent. carbohydrates, cost from 10 to 19 cents per pound. In two of these the carbohydrates are somewhat reduced, but *Loeb's P. and L. Gluten Bread,* costing two and one-half times as much as ordinary bread, contains quite as much carbohydrates.

HARD BREADS AND OTHER BAKERY PRODUCTS.

The table shows the analyses of 150 samples of 113 brands of hard breads, biscuits, rusks, cakes and other bakery products, —materials usually containing ten per cent. or less of moisture.

All diabetics have a craving for bread, and to secure a proper substitute for this important food is a serious problem for the physician. As previously suggested, very light and porous products under the name of "Luftbrot," or aerated bread, have been offered as such a substitute. Their bulk not only serves as a useful deception to the patient, but also supplies a suitable vehicle for other foods like butter, cheese and nut pastes. Ten brands of this sort of bread are represented in the tables. Two samples of *Brusson Gluten Bread* were analyzed, which contained 47 and 57 per cent. of carbohydrates, with 40 and 50 per cent. of starch. The manufacturer's statements that they "are infinitely superior to any others . . . and are more nourishing, more palatable, produce less diabetic sugar than any others" are obviously untrue. Pound for pound this bread supplies about as much carbohydrates as ordinary bread. *Charrasse Pain de Gluten* is a somewhat better product, containing 44 per cent. carbohydrates with 27 per cent. starch. The statement that "c'est l'aliment le plus riche et le plus reconstituant pour les estomacs faibles" is somewhat overenthusiastic. *Fritz's Braunes Luftbrot "B"* contains a little more protein than the brand just mentioned, and less than half as much carbohydrates.

In *Fromm's Luft Bread* the carbohydrates are reduced to 31 per cent. and the starch to 23 per cent. The manufacturer's claim that it contains "27 per cent. starch and will produce the desired results when the intake of carbohydrates is not so restricted" is reasonable and sound. In *Fromm's Uni Bread* we are offered a product even better, in fact one of the best preparations of this kind sold in the American markets. It contained only 9 per cent. carbohydrates with about 3 per cent. starch. The statement that it contains "7 per cent. starch and is recommended for very severe cases" is justified by our analysis.

The Health Food Co. offers two preparations of this class, *No. 1 Proto Puffs* and *No. 2 Proto Puffs.* In the former we find 76 per cent. protein and 11 to 13 per cent. carbohydrates with about 4 per cent. starch; in the latter 52 to 56 per cent. protein and 31 to 36 per cent. carbohydrates with 19 per cent. starch. The manufacturer's claims for these breads as diabetic foods are refreshingly different from those usually found. After giving the analysis of the *No. 1 Proto Puffs,* which we find to be substantially correct, they say "This is found to be the proper food for the diabetic to begin on. After the elimination of the sugar—which your doctor will determine—by the aid of this excellent high proteid bread, a cautious effort to establish starch tolerance may be made by the gradually increasing ingestion of the No. 2 Proto Puff." These statements are in strict accord with the best modern methods of diabetic treatment.

Van Abbott's Gluten Bread and *Gluten Biscottes* are similar in composition to *Fromm's Luft Bread* and *No. 2 Proto Puffs,* containing 54 and 52 per cent. protein and 31 and 33 per cent. carbohydrates respectively.

Loeb's Gluten Luft Bread is claimed to contain 52 per cent. protein and 35 per cent. carbohydrates, but we find only 28 per cent. of the former with 54 per cent. of the latter and 44 per cent. starch. The statement that "starch is almost completely eliminated" is false.

The following summary shows the relative composition of these eight brands of "Luftbrot," in the order of their carbohydrates:—

	Protein %	Carbohydrates %
Fromm's Uni Bread	71.7	9.4
No. 1 Proto Puffs	76.1	11.9
Fritz's Braunes Luftbrot "B"	42.6	19.8
Fromm's Luft Bread	50.9	30.7
Van Abbott's Gluten Bread	54.1	30.9
Van Abbott's Gluten Biscottes	51.6	33.0
No. 2 Proto Puffs	54.5	33.3
Charrasse Pain de Gluten	40.8	43.5
Brusson Gluten Bread	34.7	52.0
Loeb's Gluten Luft Bread	27.9	54.2

The remaining samples included under this caption are various rolls, biscuits, rusks, cakes, etc. Some are excellent, while others contain carbohydrates in great excess.

The brands relatively low in carbohydrates were as follows:—

	Carbohydrates %
Kalari Batons ('09)	1*
" Biscuits ('09)	2*
Casoid Dinner Rolls ('09)	2*
Kellogg's 80% Gluten Biscuit ('12)	4
Casoid Biscuits No. 1 ('13)	6
" " No. 2 ('09)	6*
Akoll Biscuits ('12)	6
" " ('13)	7
Kalari Batons ('13)	7
Casoid Biscuits No. 1 ('06)	8*
" " No. 3 ('09)	8*
" " No. 1 ('09)	9*
Groetzsch's Pfeffernüsse	10
Kellogg's Pure Gluten Biscuit ('06)	10
" Potato Gluten Biscuit ('06)	11
Alpha Diabetic Wafers ('13)	11
Gumpert's Diabetiker Stangen ('10)	11*
Rademann's Diabetiker-Makronen ('10)	11
Van Abbott's Walnut Biscuits	12
Kellogg's Potato Gluten Biscuit ('09)	13*
Van Abbott's Euthenia Biscuits	13
" " Gluten Butter Biscuits	13
Bischof's Diabetic Gluten Bread ('07)	14
Callard's Cocoanut Biscuit ('09)	16*
Van Abbott's Caraway Biscuits	16
" " Diabetic Rusks	16
Groetzsch's Diab.-Salzbrezeln ('10)	17
Rademann's Diabetiker-Stangen ('10)	17
Van Abbott's Ginger Biscuits	17
Hundhausen's Aleuronatzwieback, h. g.	18*
Callard's Ginger Biscuits ('09)	18*
" Prolactic Biscuits ('09)	19*
Rademann's Diabetiker-Biskuits ('93)	20
Casoid Rusks ('09)	21*
Callard's Almond Shortbreads	21*
Protosoy Diabetic Wafers ('13)	21
Rademann's Diabetiker-Makronen ('10 & '13)	21
Casoid Lunch Biscuits ('09)	22*
Rademann's Diab.-Chok.-Biskuits ('93)	22
Fritz's Mandelbrot ('10)	23
Groetzsch's Diab.-Salzbrezeln ('10)	23*
Health Food Salvia Sticks ('06)	24
Rademann's Diabetiker-Stangen ('10)	25*

Some of the above brands showed wide variations in carbohydrate content in different years. *Kellogg's Potato Gluten Biscuit* in 1906 and 1909 contained 11 and 13 per cent., respectively, while the sample analyzed this year contained 48 per cent.; the protein was reduced from 80 and 76 to 42 per cent. An error may have been made in packing, but the sample was purchased directly from the manufacturer and was plainly labeled as being this brand. Likewise *Kellogg's Pure Gluten Biscuit,* analyzed in this laboratory in 1906, contained 80 per cent. protein and 10 per cent. carbohydrates, but when analyzed by Fetterolf in 1909 contained 48 and 39 per cent., respectively. An old analysis of *Rademann's Diabetiker-Biskuits,* made in 1893, showed 20 per cent. carbohydrates, while this year we found 45 per cent. The same firm's *Diabetiker-Makronen* contained 11 per cent. in 1910, according to one analyst, while another analyst in the same year and we this year found 21 per cent. Their *Diabetiker-Stangen* also contained 17, 25 and 30 per cent. of carbohydrates in 1910, 1910 and 1913, respectively.

* Includes fiber.

The *Charrasse* products all contained considerable carbohydrates (43 to 73 per cent.) and were quite uniform in composition except *Gluten Exquis Biscuits aux Amandes,* which contained a high percentage of fat (24), but with over 50 per cent. carbohydrates, and *Biscottes Lucullus,* which contained 73 per cent. carbohydrates with 59 per cent. starch. To call such a preparation as the last named "Le Régal des Diabétiques" is dangerously false and misleading.

Likewise the *Fromm* products, excepting those already noted, contained from 37 to 68 per cent. carbohydrates. The *Almondform Wafers, Butterbrezeln, Crackers, Eierbiscuit, Hazelnuss-Stangen, Makronen, Salz-Stangen* and *Stangenin,* all contained more carbohydrates than ordinary wheat bread. The *Hazelnuss-Stangen* and *Makronen* showed no starch, but did contain large amounts of soluble carbohydrates. The former, by the official method of cold-water extraction, gave 20.16 per cent. reducing sugars as dextrose before inversion, and 33.25 per cent. after. Browne's* method of alcohol extraction gave before inversion 19.64 and after inversion 31.96 per cent. reducing sugars as dextrose, showing 11.89 per cent. sucrose. The *Makronen* by the latter method gave before inversion 20.56 and after inversion 33.04 per cent. reducing sugars as dextrose, showing 12.08 per cent. sucrose. Both samples also contained dextrin.

Gericke's Doppel-Porterzwieback, Mandelbrot, Porterbiskuits and *Porterzwieback* contained 40, 43, 63 and 72 per cent. carbohydrates, respectively. In *Gericke's Sifarbiskuits* these were reduced to 35 per cent.

Groetzsch's Pfeffernüsse contained only about 10 per cent. carbohydrates, with from 24 to 32 per cent. fat.

* Browne, C. A., Handbook of Sugar Analysis, New York, 1912, p. 446.

Frank's Erdnuss-Kakes contained 37 per cent. carbohydrates, while *Gumpert's Doppel-Diabetiker-Zwieback* contained 28 per cent. Both of these preparations showed considerably less carbohydrates than the ordinary products.

The three samples of *Günther's Aleuronat-Kakes,* analyzed in 1892 and 1897, showed prohibitive amounts of carbohydrates: 69, 67 and 70 per cent.

The *Health Food Co.'s Diabetic Biscuit* contained 55 and 54 per cent. carbohydrates in 1906 and 1913, respectively, about the same as in wheat bread. Their *Glutona* showed even more. *Gluten Nuggets,* while not specifically recommended for diabetics on the label, are included in the company's list with their diabetic foods; they contained 48 per cent. carbohydrates. *Glutosac Butter Wafers, Rusks, Plain Wafers* and *Zwieback* contained about the same amount of carbohydrates, from 49 to 52 per cent. All of these are listed as diabetic foods. Of the *Butter Wafers* the company says "They are pleasant and safe for a diabetic,"—a most doubtful claim; of the *Zwieback* they say "It is the most popular food offered the diabetic, the starch in it is well carbonized." We do not know just what the last claim means, but our analysis shows a high percentage of unconverted starch. *Protosac Rusks* contained 49 per cent. carbohydrates, showing that the statement that it is "a bread largely lessened in starch" is incorrect. This company's *Protosoy Diabetic Wafers* and *Salvia Sticks* contained 21 and 24 per cent. carbohydrates and might prove to be useful food adjuncts, when a patient's tolerance for carbohydrates had been established.

Heintz Gluten Biscuits and *Glutin Biscuits* are not proper diabetic foods, the former containing 58 and the latter 67 per cent. carbohydrates. Their low protein content makes their sale as gluten products entirely unjustifiable. In a letter from the company the *Gluten Biscuits* are specifically recommended "for the use of diabetics." The *Glutin Biscuits* are "recommended as an article of diet for people who suffer from some diseases where the diet of starch has to be restricted." It is evident that a person using a food containing 14 per cent. more carbohydrates than wheat bread, and only about 4 per cent. less than ordinary crackers, would have some difficulty in restricting his intake of starch by this means.

Hundhausen's Aleuronatzwieback (low gluten) and *Aleuronat Biskuits* and *Kakes* contained from 52 to 65 per cent. carbohydrates. All of these analyses, it should be noted, were made about twenty years ago, and are of historical rather than of practical interest.

Jireh Diabetic Biscuits, Diabetic Rusks, Diatetic Biscuits and *Diatetic Rusks,* with their 68 to 72 per cent. carbohydrates, are totally unfit to be sold as diabetic foods. Here again we see the juggling of the words "diabetic" and "diatetic" previously noted. *Jireh Wheat Nuts* showed somewhat less carbohydrates, largely due to the increased fat content, but the carbohydrates are still too high to warrant their safe use by diabetics.

Johnson Educator Food Co.'s Almond Biscuits, Diabetic Biscuits, Educator Crackers, Gluten Rusk, Gluten Wafers and *Glutine* contained from 54 to 74 per cent. carbohydrates. In the booklet advertising these foods we read the following statements:—

"To all persons who find it necessary or desirable to eliminate starchy foods from their diet, this little talk is directed. . . . For those suffering from Diabetes . . . he (Dr. Wm. L. Johnson) originated the Educator Gluten Foods . . . Medical research has proved that a person afflicted with Kidney Trouble should use foods containing a maximum of protein and a minimum of starch. . . . So in order to obtain a wheat food suitable for a Diabetic, we take out a large proportion of the starch from the whole wheat flour. . . . Educator Gluten Foods are the best on the market."

These extracts are sufficient to demonstrate that the manufacturers realize the necessity for foods of low carbohydrate content for the diabetic, and that they claim their foods are such. Notwithstanding these statements our analyses establish their high percentages of carbohydrates, in all cases higher than the amount contained in wheat bread. *Educator Gluten Bread Sticks* and *Educator Gluten Cookies,* on the other hand, showed a considerable reduction in carbohydrates. The former, however, does not contain "a maximum of protein and a minimum of starch."

Kellogg's Avena-Gluten Biscuit contained 55 per cent. carbohydrates and *Taro-Gluten Biscuit* 58 per cent. Concerning the former the company says:—

"Following the discoveries of von Noorden and others showing the special and valuable properties of oatmeal . . . for diabetics, we have prepared gluten biscuits in which the starch of wheat is replaced by that of the oat. . . . These biscuits are to be used on the . . . oatmeal days or in combination with a green diet."

To these statements we take no exception provided the purpose of the food is always kept in mind by the patient; but these biscuits are no more suited to the general diabetic diet than oatmeal itself or potatoes. For *Taro-Gluten Biscuit* the company claims "A Food for Diabetics prepared from washed gluten and Taro . . . which is assimilated more easily than cereal starches and hence especially adapted to the use of diabetics." Even were this statement true—and we believe it to be far from verified—the same precautions in the use of these biscuits would be necessary as with oatmeal or other preparations sometimes recommended for the therapeutic use of diabetics for limited periods. A food containing 48 per cent. of insoluble starch is not a suitable general diabetic food. *Kellogg's 40% Gluten Biscuit* is "guaranteed to contain 40 per cent. of pure gluten." This figure was reached by only two of the five samples recorded in our table. In the company's booklet we read "Our glutens are prepared by a process of our own devising, and are all thoroughly standardized, so that in their use the physician and the patient know just the amount of starch eaten. Our glutens are on this account indispensable for persons suffering from diabetes." A preparation showing from 36 to 47 per cent. protein and from 41 to 53 per cent. carbohydrates can hardly be said to be "thoroughly standardized." The carbohydrate content of these biscuits would justify their use only when the patient's tolerance had been well established.

Kirche's Aleuronat-Kakes and *Schelle's Aleuronat-Kakes* contained 62 and 63 per cent. carbohydrates, respectively,—excessive amounts.

Klopfer's Glidinebrot contained 48 per cent. protein and 35 per cent. carbohydrates.

Pure Gluten Food Co.'s Gum Gluten Biscuit Crisps resemble in composition *Kellogg's 40% Gluten Biscuit* and the same criticisms will apply. Containing 39 per cent. starch, they are certainly not "indispensable in cases of diabetes . . . and wherever the starch-restricted diet is indicated."

Rademann's Diabetiker-Bretzel and *Cakes* showed from 40 to 50 per cent. carbohydrates. Their *Dessert-Gebäck* and *Makronen*, in our present analyses, showed relatively low percentages of carbohydrates with much fat (42 to 48 per cent). *Diabetiker-Stangen* contained somewhat more carbohydrates with 44 per cent. fat. The two analyses of *Diabetiker-Zwieback*, both made in 1910 by different analysts, showed no agreement whatever, one containing 38, the other 51, per cent. carbohydrates. *Erdnuss-Biskuits* contained 39 per cent. carbohydrates with only 9 per cent. starch. *Rademann's Käsestangen* are not recommended by the manufacturer's label as a diabetic food, but we bought them as such from the New York agent. They contained only 9 to 11 per cent. protein and 46 to 50 per cent. carbohydrates, with 29 to 34 per cent. fat. The carbohydrates in *Rademann's Sanitätszwieback* (58 and 67 per cent.) are much too abundant for a diabetic food.

Uhl's Carlsbad-Water Biscuits "Sprudel Brand" are on their manufacturer's representation "according to the scientists of the day, the best substitute for bread in all stomach and intestinal troubles, as well as for sufferers from diabetes and gallstones, and are highly recommended by many medicinal authorities." A detailed analysis is given on the package, which we find to be substantially correct aside from the following dubious but interesting statement:—"She ashes which contain no poisonous mineral substance, contain 5.30 per cent. sulphuric acid, which is a proof of the employment of Carlsbad sprudel water." The biscuits contained but 1.7 per cent. ash, and it is apparent that only a few tenths of one per cent. of sulphates can be present, even accepting the manufacturer's claim. This sample is probably the most unfit preparation for diabetics that we have examined, as it contains nearly 75 per cent. of carbohydrates.

The *Van Abbott* preparations, with one exception, showed relatively low percentages of carbohydrates. The *Diabetic Rusks* contained 71 per cent. protein with 16 per cent. carbohydrates. The *Caraway Biscuits, Euthenia Biscuits* and *Ginger Biscuits* were very similar in composition, containing about 36 per cent. protein, 16 per cent. carbohydrates, with from 7 to 11 per cent. starch. The *Euthenia Biscuits* are claimed to be "free from starch," which is not strictly true. *Gluten Butter Biscuits* contained somewhat more protein and less carbohydrates. *Walnut*

Biscuits contained only 21 per cent. protein with 57 per cent. fat; only 12 per cent. carbohydrates was present with but a trace of starch. *Midolia Biscuits* contained only 18 per cent. protein with 32 per cent. carbohydrates and 13 per cent. starch. The label of this brand claimed that no starch was present, yet the analysis published in the company's booklet admits 13.36 per cent., practically what we found. All of the above brands, except the *Diabetic Rusks,* contained very high percentages of fat, ranging from 32 to 57 per cent. Accordingly they are very concentrated foods and, with the exception of the *Midolia Biscuits,* should prove useful foods for the diabetic.

Cost of Hard Breads and Bakery Products.

The cost per pound of the "luft breads" ranged from 71 cents to $2.33. The *Loeb* and *Brusson* brands, containing quite as much carbohydrates as ordinary bread, cost 84 cents and $1.33 per pound, respectively, or from 17 to 27 times the price of ordinary wheat bread. Nor does the *Charrasse Pain de Gluten,* with 44 per cent. carbohydrates, warrant a price of $1.41 per pound. *Fromm's Uni Bread* and *No. 1 Proto Puffs,* which show a somewhat similar composition, cost $2.25 and $1.13 per pound, respectively. Likewise *Fromm's Luft Bread* and *No. 2 Proto Puffs,* also similar materials, cost $2.33 and 83 cents per pound, respectively. In other words, the two German preparations cost from two to three times more than the very similar American products. The two *Van Abbott* breads of this kind are also relatively expensive, costing $1.30 and $1.51 per pound.

Our data regarding the cost of the other bakery products are quite limited, although similar wide variations are shown for materials of nearly the same degree of usefulness to the diabetic. The biscuits, etc., containing 11 per cent. and less of carbohydrates, cost from 72 cents to $3.00 per pound. *Kellogg's 80% Gluten Biscuit, Huntley and Palmer's Akoll Biscuit,* and *Van Abbott's Caraway Biscuits, Ginger Biscuits* and *Walnut Biscuits,* however, commend themselves by their relatively low prices. Very excessive prices, especially when composition is considered, are shown in a number of brands. Five of the *Charrasse* brands, containing from 43 to 52 per cent. carbohydrates, cost from

$3.16 to $3.60 per pound. Likewise certain of the *Rademann* brands cost over $3.00 per pound. *Van Abbott's Diabetic Rusks* are very expensive at $3.63 per pound, while the same firm's *Midolia Biscuits,* although containing 32 per cent. carbohydrates, are relatively cheap at 32 cents per pound. Even the cheaper preparations, containing from 50 to 77 per cent. carbohydrates, no better, and in some cases even worse, for the diabetic's use than ordinary bread, cost from 30 to 41 cents per pound.

Quoting from this station's report for 1912:—

"The preparation of foods containing much gluten and little starch is an expensive process and high prices must be charged for the resultant foods. But when a diabetic patient pays a high price for a food, which is claimed to meet his particular needs, and analysis shows that the food is utterly unfitted for his requirements, he is defrauded and, depending on the manufacturer's claims, pays his good money for a food which may work actual harm upon him."

BREAKFAST FOODS, MACARONI, NOODLES, ETC.

Fourteen samples of twelve brands of breakfast foods were analyzed. *Brusson Gluten Semolina, Farwell and Rhines' Barley Crystals* and *Cresco Grits, Jireh Whole Wheat Farina, Jireh Frumenty* and *Kellogg's Granola* are somewhat similar in composition, with low protein and high carbohydrates (69 to 77 per cent.). They have nothing to recommend them as diabetic foods.

Brusson Farine au Gluten, Hazard's Wheat Protein Breakfast Food, Health Food Co.'s Manana, Gum Gluten Granules and *Pure Gluten Breakfast Cereal,* are poor improvements as diabetic foods over those just referred to above. In them the protein ranged from 34 to 45 and the carbohydrates from 44 to 54 per cent. Two samples of *Gum Gluten Breakfast Food* contained about 54 per cent. protein and 34 per cent. carbohydrates, while a third sample, analyzed in 1911, contained 38 and 52 per cent., respectively.

Ten brands of macaroni, vermicelli, spaghetti and noodles were analyzed. The *Brusson Macaroni, Nouillettes, Petites Pâtes* and *Vermicelle* and *Jireh Macaroni,* contained from 70 to 76 per cent. carbohydrates, and are totally unsuited for diabetics. *Marvelli Macaroni* was also high in carbohydrates, as was also probably the same company's *Spaghetti,* judging from its protein

content. The other three samples, *Loeb's Home Made Noodles, Gum Gluten Macaroni* and *Gum Gluten Noodles,* are "standard" gluten products, containing from 37 to 42 per cent. protein and 42 to 51 per cent. carbohydrates.

Relative Cost of Breakfast Foods, Noodles, etc.

The breakfast foods cost from 12 to 65 cents per pound, the price having but little relation to the carbohydrate content, or, therefore, to their fitness for the purpose in question. Four brands contained considerably less carbohydrates than the ordinary cereal breakfast foods, but the diabetic may well hesitate to pay from 20 to 60 cents per pound for foods only a little better suited to his use than the ordinary product. The other six brands are unfit for diabetics under any circumstances; if the patient's carbohydrate tolerance is so high as to permit his use of foods of this sort, he might better buy oatmeal, containing 64 per cent carbohydrates, at the current prices of 3.5 cents per pound loose, or 7 cents in carton form, than pay from 12 to 65 cents per pound for foods containing over 68 per cent. carbohydrates.

The only two brands of noodles, whose carbohydrate content should in any way recommend them to diabetics, are sold at the rate of 58 and 70 cents per pound, about four times the usual price. The remaining five samples of pastes have about the same carbohydrates as ordinary macaroni, which may be bought for 10 cents per pound, while these samples cost from 26 to 93 cents. In other words, the diabetic would pay from three to nine times as much for products no more suited to him than ordinary macaroni.

NUTS, NUT PASTES, ETC.

A number of nut preparations listed in the table were not sold specifically as diabetic foods, but were included because of their usefulness for that purpose. We give analyses of fourteen samples of peanut butter, five of almond paste or butter, two of pine nuts, one of almonds, and ten of miscellaneous nut foods. The samples of peanut butter showed considerable uniformity; the carbohydrates ranged from 12 to 20, with 3.2 to

6.5 per cent. starch. Most of the peanut butters we have examined would seem to be useful additions to the diabetic's diet, not only because of their relatively low carbohydrates, but also because of their concentration, the average sample analyzed having a calorific value of 604 Calories per 100 grams.

The three samples of *Almond Paste* analyzed by the California station in 1902-03 showed about the same content of protein and fat, but the *Chapman* sample contained 11 per cent. added corn starch; the total carbohydrates ranged from about 30 to 40 per cent. *Kellogg's Sanitas Almond Butter* was a very different preparation; it was rich in protein, very rich in fat, and contained only from 7 to 8 per cent. carbohydrates; it is a very concentrated food yielding 677 Calories per 100 grams.

The analyses of the *Pine Nuts* indicate that they are excellent diabetic foods, with from 3 to 4 per cent. carbohydrates. They also are a very concentrated food containing 616 Calories per 100 grams; and cost 75 cents per pound.

The sample of *Paper Shell Almonds* (edible portion) contained about 16 per cent. carbohydrates with no starch. The kernels made up 62 per cent. of the nuts, which cost 21 cents per pound, or 19 cents in 25 pound lots. The kernels yield 637 Calories per 100 grams.

Kellogg's Malted Nuts contained over 40 per cent. carbohydrates. The manufacturer's claims for this food are misleading:

> "Cow's milk is an excellent food for young calves, but it is a very poor food for a human infant and still less adapted to adult human beings. Thousands of persons have discovered for themselves its unwholesome properties. Malted Nuts supplies the place of cow's milk as a liquid food. Its composition is similar to that of milk."

Its composition is not "similar to milk," even considered on the dry basis, as it contains much less protein, fat and ash and much more carbohydrates than dried whole milk. Such extreme and unfair statements regarding such a useful food as milk should not be allowed to pass unchallenged. *Kellogg's Nut Butter* closely resembles peanut butter in composition, and has its same advantages as a diabetic food. *Kellogg's Nut Bromose* is a confection made of *Meltose* (a maltose preparation) and nuts. Although it contained only 3 per cent. starch, it showed about 39 per cent. carbohydrates, chiefly maltose, which renders it nearly as unfit for a diabetic food as *Meltose* itself. *Kellogg's*

Nut Meal is a peanut meal, containing only 12 per cent. carbohydrates. *Kellogg's Nuttolene* and *Protose* likewise contained only 6 and 4 per cent. carbohydrates, respectively. All of these last three preparations are quite suitable as adjuncts to the diabetic's diet.

Nashville Malted Nut Food contained about 27 per cent. carbohydrates with 3 per cent. starch. The same firm's *Nutcysa* and *Nutfoda* contained about 6 per cent. carbohydrates, the low percentage being in part due to the high moisture content, 57 and 62 per cent. respectively. The cost of these foods, 15 cents per pound, is relatively low, but only 266 and 182 Calories per 100 grams, respectively, are yielded by them. *Nashville Nut Butter* had all the characteristics of a peanut butter, and is a suitable diabetic food.

CHOCOLATE AND COCOA PREPARATIONS.

Although commercial chocolate and cocoa show considerable variations in composition, on the average they contain the following amounts of carbohydrates:—

Plain chocolate	25	per cent.
Cocoa	38	"
Milk chocolate	51	"
Sweet chocolate	67	"

In judging the value of a diabetic chocolate or cocoa, in comparison with the ordinary commercial preparations, these carbohydrate values must be kept in mind. Certain European manufacturers have substituted levulose, or fruit sugar, for sucrose or lactose, acting on the theory that levulose is less objectionable for diabetics than other forms of sugar. In this connection it is interesting to note some recent comments of von Noorden on this subject in his *Die Zuckerkrankheit und ihre Behandlung,* Berlin, 1910, on page 270 of which we read

"That levulose, milk sugar and inulin are more useful than the other carbohydrates is a common opinion, but the importance of their use in practice does not correspond with the theory. In light cases the form of carbohydrate makes little difference; in severe cases the advantage from using levulose, milk sugar, etc., is only slightly greater than from using bread and flour. . . . Only in certain cases does it appear to me that the special form of carbohydrate possesses any particular significance."

On page 92 of the same work he tells us that of the carbohydrates, dextrose is the worst with maltose almost as bad, and that starch is much like dextrose in its effect, although certain forms of starch, such as oat starch, act differently in particular cases. He says that levulose increases glycosuria only about half as much as dextrose, when used occasionally, but with long use it is as bad as dextrose and starch. In many severe cases the use of levulose but once shows quite as harmful an effect as starch, and the same is true of inulin. Lactose and sucrose occupy an intermediate position between dextrose and levulose, generally a little nearer the former.

In addition to this substitution of carbohydrates, it is apparent that the carbohydrates of a chocolate or cocoa may be reduced by the addition of nitrogenous matter, such as casein or other protein preparations. Chocolate contains on the average about 13 and cocoa about 22 per cent. of protein (N x 6.25), so that percentages much higher than these would indicate the additions just suggested.

In the table we list the analyses of seven brands of specially recommended chocolate, four of cocoa and one of chocolate-covered almonds.

The chocolates contained from 10 to 50 per cent. carbohydrates, with 11 to 25 per cent. protein and 25 to 61 per cent. fat. The addition of some form of protein is indicated in all the samples. In only three cases, however, did the percentage of carbohydrates fall much below that found in ordinary plain chocolate, although all the brands showed much lower carbohydrates than either ordinary milk- or sweet-chocolate. It is evident that these preparations possess slight advantages over the ordinary preparations, but the advantage gained is quite disproportionate to the cost of the various brands. *Brusson Chocolat with Added Gluten,* with 26 per cent. carbohydrates, costs $1.63 per pound; *Fromm's Conglutin-Diabetiker-Schokolade,* with 33 per cent., $1.89 per pound; and *Rademann's Diabetiker-Chokolade,* with 17 per cent., $2.06 per pound; in other words, from 4 to 7 times the price of ordinary chocolate.

The cocoas contained from 21 to 51 per cent. carbohydrates, with 18 to 53 per cent. protein and 11 to 24 per cent. fat, and 5 to 33 per cent. starch. All but one of the brands contained less protein and fat and more carbohydrates than ordinary cocoa.

Plasmon Cocoa, however, showed a large addition of casein with a correspondingly decreased content of fat and carbohydrates. Ordinary pure cocoa contains about 15 per cent. of starch, sugar and dextrin (carbohydrates). *Charrasse Gluto-Cacao* slightly exceeded this amount, while the two samples of *Jireh Diabetic Cocoa* contained about twice as much carbohydrates as pure cocoa. In this brand there were not only the usual carbohydrates of cocoa but also an added quantity in the form of what the manufacturer formerly called "starch-changed prepared barley." In the most recent Jireh circular we read "This is a pure Cocoa combined with starch-treated Cereal. The Barley adds greatly to the strengthening force and just suits people who require a rigorous diabetic regimen." The fallacy of these "starch-treated" foods has been referred to in a previous section. The price of *Jireh Cocoa* is 60 cents per pound, somewhat higher than that of ordinary cocoa. The only other price we have for these cocoas is that of *Rademann's Diabetiker-Cacao,* which costs $1.41 per pound. We fail to see what advantages this brand possesses over ordinary cocoa.

The *Casoid Chocolate Almonds* have much to commend them as a diabetic confection, as they contained only about 16 per cent. carbohydrates. Their cost, $2.12 per pound, however, limits their use to those to whom price is no object.

MISCELLANEOUS PRODUCTS.

In the table are also given the analyses of four diabetic milks, a coffee substitute and a sugar preparation. The two preparations of *Rose's Diabetesmilch* showed relatively little lactose, but the protein also was much lower than in normal milk. The low solids in one sample, 7.5 per cent., suggests that the decrease in milk sugar has been obtained simply by the addition of a little cream and much water.

Whiting's Sugar-Free Milk, an American product, is, however, of special interest, as it proves to be just what is claimed, namely a milk from which all but the merest traces of carbohydrate have been removed. Our analysis, the average of three samples, agrees closely with that claimed; a small amount of gelatin was present, but no saccharin or preservative. This is sold by D. Whiting and Sons, 570 Rutherford Ave., Boston; the price is 25 cents per 8 oz. bottle, or $1.25 per case of six 8 oz. bottles.

Dr. Bouma Sugar-Free Fat-Milk, sold by Gustav Muller and Co., New York, like the *Whiting* milk is free from carbohydrates, but is much less concentrated, containing about two-thirds as much fat and less than half as much protein; however, it is considerably cheaper.

Kaffeebrod is a so-called "Cereal Coffee," containing 72 per cent. carbohydrates; it contains only 10 per cent. unconverted starch.

Kellogg's Sanitas Meltose was analyzed by this station in 1911 and was found to contain 72 per cent. carbohydrates, of which about 47 per cent. was maltose, and 19 per cent. dextrin. In the manufacturer's booklet *Practical Suggestions About Diet in Diabetes* we read the following concerning this preparation:—

> "A new sugar prepared by digesting cereal starch with the diastase of malt. . . . Has the appearance of honey or syrup, but contains no cane-sugar or other artificial sweet. Is identical in character with the normal product of starch digestion in the stomach, hence may ordinarily be eaten as freely as desired without any injury whatever. This is a most excellent carbohydrate for diabetics, being already digested and prepared for easy assimilation."

It is not accurate to call maltose "a new sugar"; we find *Meltose* to contain an insignificant amount of cane sugar, which the manufacturer, however, strangely enough calls an "artificial sweet." Furthermore in view of the claims for the superior excellence of this product as a diabetic food it is of interest to recall the quotation already cited from von Noorden where he tells us that "of carbohydrates dextrose is the worst with maltose almost as bad."

OTHER MISCELLANEOUS PRODUCTS.

Certain other recommended products were analyzed, but because of their diversity in composition are not tabulated.

Two brands of baking powder were examined. The *Casoid* preparation contained no starch; its cost is $1.03 per pound. On the other hand, the two samples of *Jireh Diabetic Baking Powder,* analyzed in 1906, contained from 14 to 16 per cent.

starch. Although this is less than often found in ordinary baking powder, there are brands on the market that contain no starch whatever. The diabetic who wishes a starch-free baking powder may better prepare it at home, in small quantities at a time, using two parts of cream of tartar to one of bicarbonate of soda, neither of which, when pure, contains any starch. An excellent article can be thus prepared for about 25 cents per pound. *Jireh Baking Powder* costs 30 cents per half pound.

Health Food Co.'s Pomarius claims to be "The filtered juice of the choicest fruit reduced in vacuo to a dense jelly of admirable flavor and containing only sugar of the fruit." The sample polarized —40° at 20° C. both before and after inversion. The total copper-reducing bodies after inversion amounted to 55.82 per cent. calculated as invert sugar. We do not find that the manufacturer specifically recommends this jelly as a diabetic food, for which it is obviously inappropriate.

Ordinary jams, preserves and marmalades contain 50 per cent. or more carbohydrates. *Casoid Sugarless Jam* and *Casoid Sugarless Marmalade* contained only 1.46 and 1.24 per cent. invert sugar, respectively, making them admirably suited as adjuncts to the diabetic's dietary. The brands of *Rademann's Entzuckert Conservirte Früchte* analyzed contained somewhat more invert sugar, 3.67 and 3.41 per cent., but very low percentages for materials of this kind. *Rademann's* preserved *Erdbeeren in eigenem Saft* contained 5.72 per cent. invert sugar, and the same firm's *Preisselbeeren ohne Zucker* contained 7.00 per cent. *Rademann's Feinste Johannisbeer Saft ohne Zucker* contained only 0.85 per cent. invert sugar, compared with an average of 9 per cent. found in ordinary samples of currant juice.

All of the *Rademann* fruit preparations, except the *Johannisbeer Saft,* were labeled "artificially colored." In three of the four brands the color used was found to be Ponceau 3R; in the fourth sample we were unable to identify the color. While Ponceau 3R is one of the permitted colors sanctioned by the U. S. government, any sort of coal-tar color would seem to be out of place in foods intended primarily for the use of invalids.

Tomatoes für Diabetiker (*Paradiesäpfel*), sold by Gustav Muller and Co., New York, contained 7.30 per cent. invert sugar, considerably less than found in ordinary tomato preserves, but more than found in many ketchups and most brands of canned tomatoes.

Van Abbott's Diabetic Table Jelly, Orange, contained no copper reducing matters, but was colored with Naphthol Yellow S, a permitted coal-tar dye. It cost 24 cents per bottle.

PARTIAL ANALYSES.

In order to complete the compilation of analyses of diabetic foods Table II has been prepared in which the carbohydrate content of 87 samples of 74 brands is given. Detailed analyses of a number of these brands are given in Table I. The other samples require no special comment, as none of them, so far as we know, except some of the Fromm and Rademann products, are on the American market.

WINES.

The term "dry" as applied to wines apparently has a relative rather than an absolute value. For instance, we find recorded a dry California sauterne which contained 3.57 grams reducing sugar per 100 cc., another containing only 0.07 gram. The same condition can be found in practically all classes of so-called dry wines. Certain authorities on diabetes have advised us of their difficulty in securing wines which they could recommend to be of low sugar content; and the scope of this report was, therefore, broadened to include a number of samples of wine purporting to be of this class. While it was recognized that there are doubtless many brands of wine on the market that would be found sufficiently dry for the diabetic's use, and although it was known that a limited number of brands were specifically sold for that purpose, the high cost of many of these precluded their use by any but the well-to-do. We endeavored, therefore, to find inexpensive wines which would prove satisfactory. Another important consideration was the ability of the manufacturer to guarantee that his product would run fairly uniform in composition, as regards sugar, from year to year. It was believed that the larger manufacturers could better meet this condition, and from this class we have taken our samples.

Table II.—Other Partial Analyses.

	Manufacturer and Brand.	Carbohydrates.	Weight equivalent to carbohydrates in 10 gms. of wheat bread.
		%	gms.
45	Avedyk (Berlin). Vollbrot	40	13
46	Blanc (Paris). Brot in Stangenform	44	12
46	" " " Tafelform	46	12
47	Ebstein. Aleuronatbrot	27	20
47	Fritz (Vienna). Braunes Luftbrot B	20	27
47	" " Kleberbrot	47	11
47	" " Mandelbrot	23	23
47	" " Lithonbrot	15	35
47	Fromm (Dresden). Eiweissbrot	38	14
45	" " Konglutinbrot	39	14
46	" " "	40	13
47	" " "	47	11
47	" " Lithonbrot	14	38
47	" " Unibrot	9	59
47	Gericke (Potsdam). Diabetikerbrot	34	16
46	" " Doppel-Porterbrot	33	16
47	" " "	35	15
46	" " Doppel-Porterzwieback	22	23
47	" " "	41	13
47	" " Mandelbrot	43	12
47	" " Porter-Biskuits	63	8
47	" " " -Zwieback	72	7
46	" " Sifarbiskuits	5	106
46	" " Sifarbrot	5	106
47	" " Ultramehl	5	106
45	Görtner. Diabetesmilch	less than 1	530+
46	Günther (Frankfurt). Aleuronatbrot	33	16
46	" " Aleuronatkakes	55	10
46	" " Aleuronatzwieback	48	11
45	Hövel (Berlin). Saccharinschokolade	18	29
46	" " "	18	29
46	Hundhausen (Hamm). Glutenmehl	7	76
45	Lindheiner (Frankfurt). Diabetesmilch	0.9–1.0	589–530
46	Marcel (Paris). Soyabrot	14	38
45	Pavy. Mandelbrot	7	76
45	Platschek (Karlsbad). Glutenmehl	48	11
45	" " Kakao für Diabetiker	18	29
46	" " " " "	19	28
46	" " Sojabohnenmehl	49	11
45	Pokorny (Teplitz). Diabetikerbrot	0.8	663
47	Rademann (Frankfurt). Diabetiker-Brot	30	18
45	" " " "	30	18
47	" " " Kakao	12	44
47	" " " Kakes	40	13
46	" " " "	50	11
47	" " " Mehl	51	10
47	" " " Schokolade	10	53
47	" " " Stangen	17	31

[45] Kraus. Untersuch. zur Chemie der Diabetes-Küche., Zeit. diätet. u. phys. Therap., 1; Wien. klin. Wochenschr. 11, 645; (Abst. in Chem. Centralbl., 1898, ii, 304). [46] v. Noorden. Ernährungstherapie bei Stoffwechselkrankheiten in E. v. Leyden's Handb. der Ernährungstherapie und Diätetik, 1904, ii, 234. [47] Strauss. Vorlesungen über Diätbehandlung innerer Krankheiten, Aufl. III, 1912, 211–215.

Table II.—Other Partial Analyses.—*Continued.*

	Manufacturer and Brand.	Carbohydrates.	Weight equivalent to carbohydrates in 10 gms. of wheat bread.
		%	gms.
47	Rademann (Frankfurt). Diabetiker-Zwieback	38	14
46	" " " "	45	12
47	" " "D-K." Brot	59	9
46	" " "D-K." Schrotbrot	35	15
46	" " Grahambrot	28	19
46	" " Haferbrotscheiben	65	8
46	" " Makkaroni	56	9
46	" " Nudeln	54	10
47	" " Sanitätszwieback	58	9
47	" " Schwarzbrot	33	16
46	" " "	38	14
47	" " Weissbrot	28	19
46	" " "	30	18
46	" " Früchte in eigenen Safte. Äpfel	5–7	106–76
46	" " " " Aprikosen	6–7	88–76
46	Rademann (Frankfurt). Früchte in eigenen Safte. Birnen	5–8	106–66
46	" " " " Erdbeeren	5–7	106–76
46	Rademann (Frankfurt). Früchte in eigenen Safte. Heidelbeeren	3–4	177–133
46	Rademann (Frankfurt). Früchte in eigenen Safte. Himbeersaft	1	530
46	Rademann (Frankfurt). Früchte in eigenen Safte. Mirabellen	6–8	88–66
46	Rademann (Frankfurt). Früchte in eigenen Safte. Reineklauden	5–7	106–76
46	Rademann (Frankfurt). Früchte in eigenen Safte. Stachelbeeren	2–4	265–133
46	Rademann (Frankfurt). Früchte in eigenen Safte. Weichselkirschen	6–8	88–66
46	Rademann (Frankfurt). Früchte in eigenen Safte. Zwetschen	6–7	88–76
46	Rademann (Frankfurt). Entzuckerte Früchte (verschiedener Art)	4–5	133–106
46	Remy & Kohlhaas (Erbach). Entzuckerte Früchte (verschiedener Art)	3–5	177–106
46	Roborat-Gebäcke (Berlin). Schwarzbrot	24	22
46	" " Stangen	8	66
46	" " Weissbrot	24	22
47	" " Zwieback	22	24
46	Salus (Braunschweig). Brot	35	15
46	" " Schwarzbrot	35	15
47	" " Weissbrot	38	14
46	Seidl (München). Aleuronatbrot	47	11
47	" " Kleberbrot	50	11
46	" " "	54	10
47	" " Kleberzwieback	45	12
46	" " "	67	8
	Stollwerck (Köln). Lävuloseschokolade	56	9

[46] v. Noorden. Ernährungstherapie bei Stoffwechselkrankheiten in E. v. Leyden's Handb. der Ernährungstherapie und Diätetik, 1904, ii, 234. [47] Strauss. Vorlesungen über Diätbehandlung innerer Krankheiten, Aufl. III, 1912, 211–215.

TABLE III.—

WINES.

Manufacturer or Agent and Brand.	Specific gravity at 15.5° C.	Alcohol by volume.	Total sugars as invert sugar after inversion per 100 cc.	Volume equivalent to carbohydrates in 10 gms. of wheat bread.	Selling Prices.
		%	gms.	liters.	
Alfonso & Hipolito Sancho Vinos de Jerez Amontillado Don Quixote (Wm. J. Sheehan Co., New Haven, Agts.)	0.98977	20.60	1.23	0.43	$14.50 per 12 bott.
Brotherhood Wine Co., New York City. Sunnyside Claret	0.99466	11.87	0.16	3.31	4.50 per 12 qts.; $ 1.25 per gall.
" " " " " Riesling	0.99329	12.37	0.34	1.56	5.00 per 12 qts.; 1.50 per gall.
" " " " " Vin-Crest Brut	0.99736	12.24	1.66	0.32	20.00 per 12 bott.; 22.00 per 24 ½ bott.
*California Wine Association, New York City. Riesling	0.99298	11.31	0.10	5.30	4.00 per 12 qts,
* " " " " " Zinfandel	0.99454	11.62	0.16	3.31	4.25 per 12 qts.
*Calwa Distributing Co., New York City. "Calwa" Brand Greystone (Light Hock Type).	0.99290	11.81	0.19	2.79	5.00 per 12 qts.
* " " " " " " La Loma (Burgundy Type)	0.99439	11.27	0.14	3.79	7.00 per 12 qts.
* " " " " " " Vine Cliff (Riesling)	0.99294	10.90	0.17	3.12	9.00 per 12 qts.
* " " " " " " Winehaven (Table Claret)	0.99500	11.46	0.14	3.79	5.00 per 12 qts.
H. T. Dewey & Sons Co., New York City. Ives Claret	0.99359	12.53	0.24	2.21	0.50 per bott.; $5.00 per 12 bott.; $6.00 per 24 ½ bott.; $1.50 per gall.
" " " " Moselle Type	0.99001	8.37	0.14	3.79	Same as Ives Claret.
" " " " Old Burgundy Type	0.99422	11.14	0.27	1.96	0.75 per bott.; $8.00 per 12 bott.; 9.00 per 24 ½ bott.; $2.50 per gall.
" " " " Ruby Claret	0.99325	13.03	0.27	1.96	0.35 per bott.; $4.00 per 12 bott.; 5.00 per 24 ½ bott.; $1.25 per gall.
†Pedro Domecq's Manzanilla Sherry	0.98558	20.86	0.32	1.63	1.25 per full qt.
Empire State Wine Co., Penn Yan, N. Y. Dry Catawba	0.99059	12.80	0.15	3.53	
" " " " " State Seal Champagne	0.99666	12.39	1.51	0.35	
Los Angeles Co., Boston, Mass. California Chasselas	1.00388	12.12	2.97	0.18	0.50 per bott.; $5.00 per doz.; $5.75 per 2 doz. ½ bott.
" " " " " "	1.00419	11.68	2.99	0.18	
" " " " Gutedel	0.99428	11.87	0.79	0.67	0.40 per bott.; 3.85 per doz.; 4.60 per 2 doz. ½ bott.
" " " " " "	0.99181	11.56	0.19	2.79	
Monticello Wine Co., Charlottesville, Va. Extra V. Claret	0.99456	12.80	0.25	2.12	4.00 per 12 qts.; $5.00 per 24 pts.
" " " " Norton's Virginia	0.99560	12.57	0.37	1.43	5.00 per 12 qts.; 6.00 per 24 pts.
" " " " Virginia Claret	0.99275	12.54	0.20	2.65	3.00 per 12 qts.; 4.00 per 24 pts.
" " " " Virginia Hock	0.99312	12.60	0.22	2.41	4.00 per 12 qts.; 5.00 per 24 pts.
Pleasant Valley Wine Co., Rheims, N. Y. Claret	0.99464	11.22	0.29	1.83	
" " " " " Dry Catawba	0.99054	12.02	0.18	2.94	
" " " " " Great Western Extra Dry	1.01008	12.33	4.36	0.12	15.00 per 24 pts.
M. Schreiber, Baden, Austria. Diätetischer Rothwein (E. Loeb & Co., New York, Agts.).	0.99484	11.21	0.15	3.53	13.75 per 12 qts.; $14.75 per 24 pts.
" " " " Weisswein (" " " ").	0.99533	10.48	0.11	4.82	14.75 per 12 qts.; 15.75 per 24 pts.
William J. Sheehan Co., New Haven, (Agts.). California Cabernet	0.99499	11.49	0.31	1.71	6.00 per 12 bott.; $7.00 per 24 ½ bott.
" " " " " " Hock	0.99322	11.21	0.14	3.79	5.00 per 12 bott.; 6.00 per 24 ½ bott.
" " " " " " Riesling	0.99180	11.15	0.14	3.79	6.00 per 12 bott.; 7.00 per 24 ½ bott.
" " " " " " Zinfandel	0.99485	11.32	0.16	3.31	6.50 per 12 bott.; 7.50 per 24 ½ bott.
Urbana Wine Co., Urbana, N. Y. Gold Seal Brut	1.00082	12.14	2.30	0.23	
" " " " " " " Absolutely Dry	0.99301	12.65	0.54	0.98	15.00 per 12 qts.; $17.00 per 24 pts.
" " " " " Sparkling Red, Special Dry	1.00608	11.26	2.86	0.19	
" " " " " " " " Absolutely Dry	0.99486	11.98	0.29	1.83	15.00 per 12 qts.; 17.00 per 24 pts.

* Sold by M. Zunder & Sons, New Haven.

† Sold by Chris. Xander, Washington, D. C.

The analyses here recorded must in no sense be considered as an inspection of the particular wines as regards purity, quality and general excellence, as our only inquiry has been whether or not they contained little enough sugar to be appropriate for the use of diabetics. A limited number of representative manufacturers were written to, our needs fully explained, and samples which they thought might meet our requirements were submitted by them. Where we are obliged to report rather high sugar contents, these must not be understood as reflecting in any way on the wine *per se,* but simply that it is not specially suited to diabetics.

With two exceptions all the samples were supplied to us *gratis,* and we take this opportunity to thank the following manufacturers and jobbers for their courtesy and coöperation:—

Brotherhood Wine Co., Spring and Washington Sts., New York City; California Wine Association, 410 West 14th St., New York City; H. T. Dewey and Sons Co., 138 Fulton St., New York City; Empire State Wine Co., Penn Yan, N. Y.; Los Angeles Co., 51 Summer St., Boston, Mass.; Monticello Wine Co., Charlottesville, Va.; Pleasant Valley Wine Co., Rheims, N. Y.; Wm. J. Sheehan Co., New Haven, Conn.; Urbana Wine Co., N. Y.; Christian Xander, 909 7th St., N. W., Washington, D. C.; M. Zunder and Sons, New Haven, Conn.

Thirty-eight samples of the following types of wine were analyzed:—nine Clarets, five Champagnes, eight Hocks, four Rieslings, four Burgundies, two each of Sherry, Zinfandel and Catawba, and one each of Cabernet and Moselle. The Clarets were all low in invert sugar, from 0.14 to 0.37 gram per 100 cc., *Sunnyside, Winehaven* and *Schreiber's Rothwein* containing from 0.14 to 0.16 gram. The samples of Champagne were not so satisfactory. Published analyses of twenty-nine samples of French and German dry sparkling wines show a range in reducing sugars from 0.13 to 1.95 grams per 100 cc., with an average of 0.53 gram. American dry Champagnes appear to carry somewhat more sugar than imported wines of this type. Four of our samples ranged from 1.51 to 4.56 grams; the fifth sample, *Gold Seal Brut, Absolutely Dry,* however, contained only 0.54 gram, probably a very satisfactory figure for a Champagne. Four of the Hocks contained only from 0.11 to 0.22 gram. The *Chasselas* brand, a white wine of unknown type, contained 2.97 and 2.99 grams, amounts much too high for the diabetic's use. The

Gutedel brand of the same company was somewhat variable, one bottle containing 0.79 grams, while another contained only 0.19 grams. The two still Burgundies contained only 0.14 and 0.27 gram; the *Sparkling Red, Special Dry,* of the Urbana Wine Co., contained 2.30 grams, a comparatively high figure, while the same brand, *Absolutely Dry,* contained but 0.29 gram. Three of these Burgundies, therefore, meet the diabetic's requirements. The four Rieslings contained from 0.10 to 0.34 gram, the two Zinfandels 0.10 and 0.16 gram, the two Catawbas 0.15 and 0.18 gram, the Moselle 0.14 gram and the Cabernet 0.30 gram. All of these ten wines are satisfactory wines for the diabetic. Both brands of Sherry analyzed are very dry wines of this type, but the *Manzanilla* brand with only 0.32 gram of sugar is the more satisfactory Sherry for the diabetic.

SUMMARY.

The main purpose of this investigation was not so much to detect fraud as to secure information which would be of benefit to the diabetic and to the physician who seeks foods suitable for a low-carbohydrate diet. A summary follows of the brands whose analyses showed 35 per cent. or less of carbohydrates, arranged in the order of their carbohydrate content. In the brands marked (*) the carbohydrates include fiber. (See also page 15.) Where a date follows in parentheses after a brand name it signifies that the brand showed marked variations in different years; in other cases, where the agreement was close, the results have been averaged.

Under 5 per cent. Carbohydrates.

Casoid Baking Powder	.0	Soson	1.1
Dr. Bouma Sugar-Free Fat-Milk	.0	Rose's Diabetesmilch	1.2
Van Abbott's Diabetic Table Jelly, Orange	.0	Casoid Sugarless Marmalade	1.2
Whiting's Sugar-Free Milk	.0	Energin	1.3
Rademann's Johannisbeer Saft ohne Zucker	0.9	Casoid Sugarless Jam	1.5
Kalari Batons ('09)	0.9*	Kalari Biscuit	1.7*
Glidine	1.0	Casoid Dinner Rolls	2.1*
		Casoid Flour	2.2*†
		Tropon	2.7*

* Includes fiber.
† See page 15.

Roborat	2.9
Gericke's Aleuronat	3.1*
Jireh Diatetic Pine Nuts	3.4
Rademann's Preserved Fruits, "entzuckert"	3.5
Kellogg's Protose	3.6
Hundhausen's Aleuronat (pure)	4.0
Barker's Gluten Food "A"	4.1
Bauer's Sanatogen	4.2†
Kellogg's Pine Nuts	4.2
Kellogg's 80% Gluten Biscuits	4.4
Amthor's Weizen-Protein	4.8
Bischof's Gluten Flour	5.0

5 to 10 per cent. Carbohydrates.

Casoid Biscuits No. 2	5.6*
Rademann's Preserved Fruits "in eigenem Saft"	5.7
Casoid Biscuits No. 1 ('13)	5.8
Barker's Gluten Food "B"	5.9
Kellogg's Nuttolene	6.3
Nashville Nutcysa	6.3
Huntley and Palmer's Akoll Biscuits	6.5
Nashville Nutfoda	6.8
Rademann's Preserved Fruits, "ohne Zucker"	7.0
Muller's Tomatoes für Diabetiker	7.3
Kalari Batons ('13)	7.4
Barker's Gluten Food "C"	7.7
Casoid Biscuits No. 3	7.8*
Gumpert's Ultrabrot	7.8
Kellogg's 80% Gluten ('12)	7.9
Van Abbott's Almond Flour	7.9
Casoid Biscuits No. 1 ('06, '09)	8.0*
Kellogg's Almond Butter	8.2
Fromm's Uni Bread	9.0
Plasmon	9.3†
Gumpert's Ultramehl	9.4*
Metcalf's Vegetable Gluten ('13)	9.8
Groetzsch's Pfeffernüsse	9.8*

10 to 15 per cent. Carbohydrates.

Kellogg's Pure Gluten Biscuit ('06)	10.2
Hundhausen's Aleuronat (less pure)	10.6
Gumpert's Diabetiker-Stangen	11.0*
Health Food Pure Washed Gluten Flour ('13)	11.1
Health Food Alpha Diabetic Wafers	11.3
Loeb's Imported Gluten Flour	11.8
Health Food No. 1 Proto Puffs	11.9
Kellogg's Potato Gluten Biscuit ('06, '09)	11.9*
Kellogg's Nut Meal	12.1
Van Abbott's Walnut Biscuits	12.3
Kellogg's 80% Gluten ('09)	12.5*
Van Abbott's Gluten Flour	12.6
" " Gluten Butter Biscuits	12.7
Nashville Nut Butter	13.0
Van Abbott's Euthenia Biscuits	13.2
Kellogg's Nut Butter	13.9
Bischof's Diabetic Gluten Bread	14.3
Fromm's Litonbrot	14.3
Gericke's Sifarbrot	15.0
Jireh Diabetic Baking Powder	15.0
Peanut Butter (range 12-20)	15.0

* Includes fiber.

† See page 15.

15 to 20 per cent. Carbohydrates.

Fritz's Litonbrot	15.4
Van Abbott's Caraway Biscuits	15.9
Van Abbott's Diabetic Rusks	16.0
Casoid Chocolate Almonds	16.1
California Paper Shell Almonds	16.3
Callard's Cocoanut Biscuit	16.4*
Van Abbott's Ginger Biscuits	16.7
Rademann's Diabetiker-Chokolade	16.9
Health Food Almond Meal	16.9
Groetzsch's Essschokolade	17.2
Hundhausen's Aleuronatzwieback	17.7*
Callard's Ginger Biscuit	18.1*
" Prolactic Biscuit	19.3*
Rademann's Erdnuss-Brot	19.7
Fritz's Braunes Luftbrot "B"	19.8
Groetzsch's Diabetiker-Salzbrezeln	20.0*

20 to 25 per cent. Carbohydrates.

Goldscheider's Sinamylbrot	20.2
Callard's Almond Shortbreads	20.7*
" Casoid Rusks	20.8*
Rademann's Diabetiker-Makronen	20.8
Plasmon Cocoa	20.9*
Health Food Protosoy Diabetic Wafers	21.2
Jireh Patent Cotton Seed Flour	21.3
Casoid Lunch Biscuit	21.6*
Rademann's Litonbrot	21.6
" Diabetiker-Chokolade-Biskuit	21.9
Fritz's Mandelbrot	23.1
Cereo Soy Bean Gruel Flour	23.7
Health Food Salvia Sticks	24.0
" " Protosoy Soy Flour	24.5
Metcalf's Soja Bean Meal	25.0

25 to 35 per cent. Carbohydrates.

Jireh Soja Bean Meal	25.8
Gericke's Dreifach-Porterbrot	26.0
Groetzsch's Kochschokolade	26.1
Brusson Chocolat with Added Gluten	26.4
Rademann's Diabetiker-Stangen	27.0
" " -Dessert-Gebäck	27.5
Nashville Malted Nut Food	27.5*
Gumpert's Doppel-Diabetiker-Zwieback	27.6
Metcalf's Vegetable Gluten ('06)	28.1
Health Food Pure Washed Gluten Flour ('06)	29.5
Fromm's Luft Bread	30.7
Van Abbott's Gluten Bread	30.9
Spencer's Almond Paste	31.6*
Van Abbott's Midolia Biscuits	31.6
" " Gluten Semola	32.4
Fromm's Conglutin-Diabetiker-Schokolade	32.7
Frank's Protein-Roggenbrot	33.0
Van Abbott's Gluten Biscottes	33.0
Health Food No. 2 Proto Puffs	33.3
Frank's Protein-Weizenbrot	33.5
Ferguson Gluten Bread	33.6
Gum Gluten Breakfast Food	34.2
Gericke's Sifarbiskuits	35.3

Addresses of Manufacturers and Agents.

The following is a list of the manufacturers or jobbers, with addresses, whose brands are referred to in this report, and which

* Includes fiber.

are sold in America. *This list is given simply as a convenience, and is intended in no sense as recommendation of any specific firm.*

Acme Mills Co., Portland, Ore. Atlantic Peanut Refinery, Philadelphia, Pa. Herman Barker, Somerville, Mass. The Bauer Chem. Co., 30 Irving Place, New York. J. W. Beardsley's Sons, New York. Beech-Nut Packing Co., Canajoharie, N. Y. A. C. Blenner and Co., New Haven, Conn. Berliner Milchkur-Anstalt, Hellersdorf, Berlin W. 10, Germany, (Bouma Milk). D. W. Brooks, Newark, N. J. Brusson Jeune, Villemur, Haute-Garonne, France. Callard, Stewart & Watt, 74 Regent St., London, Eng. Cereo Co., Tappan, N. Y. Dillon & Douglass, New Haven, Conn. Farwell & Rhines, Watertown, N. Y. Ferguson Bakery, 853 Albany St., Boston, Mass. Fromm & Co., Dresden, Germany. O. B. Gilman, 205 Tremont St., Boston, Mass. Golden Rod Mill Co., Portland, Ore. Glutinerie de Vichy et de la Méditerranée, 4 Rue Sévigné, Vichy, France (Charrasse). The Health Food Co., 25 Lexington Ave., New York. H. J. Heinz Co., Pittsburgh, Pa. Heintz Food Co., 208 N. Wabash Ave., Chicago, Ill. Huntley and Palmer, Reading, England. Jireh Diabetic Food Co., 727 Seventh Ave., New York. Johnson Educator Food Co., Boston, Mass. The Kellogg Food Co., Battle Creek, Mich. Francis H. Leggett & Co., New York. Eugene Loeb, 2016 Madison Ave., New York. E. Loeb & Co., 83 Beaver St., New York. Maclaren Imperial Cheese Co., Detroit, Mich. Thos. Martindale & Co., 10th and Market Sts., Philadelphia, Pa. The Marvelli Co., Detroit, Mich. Mayflower Mills, Fort Wayne, Ind. Menley and James, 168 Duane St., New York. Theo. Metcalf Co., 39 Tremont St., Boston, Mass. Gustav Muller and Co., 11 W. 27th St., New York. Nashville Sanitarium-Food Co., Nashville, Tenn. Nut Products Co., New Haven, Conn. Peanolia Food Co., New Haven, Conn. S. S. Pierce Co., Tremont St., Boston, Mass. Pieser-Livingston Co., 1527 So. Halsted St., Chicago, Ill. Plasmon Co., 66a Farringdon St., London, Eng. Pure Gluten Food Co., 90 W. Broadway, New York. Rademann's Nährmittelfabrik, Frankfurt, Germany. Sprague, Warner & Co., Chicago, Ill. Roman Uhl, Karlsbad, Bohemia. D. Whiting and Sons, 570 Rutherford Ave., Boston, Maass. Wilson Bros., Rochester, N. Y.

The American agents for the Callard, Stewart & Watt preparations are Thos. Leeming & Co., 99 Chambers St., New York; for the Bouma, Brusson, Charrasse, Fromm and Rademann preparations, Gustav Muller & Co., 11 West 27th St., New York; and for Huntley & Palmer, William A. Hazard & Co., 29 Broadway, New York. We do not know the American agents for the following foreign firms whose preparations are listed in our tables:

Amthor & Co., Halle, Germany. Avedyk, Berlin, Germany. Bischof & Co., London, Eng. Blanc, Paris. Chemische Fabrik, Dr. Klopfer, Dresden, Germany. Eiweiss-Extrakt Co., Altona, Germany. Frank & Co., Bockenheim, Germany. Fritz, Vienna, Austria. Gericke, Potsdam, Germany. Karl Goldscheider, 4 Naglergasse, Karlsbad, Austria. Eugen Groetzsch, 22 Mainzerlandstr., Frankfurt, Germany. F. W. Gumpert, 22 Konigstr., Berlin, Germany. F. Günther, Frankfurt, Germany. Hövel, Berlin, Germany. R. Hundhausen, Hamm, Germany. Kirche, Düsseldorf, Germany. Krecke & Co., Salzuflen, Germany. Lindheiner, Frankfurt, Germany. Marcel, Paris. H. Niemöller, Gütersloh, Germany. Platschek, Karlsbad, Austria. Pokorny, Telpitz, Austria. Remy & Kohlhaas, Erbach, Germany. Roborat-Gebäcke, Berlin, Germany. Salus, Braunschweig, Germany. Schelle, Braunschweig, Germany. Schelte, Münster, Germany. Ant. Seidl, Nürnberg, Germany. Stollwerck, Köln, Germany. Troponwerke, Mülheim-Rhein, Germany. G. Van Abbott & Sons, Baden Place, Crosby Row, London, Eng.

SACCHARIN PREPARATIONS.

Saccharin is extensively used by diabetics as a substitute for sugar as a sweetening agent. Though passing through the body unchanged, and therefore supplying no nutriment, it is a useful means of furnishing the sweet flavor in foods demanded by most diabetics. On account of its intense sweetness (500-550 times that of cane sugar) only small quantities need be used. Combined with its sweetness it possesses a pronounced bitter taste, which in itself prevents an excessive use.

It is unnecessary in this place to elaborate on the chemistry of saccharin, other than to state that it is the ortho anhydrid of sulphaminbenzoic acid with the formula $C_6H_4.CO.SO_2.NH$. It is frequently contaminated with the *para* anhydrid, and sometimes contains carbohydrates such as glucose and milk sugar, or benzoic or salicylic acids. (U. S. Pharm., 8th Rev., p. 71.)

Saccharin itself is only slightly soluble in cold water, a property which interferes somewhat with its general use. Its sodium salt, however, known commercially as "crystallose" or "saccharin soluble," readily dissolves even in cold water, and has nearly the same sweetening power as saccharin, and a better taste.

Saccharin appears on the market as the refined salt, as "crystals," as "soluble saccharin," and also in tablet form where it is usually combined with about an equal weight of sodium bicarbonate. It is also sold under a number of special proprietary names.

The following synonyms for saccharin are given in Merck's Index (1907):—

Agucarina, Anhydroorthosulphaminebenzoic Acid, Benzosulphinide (U. S. Pharm.), Benzoylsulphonic Imide, Garantose, Gluside, Glusidum (Brit. Pharm.), Glusimide, Glycophenol, Glycosine, Neo-Saccharin, Saccharinol, Saccharinose, Saccharol, Saxin, Sykose, Toluolsüss and Zuckerin.

Other names of saccharin preparations found in the literature and the trade are Crystallose, Heyden Sugar, Intensac, Monnet's Süssstoff, Power, Satoin, Sodium Saccharin, Soluble Saccharin, Sugarine, Sugar Gems, Sweetina and Sykorin.

We have examined a number of these commercial preparations, the results being given in Table IV. They are of especial interest in connection with the cost of the preparations, emphasizing the phenomenon so often noted with proprietary products, namely, the assumed increased value given to an ordinary material by the use of a mysterious or fanciful name.

TABLE IV.—SACCHARIN PREPARATIONS.

Brand.	Form.	Net weight of package.	Cost. Per package.	Cost. Per pound.
		gms.	cts.	
Saccharin.				
Garantose, Refined. The Heyden Chem. Works, N. Y. City	Powder.	28.70	25	$ 3.26
" " Dist. by Merck & Co., N. Y. City....	"	27.77	25	3.37
Soluble Saccharin.				
Saxin, Tabloid Brand. Burroughs, Wellcome & Co., London	Tablets.	2.36	25	39.78
Jireh Saccharine Crystals. Jireh Diabetic Food Co., N. Y. City	Crystals.	6.36	25	14.71
Sugar Gems. John Mason, East Orange, N. J.	Flakes.	6.51	25	14.37
Saccharin Soluble Tablets. Eli Lilly & Co., Indianapolis, Ind.	Tablets.	6.35	21	12.37
Hoyt's Sweetina. The Pure Gluten Food Co., N. Y. City	Crystals.	10 77	25	8.69
Crystallose Heyden. The Heyden Chem. Works, N. Y. City	"	28.38	75	9.89
Intensac. Liquid Carbonic Co., N. Y. City	Powder,	....	....	*
Fahlberg's Saccharin Crystals	Crystals.	....	....	26.21
Tablet Triturates Saccharin Soluble. Parke, Davis & Co., Detroit, Mich.	Tablets.	4.35	20	17.19
Saccharin and Sodium Bicarbonate.				
Saccharin Tablets. Merck & Co., N. Y. City	Tablets.	2.73	25	34.37
" " " " " "	"	4.17	25	22.43
" " Dist. by E. A. Gessner, New Haven...	"	10.61	25	8.82
" " Dist. by Bronson & Pelcher, New Haven	"	9.25	24	9.71
Saccharin-Täfelchen No. 1. Fahlberg, List & Co., Magdeburg	"	1.64	....	20.16
Saccharin Solution.				
Satoin. Gustav Muller & Co., N. Y. City	Solution.	....	100	....

* Quoted at $1.75 per lb.

SEVENTEEN preparations were analyzed, one of which was an alcoholic solution of saccharin, two refined saccharin in powder form, nine "soluble" saccharin, and five saccharin combined with sodium bicarbonate in tablet form. With a few exceptions the samples were purchased in small vials, costing from 20 to 25 cents each.

REFINED SACCHARIN. The two samples of *Garantose* proved to be practically pure saccharin in powder form, and were only slightly soluble in cold water, but dissolved readily in hot water. 28 to 29 grams cost 25 cents, or from $3.26 to $3.37 per lb. The following claims were made for this product:—

"Garantose is more wholesome, cleaner in taste, more uniform in effect, and much cheaper to use, than sugar. Garantose is absolutely harmless. . . . 550 times as sweet as the best sugar."

There certainly is no justification in the claim that a non-assimilable material like saccharin is more wholesome than a nutritious food such as sugar, except in the case of the diabetic, and this sweeping claim is entirely incorrect as referring to its general use as a sugar substitute. Moreover the claim that it "is absolutely harmless" is not supported by the facts. It is true that the Referee Board in its report made the guarded statement that "saccharin in small quantities (0.3 gm. per day or less) added to the food is without deleterious or poisonous action and is not injurious to the health of normal adults, so far as it is ascertainable by available methods of study." They further found, however, that "saccharin in large quantities (over 0.3 gm. per day and especially above 1 gm. daily) added to the food, if taken for considerable periods of time, especially after months, is liable to induce disturbances of digestion." To call such a material "absolutely harmless" is quite unjustified. The same criticism of course applies to all these preparations in which their harmlessness is emphasized.

SOLUBLE SACCHARIN. The nine samples contained from 80 to 87 per cent. of saccharin. Their ready solubility in cold water gives them a considerable advantage over saccharin itself. The brands included in this group are as follows:—

Saxin, Tabloid Brand claimed to be "perfectly harmless and may always be used when sugar is objectionable. About 600 times sweeter than sugar." The weight of 100 tablets, costing 25 cents, was 2.36 gms., or a calculated cost per lb. of $39.78.

Jireh Saccharine Crystals claimed to be "more economical and preferable to the ordinary saccharine tablets as it contains no starch or other mixture . . . it is 500 times sweeter than sugar." The insinuation that saccharin usually contains starch is quite unwarranted. 6.36 gms. cost 25 cents, or at the rate of $14.71 per lb.

Sugar Gems claimed to be the "only substitute authorized by German Government . . . the only safe sweetener." The use of the word "sugar" in connection with the brand name of this article is of course illegal under the Federal Food and Drugs Act. The following are some other statements made concerning this product in its advertising literature:— "The sugar of commerce *is nothing else but Concentrated Crystallized Acid.* . . . The loss of energy through the consumption of sugar . . . can never be made good, as it has left its marks on the race. . . . What has been destroyed by sugar is lost and cannot be regenerated. . . . Doctors not afraid to be unpopular by going against their patient's likings, call sugar *the most dangerous stuff consumed. . . . Kills every year many thousands of little ones.* . . . The *Only Safe Sweetener* is my German substitute . . . its *Absolute Healthfulness* was long ago placed beyond all doubt."

It should be remembered that these statements were made not as recommending this product for the use of diabetics, but as a substitute for sugar in the daily requirements of the normal household. The manufacturer's certainty as to the harmlessness of *Sugar Gems* is not evidenced in the following words of warning in a recent letter to the writers: "Would ask you to read instructions carefully, remembering that you are dealing with concentrated sweetness and that an overdose is even more unpleasant than an overdose of sugar." A 25-cent box of Sugar Gems weighed 6.5 gms., making the cost per lb. $14.37.

Lilly's Saccharin Soluble Tablets made no special claims. 100 tablets, costing 21 cents, weighed 6.35 gms., or at the rate of $12.37 per lb.

Hoyt's Sweetina "a soluble soda salt of pure saccharine." The 25-cent vial weighed 10.77 gms., making the cost per lb. $8.69.

Crystallose Heyden (Uniform Crystals). The sample, costing 75 cents, weighed 28.38 gms., or at the rate of $9.89 per lb. The cost was about three times greater than for the same firm's saccharin sold under the name of Garantose.

Intensac. The small sample analyzed was obtained from the Liquid Carbonic Co., who quoted a price of $1.75 per lb. The main sale of this preparation is probably to bottlers of soda water and other "soft" drinks.

Fahlberg's Saccharin Crystals cost $3.50 per 50 gms., or at the rate of $26.21 per lb.

Parke, Davis and Co.'s Tablet Triturates Saccharin Soluble contained a somewhat lower percentage of saccharin than the other soluble preparations. 100 tablets, weighing 4.35 gms., cost 20 cents, or at the rate of $17.19 per lb.

SACCHARIN TABLETS. Five samples were examined; in most of these saccharin and sodium bicarbonate were found in about equal amounts, the latter salt doubtless being used in part to increase the saccharin's solubility. They were as follows:—

Merck's Saccharin Tablets. 100 tablets weighed 4.17 gms., and cost at the rate of $22.43 per lb. Another sample of the same firm's tablets of smaller size weighed 2.73 gms., and cost at the rate of $34.37 per lb. These prices appear to be very high, especially in view of the fact that they contain only about 50 per cent. of saccharin. $41 or $65 per pound for bicarbonate of soda should satisfy even the most grasping manufacturer.

Saccharin Tablets, sold by E. A. Gessner, New Haven, weighed 10.61 gms., and cost at the rate of $8.82 per lb.

Saccharin Tablets, sold by Bronson and Pelcher Co., New Haven, weighed 9.25 gms., and cost at the rate of $9.71 per lb.

Fahlberg, List and Co.'s Saccharin-Täfelchen No. 1, "110 fach süss" cost $3.50 per 1000, or $20.16 per lb. They contained only about 20 per cent. of saccharin.

SACCHARIN SOLUTIONS. One liquid preparation, sold under the name of *Satoin* by Gustav Muller and Co., New York, was examined. "A Harmless Substitute for Sugar." Its specific gravity at 15.5° C. was 1.00809; it contained 17.53 per cent.

alcohol by volume and 6.99 per cent. solids. The bottle contained 350 cc. of liquid, or 24.66 gms. of solids. As the cost of the bottle of *Satoin* is one dollar, saccharin in this form would cost $15.18 per lb.

Cost of Saccharin Preparations.

The cost of these preparations is the most important point to consider. There was no evidence of adulteration in any of the samples and the various preparations were apparently true to name. While probably all of these materials, with the exception of Intensac, could be purchased at a much lower figure than the pound price calculated by us, the calculated cost in each case is based on samples of similar size and the prices are at least comparable.

Refined saccharin cost from $3.26 to $3.37 per lb.

Soluble saccharin, or the sodium salt, cost from $8.69 to $39.78 per lb.; the bulk price quoted for *Intensac* was $1.75 per lb.

Saccharin compressed into tablets with about an equal weight of sodium bicarbonate cost from $8.82 to $34.37 per lb.

It should be remembered that the individual preparations in each of these three groups are of practically the same strength, and only slight variations in price should be expected. However, we find one brand of soluble saccharin costing 4.5 times as much as another of equal strength, and one brand of tablets costing 4 times as much as another quite as good.

In *Satoin* the sweetener costs at the rate of $15.18 per lb.

Other Artificial Sweeteners.

Substitutes for sugar, other than saccharin, have been suggested and are on the market, but we have analyzed none of them. The more important of these are as follows:—

Dulcin (Sucrol), para-phenetol carbamide, $C_2H_5O.C_6H_4.NH.CO.NH_2$. It is a white powder of needle-like crystals, sparingly soluble in cold water, ether, petroleum ether and chloroform, but readily soluble in acetic ether. It is 400 times sweeter than cane sugar. Its use in large quantities is objectionable; in small quantities no disadvantages from its use have been observed. It has a more sugar-like taste than saccharin.

Glucin, the sodium salt of a mixture of the mono- and di-sulphonic acids of a substance having the formula $C_{19}H_{16}N_4$. It is a light brown powder readily soluble in water, and is 300 times sweeter than cane sugar.

Hediosit, $C_7H_{12}O_7$, is the lactone of glycoheptoic acid. It is white, crystalline, of sweet taste and oxidizable in the body. Albu,* however, claims that its sweetening power is so small that practically it has little value.

Edulcoren. This is claimed to be used as a sweetener in *Charrasse's Bonbons Pectoraux.* Further than this we have no information.

AVERAGE CARBOHYDRATE CONTENT OF FOODS.

Table V has been prepared to show the average carbohydrate content of the commonly used foods. The foods are arranged in groups of somewhat similar character, in each case in the order of carbohydrate content. Many foods show a wide range in carbohydrates, and in such cases the range is given in parentheses. In certain instances too much value must not be given to the averages here published. Sausage, for instance, frequently is starch-free except for the small amount contained in the spices used, but more commonly it is loaded up with cereal or potato starch, sometimes over 8 per cent. The same variation, though here a natural one, is shown by many vegetables, such as turnips, squash, potatoes and mushrooms. The sugar content of the different fruits also is most variable, and the averages given must be accepted with caution.

The averages have been compiled from a number of sources, but are in the main based on the compilations of Atwater and Bryant, and König, and on analyses made in this laboratory. For the analyses of wines we are chiefly indebted to König and various bulletins of the Bureau of Chemistry of the U. S. Dept. of Agriculture.

Having doubted the accuracy of many of the reported analyses of cheese, especially as regards its lactose content, we enlisted the coöperation of Dr. James N. Currie, of the Storrs Agricultural Experiment Station, who kindly determined lactose in a number of varieties of this most useful food for diabetics. His report is given on page 95.

* Albu, A., Die Ernährung von Zuckerkranken, Halle, 1912, p. 61.

TABLE V.—AVERAGE CARBOHYDRATE CONTENT OF FOODS.

Food.	Per cent. Carbohydrates.	Weight of food containing same amount of carbohydrates as 10 gms. wheat bread.
		gms.
Animal Products.		
All ordinary meats, poultry and game (except those specified)	0	....
Brains, Bone Marrow, Pig's Feet, Gelatine, Sweetbreads, Tongue, Eggs, Beef Juice and true Meat Extract	0	....
Camembert, Cheddar, Edam, Münster, Roquefort and Swiss Cheese	0	....
Tripe, dried beef and beef kidneys	Trace	....
Bologna sausage (range 0.2–3.1)	0.6	883 (2650–171)
Pork sausage (range 0–8.6)	1.4	379 (×–62)
Beef liver	1.5	353
Neufchatel cheese	1.5	353
Kephir	1.6	331
Skimmed milk cheese (range 0–9.0)	2.0	265 (×–59)
Full cream cheese (range 1.1–4.0)	2.3	230 (482–133)
Chicken liver	2.4	221
Pineapple cheese	2.6	204
Frankfort sausage (range 0–6.6)	3.4	156 (×–80)
Cottage cheese	3.6	147
Goose liver	3.7	143
Cream	4.5	118
Animal Products. *(cont.)*		
Buttermilk	4.8	111
Sheep liver	5.0	106
Milk	5.0	106
Skimmed milk	5.0	106
Whey	5.0	106
Koumiss	5	106
Condensed milk, unsweetened	11	48
Calf's foot jelly	17	31
Condensed milk, sweetened	54	10
Fish and Shell Fish.		
All common varieties except those specified	0	....
Canned shrimp and lobster	Trace	....
Crayfish	1.0	530
Crabs	1.2	442
Clams, long	2.0	265
Shad roe	2.6	204
Scallops (range 1.1–5.6)	3.4	156 (482–95)
Oysters (range 1.8–6.7)	3.7	143 (294–79)
Mussels	4.1	129
Clams, round	4.7	113
Sturgeon caviare	8.0	66

Food.	Per cent. Carbohydrates.	Weight of food containing same amount of carbohydrates as 10 gms. wheat bread.
		gms.
Oils and Fats.		
Butter, lard, tallow, oleomargarine, cod liver oil, olive oil and other edible oils	0	....
Cereals, (whole grains).		
Buckwheat	61	9
Millet	68	8
Oats, hulled	69	8
Corn (maize)	69	8
Barley	70	8
Wheat	71	7
Rye	72	7
Rice, hulled	77	7
Rice, polished	79	7
Flours, Meals, etc.		
Soy bean meal	34	16
Pea flour	57	9
Acorn meal	64	8
Barley flour	66	8
Oat meal	67	8
Graham flour	70	8
Kafir corn flour	70	8
Entire wheat flour	71	7
Prepared wheat flour	73	7
Self-raising buckwheat flour	73	7
Corn meal	74	7
Wheat flour	75	7
Pop corn, popped	77	7
Buckwheat flour	78	7
Rye flour	78	7
Rice flour	79	7
Cassava meal	81	7
Potato starch	81	7
Flours, Meals, etc. *(cont.)*		
Sago starch	81	7
Tapioca (Arrowroot)	84	6
Banana flour	85	6
Corn starch	85	6
Pastes.		
Noodles	72	7
Vermicelli	72	7
Macaroni	73	7
Spaghetti	74	7
Cereal Breakfast Foods.		
Rolled oats	64	8
"Holland Rusk"	72	7
"Ralston Health Food"	72	7
"Quaker Wheat Berries"	72	7
"Wheatlet"	74	7
"Force"	74	7
Cracked Wheat	74	7
"Pettijohn's Breakfast Food"	74	7
"Malt Breakfast Food"	75	7
"Cream of Wheat"	75	7
"Triscuit"	75	7
"Grape-Nuts"	75	7
"Zest"	75	7
Farina	75	7
"Wheatena"	76	7
"Mapl-Flake"	76	7
"Shredded Wheat Biscuit"	76	7
Hominy	78	7
Puffed rice	80	7
Toasted corn flakes	81	7

TABLE V.—AVERAGE CARBOHYDRATE CONTENT OF FOODS.—*Continued.*

Food.	Per cent. Carbohydrates.	Weight of food containing same amount of carbohydrates as 10 gms. wheat bread.
		gms.
Infant Foods.		
"Allenburys' Milk Food No. 1"	66	8
"Allenburys' Milk Food No. 2"	68	8
Malted milk	71	7
"Wampole's Milk Food"	73	7
"Imperial Granum"	76	7
"Benger's Food for Infants"	77	7
"Wells, Richardson & Co.'s Cereal Milk"	78	7
"Nestle's Food"	79	7
"Mellins' Infant Food"	81	7
"Wells, Richardson & Co.'s Lactated Food"	81	7
"Ridge's Food"	81	7
"Carnrick's Lacto-Preparata"	81	7
"Carnrick's Soluble Food"	81	7
"Sunbright's California Baby Food"	81	7
"Allenbury's Malted Food No. 3"	83	6
"Taroena"	84	6
"Fessenden's Food"	86	6
"Eskay's Albumenized Food"	88	6
"Just's Dietetic Cereal Food"	92	6
"Peptogenic Milk Powder	95	6
Breads, Crackers and Pastry.		
Peanut bread	20	27
Acorn bread	27	20
Cassava bread	27	20
Peanut zwieback	28	19
Whole rye bread	35	15
Mince pie	38	14
(range 30–44)		(18–12)
Apple pie	43	12
Corn bread	46	12
Brown bread	47	11
Whole wheat bread	49	11
Graham bread	51	10
Doughnuts	52	10
(range 45–63)		(12–8)
Rye bread	53	10
Wheat bread	53	10
Rolls	56	9
Toasted bread	61	9
Cake (except fruit cake)	63	8
(range 53–78)		(10–7)
Jumbles	63	8
(range 52–71)		(10–7)
Alfalfa bread	64	8
Fruit cake	64	8
Macaroons	64	8
(range 57–70)		(9–8)
Crackers	71	7
(range 63–81)		(8–6)

Food.	Per cent. Carbohydrates.	Weight of food containing same amount of carbohydrates as 10 gms. wheat bread.
Breads, Crackers, and Pastry. *(cont.)*		
Vanilla wafers	71	7
(range 65–77)		(8–7)
Cookies	73	7
(range 61–82)		(9–6)
Zwieback	74	7
Ginger snaps	75	7
(range 71–80)		
Ice cream cones	77	7
Syrups, Sugars, etc.		
Molasses	69	8
(range 59–77)		(9–7)
Syrup	70	8
(range 63–73)		(8–7)
Maple syrup	71	7
(range 46–82)		(12–6)
Honey	78	7
(range 68–87)		(8–6)
Maple sugar	83	6
(range 74–95)		(7–6)
Brown sugar	95	6
Candy	96	6
Granulated or powdered sugar	100	5
Fresh Vegetables.		
Lettuce	2.2	241
Cucumbers	2.3	230
Spinach	2.3	230
Asparagus	2.4	221
Rhubarb	2.5	212
Endive	2.6	204
Vegetable marrow	2.6	204
Sorrel	3.0	177
Sauerkraut	3.0	177
Fresh Vegetables. *(cont.)*		
Beet greens, cooked	3.2	166
Celery	3.3	161
Tomatoes	3.3	161
Brussels sprouts	3.4	156
Watercress	3.7	143
Sea-kale	3.8	139
Okra	4.0	133
Cauliflower	4.3	123
Eggplant	4.3	123
Cabbage	4.7	113
(range 3–6.5)		(177–82)
Radishes	5	106
(range 2.7–7.5)		(196–71)
Leeks	6	88
Mushrooms	6	88
(range 2–18)		(265–30)
Pumpkins	6	88
(range 3–14)		(177–38)
String beans	6	88
(range 3.9–10)		(136–53)
Turnips	6	88
(range 2.3–18)		(230–30)
Kohl-rabi	7	76
(range 3.5–14)		(151–38)
Oyster plant	7	76
Rutabagas	7	76
(range 3–12)		(177–44)
Truffles	7	76
Squash	8	66
(range 3–15)		(177–35)
Beets	9	59
(range 6–10)		(88–53)
Carrots	9	59
(range 5.9–11.5)		(90–46)

TABLE V.—AVERAGE CARBOHYDRATE CONTENT OF FOODS.—*Continued.*

Food.	Per cent. Carbohydrates.	Weight of food containing same amount of carbohydrates as 10 gms. wheat bread.
		gms.
Fresh Vegetables. *(cont.)*		
Onions	9	56
(range 4–14)		(133–38)
Parsnips	11	48
(range 6–14)		(88–38)
Chicory	15	35
Peas	15	35
Artichokes	16	33
Yams	16	33
Corn	19	27
Potatoes	20	27
(range 13–27)		(41–20)
Lima beans	22	24
Sweet potatoes	26	20
(range 16.5–44.5)		(32–12)
Soy beans	28	19
(range 19.3 to 39.0)		(27–14)
Dried Vegetables.		
*Beans	55	10
Cow peas	55	10
Peas	58	9
Lentils	59	9
Lima beans	66	8
Canned Vegetables		
Beans, haricots verts	2.0	265
Asparagus	2.3	230
(range 1.6–3.3)		(331–161)
Brussels sprouts	2.9	183
Okra	2.9	183
Tomatoes	3.0	177
(range 1.0–4.5)		(530–118)
String beans	3.3	161
(range 1.5–4.5)		(353–118)
Macedoine, mixed vegetables	3.9	136
(range 1.9–5.0)		(279–106)
Artichokes	4.4	120
(range 3.2–6.1)		(166–87)
Pumpkins	6	88
(range 3.6–7.3)		(147–73)
Peas	10	53
(range 4.3–17.2)		(123–31)
Squash	10	53
(range 3.6–12.8)		(147–41)
Beans, haricots flageolets	11	48
(range 9.8–12.4)		(54–43)
Lima beans	13	41
(range 9.6–16.5)		(55–32)
Baked beans	17	31
Red kidney beans	17	31

Food.	Per cent. Carbohydrates.	Weight of food containing same amount of carbohydrates as 10 gms. wheat bread.
		gms.
Canned Vegetables. *(cont.)*		
Corn	18	29
(range 11.7–25.1)		(45–21)
Succotash	18	29
(range 13.9–21.3)		(38–25)
Pickles and Condiments.		
Distilled vinegar	0	....
Cider vinegar	0.25	2120
Cucumber pickles	2.7	196
Olives, ripe	4.3	123
Capers	5	106
Prepared mustard	5	106
" " + cereal	7	76
(range 4–15)		(133–35)
Ketchup	10	53
(range 3–26)		(177–20)
Spiced salad vinegar	10	53
Horseradish	11	48
Olives, green	12	44
Chili sauce	20	27
(range 14–28)		(38–19)
Spiced pickles	21	25
Fruits and Berries.		
Strawberries	5	106
Grape fruit	6	88
Alligator pear	7	76
Lemons	7	76
Watermelons	7	76
Blackberries	8	66
Cranberries	8	66
Peaches	9	59
Muskmelons	10	53
Raspberries	10	53
Fruits and Berries. *(cont.)*		
Whortleberries	10	53
Apples	11	48
Pears	11	48
Apricots	12	44
Gooseberries	12	44
Mulberries	12	44
Pineapples	12	44
Currants	13	41
Oranges	13	41
Mangoes	13	41
Grapes	15	35
Nectarines	15	35
Cherries	17	31
Figs	17	31
Huckleberries	17	31
Plums	17	31
Pomegranates	17	31
Prunes	19	28
Bananas	20	27
Persimmons	32	17
Dates	54	10
Dried Fruits.		
Apricots	63	8
Apples	66	8
Peaches	70	7
Pears	73	7
Prunes	73	7
Currants	74	7
Figs	74	7
Raisins	76	7
Citron	78	7
Dates	78	7
Raspberries	80	7

TABLE V.—AVERAGE CARBOHYDRATE CONTENT OF FOODS.—*Continued.*

Food.	Per cent. Carbohydrates.	Weight of food containing same amount of carbohydrates as 10 gms. wheat bread.
		gms.
Canned Fruits.		
Peaches	11	48
Blueberries	13	41
Pineapples	15	35
(range 6–25)		(88–21)
Apricots	17	31
Pears	18	29
Cherries	21	25
Crab apples	54	10
Blackberries	56	9
Jams, Preserves and Marmalade.		
Apple butter	47	11
Gooseberry	55	10
Plum	57	9
Peach	59	9
Currant	60	9
Strawberry	61	9
Tomato	61	9
Raspberry	62	9
Apricot	64	8
Pineapple	65	8
Orange	66	8
Quince	66	8
Grape	67	8
Grape fruit	68	8
Blackberry	71	7
Cherry	71	7
Jellies.		
Cranberry	55	10
Orange	62	9
Grape	63	8
Apple	64	8
Barberry	64	8
Currant	64	8
Strawberry	64	8
Quince	65	8
Raspberry	65	8
Plum	67	8
Peach	68	8
Pineapple	69	8
Cherry	71	7
Guava	82	6
Fruit Juices.		
Strawberry	4	133
Lime	7	76
Blackberry	8	66
Currant	9	59
Raspberry	9	59
Peach	10	53
Quince	10	53
Apple	11	48
Plum	11	48
Orange	13	41
Pineapple	13	41
Cherry	14	38
Huckleberry	14	38
Grape, (commercial)	18	29

Nuts.		
Butternuts	3.5	151
Java almond	4.1	129
Pignolias	6	88
Brazil nuts	9	59
Paradise nuts	10	53
Walnuts, black	10	53
Hickory nuts	11	48
Pecans	11	48
Filberts	12	44
Beechnuts	13	41
Walnuts, soft shell	15	35
Almonds	16	33
Pistachios	16	33
Peanut butter	17	31
Pine nuts, other than pignolias	17	31
(range 8–26)		(66–20)
Peanuts	22	24
(range 13–37)		(41–14)
Cocoanuts	25	21
Prepared cocoanut	32	17
Chestnuts, fresh	40	13
Acorns, fresh	50	11
Acorns, dried	68	8
Chestnuts, dried	72	7
Lichi nuts	78	7
Soups.		
Bouillon, consommé and julienne	Trace.	....
Beef	1.1	482
Chicken	1.8	294
Mock turtle	2.8	189
Green turtle	3.9	136
Oxtail	4.3	123
Chicken gumbo	4.7	113
Cream of celery	5	106
Cream of asparagus	6	88
Soups. *(cont.)*		
Meat stew	6	88
Mulligatawny	6	88
Cream of pea	6	88
Clam chowder	7	76
Cream of corn	8	66
Pea	8	66
(range 5–11)		(106–48)
Tomato	9	59
(range 5–14)		(106–38)
Bean	9	59
Non-alcoholic Beverages.		
Tea (0.5 oz. to 1 pt. water)	0.6	883
Coffee (1 oz. to 1 pt. water)	0.7	757
Cocoa (0.5 oz. to 1 pt. water)	1.1	482
Cider	4.5	118
(range 0–13.5)		(×–39)
Cocoa (0.5 oz. to 1 pt. milk)	6	88
Cream or lemon soda	7	76
Sarsaparilla	7	76
Birch beer	8	66
Ginger ale	8	66
Root beer	9	59
Miscellaneous.		
Plain chocolate	25	21
Cocoa nibs, roasted	28	19
Baking powder	32	17
(range 0–51.5)		(×–10)
Mince meat, home-made	32	17
Cocoa	38	14
Milk chocolate	51	10
Milk cocoa	52	10
Custard powders	59	9
Mince meat, compressed	60	9
Sweet chocolate	67	8
Jelly powders	89	6
Ice cream powders (Jell-O)	96	6

TABLE V.—AVERAGE CARBOHYDRATE CONTENT OF FOODS.—*Concluded.*

	Gms. reducing sugars per 100cc.	Volume supplying same amount of carbohydrates as 10 gms. wheat bread.
Dry Wines.		liters
California, red, Bordeaux or Claret (range .04– .63)	0.16	3.31 (13.25– .84)
" " Burgundy (range .03– .42)	0.15	3.53 (17.67–1.26)
" " Zinfandel (range .03– .35)	0.15	3.53 (17.67–1.51)
" white, Rhine (range .06– .63)	0.15	3.53 (8.83– .84)
" " Burgundy (range .10– .45)	0.23	2.31 (5.30–1.18)
" " Sauterne (range .07– 3.57)	0.64	.83 (7.57– .15)
French, red (range .11– .84)	0.23	2.31 (4.82– .63)
" white (range .65– 1.02)	0.84	.63 (.82– .52)
German, white (range .09– 1.96)	0.20	2.65 (5.89– .27)
Hungarian, white (range .04– .86)	0.25	2.12 (13.25– .62)
Italian, red (range .02– 2.70)	0.16	3.31 (26.50– .20)
" white (range .02– 2.15)	0.19	2.79 (26.50– .25)
North Carolina (range .08– 1.75)	0.49	1.08 (6.63– .30)
Ohio (range .07– 1.54)	0.31	1.71 (7.57– .35)
Portugese, red (range .01– 1.21)	0.16	3.31 (53.00– .44)
" white (range .10– 1.19)	0.32	1.63 (5.30– .45)
Rhine, red (range .06– .27)	0.13	4.08 (8.83–1.96)
" white (range .02– 1.02)	0.18	2.94 (26.50– .52)
Spanish, red (range .19– .54)	0.35	1.51 (2.79– .98)
" white (range .27– .62)	0.42	1.24 (1.96– .86)
Sparkling, French and German (range .13– 1.95)	0.53	1.00 (4.08– .27)
Swiss, red (range .10– .27)	0.13	4.08 (5.30–1.96)
" white (range .08– .38)	0.10	5.30 (6.63–1.40)
Virginia (range .06– 1.23)	0.16	3.31 (8.83– .43)
Sweet Wines.		
California Port (range .23–13.56)	4.76	0.11 (2.31– .04)
" Madeira and Sherry (range .12–17.21)	5.38	0.10 (4.42– .03)
French (range .73–12.40)	5.38	0.10 (.73– .04)
German (range .64–12.13)	4.60	0.12 (.83– .04)
Madeira (range 2.48– 3.88)	2.95	0.18 (.21– .14)
Malaga (range 12.50–25.20)	18.32	0.03 (.04– .02)
Marsala (range 2.67– 8.24)	3.25	0.16 (.20– .06)
Port (range 3.76– 8.17)	6.04	0.09 (.14– .06)
Rhine (range 1.82–10.69)	6.35	0.08 (.29– .05)
Sherry (range .52– 4.80)	2.54	0.21 (1.02– .11)
Sparkling, American (range 6.51–12.02)	8.28	0.06 (.08– .04)
" French and German (range 8.00–18.50)	10.92	0.05 (.07– .03)
Tokay, true (range 1.86–20.50)	12.62	0.04 (.28– .03)
" commercial (range 2.70–40.70)	19.80	0.03 (.20– .01)
Vermouth (range 3.47–14.39)	9.46	0.06 (.15– .04)
Other Alcoholic Beverages.	%*	gms.*
Brandy, Gin, Rum and Whiskey	0	—
Absinth	trace	—
Angostura	4.2	126
Beer	4.5	118
Weiss bier	4.6	115
Ale	5.1	104
Porter or Stout	7.0	76
Malt extract, commercial	10.6	50
Curaçao	25.5	21
Crême de Menthe	27.7	19
Kümmel	31.2	17
Benedictine	32.6	16
Anisette	34.4	15
Chartreuse	34.4	15
Maraschino	52.3	10
Malt extract, true	71.3	7

* See heading on previous page.

THE LACTOSE CONTENT OF CHEESE.

Lactose is carried into fresh curd in amounts about proportional to the water or whey content. This means that a fresh curd, containing 50 per cent. of water, and made from a milk containing 5 per cent. of lactose, will contain about 2.5 per cent. of lactose. Cheeses undergoing no ripening process, such as cottage, cream, and most of the Neufchatel, contain lactose in amounts ranging from about 2.5 to a fraction of one per cent. In all the cheeses examined which had been submitted to a long ripening process, the milk sugar had entirely disappeared.

Table Showing Lactose Content of Cheese.

Variety	Brand	Remarks	Mgm. lactose in 10 gms. cheese I	Mgm. lactose in 10 gms. cheese II	Per cent. Dry Matter in cheese
Cottage	Storrs Dairy	1 day old	252.9	....	36.28
Cream	Speedwell Farms	fresh	170.7	171.5	53.90
"	Storrs Dairy	1 day old	177.0	....	52.63
"	same cheese	8 days old	162.1	156.9	....
"	" "	12 days old	106.9	104.6	....
Neufchatel	Speedwell Farms	fresh	221.1	222.3	43.86
"	International	slimy on surface	82.8	81.9	42.90
Münster	.....	.....	0.0	0.0	54.74
Swiss	Imported	.....	0.0	0.0	70.08
Roquefort	Louis Rigal	.....	0.0	0.0	58.53
Camembert	Delicieux	.....	0.0	0.0	41.61
Edam	.....	.....	0.0	0.0	69.79
Cheddar	American	mild	0.0	0.0	66.83
"	"	strong	0.0	0.0	70.31

Method Employed for Sugar Estimation.

To estimate lactose, exactly 10 grams of cheese were weighed into a small beaker, rubbed to a smooth cream with hot water in a small mortar, and rinsed into a 155 cc. graduated flask with ground glass stopper. 20 cc. of a saturated solution of sodium fluoride were added to remove the dissolved lime salts (Scheibe's modification). The flask was filled to the 155 cc. mark, and set aside with frequent shaking until the contents came to room temperature. The flask was then again filled to the 155 cc. mark, shaken and contents filtered. 100 cc. of the filtrate were added to boiling Fehling's solution, the volume of liquid made up to 300 cc., brought to the boiling point and boiled for six minutes. The cuprous oxide was filtered through asbestos, dried at 100° C., heated to redness in a muffle furnace with door-stop removed, and weighed as cupric oxide. The weight of oxide, multiplied by $\frac{3}{2}$, was calculated to copper and the lactose equivalent found from the Soxhlet-Wein tables.

The percentage of dry matter in the cheese was determined from the loss of weight during 10 hours heating in a boiling water oven, so that the percentage of lactose can be calculated on that basis if desired.

PART II.

Report on Commercial Fertilizers, 1913.

By E. H. Jenkins, *Director,* and John Phillips Street, *Chemist in charge of the Analytical Laboratory.*

During 1913 forty-three individuals and firms have entered for sale in this state four hundred and twenty-five brands of fertilizers, classified as follows:

Nitrogenous superphosphates	308
Bone manures and "bone and potash"	26
Fish, tankage, castor pomace and chemicals	91
Total	425

During the spring months Mr. V. L. Churchill, the sampling agent, visited one hundred and six towns and villages of Connecticut for the purpose and gathered seven hundred and seven samples of commercial fertilizers.

These represented all the brands registered with exception of the following: *American Agricultural Chemical Co.'s* H. G. Bone; *Bradley's* H. G. Tobacco Manure, Complete Corn and Grain, Overland Fertilizer; *Williams & Clark's* Root Manure; *East India Co.'s* Ex. Grade Tobacco Manure; *Armour Fertilizer Works'* Connecticut Valley Tobacco Starter,* Fruit and Root Crop Special*; *Central Phosphate Co.'s* Rock Phosphate; *E. D. Chittenden Co.'s* Potato and Grain; *Coe-Mortimer Co.'s* H. G. Sulphate of Potash, Double Strength Top Dressing; *Consumers' Fertilizer Co.'s* Mak-Gro. Odorless Plant Food,* Early Crop Odorless Fertilizer*; *Essex Fertilizer Co.'s* Special Tobacco Manure; *Ernest L. James'* Ground Bone*; *Lister Agl. Chem. Works'* Special 10 per cent. Potato Fertilizer,* Special Grass Mixture*; *Munroe & Son's* Wood Ashes; *New England Fertilizer Co.'s* Tankage; *Niantic Men. Oil & Guano Co.'s* Acid. Fish Guano; *Parmenter and Polsey's* P. & P. Potato Fertilizer;

* A sample sent by the manufacturer was analyzed.

Wilcox Fertilizer Co.'s H. G. Tankage; *Worcester Rendering Co.'s* Corn and Grain,* Potato Fertilizer.*

Large numbers of samples have also been sent for analysis by purchasers, making the total number analyzed as follows:

1. *Containing nitrogen as the chief active ingredient:*	
Nitrate of soda and nitrate of lime	15
Dried blood	2
Cotton seed meal	315
Castor pomace	8
Other nitrogenous matter	1
2. *Containing phosphoric acid as the chief active ingredient:*	
Ground phosphate rock, bone ash and calcined phosphate	8
Thomas slag or basic phosphate	12
Precipitated bone	7
Dissolved rock phosphate or acid phosphate	19
3. *Containing potash as the chief active ingredient:*	
High grade sulphate of potash	8
Double sulphate of potash and magnesia	2
Muriate of potash	16
Kainit	5
Vegetable potash and cotton hull and cotton boll ashes	5
4. *Raw materials chiefly valuable for nitrogen and phosphoric acid:*	
Fish manures	11
Slaughter house tankage	9
Garbage tankage	2
Bone manures	35
5. *Mixed fertilizers:*	
Acid phosphate and potash	2
Tobacco fertilizers containing only phosphates and potash	5
Nitrogenous superphosphates	347
Home mixtures	6
6. *Miscellaneous fertilizers, lime, ashes, etc.*	54
Total	894

EXPLANATIONS CONCERNING THE ANALYSES.

The analyses given on the following pages show the percentage quantities of nitrogen, phosphoric acid and potash present in the samples, and, in many cases, their solubilities which give some indication as to their probable availability to crops.

Each analysis is the average of two closely agreeing determinations made independently by two expert analysts following the methods of the American Association of Official Agricultural Chemists.

* A sample sent by the manufacturer was analyzed.

Samples are numbered consecutively as received.

The prices given are those quoted by the sellers of the goods to our agent as their *cash ton* prices. In some cases quite different prices are charged by dealers for the same goods. *These quotations, therefore, should be regarded only as a general guide,* not at all as a basis for individual purchases. This matter is further explained on page 137.

When materials contain either nitrogen, phosphoric acid, or potash as the single fertilizer ingredient, the cost per pound of that ingredient is easily calculated from the ton price and the analysis. Thus, if a sample of muriate of potash contains 50.2 per cent. of potash, which is 1004 pounds per ton, and costs $42.50 per ton, actual potash costs 4250 ÷ 1004, or 4.2 cents per pound.

Fertilizers which are mixtures of various raw materials and contain two or more of the fertilizer ingredients above named are reported with an attached valuation.

VALUATION OF FERTILIZERS.

There is so much misunderstanding as to the meaning of the term valuation as it is used in our fertilizer reports that particular attention is called to the following explanations:

The valuation of a fertilizer is the result of calculating the retail cash cost at freight centers of an amount of nitrogen, phosphoric acid and potash in high grade materials equal to the amount contained in one ton of the fertilizer. It is a valuation of only one factor which makes up the cost of a fertilizer, namely, the market cost of the three kinds of plant food in it. *Valuation no more shows the fair retail price of a fertilizer than quotations of steel billets can show the fair price for small amounts of structural steel of a specified shape.* If, however, the prices of steel remain fairly uniform, a comparison of these quotations with the rates charged by different companies *in open competition* for the finished product is a help, though not a perfect guide, to the buyer in studying the bids of different manufacturers.

To illustrate: Of two fertilizers, A and B, let us assume that A contains 3.5 per cent. of organic nitrogen, 4.5 per cent. of

water-soluble, 3 per cent. of citrate-soluble and 1 per cent. of insoluble phosphoric acid and 6 per cent. of potash, and sells at retail for $35.00. B contains 2.0 per cent. organic nitrogen, 3.5 per cent. of water-soluble, 3 per cent. citrate-soluble and 4 per cent. insoluble phosphoric acid and 8 per cent. of potash, and retails for $32.00.

We assume that both are compounded of raw materials of good quality and ready availability to crops, are sold by well-known and reputable manufacturers, and the prices are the best obtainable by the buyer for these two brands. The question is, which is the better purchase: 70 pounds of nitrogen, 150 pounds of soluble phosphoric acid, 20 pounds of insoluble phosphoric acid and 120 pounds of potash at $35.00; or 40 pounds of nitrogen, 130 pounds of soluble phosphoric acid, 80 pounds of insoluble phosphoric acid and 160 pounds of potash for $32.00. Obviously the first thing to do is to get the approximate value of all these separate ingredients in one figure so as to have some common basis of comparison. In a ton of A are 70 pounds of organic nitrogen, which can be bought for about 19 cents a pound; 150 pounds of soluble phosphoric acid, which can be bought for 4½ cents per pound in form of acid phosphate; 20 pounds of insoluble phosphoric acid, for which we may allow 2 cents per pound; 120 pounds of potash, which can be bought in form of muriate for 4¼ cents per pound.

Calculating as follows,

$$\begin{aligned} 70 \times 19 &= 13.30 \\ 150 \times 4\tfrac{1}{2} &= 6.75 \\ 20 \times 2 &= .40 \\ 120 \times 4\tfrac{1}{4} &= 5.10 \\ \hline & 25.55 \end{aligned}$$

it appears that the plant food in fertilizer A can be bought, at freight centers, in raw materials, for about $25.55, and a similar calculation shows that the corresponding figure for fertilizer B is $21.85. These two figures are the "valuations" of the two fertilizers. Each gives a single figure to represent the *trade value of the actual plant food* in each of these two fertilizers, A and B, but neither shows the fair market price of the goods.

Valuations do not, of course, show the agricultural value of the plant food in fertilizers. Nor do they show the cost to the manufacturer of the stock which he used in the mixture.

His profit comes in part from skill and judgment in buying the plant food on the most favorable terms. The valuation shows simply what it would cost the farmer to buy the same amount of plant food as the mixed fertilizer contains, at freight centers, unmixed, in raw materials of good quality.

But the cost of the plant food contained in a mixed fertilizer is but one item, though the largest single item, in its cost. Other items are grinding and mixing, bags, freight, agents' commissions, as well as other items, overhead factory charges, losses and profits.

It cannot be stated too emphatically that the valuation does not and cannot show the fair retail price of fertilizers, but only one item—the largest item to be sure—of the cost. In fact one must add ten dollars or more to the valuation to approximate what would be, in most cases, a fair selling price.

Fertilizer A costs $35.00, and the plant food in it has a valuation of $25.55. Fertilizer B costs $32, and its plant food a valuation of $21.85. The charges for converting the raw materials into a uniform mixture and delivering it are $9.45 in A and $10.15 in B; or, in A about 37 per cent. of the valuation of the plant food in it, and in B 46.4 per cent.—figures which we call percentage difference between cost and valuation. Assuming the substantial accuracy of the costs of plant food and that the nitrogen, phosphoric acid and potash are equally valuable in both brands, it is clear that A is a better purchase than B. For while the difference between cost and valuation (i. e., the cost of manufacture and selling) is only 70 cents more in B than in A, in the latter it is about 46 per cent. of the value of the raw material, and in the former only about 37 per cent.

To recapitulate:

1. Valuation represents one item, and the largest item, in the cost of mixed commercial fertilizers. It is a valuation of only one factor which makes up the market price, namely, the average market cost of the untreated raw materials of high quality which enter into its composition.

2. It affords a basis for estimating, approximately, the fair selling price.

3. It affords a basis of comparing fertilizers which differ considerably in composition and price.

4. It does not represent the fair selling price.

5. It does not show the agricultural value of the ingredients in it.

The trade-values used in the calculations made in this report are only approximately correct, for market prices constantly fluctuate, but they are accurate enough to be used to compare fertilizers which are on sale at the same time.

Trade-Values of Fertilizer Elements for 1913.

The average trade-values or retail costs in market, per pound, of the ordinarily occurring forms of nitrogen, phosphoric acid and potash in raw materials and chemicals, as found in New England, New York and New Jersey markets during 1912 and adopted at a conference of representatives of the New England, New York and New Jersey Stations in March, 1913, are as follows:

	Cents per pound.
Nitrogen in nitrates and ammonia salts	18½
Nitrogen, organic, in fine dry fish, blood and meat	20
in cotton seed meal and castor pomace	20
in fine* bone and tankage and in mixed fertilizers	19
in coarse* bone and tankage	15
Phosphoric acid, water-soluble	4½
citrate-soluble† and in fine bone and tankage, cotton seed meal and castor pomace	4
in coarse bone and tankage and ashes	3½
insoluble in water or citrate solution in mixed fertilizers	2
Potash in high grade sulphate and mixtures free from muriates	5¼
cotton seed meal and castor pomace	5
muriate	4¼

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

*In this report, "fine," as applied to bone and tankage, signifies smaller than $\frac{1}{60}$ inch; "coarse," larger than $\frac{1}{60}$ inch.

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

Method of Valuation of Bone and Tankage.

To obtain the valuation of ground bone or tankage the sample is sifted into two grades, that finer than $\frac{1}{60}$ inch, "fine," and that coarser than $\frac{1}{60}$ inch, "coarse."

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

Method of Valuation of Mixed Fertilizers.

The organic nitrogen in mixed fertilizers is reckoned at 19 cents per pound, nitrogen of nitrates, and ammonia salts and phosphoric acid in its three forms of solubility, at the prices given above. Potash is rated at 4¼ cents, if sufficient chlorine is present in the fertilizer to combine with it to make muriate. If there is more potash present than will combine with the chlorine, then this excess of potash is reckoned at 5¼ cents per pound, except in certain special cases, to be noted later, where carbonate of potash has been used in the mixture.

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

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

I. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN.

NITRATE OF SODA OR SODIUM NITRATE.

As offered in the Connecticut market this year, nitrate of soda contains about 15.4 per cent. of nitrogen, equivalent to 93.5 per cent. of pure sodium nitrate. The other usual con-

stituents are moisture and small quantities of common salt and Glauber's salt (sodium sulphate).

2552. Sold by E. Manchester & Sons, Winsted. Sent by W. A. Simpson, Wallingford.

2508. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

2501. Sold by Bowker Fertilizer Co., New York. Stock of J. P. Barstow & Co., Norwich.

2635. Sold by Lowell Fertilizer Co., Boston. Stock of G. C. Bradley, New Haven.

2634. Sold by Nitrate Agencies Co., New York. Stock of Apothecaries Hall Co., Waterbury, $58.00, and C. R. Treat, Orange, $55.00.

2191. Sold by E. Manchester & Sons, Winsted. Sent by John Gotta, Portland.

2506. Sold by Coe-Mortimer Co., New York. Stock of L. A. Gowdy, Somerville.

2715. Sold by American Agricultural Chemical Co., New York. Stock of F. T. Blish Hdw. Co., South Manchester.

2496. Sold by Armour Fertilizer Works, Chrome, N. J. Stock of Geo. S. Phelps & Co., Thompsonville.

2707. Sold by Wilcox Fertilizer Co., Mystic. Sampled at factory.

2018. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Stock of H. D. Johnson, Highwood.

2020. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Stock of Connecticut School for Boys, Meriden.

2924 and **2925.** Sold by Lowell Fertilizer Co., Boston. Stock of A. N. Farnham, Westville. These two lots represented damaged goods and were sold on terms very favorable to the buyer.

ANALYSES OF NITRATE OF SODA.

Station No.	2552	2508	2501	2635	2634	2191	2506
Percentage amounts of							
Nitrogen guaranteed	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Nitrogen found	15.60	15.88	15.72	15.20	15.12	15.00	15.80
Equiv. to sodium nitrate	94.72	96.42	95.45	92.29	91.80	91.07	95.93
Cost per ton	$54.87	56.00	58.00	56.00	56.50	56.40	60.00
Nitrogen costs cents per pound	**17.6**	**17.8**	**18.4**	**18.4**	**18.7**	**18.8**	**19.0**

Station No.	2715	2496	2707	2018	2020	2924	2925
Percentage amounts of							
Nitrogen guaranteed	15.00	14.81	15.00	15.00	15.00	.....	.....
Nitrogen found	15.36	15.72	15.18	15.48	15.44	14.82*	14.92*
Equiv. to sodium nitrate	93.26	95.45	92.17	93.99	93.74	89.98	90.59
Cost per ton	$60.00	62.00	60.00	....	....	....	....
Nitrogen costs cents per pound	**19.5**	**19.7**	**19.8**	....	....	....	....

The cost of nitrogen in this form has ranged from 17.6 to 19.8 cents per pound, the average being 18.8 cents. This was the average price in small lots at retail. It was bought in car lots or mixed car lots for about 17.3 cents per pound. The cost of nitrate of soda is of course subject to sudden changes so that the same firm may sell for several dollars per ton more or less in one month than in another.

DRIED BLOOD.

2026. Sold by Pittsburg Provision and Packing Co., Pittsburg. Stock of H. D. Johnson, Highwood. Contained 11.68 per cent. nitrogen, equivalent to 14.17 per cent. ammonia.

2638. Sold by American Agricultural Chemical Co., New York. Stock of E. E. Burwell, New Haven; guaranty, 9.87 per cent. nitrogen. Contained 9.59 per cent. nitrogen, equivalent to 11.65 per cent. ammonia.

NITRATE OF LIME.

1086. Sent by The Everett B. Clark Co., Milford. It contained 11.95 per cent. nitrogen, all in the form of nitrate and 25.20 per cent. lime.

All but 2.38 per cent. of the sample was water-soluble and all but 0.37 per cent. was soluble in acid. The nitrogen in this material is doubtless as quickly available as that of nitrate of soda and in addition to the nitrogen it supplies lime. The great objection to its use as a fertilizer is that it absorbs water very rapidly and is therefore difficult to handle. A small sample exposed to the damp air of the laboratory for one day absorbed 23.4 per cent. of moisture.

COTTON SEED MEAL.

(ANALYSES ON PAGES 108-112.)

The Station has examined 315 samples of cotton seed meal which was used as a fertilizer this year. These represented some 6,970 tons and a cash outlay by Connecticut farmers of about

* Sold at a reduced price because of lower quality.

$239,000. Each analysis has been reported to the dealer and to the purchasers from each car so far as they were known to us. Buyers should in every case call for the Station analysis, which is usually in the dealers' hands, and claim a rebate on all lots which do not come up to guaranty. Of these 315 analyses, 174 are not here reported. All of them practically met the sellers' guaranties, and they are omitted because they are no longer of general interest and value and the space they would fill is much needed for matters of present importance.

The analyses here reported are of 132 samples which did not meet their guaranties and 9 on which no guaranties were reported to us.

Of the 315 samples the average per cent. of nitrogen is 6.89 (extremes 5.48 and 8.0), the cost per ton is $33.00 (extremes $30.25 and $38.00) and the cost per pound of nitrogen 20.7 cents (extremes 17.8 and 24.8 cents).

The cost per pound of nitrogen is figured by allowing $4.42 for the potash and phosphoric acid in a ton of meal, subtracting this from the cost and dividing the remainder by the number of pounds of nitrogen in the ton.

The average percentage of nitrogen was 0.10 higher and the cost per pound of nitrogen more than a cent lower in the samples which met their guaranties.

Those who wish to have samples of meal examined at the Station must bear in mind that proper sampling is no less important than accurate analysis, and that careless sampling makes the analysis worse than useless. The seller will not and should not accept an analysis, unless he has proof that the sample was properly drawn. At least twenty bags should be opened in every car lot and about a pint taken from each, by thrusting the hand or a cup down into the meal. These samples should then be mixed carefully, and two samples drawn from the mixture, one to be sent to the Station and the other held for the manufacturer in case it is called for. The one who samples should be prepared to make affidavit as to the date, number of car, number of bags opened, etc. The sample sent to the Station should be fully described on a blank, which will be furnished on application.

This information should be given to the Station before the analysis is undertaken, for the Station has no right to do work with state funds unless it has some assurance that the work, when done, will be of value to the public. Frequently we receive

samples with no marks to identify them, broken packages from which a part or all the sample has run out over the mail matter, samples quite too small to be representative, and samples not of stock delivered in the state but of what some shipper *proposes* to supply. These, of course, are worthless, but they are not positively harmful, whereas a sample of meal on sale in the state, which is apparently all right, but has not been carefully drawn, may do great injustice either to buyer or seller.

CASTOR POMACE.

Castor pomace, a residue from the manufacture of castor oil, and extremely poisonous to stock, which will eat it greedily if given the chance, is used to some extent as a fertilizer for tobacco.

2630. Sold by Olds and Whipple, Hartford. Sent by J. E. Phelps, Suffield.

2705. Sold by Rogers Manufacturing Co., Rockfall. Sampled at factory.

2492. Sold by F. S. Bidwell & Co., Windsor Locks. Sent by F. B. Hatheway, Suffield.

2697 and **2499.** Sold by Baker Castor Oil Co., New York. Stock of F. S. Bidwell & Co., Windsor Locks, and of Spencer Bros., Suffield.

2636. Grey Pomace. Sold by Olds and Whipple, Hartford. Sampled at factory.

2456. Sold by H. J. Baker Bros., New York. Sent by A. E. Holcomb, North Granby.

2637. Sold by American Agricultural Chemical Co., New York. Stock of G. A. Williams, East Hartford.

ANALYSES.

Station No.	2630	2705	2492	2697	2499	2636	2456	2637
Percentage amounts of								
Nitrogen guaranteed	5.50	4.92	4.25	4.50	4.50	5.00	....	4.50
Nitrogen found	5.74	4.90	4.75	4.58	4.34	4.42	4.36	4.26
Cost per ton .....$	25.00	25.00	25.00	25.00	24.00	25.00	25.00	....
Nitrogen costs cents per pound	**19.5**	**22.9**	**23.6**	**24.4**	**24.7**	**25.3**	**25.7**	....

The Baker Castor Oil Co. stated that our analyses showed much less nitrogen than found in other samples, the lowest recently reported being 4.70. In the three samples taken from different stocks in Connecticut we found 4.58, 4.34, 4.36 per cent.

Analyses of Cotton Seed Meals Without a Guaranty or Below Their Guaranty.

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. of Nitrogen.		Cost per ton.	Nitrogen costs cents per pound.
			Found.	Guaranteed.		
	Alamo Oil and Refining Co.,		%	%		
2632	San Antonio, Tex.	G. H. Harmon, Suffield	7.68	....	$35.00	19.9
2457	**F. W. Brode and Co.**	A. E. Holcomb	6.74	....	33.50	21.6
2091	6232	Amos D. Bridge's Sons	6.39	6.50	31.75	21.4
	Humphreys, Godwin and Co.					
1910	150407	Olds and Whipple	8.00	8.14	38.00	21.0
2108	36796	" "	7.96	8.14	37.50	20.8
2176	4281	" "	7.95	8.14	38.00	21.1
2116	49309	" "	7.88	8.14	37.50	21.0
1977	7929	" "	7.84	8.11	38.00	21.4
1979	130355	" "	7.83	7.96	37.50	21.1
2082	121689	" "	7.83	8.11	37.50	21.1
1978	33895	" "	7.81	7.95	37.50	21.2
2110	30487	" "	7.80	8.06	37.50	21.2
2113	4381	" "	7.79	8.14	37.50	21.2
2006	87692	" "	7.77	7.94	38.00	21.6
1913	62091	" "	7.76	8.05	38.00	21.6
2112	12208	" "	7.74	8.14	37.50	21.4
1769	114509	" "	7.73	7.89	37.00	21.1
2295	80575	C. O. Bidwell	7.64	7.75	36.50	21.0
2211	10170	Olds and Whipple	7.57	7.69	34.00	19.5
2177	90256	" "	7.52	7.69	35.00	20.3
2567	58355	" "	7.52	7.81	37.00	21.7
2005	11040	" "	7.50	8.02	38.00	22.4
2212	70170	" "	7.49	7.69	34.00	19.7
2219	93304	" "	7.49	7.69	35.00	20.4
2534	72981, 67504, 24975, 94192, 65161	" "	7.36	7.53	36.00	21.5
2570	66257, 191862, 17283, 28873, 515018	" "	7.35	7.53	37.00	22.2

Analyses of Cotton Seed Meals Without a Guaranty or Below Their Guaranty.—*Continuea.*

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. of Nitrogen.		Cost per ton.	Nitrogen costs cents per pound.
			Found.	Guaranteed.		
			%	%		
2003	39746	Olds and Whipple	7.29	7.40	$35.00	21.0
2446	33368	Conn. Tobacco Corp.	7.29	7.57	*	22.5
2588	100447	" " "	7.28	7.57	*	22.5
2111	34074	Olds and Whipple	7.28	7.40	34.00	20.3
2004	14365	" "	7.27	7.40	35.00	21.0
2034	6979	" "	7.27	7.40	35.00	21.0
2035	101412	" "	7.26	7.40	35.00	21.1
2173	13438	" "	7.26	7.40	34.50	20.7
2564	527465	Conn. Tobacco Corp.	7.25	....	*	22.5
1976	47865	Olds and Whipple	7.24	7.40	35.00	21.1
2174	575749	" "	7.22	7.40	34.50	20.8
2218	12371	Bissell-Graves Co.	7.21	7.50	32.65	19.6
2386	122774	Olds and Whipple	7.20	7.40	35.00	21.2
2097	32898	" "	7.19	7.40	35.00	21.3
2081	62792	" "	7.19	7.40	35.00	21.3
2095	16197	" "	7.19	7.40	33.00	19.9
1988	69252	" "	7.17	7.40	35.00	21.3
1990	27331	" "	7.15	7.40	35.00	21.4
2029	107583	" "	7.14	7.40	35.00	21.4
2080	99121	" "	7.11	7.40	35.00	21.5
2465	56456	" "	7.07	7.20	34.00	20.9
2058	29926	Bissell-Graves Co.	7.07	7.50	32.65	20.0
2049	250080	" " "	7.05	7.50	32.65	20.0
2203	23054	Spencer Bros.	7.03	7.50	33.50	20.7
2114	4992	Olds and Whipple	7.02	7.20	33.00	20.4
2036	32133	" "	7.02	7.40	35.00	21.8
2448	19347	Conn. Tobacco Corp.	7.00	7.24	*	22.5
2007	18441	Olds and Whipple	6.98	7.20	34.00	21.2
2585	131346	Conn. Tobacco Corp.	6.98	7.17	*	22.5
2118	19495	Olds and Whipple	6.96	7.20	33.00	20.5
2215	25722	" "	6.95	7.20	33.00	20.6
2326	58391	" "	6.95	7.07	34.50	21.6

*$3.70 per unit of ammonia.

ANALYSES OF COTTON SEED MEALS WITHOUT A GUARANTY OR BELOW THEIR GUARANTY.—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. of Nitrogen.		Cost per ton.	Nitrogen costs cents per pound.
			Found.	Guaranteed.		
			%	%		
1908	83713	Olds and Whipple	6.95	8.05	$37.00	23.4
2056	16340	Bissell-Graves Co.	6.94	7.50	32.65	20.3
2461	39390	Olds and Whipple	6.92	7.08	33.50	21.0
1816	94285	" "	6.92	7.40	34.00	21.4
2115	114011	" "	6.92	7.20	33.00	20.7
1989	71833	" "	6.90	7.20	34.00	21.4
1909	110695	" "	6.90	8.05	37.00	23.6
2100	51583	Bissell-Graves Co.	6.87	7.50	32.65	20.5
2033	6320	" "	6.83	7.50	32.65	20.7
2589	14756	Conn. Tobacco Corp.	6.80	7.07	*	22.5
2117	65193	Olds and Whipple	6.79	7.20	33.00	21.0
2460	27539	" "	6.75	7.08	32.00	20.4
1994	64100	" "	6.72	6.99	32.50	20.9
2057	15911	Bissell-Graves Co.	6.72	7.50	32.65	21.0
2378	10031	Spencer Bros.	6.70	7.00	31.50	20.2
2370	6926	" "	6.70	7.00	31.50	20.2
2427	98470	Olds and Whipple	6.68	6.79	32.50	21.0
2037	130126	" "	6.66	7.40	35.00	23.0
1905	27469	" "	6.66	6.99	32.00	20.7
2096	34814	" "	6.66	7.20	33.00	21.5
2462	24798	" "	6.66	7.08	32.00	20.7
1917	13569	" "	6.64	6.99	32.00	20.8
2380	21409	Spencer Bros.	6.62	7.00	31.50	20.5
1907	62186	Olds and Whipple	6.61	8.05	37.00	24.6
2098	147694	" "	6.60	7.20	33.00	21.7
1906	114416	" "	6.58	8.05	37.00	24.8
2099	121701	Bissell-Graves Co.	6.53	7.50	32.65	21.6
2373	32311	Spencer Bros.	6.46	7.00	31.50	21.0
2216	28226	Olds and Whipple	6.42	6.58	32.00	21.5
2043	61071	Spencer Bros.	6.39	6.50	31.50	21.2
2199	577798	" "	6.39	6.50	30.75	20.6
2197	15339	L. C. Brainard	6.38	6.50	31.00	20.8

*$3.70 per unit of ammonia.

ANALYSES OF COTTON SEED MEALS WITHOUT A GUARANTY OR BELOW THEIR GUARANTY.—*Continued.*

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. of Nitrogen.		Cost per ton.	Nitrogen costs cents per pound.
			Found.	Guaranteed.		
			%	%		
2040	38472	Spencer Bros.	6.36	6.50	$31.50	21.3
1841	13106	Olds and Whipple	6.36	7.40	34.00	23.3
2322	18628	Griffin-Neuberger Tob. Co.	6.36	6.58	30.75	20.7
2331	76249	Olds and Whipple	6.35	6.58	32.50	21.1
2566	27879	Conn. Tobacco Corp.	6.32	....	*	22.5
1775	73	Spencer Bros.	6.30	6.50	31.50	21.5
1673	Athol	" "	6.28	6.50	31.50	21.6
2088	106703	Loomis Bros. Co.	6.27	6.50	32.00	22.0
2065	110650	F. M. Thompson	6.26	6.50	32.00	22.0
2206	108885	Bissell-Graves Co.	6.22	7.50	32.65	22.7
2335	41229	G. S. Phelps & Co.	6.20	6.50	33.50	23.5
2327	13629	Olds and Whipple	6.06	6.58	32.50	23.2
1894	131067	" "	6.02	6.99	31.00	22.1
2379	34312	Spencer Bros.	5.98	6.50	31.50	22.6
1895	87210	Olds and Whipple	5.94	6.99	31.00	22.4
	Imperial Cotton Milling Co.					
1764	No. 1	J. J. Campbell	7.15	....	32.00	19.3
1765	No. 2	"	6.98	....	31.25	20.0
	Meech and Stoddard.					
2355		Amer. Sumatra Tobacco Co.	6.64	6.75	.....	....
2064		" " "	6.58	6.75	30.40	19.7
2357		" " "	6.57	6.75	.....	....
2353		" " "	6.48	6.75	.....	....
2184		" " "	6.24	6.50	30.40	20.8
	Memphis Cotton Oil Co.					
1741	19484	The Coles Co.	6.43	6.55	34.00	23.0
	Olds and Whipple.					
2062		L. B. Haas and Co.	7.82	8.16	37.13	20.9
2560		C. W. Porter	7.72	7.84	36.00	20.5
2210	109035	Conn. Tobacco Corp.	7.52	7.73	*	22.5

*$3.70 per unit of ammonia.

ANALYSES OF COTTON SEED MEALS WITHOUT A GUARANTY OR BELOW THEIR GUARANTY.—*Concluded.*

Station No.	Manufacturer or Jobber, Car No. or Marks.	Purchased, Sampled or Sent by	Per cent. of Nitrogen.		Cost per ton.	Nitrogen costs cents per pound.
			Found.	Guaranteed.		
			%	%		
2449	96548	Conn. Tobacco Corp.	7.03	7.24	*	22.5
2208	35587	" "	6.95	7.24	*	22.5
2129		L. B. Haas and Co.	6.83	7.74	$35.25	22.6
	Geo. B. Robinson, Jr.					
2389	12425	Griffin-Neuberger Tobacco Co.	6.32	6.58	30.25	20.4
2285	15042	" " "	6.30	6.58	30.25	20.5
2284	25842	" " "	6.20	6.58	30.25	20.8
	W. Newton Smith.					
1898	4126	Olds and Whipple	6.46	6.58	31.00	20.6
1897	123789	" "	6.41	6.58	31.00	20.7
1683	78862	" "	6.41	6.58	30.00	20.0
2083	80066	" "	6.38	6.58	31.00	20.8
2063	71853	" "	6.36	6.58	31.00	20.9
1675	131392	" "	6.34	6.58	30.00	20.2
2084	21440	" "	6.29	6.58	31.00	21.1
1840	102605	" "	6.27	6.58	31.00	21.2
1985	452	" "	6.15	6.58	31.00	21.6
2051	74585	" "	6.11	6.58	31.00	21.8
2052	35529	" "	6.11	6.58	31.00	21.7
2053	61076	" "	6.11	6.58	31.00	21.7
1896	36413	" "	6.02	6.58	31.00	22.1
1980	14783	" "	5.90	6.58	31.00	22.5
1981	48424	" "	5.48	6.58	31.00	24.3
	Southern Cotton Oil Co.					
1918	101814	Olds and Whipple	6.81	....	32.00	20.2
	Jobber Unknown.					
2338		P. J. Rogers	6.99	....	31.25	19.2
2337		"	6.56	....	32.50	21.4
2682		C. F. Miskill	6.08	6.50	32.50	23.1

* $3.70 per unit of ammonia.

The American Agricultural Chemical Co. stated that the lowest nitrogen percentage reported by other chemists in the preceding nine months was 4.53. Our analysis **2637** gave 4.26.

Castor pomace is quite variable in composition and contains as a rule rather less nitrogen than formerly. The cost of nitrogen is higher than in any other raw material commonly used as a fertilizer, ranging according to our analyses this year from 19.5 to 25.7 cents per pound.

In view of the discrepancies between the analyses of cargoes, as shown by the importers or manufacturers of fertilizers, and those made on samples of small lots taken by the Station in this state, it must be remembered that the latter represent what farmers are buying and that while the average of a whole cargo may show a certain percentage, the average of a few hundred bags from that cargo may be quite different.

The same thing is frequently noticed in a car lot of cotton seed meal shipped from a single factory. The car lot sample is often quite different from a sample drawn from a few tons taken from that car.

NITROGENOUS MATERIAL.

2966. Sent by Olds & Whipple, Hartford. Of unknown origin imported from abroad.

Nitrogen as nitrates	0.07
" as ammonia	0.21
" organic water-soluble	3.65
" " active, insoluble	2.13
" " inactive, insoluble	1.12
Total nitrogen	7.18

Judging from the chemical examination alone the material is of value as a source of available nitrogen.

II. RAW MATERIALS CHIEFLY VALUABLE FOR PHOSPHORIC ACID.

GROUND PHOSPHATE ROCK.

933. Sold by Federal Chemical Co., Columbia, Tenn. Stock of S. L. Tuttle, Wallingford; price, bulk car lot, delivered, $7.60

per ton; contained 28.02 per cent. phosphoric acid. Cost of phosphoric acid 1.36 cents per pound.

1091. Sent by E. R. Jamieson, Southington. Contained 30.26 per cent. phosphoric acid.

1479. Sold by Federal Chemical Co., Columbia, Tenn. Sent by E. A. Jones, New Canaan. Price $8.00 per ton in car lots, delivered. Contained 28.60 per cent. phosphoric acid. Phosphoric acid cost 1.4 cents per pound.

2182. Sold by Federal Chemical Co., Columbia, Tenn. Sent by E. H. Kelly, Unionville. Guaranteed to contain 13 per cent. phosphorus. It contained 30.50 per cent. phosphoric acid, equivalent to 13.3 per cent. phosphorus. It cost $8.90 per ton, car lot, delivered. Phosphoric acid cost 1.46 cents per pound.

2524. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Used at Station farm. It contained 29.27 per cent. phosphoric acid.

2713. Sold by American Agricultural Chemical Co., New York. Stock of O. C. Gardner, Yantic, guaranty 30.20 per cent. phosphoric acid. It contained 29.22 per cent. and cost, delivered, $13.20. Phosphoric acid cost 2.3 cents per pound.

BONE ASH.

928. Bone used for case hardening. The bone has been roasted without free access of air till its nitrogen has been almost all expelled and its organic matter reduced to carbon. The sample contained 0.16 per cent. of nitrogen and 39.06 per cent. of phosphoric acid. It yields no immediate return as a fertilizer, but, finely ground, might help to stock the land with phosphoric acid, like ground rock phosphate.

CALCINED ROCK PHOSPHATE.

This is prepared by a patent process in which, it is stated, the rock is roasted with a small amount of alkali mixture which is later removed in large part. The sample, **942**, was sent by Ellis Soper of New York and contained 0.17 per cent. of water-soluble phosphoric acid, 26.87 per cent. of citrate-soluble, 5.12 of citrate-insoluble, making 32.16 per cent. of total phosphoric acid. No price is given.

BASIC SLAG, BASIC PHOSPHATE OR THOMAS PHOSPHATE POWDER.

This material is a finely ground slag produced by a special process of removing phosphorus from iron. The best grade contains from 17 to 19 per cent. phosphoric acid, 35 to 50 per cent. lime, 13 per cent. or more of iron, and smaller quantities of magnesia and manganese.

Very little of the phosphoric acid is soluble in water, but by a conventional method of extraction (Wagner's) the larger part of the phosphoric acid in slag of good quality is soluble in the citric acid used. Pot and field experiments and practical experience alike have shown that the phosphoric acid of basic slag is quite readily available to crops and it has come into rather extensive use, particularly by orchardists. Basic slag of good grade should contain 15 per cent. or more of "available" phosphoric acid.

2890. Sold by American Agricultural Chemical Co., New York. Stock of Conn. Valley Orchard Co., Berlin.

2885. Sold by Apothecaries Hall Co., Waterbury. Stock of C. F. Curtiss, Milldale.

2886. Sold by Coe-Mortimer Co., New York. Stock of M. Keeney, Somersville.

1768 and **1899.** Bought through E. D. Curtis, Bantam. Sent by C. L. Gold, West Cornwall, and Walter Sheperd, Shaker Station.

1454, Nov., 1912, and **2195**, April, 1913. Sold by E. Manchester & Sons, Winsted. Sent by E. D. Curtis, Bantam, and John Gotta, Portland.

1453. Sold by R. A. Munro & Co., New York, Nov., 1912. Sent by E. D. Curtis, Bantam.

2887. Sold by Nitrate Agencies Co., New York. Stock of Spencer Bros., Suffield.

2888. Sold by Sanderson Fertilizer and Chemical Co., New Haven. Sampled at factory.

2889 and **2001.** Sold by Wilcox Fertilizer Co., Mystic. The first sampled at factory, the second sent by A. E. Plant, Branford.

Analyses of Basic Slag.

Station No.	Phosphoric Acid. Guaranteed.	Total found.	"Available" found.	Insoluble found.	Cost per ton.	"Available" Phosphoric Acid costs, cents per pound.
2890	17.00	18.14	14.79	3.35	$18.00	**6.1**
2885	17.00	16.98	14.40	2.58	.....	...
2886	17.00	19.14	17.05	2.09	13.50*	**4.0**
1768	.....	.....	16.07	....	.....	...
1899	.....	.....	16.18	....	.....	...
1454	16.00	17.71	13.23	4.48	16.00	**6.0**
2195	17.00	17.20	15.61	1.59	14.50	**4.6**
1453	17.00	18.85	16.35	2.50	?	...
2887	17.00	16.96	14.17	2.79	16.00	**5.6**
2888	17.00	18.14	16.17	1.97	18.00	**5.6**
2889	16.00	16.41	14.99	1.42	15.50	**5.2**
2001	16.00	16.66	15.10	1.56	14.00	**4.6**

Eight of these basic slags have 15 per cent. or more of "available" phosphoric acid and are strictly high grade. **1454**, *of last year's stock,* is inferior, having only 13.23 per cent. "available." The other, bought of the same importers in 1913, **1453**, is of high grade.

Some of the prices given are for small lots, others for car lots.

In large shipments we understand it has been bought for less than $12.00 per ton.

The cost of "available" phosphoric acid ranges from 4.0 to 6.1 cents per pound. This makes no allowance for the lime of which slag may contain from 35 to 50 per cent. Of this probably 25 to 30 per cent. is combined with acids, as it is in acid phosphate or raw phosphate, but a certain undetermined amount is capable of directly neutralizing soil acidity and favoring nitrification and other activities of microbe life in the soil. The favorable action of basic slag is no doubt in part due to this action.

* Car lot.

PRECIPITATED BONE.

This material, understood to be a by-product of glue manufacture, is a fine, dry, white powder, neutral in reaction and having the composition given below. It is used chiefly as a tobacco fertilizer.

2629. Sold by American Agricultural Chemical Co., New York. Sent by J. E. Phelps, Suffield.

The other six samples were sold by Olds & Whipple, Hartford, five of them in car lots to the Connecticut Tobacco Corporation, the sixth, **2701**, mixture of samples taken at factory and from stock of Herman Ude, Suffield.

Station No.....	**2629**	**2452**	**2453**	**2563**	**2591**	**2592**	**2701**
Water-soluble phosphoric acid.....	1.31	1.05	1.01	1.01	0.93	1.01	0.94
Citrate-soluble phosphoric acid..	34.76	38.00	38.08	37.50	33.16	37.76	37.22
Citrate-insoluble phosphoric acid..	1.01	0.27	0.31	0.13	0.29	0.27	0.52
Total phosphoric acid.....	37.08	39.32	39.40	38.64	34.38	39.04	38.68
"Available" phosphoric acid guaranteed.....	35.00	38.55	38.55	.....	38.55	38.55	38.00
Cost per ton.....	$42.00	39.32*	39.40*	38.64*	34.38*	39.04*	44.00†

These samples contained on the average 37.68 per cent. "available" phosphoric acid which cost about 5 cents per pound in car lots.

DISSOLVED ROCK PHOSPHATE OR ACID PHOSPHATE.

This material is made by treating mineral phosphates or phosphate rock with sulphuric acid, which makes the phosphates largely soluble in water and converts a large part of the lime which was combined with the phosphate into calcium sulphate or land plaster.

The guaranty gives the percentage of "available" phosphoric acid. This is purely a trade name for the sum of the water-soluble and citrate-soluble phosphoric acid. It has no reference

* $1.00 per unit car lots. † Retail.

to the actual availability of the phosphoric acid to crops. In the case of well-made acid phosphates, however, having domestic rock phosphates as a base, it is fair to assume that the greater part of the "available" phosphoric acid as defined above is actually readily available to crops.

2698. Sold by L. T. Frisbie Co., New Haven. Sampled at factory.

2548. Sold by E. Manchester & Sons, Winsted. Sent by W. A. Simpson, Wallingford.

2562, 2593 and **2594.** Sold by Olds & Whipple, Hartford. Sent by Connecticut Tobacco Corporation, Silver Lane.

2451 and **2450.** Sold by Olds & Whipple, Hartford. Sent by Connecticut Tobacco Corporation, Tariffville.

2702. Sold by Rogers Manufacturing Co., Rockfall. Sampled at factory.

2711. Sold by American Agricultural Chemical Co., New York. Stock of S. D. Woodruff & Sons, Orange, price not given, and John Lynch, Ellington, $15.00 per ton.

2655. Sold by Nitrate Agencies Co., New York. Stock of C. A. Templeton, Waterbury.

2712. Sold by American Agricultural Chemical Co., New York. Stock of Apothecaries Hall Co., Waterbury, $14.00, and Connecticut Valley Orchard Co., Berlin, $15.00.

2652. Sold by Bowker Fertilizer Co., New York. Stock of G. A. Williams, East Hartford, price not quoted, and J. P. Barstow & Co., Norwich, $15.00.

2650. "Star Phosphate." Sold by Armour Fertilizer Works, Chrome, N. J. Stock of Geo. S. Phelps & Co., Thompsonville.

2653. "H. G. Soluble Phosphate." Sold by Coe-Mortimer Co., New York. Stock of L. A. Gowdy, Somersville.

2016 and **2021.** Sold by Sanderson Fertilizer and Chemical Co., New Haven. Stock of H. D. Johnson, Highwood, and Connecticut School for Boys, Meriden.

2710. Sold by Wilcox Fertilizer Co., Mystic. Stock of F. H. Thrall, Windsor.

2927. Sold by Niantic Menhaden Oil and Guano Co., Niantic. Sent by The P. Schwartz Co., New London.

ANALYSES.

Station No.	Water-soluble phosphoric acid.	Citrate-soluble phosphoric acid.	Citrate-insoluble phosphoric acid.	Total phosphoric acid	"Available" phosphoric acid found.	"Available" phosphoric acid guaranteed.	Cost per ton.	"Available" phosphoric acid costs per pound.
	%	%	%	%	%	%	$	cts.
2698	15.16	2.19	0.23	17.58	17.35	12.00	12.00*	3.4
2548	13.87	2.24	0.83	16.94	16.11	16.00	11.92*	3.7
2562	15.72	1.65	0.46	17.83	17.37	.....	15.00	4.3
2451	15.83	1.69	0.87	18.39	17.52	16.00	15.00	4.3
2450	15.00	2.20	0.29	17.49	17.20	16.00	15.00	4.4
2593	14.23	2.37	0.52	17.12	16.60	16.00	15.00	4.5
2594	14.27	2.25	0.47	16.99	16.52	16.00	15.00	4.5
2702	13.68	2.75	0.12	16.55	16.43	16.00	15.00	4.6
2711	12.02	4.32	0.37	16.71	16.34	16.00	15.00	4.6
2655	9.79	5.15	1.51	16.45	14.94	14.00	14.50	4.9
2712	11.03	3.37	0.95	15.35	14.40	14.00	14.50	5.0
2652	9.08	5.30	1.41	15.79	14.38	14.00	15.00	5.2
2650	11.07	2.70	0.38	14.15	13.77	14.00	15.00	5.4
2653	11.66	2.58	1.27	15.51	14.24	14.00	16.00	5.6
2016	9.63	5.53	0.69	15.85	15.16	14.00	.....	...
2021	12.60	2.87	0.50	15.97	15.47	14.00	.....	...
2710	14.22	2.40	0.88	17.50	16.62	15.50	14.00	4.2
2927	14.19	2.90	0.19	17.28	17.09	.....	16.00	4.7

Two grades of acid phosphate are commonly sold, one with a guaranty of 16 per cent. available and the other with a guaranty of 14 per cent. Most of the samples analyzed this year are of the 16 per cent. grade.

The actual retail cost of available phosphoric acid has ranged from 4.3 to 5.6 cents per pound and with an average of about 4.7 cents. In car lots it has been bought as low as 3.3 cents by farmers.

III. RAW MATERIALS OF HIGH GRADE CONTAINING POTASH.

HIGH-GRADE SULPHATE OF POTASH.

(ANALYSES ON PAGE 121.)

This chemical should contain about 90 per cent. of pure potassium sulphate (sulphate of potash), equivalent to about 49 per cent. of potassium oxide ("actual potash"), and it should be nearly free from chlorids.

* Probably car lot.

DOUBLE MANURE SALT.

(ANALYSES ON PAGE 121.)

This salt is frequently sold on a guaranty of "48-50 per cent. sulphate," which is equivalent to 25.9-27.0 per cent. of actual potash. Besides 46-50 per cent. of potassium sulphate, it contains over 30 per cent. of magnesium sulphate, chlorin equivalent to 3 per cent. of common salt, a little sodium and calcium sulphates, and varying amounts of moisture.

MURIATE OF POTASH.

(ANALYSES ON PAGES 121 AND 122.)

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

KAINIT.

(ANALYSES ON PAGE 122.)

Kainit contains from 11 to 15 per cent. of actual potash, more than that quantity of soda, and rather less magnesia. These "bases" are combined with chlorin and sulphuric acid. It usually contains more water than either sulphate or muriate of potash, and is sold on a guaranty of from 12 to 15 per cent. of potash.

Two of the samples of high-grade sulphate of potash contained considerably less than the guaranteed amount. These were **2504** and **2893** which represents a resampling of the same stock. Believing that the bags might have gathered moisture which would increase the weight, thus compensating for a lower percentage as explained on p. 9 of our last report, seven packages were weighed; two weighed just 200 pounds but five were short from 2 to 10 pounds in weight.

All the samples of double sulphate and muriate of potash and of kainit were of good quality and met their guaranties.

The approximate retail cost per pound of actual potash as shown by the analyses has been:

In high-grade sulphate	**5.3**	**cents**
low-grade "	**5.8**	**"**
muriate	**4.1**	**"**
kainit	**5.8**	**"**

POTASH SALTS. PERCENTAGE COMPOSITION AND COST PER POUND OF POTASH.

Station No.	Sampled and sent by	Potash soluble in water. Guaranteed.	Potash soluble in water. Found.	Cost per ton.	Potash costs per pound.
	High-Grade Sulphate of Potash.	%	%	$	cts.
2895	Wilcox Fertilizer Co.	Station Agent	48.0	49.00	50.50	5.1
2644	Sanderson Fertilizer and Chemical Co.	Station Agent	48.0	50.12	52.00	5.2
2641	Spencer Bros., Suffield, from Nitrate Agencies Co.	Station Agent	48.0	50.66	53.00	5.2
2498	Geo. S. Phelps & Co., Thompsonville, from Armour Fert. Works	Station Agent	48.0	49.11	52.00	5.3
2504	Apothecaries Hall Co., Waterbury, from Buffalo Fert. Works	Station Agent	48.0	46.44	52.00	5.6
2893	Apothecaries Hall Co., Waterbury, from Buffalo Fert. Works	Station Agent	48.0	46.56	52.00	5.6
2511	R. R. Holabird, Montowese, from German Kali Works	Station Agent	47.0	49.44	....	....
2648	J. P. Norton, Broad Brook and E. N. Austin, Suffield, from Amer. Agr. Chem. Co.	Station Agent	48.0	49.38	....	....
	Double Manure Salt.					
2646	E. Halladay, $31, and E. N. Austin, $29, Suffield, from Amer. Agr. Chem. Co.	Station Agent	26.0	26.08	30.00	5.8
2022	Conn. School for Boys, Meriden, from Sanderson Fert. and Chem. Co.	Station Agent	26.0	28.06	....	....
	Muriate of Potash.					
2000	A. E. Plant, Branford, from Wilcox Fert. Co.	Purchaser	50.56	51.40	40.00	3.9
2551	W. A. Simpson, Wallingford, from E. Manchester & Sons	Purchaser	49.00	49.72	38.92*	3.9
2192	John Gotta, Portland, from E. Manchester & Sons	Purchaser	49.00	49.64	39.90	4.0
2497	Geo. S. Phelps & Co., Thompsonville, from Armour Fert. Works	Station Agent	48.00	53.23	42.50	4.0

* Probably mixed car lot.

POTASH SALTS. PERCENTAGE COMPOSITION AND COST PER POUND OF POTASH.—*Continued.*

Station No.		Sampled and sent by	Potash soluble in water. Guaranteed.	Potash soluble in water. Found.	Cost per ton.	Potash costs per pound.
			%	%	$	cts.
2500	G. H. Hale, So. Glastonbury, from Bowker Fert. Co.	Station Agent	49.00	51.74	41.50	4.0
2507	A. Grulich, Meriden. from L. T. Frisbie Co.	Station Agent	50.00	49.80	41.00	4.1
2645	G. C. Bradley, New Haven, from Lowell Fert. Co.	Station Agent	50.00	50.01	41.00	4.1
2502	Apothecaries Hall Co., Waterbury, from Buffalo Fert. Works	Station Agent	48.00	49.58	42.00	4.2
2649	C. Buckingham, Southport, $45, and E. N. Austin, Suffield, $43, from Amer. Agr. Chem. Co.	Station Agent	49.00	51.56	44.00	4.3
2505	L. A. Gowdy, Somerville, from Coe-Mortimer Co.	Station Agent	49.00	51.40	45.00	4.4
2510	S. B. Wakeman, Saugatuck, from German Kali Works	Station Agent	48.00	50.02	44.60	4.5
2017	H. D. Johnson, Highwood, from Sanderson Fert. and Chem. Co.	Station Agent	49.00	51.58	....	....
2023	Conn. School for Boys, Meriden, from Sanderson Fert. and Chem. Co.	Station Agent	49.00	51.26	....	....
2640	C. R. Treat, Orange, from Nitrate Agencies Co.	Station Agent	50.00	51.20	38.00*	3.7
2894	Wilcox Fertilizer Co.	Station Agent	50.00	51.60	42.00	4.1
2969	Unknown	A. Carini, So. Glastonbury	....	47.64	....	....
	Kainit.					
2509	S. B. Wakeman, Saugatuck, from German Kali Works	Station Agent	12.00	13.80	15.30	5.2
2642	E. White, Rockville, from Nitrate Agencies Co.	Station Agent	12.00	14.84	16.50	5.6
2503	Apothecaries Hall Co., Waterbury, from Buffalo Fert. Works	Station Agent	12.00	13.28	16.00	6.0
2024	Conn. School for Boys, Meriden, from Sanderson Fert. and Chem. Co.	Station Agent	12.00	13.32	....	....
2647	E. E. Burwell, New Haven, from Amer. Agr. Chem. Co.	Station Agent	12.00	12.88	16.00	6.2

* Probably mixed car lot.

VEGETABLE POTASH.

This material, which we understand is a residue from beet sugar manufacture, is used as a tobacco fertilizer, most of its potash being in the carbonate form.

The single sample, **2643**, sold by Olds & Whipple, Hartford, and from the stock of Herman Ude, Suffield, contained 26.42 per cent. potash.

COTTON BOLL AND COTTON HULL ASHES.

These ashes usually contain from 7 to 10 per cent. of phosphoric acid but are bought solely for their content of potash, which is chiefly in form of carbonate, and used only on tobacco. Cotton hull ashes, now very hard to get, proved to be the best form of potash for growing wrapper leaf.

2493. Sent by L. B. Haas & Co., Hartford. Guaranty 17.95 per cent. potash. Cost $32.00. They contained 16.74 per cent. of *water-soluble* potash, making the cost of this form of potash about 9.6 cents per pound.

2932. Sent by Spencer Bros., Suffield, bought of American Cotton Oil Co., New York City. The guaranty was first given as 11.97 and price $26.93. Later Spencer Bros. were advised that the guaranty was 22.92 and the price $51.57. The first guaranty was evidently the correct one. The sample contained 11.16 per cent. of *water-soluble* potash, making the cost per pound of this potash 12 cents.

2931. Cotton Boll Ashes, sent by Spencer Bros., Suffield, bought of the American Cotton Oil Co., New York, guaranteed 22.50 per cent. potash. It contained 21.74 per cent. of water-soluble potash, and cost $50.62 per ton, making the cost per pound of this potash 11.6 cents.

2561. Cotton Hull Ashes, bought of Olds & Whipple, Hartford. Sampled and sent by C. W. Porter, Hockanum. This sample contained, by our analysis, 23.26 per cent. of water-soluble potash and at the price charged, $52.00, this potash cost 11.2 cents per pound.

A portion of the sample, analyzed by a commercial chemist, gave 26.72 per cent. of water-soluble potash. Repeated analyses by our own chemists fail to essentially change the figure first reported.

Actual potash in form of high-grade sulphate or of double sulphate cost at retail from five to six cents per pound, in form of muriate about 4 to 4.5 cents and in kainit from 5 to 6 cents per pound. In form of carbonate, vegetable potash and cotton hull or cotton boll ashes, 9 to 12 cents.

For tobacco, only sulphates or carbonates can be safely used. Large quantities of muriate or kainit, especially if put on just before planting potatoes, lower the starch content and damage their eating quality, though in our experience moderate amounts, 150-200 pounds per acre, have not noticeably impaired the eating quality.

Experiments over a period of twenty years at the Massachusetts Station showed sulphates to have a better effect on color and other qualities of fruit than muriate, though experiments for shorter periods on other soils have not showed the same effect.

Otherwise, and for general use, the muriate is preferable, because of its lower cost.

Kainit is used somewhat as a top-dressing for meadows and pasture with favorable results.

IV. RAW MATERIALS CHIEFLY VALUABLE FOR NITROGEN AND PHOSPHORIC ACID.

FISH MANURES.

"Fish Scrap," or Dry Ground Fish, as it has been sold in this state for many years, is the dried and ground residue left after expressing the oil from porgies or menhaden. It is sometimes "acidulated" with oil of vitriol. It usually contains 8 per cent. or more of nitrogen and 6 to 7 per cent. of phosphoric acid.

Of the eleven samples analyzed all but three have higher percentages of nitrogen and phosphoric acid than are guaranteed.

SLAUGHTER HOUSE TANKAGE.

After boiling or steaming various slaughter-house wastes, fat rises to the surface and is removed; the soup is run off and the settlings remaining in the tanks ("tankage") are dried,

PERCENTAGE COMPOSITION AND VALUATION OF FISH MANURES.

Station No.	Manufacturer and Dealer.	Nitrogen.				Phosphoric Acid.			Total Phosphoric Acid.		Cost per ton.	Valuation per ton.
		As Ammonia.	As Organic.	Total found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.		
	Sampled by Station:											
2883	American Agr. Chem. Co. Stock of G. S. Phelps & Co., Thompsonville, $46, and J. Rostek, Melrose, $42	0.38	7.53	7.91	**8.23**	0.77	5.14	1.38	7.29	**6.0**	$44.00	$36.88
2651	Bowker Fertilizer Co. Stock of Seth Viets, W. Suffield	0.44	7.82	8.26	**8.23**	0.74	4.33	1.61	6.68	**6.0**	43.00	37.68
2879	Niantic Menhaden Oil & Guano Co. Stock of E. N. Austin, Suffield	0.20	8.82	9.02	**8.25**	0.65	5.31	1.75	7.71	**6.0**	40.00	41.56
2700	Olds & Whipple, Hartford. Sampled at factory	0.90	7.26	8.16	**7.40**	0.93	4.81	1.37	7.11	**5.5**	45.00	37.61
2704	(Acidulated Fish) Rogers Mfg. Co. Sampled at factory	0.70	6.98	7.68	**7.80**	1.63	3.54	0.55	5.72	**5.0**	40.00	35.03
2706	Sanderson Fert. & Chem. Co. Stock of J. M. Bahr, Warehouse Point	0.14	7.36	7.50	**8.23**	0.36	4.72	1.20	6.28	**6.0**	42.00	34.54
2708	Dry Ground Fish Guano, Wilcox Fert. Co. Stock of M. E. Thompson, Ellington	0.04	8.98	9.02	**8.24**	0.50	3.71	1.89	6.10	**6.0**	41.00	40.25
2709	Dry Ground Acidulated Fish, Wilcox Fert. Co. Stock of C. J. Palozej, Rockville, and of factory	0.74	7.22	7.96	**7.81**	1.57	3.70	0.83	6.10	**6.0**	40.50	36.32
	Sampled by Purchasers:											
1674	American Agr. Chem. Co. Sent by Spencer Bros., Suffield	...	...	8.60	**8.23**	...	...	...	...	....	42.00	....
2628	American Agr. Chem. Co. Sent by J. E. Phelps, Suffield	...	...	8.20	**8.23**	...	...	...	8.30	**6.0**	42.00	....
2250	Niantic Menhaden Oil & Guano Co. Sent by Bissell-Graves Co., Suffield	0.50	8.34	8.84	**8.25**	0.81	5.17	1.48	7.46	**6.0**	43.00	40.67

ANALYSES OF TANKAGE.

Station No.	Manufacturer.	Dealer or Purchaser.
2714	American Agricultural Chemical Co..	E. Halladay, Suffield.....
2654	L. T. Frisbie Co.....	Apothecaries Hall Co., Waterbury, $32, and W. S. Morris, Wethersfield, $30.....
2193	E. Manchester & Sons.....	John Gotta, Portland.....
2549	E. Manchester & Sons.....	W. A. Simpson, Wallingford.....
2699	Nitrate Agencies Co.....	Spencer Bros., Suffield.....
2703	Rogers Manufacturing Co.....	Sampled at factory.....
2454	C. M. Shay Fertilizer Co.....	C. R. Burr & Co., Manchester .....
2015	Sanderson Fertilizer & Chemical Co..	H. D. Johnson, Highwood.....
2019	Sanderson Fertilizer & Chemical Co..	Conn. School for Boys, Meriden.....

ground and sold as a fertilizer. As the analyses show, it has a wide range of composition, depending largely on the relative amounts of bone and of meat scraps which are "rendered" as above, but in general, nitrogen gives more than half the value to the material. Like bone the immediate agricultural value of tankage depends not only on the chemical composition but also on the fineness.

In **2654** both nitrogen and phosphoric acid were below the guaranty. At the manufacturer's request we repeated our analysis getting substantially the same result as before, but were unable to get another sample of this brand for analysis.

Four other samples contained less nitrogen than was guaranteed and in two the phosphoric acid was less than guaranteed.

As far as the solubility of their nitrogen is concerned all were of good quality and free from inferior forms.

GARBAGE TANKAGE.

This material has a composition wholly different from that of slaughter-house tankage and is very greatly inferior in nitrogen solubility and fertilizing value.

ANALYSES OF TANKAGE.

Chemical Analysis.								Mechanical Analysis.			
Nitrogen.						Phosphoric Acid.					
As Ammonia.	Water-Soluble Organic.	Active Insoluble Organic.	Inactive Insoluble Organic.	Total found.	Total guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Dealer's cash price per ton.	Valuation per ton.
0.54	1.37	3.05	1.18	6.14	4.94	13.13	13.73	60	40	$31.00	$31.35
0.10	1.78	1.79	0.73	4.40	4.94	14.66	15.00	50	50	31.00	25.96
0.32	0.95	2.41	1.90	4.58	4.94	15.70	13.00	49	51	24.50	27.32
0.34	1.10	3.00	1.06	5.50	4.94	14.87	13.73	57	43	23.54*	30.28
0.06	1.88	2.80	0.83	5.57	5.75	16.66	13.50	59	41	35.00	32.00
0.52	1.76	1.88	0.64	4.80	4.94	18.18	14.00	52	48	30.00	30.07
0.12	3.23	1.98	0.89	6.38	6.56	10.46	....	48	52	....	29.41
0.20	2.98	3.40	0.76	7.34	7.38	11.10	....	52	48	....	33.42
0.21	1.58	3.00	0.96	5.75	4.94	13.70	12.00	48	52	....	29.71

* Probably car lots.

Two small samples were received from individuals with inquiries as to their value.

902 from C. L. Bill, Bridgeport, taken from the local garbage plant contained 1.99 per cent. of nitrogen. **1653** from S. D. Woodruff & Sons, Orange, contained 2.13 per cent. of nitrogen.

The quality of the nitrogen is shown by the following tests of the sample **1653**:

Nitrogen as nitrates and ammonia	0.07
" organic, water-soluble	0.57
" " active, insoluble	0.29
" " inactive, insoluble	1.20
" Total	2.13

More than one-half of the nitrogen, as the analysis shows, is probably agriculturally inert.

BONE MANURES.

Of the twenty-five samples drawn by the Station, eight do not fully meet their minimum guaranty in respect of both nitrogen and phosphoric acid. In all but two, however, a deficiency

ANALYSES OF

Station No.	Manufacturer and Brand.	Dealer or Purchaser.
	Sampled by Station Agent:	
2918	Amer. Agr. Chem. Co., Bone Meal	F. T. Blish Hardware Co.
2919	Amer. Agr. Chem. Co., Fine Ground Bone	R. H. Hall
2897	Apothecaries Hall Co.	Factory
2898	Armour Fertilizer Works, Bone Meal	Brower & Malone Feed Co.
2899	Berkshire Fertilizer Co., Ground Bone	Hotchkiss & Templeton
2900	Valentine Bohl, Self-Recommending Fertilizer.	Factory
2901	Bowker Fertilizer Co., Fresh Ground Bone	A. D. Bridge's Sons
2903	Coe-Mortimer Co., XX Fine Ground Bone	Olson & Lunden
2904	L. T. Frisbie Co., Fine Bone Meal	Factory
2902	International Agr. Corp., Bone Meal	J. R. Reinhard & Sons
2905	Lister's Agr. Chem. Works, Bone Meal	F. C. Benjamin & Co.
2875	Lister's Agr. Chem. Works, Ground Bone and Tankage	F. C. Benjamin & Co.
2916	Lowell Fertilizer Co., Ground Bone	M. E. Cooke
2906	New England Fertilizer Co., Ground Bone	A. Grulich
2907	Nitrate Agencies Co., Ground Bone	C. A. Templeton
2908	Olds & Whipple, Pure Bone Meal	Factory
2909	Rogers & Hubbard Co., Knuckle Bone Flour	H. W. Andrews
2910	Rogers & Hubbard Co., Strictly Pure Fine Bone	J. P. Barstow & Co.
2911	Rogers Mfg. Co., Knuckle Bone Flour	Cadwell & Jones
2912	Rogers Mfg. Co., Fine Ground Bone	David Shea
2913	Sanderson Fert. & Chem. Co., Ground Bone	J. P. Barstow & Co.
2914	C. M. Shay Fertilizer Co., Pure Ground Bone	Knowles-Lombard Co.
2915	M. L. Shoemaker & Co., Swift-Sure Bone Meal	Spencer Bros.
2971	Van Iderstine Co., Pure Ground Bone	E. B. Clark Co.
2917	Wilcox Fertilizer Co., Pure Ground Bone	Factory
	Sampled by Purchasers and others:	
2279	International Agr. Corp., Bone Meal	Chas. C. Chapin
2254	E. L. James, Warrenville, Ground Bone	Sent by Manufacturer
2194	E. Manchester & Sons, Fine Ground Bone	John Gotta
2550	E. Manchester & Sons, Fine Ground Bone	W. A. Simpson
2920	National Fertilizer Co., Bone	C. D. Way
2027	Pittsburg Provision & Pack. Co., Pure Raw Bone Meal	H. D. Johnson
2621	Sanderson Fert. & Chem. Co., Fine Ground Bone	O. G. Beard
1999	Wilcox Fertilizer Co., Pure Ground Bone	A. E. Plant
2393	Wilcox Fertilizer Co., Pure Ground Bone	C. S. Keeney
2941		W. H. MacKenzie

BONE MANURES.

Chemical Analysis.				Mechanical Analysis.			
Nitrogen.		Phosphoric Acid.					
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.	Dealer's cash price per ton.	Valuation per ton.
1.66	1.65	15.53	13.75	61	39	$29.00	$17.62
2.28	2.47	23.59	22.88	61	39	33.00	25.93
2.31	2.26	26.94	22.88	65	35	30.00	28.77
2.19	2.47	28.66	22.50	63	37	39.00	29.57
2.12	2.50	28.20	20.00	67	33	33.00	29.10
4.33	3.80	21.67	23.00	70	30	32.00	32.10
2.66	2.47	25.41	22.88	60	40	34.00	28.57
2.68	2.47	23.62	22.88	64	36	.....	27.46
2.55	2.46	27.02	23.00	72	28	30.00	29.98
3.05	2.40	19.62	22.00	62	38	31.00	25.61
3.65	2.67	24.18	22.88	33	67	34.00	29.66
2.80	2.67	11.96	12.00	55	45	29.00	18.67
2.44	2.47	26.94	23.00	64	36	32.00	29.15
2.61	2.46	26.74	23.00	70	30	32.00	29.88
2.12	2.46	24.26	22.88	76	24	34.00	26.48
3.28	2.50	25.89	22.00	51	49	33.00	30.65
3.96	3.82	25.61	24.50	51	49	38.00	32.76
3.84	3.70	21.08	22.00	37	63	38.00	28.22
3.97	3.80	25.53	25.00	50	50	40.00	32.65
3.54	3.50	26.58	25.00	90	10	34.00	34.17
2.38	2.47	26.56	20.00	83	17	34.00	29.54
2.99	2.47	24.79	25.00	59	41	33.00	29.22
5.43	4.53	23.44	20.00	60	40	38.00	36.71
2.12	2.00	28.17	27.00	46	54	30.00	28.15
3.98	2.46	25.00	22.00	80	20	32.50	33.99
2.83	2.47	20.85	22.00	56	44	.....	.....
3.98	3.00	20.34	20.00	1	99	.....	.....
2.31	2.47	26.10	23.00	46	54	28.75	.....
2.99	2.47	24.10	22.88	64	36	27.92	.....
1.47	1.65	15.02	13.73	56	44	27.00	.....
3.55	3.75	20.88	22.00	62	38	.....	.....
2.98	2.47	25.10	20.00	43	57	33.00	.....
2.85	2.46	26.14	22.00	54	46	28.00	.....
4.40	2.46	23.02	23.00	76	24	30.00	.....
3.47	....	26.94	.....	..	..	. ...	.....

of one element is more than compensated, as far as money is concerned, by a surplus of the other.

In these two cases, **2919** and **2907**, the deficiencies of money value are respectively 21 and 26 cents.

Where there is a small deficiency of one ingredient it is made good by corresponding excess of another but it is not made good to the careful farmer where there is a *large* deficiency of one, although compensated by a large over-run of another; for his calculation of the amount of nitrogen or other ingredient which he is putting on a crop is incorrect if the fertilizer varies greatly from its guaranteed composition on which he depends in preparing his formula.

Cost and Valuation. Of the twenty-one samples of bone of average composition the average cost is $33.82 and average valuation $30.04.

V. MIXED FERTILIZERS.

MIXTURES OF PHOSPHATES WITH POTASH SALTS.

2884. Wheeler's Grass and Oats, made by American Agricultural Chemical Co., New York City; sampled from stock of M. E. Crawford, New Canaan.

2876. Dissolved Phosphate and Potash, made by Lister's Agricultural Chemical Works, Newark, N. J.; sampled from stock of F. C. Benjamin & Co., Danbury.

	2884	2876
Phosphoric acid, water-soluble	7.93	6.99
" " citrate-soluble	3.66	3.11
" " citrate-insoluble	1.27	0.19
" " total, found	12.86	10.29
" " " guaranteed	12.00	11.00
Water-soluble potash found	2.12	2.12
" " guaranteed	2.00	2.00
Cost per ton		$20.00
Valuation per ton	$12.38	10.66

Eleven hundred pounds of acid phosphate, which can be bought anywhere in the state in small lots for $8.25, and 86 pounds of muriate of potash, purchasable anywhere for $1.83, would make a mixture containing as much as or more phosphoric acid and potash than the above commercial mixtures. These facts can be readily proved from the preceding pages of this report.

The mixture would weigh 1,200 instead of 2,000 pounds, thus saving two-fifths of the weight to be hauled, handled and spread.

The cost would be $10.08 and two men who could not in two hours' time, break all the lumps of muriate with a shovel or maul, mix thoroughly on the barn floor and rebag ready for use, ought to be working in a shop and not on a farm. This makes the cost of mixing less than one dollar, and the total cost to the user about $11.00 a ton, which is our average "valuation." Evidently the "valuation" is excessive in these cases for it is intended to show merely the *cost of the raw materials, unmixed, at freight centers,* which in this case would not be over $11.00.

MIXED TOBACCO FERTILIZERS CONTAINING CHIEFLY PHOSPHORIC ACID AND POTASH.

2882. Tobacco Ash Manure. Made by the American Ag'l Chem'l Co. Stock of L. J. Grant, Wapping.

2361 and **2362.** Bowker's Tobacco Ash Elements, from stock of Henry Adams, Suffield. The first sample was drawn in the usual way from seven packages. The second sample was drawn from a mixture of the contents of three bags which were emptied and thoroughly mixed in one heap. The differences in percentages are not significant.

2878. Ash Compound for Tobacco. Made by the National Fertilizer Co., N. Y. Stock of H. A. Chittenden, No. Granby. The potash being less than guaranteed, the manufacturer called for a portion of our sample in which his chemist found 15.58 per cent. water-soluble potash. Our figures were 14.91 and 15.03 per cent. Another Station to whom we referred the sample found 14.92 and 15.00 per cent.

2880. Vegetable Potash and Bone. Made by Olds & Whipple. Stock of J. B. Rose, Suffield.

2881. Carbonate Formula for Tobacco. Made by Rogers M'f'g Co., Rockfall. Stock of E. M. Griffin, Granby.

2926. The same brand from stock of Robert Bond, Suffield. The per cent. of potash found is far below guaranty. This is explained by the fact that potash which had been in storage over one season was used on the basis of its composition when bought. It had, however, absorbed enough moisture in storage to materially lessen the *percentage* of potash in the salt. There was no loss of potash in storage, but a gain in total weight from

absorbed water and of course 100 pounds of the salt contained a smaller percentage of actual potash. The manufacturer states that a rebate was given to purchasers on account of this deficiency of potash.

ANALYSES.

	2882	2878	2880	2881	2926	2361	2362
Water-soluble phosphoric acid.....	1.55	1.08	0.75	0.33	0.23	0.96	0.90
Citrate-soluble " "	7.14	7.71	12.37	5.06	3.96	5.78	5.77
Citrate-insoluble " "	0.37	0.87	0.10	2.96	3.15	1.36	1.15
Total phosphoric acid found.....	9.06	9.66	13.22	8.35	7.34	8.10	7.82
" " guaranteed....	9.00	9.00	12.00	....	....	9.00	9.00
Potash calculated as muriate.....	0.90	1.20	1.10	1.50	1.75	0.98	0.74
" " sulphate.....	14.89	13.83	1.42	2.30	2.14	13.73	14.22
" " carbonate.....	....	....	15.20	7.92	7.86	....	....
Total potash found.....	15.79	15.03	17.72	11.72*	11.75*	14.71	14.96
" " guaranteed.....	16.00	16.00	15.00	14.00	14.00	15.00	15.00
Valuation per ton.....$	23.66	23.03	37.37	21.90	20.96	21.65	21.75

* See note above.

NITROGENOUS SUPERPHOSPHATES.

In the following table are given analyses of 315 samples of nitrogenous superphosphates drawn by the Station agent and of 30 samples sent by individuals. The brands are given under the names of their manufacturers arranged alphabetically.

All of the determinations are made in duplicate by expert chemists, are frequently checked by chemists elsewhere, and we have every reason to believe, are correct. We may assume a possible error not greater than 0.1 per cent. of nitrogen and 0.15 per cent. of phosphoric acid and potash, due to errors of analysis.

Whether the samples accurately represent the average composition of the brands is less certain. Four or five packages of each brand are sampled with an instrument which takes a section of the contents from top to bottom. Often a considerably larger number are thus sampled, and the analysis is made on a mixture of these separate samples. Frequently samples of a given brand are drawn as above described in several different towns, and these samples are mixed and analyzed as one sample.

Nevertheless, as will appear on following pages, the analysis in some cases is unsatisfactory to the manufacturer, who claims that it does not represent fairly the average quality of the brand

in question. Analyses of the same brand made on samples drawn in other states or on samples drawn from the factory pile from which the shipment was made, may show results quite different from our own.

The causes of these discrepancies, irritating alike to the manufacturer and to the Station, are various. Some are quite evident and others are probably not understood. A mixture of dry materials which have very different specific weights always separates more or less when it is moved or shaken either in the pile or in the bags. In a pile of such a mixture the coarser and heavier particles will be found around the outside edge of the heap, and goods bagged from this part will not have the same composition as from other parts of the pile.

When fertilizer bags are torn in handling, the dealer must rebag their contents, and he uses what sacks he may have at hand. This may cause confusion of brands and the mixing of fertilizer sweepings.

Each analysis is reported as soon as done to the persons owning the stock, and also to the manufacturer. If the analysis does not in his view represent the goods fairly, the Station has, wherever it could be done, drawn and tested other samples of the brand. It cannot, however, suppress any analysis which it has made.

Analyses Requiring Special Notice.

2256. Bradley's Complete Manure for Potatoes and Vegetables, page 142. The nitrogen being below guaranty, at request of the manufacturer, a second sample was drawn from another dealer, **2867,** which contained considerably more nitrogen and phosphoric acid than the first.

2359. Armour's Brewer's Special Tobacco Fertilizer, page 146. The sample contained slightly less nitrogen and 2 per cent. more potash than guaranteed. Upon the protest of the manufacturer, a second sample, **2557,** was drawn and analyzed. This fully met the guaranty.

2270. Berkshire Long Island Special, page 148. The sample showed a deficiency of 0.18 per cent. nitrogen, but a much larger overrun of both phosphoric acid and potash. A second sample, **2868,** met the guaranty in all particulars.

2272. Bowker's Early Potato Manure, page 148, was found below guaranty in both nitrogen and potash. A second sample

was therefore drawn, **2869**, which was slightly deficient in nitrogen (by 0.21 per cent.) with an overrun of potash of 0.95 per cent.

2581. Stockbridge Special Complete Manure for Top Dressing, page 148, was found below guaranty in both nitrogen and potash. A second sample, **2870**, drawn from a different dealer, showed like deficiencies.

2596. Chittenden's Complete Tobacco and Onion Grower and **2600**, Chittenden's Tobacco Special, page 150. The manufacturer writes that only high-grade sulphate of potash was used in these goods and the percentages of chlorine found by us are too high. The percentage given is the lowest of three closely-agreeing determinations. With reference to the occurrence of chlorine in goods of this kind, see page 103.

2228. Clark's Special Mixture for General Use, see page 150. Our analysis shows the percentage of nitrogen 0.25 below guaranty and a large overrun of phosphoric acid and potash. We were unable to get another sample of this brand for comparison. The manufacturer's chemist found 0.14 per cent. of nitrogen more than here reported, 0.39 less of phosphoric acid, and 0.3 per cent. less of potash.

2863. Lister's Special Grass Mixture, see page 154. This analysis was made on a sample furnished by the manufacturer as provided by law, with affidavit of its accuracy. It ran considerably higher in nitrogen and lower in potash than the guaranty. At the request of the manufacturer, who stated that the sample first sent was not representative of the brand, a second sample, **2942**, likewise furnished by the manufacturer, was analyzed.

2367. See page 154. This sample was drawn from stock of G. C. Neal, Hamden, for Lister's Success Phosphate. Its composition is not at all that of this brand, but corresponds closely with Lister's 2-10-4 brand, or Corn No. 2 Fertilizer, which the dealer, we are advised, also had in stock. A sample of Lister's Success Fertilizer was drawn in another place, **2871**, the analysis of which agreed closely with the guaranty.

2668. National Market Garden Fertilizer, see page 156, having shown decidedly less phosphoric acid than was guaranteed, a second sample, drawn from another dealer, was analyzed, which showed an overrun of both potash and phosphoric acid, with a slight deficiency of nitrogen.

2348. New England Superphosphate, see page 156. The analysis shows a deficiency of both nitrogen and potash. A portion of the sample was examined by the company's chemist, who obtained considerably higher percentages of all three ingredients than we found, though somewhat less nitrogen than was guaranteed. A second sample, **2872**, drawn from stock of another dealer, fully meets the guaranty.

2394. F. S. Royster Co.'s Ammoniated Potato Manure, see page 160, contained 0.37 per cent. less nitrogen than guaranteed. A second sample, **2873**, drawn from another dealer, contained only 0.14 per cent. less nitrogen than guaranteed.

2397 and **2849.** Royster's H. G. Tobacco Manure, see page 160. The first analysis having shown a deficiency of nitrogen, a second sample was analyzed which showed a smaller deficiency of nitrogen but a considerable deficiency of potash.

2278. See page 164. This is an imported fertilizer made in London, England, and sold by A. Boddington, New York City. It is sold in small lots at the rate of 14 pounds for $1.25, probably for florists' use.

2332 and **2333**, see page 164, represent samples of two carloads of Coe-Mortimer's Ideal Tobacco. Each sample taken from twenty bags or more. Both fully meet the guaranty.

2995, see page 166, is a fertilizer made and sold by the Isle of Pines Fruit Growers Association.

2610. A sample of Chittenden's Grass and Grain, drawn from six bags, from stock of W. J. Norton, Broad Brook, contained nitrogen 3.25, phosphoric acid 10.03, potash 5.61, the guaranteed percentages being 4, 8 and 5. The manufacturer states that the goods shipped to Mr. Norton were separately sampled at shipment and sends the affidavit of the sampler to that effect, also the analysis by a reliable commercial chemist which shows 4.37 per cent. of nitrogen, and our own analysis of this sample shows 4.42 per cent. These facts indicate that the sample taken by our agent did not fairly represent the goods shipped by the company, but the cause of the discrepancy cannot now be determined.

Regarding Guaranties.

Of the 315 samples of nitrogenous superphosphates examined, ninety-two did not contain each ingredient in the amount stated in the manufacturers' *minimum* guaranty.

Seventy-eight were deficient in respect of one ingredient, fourteen in respect of two, and one in respect of the three ingredients, nitrogen, phosphoric acid and potash.

Fifty-nine were deficient in nitrogen, the most costly element, and twenty-nine were deficient in potash.

In most cases a deficiency of one ingredient was made up as regards money value by an overrun of one or both of the other ingredients. The following twenty samples, however, were deficient in money value by the amounts named.

2256. Bradley's Complete for Potatoes and Vegetables, $1.80 deficiency. But see second analysis of the same brand and note regarding it.

2422. Wheeler's Havana Tobacco Grower, $0.39 deficiency.

2754. Williams & Clark's Americus Ammoniated Superphosphate, $0.42 deficiency.

2752. Williams & Clark's Springfall Phosphate, $0.36 deficiency.

2272. Bowker's Early Potato Manure, deficiency $1.78, but see second analysis of the same brand and note regarding it.

2275. Bowker's Market Garden Fertilizer, deficiency $0.40.

2581. Stockbridge Special for Top Dressing, deficiency $1.69.

2613. Coe-Mortimer's Conn. Wrapper Grower, deficiency $0.23.

2405. Lowell Fertilizer Co.'s Bone Fertilizer for Corn, etc., deficiency $0.80.

2667. National Fertilizer Co. Formula A, deficiency $0.43.

2788. National Fertilizer Co.'s H. G. Top Dressing, deficiency $2.34.

2796. New England Fertilizer Co.'s Potato Grower, 10% Potash, deficiency $0.75.

2348. New England Fertilizer Co.'s Superphosphate, deficiency $1.17, but see second analysis and note regarding it.

2797. Parmenter & Polsey's Potato Grower with 10% Potash, deficiency $0.67.

2394. Royster Guano Co.'s Ammoniated Potato Manure, deficiency $0.90, but see second analysis and note regarding it.

2396. Royster's Fish and Potash, deficiency $0.74.

2397. Royster's H. G. Tobacco Manure, deficiency $0.67. See second analysis and note regarding it.

2849. Royster's H. G. Tobacco Manure, deficiency $1.02.

2399. Royster's H. G. Top Dressing, deficiency $0.93.

2445. Sanderson's Formula B, deficiency $0.75.

Regarding Valuation.

The method and meaning of valuation is explained on pages 99 to 103 and the table of trade values will be found on page 102.

It must be remembered that "valuation" as used in this report *is not a valuation of the brand in question but of the nitrogen, phosphoric acid and potash in it;* that is, it shows approximately what the same amounts of these ingredients as are contained in a ton of the mixed fertilizer would cost, unmixed, for cash, at freight centers in this State, in their unground and unmixed condition. To make a fair valuation of the manufactured fertilizer itself would necessitate adding to our valuation the average cost of mixing and bagging, bags, shrinkage, cost of storage, selling, collecting, freight, etc., items which would probably aggregate $8.00 to $12.00 per ton.

Regarding the Cost of Mixed Fertilizers.

The costs given in the table of analyses are those reported to the Station by retail agents as *cash ton prices* charged by them to customers. The fertilizer manufacturer as a rule has no control over the prices at which these goods are sold to farmers, that being fixed wholly by the retailer, who may allow himself a very small or a very large margin of profit. Hence, it comes that one dealer will charge for a given brand anywhere from one to seven dollars per ton more than another, even where freight rates are the same, and the prices given in the table do not certainly represent the average cost, but what single dealers state is their charge for the brand. One dealer sells scarcely any for cash, and his price quoted to us is really a time price. Another dealer may quote a price not much above the cost of the goods to him, using fertilizers as a "leader," in the same way that a grocer sells sugar or other goods to attract custom.

To illustrate: the price of a certain fertilizer as reported by the retail agent is $33.00. Its cost delivered to the agent is $25.89, if paid for by July 1st, an advance by the retailer of $7.11 per ton, or of 27 per cent.

Another brand costs the retailer $25.50. The dealer's retail price, as reported to the Station, is $31.00, an advance of $5.50, or 21 per cent.

In a number of cases which appear in the table of analyses, differences in the cost price of the same brand appear, ranging from $1.50 to $6.00 per ton. These cannot be chiefly explained by differences in freight rates.

Retail dealers sell both mixed fertilizers and unmixed chemicals at a varying scale of profit depending on distance from station, quantity bought, credit of the buyer and other circumstances.

The foregoing makes it clear that the prices of mixed fertilizers which appear in the table represent more nearly the *maximum* cash prices to consumers than the average prices and, therefore, indicate only approximately, but not at all accurately, the usual market prices.

Therefore, a comparison between the valuation and the price of a fertilizer as quoted by a single dealer does not at all represent the average for Connecticut for that particular brand, but only the state of the case for the dealer whose quotation is made.

On the Purchase of Fertilizers.

The analyses printed in this report show the composition and prices of the various fertilizers which have been sold and used in the state this year. Their historical interest is small, however. For that alone they are hardly worth study. Their chief value is as a guide to purchases for next year. Let us notice some things which they suggest.

It is essential to the farmer to get at the cheapest rate the nitrogen, phosphoric acid, potash, lime and vegetable matter which his soil and crops need. He must get them in forms which may be expected to yield immediate returns and in quantity which, with proper rotation, will maintain the fertility of his land. He cannot, under present conditions, go further and farm at a loss for a term of years, as an investment to be repaid out of an ultimate profit, for he has neither the "expectancy of life" nor the capital to risk this investment. Phosphoric acid and potash when needed he must buy and, under present conditions, a part at least of the nitrogen, aiming, however, to get what he can of it from the air through his crops, in feed residues, green manures and by proper rotations.

He has to consider the *availability* of the fertilizer materials to the crops on which they are used,—their *fineness*, so far as is necessary to make them easily distributed by his farm machinery, and their *cost delivered* on the land. Other qualities are subordinate.

Availability. It is easy to buy raw materials of the same availability as are used in the best commercial mixed fertilizers.

Inferior materials, especially nitrogenous matters, are offered as bargains; like "garbage tankage," "cocoa shells," etc., as well as mixtures of good and inert forms of nitrogen, but reputable firms can be trusted to supply raw materials of high grade only, and the Station can prove, when asked, whether they are as represented.

Commercial mixtures bought of these firms, as examination has shown, are also as generally as the raw materials themselves of good quality.

The work of this and other stations, with the coöperation of the trade, has brought about this satisfactory situation.

Fineness. Commercial mixtures, having been milled and screened, are finer than some of the raw materials which the farmer buys. Ground raw phosphate, basic phosphate, precipitated bone, sulphate of potash, fish, tankage and fine bone (the only kind to buy), are almost always fine enough for drilling. Nitrate of soda and muriate of potash need some crushing or grinding and screening, and acid phosphate has soft lumps, easily broken down. This must be taken into account in figuring the cost of home-mixing.

Cost of Plant Food.

The analyses in this report show the following facts:

Nitrogen in nitrate of soda has sold at retail for from 17.6 to 19.8 cents per pound, or about 18.8 cents as an average. When bought in car lots, or mixed car lots, it has cost 1½ cents less.

In dried blood it has cost about 18½ cents retail.

In cotton seed meal about 20.7 cents in 10-ton or in car lots.

In fish manures,—allowing 4.7 cents per pound for available phosphoric acid (the retail cost in acid phosphate) and 2 cents per pound for insoluble phosphoric acid,—nitrogen has cost at retail about 22½ cents. In tankage and fine bone probably

the cost is about the same at retail and considerably less when bought in mixed car lots.

Total phosphoric acid has cost per pound delivered:

In ground rock phosphate, at retail, 2.3 cents; in car lots, at lowest quotation, 1.36 cents.

In basic phosphate,* at lowest quotation, at retail, 4.6 cents; in car lots, 3.4 cents.

In precipitated bone, at retail, 5.7 cents; in car lots, at lowest quotation, 5.0 cents.

In acid phosphate, at retail, 4.5 cents; in car lots, at lowest quotation, 3.2 cents.

The cost of phosphoric acid in ground rock phosphate given above is figured on bulk shipment and in the other phosphates on bagged shipments, which makes a difference of not far from $1.00 to $1.50 per ton of phosphate. This, in the case of acid phosphate, would be equivalent to half a cent per pound for phosphoric acid.

Soluble and "available" phosphoric acid per pound has cost delivered:

In ground rock phosphate (very little present).

In basic phosphate, at retail, 5.4 cents; in car lots, 3.9 cents.

In precipitated bone, at retail, 5.8 cents; in car lots, 5.2 cents.

In acid phosphate, at retail, 4.7 cents; in car lots, 3.3 cents.

Water-soluble potash has cost per pound delivered:

In high-grade sulphate, 5.3 cents.

In double sulphate of potash, 5.8 cents; in car lots, lowest price, 4.8 cents.

In muriate of potash, 4.1 cents; in car lots, lowest price, 3.6 cents.

In cotton hull ashes, lowest price for car lots, 9.6 cents.

The above prices of fertilizer chemicals are *for spot cash,* on or before delivery of the goods.

They show clearly the great advantage of coöperative buying in car lots, or mixed car lots, directly from manufacturers or brokers.

The farmer on any considerable scale sells a large part of his marketed produce at nearly wholesale rates, not at the prices which the retailer gets for small lots. He cannot afford to buy his

* With no allowance for lime.

fertilizers, barrels, crates, or baskets in small lots at retail. His buying should be largely at wholesale, as well as his selling.

This is already practiced by the tobacco growers in buying cotton seed meal, by certain orchardists and farmers' associations, like the Highwood Fruit and Vegetable Growers' Association and the Jewish Farmers' Association, and has proved to be a great economy. A saving of $3.00 to $4.00 a ton on nitrate of soda, or acid phosphate, or muriate, is certainly worth the effort necessary to "get together" seasonably, determine what kinds and how much of each material are needed and get quotations on goods of guaranteed composition from a number of firms who handle these materials.

With these guaranties and prices the farmer can figure exactly what raw materials for fertilizers will cost him delivered. If he wishes to mix them, he must make an estimate on cost of pulverizing, screening where necessary, mixing and rebagging, for which no other bags are needed than those in which the chemicals come. If he is going to store for some time mixtures which consist largely of chemicals, such as nitrate, potash salts and acid phosphate, without much bone, tankage or fish, he will find it wise to mix in each ton 150 pounds or more of some fine dry inert material, like sawdust, peat, or even fine limestone, to keep the mixture from caking in the bags.

He will not strive to so mix his formulas as to make even tons or half tons. He should think in terms of pounds of plant food, not in tons of phosphate. For example, if he is going to put on an acre 36 pounds of nitrogen, 72 of phosphoric acid and 72 of potash, and has ten acres, let him make a mixture containing 360 pounds of nitrogen and 720 pounds each of phosphoric acid and potash, regardless of whether it weighs 4½ tons, 9 tons, or any other amount. He can do it with 900 pounds of a 4-8-8 formula, 1800 pounds of a 2-4-4 formula, or 700 pounds of a mixture containing 5.1 per cent. of nitrogen, 10.3 of phosphoric acid, and 10.3 of potash.

Will it pay him to make these mixtures himself, or is it more economical to buy them already made?

This question cannot be answered either yes or no by the institute worker, or the teacher, or the "agricultural expert," without having before him the data regarding the cost of raw materials *to the individual inquirer* and also the same facts regard-

Nitrogenous Superphosphates.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.*
	Sampled by Station Agent:			
	The American Agricultural Chemical Co., New York City.			
2255	Grass and Lawn Top Dressing	Waterbury	$36.00	$21.85
2685	High Grade Fertilizer with 10% Potash	No. Stonington	36.00	24.17
	Bradley Branch:			
2689	B. D. Guano	Moodus	26.00	15.29
2256†	Complete Manure for Potatoes and Vegetables	Norwich Town	38.00	23.70
2867†	Complete Manure for Potatoes and Vegetables	Milford	36.50	26.16
2686	Complete Manure for Top Dressing, Grass and Grain	Yantic	36.00	27.83
2687	Complete Manure with 10% Potash	Groton	‡31.30	28.11
2259	Corn Phosphate	Norwich Town	30.00	16.76
2723	Eclipse Phosphate	Putnam	27.00	13.26
2695	Excelsior Fish and Potash	Bristol	29.00	18.12
2691	Farmers' New Method Fertilizer	Putnam	28.00	17.63
2719	Greyhound Fertilizer	Stamford	40.00	27.79
2693	Half Century Fertilizer	Middletown	32.00	18.54
2692	Menhaden Fish Phosphate	Middletown	30.00	16.29
2257	New Rival Fertilizer	Middletown	30.00	15.97
2688	Niagara Phosphate	Putnam	26.00	13.16
2236	Patent Superphosphate	Hazardville, Suffield, Milford	28.75	17.33
2694	Potato Fertilizer	Stafford Springs	35.00	17.52
2696	Potato Manure	Norwich Town	33.00	20.24
2720	Potato and Vegetable Manure	Stamford	37.00	26.92
2237	Retriever Manure	Suffield, Milford, Norwalk	34.00	20.12
2690	Superior Compound	East Haddam	29.00	19.88
2718	Sure Growth Phosphate	Hazardville	34.00	24.20
2722	Tobacco Manure (Carbonate)	Glastonbury	37.00	30.98
2721	Tobacco Manure (Sulphate)	Milford	35.00	27.75
2414	Top Dresser	Milford	37.50	27.84
2258	Weymouth Staple Phosphate	Hazardville	37.00	22.47
2717	XL Superphosphate of Lime	Stafford Springs	35.00	19.21
	Church Branch:			
2415	Fish and Potash	Ellington	27.00	15.94
	East India Branch:			
2731	Black Hawk Fertilizer	Burnside	31.00	20.46
2732	Cabbage and Potato Manure	Gaylordsville	38.75	28.04

* Note explanations regarding Valuation, p. 99. † See note, p. 133. ‡ f. o. b. Boston.

Analyses and Valuations.

Nitrogen.					Phosphoric Acid.							Potash.			Station No.
			Total Nitrogen.					Total.		So-called "Available."		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	
1.79	0.20	1.76	3.75	3.91	3.30	2.56	1.51	7.37	6.0	5.86	5.0	2.56	2.56	2.0	2255
0.27	1.04	1.39	2.70	2.47	3.17	3.17	1.34	7.68	7.0	6.34	6.0	9.54	9.54	10.0	2685
0.06	0.07	0.90	1.03	0.82	5.99	2.32	1.36	9.67	9.0	8.31	8.0	4.24	4.24	4.0	2689
1.35	0.68	0.81	2.84	3.29	4.17	3.87	1.04	9.08	9.0	8.04	8.0	6.86	6.86	7.0	2256
0.16	1.34	1.88	3.38	3.29	5.22	2.89	1.77	9.88	9.0	8.11	8.0	6.76	6.76	7.0	2867
3.01	1.08	0.86	4.95	4.94	2.22	2.30	1.04	5.56	5.0	4.52	4.0	6.07	6.07	6.0	2686
....	1.94	1.53	3.47	3.29	5.20	1.34	0.52	7.06	7.0	6.54	6.0	10.78	10.78	10.0	2687
0.65	0.32	1.06	2.03	2.06	5.20	3.09	1.32	9.61	9.0	8.29	8.0	1.72	1.72	1.5	2259
0.12	0.06	0.75	0.93	1.03	5.47	3.08	1.52	10.07	9.0	8.55	8.0	2.07	2.07	2.0	2723
....	0.32	2.27	2.59	2.47	2.36	2.45	1.84	6.65	5.0	4.81	4.0	4.10	4.10	4.0	2695
0.77	0.06	1.13	1.96	1.65	4.77	3.26	1.10	9.13	9.0	8.03	8.0	3.45	3.45	3.0	2691
....	1.96	1.38	3.34	3.29	5.53	1.07	0.92	8.12	7.0	7.20	6.0	10.13	10.13	10.0	2719
....	0.40	1.65	2.05	2.06	5.67	2.78	1.38	9.83	9 0	8.45	8.0	3.43	3.43	3.0	2693
....	0.74	1.42	2.16	2.06	4.11	2.57	1.28	7.96	7.0	6.68	6.0	2.21	2.21	2.0	2692
0.09	0.12	1.11	1.32	1.23	4.68	2.27	1.10	8.05	7.0	6.95	6.0	5.31	5.31	5.0	2257
0.14	0.06	0.85	1.05	0.82	4.77	2.98	1.56	9.31	8.0	7.75	7.0	2.24	2.24	1.0	2688
....	0.68	1.32	2.00	2.06	6.21	2.46	1.68	10.35	9.0	8.67	8.0	1.83	1.83	1.5	2236
0.75	0.10	1.23	2.08	2.06	3 88	3.76	1.47	9.11	9.0	7.64	8.0	3.07	3.07	3.0	2694
0.97	0.52	1.01	2.50	2.47	3.23	2.98	1.22	7.43	7.0	6.21	6.0	6.01	6.01	5.0	2696
0.18	2.20	1.06	3.44	3.29	6.08	2.24	1.16	9.48	9.0	8.32	8.0	7.48	7.48	7.0	2720
0.28	0.34	1.86	2.48	2.47	4.02	2.78	1.16	7.96	7.0	6.80	6.0	5.24	5.24	5.0	2237
....	0.38	1.02	1.40	0.82	7.42	2.05	0.93	10.40	10.0	9.47	9.0	6.94	6.94	7.0	2690
0.56	0.90	1.76	3.22	2.47	5.38	2.67	1.22	9.27	10.0	8.05	9.0	5.46	5.46	4.0	2718
0.33	0.02	4.74	5.09	4.53	0.27	3.83	0.33	4.43	4.0	4.10	3.0	0.90	*6.08	5.5	2722
0.33	0.02	4.15	4.50	4.53	0.74	4.56	0.43	5.73	4.0	5.30	3.0	0.70	6.03	5.5	2721
1.26	0.86	2.76	4.88	4.94	2.56	2.23	0.97	5.76	5.0	4.79	4.0	5.93	5.93	6.0	2414
0.15	0.44	1.16	1.75	1.65	6.01	2.41	1.09	9.51	9.0	8.42	8.0	9.52	9.52	10.0	2258
....	1.14	1.28	2.42	2.47	5.89	3.11	1.18	10.18	10.0	9.00	9.0	2.20	2.20	2.0	2717
0.54	0.10	1.36	2.00	2.06	3.31	3.12	1.94	8.37	7.0	6.43	6.0	2.52	2.52	2.0	2415
....	0.70	1.71	2.41	2.47	7.36	2.35	1.48	11.19	10.0	9.71	9.0	2.68	2.68	2.0	2731
2.14	0.78	1.04	3.96	4.11	6.18	1.77	1.01	8.96	8.0	7.95	7.0	6.94	6.94	7.0	2732

* 1.47 as sulphate, 3.71 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	The American Agricultural Chemical Co., New York City. *(Continued.)*			
	East India Branch: (Continued.)			
2265	Church's Fish and Potash	Southport	$27.00	$17.17
2730	Corn King	Burnside	34.00	21.86
2417	Fish and Potash	Southport	26.00	18.77
2724	Fruit Growers' Friend	Stratford	30.00	18.07
2419	Garden and Farm Manure	Southport	36.50	26.91
2725	Pilgrim Fertilizer	So. Meriden	30.00	15.68
2418	Potato Manure	Burnside	37.50	26.55
2416	Sea Fowl Guano	So. Meriden	33.00	17.87
2727	10% Vegetable and Potato	Southport	32.75	24.11
2726	Tiger Brand	So. Meriden	32.00	15.89
2483	Tobacco Special (Carbonate)	Burnside	36.00	30.73
2733	Tobacco Special (Sulphate)	Gaylordsville	35.00	27.46
2260	Unexcelled Fertilizer	Southport	28.00	17.91
2261	Unexcelled Fertilizer	New Canaan	34.00	18.71
2729	Vegetable, Vine and Potato	Southport	32.00	23.97
2728	Wheat and Haymaker	East Haddam	38.00	26.48
	Great Eastern Branch:			
2734	General	New Hartford	25.00	15.06
2735	H. G. Vegetable, Vine and Tobacco Fertilizer	East Hampton	33.00	20.81
2736	Northern Corn Special	East Granby	30.00	20.62
	Packers' Union Branch:			
2738	Animal Corn Fertilizer	Waterford	32.00	19.88
2420	Gardeners' Complete Manure	New Canaan	.....	25.78
2737	Potato Manure	East Hampton	33.00	21.58
	Quinnipiac Branch:			
2262	Corn Manure	Westport	32.00	17.60
2745	Fish and Potash Mixture	Unionville	32.00	18.27
2744	Market Garden Manure	Milford	38.00	26.67
2263	Phosphate	New London	32.00	19.02
2740	Potato Manure	Westport	34.00	19.50
2739	Potato Phosphate	New London	33.00	17.36
2421	Wrapper Leaf Brand Tobacco Mature	Windsor	.....	28.03
	Wheeler Branch:			
2748	Connecticut Tobacco Grower	East Granby	37.00	27.40
2746	Corn Fertilizer	Granby	29.00	16.86
2422	Havana Tobacco Grower	Southington	38.00	24.72
2747	Potato Manure	East Granby	31.00	20.02

ANALYSES AND VALUATIONS—*Continued.*

Station No.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Nitrogen. Total Nitrogen. Found.	Nitrogen. Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
2265	0.22	0.72	1.30	2.24	2.06	4.53	2.34	0.92	7.79	7.0	6.87	6.0	2.87	2.87	2.0	2265
2730	....	0.88	1.42	2.30	2.47	5.65	2.68	1.61	9.94	9.0	8.33	8.0	6.27	6.27	6.0	2730
2417	0.72	0.70	1.32	2.74	2.47	2.89	2.01	0.90	5.80	5.0	4.90	4.0	4.62	4.62	4.0	2417
2724	0.07	0.12	0.81	1.00	0.82	6.27	2.98	1.51	10.76	10.0	9.25	9.0	6.67	6.67	7.0	2724
2419	0.20	1.54	1.69	3.43	3.29	6.46	2.06	1.13	9.65	9.0	8.52	8.0	7.22	7.22	7.0	2419
2725	....	0.14	0.89	1.03	0.82	6.00	2.73	1.45	10.18	9.0	8.73	8.0	4.26	4.26	4.0	2725
2418	0.11	2.00	1.31	3.42	3.29	2.91	3.13	1.24	7.28	7.0	6.04	6.0	9.58	9.58	10.0	2418
2416	0.36	0.18	1.62	2.16	2.06	5.70	2.87	1.70	10.27	9.0	8.57	8.0	1.88	1.88	1.5	2416
2727	0.57	0.30	1.01	1.88	1.65	4.59	4.01	1.39	9.99	9.0	8.60	8.0	10.76	10.76	10.0	2727
2726	0.10	0.16	1.13	1.39	1.23	2.71	3.75	1.65	8.11	7.0	6.46	6.0	5.34	5.34	5.0	2726
2483	0.34	0.04	4.37	4.75	4.53	0.36	5.87	0.38	6.61	4.0	6.23	3.0	0.82	*5.67	5.5	2483
2733	....	0.10	4.40	4.50	4.53	0.57	4.21	0.64	5.42	4.0	4.78	3.0	0.80	6.09	5.5	2733
2260	0.13	0.54	1.25	1.92	2.06	5.82	2.86	1.29	9.97	9.0	8.68	8.0	3.09	3.09	3.0	2260
2261	0.11	0 68	1.31	2.10	2.06	5.47	3.00	1.14	9.61	9.0	8.47	8.0	3.43	3.43	3.0	2261
2729	0.73	0.38	1.46	2.57	2.47	3.39	3.02	1.24	7.65	7.0	6.41	6.0	9.81	9.81	10.0	2729
2728	0.12	0.90	0.80	1.82	1.65	6.66	4.94	2.41	14.01	11.0	11.60	10.0	10.32	10.32	10.0	2728
2734	....	0.10	0.83	0.93	0.82	5.77	2.77	1.14	9.68	9.0	8.54	8.0	4.32	4.32	4.0	2734
2735	....	0.30	1.74	2.04	2.06	5.32	2.88	2.10	10.30	9.0	8.20	8.0	6.07	6.07	6.0	2735
2736	0.26	1.00	1.38	2.64	2.47	6.58	2.71	1.56	10.85	10.0	9.29	9.0	2.37	2.37	2.0	2736
2738	0.17	1.04	1.42	2.63	2.47	5.22	3.44	2.07	10.73	10.0	8.66	9.0	2.02	2.02	2.0	2738
2420	....	1.26	1.10	2.36	2.47	3.85	2.64	1.61	8.10	7.0	6.49	6.0	1.06	10.16	10.0	2420
2737	0.42	0.20	1.58	2.20	2.06	6.37	2.44	1.07	9.88	9.0	8.81	8.0	6.09	6.09	6.0	2737
2262	0.14	0.86	1.08	2.08	2.06	6.08	2.72	1.46	10.26	9.0	8.80	8.0	1.85	1.85	1.5	2262
2745	....	0.30	2.29	2.59	2.47	2.37	2.64	2.01	7.02	5.0	5.01	4.0	4.02	4.02	4.0	2745
2744	0.14	2.30	0.97	3.41	3.29	6.19	2.31	1.01	9.51	9.0	8.50	8.0	7.21	7.21	7.0	2744
2263	0.51	0.10	1.69	2.30	2.47	4.76	4.49	1.05	10.30	10.0	9.25	9.0	2.41	2.41	2.0	2263
2740	0.70	0.30	1.29	2.29	2.47	4.57	2.51	0.84	7.92	7.0	7.08	6.0	5.22	5.22	5.0	2740
2739	0.65	0.10	1.30	2.05	2.06	3.68	3.93	1.47	9.08	9.0	7.61	8.0	3.06	3.06	3.0	2739
2421	....	0.08	4.44	4.52	4.53	0.90	3.74	0.41	5.05	4.0	4.64	3.0	0.56	6.67	5.5	2421
2748	....	0.10	4.22	4.32	4.53	0.96	4.49	0.43	5.88	4.0	5.45	3.0	1.14	6.28	5.5	2748
2746	....	0.90	1.02	1.92	1.65	6.04	2.18	1.20	9.42	9.0	8.22	8.0	2.34	2.34	2.0	2746
2422	....	1.24	1.12	2.36	2.47	4.33	2.17	1.16	7.66	7.0	6.50	6.0	1.26	9.55	10.0	2422
2747	0.28	0.50	1.46	2.24	2.06	5.61	2.88	1.10	9.59	9.0	8.49	8.0	4.46	4.46	3.0	2747

*1.67 as sulphate, 3.18 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent: Williams and Clark Branch:			
2754	Americus Ammoniated Bone Superphosphate	Clark's Corner	$31.00	$18.76
2425	Americus Corn Phosphate	Ellington	27.50	16.78
2750	Americus Fertilizer	Waterbury	38.00	24.43
2753	Americus Potato Manure	Brooklyn	30.00	18.07
2765	Aroostook Potato Phosphate	So. Manchester	39.00	27.49
2264	Chesterfield Manure	Waterbury	35.00	20.08
2423	Elk Brand	Milford	32.00	15.80
2424	Fish Guano	Wapping	28.00	16.22
2749	Good Grower	Waterbury	35.00	16.34
2766	Great Planet Manure	Wapping	38.00	27.64
2763	Mammoth Oak Phosphate	Norfolk	39.00	27.42
2764	Meadow Queen Fertilizer	Waterbury	33.00	20.61
2755	Potash and Fish	So. Manchester	30.00	18.36
2768	Seed Leaf Tobacco Manure (Carbonate)	Hillstown	38.00	30.60
2767	Seed Leaf Tobacco Manure (Sulphate)	Hillstown	36.00	26.41
2752	Springfall Phosphate	Milford	32.00	17.50
2751	Sterling Plant Food	Milford	31.00	17.19
	Armour Fertilizing Works, Baltimore, Md.			
2267	All Soluble	Norwalk	33.00	21.75
2436	Ammoniated Bone with Potash	Willimantic	30.00	19.38
2298	Bidwell's Formula for all Crops	Windsor Locks	30.00	23.54
2434	Bone, Blood and Potash	Thompsonville	37.50	29.02
2512	Bone, Blood and Potash	Brooklyn	30.00	29.30
2359*	Brewer's Special Tobacco Fertilizer	East Hartford	36.00	28.20
2557	Brewer's Special Tobacco Fertilizer	East Hartford	36.00	28.80
2520	Complete Potato Fertilizer	Norwalk	33.00	21.21
2437	Conn. Valley Tobacco Grower	Hazardville	37.00	28.27
2861	Conn. Valley Tobacco Starter	Manufacturer	.....	20.09
2521	Corn King	Danielson	32.00	21.02
2519	Fish and Potash	Norwalk	31.00	17.82
2860	Fruit and Root Crop Special	Manufacturer	.....	18.99
2268	High Grade Potato Fertilizer	New Haven	32.00	23.29
2435	Market Garden Special	Rockville	38.00	26.09

* See note, p. 133.

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available."		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
0.36	0.22	1.67	2.25	2.47	5.01	3.74	1.15	9.90	10.0	8.75	9.0	2.72	2.72	2.0	2754
0.17	0.74	1.19	2.10	2.06	4.40	3.63	1.54	9.57	9.0	8.03	8.0	1.66	1.66	1.5	2425
0.10	0.22	1.58	1.90	1.65	5.78	2.46	1.61	9.85	9.0	8.24	8.0	11.10	11.10	10.0	2750
0.68	0.48	0.99	2.15	2.06	4.76	3.25	1.15	9.16	9.0	8.01	8.0	3.14	3.14	3.0	2753
....	1.90	1.42	3.32	3.29	5.50	1.34	0.51	7.35	7.0	6.84	6.0	10.40	10.40	10.0	2765
....	0.32	2.18	2.50	2.47	3.44	3.09	1.27	7.80	7.0	6.53	6.0	5.34	5.34	5.0	2264
0.05	0.10	0.90	1.05	0.82	5.98	2.66	1.48	10.12	9.0	8.64	8.0	4.38	4.38	4.0	2423
0.19	0.56	1.31	2.06	2.06	4.95	1.88	0.96	7.79	7.0	6.83	6.0	2.50	2.50	2.0	2424
0.46	0.12	0.80	1.38	1.23	3.44	3.22	2.10	8.76	7.0	6.66	6.0	5.46	5.46	5.0	2749
0.23	2.16	1.23	3.62	3.29	6.22	2.23	0.99	9.44	9.0	8.45	8.0	7.47	7.47	7.0	2766
0.52	1.75	1.01	3.28	2.47	3.83	2.69	1.16	7.68	7.0	6.52	6.0	10.73	10.73	10.0	2763
0.19	0.72	1.74	2.65	2.47	6.06	2.99	2.02	11.07	10.0	9.05	9.0	2.34	2.34	2.0	2764
....	0.30	2.32	2.62	2.47	2.15	2.47	1.92	6.54	5.0	4.62	4.0	4.40	4.40	4.0	2755
0.41	0.02	4.71	5.14	4.53	0.29	3.47	0.28	4.04	4.0	3.76	3.0	0.78	*5.79	5.5	2768
0.25	0.05	4.00	4.30	4.53	0.41	3.53	1.65	5.59	4.0	3.94	3.0	0.51	6.04	5.5	2767
....	0.58	1.35	1.93	2.06	5.01	3.24	1.59	9.84	9.0	8.25	8.0	2.92	2.92	3.0	2752
....	0.88	1.11	1.99	2.06	5.61	2.93	1.78	10.32	9.0	8.54	8.0	1.89	1.89	1.5	2751
0.44	1.08	1.40	2.92	2.87	5.31	2.39	0.90	8.60	9.5	7.70	8.0	4.41	4.41	4.0	2267
0.17	0.20	2.21	2.58	2.47	4.10	2.84	1.48	8.42	6.5	6.94	6.0	3.60	3.60	2.0	2436
0.91	0.18	1.71	2.80	2.47	5.81	2.37	1.59	9.77	8.5	8.18	8.0	0.84	5.14	5.0	2298
0.14	2.38	1.59	4.11	4.11	7.26	0.89	0.20	8.35	8.5	8.15	8.0	7.45	7.45	7.0	2434
....	2.08	2.06	4.14	4.11	6.36	1.63	0.22	8.21	8.5	7.99	8.0	7.84	7.84	7.0	2512
0.89	0.08	3.41	4.38	4.52	2.95	1.27	0.20	4.42	4.5	4.22	4.0	0.36	7.58	5.5	2359
0.95	0.10	3.75	4.80	4.52	3.20	1.62	0.46	5.28	4.5	4.82	4.0	0.48	6.09	5.5	2557
0.16	0.42	1.66	2.24	1.65	5.15	2.33	0.68	8.16	7.5	7.48	7.0	7.05	7.05	6.0	2520
1.00	0.10	3.64	4.74	4.52	2.76	1.36	0.14	4.26	4.5	4.12	4.0	0.60	6.53	5.5	2437
0.44	0.44	1.64	2.52	2.47	5.99	2.32	1.20	9.51	....	8.31	8.0	3.38	3.38	3.0	2861
0.69	0.40	1.61	2.70	2.47	4.44	3.27	1.65	9.36	8.5	7.71	8.0	4.22	4.22	4.0	2521
0.23	0.38	1.88	2.49	2.05	3.79	2.50	1.25	7.54	6.5	6.29	6.0	2.95	2.95	2.0	2519
0.05	0.50	1.22	1.77	1.65	5.09	3.32	1.02	9.43	....	8.41	8.0	5.48	5.48	5.0	2860
0.13	0.08	1.38	1.59	1.65	6.12	1.94	0.64	8.70	8.5	8.06	8.0	11.70	11.70	10.0	2268
0.47	0.65	2.04	3.16	3.29	5.44	2.77	1.24	9.45	8.5	8.21	8.0	7.73	7.73	7.0	2435

* 1.29 as sulphate, 3.72 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	Berkshire Fertilizer Co., Bridgeport, Conn.			
2269	Ammoniated Bone Phosphate	Norwich Town	$28.00	$15.28
2438	Complete Fertilizer	Buckland	33.00	24.77
2769	Fish and Potash	Rockville	.....	20.09
2522	Grass Special	Norwich Town	35.00	26.60
2270*	Long Island Special	Wethersfield	34.00	25.08
2868	Long Island Special	Milldale	34.00	.....
2439	Potato and Vegetable Phosphate	Waterbury	32.00	18.64
2476	Tobacco Special with Carbonate	Hillstown	38.00	33.02
	F. E. Boardman, Middletown, Conn.			
2360	Complete Fertilizer for Potatoes and General Crops	Middletown	34.00	27.26
	Bowker Fertilizer Co., New York City.			
2484	Complete Alkaline Tobacco Grower	Windsor	31.50	25.21
2477	Complete Alkaline Tobacco Grower (Carbonate)	Suffield	35.50	27.56
2271	Corn Phosphate	Willimantic	28.00	15.85
2272*	Early Potato Manure	Yalesville	38.00	23.30
2869	Early Potato Manure	Rockville	38.00	.....
2273	Farm and Garden Phosphate	New Haven	30.00	15.66
2274	Fisherman's Brand Fish and Potash	Hazardville	30.00	17.63
2536	Gloucester Fish and Potash	New Haven	25.00	13.53
2574	Hill and Drill Phosphate	Hazardville	34.00	20.80
2575	Lawn and Garden Dressing	New Haven	50.00	22.88
2275	Market Garden Fertilizer	New Canaan	38.00	23.04
2276	Potato and Vegetable Fertilizer	Waterbury	35.00	21.21
2582	Potato and Vegetable Phosphate	Norwich	34.00	16.17
2576	Special Crop Grower	New Canaan	36.00	23.66
2578	Stockbridge Sp'l Complete Manure for Corn and all Grain Crops	Rockville	40.00	27.90
2579	Stockbridge Sp'l Complete Manure for Potatoes and Vegetables	New Haven	40.00	26.84
2580	Stockbridge Sp'l Complete Manure for Seeding Down, etc	Yalesville	38.00	27.76
2770	Stockbridge Sp'l Complete Manure for Tobacco	Cromwell	49.00	36.22
2581†	Stockbridge Sp'l Complete Manure for Top Dressing, Grass and Grain	New Britain	41.00	25.82

* See note, p. 133.

† See note, p. 134.

ANALYSES AND VALUATIONS—*Continued.*

Station No.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Nitrogen. Total Nitrogen. Found.	Nitrogen. Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
2269	....	0.10	1.20	1.30	0.80	6.73	1.82	0.29	8.84	9.0	8.55	8.0	3.19	3.19	2.0	2269
2438	....	0.20	2.66	2.86	2.50	5.34	3.45	1.83	10.62	9.0	8.79	8.0	2.42	5.81	6.0	2438
2769	....	0.12	2.66	2.78	2.50	1.11	5.40	0.82	7.33	6.0	6.51	4.0	4.58	4.58	3.0	2769
2522	3.33	0.08	2.04	5.45	5.00	2.80	1.22	0.37	4.39	5.0	4.02	4.0	3.03	3.03	2.0	2522
2270*	....	0.08	3.04	3.12	3.30	5.13	2.08	0.58	7.79	7.0	7.21	6.0	7.91	7.91	7.0	2270
2868	0.11	....	3.54	3.65	3.30	4.39	2.71	0.55	7.65	7.0	7.10	6.0	7.31	7.31	7.0	2868
2439	0.06	0.12	1.96	2.14	1.70	4.49	2.29	0.50	7.28	7.0	6.78	6.0	5.25	5.25	4.0	2439
2476	0.33	0.08	4.46	4.87	4.50	0.86	3.39	0.18	4.43	4.0	4.25	3.0	0.66	*7.32	5.5	2476
2360	0.75	0.88	1.65	3.28	3.00	4.99	3.21	0.51	8.71	....	8.20	7.0	9.05	9.05	9.0	2360
2484	....	....	4.01	4.01	4.11	0.56	5.11	0.47	6.14	5.0	5.67	4.0	0.58	5.06	5.0	2484
2477	....	....	4.04	4.04	4.11	0.56	4.72	0.52	5.80	5.0	5.28	4.0	0.70	†5.53	5.0	2477
2271	0.09	1.04	0.67	1.80	1.65	5.07	2.93	0.96	8.96	9.0	8.00	8.0	2.16	2.16	2.0	2271
2272*	0.72	1.14	1.21	3.07	3.29	3.85	3.17	2.05	9.07	8.0	7.02	7.0	5.87	5.87	7.0	2272
2869	0.94	0.76	1.38	3.08	3.29	3.87	3.13	1.07	8.07	8.0	7.00	7.0	7.95	7.95	7.0	2869
2273	0.35	0.64	0.77	1.76	1.65	3.25	4.42	1.60	9.27	9.0	7.67	8.0	2.29	2.29	2.0	2273
2274	0.10	1.10	1.38	2.58	2.47	1.97	2.29	1.62	5.88	5.0	4.26	4.0	4.35	4.35	4.0	2274
2536	....	0.10	0.95	1.05	0.82	5.63	2.82	1.64	10.09	9.0	8.45	8.0	1.83	1.83	1.0	2536
2574	0.52	1.00	1.10	2.62	2.47	6.07	3.37	1.69	11.13	10.0	9.44	9.0	2.54	2.54	2.0	2574
2575	0.71	1.24	1.32	3.27	3.29	1.76	4.38	3.81	9.95	5.0	6.14	4.0	4.75	4.75	5.0	2575
2275	....	1.10	1.22	2.32	2.47	2.73	3.74	1.46	7.93	7.0	6.47	6.0	9.76	9.76	10.0	2275
2276	0.14	1.18	1.36	2.68	2.47	5.78	2.46	1.32	9.56	9.0	8.24	8.0	4.06	4.06	4.0	2276
2582	0.08	0.60	1.05	1.73	1.65	3.33	4.87	2.35	10.55	9.0	8.20	8.0	2.14	2.14	2.0	2582
2576	0.15	0.46	1.44	2.05	1.65	5.24	2.87	1.19	9.30	9.0	8.11	8.0	9.92	9.92	10.0	2576
2578	1.48	0.90	1.01	3.39	3.29	6.36	3.67	1.25	11.28	11.0	10.03	10.0	7.16	7.16	7.0	2578
2579	0.11	1.45	1.63	3.19	3.29	3.92	2.52	1.15	7.59	7.0	6.44	6.0	10.42	10.42	10.0	2579
2580	0.18	1.36	1.32	2.86	2.47	6.80	3.37	0.83	11.00	11.0	10.17	10.0	1.67	7.83	8.0	2580
2770	....	2.84	2.76	5.60	5.76	3.27	1.62	0.99	5.88	5.0	4.89	4.0	1.44	10.35	10.0	2770
2581†	0.83	2.30	1.33	4.46	4.94	2.48	2.32	1.29	6.09	5.0	4.80	4.0	5.39	5.39	6.0	2581

* 0.39 as sulphate, 6.27 as carbonate.

† 1.12 as sulphate, 3.71 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	Bowker Fertilizer Co., New York City. *(Continued.)*			
2870	Stockbridge Sp'l Complete Manure for Top Dressing Grass and Grain	West Cheshire	$38.00	.....
2277	Sure Crop Phosphate	Yalesville	27.00	$14.28
2577	Tobacco Starter	Wapping	32.00	21.57
	The E. D. Chittenden Co., Bridgeport, Conn.			
2596*	Complete Tobacco and Onion Grower	Broad Brook	36.00	26.57
2597	Connecticut Tobacco Grower	Broad Brook	45.00	31.25
2598	Fish and Potash, Special Formula	Suffield	32.00	19.11
2599	Grain and Vegetable	Green's Farms	33.00	22.13
2600*	Tobacco Special	Suffield	36.00	26.03
	The Everett B. Clark Seed Co., Milford, Conn.			
2228*	Clark's Special Mixture	Milford	32.00	26.50
2229	Special 10% Brand	Milford	33.00	27.70
	The Coe-Mortimer Co., New York City.			
2340	Celebrated Special Potato Fertilizer	West Hartford	33.00	18.31
2341	Complete Manure 10% Potash	Wethersfield	36.50	25.33
2613	Connecticut Wrapper Grower	Windsor	.....	36.27
2611	Gold Brand, Excelsior Guano	West Hartford	38.00	23.06
2342	H. G. Ammoniated Bone Superphosphate	Norwich	31.00	18.92
2487	Ideal Tobacco Fertilizer	Somersville	36.50	26.50
2772	New Englander Corn and Potato Fertilizer	Winsted	31.00	14.46
2486	Peruvian Tobacco Fertilizer for Wrapper Leaf	Suffield	50.00	35.71
2343	Peruvian Vegetable Grower	West Cheshire	41.75	30.14
2612	Red Brand, Excelsior Guano	West Cheshire	37.50	26.33
	Conn. Valley Orchard Co., Berlin, Conn.			
2670	H. G. Special Fertilizer	Berlin	26.00	21.92

* See note, p. 134.

ANALYSES AND VALUATIONS—*Continued.*

Station No.	NITROGEN. As Nitrates.	As Ammonia.	Organic.	Total Nitrogen. Found.	Guaranteed.	PHOSPHORIC ACID. Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total. Found.	Guaranteed.	So-called "Available." Found.	Guaranteed.	POTASH. Found. As Muriate.	Total.	Guaranteed.	Station No.
2870	....	....	....	3.86	4.94	....	....	....	7.15	5.0	....	4.0	....	5.19	6.0	2870
2277	0.09	0.24	0.59	0.92	0.82	6.19	2.99	2.01	11.19	10.0	9.18	9.0	2.42	2.42	2.0	2277
2577	....	0.70	2.14	2.84	2.47	7.24	1.60	0.70	9.54	9.0	8.84	8.0	0.35	2.70	3.0	2577
2596*	0.10	3.00	0.51	3.61	3.30	5.89	3.09	0.41	9.39	9.0	8.98	8.0	1.37	5.25	5.0	2596
2597	0.16	3.15	1.43	4.74	4.95	0.45	4.51	0.54	5.50	5.0	4.96	4.0	1.95	9.25	8.0	2597
2598	0.12	0.55	1.58	2.25	2.47	1.88	5.06	1.07	8.01	7.0	6.94	6.0	5.25	5.25	4.0	2598
2599	0.08	1.30	1.08	2.46	2.47	6.25	2.27	0.42	8.94	9.0	8.52	8.0	6.24	6.24	6.0	2599
2600*	0.14	2.48	1.56	4.18	4.50	0.79	3.31	0.40	4.50	4.0	4.10	3.0	2.23	6.97	5.5	2600
2228*	1.43	0.90	0.71	3.04	3.29	6.10	2.40	0.77	9.27	....	8.50	8.0	8.78	8.78	7.0	2228
2229	1.46	0.92	0.94	3.32	3.29	4.62	2.44	0.83	7.89	....	7.06	6.0	10.46	10.46	10.0	2229
2340	0.14	0.28	1.37	1.79	1.65	6.20	2.23	1.61	10.04	9.0	8.43	8.0	4.16	4.16	4.0	2340
2341	0.15	0.70	1.83	2.68	2.47	4.34	2.21	1.91	8.46	7.0	6.55	6.0	10.34	10.34	10.0	2341
2613	0.18	3.80	1.59	5.57	5.76	4.83	1.44	1.01	7.28	6.0	6.27	5.0	1.40	9.41	10.0	2613
2611	0.12	1.02	1.32	2.46	2.47	6.42	2.58	1.75	10.75	9.0	9.00	8.0	6.22	6.22	6.0	2611
2342	0.21	0.20	1.69	2.10	1.85	5.75	2.63	2.03	10.41	9.0	8.38	8.0	3.40	3.40	3.0	2342
2487	....	....	4.40	4.40	4.53	0.55	3.89	0.50	4.94	4.0	4.44	3.0	0.70	5.81	5.5	2487
2772	0.11	0.16	0.75	1.02	0.82	5.45	3.05	1.22	9.72	9.0	8.50	8.0	3.26	3.26	3.0	2772
2486	0.48	2.78	1.79	5.05	4.94	5.29	2.12	0.42	7.83	7.0	7.41	6.0	1.25	9.96	10.0	2486
2343	1.40	0.16	1.76	3.32	3.29	6.38	2.35	0.83	9.56	9.0	8.73	8.0	2.30	9.70	9.0	2343
2612	0.09	2.08	1.16	3.33	3.29	6.49	1.80	1.48	9.77	9.0	8.29	8.0	7.08	7.08	7 0	2612
2670	0.12	0.18	2.30	2.60	2.47	6.52	2.59	0.96	10.07	10.0	9.11	9.0	4.41	4.41	4.0	2670

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	Consumers' Fertilizer Co., of New Jersey, New York City.			
2862	Early Crop Odorless Fertilizer	Manufacturer	$45.00	$28.06
2857	Mak-Gro Odorless Plant Food	Manufacturer	43.50	27.09
	T. H. Eldredge, Norwich, Conn.			
2231	Special Fish and Potash	Norwich	30.00	17.47
2230	Special Superphosphate	Norwich	28.00	15.34
	Essex Fertilizer Co., Boston, Mass.			
2344	Complete Manure for Corn, Grain and Grass	East Hartford	39.50	26.44
2347	Complete Manure for Potatoes, Roots and Vegetables	Plainville	39.50	26.53
2346	Market Garden and Potato Manure	Plainville	33.00	19.29
2830	New Tobacco Fertilizer	East Hartford	40.00	26.41
2614	Tobacco Starter and Grower	Ellington	39.00	27.11
2345	XXX Fish and Potash	East Hartford	32.00	18.37
	The L. T. Frisbie Co., New Haven, Conn.			
2615	Connecticut Special Fertilizer	Rockville	38.00	24.21
2232	Corn and Grain Fertilizer	Bridgeport, Hartford, Meriden.	28.25	18.50
2302	Potato Manure	Bridgeport	35.00	21.04
2303	Top Dressing	New Haven	39.00	26.16
2616	Vegetable Grower	Wethersfield	35.00	25.02
	International Agricultural Corporation. *Buffalo Fertilizer Works, Buffalo, N. Y.*			
2299	Celery and Potato Special	New London	36.00	22.42
2301	Farmers' Choice	Ansonia	25.00	15.92
2609	Fish Guano	Stafford Springs	26.00	15.02
2608	High Grade Manure	Brooklyn	34.00	28.42
2771	New England Special	Ansonia	28.00	20.70
2485	Tobacco Producer	West Suffield	.....	27.68
2300	Top Dresser	West Cheshire	42.00	31.10
2583	Vegetable and Potato	Brooklyn	34.00	24.53
	Lister's Agricultural Chemical Works, Newark, N. J.			
2368	Ammoniated Dissolved Bone Superphosphate	No. Branford	30.00	17.47
2478	Complete Tobacco Manure (Carbonate)	Simsbury	37.00	28.75

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			Station No.
			Total Nitrogen.					Total.		So-called "Available."		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	
3.24	....	0.27	3.51	3.28	5.43	1.53	0.09	7.05	7.0	6.96	6.0	1.00	8.66	8.0	2862
2.60	....	0.25	2.85	2.46	7.88	1.51	0.09	9.48	9.0	9.39	8.0	1.14	8.01	8.0	2857
....	0.12	1.90	2.02	2.05	2.33	3.63	1.92	7.88	6.0	5.96	5.0	4.75	4.75	4.0	2231
....	0.06	1.26	1.32	1.00	2.89	6.20	1.59	10.68	10.0	9.09	8.0	2.51	2.51	2.0	2230
0.08	0.04	2.90	3.02	3.28	3.95	2.76	0.86	7.57	7.0	6.71	6.0	10.42	10.42	10.0	2344
....	0.08	2.98	3.06	3.28	4.34	2.82	0.82	7.98	7.0	7.16	6.0	9.89	9.89	10.0	2347
....	0.02	1.87	1.89	2.00	5.89	2.82	0.96	9.67	9.0	8.71	8.0	4.90	4.90	5.0	2346
1.31	0.10	2.77	4.18	4.10	3.57	1.13	0.52	5.22	5.0	4.70	4.0	0.74	6.18	6.0	2830
1.57	....	2.67	4.24	4.10	1.29	3.48	2.09	6.86	5.0	4.77	4.0	1.17	6.19	6.0	2614
....	0.04	2.10	2.14	2.00	5.18	2.77	1.34	9.29	9.0	7.95	8.0	3.32	3.32	3.0	2345
0.84	0.04	1.51	2.39	2.46	2.80	3.82	1.52	8.14	7.0	6.62	6.0	10.61	10.61	10.0	2615
....	0.72	1.28	2.00	1.64	2.43	5.82	3.25	11.50	9.0	8.25	8.0	3.30	3.30	3.0	2232
....	0.80	1.82	2.62	2.46	4.20	2.87	1.07	8.14	8.0	7.07	6.0	5.47	5.47	6.0	2302
0.38	0.10	3.68	4.16	4.10	4.02	3.46	0.95	8.43	8.0	7.48	7.0	4.27	4.27	4.0	2303
0.47	0.72	2.05	3.24	3.29	2.87	4.39	1.36	8.62	8.0	7.26	6.0	7.29	7.29	8.0	2616
0.81	0.20	0.69	1.70	1.50	5.30	2.87	0.75	8.92	9.0	8.17	8.0	10.22	10.22	10.0	2299
....	0.10	0.85	0.95	0.80	4.86	3.48	1.04	9.38	9.0	8.34	8.0	5.59	5.59	5.0	2301
0.11	0.06	0.98	1.15	0.80	5.97	3.65	1.04	10.66	10.0	9.62	9.0	2.30	2.30	2.0	2609
1.81	0.52	1.09	3.42	3.30	5.63	1.97	0.38	7.98	8.0	7.60	7.0	10.42	10.42	10.0	2608
0.29	0.62	1.09	2.00	1.60	6.13	3.02	1.16	10.31	10.0	9.15	9.0	5.65	5.65	5.0	2771
....	1.18	3.26	4.44	4.50	1.30	3.88	1.06	6.24	6.0	5.18	5.0	0.62	6.05	5.5	2485
1.09	3.20	1.05	5.34	5.70	4.45	2.38	1.11	7.94	7.0	6.83	6.0	5.75	5.75	5.0	2300
1.30	0.26	1.08	2.64	2.40	6.79	2.17	0.47	9.43	9.0	8.96	8.0	7.79	7.79	7.0	2583
....	0.32	1.84	2.16	2.06	4.82	3.24	1.98	10.04	9.0	8.06	8.0	1.86	1.86	1.5	2368
1.93	0.02	2.33	4.28	4.11	0.50	4.37	3.02	7.89	6.0	4.87	4.0	0.44	*5.16	5.0	2478

* 0.72 as sulphate, 4.00 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	Lister's Agricultural Chemical Works, Newark, N. J. *(Continued.)*			
2617	Complete Tobacco Manure (Sulphate)	Warehouse Point	.....	$24.77
2366	Corn and Potato Fertilizer	Danbury	$30.00	16.06
2369	Potato Manure	Burnside	37.00	27.18
2863*	Special Grass Mixture	Manufacturer	36.00	25.33
2942	Special Grass Mixture	Manufacturer	.....	.....
2864	Special 10% Potato Fertilizer	Manufacturer	35.00	23.12
2773	Standard Pure Bone Superphosphate of Lime	Wallingford	30.40	20.84
2367*	Success Fertilizer (?)	Hamden	.....	19.85
2871	Success Fertilizer	Moodus	30.00	16.14
2774	3–6–10 for Potatoes	Glastonbury	36.00	24.51
	Lowell Fertilizer Co., Boston, Mass.			
2404	Animal Brand	Suffield	33.00	20.29
2405	Bone Fertilizer for Corn, Grain, etc.	Cheshire	30.00	15.31
2545	Corn and Vegetable Manure	Wallingford	40.00	25.46
2544	Empress Brand	Moosup	24.50	12.48
2542	Market Garden Manure	So. Manchester	38.00	27.09
2543	Perfect Tobacco Grower	Ellington	38.00	26.53
2541	Potato Grower	Granby	37.00	26.94
2540	Potato Manure	Southington	34.00	16.35
2539	Potato Phosphate	Cheshire	35.00	22.61
2538	Special Grass Mixture for Top Dressing and Lawns	New Haven	36.00	28.72
2856	Special Potato Fertilizer with 10% Potash	Torrington	37.00	24.28
2546	Special Tobacco Manure from Vegetable and Animal Matter	Windsor	37.00	29.85
2537	Superior Fertilizer with 10% Potash	Rockville	40.00	28.86
	E. Manchester & Sons, Winsted, Conn.			
2781	Formula	Ellington	32.00	28.61
2783	Helper	Winsted	28.00	20.46
2782	Special	Winsted	36.00	34.22
	The Mapes' Formula and Peruvian Guano Co., New York City.			
2233	Average Soil Complete Manure	Windsor Locks, Glastonbury, Southington	39.00	28.42
2618	Cereal Brand	Hazardville	32.00	15.83

* See note, p. 134.

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total. Nitrogen.					Total.		So-called "Available."		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
1.56	0.14	2.24	3.94	4.11	2.03	2.57	1.30	5.90	5.0	4.60	4.0	0.92	5.47	5.0	2617
....	0.22	1.40	1.62	1.65	5.55	2.42	1.16	9.13	9.0	7.97	8.0	2.98	2.98	3.0	2366
0.06	2.14	1.38	3.58	3.29	6.07	2.37	1.28	9.72	9.0	8.44	8.0	6.98	6.98	7.0	2369
0.11	0.08	1.96	2.15	1.65	7.84	3.03	0.63	11.50	11.0	10.87	10.0	8.75	8.75	10.0	2863
...	.....	....	1.70	1.65	....	....	....	9.36	11.0	.....	....	....	10.29	10.0	2942
....	0.14	1.52	1.66	1.65	3.07	5.09	1.78	9.94	9.0	8.16	8.0	10.92	10.92	10.0	2864
....	1.04	1.58	2.62	2.47	6.81	2.66	1.24	10.71	10.0	9.47	9.0	2.62	2.62	2.0	2773
....	0.14	1.48	1.62	1.23	7.81	2.95	1.69	12.45	10.0	10.76	9.0	4.28	4.28	2.0	2367
0.06	0.06	1.36	1.48	1.23	6.12	3.22	1.61	10.95	10.0	9.34	9.0	2.12	2.12	2.0	2871
0.90	0.12	1.64	2.66	2.47	1.94	3.86	1.94	7.74	7.0	5.80	6.0	10.46	10.46	10.0	2774
....	0.10	2.38	2.48	2.46	4.91	2.76	1.75	9.42	9.0	7.67	8.0	4.18	4.18	4.0	2404
....	0.05	1.49	1.54	1.64	5.64	1.98	0.93	8.55	9.0	7.62	8.0	2.86	2.86	3.0	2405
....	0.08	2.92	3.00	3.28	5.55	2.60	1.09	9.24	9.0	8.15	8.0	7.69	7.69	7.0	2545
....	0.04	1.13	1.17	1.24	4.49	2.53	0.90	7.92	8.0	7.02	7.0	1.90	1.90	2.0	2544
....	0.06	3.94	4.00	4.10	4.79	2.64	1.05	8.48	8.0	7.43	7.0	5.94	5.94	6.0	2542
1.45	0.34	2.53	4.32	4.10	1.68	2.94	1.43	6.05	5.0	4.62	4.0	1.00	5.77	6.0	2543
....	0.08	2.96	3.04	3.28	4.30	2.20	0.96	7.46	7.0	6.50	6.0	11.03	11.03	10.0	2541
....	0.10	1.52	1.62	1.64	5.16	1.76	0.96	7.88	8.0	6.92	7.0	4.44	4.44	4.0	2540
0.34	0.06	2.22	2.62	2.46	5.69	2.74	0.78	9.21	9.0	8.43	8.0	5.97	5.97	6.0	2539
0.11	0.10	3.91	4.12	4.10	5.10	3.00	1.34	9.44	8.0	8.10	7.0	6.53	6.53	6.0	2538
0.07	0.10	2.45	2.62	2.46	4.06	2.45	0.83	7.34	7.0	6.51	6.0	9.88	9.88	10.0	2856
1.24	0.10	2.78	4.12	4.10	5.25	0.98	0.31	6.54	7.0	6.23	6.0	1.13	8.50	8.0	2546
....	0.08	3.54	3.62	3.69	4.71	2.39	1.32	8.42	8.0	7.10	7.0	9.92	9.92	10.0	2537
0.16	2.03	1.61	3.80	3.50	5.83	2.40	1.02	9.25	....	8.23	7.5	8.01	8.01	8.0	2781
0.15	0.30	1.33	1.78	1.64	4.86	3.61	1.00	9.47	....	8.47	8.0	8.09	8.09	8.0	2783
0.02	4.76	0.36	5.14	5.00	5.59	2.34	0.81	8.74	....	7.93	7.5	0.76	7.71	7.5	2782
1.74	1.06	1.48	4.28	4.12	1.70	5.75	0.87	8.32	8.0	7.45	7.0	0.54	5.78	5.0	2233
0.67	0.10	1.23	2.00	1.65	0.90	4.64	2.88	8.42	8.0	5.54	6.0	3.09	3.09	3.0	2618

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	The Mapes' Formula and Peruvian Guano Co., New York City. *(Cont.)*			
2619	Complete Manure "A" Brand	Meriden	$35.00	$21.06
2235	Corn Manure	Meriden, Windsor Locks, Norwich	37.00	22.64
2877*	Dissolved Bone	Hartford	34.00	24.50
2658	Economical Potato Manure	Hartford	38.00	27.67
2784	Fruit and Vine Manure	Hartford	42.00	23.56
2234	Potato Manure	Meriden, Suffield, Windsor Locks	41.75	28.90
2659	Seeding Down Manure	Forestville	41.00	31.90
2479	Tobacco Ash Constitutents	Suffield	35.00	30.46
2480	Tobacco Manure Wrapper Brand	Windsor	50.00	44.26
2660	Tobacco Starter Improved	Windsor Locks	39.00	26.27
2661	Top Dresser Improved, Full Strength	Hartford	54.00	46.14
2662	Top Dresser Improved, Half Strength	Middletown	37.00	22.95
2663	Vegetable Manure for Light Soils	Glastonbury	44.00	32.74
	The National Fertilizer Co., New York City.			
2365	Ammoniated Bone Phosphate	East Hartford	.....	16.63
2364	Complete Grass Fertilizer	Willimantic	37.00	29.47
2363	Complete Root and Grain Fertilizer	So. Manchester	38.00	25.90
2664	Complete Tobacco Fertilizer	Suffield	37.00	26.38
2789	Conn. Valley Tobacco Grower	Broad Brook	44.00	35.84
2665	Eureka Potato Fertilizer	Ellington	34.50	23.87
2666	Fish and Potash	So. Manchester	31.00	20.70
2667	Formula "A"	Willimantic	35.00	22.46
2788	H. G. Top Dressing	So. Manchester	59.00	41.44
2668†	Market Garden Fertilizer	Greenwich	38.00	22.98
2943	Market Garden Fertilizer	North Granby	34.00	.....
2785	Potato Phosphate	Wallingford	33.00	21.52
2786	Tobacco Special	Broad Brook	31.00	28.89
2481	Tobacco Special with Carbonate	Somersville	37.00	29.48
2787	XXX Fish and Potash	So. Manchester	29.00	17.94
	New England Fertilizer Co., Boston, Mass.			
2792	Corn and Grain Fertilizer	Rockville	29.00	11.96
2793	Corn Phosphate	Unionville	31.00	15.99
2794	High Grade Potato Fertilizer	East Woodstock	34.00	22.13
2349	Perfect Tobacco Grower	Suffield	39.00	25.86
2795	Potato Fertilizer	Plantsville	34.00	17.47
2796	Potato Grower with 10% Potash	Jewett City	35.00	22.67
2348‡	Superphosphate	Warehouse Point	32.00	17.79
2872	Superphosphate	Suffield	32.00	21.23

*Last year's stock. †See note, p. 134. ‡See note, p. 135.

ANALYSES AND VALUATIONS—*Continued.*

Station No.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Nitrogen. Total Nitrogen. Found.	Nitrogen. Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
2619	1.08	0.82	0.76	2.66	2.47	1.50	8.28	2.60	12.38	12.0	9.78	10.0	2.51	2.51	2.5	2619
2235	1.23	0.46	0.89	2.58	2.47	1.13	7.02	2.37	10.52	10.0	8.15	8.0	6.38	6.38	6.0	2235
2877*	....	0.20	2.46	2.66	2.06	3.87	12.87	1.57	18.31	12.0	16.74	....	....	....	....	2877
2658	1.30	1.06	1.18	3.54	3.30	0.54	4.19	1.87	6.60	6.0	4.73	4.0	0.80	9.55	8.0	2658
2784	0.91	0.04	0.90	1.85	1.65	0.70	4.43	2.41	7.54	7.0	5.13	5.0	0.96	11.12	10.0	2784
2234	1.93	0.75	1.13	3.81	3.71	1.82	6.87	0.84	9.53	8.0	8.69	8.0	0.50	6.96	6.0	2234
2659	1.98	....	0.80	2.78	2.47	0.06	10.54	9.45	20.05	18.0	10.60	....	10.90	10.90	10.0	2659
2479	0.13	....	0.64	0.77	0.50	0.18	1.72	3.98	5.88	5.7	1.90	....	1.79	*16.68	15.0	2479
2480	3.90	....	2.69	6.59	6.18	0.09	3.35	1.88	5.32	4.5	3.44	....	1.40	†11.09	10.5	2480
2660	1.96	0.04	2.63	4.63	4.12	0.82	7.10	1.50	9.42	8.0	7.92	6.0	0.51	1.87	1.0	2660
2661	5.56	3.25	0.59	9.40	9.88	0.27	6.87	1.52	8.66	8.0	7.14	5.0	1.20	4.96	4.0	2661
2662	2.80	1.48	0.40	4.68	4.94	0.33	2.48	1.39	4.20	4.0	2.81	2.5	0.35	2.68	2.0	2662
2663	2.33	1.24	1.83	5.40	4.94	0.82	5.62	1.94	8.38	8.0	6.44	6.0	0.70	6.38	6.0	2663
2365	0.17	0.26	1.34	1.77	1.65	4.71	3.34	1.47	9.52	9.0	8.05	8.0	2.88	2.88	2.0	2365
2364	0.43	1.14	3.11	4.68	4.11	4.20	3.59	1.27	9.06	7.0	7.79	6.0	5.50	5.50	5.0	2364
2363	1.13	0.80	1.49	3.42	3.29	6.14	2.56	0.92	9.62	9.0	8.70	8.0	6.05	6.05	6.0	2363
2664	0.25	1.50	1.75	3.50	3.29	6.17	2.36	1.32	9.85	9.0	8.53	8.0	1.10	5.23	5.0	2664
2789	....	....	4.78	4.78	4.94	0.66	3.73	0.41	4.80	4.0	4.39	3.0	0.25	‡9.30	8.0	2789
2665	0.59	0.36	1.52	2.47	2.47	4.03	2.36	0.90	7.29	7.0	6.39	6.0	10.24	10.24	10.0	2665
2666	0.15	1.26	1.59	3.00	2.88	3.48	2.59	1.66	7.73	7.0	6.07	6.0	4.21	4.21	4.0	2666
2667	0.74	0.94	1.44	3.12	3.29	3.74	2.41	0.67	6.82	7.0	6.15	6.0	6.12	6.12	6.0	2667
2788	3.04	2.00	2.82	7.86	8.43	2.07	3.81	0.63	6.51	7.25	5.88	6.25	8.13	8.13	8.0	2788
2668†	0.58	0.68	1.72	2.98	2.47	4.18	2.62	1.14	7.94	9.0	6.80	8.0	6.41	6.41	6.0	2668
2943	....	....	....	2.34	2.47	....	....	....	9.80	9.0	....	....	.....	6.29	6.0	2943
2785	0.10	0.50	1.67	2.27	2.06	5.46	2.68	1.61	9.75	9.0	8.14	8.0	6.19	6.19	6.0	2785
2786	....	0.04	4.56	4.60	4.53	0.73	5.19	0.35	6.27	4.0	5.92	3.0	1.00	6.34	5.5	2786
2481	0.38	0.10	3.96	4.44	4.53	0.54	4.74	0.32	5.60	4.0	5.28	3.0	0.74	§6.02	5.5	2481
2787	0.79	0.42	1.26	2.47	2.47	4.01	1.70	0.69	6.40	6.0	5.71	5.0	4.03	4.03	3.0	2787
2792	....	0.05	1.07	1.12	1.23	4.34	2.32	0.99	7.65	8.0	6.66	7.0	1.80	1.80	2.0	2792
2793	....	0.04	1.58	1.62	1.64	5.93	2.12	0.84	8.89	9.0	8.05	8.0	2.89	2.89	3.0	2793
2794	....	0.08	2.33	2.41	2.46	5.40	3.34	0.93	9.67	9.0	8.74	8.0	5.98	5.98	6.0	2794
2349	1.45	0.02	2.35	3.82	4.10	1.17	3.58	2.07	6.82	5.0	4.75	4.0	0.27	6.48	6.0	2349
2795	....	0.08	1.83	1.91	1.64	5.19	2.40	0.83	8.42	8.0	7.59	7.0	3.88	3.88	4.0	2795
2796	....	0.10	2.24	2.34	2.46	4.06	2.22	0.96	7.24	7.0	6.28	6.0	9.39	9.39	10.0	2796
2348‡	....	0.70	1.44	2.14	2.46	6.28	1.94	0.68	8.90	9.0	8.22	8.0	3.83	3.83	4.0	2348
2872	0.06	0.04	2.56	2.66	2.46	5.14	3.24	1.27	9.65	9.0	8.38	8.0	4.00	4.00	4.0	2872

*1.68 as sulphate, 13.21 as carbonate. †1.07 as sulphate, 8.62 as carbonate.
‡1.35 as sulphate, 7.70 as carbonate. §1.53 as sulphate, 3.75 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	The Niantic Menhaden Oil and Guano Co., South Lyme, Conn.			
2831	Bone, Fish and Potash	New London	$30.00	$20.06
2832	Corn and Grain Fertilizer	Hazardville	30.00	20.28
2833	High Grade Tobacco Fertilizer	Windsor	.....	27.05
2834	Market Garden Manure	East Hartford	36.00	27.20
2835	Potato and Vegetable Manure	Norwich	34.00	22.49
	Olds & Whipple, Hartford, Conn,			
2514	Complete Corn and Potato Fertilizer	Suffield	34.00	25.61
2516	Complete Grass Fertilizer	Hartford	34.00	29.78
2513	Complete Tobacco Fertilizer	Buckland, Suffield (3)	37.00	30.02
2517	Fish and Potash	Hartford	30.00	19.62
2515	H. G. Potato Fertilizer	Buckland	37.00	34.02
2518	Special Phosphate	Hartford	35.00	31.08
	Pan American Fertilizer Co., New York City.			
2604	Favorite Phosphate	Waterbury	29.00	16.74
2601	Ideal Compound	Waterbury	31.00	21.20
2305	Market Garden Standard	Danbury	34.00	22.97
2602	Orchard and Fruit Special	Waterbury	35.00	23.19
2304	Standard Phosphate	Danbury	27.50	15.76
2603	Vegetable and Potato Special	Waterbury	40.00	26.52
	Parmenter & Polsey Fertilizer Co., Boston, Mass.			
2440	Plymouth Rock Brand	Plainville	32.00	19.88
2797	Potato Grower with 10% Potash	Plainville	37.00	22.75
2441	Special Tobacco Grower	Wallingford	38.00	29.13
	The Rogers & Hubbard Co., Middletown, Conn.			
2798	"Bone Base" All Soils All Crops Phosphate	Wethersfield	35.00	29.10
2306	"Bone Base" Complete Phosphate	So. Manchester	30.00	18.39
2307	"Bone Base" Fertilizer for Oats and Top Dressing	Hamden	57.00	44.77
2308	"Bone Base" Fertilizer for Seeding Down, etc	Norwich	48.00	30.69
2799	"Bone Base" New Market Garden Phosphate	East Hampton	38.00	24.72
2800	"Bone Base" Potato Phosphate	Windsor	32.50	21.68

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available."		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
....	0.30	2.76	3.06	2.46	3.44	2.40	0.36	6.20	6.0	5.84	5.0	0.37	3.22	3.0	2831
....	0.34	2.58	2.92	2.06	3.58	2.71	0.40	6.69	8.0	6.29	7.0	0.40	3.57	3.5	2832
0.78	1.06	1.71	3.55	3.30	5.64	1.97	0.31	7.92	8.0	7.61	7.0	0.53	6.73	6.0	2833
1.01	1.02	1.50	3.53	4.10	5.45	2.09	0.37	7.91	8.0	7.54	7.0	0.60	7.03	6.0	2834
0.70	0.30	1.82	2.82	2.50	5.07	2.90	0.45	8.42	8.0	7.97	7.0	0.48	4.67	4.0	2835
0.18	0.84	2.72	3.74	3.30	1.27	5.18	1.70	8.15	6.0	6.45	6.0	6.50	6.50	6.0	2514
2.48	0.10	1.40	3.98	3.30	1.25	6.60	2.56	10.41	7.0	7.85	6.0	1.09	7.33	6.0	2516
0.72	0.10	4.04	4.86	4.50	0.08	3.61	0.35	4.04	3.0	3.69	3.0	0.35	*5.80	5.5	2513
0.14	0.20	2.43	2.77	2.50	2.33	3.71	1.46	7.50	6.0	6.04	5.0	4.09	4.09	3.0	2517
0.16	1.34	2.70	4.20	3.30	1.64	5.47	2.43	9.54	6.0	7.11	6.0	1.05	11.04	10.0	2515
....	1.38	3.28	4.66	4.13	2.96	3.82	1.51	8.29	....	6.78	4.0	0.54	6.95	3.0	2518
0.08	0.70	0.92	1.70	1.64	3.29	4.88	0.96	9.13	9.0	8.17	8.0	3.66	3.66	4.0	2604
0.11	1.30	1.15	2.56	2.46	5.38	3.17	1.01	9.56	9.0	8.55	8.0	4.51	4.51	4.0	2601
....	0.64	2.08	2.72	2.46	5.06	2.90	0.97	8.93	9.0	7.96	8.0	6.40	6.40	6.0	2305
0.04	0.96	0.88	1.88	1.65	2.45	5.47	1.00	8.92	9.0	7.92	8.0	10.78	10.78	10.0	2602
....	0.46	1.18	1.64	1.60	1.40	5.83	1.56	8.79	9.0	7.23	8.0	3.58	3.58	2.0	2304
....	1.70	1.41	3.11	3.00	3.00	3.80	0.61	7.41	7.0	6.80	6.0	10.46	10.46	10.0	2603
....	0.10	2.26	2.36	2.46	4.77	3.32	1.42	9.51	9.0	8.09	8.0	4.00	4.00	4.0	2440
....	0.06	2.24	2.30	2.46	4.37	2.01	0.87	7.25	7.0	6.38	6.0	9.56	9.56	10.0	2797
2.28	....	1.53	3.81	4.10	2.01	4.25	1.51	7.77	5.0	6.26	4.0	0.65	8.76	8.0	2441
2.64	0.06	1.10	3.80	3.30	4.98	4.14	1.24	10.36	9.0	9.12	8.0	7.76	7.76	7.0	2798
0.27	0.08	1.37	1.72	1.50	4.41	2.75	1.45	8.61	8.0	7.16	7.0	6.03	6.03	5.0	2306
7.78	....	0.84	8.62	8.50	0.10	5.83	2.90	8.83	8.0	5.93	4.5	8.09	8.09	8.0	2307
0.12	0.08	2.23	2.43	2.20	0.19	8.53	9.10	17.82	16.0	8.72	6.5	12.76	12.76	12.0	2308
0.91	0.10	1.40	2.41	2.00	3.85	3.41	1.45	8.71	7.0	7.26	6.0	10.45	10.45	10.0	2799
1.00	0.06	1.14	2.20	2.00	5.50	4.48	1.24	11.22	10.0	9.98	9.0	5.18	5.18	5.0	2800

*0.86 as sulphate, 4.59 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	The Rogers & Hubbard Co., Middletown, Conn. *(Continued.)*			
2309	"Bone Base" Soluble Corn and General Crops Manure	Branford	.....	$24.23
2801	"Bone Base" Soluble Potato Manure	Branford	$43.00	34.12
2802	"Bone Base" Soluble Tobacco Manure	Windsor	45.00	38.54
	The Rogers Mfg. Co., Rockfall, Conn.			
2351	All Round Fertilizer	So. Manchester	33.00	18.49
2350	Complete Potato and Vegetable Fertilizer	Wapping	32.50	22.01
2803	Fish and Potash	Meriden	35.00	23.71
2836	H. G. Corn and Onion Manure	Somersville	38.00	28.82
2837	H. G. Grass and Grain, Seeding Down	Rockfall	43.50	34.58
2838	H. G. Oats and Top-Dressing	Meriden	49.00	38.88
2839	H. G. Soluble Tobacco Manure	Granby	43.50	38.81
2846	H. G. Soluble Tobacco and Potato Manure	Somersville	40.00	30.80
2847	H. G. Tobacco Grower	Suffield	39.00	28.61
2482	H. G. Tobacco Grower, Vegetable and Carbonate Formula	Hazardville	.....	31.40
	F. S. Royster Guano Co., Baltimore, Md.			
2394*	Ammoniated Potato Manure	Stamford	31.00	18.15
2873	Ammoniated Potato Manure	North Haven	33.00	19.01
2395	Champion Crop Compound	Bristol	31.00	17.46
2396	Fish and Potash	North Haven	.....	14.96
2400	Gold Seal Potato Special	Stamford	32.00	22.81
2397*	H. G. Tobacco Manure	Windsor	.....	32.95
2849*	H. G. Tobacco Manure	Tylerville	43.00	32.41
2399	H. G. Top Dresser	Bristol	50.00	35.87
2848	Ideal Tobacco Guano	Burnside	.....	25.88
2398	Universal Truck Fertilizer	Southington	35.50	26.84
	Sanderson Fertilizer and Chemical Co., New Haven, Conn.			
2442	Atlantic Coast Bone, Fish and Potash	Guilford	24.00	17.63
2443	Complete Tobacco Grower	Warehouse Point	37.00	27.99
2444	Corn Superphosphate	Wethersfield	28.00	18.95

* See note, p. 135.

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total. Nitrogen.					Total.		So-called "Available."		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
1.31	0.06	1.27	2.64	2.50	2.00	4.84	2.58	9.42	8.0	6.84	6.0	8.98	8.98	8.0	2309
2.36	0.44	2.33	5.13	5.00	0.60	9.62	2.70	12.92	10.0	10.22	7.0	1.40	5.59	5.0	2801
2.59	0.28	2.17	5.04	5.00	0.85	8.52	2.41	11.78	10.0	9.37	7.0	1.28	10.83	10.0	2802
0.11	0.56	1.31	1.98	1.60	7.30	2.44	0.84	10.58	10.0	9.74	8.0	2.55	2.55	2.0	2351
0.22	0.02	2.28	2.52	2.25	4.61	3.78	1.23	9.62	10.0	8.39	8.0	5.66	5.66	5.0	2350
....	0.72	3.20	3.92	3.25	2.24	3.17	1.29	6.70	6.0	5.41	4.0	4.48	4.48	3.75	2803
0.85	0.14	2.75	3.74	3.60	3.28	4.88	2.28	10.44	8.0	8.16	6.0	8.16	8.16	7.0	2836
0.22	0.06	2.78	3.06	3.00	0.06	9.17	8.83	18.06	16.0	9.23	....	14.20	14.20	12.5	2837
2.86	0.30	3.22	6.38	6.30	0.46	9.30	1.10	10.86	9.0	9.76	7.0	7.83	7.83	7.5	2838
0.83	0.28	4.07	5.18	5.00	0.69	8.44	0.86	9.99	7.0	9.13	5.0	0.73	11.11	10.5	2839
0.89	0.10	2.75	3.74	3.50	0.07	6.88	0.37	7.32	9.0	6.95	7.0	1.25	10.70	8.75	2846
0.83	0.20	3.69	4.72	5.00	0.42	4.01	0.29	4.72	4.0	4.43	3.0	0.58	6.85	5.5	2847
0.85	0.10	4.25	5.20	5.00	0.61	3.09	0.28	3.98	4.0	3.70	3.0	0.39	*5.83	5.5	2482
....	1.00	1.10	2.10	2.47	2.81	3.28	1.07	7.16	6.5	6.09	6.0	5.52	5.52	5.0	2394
0.09	0.92	1.32	2.33	2.47	2.15	4.38	0.92	7.45	6.5	6.53	6.0	5.24	5.24	5.0	2873
0.18	0.82	0.78	1.78	1.65	3.93	3.90	1.13	8.96	8.5	7.83	8.0	4.34	4.34	4.0	2395
....	0.80	0.94	1.74	2.06	1.99	4.34	1.00	7.33	6.5	6.33	6.0	3.26	3.26	3.0	2396
0.10	0.70	0.80	1.60	1.65	4.27	3.87	0.82	8.96	8.5	8.14	8.0	11.22	11.22	10.0	2400
...	1.92	2.59	4.51	4.94	3.50	2.35	0.87	6.72	5.5	5.85	5.0	1.04	10.33	10.0	2397
0.21	1.75	2.66	4.62	4.94	5.01	1.30	0.42	6.73	5.5	6.31	5.0	0.62	8.99	10.0	2849
3.10	2.10	1.00	6.20	6.58	4.17	2.46	0.79	7.42	6.5	6.63	6.0	7.99	7.99	8.0	2399
0.21	1.36	2.53	4.10	4.11	2.71	1.89	0.63	5.23	4.5	4.60	4.0	0.48	6.05	6.0	2848
0.14	1.82	1.48	3.44	3.29	5.11	3.30	1.50	9.91	8.5	8.41	8.0	7.21	7.21	7.0	2398
0.16	0.10	1.94	2.20	1.67	2.81	3.19	1.00	7.00	6.0	6.00	4.0	4.49	4.49	4.0	2442
....	0.05	4.42	4.47	4.50	0.64	3.87	0.19	4.70	4.0	4.51	3.0	0.48	6.62	5.5	2443
0.14	0.06	2.02	2.22	1.67	4.86	3.79	2.24	10.89	9.0	8.65	7.0	2.62	2.62	2.0	2444

* 0.80 as sulphate, 4.64 as carbonate.

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	Sanderson Fertilizer and Chemical Co., New Haven, Conn. *(Continued.)*			
2850	Formula A	Plainville	$36.00	$24.44
2445	Formula B	Milford	35.00	23.18
2874	Formula B	Suffield	33.00	27.96
2851	Kelsey's Bone, Fish and Potash	Granby	29.00	25.34
2852	Potato Manure	Shelton	31.00	18.78
2853	Special with 10% Potash	East Hampton	36.00	27.06
2854	Top Dressing for Grass and Grain	Granby	39.00	27.14
	The C. M. Shay Fertilizer Co., Groton, Conn.			
2607	Bone Base Grass and Lawn	Guilford	39.80	29.63
2606	Complete Fertilizer	Putnam	30.00	23.95
2855	Market Garden	Putnam	36.00	31.11
2605	Potato Manure	Putnam	34.00	26.23
	M. L. Shoemaker & Co., Philadelphia, Pa.			
2403	"Swift-Sure" Guano for Truck, Corn and Onions	New Milford	31.00	21.57
2402	"Swift-Sure" Superphosphate for Potatoes	New Milford	36.00	28.24
2401	"Swift-Sure" Superphosphate for Tobacco and General Use	Suffield	36.00	27.93
	Tanner & Wilcox, Winsted, Conn.			
2573	Reliable Grass and Corn Phosphate	Winsted	37.00	31.82
2572	Reliable Potato and Garden Phosphate	Winsted	34.00	30.73
	Wilcox Fertilizer Co., Mystic, Conn.			
2671	Complete Bone Superphosphate	Ellington	27.00	20.52
2672	Corn Special	Thompsonville	31.00	23.69
2673	Fish and Potash	Norwich	26.00	18.22
2674	4–8–10 Fertilizer	Wethersfield	38.00	30.43
2675	Grass Fertilizer	Ellington	36.00	28.00
2676	H. G. Fish and Potash	Norwich	32.00	23.91
2677	H. G. Tobacco Special	Ellington	37.00	27.20
2678	Potato Fertilizer	Suffield	29.00	20.29
2679	Potato, Onion and Vegetable Phosphate	Ellington	34.00	27.97
2680	Special Superphosphate	Forestville	.....	15.58

ANALYSES AND VALUATIONS—*Continued.*

Station No.	Nitrogen. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Nitrogen. Total Nitrogen. Found.	Nitrogen. Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Phosphoric Acid. Total. Found.	Phosphoric Acid. Total. Guaranteed.	Phosphoric Acid. So-called "Available." Found.	Phosphoric Acid. So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	Station No.
2850	0.67	0.08	2.28	3.03	3.33	4.86	3.48	0.58	8.92	8.0	8.34	6.0	6.61	6.61	6.0	2850
2445	0.47	0.08	2.21	2.76	3.33	3.21	3.90	1.92	9.03	10.0	7.11	6.0	4.94	6.62	6.0	2445
2874	0.87	0.04	2.71	3.62	3.30	5.01	3.24	0.79	9.04	10.0	8.25	6.0	1.57	6.85	6.0	2874
2851	....	0.40	3.02	3.42	2.47	4.25	3.45	1.66	9.36	5.0	7.70	4.0	0.90	5.05	4.0	2851
2852	0.05	0.04	1.83	1.92	1.67	3.91	2.73	0.58	7.22	7.0	6.64	5.0	6.49	6.49	6.0	2852
2853	0.64	0.04	1.88	2.56	2.47	5.50	2.26	0.27	8.03	7.0	7.76	5.0	11.36	12.19	10.0	2853
2854	0.92	0.44	2.44	3.80	4.00	2.50	4.78	0.82	8.10	....	7.28	7.0	7.58	7.58	7.0	2854
2607	0.64	0.08	2.22	2.94	2.47	5.99	3.67	0.92	10.58	10.0	9.66	....	11.55	11.55	10.0	2607
2606	0.10	0.06	2.76	2.92	2.47	2.76	4.08	2.15	8.99	8.0	6.84	....	7.38	7.38	5.0	2606
2855	0.73	0.08	2.49	3.30	3.30	5.39	3.95	0.96	10.30	10.0	9.34	....	12.07	12.07	10.0	2855
2605	0.04	0.10	3.00	3.14	3.30	3.99	3.49	1.23	8.71	8.0	7.48	....	8.75	8.75	7.0	2605
2403	0.86	0.02	1.10	1.98	1.65	6.64	3.55	1.92	12.11	....	10.19	8.0	5.31	5.31	5.0	2403
2402	0.76	0.02	2.32	3.10	2.88	6.91	4.00	1.92	12.83	....	10.91	8.0	7.47	7.47	7.0	2402
2401	0.84	0.04	2.24	3.12	2.50	7.63	3.61	1.34	12.58	....	11.24	9.0	0.70	5.71	4.5	2401
2573	1.59	0.20	2.87	4.66	4.50	1.56	5.39	3.95	10.90	11.0	6.95	....	8.23	8.23	7.5	2573
2572	0.92	0.12	2.68	3.72	3.30	3.26	5.18	3.19	11.63	9.25	8.44	8.0	9.82	9.82	9.0	2572
2671	0.19	0.10	2.01	2.30	2.06	6.97	2.59	0.67	10.23	9.0	9.56	8.0	3.77	3.77	3.0	2671
2672	0.17	0.76	1.85	2.78	2.46	7.51	1.60	0.45	9.56	9.0	9.11	8.0	5.88	5.88	5.0	2672
2673	....	0.28	2.25	2.53	2.46	1.70	3.86	1.87	7.43	6.0	5.56	5.0	3.83	3.83	3.0	2673
2674	0.84	1.06	1.51	3.41	3.30	7.44	1.66	0.60	9.70	9.0	9.10	8.0	8.97	10.66	10.0	2674
2675	0.99	1.04	2.34	4.37	4.12	5.99	1.49	0.40	7.88	7.0	7.48	6.0	5.72	5.72	5.0	2675
2676	....	0.14	3.35	3.49	3.30	4.26	2.36	0.86	7.48	7.0	6.62	6.0	5.41	5.41	5.0	2676
2677	0.16	0.94	2.61	3.71	3.30	0.31	4.81	2.81	7.93	7.0	5.12	5.0	0.80	7.73	7.0	2677
2678	0.10	0.10	2.28	2.48	2.05	2.53	3.84	1.88	8.25	7.0	6.37	6.0	3.89	5.30	5.0	2678
2679	0.33	0.98	2.15	3.46	3.30	7.60	1.80	0.37	9.77	9.0	9.40	8.0	6.38	7.43	7.0	2679
2680	0.24	0.02	1.20	1.46	1.03	2.61	5.87	2.19	10.67	9.0	8.48	8.0	2.51	2.51	2.0	2680

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Station Agent:			
	S. D. Woodruff & Sons, Orange, Conn.			
2103	Home Mixture	Orange	$31.00	$26.09
	Worcester Rendering Co., Auburn, Mass.			
2865	Royal Worcester Corn and Grain Fertilizer	Manufacturer	32.00	26.27
2866	Royal Worcester Potato Fertilizer	Manufacturer	36.00	30.24
	Sampled by Purchasers and others:			
2025	Amer. Agl. Chem. Co., Tobacco Mixture	*Hartford:*—C. O. Clark	34.00	26.74
2535	Wheeler's Connecticut Tobacco Grower	*Tariffville:*—J. S. Dewey	36.00	.....
2490	Bowker's Complete Alkaline Tobacco Grower (Carbonate)	*Suffield:*—Spencer Bros.	35.50	.....
2489	Chittenden's Tobacco Special	*Windsor Locks:*—C. D. Cannon	38.00	.....
2559	Chittenden's Tobacco Special	*Windsor Locks:*—C. D. Cannon	38.00	.....
2278*	Clay's Fertilizer	*Greenwich:*—G. A. Drew	.....	.....
2332*	Coe-Mortimer's Ideal Tobacco Fertilizer	*Simsbury:*—J. E. Eno	34.50	.....
2333*	Coe-Mortimer's Ideal Tobacco Fertilizer	*Simsbury:*—J. E. Eno	34.50	.....
2413	Manchester's Special	*Rockfall:*—J. L. Watrous	36.00	.....
2625	Mapes Tobacco Manure Wrapper Brand	*Burnside:*—J. M. Hickey	.....	.....
1089	National Tobacco Special	*Broad Brook:*—R. C. Lasbury	.....	.....
2627	New England Perfect Tobacco Grower	*Suffield:*—J. E. Phelps	38.00	.....
2221	Olds & Whipple Complete Tobacco Fertilizer	*Burnside:*—J. M. Hickey	36.00	.....
2624	Olds & Whipple Complete Tobacco Fertilizer	*Glastonbury:*—R. S. Williams	37.00	.....
2669	Olds & Whipple Complete Tobacco Fertilizer	*Rockville:*—H. M. Kamp	40.00	27.67
2339	Rogers H. G. Tobacco Grower, Vegetable and Carbonate Formula	*North Granby:*—P. J. Rogers	38.50	.....
2246	Rogers H. G. Tobacco Grower	*Suffield:*—Arthur Sikes	38.50	.....
2491	Sanderson's Complete Tobacco Grower	*Suffield:*—F. B. Hatheway	33.25	.....
2683	Sanderson's Complete Tobacco	*Broad Brook:*—C. F. Miskill	.....	.....

* See note, p. 135.

ANALYSES AND VALUATIONS—*Continued.*

Nitrogen.					Phosphoric Acid.							Potash.			Station No.
			Total Nitrogen.					Total.		So-called "Available."		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	
2.67	0.10	1.43	4.20	3.30	3.19	2.05	1.48	6.72	....	5.24	8.0	6.24	6.24	8.0	2103
0.18	0.04	3.03	3.25	2.25	4.89	6.18	1.94	13.01	....	11.07	8.0	4.49	4.49	3.0	2865
0.85	0.05	3.24	4.14	3.50	3.16	6.00	1.73	10.89	....	9.16	8.0	7.36	7.36	7.0	2866
....	0.11	4.38	4.49	4.53	0.89	3.02	0.40	4.31	....	3.91	3.0	0.90	6.18	5.5	2025
....	....	....	4.54	4.53	....	....	....	5.82	....	.....	3.0	....	7.22	5.5	2535
....	....	....	4.29	4.11	....	....	....	5.76	5.0	.....	4.0	....	5.91	5.0	2490
....	....	....	5.30	4.50	....	....	....	4.67	4.0	.....	3.0	....	5.79	5.5	2489
....	....	....	4.80	4.50	....	....	....	6.14	4.0	.....	3.0	....	6.52	5.5	2559
....	1.90	2.40	4.30	....	0.22	2.72	6.87	9.81	....	2.94	....	0.16	0.16	....	2278
....	....	....	4.54	4.53	....	....	....	5.40	4.0	.....	.....	....	5.71	5.5	2332
....	....	....	4.58	4.53	....	....	....	5.32	4.0	.....	.....	....	5.70	5.5	2333
....	....	....	5.42	5.00	....	....	....	9.27	....	.....	7.5	....	7.66	7.5	2413
....	....	....	6.62	6.18	....	....	....	....	4.5	.....	.....	....	.....	10.5	2625
....	....	....	4.36	4.53	....	....	....	7.06	4.0	.....	3.0	....	5.82	5.5	1089
....	....	....	4.04	4.10	....	....	....	4.93	5.0	.....	4.0	....	6.97	6.0	2627
....	....	....	4.92	4.50	....	....	....	4.96	3.0	.....	3.0	....	5.57	5.5	2221
....	....	....	4.82	4.50	....	....	....	4.85	3.0	.....	3.0	....	5.79	5.5	2624
1.00	0.02	3.41	4.43	4.50	0.16	2.99	1.69	4.84	3.0	3.15	3.0	0.66	7.49	5.5	2669
....	....	....	5.30	....	....	....	....	3.39	....	.....	.....	....	6.42	....	2339
....	....	....	5.18	....	....	....	....	4.80	....	.....	.....	....	6.32	....	2246
....	....	....	4.99	4.50	....	....	....	4.75	4.0	.....	3.0	....	4.79	5.5	2491
....	....	....	5.71	....	....	....	....	3.77	....	.....	.....	....	3.99	....	2683

NITROGENOUS SUPERPHOSPHATES.

Station No.	Manufacturer and Brand.	Place of Sampling.	Dealer's cash price per ton.	Valuation per ton.
	Sampled by Purchasers and others:			
2620	Sanderson's Top Dressing for Grass and Grain	*Shelton*:—O. G. Beard	$42.00	....
2922	Sanderson's Top Dressing for Grass and Grain, No. 1	*Granby*:—Loomis Bros. Co.	40.00	....
2923	Sanderson's Top Dressing for Grass and Grain, No. 2	*Granby*:—Loomis Bros. Co.	40.00	....
934	Sanderson's Kelsey's Fish, Bone and Potash	*New Britain*:—T. A. Stanley	27.00	$27.11
2828	Sanderson's Special Mixture No. 1.	*New Britain*:—High Rock Mt. Orchards	....	32.15
2829	Sanderson's Special Mixture No. 2.	*New Britain*:—High Rock Mt. Orchards	....	24.88
2102*	Sanderson's Woodruff's Special Mixture	*Milford*:—F. H. Woodruff & Son	32.00	26.34
2558	Shay's Special Mixture	*Manchester*:—C. R. Burr & Co.	....	....
2455	Shay's Special Mixture	*Manchester*:—C. R. Burr & Co.	....	....
2266	Fertilizer Materials Supply Co.'s Special Mixture	*Bethel*:—E. E. Havens	....	30.02
2955†	Fruit Tree Fertilizer	*Meriden*:—C. A. Runge	42.50	....

*A Special Mixture made by Sanderson Fertilizer & Chem. Co., for F. H. Woodruff & Son.

†See note, p. 135.

ing factory mixed goods. With these facts, the buyer, with very moderate knowledge of arithmetic, can answer the question for himself.

Any manufacturer will make a mixture of the kind desired by his customer, and for spot cash—the terms on which chemicals are sold—and in car lots, or mixed car lots, will quote prices considerably lower than appear in the quotations given in this report, and it may often happen at prices which the buyer finds are really lower than those at which he can buy chemicals and crush or grind and mix them.

The buyer or buyer's agent who has all these quotations from a number of firms, with definite guaranties of quality, can then easily figure whether factory-mixed or home-mixed fertilizers are *for him* cheaper.

ANALYSES AND VALUATIONS—*Concluded.*

Nitrogen.					Phosphoric Acid.							Potash.			
			Total Nitrogen.					Total.		So-called "Available."		Found.			
As Nitrates.	As Ammonia.	Organic.	Found.	Guaranteed.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Found.	Guaranteed.	Found.	Guaranteed.	As Muriate.	Total.	Guaranteed.	Station No.
....	....	....	4.11	4.00	....	....	....	8.17	....	.....	7.0	....	11.78	7.0	2620
....	....	....	4.32	4.00	....	....	....	7.54	....	.....	7.0	....	7.32	7.0	2922
....	....	....	4.18	4.00	....	....	....	7.05	....	.....	7.0	....	7.25	7.0	2923
....	0.11	3.27	3.38	2.50	3.94	4.42	1.45	9.81	5.0	8.36	4.0	1.16	6.55	4.0	934
1.41	0.16	2.61	4.18	3.71	3.82	4.79	1.41	10.02	....	8.61	8.0	10.10	10.10	10.0	2828
0.64	0.10	2.04	2.78	2.50	3.16	3.37	0.99	7.52	....	6.53	7.5	8.47	9.66	7.5	2829
0.27	0.97	2.20	3.44	3.30	2.12	5.60	1.17	8.89	....	7.72	8.0	7.68	7.68	8.0	2102
....	....	....	3.08	3.30	....	....	....	12.01	10.0	.....	....	....	9.54	10.0	2558
....	....	....	2.98	3.30	....	....	....	10.63	10.0	.....	....	....	11.82	10.0	2455
0.29	2.12	2.14	4.55	4.12	2.34	4.99	2.60	9.93	....	7.33	8.0	6.87	6.87	8.0	2266
1.08	0.12	3.23	4.43	....	....	...	....	15.49	....	.....	....	0.52	3.33	....	2955

HOME MIXTURES.

Here follow analyses of six home mixtures with a statement of the ingredients used.

2657 represents car lots mixed by the Sanderson Fertilizer & Chemical Co. for Mr. Clark, following the formula given by him and with chemicals bought by Mr. Clark. The calculated composition agrees closely with that found by analysis and in car lots the cost delivered was very little more than the valuation.

2358 and **2227** are mixtures made at the Connecticut School for Boys, of chemicals bought in mixed car lots, of course, at prices below the average retail figures, so that the cost when mixed was less than the valuation.

2523 is a mixture made by Mr. Hatheway. The chemicals were bought at average retail prices and the cost, mixed, was stated to be $35.40 per ton.

2226. No statement is given of the cost of the chemicals or mixture.

2547. A mixture made by W. A. Simpson, Wallingford, from chemicals bought at very favorable prices, presumably in car lots. The cost was considerably less than the valuation.

HOME MIXTURES—FORMULAS.

Station No.	Made by or for	Formula. Nitrate of Soda.	Dried Blood.	Ground Bone.	Tankage.	Dried Fish.	Cotton Seed Meal.	Castor Pomace.	Acid Phosphate.	Muriate of Potash.	Sulphate of Potash.	Kainit.
2657	H. E. Clark, Middlebury, Grass	400	300	900	....	....	....	....	....	....	400	....
2358	Conn. School for Boys, Meriden, Grass	500	....	....	500	....	....	....	400	250	....	350
2227	Conn. School for Boys, Meriden, Potatoes and Vegetables	100	....	....	750	....	....	....	750	200	*200	....
2523	F. B. Hatheway, Suffield	100	....	300	....	200	800	400	....	....	200	....
2226	R. H. Morgan, West Cheshire	300	....	....	700	....	....	....	600	200	200	....
2547	W. A. Simpson, Wallingford	200	....	....	800	....	....	....	700	300	....	....

* Double manure salt.

LIMESTONE.

Limestone is a very abundant and widely distributed mineral. The hardest marble used for buildings and monuments, the softer limestones which are more common here, the soft chalk not found in this state, as well as shell marl and oyster shells, are all forms of carbonate of lime or of lime and magnesia. They are all only slightly soluble in water, and more soluble in water containing carbonic acid gas.

They all consist essentially of lime (with more or less magnesia), combined with carbonic acid, forming a "carbonate."

The carbonic acid is easily driven off. Vinegar, for instance, poured on a carbonate of lime, effervesces and expels the carbonic acid gas replacing it by acetic acid (the acid of vinegar), forming an acetate in place of a carbonate of lime.

When limestone, that is, carbonate of lime and magnesia, is roasted in a furnace or kiln, the heat expels carbonic acid but leaves nothing in its place and the residue is oxide of calcium (or oxides of calcium and magnesium), which is known as "quicklime," "stone lime," "burned lime" or "mason's lime." This

HOME MIXTURES—ANALYSES.

Station No.	Nitrogen. In Nitrates.	In Ammonia.	Organic.	Total.	Phosphoric Acid. Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.	Potash. As Muriate.	Total.	Valuation per ton.
2657	3.01	0.02	2.01	5.04	0.09	7.48	5.04	12.61	0.74	11.41	$38.76
2358	3.47	0.08	1.46	5.01	2.39	3.01	1.28	6.68	9.17	9.17	31.56
2227	0.77	0.08	1.95	2.80	3.97	4.15	2.43	10.55	5.99	8.41	26.05
2523	1.04	0.12	4.22	5.38	0.44	4.49	0.75	5.68	0.41	7.15	32.05
2226	2.13	....	1.27	3.40	3.28	6.55	3.39	13.22	6.02	9.35	30.88
2547	1.36	0.12	1.96	3.44	5.56	4.14	2.58	12.28	7.99	7.99	29.05

is a caustic substance which combines with water quickly, heats tremendously and falls to a white powder, which is "slaked lime" or "water-slaked lime," used in making mortar. This slaked lime is very much finer than limestone can be ground for farmers' use, and is more soluble in water. Its solution is the "lime-water" of the drug-stores.

If quicklime is exposed to the air for some time it "slakes" in a different way and without noticeable heating. It takes up both water and carbonic acid from the air and finally falls to a powder, which is a mixture of slaked lime and carbonate of lime.

One hundred pounds of pure carbonate of lime, limestone, will yield 56 pounds of "quick lime," 74 pounds of "slaked lime" and more than that amount of "air-slaked lime." These

figures are never reached in practice because all limestone contains more or less foreign matters, minerals which are insoluble and relatively worthless to the farmer.

Aside from an outcrop in Danbury and one in Durham, most of the limestone in this state is dolomitic, that is, it contains more than half as much magnesia as lime. Magnesia is much less "caustic" than lime but pound for pound can neutralize more acid.

GROUND LIMESTONE.

The following four samples are from the Durham quarry of W. T. Coe & Son, Northford: **1814**, sent by G. A. Hopson, Wallingford, **1922** and **1923**, sent by W. T. Coe & Son, **2183**, sent by Edgar H. Norton, Wallingford.

ANALYSES OF LIMESTONE.

Station No.	1814	1922	1923	2183	2633	2965	1660	1662	1919	2488
Lime	53.26	47.36	50.54	*	47.72	48.38	46.38	45.56	45.81	46.00
Magnesia	....	....	....	....	2.17	1.46	3.26	2.18	....	3.35
Equivalent carbonate of lime	95.10	84.49	90.25	....	85.15	86.40	82.74	81.28	81.73	82.06
Equivalent carbonate of magnesia	....	....	....	....	4.54	3.06	6.81	4.56	....	7.00
Insoluble in acid	3.46	13.28	7.65	22.73	10.13	....	....	....	10.94	....

* Not over 43 per cent.

Mechanical Analyses of Limestone.

Finer than 80 mesh	..	40	26	..	97	..	50	38	25	29
40 to 80 mesh	..	16	10	..	3	..	19	7	10	11
20 to 40 "	..	29	21	..	0	..	23	25	14	19
Coarser than 20 mesh	..	15	43	..	0	..	8	30	51	41
	..	100	100	..	100	..	100	100	100	100

The following three samples are made by the Stearns Lime Co., Danbury: **1660**, 40 mesh, sampled by Station agent. **1662**, 10 mesh, sampled by Station agent. **1919**, sent by A. C. Lake, Bethlehem.

2488. Sold by National Fertilizer Co., New York City. Sampled and sent by C. D. Cannon, Windsor Locks.

Regarding the composition of the lime from the Stearns Co., its guaranty is 87 per cent. of carbonates of lime and magnesia or their equivalent, any deficiency of lime in the quarried rock being made up by the addition of the proper amount of burned lime.

The sample from Edison Portland Cement Co., **2633**, has a guaranty of 93 per cent. total carbonates of lime and magnesia. The amount found was 89.69. It is sold as 200 mesh.

2488 from the National Fertilizer Co. is guaranteed 85 per cent. carbonate of lime. 82.06 was found.

It should be said that the composition of limestone varies considerably in the vein and an accurate statement of each shipment cannot be made without considerable expense. It is therefore wise for the manufacturers to give quite conservative guaranties which will cover any material they are likely to handle.

Prices of lime-magnesia. Only on one sample of the Durham lime, **2183**, is a price given, $3.50 per ton, at the works, in bulk. This price represents a cost of not more than 36 cents per 100 pounds of actual lime, at the works, in bulk, in small quantities.

2633 from the Edison Portland Cement Co. costs $6.50 in car lots at Waterbury in cloth bags, or $4.50 with bags returned.

At the $6.50 price lime magnesia costs 65 cents per 100 pounds, at the $4.50 price, 45 cents.

The Stearns Lime Co. quoted the following prices in February, 1913, on their two grades of limestone *in car lots,* at their works.

			Cost of 100 lbs. of lime-magnesia in cents.	
	40 mesh.	20 mesh.	40 mesh.	20 mesh.*
Bulk	$2.75	$2.60	28	20
In paper bags	3.35	2.60	34	26
In burlap bags	4.00	3.25	40	33

The freight rate in this state is $1.00 per ton west of the Connecticut River and $1.25 east of it.

1919. This sample stated to be 10 mesh, cost $3.85 in bags at Watertown. As the analysis shows it was very coarse. Lime-magnesia cost about 40 cents per 100 pounds.

* Assuming the same composition as the 40 mesh.

2488. The price is given as $3.60 per ton but it is not stated how the lime was packed nor whether freight is included. At that price lime-magnesia cost 36 cents per 100 pounds.

MARL.

This is a fine soft carbonate of lime consisting chiefly of disintegrated shells. Its mechanical condition is excellent. The freight from the works to Connecticut points makes it an expensive form.

2280. Sent by C. C. Chapin, Thompsonville. Sample drawn from 50 bags in a car-load. Cost $5.00 at the works. Freight $3.00. It contained 48.34 per cent. of lime and 0.33 per cent. magnesia. Lime-magnesia costs delivered 82 cents per 100 pounds.

GROUND OYSTER SHELLS.

These consist largely of carbonate of lime. **1819** was drawn by the Station agent from a heap, exposed to the weather. It is a waste product of the Connecticut Adamant Plaster Co. of New Haven. Analysis showed

Moisture	11.76
Lime	41.14
Insoluble in acid	10.78

Its mechanical analysis was

Finer than 80 mesh	13	per cent.
Between 40 and 80 mesh	21	" "
Between 20 and 40 mesh	35	" "
Coarser than 20 mesh	31	" "
	100	

GRANULATED LIME.

This is a quicklime or burned lime, fine enough to sow without slaking. **1659** was drawn by the Station agent from stock of the New England Lime Co., Danbury.

It is made only at Adams, Mass., and its price, f. o. b., Adams, is $6.50 bulk or $8.00 bagged in car lots.

Analysis of Granulated Lime.

Lime	90.66
Magnesia	0.96
Insoluble matter	1.77
Water, free and combined	6.61
	100.00

SLAKED LIME.

The nature and methods of preparing slaked lime have been explained on page 169. It is often sold as "agricultural lime" and *may* contain a little quicklime, hydrated or slaked lime, carbonated slaked lime and imperfectly burned limestone. As the analyses show it has no very uniform composition.

1661. Burned Lime, Air-Slaked, Second Grade. Sold by Stearns Lime Co., Danbury.

1670. Agricultural Lime. Sold by Olds & Whipple, Hartford; sampled at dealer's. From Farnam Cheshire Lime Co., Farnam, Mass.

1921. Sold by New England Lime Co., West Stockbridge, Mass.; sent by F. E. Peckham, Norwich.

1920. Sold by West Stockbridge Lime Co.; sent by F. E. Peckham, Norwich.

1663. Air-slaked Lime. Sold by New England Lime Co., Redding kiln.

1669. Air-slaked Lime. Sold by Connecticut Lime Co., East Canaan.

1657. Hydrated Lime, water-slaked. Sold by New England Lime Co., New Milford kiln.

1666. Air-slaked Lime. Sold by New England Lime Co., Canaan kiln.

1667. Air-slaked Lime. Sold by New England Lime Co., East Canaan kiln.

2556. Slaked Lime. Sold by Edgewood Hardware Co., Westville. Sent by W. B. French, Westville. The sample contained about 25 per cent. of moisture.

2047. Sent by N. C. Stevens, East Canaan. Quite damp.

ANALYSES OF SLAKED LIME.

Station No.....	1661	1670	1921	1920	1663	1669	1657	1666	1667	2556	2047
Lime.....	68.94	65.12	62.08	58.08	50.00	49.32	45.64	42.70	42.66	28.33	26.52
Magnesia.....	2.80	0.72	....	....	33.66	33.02	30.40	29.02	28.56	17.91	19.07
Insoluble in acid	20.16	1.27	4.69	2.03	1.35	0.58	1.15	1.51	3.32	0.34	....
Cost per ton in bulk at factory	$4.00	$6.00*	....	....	$4.50	$4.50	$4.50	$4.50	$4.50	....	....
Paper bags....	4.60	....	....	....	....	....	....	....	....	....	....
Burlap.....	5.25	7.50*	....	....	6.00	6.00	6.00	6.00	6.00	....	....
Lime-magnesia costs in cents per 100 lbs. *bulk*	28	45*	....	....	27	27	29	31	31	....	....

* Delivered.

The difference in cost between bulk and bags amounts to from 8 to 11 cents per 100 pounds of lime-magnesia. In 10-ton lots lime costs $1.00 per ton more than in car lots.

PATENT PROCESS FERTILIZER LIME.

2760. This material, made by the Walton Quarries, Harrisburg, Penn., has been sold somewhat in this state with the claim that it will give results such as no other lime will for agricultural purposes. This claim is obviously absurd but need not be noticed here except for the fact that, presumably on account of this claim, it has been sold for $18.00 per ton delivered. There is absolutely no reason to regard it as any better agriculturally than lime which is made here and in Massachusetts and sold for less than half that price. The sample sent contained

Phosphoric acid	0.15
Potash	0.23
Lime	50.88
Magnesia	6.86
Insoluble matter	9.55

Lime-magnesia in this material cost the buyer $1.53 per 100 pounds.

LIME-KILN ASHES.

These are mixtures of the ashes of wood, used in roasting limestone, with large amounts of fine lime which fall into the furnace from the roasting lime above. They therefore contain small amounts of phosphoric acid and potash, as appears in the following analyses:

1658. Sold by New England Lime Co., New Milford kiln; stored under cover.

1664. Sold by New England Lime Co., Redding kiln.

935. Sold by New England Lime Co., East Canaan kiln; sent by F. E. Morgan, Southport.

2892. Sold by New England Lime Co., New Milford kiln; stock of J. P. Norton, Broad Brook.

1668. Sold by New England Lime Co., East Canaan kiln; not under cover.

1467. Sold by New England Lime Co., Redding kiln; sent by W. M. Shepardson, Middlebury.

1665. Sold by New England Lime Co., Canaan kiln; not under cover.

ANALYSES OF LIME-KILN ASHES.

Station No.	1658	1664	935	2892	1668	1467	1665
Lime	44.46	42.90	41.56	37.06	36.84	32.80	30.04
Magnesia	19.54	9.38	15.25	16.40	14.68	8.91	9.02
Insoluble in acid ...	1.30	2.44	4.18	2.10	4.15	5.82	2.82
Moisture	....	....	....	....	10.81	18.43	21.66
Phosphoric acid ...	1.31	1.99	1.43	0.88	1.11	1.19	0.99
Potash	2.00	6.60	1.46	0.94	1.09	1.65	4.22
Cost in car lots, bulk, f. o. b. factory ...	$8.00	$8.00	$3.50	....	$4.50	....	$4.50
Cost in car lots, bags, f. o. b. factory ...	$9.00	$9.00	....	....	$6.00	$8.00	$6.00
Cost in car lots, bags, delivered	....	....	....	$11.00	....	$9.40	....
Lime-magnesia costs cents per 100 lbs., f. o. b. factory, in bulk*	41	7.6	...	88†	26	85†	1.5

* Allowing 4 cts. per lb. for phosphoric acid, and 4¼ cts. for potash.
† Delivered.

CARBIDE LIME.

This is the residue left from generating acetylene gas from calcium carbide and is mainly a wet slaked lime containing some carbon.

We were asked whether it contained anything which would injure vegetation. We find nothing of this sort. If spread in winter on the land it is quite certain that no harm could be done.

WOOD ASHES.

2743. Wood Ashes, sent by J. E. Hopkins, Thomaston.

2891. Canada Hard Wood Ashes, sold by Bowker Fertilizer Co.; stock of Lightbourn & Pond Co., New Haven.

2896. Wood Ashes, sent by Echo Farms, Litchfield.

2929. Brass Mill Ashes, sent by J. H. Hale Orchard, Seymour.

2972. Unleached Wood Ashes, sold by Geo. L. Munroe & Sons, Oswego, N. Y. Sampled and sent by F. W. Judson, Waterbury. Cost $10.75 delivered.

2973. Hardwood Ashes, sold by John Joynt, Lucknow, Ontario. Sampled and sent by Wm. A. Murray, Fairfield. Cost $12.50 delivered.

Analyses of Wood Ashes.

Station No.	**2743**	**2891**	**2896**	**2929**	**2972**	**2973**
Water-soluble potash	4.74	3.27	3.26	4.00	0.74	3.35
Phosphoric acid	2.74	1.51	2.15	1.77	0.64	1.41
Lime	28.58	24.85	30.78	30.32	35.96	35.20
Magnesia	1.46	1.04	4.79	4.44	1.52	4.18
Water	3.70	33.90	....	....	....	....
Insoluble in acid	8.19	6.40	8.21	....	....	....

2929 cost $7.00 per ton "on the land." Allowing 4 and 4¼ cents per pound respectively for phosphoric acid and potash, lime-magnesia in these ashes cost 32 cents per 100 pounds.

2972 has the composition of dry leached ashes. At the price quoted with the above named allowance for phosphoric acid and potash, lime-magnesia costs $1.28 per 100 pounds.

2973 at the price quoted furnishes lime-magnesia for about $1.06 per 100 pounds. Wood ashes which do not supply lime-magnesia for 50 cents per 100 pounds do not, in our opinion, warrant purchasing.

"ASHES."

2962. This is a deposit taken from the flue pit of a factory boiler. Sent by S. P. Williams, Jr., Waterbury.

It is very fine coal ashes having 0.14 per cent. of water-soluble potash and 0.67 per cent. of acid-soluble phosphoric acid. It has very little value as fertilizer but may be used to stifle lice and other small insects on plants by sifting it on them.

SHEEP MANURE.

2780. Pulverized Sheep Manure, sold by American Agricultural Chemical Co., New York; sampled from stock of C. A. Templeton, Waterbury.

2790. "Sheep's Head" Pulverized Sheep Manure, sold by Natural Guano Co., Aurora, Ill.; sampled from stock of Meriden Grain and Feed Co., Meriden.

2791. Wizard Brand Manure, sold by Pulverized Manure Co., Chicago; sampled from stock of Lightbourn & Pond Co., New Haven.

	2780	**2790**	**2791**
Nitrogen in ammonia	0.09	0.16	0.14
" organic	2.09	2.16	1.66
" total, found	2.18	2.32	1.80
" " guaranteed	2.06	2.25	1.80
Phosphoric acid, water-soluble	0.63	0.65	0.60
" " citrate-soluble	0.57	0.62	0.55
" " citrate-insoluble	0.23	0.20	0.13
" " total, found	1.43	1.47	1.28
" " " guaranteed	1.25	1.25	1.00*
Potash, found	2.31	2.32	2.35
" guaranteed	0.50	1.50	1.00
Cost per ton	$30.00	$38.00	$30.00

*"Available" phosphoric acid.

Sheep manure contains an average of about 60 per cent. of dry organic matter. One ton of this manure contains about as much organic (humus-forming) matter as four tons of horse manure such as is brought from New York City stables, but for the same money more organic matter and plant food can be bought in stable manure than in sheep manure. The fine dry condition of the latter and absence of weed seeds, however, make it very convenient for use on lawns and in the greenhouse.

DRIED GROUND MANURE COMPOST.

2626. Sent by New York Stable Manure Co., Jersey City, N. J. Price per ton, f. o. b., Monmouth Junction, N. J., $25.00. The freight to central Connecticut points would be $2.50. It had the following composition:

Water	9.76	Nitrogen	2.39
Ash	45.81	Phosphoric acid	2.60
Organic matter	44.43	Potash	1.36
	100.00		

This is manure from New York which has been composted in large heaps for months. It is therefore fine and well suited for greenhouse use. It obviously contains a great deal of sand.

TOBACCO STEMS.

2092. Sent by the Keiser & Boasberg Plantation, East Windsor Hill.

1488. Broken Stems. Sold by Olds & Whipple, Hartford; sent by E. P. Brewer, Silver Lane.

	2092	1488
Nitrogen in nitrates	0.61	0.14
" " ammonia	0.18	0.02
" organic	1.56	0.86
" total	2.35	1.02
Phosphoric acid	0.29	0.71
Potash	3.22	3.98
Cost per ton	$12.00	$12.50

BAT GUANO.

941. Sent by Geo. F. Taylor Commission Co., New York. It contained 21.76 per cent. water, with nitrogen in the following forms:

Nitrogen in nitrates	2.28
" " ammonia	0.85
" organic, water-soluble	0.00
" " active insoluble	1.88
" " inactive insoluble	0.71
" total	5.72

The organic nitrogen shows by the alkaline permanganate method a solubility of 72.6 per cent.

COCOA SHELLS.

1770. Sold by Léon Henry, Hoboken, N. J.; sent by S. D. Woodruff & Sons, Orange. Price $9.00 per ton. The material is claimed to contain 2.43 per cent. nitrogen, 0.77 phosphoric acid and 2.73 potash. We examined the nitrogen only, with the following results:

Nitrogen, organic, water-soluble	0.61
" " active insoluble	0.31
" " inactive insoluble	1.40
" total	2.32

The organic nitrogen shows the very low solubility of 39.7 per cent. and it is obviously of little present agricultural value.

"SHODDY."

1457. Material from the recovery of waste rubber, sent by Dayton B. Durley, Bethany. It contained 0.53 per cent. nitrogen, 0.27 phosphoric acid and 0.23 potash.

"BY-PRODUCT."

1478. Sold by By-Products Chemical Co., New York. Sent by W. H. Reid, Stamford. Claimed to contain 5 per cent. ammonia and 6.50 "available" phosphoric acid, derived principally from animal matter and bone. Price about $18.00 per ton. It showed the following composition:

Nitrogen in nitrates	0.10
" " ammonia	0.18
" organic, water-soluble	1.73
" " active insoluble	1.46
" " inactive insoluble	1.15
total	4.62
Phosphoric acid, water-soluble	0.42
" " citrate-soluble	7.60
" " citrate-insoluble	1.70
" " total	9.72

The solubility of the organic nitrogen was 73.3 per cent. Judged by its chemical analysis alone this appears to contain its nitrogen and phosphoric acid in available forms.

"BURNING AND WASTE HEAP MATTER."

1476. Material sent by the Ensign-Bickford Co., Avon. This represents a fifteen years' accumulation of waste, consisting of hemp mill sweepings (lint and yarn), packing room waste (nails and cases), waste paper, whiting, powder, asphalt, raw or burned soap, glue, clay, talc, etc. Its composition was as follows:

Water	24.92
Nitrogen	0.26
Phosphoric acid	0.14

Potash	0.34
Lime	9.97
Magnesia	0.87
Insoluble in acid	42.11

Two-thirds of the waste is water and sand. Its chief value is in the lime which might pay for hauling a short distance and applying to waste land with a prospect of causing some improvement.

SLUDGE AND WASTE LIQUOR.

2238 Sludge and **2239** Liquor, sent by Hartford Carpet Corporation, Thompsonville. Their composition was as follows:

	Sludge.	Liquor.
Water	78.89	99.03
Ash	17.60	0.61
Organic matter	3.51	0.36
	100.00	100.00
Nitrogen	0.13	....
Phosphoric acid	0.03	....
Potash	0.24	0.03

"HUMUS."

1842. Sent by the Silliman Hardware Co., New Canaan. It contained 2.25 per cent. nitrogen and 0.74 per cent. phosphoric acid. It is apparently a dried peat. The nitrogen in peat is quite inert. Its chief value is in the vegetable matter it contains, which makes loose sandy lands more retentive of moisture. To such land it may sometimes pay to apply partly dry peat which can be got on or near the farm, but it cannot pay to buy it.

"SLAG."

2045 and **2046.** Sent by N. S. Stevens, East Canaan. Neither sample showed more than a slight trace of phosphoric acid and had practically no agricultural value.

MUCK.

912. An accumulation formed in an ice pond, sent by E. H. Clark, East Morris. It contained 50.35 per cent. water, 15.40 per cent. ash and 34.25 per cent. organic matter, with 0.30 per cent. nitrogen.

ROCK.

1468. This sample, sent by A. O. Bierce, Sharon, was thought to possess commercial value as a phosphate. It contained only 0.45 per cent. phosphoric acid, with much iron.

PART III.

THIRTEENTH REPORT

OF THE

State Entomologist of Connecticut

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

I have the honor to submit herewith my thirteenth report as State Entomologist of Connecticut. As it seemed advisable to issue all reports earlier than usual, this one covers only the fiscal year ending September 30th, 1913, except as regards nursery inspection; some of the examinations were made and the certificates issued later than that date, but it is convenient to have all the names in one list.

Respectfully submitted,

W. E. BRITTON,
State Entomologist.

REPORT OF THE RECEIPTS AND EXPENDITURES OF THE STATE ENTOMOLOGIST FROM OCTOBER 1ST, 1912, TO SEPTEMBER 30TH, 1913.

Insect Pest Account.

RECEIPTS.

From E. H. Jenkins, Treasurer	$3,000.00
Account of 1912, balance	260.11
	$3,260.11

EXPENDITURES.

For Field, office and laboratory assistance:		
B. H. Walden, salary	$1,120.00	
H. B. Kirk, salary	75.00	
Q. S. Lowry, salary	75.00	
Frances M. Valentine, salary	520.00	
Other Assistance	169.00	
		$1,959.00

Printing and illustrations		$254.59
Postage		99.30
Stationery		33.29
Telegraph and telephone		.85
Express, freight and cartage		6.15
Library		77.42
Laboratory apparatus and supplies		82.92
Office supplies		88.28
Traveling expenses		228.22
Balance, cash on hand		430.09
		$3,260.11

Gypsy Moth Control Account.

RECEIPTS.

Received from E. H. Jenkins, Treasurer	$5,000.00
Account of 1912, balance	231.07
	$5,231.07

EXPENDITURES.

For Salaries, board of scouts, etc.:		
D. J. Caffrey, salary	$ 637.50	
H. B. Kirk, salary	319.35	
Q. S. Lowry, salary	428.24	
Labor, board of scouts, etc.	2,285.37	
		$3,670.46
Printing and illustrations		5.35
Postage		11.51
Tools and supplies		115.48
Telegraph and telephone		9.50
Express, freight and cartage		7.59
Rental of storehouse		36.00
Traveling expenses		774.85
Balance, cash on hand		600.33
		$5,231.07

Memorandum:—This account of the State Entomologist has been duly audited by the State Auditors of Public Accounts

SUMMARY OF INSPECTION AND OFFICE WORK.

YEAR ENDING SEPT. 30, 1913.

468 samples of insects received for identification.
60 nurseries inspected.
60 regular certificates issued.
15 parcels inspected and certificated.
20 orchards and gardens examined.
1316 cases (259 shipments containing nearly 2,000,000 plants) imported nursery stock inspected.

189 apiaries containing 1,500 colonies, inspected. (84 apiaries containing 368 colonies, diseased with European Foul Brood.)
2499 letters written on official work.
259 reports to Federal Horticultural Board giving results of inspection of imported nursery stock.
768 bulletins mailed on request or to answer inquiries.
80 packages sent out by mail and express.
19 lectures and addresses made before granges, etc.

PUBLICATIONS OF THE ENTOMOLOGICAL DEPARTMENT, 1913.

Twelfth Report of the State Entomologist (Part III of Station Report for 1912): 88 pages, 2 text figures, 16 plates; 9,500 copies, distributed January 15, 1913.

Report of Committee on Injurious Insects: Proceedings Connecticut Pomological Society, 1912, p. 19, 4 pages.

The Mosquito Situation—Past, Present and Future: Report on Mosquito Control. Documents of the Civic Federation of New Haven, No. 10, p. 26, 12 pages, March, 1913.

Review of O'Kane's Injurious Insects: *Journal of Economic Entomology*, Vol. VI, p. 153, 1 page, February, 1913.

Mosquito Control Work in Connecticut in 1912: *Journal of Economic Entomology*, Vol. VI, p. 89, 3 pages, February, 1913.

Recent Studies on the Weevil and the Bud-Moth of the Walnut, and a Sawfly Attacking Blackberry: *Journal of Economic Entomology*, Vol. VI, p. 197, 2 pages, April, 1913.

Prevention of Mosquito Breeding,—Discussion of Paper: Proceedings American Society of Civil Engineers, Vol. XXXIX, No. 2, p. 290, 1 page, February, 1913.

Sanitation of Construction Camps,—Discussion of Paper: Proceedings American Society of Civil Engineers, Vol. XXXIX, No. 2, p. 296, 1 page, February, 1913.

The Apple-Tree Tent-Caterpillar: Bulletin 177, of this Station, 20 pages, 17 figures; 11,000 copies, August, 1913.

Connecticut Laws Relating to the Suppression of Insect Pests, Plant Diseases, and Contagious Diseases of Bees; special bulletin of this Station, 11 pages; 3,000 copies, August, 1913.

Two Walnut Insects: *Rural New Yorker*, 1 column, 2 figures, March 22, 1913.

Tent-Caterpillars and Web-Worms: *Tribune Farmer*, July 10, p. 17, 1913.

Report of Committee on Injurious Insects: *Connecticut Farmer*, February 15, 1913.

Rapid Spread of the Brown-Tail Moth: *Connecticut Farmer*, April 19, 1913.

Cabbage Maggot: *Connecticut Farmer*, May 24, 1913.

An Invasion of Tent-Caterpillars: *Connecticut Farmer*, May 24, 1913.

The Dying Hickory Trees: *Connecticut Farmer*, September 27, 1913.

Fakirs and Frauds in Tree Work: *Tree Talk*, Vol. I, No. 2, p. 6, November, 1913.

In Collaboration with Botanical Department.

Spray Calendar for Connecticut: Report of Connecticut Board of Agriculture for 1912, p. 23, 8 pages.

Entomological Staff.

W. E. Britton, Ph.D. ..... *State and Station Entomologist.*
B. H. Walden, B.Agr. ..... *First Assistant.*
Donald J. Caffrey, B.S.* ..... *Assistant.*
Harry B. Kirk† ..... *Assistant.*
Quincy S. Lowry, B.S.‡ ..... *Assistant.*
Irving W. Davis, B.S.§ ..... *Assistant.*
Miss Frances M. Valentine ..... *Stenographer.*

Mr. Walden has continued as first assistant, and has charge of all work of the office in the absence of the Entomologist.

The work of the department was somewhat interrupted twice during the season. First, by the resignation, March 1st, of Mr. Harry B. Kirk, to accept a position in the Bureau of Entomology at Washington, D. C., Forest Insect Investigations, and second, the resignation of Mr. Donald J. Caffrey, May 15th, to accept a position in the Bureau of Entomology, Cereal and Forage Crop Investigations.

Mr. Kirk had been connected with this department for only about a year but had done some satisfactory work on the life history of the walnut weevil.

Mr. Caffrey had been in charge of the gypsy and brown-tail moth field work for more than three years, and it is largely due to his careful and systematic work that the former pest has been almost eradicated from the State and that the latter has been measurably checked. His resignation at the beginning of the caterpillar season left us short handed, without time to seek experienced help. Messrs Kirk and Caffrey both receive larger salaries in their new positions than they were paid here.

Mr. Quincy S. Lowry, B.S., a graduate of the Massachusetts Agricultural College, Amherst, Mass., Class of 1913, was appointed to succeed Mr. Kirk, and entered upon his duties

* Resigned May 15th, 1913. † Resigned March 1st, 1913. ‡ Beginning March 10th, succeeding Mr. Kirk. § Beginning August 25th, succeeding Mr. Caffrey.

March 10th, having then completed his college work. He helped inspect imported nursery stock, and in May, on the resignation of Mr. Caffrey, was sent to Wallingford to take charge of the gypsy moth field work there, as he had acquired considerable experience in Massachusetts.

Mr. Irving W. Davis, B.S., also a graduate of the Massachusetts Agricultural College, was engaged late in the summer as successor to Mr. Caffrey. Mr. Davis graduated in 1911, and during the following year taught in the Middlebury College, Middlebury, Vt. During the college year of 1912-1913 he was a graduate student at the Massachusetts Agricultural College. Mr. Davis has been assistant in entomology in Massachusetts and for three summers has served there as an inspector of apiaries. He commenced work in Connecticut August 25th, and will later take charge of the field work in controlling the gypsy and brown-tail moths.

Mr. L. B. Ripley of Glastonbury, a student of Trinity College, was employed during his summer vacation, June 17th to September 13th, in the laboratory and insectary.

Miss Frances M. Valentine has continued to do the stenographic and clerical work of the office. During her vacation, Miss Hazel White was employed as a substitute.

The apiary inspection work has been done, as in past years, by Messrs. H. W. Coley of Westport and A. W. Yates of Hartford, each receiving *per diem* wages and necessary traveling expenses.

All of the persons mentioned above have been faithful in their work and to them is due much credit for whatever success has been attained in the work of this department.

Chief Lines of Work.

The work of controlling the gypsy and brown-tail moths, and of inspecting growing and imported nursery stock, and of apiaries, has required much attention.

Mr. Walden has followed out the life history of a leaf roller on privet hedges, which proved to be *Archips rosana* Linn.

Experimental work against the onion thrips was conducted in the field of Mr. John S. Buck, Wethersfield.

Spraying tests to control the pea aphis were carried on in the field of Mr. Samuel Flight, Hamden.

Tests were made on the Station farm to control the cabbage maggot in early cabbages.

The effects of sprays on the control of apple insects in the Station orchard at Mt. Carmel, has been continued in coöperation with the botanical department of the Station.

Additional observations have been made on the walnut weevil, and the white pine weevil.

Several inspections were made to locate mosquito breeding places, and to ascertain if ditches were in satisfactory condition. The surface of West River, New Haven, was oiled under direction of this office to destroy a large brood of *Culex pipiens* larvæ in the water.

General studies are being made on insects attacking vegetable crops and those attacking peach and apple orchards in Connecticut.

Minor studies have been made on a vast number of different insects, mostly injurious, and many records of value have been obtained in field and insectary.

The department coöperated with other departments of the Station in an exhibit at Goshen Fair, September 1st and 2d; Washington, September 5th; and Granby, September 30th and October 1st.

Some time has been given to the insect papers to be published by the State Geological and Natural History Survey. That on Hymenoptera is now in press and the proof has been looked over and some indexing and other work done in this office.

The more important lines of work are described in detail in the following pages of this report.

Inspection of Nurseries.

The annual inspection of Connecticut nurseries, as required by law, was commenced August 26th. The progress of the work was interrupted by rainy weather, and by the Station exhibit at three fairs, which engaged the services of Mr. Lowry for nearly three weeks. In October the arrival of hundreds of cases of imported *Azaleas* requiring immediate inspection, also hindered the work of inspecting growing stock, which was finally finished November 3d. The inspections were made by Messrs. Walden, Lowry, Davis, Ripley and Britton, none of whom could work at it continuously.

Before commencing to inspect the nurseries the following letter was sent to each nurseryman:

New Haven, Conn., August 11, 1913.

Dear Sir: The annual inspection of Connecticut nurseries will be made during the next few weeks. If you are anxious for an immediate inspection, please notify this office and we will accommodate you if possible.

As several states have recently established new and efficient inspection systems and enacted new laws, and as several dangerous insect and fungous pests are in danger of becoming distributed, we plan to make the inspection more thorough this year than ever before. All woody stock will be examined including conifers.

Stock infested with some of the worst pests cannot be allowed to remain in the nursery without danger that other plants will become infested.

If important pests are found requiring destruction or immediate treatment of stock, directions to that effect will be given, and the nurserymen should remove or treat it promptly whereupon a certificate can be granted.

If any woody field-grown, nursery or florists' stock is imported by you in the future, from foreign countries, it will be illegal for you to unpack it before the inspector arrives, unless you have permission from this office to do so. (See Chapter 184, Public Acts of 1913.)

The object of the increased inspection and prompt treatment of the infested stock, is not to make trouble for the nurserymen, but to make more effective the inspection work and to prevent the spread of destructive pests.

Very truly yours,

W. E. Britton,

State Entomologist.

On the whole, the Connecticut nurseries were more nearly free of pests than ever before. The inspection was more thorough than usual. Conifers, privet, and other stock seldom attacked by pests were examined.

In the course of nursery inspection, though trees and plants are examined for all pests (especially new ones) those of the following alphabetical list particularly, were the objects of the examination:

INSECTS.

Aspidiotus forbesi Johns.	Cherry scale.
Aspidiotus ostreæformis Curt.	European fruit scale.
Aspidiotus perniciosus Comst.	San José scale.
Asterolecanium variolosum Ratz.	Pit-Making oak scale.

Aulacaspis pentagona Targ.	West Indian peach scale.
Aulacaspis rosæ Bouché	Rose scale.
Chionaspis americana Johns.	White elm scale.
Chionaspis euonymi Comst.	Euonymus scale.
Chionaspis furfura Fitch.	Scurfy scale.
Chermes abietis Linn.	Spruce gall louse.
Cryptorhynchus lapathi Linn.	Poplar and willow weevil.
Euproctis chrysorrhœa Linn.	Brown-Tail moth.
Gossyparia spuria Modeer.	Elm scale.
Lecanium corni Bouché	Apricot scale; New York Fruit Scale.
Lepidosaphes ulmi Linn.	Oyster-shell scale.
Monarthropalpus flavus Schr.	Boxwood leaf miner.
Porthetria dispar Linn.	Gypsy moth.
Pulvinaria vitis Linn.	Cottony maple scale.
Sanninoidea exitiosa Say.	Peach borer.
Schizoneura lanigera Hausm.	Woolly apple aphis.
Scolytus rugulosus Ratz.	Shot-hole borer; Fruit bark beetle.
Toumeyella liriodendri Gmel.	Tulip-tree scale.
Zeuzera pyrina Linn.	Leopard moth.

PLANT DISEASES.

Bacillus amylovorus Burr.	Fire blight.
Bacterium tumifaciens Smith & Townsend.	Crown-gall; Hairy root.
Endothia gyrosa var. *parasitica* Murr. (Clint.)	Chestnut blight or bark disease.
Glœosporium venetum Speg.	Raspberry anthracnose.
Gymnosporangium Japonicum Syd.	Japanese juniper rust.
Gymnoconia interstitialis (Schl.) Lagerh.	Blackberrry orange rust.
Peach Yellows.	
Peridermium sps.	Pine blister rusts.
Plowrightia morbosa (Schw.) Sacc.	Black knot.

The inspectors were instructed to report all of these insects and plant diseases when found in nurseries, and to bring to the office samples of all insects found on nursery stock, which could not be readily recognized in the field. In like manner, they were instructed to watch for fungous and other diseases, and to bring in samples which were referred to Dr. G. P. Clinton, Botanist of this Station.

Wherever any of these serious troubles are found on nursery stock, the owner has been obliged to destroy certain trees and plants or parts of them, and give treatment to other stock. This

may consist of fumigating with hydrocyanic acid gas, spraying or dipping, according to the nature of the pest and the stock infested.

In each of several nurseries, a few chestnut trees were found diseased with the chestnut blight or bark disease, and these trees were ordered removed and burned.

In a number of instances persons who are not regular nurserymen desire to ship trees or shrubs to friends, or, perhaps, to plant elsewhere upon their own grounds. Such shipments are usually refused by transportation companies, unless accompanied by certificates of inspection. Fifteen such packages have been inspected during the year and a certificate issued for each.

The list of nurserymen for 1913 contains fifty-four names. Comparing it with last year's list, we find that one nursery has gone out of business, one has changed owners, and that five new ones have started. The total acreage devoted to the growing of nursery stock as given in the report of this Station for 1912, page 219, as 1082, has not changed materially though probably there has been a slight increase.

The list for 1913 follows:

NURSERY FIRMS IN CONNECTICUT RECEIVING CERTIFICATES IN 1913.

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Barnes Brothers Nursery Co.	Yalesville	Oct. 14,	545
Beattie, Wm. H.	New Haven	Oct. 30,	565
Bowditch, J. H.	Pomfret Center	Sept. 15,	528
Brainard Floral and Nursery Co.	Thompsonville	Sept. 15,	527
Bradley, H. M.	Derby	Oct. 14,	546
Braley & Co., S. A.	Burnside	Sept. 11,	523
Bretschneider, A.	Danielson	Nov. 17,	572
Brooks Bros.	Westbrook	Nov. 19,	574
Burroughs, Thos. E.	Deep River	Sept. 17,	532
Burr & Co., C. R.	Manchester	Sept. 17,	530
Chapman, C. E.	North Stonington	Oct. 27,	556
Comstock & Lyon	Norwalk	Oct. 28,	559
Conine Nursery Co., F. E.	Stratford	Sept. 29,	539
Conn. Agricultural College (Prof. A. G. Gulley)	Storrs	Nov. 18,	573
Conn. Agr. Experiment Station (W. O. Filley, State Forester)	New Haven	Oct. 28,	561
Conway, W. B.	New Haven	Sept. 6,	521
Cross Highway Nurseries	Westport	Oct. 21,	551

Name of Firm.	Location.	Certificate issued.	Number of certificate.
Dehn & Bertolf	Greenwich	Oct. 22,	552
East Rock Park Nursery (G. X. Amrhyn, Supt.)	New Haven	Sept. 24,	536
Elm City Nursery Co.	New Haven	Sept. 26,	538
Gardner's Nurseries	Cromwell	Oct. 30,	564
Hartford Park Commissioners (G. A. Parker, Supt.)	Hartford	Sept. 17,	533
Hartridge, S.	Norwich	Oct. 18,	548
Heath & Co., H. S.	Manchester	Sept. 17,	531
Hilliard, H. J.	Sound View	Nov. 13,	571
Holcomb, Irving	Granby	Oct. 16,	547
Houston & Sons, J. R.	Mansfield Depot	Oct. 27,	557
Hoyt's Sons Co., Stephen	New Canaan	Oct. 7,	542
Hubbard & Co., Paul M.	Bristol	Oct. 28,	560
Hunt & Co., W. W.	Hartford	Sept. 17,	534
Kellner, H. H.	Danbury	Oct. 23,	553
Kelsey & Sons, David	West Hartford	Nov. 4,	568
Long, J. A.	East Haven	Nov. 6,	569
Mount Carmel Forestry and Nursery Co. (C. A. Metzger, Mngr.)	Hartford	Oct. 27,	558
Munro, Chas.	New Haven	Oct. 7,	543
New Haven Nurseries Co.	New Haven	Sept. 15,	526
Northeastern Forestry Co.	Cheshire	Oct. 11,	544
Phelps, J. Wesson	Bolton	Oct. 30,	563
Pierson, A. N.	Cromwell	Oct. 21,	550
Platt Co., The Frank S.	New Haven	Sept. 24,	537
Purinton, C. O.	Hartford	Sept. 15,	529
Reck, Julius	Bridgeport	Oct. 18,	549
Schleichert, F. C.	Bridgeport	Nov. 12,	570
Scott, J. W.	Hartford	Sept. 18,	535
Seavey, Wallace	New Haven	Oct. 7,	541
Sierman, C. H.	Hartford	Sept. 12,	524
South Wilton Nurseries	South Wilton	Oct. 23,	554
Stanhope, B. P.	Niantic	Oct. 31,	566
Streckfus, H. P.	Litchfield	Sept. 6,	522
Turner & Co., Chas.	Hartford	Sept. 13,	525
Vidbourne & Co., J.	Hartford	Oct. 6,	540
Windsor Nurseries, W. B. Bryant, Prop.	Windsor	Oct. 24,	555
Woodruff, C. V.	Orange	Oct. 29,	562
Young, Mrs. Nellie A.	Pine Orchard	Nov. 4,	567

INSPECTION OF IMPORTED NURSERY STOCK.

By W. E. Britton and B. H. Walden.

In the report of this Station for 1912, page 223, it was announced that a Federal quarantine and inspection law had been enacted to become operative October 1, 1912. This law provides for a system of notices and permits covering all imported field-grown woody stock entering the United States from other countries, and its enforcement is vested in a board designated as the Federal Horticultural Board. (See Circular 41, Office of Secretary of Agriculture.)

The regulations of the Federal Horticultural Board require that the importer, who is usually the broker, shall send a notice of each shipment to the state nursery inspector of the state to which the shipment is consigned. The Federal Horticultural Board issues a permit before the stock can enter the United States, and this Board also sends to each state inspector a notice in duplicate of each shipment consigned to that state. Both copies are to be filled out after the stock has been inspected; one is returned to the Federal Horticultural Board and the other kept on file as a record in the state inspector's office.

Though in Connecticut for the past four years we have inspected the imported stock received at the regular nurseries, only a portion of the stock imported by florists and private estates has been examined. In fact, in many cases we did not know about the importations. After the Federal Law became operative October 1, 1912, however, we received notices, the same as for all other stock, and we requested that the consignee send notice to this office immediately on the arrival of each shipment so that we might inspect it. Return post cards were furnished. In some cases the consignee complied with the request, but in many instances the stock was unpacked and distributed without sending such notice. In other cases notice was sent, and the inspector found that the stock had been unpacked and mixed with other stock, or perhaps some of it shipped away, so that it was impossible to give it a proper inspection. It seemed futile to attempt to inspect this stock at all unless the inspection could be thoroughly and properly done. The matter was, therefore, placed before the legislature and

Section 4388 of the General Statutes, was amended to read as follows:

Sec. 4388. *Certificate of Inspection of nursery stock. Penalty. All nursery stock shipped into this state shall bear on each package a certificate that the contents of said package have been inspected by a state or government officer and that said contents appear free from all dangerous insects and diseases. If nursery stock is brought into the state without such a certificate, the express, freight, or other transportation company or person shall, before delivering shipment to consignee, notify the state entomologist of the facts, giving name and address of consignee, origin of shipment, and approximate number of cars, boxes, or packages, and probable date of delivery to the consignee. The state entomologist may cause the inspection and if infested the treatment of the stock. No person, firm, or corporation shall unpack any woody field-grown nursery or florists' stock brought into this state from foreign countries except in the presence of an inspector, unless given permission to do so by said state entomologist or one of his deputies. If such stock is found infested with any dangerous pests the state entomologist may at his discretion order it treated. Any person violating any of the provisions of this act shall be fined not more than fifty dollars. (Amendment approved June 5, 1913.)

After the passage of the new law, and before the arrival of many shipments of imported stock, the following letter was sent to all florists and others, of which there were records in this office, as having received importations of stock from foreign countries.

NEW HAVEN, CONN., August 23, 1913.

To Connecticut Importers of Nursery Stock:

GENTLEMEN:—Your name is among those who, during the past two or three years, have imported into Connecticut, nursery stock from foreign countries.

I wish to call your attention to the recent change in the General Statutes of Connecticut, Section 4388, a copy of which is enclosed. You will see that hereafter it will be illegal to unpack such shipments of nursery stock except in the presence of an inspector, unless permission is obtained from this office.

In the future when stock from foreign countries arrives at your place, please send notice promptly to this office, and an inspection will be made at the earliest possible moment. If for any reason you desire to unpack the stock before the inspector arrives, you should telephone to this office for permission to do so.

* See Chapter 184, Public Acts of 1913.

The object of inspecting such stock is to prevent the establishment in the United States of pests now existing in other countries.

Very truly yours,

W. E. BRITTON,

State Entomologist.

During the year just closed, 1316 boxes and packages of imported nursery stock has been inspected by this department. This stock was contained in 246 separate shipments. Of thirteen other shipments reported, four were reshipped to other states, two were greenhouse grown, four contained herbaceous stock, and three were not received by the consignee. These of course were not inspected. The stock came from the following sources.

IMPORTED NURSERY STOCK.

INSPECTED DURING THE YEAR ENDING SEPTEMBER 30, 1913.

Country.	*No. Shipments.*	*No. Cases.*
Holland	103	681
Belgium	57	377
France	26	117
England	21	62
Germany	11	15
Scotland	8	11
Ireland	5	30
Hungary	1	1
Japan	3	8
Italy	1	1
Source not traced	10	13
Total	246	1316

In the inspection of this imported nursery stock, in 1913 insects and plant diseases were found in seven shipments as follows:

On March 22, 1913, a species of *Lachnus* was found on conifers from the nursery of F. Delauney, Angers, France.

A single specimen of the Chrysomelid beetle, *Agelastica* (*Galeruca*) *alni* Linn., was found April 4 by Mr. Lowry on the outside of a box of general ornamental stock from the nursery of H. den Ouden and Son, Boskoop, Holland. The same species was previously found in a shipment of English ivy, *Hedera helix* from Holland, and was noted in the report of this Station for 1912, page 292.

The oyster-shell scale, *Lepidosaphes ulmi* Linn., on lilac, and an aphis (undetermined) on maple, was found April 7 in a shipment of stock from Alma Nurseries, Oudenbosch, Holland.

An egg mass of the Chinese mantid, *Tenodera sinensis* Sauss., was found April 26 on umbrella pine from the Yokohama Nursery Co., Yokohama, Japan.

On April 28, two specimens of mealy bug (not identified) were found on conifers from the nursery of Arthur De Meyer, Ghent, Belgium.

On May 16, specimens of a soft scale, *Coccus hesperidum* Linn., and of the circular or fig scale, *Chrysomphalus aonidum* Linn., were taken from bay trees (*Laurus nobilis*) from Societé Anonyme Horticole de Mont St. Amand, Ghent, Belgium.

On May 27, a single noctuid pupa was found in a nest in the top of a plant of box (*Buxus*) from the nursery of Kluis and Koning, Boskoop, Holland. The nest may have been an old bird's nest or a mouse nest. The adult moth emerged shortly and was identified by Dr. H. G. Dyar as *Mamestra dissimilis* K.

Late in the fall on a number of shipments of *Azaleas,* mostly from Belgium, there was found an *Aleyrodes* which Professor A. L. Quaintance considers an undescribed species.

On March 28, the Juniper rust, *Gymnosporangium clavariæforme,* Jacq., was found on 78 three-year seedlings of *Juniperus communis* var. *hybernica* from the nursery of James Fil, Ussy, France. This rust was determined by Dr. G. P. Clinton, botanist of this Station.

Late in the fall a number of shipments of *Azaleas,* mostly from Belgium nurseries, contained small galls on the new shoots and leaves, and occasionally on the hardened wood. These galls were considered to be caused by a fungus *Exobasidium,* by Mrs. Flora Patterson of Washington, D. C., but as the fungus was not in fruit, it could not be specifically determined.

The actual work of inspecting this imported stock has been mostly done by the assistants. In order to inspect stock at distant points it is often necessary to take early trains and return to New Haven late in the evening. Many days the inspector is thus obliged to work twelve or more hours. A record was kept of the time required to inspect each shipment including that of traveling both ways; this is equivalent to one man working

151 days of eight hours each, or more than six months of the year. At the salaries usually paid assistants, the services of the inspector for this time, together with the necessary traveling expenses, amounts to more than one thousand dollars. By recent legislative provision the expense of this work may now be charged wholly to the gypsy and brown-tail moth account.

INSPECTION OF APIARIES.

At the Autumn meeting of the Connecticut Beekeepers' Association, held in Middletown in 1912, it was voted to ask for a larger appropriation for inspecting apiaries and to amend the law to make the work more effective. A legislative committee was appointed to attend to the matter, the following points to be included:

1. Authority to inspect without complaint.
2. Authority to quarantine diseased apiaries.
3. Requiring that a certificate of good health accompany each shipment of bees whether brought into the state from without or moved from one point to another within the state.
4. A larger appropriation.

After due consideration and several conferences, in which the State Entomologist was present, a bill was introduced into the General Assembly which was intended to replace the law on the statute books. This bill asked for an appropriation of $1,500.00 annually for inspection of apiaries. Hearings were held before the Committees on Agriculture and on Appropriations; certain changes were made by the Clerk of Bills in the wording of certain sections, and the appropriation was cut to $750.00 per year. The act as finally passed is as follows:

An Act Concerning the Suppression of Contagious Diseases Among Bees.

Chapter 141 of Public Acts of 1913.

Section 1. *Duty of state entomologist.* It shall be the duty of the state entomologist, to such extent as he shall deem necessary or expedient, to examine apiaries and to quarantine such as are diseased, and to treat or destroy cases of the disease known as foul brood.

SEC. 2. *Authority to inspect.* The state entomologist may appoint such deputies or inspectors as he may deem necessary or expedient, and said state entomologist, or any person whom he may appoint for that purpose, shall have access at reasonable times to any apiary or place where bees are kept or where honeycomb and appliances are stored.

SEC. 3. *Regulations and records.* The state entomologist is hereby authorized to make suitable regulations regarding inspections and quarantine and to prescribe suitable forms for permanent records which shall be on file and open to public inspection, and to make reasonable rules for the services of said deputies or inspectors, and may pay a reasonable sum for such services.

SEC. 4. *Quarantine.* No person or corporation shall remove bees under quarantine to another locality without obtaining the written permission of a duly authorized inspector. No person or transportation company shall receive for transportation any colony or package of bees, unless said colony or package is accompanied by a certificate of good health, furnished by a duly authorized inspector. No person or transportation company shall deliver any colony or package of bees brought from any other country, province, state, or territory unless accompanied by a certificate of health furnished by a duly authorized inspector of such country, province, state, or territory. Any person or transportation company receiving a shipment of bees from without the state, unaccompanied by such certificate, shall before delivering such shipment to its consignee, notify the state entomologist and hold such shipment until inspected by a duly authorized inspector. In case contagious diseases are found therein such shipment shall be returned to the consignor or delivered to a duly authorized inspector of this state for treatment or destruction, provided the requirements of this section shall not apply to shipments of brood comb, with or without bees, suspected of being diseased and consigned to the state entomologist, the agricultural experiment station, or any duly authorized apiary inspector of the state, or to the bureau of entomology of the United States or the United States department of agriculture, providing there shall be no destruction of any shipment of bees as herein provided in the absence of reasonable notice to the consignee thereof.

SEC. 5. *Hindrance illegal.* No person shall resist or hinder the state entomologist, or any deputy or inspector whom he may appoint, in the performance of the duties imposed by this act

SEC. 6. *Penalty.* Any person violating any of the provisions of this act shall be fined not more than fifty dollars.

SEC. 7. *Appropriation.* The necessary expenses incurred under the provisions of this act to an amount not exceeding seven hundred and fifty dollars annually, shall be paid by the comptroller on duly accredited vouchers.

SEC. 8. Chapter 185 of the public acts of 1909 is hereby repealed.

Approved June 6, 1913.

As the appropriation provided in Section 7, did not become available until after October 1st, 1913, it is too late to use it in any inspection work before next season. The $300.00 remaining unexpended, under the old law, was available, and the work of inspecting apiaries in 1913 was continued as in previous years, Mr. H. W. Coley of Westport acting as inspector for the four southern counties of the state and Mr. A. W. Yates for the four northern counties.

As in 1912, an effort was made to examine apiaries in sections of the state not previously covered by the inspectors. Considerable European foul brood was found in Chatham, Coventry, Danbury, Norwich, Putnam, Pomfret, Thomaston, and Winchester. Some infested colonies were found in Andover, Barkhamsted, Beacon Falls, Bloomfield, Bolton, Burlington, Canton, Darien, Derby, Fairfield, Farmington, Litchfield, Manchester, Marlboro, Meriden, Montville, Norwalk, Stamford, Stratford, Waterbury, Wethersfield, West Hartford, Weston, Westport and Wilton. Most of the apiaries examined had not been inspected the previous season.

The statistics of apiary inspection in 1913 are shown in the following table:

APIARIES INSPECTED, 1913.

	Apiaries	Colonies
Number inspected	189	1,500
Infested, European foul brood	84	368
Per cent. infested	44.4	24.5
Other troubles:		
Sacbrood		42
Average number of colonies per apiary		7.9
Cost of inspection, paid by state		$299.90
Cost of inspection, paid by Station		8.60
Total cost of inspection		$308.50
Average cost per apiary	$1.63	
Average cost per colony	.21	

For the purpose of comparison a summary of the inspections for the past four years, since the work was instituted, is given in the following table:

SUMMARY OF APIARY INSPECTION IN CONNECTICUT.

	1910	1911	1912	1913
Number apiaries inspected	208	162	153	189
Number infested Europ. foul brood	158	84	73	84
Per cent. infested Europ. foul brood	75.9	51.8	47.7	44.4
Number colonies inspected	1,595	1,571	1,431	1,500
Number infested Europ. foul brood	793	431	337	368
Per cent. infested Europ. foul brood	49.7	27.4	23.5	24.5
Average number of colonies per apiary	7.6	9.7	9.3	7.9
Total cost of inspection	$499.85	$323.08	$299.80	$308.50
Average cost per apiary	2.40	1.99	1.96	1.63
Average cost per colony	.28	.21	.21	.21

With the increased appropriation available for next season, and with authority to inspect without complaint, it will be possible to inspect a much larger number of apiaries than ever before. The cost per apiary and also per colony, should be slightly reduced.

On account of the importance and necessary part which insects play in the pollination of cultivated plants, the apiary interests of Connecticut are far more important than the statistics of valuation would seem to show.

GYPSY MOTH CONTROL WORK.

This insect has been all but exterminated in the only two areas known to be infested in Connecticut, Wallingford and Stonington. The field work for the past three years has been in charge of Mr. Donald J. Caffrey, who resigned May 15th, at the beginning of the caterpillar season, to accept a position in the Bureau of Entomology at Washington. No caterpillars or egg-masses have been found in Stonington since the spring or 1911 when three egg-masses were destroyed, and the pest was thought to be exterminated in this locality. The finding of a few caterpillars, therefore, last summer, places the matter in a different light.

In the summer of 1912 only twenty-six caterpillars and one pupa were found at Wallingford, an account of which appears in the latest report of this Station (see report for 1912, pp. 224-226).

The scouting for egg-masses began on November 21, 1912, and was conducted by two Federal scouts and Messrs. Donald J. Caffrey and H. B. Kirk of the staff of this department.

SCOUTING FOR EGG-MASSES.*

Wallingford.

As the result of this scouting two egg-masses were discovered, one on the brick foundation of the house at No. 53 South Orchard Street, and another on the fence in the rear of No. 45 South Orchard Street, a few paces further north. A careful and systematic search of the square, where caterpillars had been taken the previous summer, failed to reveal any egg-masses; this square being examined twice, once by the State scouts and again by the Federal scouts.

The area between Main Street, and the railroad tracks was finished at Christmas. The work was then transferred to Stonington until January 6th, when operations at Wallingford were again resumed. The time from this date until January 20th, was occupied in scouting the outlying regions as far as the Masonic Home on the west, Soldier's monument and borough limits on the north, East Wallingford railroad station on the east, and the railroad bridge on the south.

Stonington.

Although caterpillars or egg-masses have not been found in Stonington for the past two years, it was deemed advisable to examine the area formerly infested, to guard against any possible outbreak that may occur. Accordingly the writer, accompanied by two Federal scouts, went to Stonington on December 26th, 1912, and remained until January 4th, 1913. During this time the trees, bushes, etc., were examined all through the borough itself and as far east as the velvet mill and Chapman's, on the north to the open space above Darrel's, and on the west to Walnut Grove. Particular attention was given the locality around Stanton's and Koelb's, where the caterpillars were last found. No egg-masses of the gypsy moth were discovered in this area.

SCOUTING IN OTHER PARTS OF THE STATE.

Scouting for gypsy moth egg-masses in other parts of the state was started on April 17th, and continued until May 10th. F. W. Carter and W. A. Collins, two Federal scouts, were detailed for this work and were assisted for part of the time by the writer (Mr. Caffrey).

* Written by D. J. Caffrey.

New London.

About two weeks were devoted to the vicinity of New London on both sides of the river. The danger of the gypsy moth being introduced into this section may be considered great, as the annual Harvard-Yale boat races in June, on the Thames River, attract many people who come in automobiles from the badly infested districts in Massachusetts and Rhode Island. This occurs at a time when the caterpillars are most active with the consequent danger of introducing the species.

On the west side of the river the city of New London was scouted on the south to Ocean Beach and along the main road north through Quaker Hill, Montville and Uncasville to Thamesville.

On the east side of the river Groton was scouted on the south to Avery Point and along the main road north through Gales Ferry to Norwich, including the section around Laurel Hill. In addition the trees around the railroad yards at Midway were examined and along the road leading east from Poquonoc Bridge.

No traces of the gypsy moth were found at the above named places.

Thompson.

One week was devoted to scouting in the town of Thompson. The gypsy moth has been found in the adjoining towns a few miles from the line in both Massachusetts and Rhode Island, and may be expected at some time to establish itself in Thompson, or neighboring towns, because of the natural spread of the insect. The villages of the town were scouted and most of the territory in the northern and eastern parts of the town. No egg-masses were found.

In this work, only the apple and white oak trees were examined with those along the streets and highways, as it has been repeatedly noted that when the insect is first discovered in any locality, the egg-masses are invariably on apple, white oak or street trees.

From the foregoing notes by Mr. Caffrey, it will be seen that in all of this work, by the Federal scouts and the scouts of this department, only two gypsy moth egg-masses were found—and those in Wallingford.

DESTROYING CATERPILLARS.

Wallingford.

On the resignation of Mr. Caffrey, in May, Mr. Quincy S. Lowry, who had gained experience in gypsy moth work in his native town in Massachusetts, was placed in charge of the field work at Wallingford. Messrs. Walden, Caffrey, Lowry and Britton visited Wallingford on May 12th, and looked over the situation. Small rose bushes, growing close to the spot where one egg-mass was creosoted during the winter at No. 53 South Orchard Street, were examined and two caterpillars found. On May 20th, Mr. Lowry found another caterpillar near this place on a rose bush. These three were the only caterpillars taken in Wallingford in the summer of 1913.

The trees were banded as usual, beginning May 19th and finishing a few days later. The section banded included the area between the railroad tracks on the west to Church Street, on the north to North Main Street, to Center Street, then east to Fair Street, and south to Ward Street, and 2,135 bands were applied. Tanglefoot bands were also used on all the trees in the cemetery and in several other places which had previously been considered as danger spots.

The burlap bands were turned about every other day. Messrs. C. W. Bolton, R. A. Emmons and George H. Hassett were employed to do this work. Mr. Lowry spent much of his time in scouting inside and outside of the banded territory. Many trees were climbed and searched for caterpillars, but none were found. The bands were removed August 9th and the men discharged.

Messrs. McIntyre and Foster, Federal employees who scouted around Stonington, worked at Wallingford during the week of August 11th-16th, examining the territory outside of the banded area. No gypsy moths were found. The work will be continued under the supervision of Mr. Davis and kept up until it is reasonably certain that the pest has been wholly eradicated from this locality.

RECORD OF GYPSY MOTHS DESTROYED AT WALLINGFORD.

Year	Egg-Masses	Caterpillars	Cocoons
1910	8,234	8,936	96
1911	23	1,551	15
1912	5	26	1
1913	2	3	0

Stonington.

Mr. Fred Hoadley, who has been employed for several seasons, had charge of the field work during the summer of 1913. He began banding trees May 19th, and finished before June 1st. At first no others were employed, but on June 27th Mr. Hoadley found a caterpillar on one of the apple trees north of the Stanton House. This discovery was reported promptly to this office by telephone, and I visited the place that afternoon. There are thirteen trees of rather large size in this group, which adjoins Darrel's, and which is perhaps four hundred feet from the Main Street highway with tall grass between. Mr. Hoadley was then instructed to extend the banded area, to hire more men to prune trees and to turn burlap bands, and to personally scout for caterpillars in addition to superintending the work of the other men. The first week in July a caterpillar was found in the yard of the late Dr. C. E. Brayton, on Elm Street, and another in the yard of Clark Lillibridge, corner of Trumbull and North Main streets. Two weeks later, a caterpillar was found in the apple orchard back of the old Stanton House, several hundred feet south of where the first one was discovered in June. A chrysalis or cocoon, was found July 25th in Mr. Sylvia's yard, corner of Oak and North Main streets. On the same day a caterpillar was found on an apple tree near North Main Street, in the rear of Mrs. Babcock's house on Broad Street. On August 13th, Mr. Hoadley found a female moth depositing eggs on an apple tree in the rear of the old house on the Stanton place. The moth was killed and the egg-mass creosoted.

Thus altogether five caterpillars, one cocoon or chrysalis and one female moth, or a total of seven gypsy moths were found in Stonington, where no caterpillars had been found since 1910 and no egg-masses since 1911, though the trees have been banded each year. The presence of the caterpillars is not yet understood, unless it be a reinfestation. The pest could hardly have remained in Stonington all of this time, without there being more caterpillars in 1913, and without escaping notice. The few that were found were rather widely scattered, some being perhaps nearly one-fourth of a mile apart.

Scouting was widespread and thorough. In addition to that done by Mr. Hoadley, Mr. L. B. Ripley was sent to Stonington where he worked during the week ending July 26th. He examined much territory both in and outside of the banded area but found nothing.

Messrs. McIntyre and Foster, trained scouts, were sent to Stonington by Mr. A. F. Burgess of Boston, Mass., who now has charge of the Federal work against the gypsy and brown-tail moths. These men worked there from July 28th to August 9th, and spent most of their time examining the territory outside of the banded area, especially within the town of Stonington, north, east and west of the borough, with a view of discovering infestations from which the caterpillars might have been carried into Stonington or blown there by the winds. The young caterpillars are now known to blow several miles, especially from high elevations.

Messrs. McIntyre and Foster scouted the road to Westerly, Elihu's Island, the road to Mystic, and the roads between Stonington and Old Mystic. They also visited Mason's Island and Fisher's Island. They found no other infestation in Connecticut, but did find a single chrysalis or cocoon near the end of the trolley line in Westerly, R. I. As Mr. McIntyre, with a gang of men, scouted all around Westerly in the spring of 1912 and found nothing, it did not seem possible that any large infestation could have developed there.

The men employed by Mr. Hoadley in Stonington were Paul McDermott, Henry McGowan, Edward Higgins, Henry C. Sylvia, Herman Simon and John Flynn. Altogether about 2,800 burlap bands were applied and tanglefoot was used on a number of trees. The burlap was all removed and the work closed for the season on September 2d.

All old apple trees within the infested area were scraped, pruned, and cavities filled a few years ago, when Mr. G. H. Hollister was in charge of the work. Much brush was cut and the territory generally cleaned up. Though it has not received particular attention since, and more of this work still remains to be done, the trees generally are in much better condition than when Mr. Hollister started there.

Mr. Davis now takes charge, and will make every possible effort to again exterminate the pest in this locality. The trees will be pruned and put into condition for our work, and the

banded area which has been reduced since 1911, because no caterpillars were found, must again be extended.

RECORD OF GYPSY MOTHS DESTROYED IN STONINGTON.

Year	Egg-Masses	Caterpillars	Cocoons
1906	73	10,000	47
1907	118	2,936	200
1908	73	2,560	44
1909	6	98	0
1910	1	146	1
1911	3	0	0
1912	0	0	0
1913	0	5	1

CONTROLLING THE BROWN-TAIL MOTH IN 1913.

BY W. E. BRITTON AND DONALD J. CAFFREY.

An account of previous work against this insect may be found in the reports of this Station for 1910, pp. 683 to 689; 1911, pp. 281 to 286; 1912, pp. 229 to 236.

The control measures against the brown-tail moth were continued in 1913 along the same lines as in former years. During the past winter three gangs of men were employed in scouting Windham County, Tolland County, the eastern half of Hartford County, and all of New London County, except the southwestern corner, in order to destroy the nests of the insect when found and to determine the limits of infestation. Nests were found and destroyed in that portion of the State lying east of Suffield and West Hartford, and north of West Hartford, Willimantic and Jewett City, with scattering infestations in Norwich and Stonington.

The worst infested area comprises Thompson, Woodstock, Putnam and Pomfret. At Hartford and Suffield small badly infested areas were found, with scattering nests in the vicinity. In the other towns found to be infested the nests were few in number and widely distributed.

The territory to be scouted was divided between the gangs employed for that purpose. One gang in charge of Mr. J. H. Osgood, commencing December 26th, worked the towns in the northeastern corner, another gang in charge of Mr. H. B. Kirk, beginning January 31st, worked the towns south of Central Village and east of Willimantic to Fisher's Island Sound. After Mr. Kirk's resignation, March 1st, Mr. E. R. Sherman took that gang and scouted Manchester and East Hartford. All the other towns were scouted by the gang in charge of one of the writers (Mr. Caffrey).

In the towns found to be badly infested the entire area, exclusive of woodlands, was scouted, but where only a slight infestation was encountered the work was confined to the villages, the orchards and along the main highways of travel. All nurseries situated in the towns scouted were given special attention to prevent any possible spread of the pest through the shipping of nursery stock. Pear, apple and white oak trees, situated near lights seemed to be preferred by the pest, and from these trees most of the nests were taken.

The problem of control is increased by the fact that adults are coming in each year from the adjoining states of Massachusetts and Rhode Island and that the large woodland and brush tracts contain nests which are impossible to find and destroy. It seems probable, judging from present conditions, that the insect will gradually spread west and south to include the entire State, unless the natural insect enemies and fungous diseases, combined with spraying and removing the nests, serve to keep the pest in check.

The following is a result of conditions existing in the various towns:

Thompson.

Conditions in the town of Thompson showed considerable improvement over those of the previous year. Nests were taken in nearly the same localities but were not so numerous as in 1912, or so widely scattered. The heaviest part of the infestation is confined to the northern part of the town and to the villages. At Thompson village 184 nests were cut from fruit trees in the vicinity of the four corners near the hotel. Half a mile northeast on the farm of H. B. Ingraham, was the worst infested spot in the entire township, 280 nests being cut from the trees at this place, of which 130 were on one pear tree. Along the road over Brandy Hill and around East Thompson Station, twenty-nine scattered nests were found. Between East Thompson Station and Wilsonville the nests were found in nearly every

orchard, and in one case a group of twenty-five were cut from a small orchard near the State line on the road to Webster, Mass. At Wilsonville, ten nests; Thompson Station, two nests; Grosvenor Dale, ten nests; New Boston, ten nests; Quinebaug, thirty nests. The localities between Quinebaug and New Boston, in the northwest corner of the town, was badly infested, seventy-eight nests coming from this section. West Thompson gave eight nests and the region around Quaddick Reservoir, five nests. Around West Thompson, Mechanicsville and Quaddick the nests were few and widely scattered. A total of 750 nests were gathered in the town of Thompson.

Woodstock.

The eastern and northern parts of the town of Woodstock were found to be badly infested, while more nests were taken in the western part of the town than in any previous year. In the section around Harrisville, 220 nests were cut. Between Pomfret line and South Woodstock the nests were very numerous, especially at Harrington Farm and Potter's, where 300 nests were taken. In the large orchard just east of the Fair Grounds, we found seventy nests; on the estate of Dr. Shepherd, near the lake, two nests; on the estate of Clarence Brunn, two nests, and a few others were scattered about. On the ridge west of Woodstock Pond there were forty-four nests, at the farms of Patrick Mehan and Carl Eke. On Woodstock Hill, Dr. Spaulding's, fifty-four nests, and a few more in the vicinity. To the east of Woodstock Hill the nests were scattered. Just north there were fifty nests opposite the farm of Mr. Lester. At Mr. William Chandler's, East Woodstock, there were ninety nests; one mile east of East Woodstock, on the farm of Mr. Morse, 125 nests, with scattered nests in adjoining orchards. On the May Farm, in the same neighborhood, thirty nests were taken. At Gustavus Johnson's, towards New Boston, there were 132 nests; northwest from Woodstock Hill at Frank Miller's, eighty-one nests; in North Woodstock village several scattered nests were gathered. Two miles northwest of the village, on Thomas Milligan's place, there were 201 nests; around the locality known as "English Neighborhood" the nests were found to be numerous, and in the orchard of Irving Paine, eighty-two nests were taken. At L. H. Healey's, between Woodstock Hill and the road running

east to East Woodstock, twenty-one nests were found; east of West Woodstock at Frank Carlson's, eleven nests. All through this section single nests were found in the orchards connected with the farms. On Bungee Hill, near West Woodstock, at Jarvis Hall farm, there were five nests. In Kenyonville two nests were found, one at the east of the village and one near Crystal Pond.

This makes a total of 2,144 nests in the town of Woodstock.

Putnam.

At Putnam the control measures of previous years have kept the insect from doing serious damage. The caterpillars have not been numerous enough to defoliate the trees or to cause trouble from the "brown-tail rash," which would have been the case if the nests had not been removed each year. Great numbers of the adults are coming in each year from the badly infested districts in Massachusetts and Rhode Island, and this fact makes the problem of control a very difficult one.

The nests were found to be scattered over a greater area than formerly and were not so numerous in the center of the city. The worst infested section in the city was between Front, School and May streets, to the Quinebaug River, where 1,568 nests were cut. Around the Children's Home there were 240 nests; Putnam Heights, ninety-two nests; Rhodesville, forty-one nests; Day Memorial Hospital, ten nests; around Gary school house, twenty-eight nests; Poor Farm, two nests; between Putnam Heights and Rhode Island line, twenty-three nests. Sixty-six nests were cut from the large oak trees on Oak Hill and from the oak trees near Morse Mills, thirty nests. East of Oak Hill only a few nests were taken, and along the northern border of the town no nests were found. Altogether the men destroyed 2,180 nests in the town of Putnam.

Pomfret.

In the town of Pomfret the nests were present in slightly greater numbers than last year and were distributed throughout the entire township. The worst infested place was on the Grosvenor estate, one mile north of Abington post office, where 229 nests were taken. Between the railroad and the stage road to Putnam, the nests were numerous, 211 being cut. West of Gary

school house, thirty-five nests; along the northern town line, sixty-five nests; between Pomfret Street and Eastford town line, 225 nests, which were scattered through the various orchards north of Abington. Solitary nests were found at Dwight Botham's, one and one-quarter miles west of Abington post office; at Dround's, one-half mile to the south; at Smith's, one mile south of Abington; at Edward Peale's, near Abington Station; at Young's, south of Pomfret station; and at Arthur Botham's, one-half mile south of Pomfret station. Forty-eight nests were taken in the Russell orchard just north of the Pomfret-Brooklyn line, adjoining Lapsley's orchards. Four nests were found at Pomfret landing. No nests were taken in the nursery of J. H. Bowditch or its immediate vicinity. A total of 841 nests were found in the town of Pomfret.

Killingly.

In the town of Killingly the nests, although few in number, were found to be distributed throughout the entire township, and were apparently the result of adults coming in from Rhode Island, or from the infested districts in Putnam and Pomfret. Along the ridge of Chestnut Hill, northeast of East Killingly, forty-nine nests were cut. Near Elmville Mill, at Chase's, six nests; at Day farm, midway between Danielson and Williamsville, two nests; and four nests were found about a mile east of South Killingly. In the borough of Danielson, three nests were found along North Street, three nests near the High School, four nests on Broad Street, two nests on Maple Street, in the Brooklyn side of Danielson. Solitary nests were found at house south of Putnam Heights, at first farm south of Putnam town line on East Putnam road, near the Street Railway car barn, near a cottage on south side of Alexander's Pond, at the top of Mashentuck Hill beyond city reservoir, and at Stillwell's, one and one-half miles northeast from East Killingly, making a total of seventy-eight nests in the town of Killingly.

Brooklyn.

The infestation in Brooklyn was confined to the eastern and northern portions of the town. In Lapsley's orchards, near the Pomfret border, twenty-nine nests were cut; one nest at Chapman's on the south side of Bush Hill; nine nests scattered about

the village; three nests on main road, between Brooklyn village and Danielson; twenty-one nests along Allen Hill road and two nests on Brooklyn side of Danielson on Maple Street. Nothing was found in the western part of the town around Axworth Hill or in the region around the southern border of Wauregan. A total of sixty-five nests were gathered in the town of Brooklyn.

Sterling.

No nests were taken in the town of Sterling, although this town must be regarded as infested, because a single nest was found during the scouting operations of 1912. The villages of Oneco, Sterling Station and Sterling were scouted and also the main roads of the town to the north end south of the railroad.

Plainfield.

In the town of Plainfield one nest was taken on the hill to the east of Wauregan village, one nest a mile further north on the main road to Danielson, and one nest in the village of Moosup, just below the Catholic Church. Central Village, Black Hill, Almyville, Plainfield Village and Plainfield Junction were scouted and also along the main roads of the town, but nothing more was discovered. Only three nests were found in the town of Plainfield.

Voluntown.

The village of Voluntown was scouted and along the main road running east. No nests were found.

Griswold.

At Jewett City, in the town of Griswold, thirteen nests were taken from two adjoining yards, on East Main Street, on pear trees. Along North Main Street, two nests were found in two different yards, on apple trees. The villages of Hopeville, Clayville, Pachaug, Doaneville and Glasko were scouted and also the main roads of the town, but no additional nests were found, leaving a record of fifteen nests for the town of Griswold.

North Stonington.

The villages of North Stonington, Pendleton Hill, Laurel Glen and Clark's Falls were scouted, and also along the line of the Norwich and Westerly trolley. No nests were found.

Preston.

Preston Village, Long Society, Preston City, Preston Plains, Preston Mills and Poquetanock were scouted and also along the trolley lines. No nests were found.

Ledyard.

Gales Ferry, Allyn Point and along the road leading to Ledyard village and northward to Preston were scouted, but no nests found. Special attention was given the road along the course of the Yale-Harvard boat race, as many automobiles from infested districts, to the north and east, are parked in this vicinity during the progress of the race and are very liable to bring caterpillars or adults with them. No nests were found in Ledyard.

Stonington.

In the town of Stonington, two nests were found at Stillmanville, just across the Pawcatuck River from Westerly, R. I., and three nests at Downerville in the same locality. While scouting for gypsy moth egg-masses in the borough of Stonington, Mr. Caffrey found one nest in the rear of the Stonington Automobile Station, and one nest at Koelb's, both on Elm Street. In the village of Mystic, forty-six nests were found in four adjoining yards one-quarter mile northeast of the village on the road toward North Stonington. Two nests were found along the main road between Mystic and Stonington borough. No nests were found at Old Mystic, Wequetequock or along the roads to the north. This makes a total of sixty nests in the town of Stonington, and the infestation appears to be an isolated one.

Groton.

In the town of Groton, the villages of West Mystic, Noank, Burnett Corner, Midway, Poquonoc Bridge and Poquonoc Plains, Eastern Point, Groton Town, Mamacoke and around the United States Naval Station, and along the roads fronting the Thames River and the Sound were scouted but no nests found.

New London.

All territory within the limits of the city was scouted. No nests were found.

Waterford.

The main road running north and south between New London and Norwich was followed and the villages of Waterford, Quaker Hill and Bartlett scouted. No nests were found.

Montville.

Uncasville, Kitemaug, Massepeag, Mohegan, Montville Town and Fair Oaks were scouted, and also the main road running north and south. No nests were discovered.

Norwich.

An isolated infestation was discovered in the city of Norwich in May, 1912. At that time all trees were sprayed on which the caterpillars were feeding, and this had the effect of holding the insect in check. One nest was found in the city of Norwich, corner of Willow Street and Broadway. One nest in the Laurel Hill section of Norwich, at 168 Laurel Hill Avenue. The entire town of Norwich was scouted, including Greenville, Taft Station, Taftville, Occum, Yantic, Norwichtown and Thamesville. No additional nests were found at any of these latter places except an old nest on the M. Morgan estate in Thamesville. Only two nests were found in the town of Norwich.

Bozrah.

Bozrah Street, Fitchville, Bozrahville, and along the main roads connecting these villages were scouted. No nests were found, but Mr. D. M. Rogers reports that one of his men (Mr. Vinton) observed a nest in this town.

Lisbon.

With the exception of a few houses along the northern border, the entire town of Lisbon, including Newent, Jewett Station and the Lisbon side of Jewett City, was scouted. No nests were found.

Sprague.

The entire town of Sprague was covered, including Baltic, Versailles, Versailles Station and Hanover. In an orchard beside the road, one-quarter mile east from Hanover, three nests were found.

Franklin.

Franklin Station, Franklin Village, North Franklin, Avery Hill, Pleasure Hill, Franklin side of Yantic and all main roads connecting these villages were scouted. No nests were found.

Canterbury.

In the town of Canterbury, Packersville was scouted, as were the main road to Canterbury Village from Packersville and all roads in the vicinity of the village and Westminster. No nests were found.

Scotland.

The main road from Windham, Scotland Village with surroundings, and the road to Scotland Station were scouted. No nests were found.

Windham.

The entire town of Windham was scouted very carefully, as the vicinity of Willimantic was looked upon as a danger spot, due to the fact that it is a junction point of many railroads. Windham Center, North Windham, South Windham, and all roads in the town were also scouted. One nest was taken at Windham Center on the property of J. H. Lockman, this being the only nest found in the town of Windham.

Hampton.

At Hampton Village, seventy-one nests were cut from a group of old apple trees near the post office; two nests along the road to the railroad station, and one nest one and one-half miles northeast of the village on the road to Elliotts. No nests were taken at Clark's Corner, at Hampton Station, or in the northern part of the town. Thus seventy-four nests were destroyed in the town of Hampton.

Chaplin.

The entire town of Chaplin was scouted, except the northwestern corner. No nests were found.

Mansfield.

One nest was taken at Mansfield Hollow, near the cross roads, on a pear tree in the yard of Mr. Bowers. One nest was found

near the trolley line between Willimantic and South Coventry, in the southwest corner of the town of Mansfield, on the property of Philip Bergevin, corner Babcock Hill Road. In addition Professor G. H. Lamson reported one nest from the college orchard at Storrs, and one nest at Mansfield Four Corners. No nests were found at Eagleville, Mansfield Depot, Spring Hill, Hank Hill, Gurleyville, Chaffeeville or Mansfield Center. A total of four nests were gathered in the town of Mansfield.

Eastford.

Phœnixville, Eastford Village, North Ashford, and the roads connecting these villages were scouted. One nest was taken in Eastford Village on the property of George Griggs; one nest in Phœnixville, at John McNair's, on top of the hill east of the village, making two nests for the town of Eastford.

Ashford.

The villages of Westford, Westford Hill, North Ashford, Warrenville and Ashford were scouted. No nests were found.

Union.

The village of Union and roads leading east to Woodstock, west to Stafford and north through Mashapaug were scouted. A nest was found on the first farm south of the Wells property, making one nest for the town of Union.

Stafford.

At Stafford Springs, one nest was taken on the property of Mr. Fox, West Street; one nest near the fair grounds at the second house north of the railroad crossing; one nest in town park and one nest on top of hill along the road leading to Staffordville. Nothing was found at West Stafford, Ellithorpe, Orcuttville, Haydensville, Stafford Village or Staffordsville. This gives a total of four nests in the town of Stafford.

Somers.

Two nests were taken at Somerville in front of Trolley Station No. 40, on apple trees beside the road; one nest in Somers Village, near Trolley Station No. 50, on an apple tree beside the road, and two nests at the fork of the roads one-quarter mile

due south of the village. At North Somers, one nest was taken on the farm of Percey E. Giffey, near the state line, making six nests in the town of Somers.

Enfield.

In the town of Enfield, one nest was found on the property of Herbert Chilson, three-quarters of a mile south of the State line on the main road to Springfield; one nest on property of F. St. George, Maple Street, near the main road; one nest one-quarter mile due east of the Warehouse Point railroad station, on Enfield Street; two nests in Hazardville, at corner Main and Bridge Streets, and one nest along the trolley line one mile east of Thompsonville, on an apple tree near the roadside. Nothing was found at Thompsonville, Enfield Village, Shakers Station, Shakers Village or Scitico. A total of six nests were found in the town of Enfield.

Willington.

West Willington, Willington Village, East Willington, South Willington and the roads connecting them were scouted but no nests found.

Tolland.

The village of Tolland was scouted as well as the roads to the north and south of the village and east to the railroad. No nests were found.

Ellington.

Ellington Village, Sadd's Mills, Crystal Lake, Windemere, and the main roads of the town were scouted but no nests found.

East Windsor.

Warehouse Point was scouted, including the region around Prospect Hill, also the main road along the river toward East Hartford. At Broad Brook, one nest was taken at Marian's farm, on the Hartford road, one-quarter mile south of the village; one nest at Twombley's, just east of the railroad crossing near the station; and one nest at H. W. Reed's on Main Street. Nothing was found at Melrose or vicinity. A total of three nests were taken in the town of East Windsor.

Coventry.

South Coventry, North Coventry, the section around Bald Hill, South Coventry Station and the main roads of the town were scouted. One nest was found one-half mile north of South Coventry, on Ripley Hill, at corner of the road to Eagleville, this being the only nest found in the town of Coventry.

Bolton.

The entire town of Bolton was scouted, including Bolton Notch, Quarryville, and Bolton Village. Special attention was given the nursery of J. Wesson Phelps and vicinity. No nests were found in the town.

Vernon.

The city of Rockville and vicinity was scouted and one nest taken from a pear tree near the corner of Prospect and Mountain Streets, where a high concrete wall abuts the trolley tracks. Vernon Center, Vernon Station, and Talcottville were also scouted but no additional nests found. Only one nest was found in the town of Vernon.

Manchester.

The entire town of Manchester was scouted, including Buckland, Manchester Village, Manchester Green and South Manchester. Special attention was given the nursery of C. R. Burr & Co., the stock being examined very carefully to prevent any possible spread of the insect through the medium of nursery stock. No nests were found in the town.

South Windsor.

East Windsor Hill, South Windsor, the main road along the river, section around South Windsor Station, Wapping and vicinity were scouted. The nursery stock of C. R. Burr & Co., between Wapping and Buckland was also examined, but no nests were found.

East Hartford.

In East Hartford, at 63 Connecticut Boulevard, twenty nests were cut from three pear trees and one apple tree; at No. 494 Main Street, nine nests were cut from five pear trees. The remainder of that town, including Burnham and Burnside, was scouted but no additional nests found, making a total of twenty-nine nests in the town of East Hartford.

Wethersfield.

The village of Wethersfield and vicinity was scouted and as far south as Maple Street, also around the State prison and all roads north of the town line. No nests were found.

Hartford.

The entire city of Hartford was systematically scouted. A bad infestation was discovered in the square bounded by Main, Park, John, and Buckingham Streets, on a group of large pear trees. From the number of old nests and pupa cases found it seems probable that this colony had been present in the city for at least two years. The worst infested yard was in the rear of 239 Main Street, where 456 nests were cut from nine pear trees, one tree alone containing 221 nests. In the adjoining yard 173 nests were cut from three pear trees, six nests from an elm and four nests from a plum tree. The writer visited the place on March 11, in company with Mr. G. A. Parker, Superintendent of Parks; Mr. W. A. Muirhead, Superintendent of Trees, and several other city officials and employees, so that the men who are engaged in park and tree work in the City of Hartford, might become familiar with the appearance of the nests. Some of the infested trees are shown on plate I, b. Scattering nests were found throughout this square and on the opposite sides of Main and John Streets. The remaining nests found in the city were widely scattered and seemed to be the result of adults coming from the badly infested section. Solitary nests were found at No. 49 Elmer Street, near corner Capen Street and Windsor Avenue, at 281 Trumbull Street, at corner Charter Oak Avenue, and Governor Street, at corner Hudson and Buckingham Streets, at corner Washington and Madison Streets, at corner Wyllys Street and Wethersfield Avenue, at 14 Wyllys Street, at 23 Charter Oak Place, at 25 Wyllys Street, at 84 Maple Street, and six nests along east side of Buckingham Street. No nests were found in any of the various nurseries throughout the city or in any of the public parks. A total of 747 nests, therefore, were found in the City of Hartford.

West Hartford.

All territory within the town limits of West Hartford was scouted. At C. W. Hall's, 239 North Main Street, four nests were taken and one nest at Fred Bishop's, opposite the corner of Farmington and Outlook Avenues. Mr. N. A. Millane, Superintendent of The Frost & Bartlett Co., tree specialists, had previously sent a nest to the office, which he found while renovating the apple orchard of R. J. Jacobs on the Mountain Road. No other nests were found in this orchard or in the immediate vicinity. A total of six nests were found in the town of West Hartford.

Farmington.

The villages of Unionville and Farmington were scouted with the main road connecting these villages with West Hartford. No nests were found.

Windsor.

The villages of Windsor, Hayden's, Poquonock and Rainbow were scouted; also the main road from Windsor Locks to Hartford and the road from Rainbow to Windsor. One nest was taken on Spring Street in the village of Windsor, this being the only one found in the town.

Bloomfield.

The village of Bloomfield was scouted and all territory in the southeastern corner of the town. No nests were found.

Windsor Locks.

The entire town of Windsor Locks was scouted, but no nests were found.

Suffield.

In the town of Suffield, a badly infested section was discovered just west of the Fair Grounds, near the corner of West Suffield Road and Hasting's Hill Road. In this section 300 nests were cut from a group of high apple trees at Arnold's and 245 nests from apple, pear and wild cherry trees on the farms of Burke, Leach and Grey. Three nests were found around Hasting's Hill crossroads and scattering nests along Hasting's Hill Road north and south of that point. Solitary nests were taken at William Orr's on Grant Street, at Charles Adams on Ratley Street, at Lily's, one-quarter mile due south from West Suffield crossroads, at Fuller's corner, at corner North Street and Halladay Avenue,

at corner North and Hickory Streets; near northeastern end of Thompsonville bridge; at Bowker's, near Stony Brook bridge; at Pinney estate on Prospect Hill; at estate opposite Kent's Corner; three nests along South Street and two nests beside the railroad tracks south of the station, making a total of 565 nests for the town of Suffield.

Lebanon.

All territory in the northern and eastern part of Lebanon was scouted, including Lebanon Village, Lebanon Street, Lebanon Station, Chestnut Hill, Liberty Hill, Leonard Bridge and the Lebanon side of Bozrahville. A great number of apple trees were present in the vicinity of Lebanon Street. No nests were found in the town.

Columbia.

The territory scouted consisted of the road running from Chestnut Hill through Columbia village as far as Columbia reservoir, thence along the next road south to Leonard Bridge. Also along the road running south of the railroad through Hop River village to Willimantic. No nests were found.

Andover.

Andover Station and vicinity was scouted, and also the road coming from Bolton Notch toward Hop River and along the main road south to Hebron. No nests were found.

Hebron.

Gilead, Hebron Village and Turnerville were scouted, with the main roads connecting these villages. No nests were found.

Colchester.

All territory within the radius of a mile from the railroad station was scouted in the village of Colchester. No nests were found.

Middletown.

In Middletown the city was scouted on the west to the freight yards, Johnson Street, Prospect Street and the Air Line railroad tracks; on the south to Baldwin Street, Park Street, Fountain Avenue and High Street; on the east as far as Warwick Street

to Durham Avenue and Farm Hill Road. In addition, the region known as South Farms was scouted as far as the grounds surrounding the Insane Asylum. No nests were found.

New Britain.

The City of New Britain was scouted on the north to Broad Street, Lasalle Street and Fairview Cemetery; on the west to Burritt Street, Black Rock Road and Lincoln Street; on the south to Shuttle Meadow Road and Brook Street, and on the east to the side streets branching from East Street. No nests were found.

Saybrook Junction.

The territory scouted included all that portion of the village north of the railroad tracks, west to Trolley Station No. 57, near Oyster River, south to the road leading to North Cove and east to the river. No nests were found.

SUMMARY.

The result of control measures against the brown-tail moth in Connecticut during the past winter indicates that the area known to be infested has been greatly increased since last year and now includes over twenty-seven towns in that portion of the State lying east of Suffield and West Hartford, and north of West Hartford, Willimantic and Jewett City, with separate infestations at Norwich and Stonington. The number of nests have slightly increased in some of the towns where the insect had previously been known to occur, and in addition large infestations were found at Hartford and Suffield. The other towns in the list are infested only to a slight degree.

It should be borne in mind that in this work described in the foregoing pages, as has already been stated, the open country only was carefully examined, particular attention being given to the fruit trees in orchards and around dwelling houses and along the highways.

The brown-tail moth also attacks oak trees in the woodlands, but on account of the leaves hanging upon these trees it is almost impossible to detect the nests. Moreover, many of them are so far from the ground that it would be very expensive to reach them. For these reasons, it is impracticable to scout the entire

State and destroy the nests. In the future local work must be done by property owners, and the city and town authorities. Some law requiring this, and similar to the Massachusetts and New Hampshire laws, will probably be found necessary.

The following figures show the record of the nests actually found in each town and destroyed. In Windham County this work has been done for three years and the figures for each year are given. Most of the other towns named in the list have not previously been examined for nests, and many towns not included in the list have also been scouted and no pests found.

NUMBER OF WINTER NESTS DESTROYED.

	1911	1912	1913
Hartford County.			
Enfield	..	..	6
Hartford	..	..	747
East Hartford	..	..	29
West Hartford	..	..	6
Suffield	..	..	565
Windsor	..	..	1
East Windsor	..	..	3
Tolland County.			
Coventry	..	..	1
Mansfield	..	..	4
Somers	..	..	6
Stafford	..	1	4
Union	..	..	1
Vernon	..	..	1
Windham County.			
Brooklyn	..	35	65
Eastford	..	..	2
Hampton	..	..	74
Killingly	6	27	78
Plainfield	..	13	3
Pomfret	89	82	841
Putnam	5,989	1,260	2,180
Sterling	..	1	..
Thompson	112	966	750
Windham	..	..	1
Woodstock	937	699	2,144
New London County.			
Bozrah	..	..	..*
Griswold	..	..	15

* Reported by Mr. Vinton to D. M. Rogers.

	1911	1912	1913
Norwich	..	..	2
Sprague	..	..	3
Stonington	..	..	60
Total	7,133	3,084	7,592

FEDERAL QUARANTINE IN CONNECTICUT.

On account of the presence of the brown-tail moth in Connecticut, and the danger of spreading this insect by shipping nursery stock, a quarantine was established by the Federal Horticultural Board, becoming effective on and after November 25, 1912, and including in Connecticut the towns of Stafford, Union, Woodstock, Thompson, Pomfret, Putnam and Killingly. Nursery stock within this area could not be shipped outside of it, unless inspected at the time of packing, and duly certified by a Federal inspector. On June 12, 1913, a hearing was held in Washington, D. C., before the Federal Horticultural Board, relative to extending the quarantine lines to coincide with the present infested area. The entomologist attended this hearing and showed by means of a map the location of the infested towns and names which were given in a separate list. The quarantine was therefore extended to take effect August 1st, 1913, and to include Suffield, Windsor Locks, Windsor, Bloomfield, West Hartford, Hartford, East Hartford, Manchester, Bolton, Coventry, Windham, Franklin, Bozrah, Norwich, Preston, North Stonington, Stonington, and all territory north and east of these towns within the State of Connecticut.

All persons within the quarantined area desiring to ship nursery stock outside of this territory should apply to Mr. D. M. Rogers, 43 Tremont Street, Boston, Mass. To accommodate nurserymen one or more Federal inspectors will be stationed in Connecticut during the shipping season.

The infested towns, as well as the quarantined area are shown by the map on plate I, a.

INTRODUCTION OF INSECT PARASITES INTO CONNECTICUT.

The Federal authorities, in coöperation with the State of Massachusetts, have been instrumental in collecting and importing into this country all the parasites known to attack both the gypsy and brown-tail moths in the various European and Asiatic

countries where these moths occur. Some of these parasites have been reared in large numbers at the parasite laboratory at Melrose Highlands, Mass., have been liberated in Massachusetts and the other infested states, and have already survived several New England winters.

In Connecticut we aim to exterminate the gypsy moth in the small isolated colonies at Wallingford and Stonington, but the brown-tail moth is spreading into the State with considerable rapidity from a large infested area covering the whole of Rhode Island, the greater portion of Massachusetts, the eastern part of Vermont, nearly all of New Hampshire and Southern Maine. Both sexes fly, and a gale during the first half of July, when the adults are flying, will often carry large numbers of the moths in the direction of the prevailing winds. Extermination through artificial measures is, therefore, out of the question, and we must aim to check its spread and to control it by reducing its numbers to the minimum; then it will be much less serious as a pest. One of the most promising methods of control is through its natural enemies. In the report of this Station for 1910, page 689, mention is made of the fact that a native fungus, *Empusa aulicæ* Reichardt, attacks and kills a large proportion of brown-tail caterpillars in moist seasons.

One of the most effective of the introduced parasites is a small hymenopterous or four-winged fly of the family Ichneumonidæ, *Apanteles lacteicolor* Vier., which attacks the hibernating caterpillars. This species was colonized in Massachusetts in 1908, specimens have been recovered each year since 1909, and it withstands our climate and spreads widely. In 1912, Mr. A. F. Burgess of the Bureau of Entomology, who has charge of this work at Melrose Highlands, Mass., had a colony of about 1,000 individuals planted at Putnam, Conn. In 1913, this parasite was recovered from nests collected by Mr. Caffrey in Thompson, Woodstock, Pomfret, Somers and Stafford. In 1913, additional colonies were planted in Hartford, Suffield, Mansfield, Hampton, Danielson, Plainfield, Griswold, Norwich and Stonington.

A two-winged or Dipterous fly of the family Tachinidæ, *Compsilura concinnata* Meig., parasitizes both the gypsy and brown-tail caterpillars and seems to be well established and spreading freely in Massachusetts. A colony of over 600 of these flies was planted in Putnam, Conn., in 1912. We have no records to show that it has been recovered. An additional colony of this species was planted in Hartford in 1913.

The planting of these effective parasites along the boundary of the infestation, will doubtless reduce the numbers of brown-tail moths and thus check its spread southward and westward. These parasites cannot prove harmful in any way. The former (*Apanteles*) attacks our native caterpillars of the genera *Datana* and *Hyphantria* (fall web-worm) and the latter (*Compsilura*) has been reared from the tussock moth, the fall web-worm and the imported cabbage worm, all of which we would like to see reduced in numbers.

A LEPIDOPTEROUS LEAF-FOLDER ON PRIVET.

Archips rosana Linn.

By B. H. Walden.

Many privet hedges in New Haven were attacked during May, 1913, by larvæ which tied together the terminal leaves, forming an enclosure within which they fed. As privet foliage is seldom troubled by insects, it seemed probable that the species might prove interesting, so material was collected and adults reared. The adult proved to be a Tortricid moth and specimens were sent to Mr. W. D. Kearfott, who determined the species as *Archips rosana* Linn.

Archips rosana is a species introduced from Europe and the first economic mention of it in this country is by Messrs Comstock and Slingerland, who described and figured it as a pest of currants. (Cornell Univ. Agr. Expt. Sta., Bull. XXIII, pp. 119-121, 1890.) In bulletin 27, n. s., Division of Entomology, p. 88, 1901, Dr. Chittenden mentions this insect as the "Rose Leaf-folder" and states that while the species attacks roses, it is not particularly troublesome, but may become a pest at any time.

Professor C. H. Fernald lists the following as food plants of this species in Europe,—Apple, Elm, Willow, Birch, Wild Rose, Raspberry, Hazel, Linden, Aspen, Hawthorn, Currant and Gooseberry. (Trans. Amer. Soc., Vol. X, p. 11, 1882.)

Mr. Kearfott states in his letter that he has examined material bred from blackberry and currants; he also states that while

the species exists in colonies in a few localities, it does not seem to be common in North America.

During the past season a few larvæ were found on roses planted next to a badly infested privet hedge, but the insect showed a decided preference for the privet.

On the Station grounds, gooseberry, black and red currants were found slightly infested with larvæ which appeared to be those of *Archips rosana*, but as the material collected was parasitized, no adults were reared. No larvæ were observed on the blackberries which were growing nearby.

Abundance.

On May 20th, the writer, at the request of the owner, examined a privet hedge on Canner Street. The hedge was about one hundred and fifty feet long, and while generally infested the infestation was worse on a portion which was in partial shade. Here nearly every tip was infested. On June 5th, another hedge in the same neighborhood was examined and nearly every tip found infested. Reports of other badly infested hedges in the vicinity were received. A hedge about a mile and a half away showed the work of the insect and every hedge examined between these two points was found to be more or less infested.

Life History and Habits.

The eggs are laid on the twigs in small, flattened, oval masses, covered with a dull, waxy substance. When first laid, the mass is light green in color but changes to gray later in the season. The masses laid in the breeding cage varied from about 3 mm. (⅛ inch) to 8 mm. (⅓ inch) in length and contained from twenty-four to eighty-one eggs.

The eggs were first observed in the breeding cage June 19, where they were laid on the glass. Egg masses were also found on fence posts near the infested hedges.

The eggs hatch from about the first to the middle of May, depending upon the season. Those observed by Messrs. Comstock and Slingerland hatched during the last days of April. The larvæ, when observed on May 20th, varied from 4 mm. to 13.5 mm. in length, and the smaller ones were white in color with the head, thoracic shield and legs black.

The larva feeds on the tips of the growth where it draws two or more leaves together with fine silken threads, thus forming an enclosure within which a single larva feeds. When disturbed the larva will drop down on a thread similar to a canker worm.

The full-grown larva is dull apple-green in color, head dark brown, nearly black. Thoracic shield with the posterior third dark brown, becoming lighter towards the anterior margin. Legs with the basal joints green, the two remaining joints brownish. Average length 19 mm., average width 2.5 mm., width of head 1.75 mm. Body slightly flattened, sides nearly parallel; the last two anal segments slightly narrowed.

The larva pupates in the enclosed leaves. The pupa is about 12 to 13 mm. (½ inch) long, light brown in color, and each of the abdominal segments bear dorsally two transverse rows of blunt spines which project backwards. The last segment is long and tapering with eight long slender hooks at the end; four at the extreme tip and two slightly back of these on either side.

The pupa wriggles vigorously when disturbed. When the adult is ready to emerge the pupa pushes about two-thirds out of the enclosed leaves, holding to them by means of the hooks at the end. The first pupæ were found in the breeding cage on June 3d. More material was collected June 5th, which contained thirty-one larvæ and six pupæ. The first adults were obtained June 10th and continued to emerge until after the 20th of June.

The adult moth has a wing spread of from 18 to 22 mm. (¾ to ⅞ of an inch). The color and markings are quite variable. The fore wings are light to olive-brown crossed with darker markings; the rear wings in the darker specimens are of a uniform dusky color, while in the lighter specimens the outer third is of a light yellowish brown color.

There is but one brood each year. The winter is passed in the egg stage, the eggs being laid on the twigs during the latter half of June and hatch about the first of the following May. The larvæ become full grown in about a month, pupating soon after the first of June, the adults emerge from eight to twelve days later.

The larva, pupa, adult and folded privet leaves are shown on plates III and IV.

Parasites.

Many of the larvæ, when nearly grown, had eggs of Tachinid flies deposited upon the head and first segment of the body, this being the portion of the larva that was exposed while feeding. Of fifty-three larvæ collected on June 5th and 6th, eighteen, or about thirty-four per cent., were thus parasitized. Tachinid flies began to emerge from this material on June 18th. The specimens were determined by Mr. Harrison E. Smith of the Bureau of Entomology, as *Exorista pyste* Walk. From the material collected on gooseberry there emerged small Hymenopterous parasites, which have not yet been determined.

Treatment.

This insect will hardly prove a serious pest of privet hedges, as the common practice of trimming the hedges will remove most of the infested tips, which should be gathered and destroyed to kill the larvæ. Some of the larvæ will spin down to the ground when disturbed and later return to the plants. The hedges should be examined after a few days and any infested tips should be removed. In some cases it may be advisable to trim the hedge somewhat earlier than if it were not infested. Should this insect become troublesome on currants and gooseberries it may be controlled by a thorough spraying with lead arsenate at the rate of two pounds in fifty gallons of water, soon after the leaves unfold. This treatment will also keep the currant worm in check. Where it is not advisable to spray, hand picking will be the only remedy.

UNUSUAL ABUNDANCE OF THE APPLE-TREE TENT-CATERPILLAR.

Malacosoma (*Clisiocampa*) *americana* Fabr.

This insect, which is usually common on apple and wild cherry trees along the roadsides and hedge rows, was probably more abundant in 1913 than in any other season in recent years. The year of 1902 was a "caterpillar year" and bulletin 139 was issued to supply information regarding the pest and how to combat it. This bulletin was reprinted in the report of this Station for 1902, page 139, but has long been out of print.

Following 1902, tent-caterpillars decreased in abundance and for several years were not much in evidence, and did no damage. In 1911 and 1912 they were on the increase and a number of specimens and inquiries regarding them were received from various parts of the state.

Early in 1913 many egg-clusters were sent in, and when the trees put out their leaves in May it was evident that 1913 was a "caterpillar year," there being more nests or tents than in any year since 1902. In New Haven the nests were not very abundant, but back a few miles from the coast every neglected apple tree, every black cherry tree and every choke cherry bush, had from one to fifteen or twenty nests, and many apple trees were entirely stripped. At Stonington, which is a coast town, the caterpillars were extremely abundant and many trees were stripped. In Litchfield county the nests were very abundant. They were so reported from Salisbury and Norfolk and the writer observed them in portions of Roxbury, Woodbury and Washington, as well as in Waterbury, Middlebury and Southbury of New Haven County. Nearly all the roadside apple and wild cherry trees as well as the neglected orchards were stripped. In Newtown, nests were so abundant that prizes were offered for their destruction.

During the year samples of the tent-caterpillar were received at this office from Union, East Woodstock, East Hampton, Torrington, Salisbury, Woodbury, East Granby, Stepney Depot, New London, Madison, Guilford and New Haven. Many inquiries were also received unaccompanied by specimens.

Specimens of the forest tent-caterpillar, *Malacosoma disstria* Hbn., were received from Wallingford and Salisbury.

The great abundance of tent-caterpillars and the fact that bulletin 139 is out of print, led to the preparation of a new publication on the subject, which appeared in August as bulletin 177, and gave a full account of the insect. This bulletin contained twenty pages and seventeen illustrations and was distributed to the names on the regular mailing list of the Station. Copies were also sent to many correspondents.

Tent-caterpillars were abundant at Wallingford and at Stonington and crawled under the gypsy moth bands to make their cocoons. On June 23, the men in charge of the work at these places were instructed to collect all cocoons found under the

bands, and these were brought to the laboratory for the purpose of rearing parasites. Moths emerged from two-thirds of the cocoons gathered at Wallingford, but of those collected at Stonington, more than two-fifths or nearly one-half were parasitized. Of 354 cocoons collected at Stonington, 140 gave ichneumon flies, seven Tachinid flies, and the moths emerged from 207 cocoons. A large proportion of the ichneumon flies belonged to the genus *Pimpla, P. conquisitor* Say., being one of the commonest species.

Bulletin 177 cannot be reproduced in this report. Those desiring the detailed account of the insect should send for it. For the convenience of the reader some of the illustrations are shown on plates V and VI and the summary is given below.

SUMMARY OF BULLETIN 177.

1. The apple-tree tent-caterpillar, a native insect and one of the chief leaf-eating enemies of the orchard, has been very abundant throughout Connecticut the present season and has injured fruit trees by defoliating them in May. Wild cherry is probably the natural food of the species, but when abundant it attacks apple and other fruit trees.

2. Eggs are laid on the twigs of the food plant in summer and hatch the following April. After a few days the young caterpillars form on the branches a nest in which they live, going out from it to feed. They are always within the nest at night and in cloudy weather. They become full-grown in about six weeks and spin white silken cocoons from which the adults emerge two weeks later.

3. The small grey eggs are deposited in masses of 200 or more encircling the twigs, and are covered with a brownish substance. The full-grown caterpillar is over two inches long, black above and below, and blue on the sides, with a white stripe along the back. It is thinly covered with light brown hairs. The white cocoon is about one inch in length and half an inch in thickness. The adult is a reddish brown moth with two whitish stripes extending obliquely across each fore wing.

4. The species is usually held in check by its natural enemies, which consist of several kinds of birds, parasitic insects and a bacterial disease.

5. The remedies are: to gather and destroy the egg-masses during the winter months; an effective method of accomplishing this is to offer a bounty or prizes to school children for them; spray when the leaves appear, using three pounds of lead arsenate or one-half pound of Paris green to 50 gallons of water or Bordeaux mixture; if impracticable to spray, brush off the nests as soon as they can be found, choosing the early morning or cloudy weather, when the caterpillars are inside the nests; burning the nests on the trees is not to be recommended.

SCARCITY OF WHITE GRUBS IN 1913.

White grubs were extremely abundant in Connecticut in 1912, and caused great injury to grass lands, and to such cultivated crops as strawberries, corn and potatoes. An illustrated account of this damage was given in the report of this Station for 1912, page 288.

Many growers feared similar damage in 1913, though it was explained to correspondents that the large or nearly mature grubs caused most of the damage and that they would become fully grown and transform to beetles, and therefore, would not be able to injure the roots of plants in 1913. The possibility was mentioned, however, of a younger brood causing damage, and it was with some interest that we watched results.

At the Station farm at Mt. Carmel a grass field was plowed in April. The field had been in grass for many years and was "run out" and needed tillage and fertilizing. It was on this field that the cabbage plants mentioned on page 232 were set on April 25th. White grubs were not noticed in the soil, but small June beetles, probably *Lachnosterna tristis* Fabr., were extremely numerous in the ground, though many had been crushed in the operations of plowing and harrowing.

Few complaints of white grub injury were received in the correspondence of this office in 1913. In order to collect information on this point the following letter was mailed to fifteen correspondents in various parts of the state who reported damage in 1912:

> "Last year in correspondence with this office you reported considerable injury to fields and crops in your vicinity from the attacks of white grubs. Were these insects sufficiently abundant to injure your crops in 1913?
>
> I shall appreciate a prompt reply in the inclosed stamped and addressed envelope, giving your own experience and observations."

Of the thirteen replies received, only one reported damage, and this was to a field of strawberries set in the spring of 1913. Potatoes were also slightly eaten. Most of the correspondents stated that not only were their own crops unmolested, but that

they had not heard of any damage this year in their vicinity, where their neighbors' crops were greatly damaged in 1912.

As the grubs were so abundant in 1912, we fairly expected the adult beetles to be correspondingly abundant in 1913. Such, however, was apparently not the case.

On the evening of May 3d, which was a warm day, in the writer's own garden the beetles emerged in such abundance that they made a conspicuous humming noise in the trees. As this was the first appearance of the adults only one or two specimens were collected, as it was expected that they would continue to be abundant. These have been identified by Mr. John J. Davis of the Bureau of Entomology as *Lachnosterna fraterna* Harr. and *L. fusca* Frœhl. A period of cool weather followed, however, and the beetles disappeared and were not again abundant. In fact, very few adult June beetles were collected or seen afterwards, during the season.

TAXUS PLANTS IN NURSERY INJURED BY A WEEVIL.

Otiorhynchus sulcatus Fabr.

On April 2, 1913, Mr. D. J. Caffrey was shown in the nursery of James H. Bowditch at Pomfret some plants of Japanese yew, *Taxus cuspidata* var. *brevifolia,* which had been injured by an insect which devoured the small roots, and girdled both the larger ones and the main stem below the surface of the ground.

The foreman, Mr. Baker, stated that in 1912, in a plot of 150 plants worth $1.50 each, more than 100 plants were killed, and others injured by this insect, which had been more or less troublesome for at least five years, and probably for six or seven. Mr. Baker further stated that altogether this grub had caused them several hundred dollars damage and had attacked all the different kinds of yew grown in the nursery, though apparently preferring the Washington, Weeping and Japanese varieties. He had also found *Retinospora ericoides* somewhat injured.

Mr. Caffrey collected specimens, but as his work kept him elsewhere, they were not brought to the laboratory for several days, and were then all dead. We recognized the grubs as the larvæ of a curculionid beetle, but could not accurately identify the species without the adults.

In response to our request for more material, Mr. Baker sent two *Taxus* plants and a box of soil containing about twenty-five larvæ, some of which appeared to be nearly full grown, and a few had already made cells in which to transform. This material was received April 11, and the plants were set in the soil accompanying them in a large breeding cage in the insectary.

On April 22 and 23, several adults emerged and we recognized the species as *Otiorhynchus sulcatus* Fabr., which is shown on plate VII, b.

A similar injury to the roots of young hemlocks was recorded in the report of this Station for 1909, page 370, caused by another species of the same genus *Otiorhynchus ovatus* Linn., commonly known as the strawberry crown girdler. Both *ovatus* and *sulcatus* are European species and the latter is recorded* as injuring *Taxus* and *Rhododendron* plants in Europe. Miss Ormerod reported the species as seriously injuring twelve acres of beets in England,† and it has attacked various other vegetable crops in Europe, but so far has not been generally considered as a particularly destructive insect in America. It has attacked garden vegetables occasionally causing injury, in both its larval and adult stages. In New York State the late Dr. J. A. Lintner considered *sulcatus* a rare species,‡ but in 1897 it was found injuring strawberry plants at Rochester, N. Y.§

Otiorhynchus sulcatus has been recorded as injuring grape vines and has been called the "black vine weevil" and the "black fruit weevil." The late Dr. James Fletcher of Canada received examples from Victoria, B. C., which were feeding upon the roots of cyclamens in greenhouses.‖ Johannsen has also recorded injury to cyclamens in Maine.¶ The adults have been known to feed upon the fronds of ferns.** Forbes states†† that "this European species seems not to thrive in the United States" and that it is comparatively rare in this country.

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* Reh, Handbuch der Pflanzenkrankheiten, Die tierischen Feinde III, p. 542, 1913.

† Manual of Injurious Insects and Methods of Prevention, p. 361, 1890.

‡ Report New York State Entomologist, X, p. 419, 1894.

§ Report New York State Entomologist, XIII, p. 374, 1897.

‖ Insect Life, Vol. VI, p. 284, 1894.

¶ Maine Agr. Expt. Station, Bull. 187, p. 8, 1911.

** Insect Life, Vol. IV, p. 222, 1892.

†† Report of Illinois State Entomologist, XXI, p. 144, 1900.

In Smith's Insects of New Jersey, 1909, *O. sulcatus* is listed as occurring in New Jersey "under hemlock bark."

The adult is one of the snout beetles or weevils and is three-eighths to one-half inch in length, color dark brown or black, marked with scattering spots of light brown pubescence. There is much variation but the pubescence usually extends all over the beetle, including legs, antennæ and head. The thorax and elytra are rough. The proboscis has a groove or sulcus down the front.

This insect is shown in its larval, pupal and adult stages, natural size, on plate VIII, b. The Station collection contains specimens from New Canaan, Litchfield, Middletown, Pomfret and New Haven.

It is doubtful if any treatment can be successfully applied to prevent further injury to *Taxus* by this insect, but possibly carbon disulphide injected into the ground around the plants in late summer might kill the larvæ before they had seriously injured the plants.

FIELD TESTS IN CONTROLLING CERTAIN INSECTS ATTACKING VEGETABLE CROPS.

By W. E. Britton and B. H. Walden.

The Cabbage Maggot, *Pegomya brassicæ* Bouché.

At the Station farm at Mt. Carmel, 950 cabbage plants were set on April 25, on new ground plowed in the spring and thoroughly pulverized with the disk harrow. The plants were set in five rows, each row nearly 350 feet in length, and containing 190 plants. The rows extended nearly north and south and adjoined the old apple orchard where spraying tests have been conducted for the past three seasons. The varieties were Early Summer, two rows; Wakefield, one row; Succession, two rows, and All Seasons, one row.

A section crossing the five rows, being approximately the second fourth of the area starting from the south end, was selected for applying tar paper disks. This section contained fifty-one plants per row, or a total of 255 plants. The disks were cut in the form of hexagons, four inches in diameter, from single ply tar paper and were placed on the stems of the plants at the time of setting.

Some of the plants were "damping off" at the time of setting and some failed to recover. For this reason there were some vacancies or "missing plants." Later, the cabbage maggot attacked and killed others. A few plants headed and were harvested without keeping a record. When the plants were finally examined on June 7, their condition was as follows:

Untreated	31 per cent. missing.
Disked	15 " " "

Of the remaining plants maggots had attacked a much greater proportion of the untreated ones, as the following figures show:

Untreated	12.0 per cent. maggoty.
Disked	0.05 " " "

The Cabbage Aphis, *Aphis brassicæ* Linn.

This insect was troublesome in many cabbage fields in Connecticut in 1913 and appeared in such numbers on some of the plants at the Station farm that Mr. Ripley sprayed the infested plants on August 14, using "Black Leaf 40" at the rate of one teaspoonful to a gallon of water, with soap added to act as a spreader. When examined, the next day, it appeared that all aphids which had been hit by the spray were dead.

The Onion Thrips, *Thrips tabaci* Linde.

During the past few seasons, onions in Connecticut have been seriously attacked by the onion thrips. In several instances the growers have given up raising onions on account of this pest.

Early in the season experiments were planned to combat the onion thrips. A grower in Wethersfield offered the use of his field and to coöperate with us by furnishing help to do the work and an outfit to do the spraying. The experiments were not carried out as planned for several reasons, the most important of which were, lack of assistants who could look after the work at the proper time, difficulty in obtaining an adequate outfit for spraying the onions and a scarcity of help which could be obtained by the owner at a reasonable price to help in the work.

The onions were examined on June 19th, when it was found that the thrips were just beginning to make their appearance. The first application was made to a portion of the field on June 24th and 25th. The owner had obtained on trial a sprayer of the "wheel barrow" type designed to spray four rows, the pump being operated from the wheel, by means of a sprocket and chain gear as the operator pushed the outfit between the rows. It was found at the start that there was not sufficient power to carry four nozzles, so two of these were disconnected. Even with only two nozzles the onions were not thoroughly covered. The gearing was then detached from the pump lever and the row attachment discarded. Two lines of hose with short extension rods were attached to the pump and the work continued with one man to pump and wheel the outfit, and two to direct the spray as shown on plate VIII, b. The onions were sprayed as thoroughly as possible, but upon making an examination a few hours later it was found that the spray had not penetrated to the base of the leaves below the sheath which enclosed them. Most of the thrips at this time were below the sheath and as the spray had not reached them were as lively as ever. A few days later the owner reported that he could see no difference in regard to the number of thrips on the sprayed and the unsprayed onions. The following preparations were used in the tests:

"Black Leaf 40," 1 part to 768 parts of water and soft-soap.
"Black Leaf 40," 1 part to 950 parts of water and soft-soap.
"Scalecide," 1 part to 50 parts of water.
Lime and Sulphur, 1½ parts to 50 parts water with paste spreader.

Homemade soft-soap was used as a spreader with "Black Leaf 40," the actual amount being determined by trial, which proved to be about one pint to ten gallons.

The "Scalecide" did not coat the onions as well as the "Black Leaf 40," and injury to the plants was apparent within a short time after being applied.

The lime and sulphur with flour paste as a spreader did not coat the onions satisfactorily.

On July 12th a portion of the field was sprayed with "Black Leaf 40," 1-950, with soft-soap as a spreader. This being applied with a barrel pump operated by a gasolene engine which held the pressure at about eighty pounds. At this time the

onions were much larger and the sheaths more open, and the spray appeared to reach nearly all of the thrips. The owner, however, reported later that he could see no benefit from this treatment.

The Pea Aphis, *Nectarophora pisi* Kalt.

On June 13th, a market gardener in Hamden reported to this office that his peas and those of several neighboring growers were seriously infested with the pea aphis, and requested advice in regard to treatment. The pea aphis had not been especially troublesome in Connecticut since 1900, and consequently we had not tried any of the more recent preparations against this pest. We therefore offered to make, at once, a few tests to demonstrate whether or not this insect could readily be killed by spraying. The owner could then determine if it was practicable for him to treat his whole field.

The tests were made during the afternoon of June 13th, the same day that the report was received. About fifty feet on each of eighteen rows in the most seriously infested portion of the field were sprayed as follows:

3 rows, "Black Leaf 40," 2 teaspoonfuls in 1 gallon of water with paste spreader (4 lbs. flour to 100 gallons of water).
3 rows, "Black Leaf 40," 2 teaspoonfuls in 1 gallon of water with soap (4 lbs. in 100 gallons of water).
8 rows, "Black Leaf 40," 1 teaspoonful in 1 gallon of water with soap (4 to 100).
4 rows, "Scalecide," 1 part to 50 parts of water.

Spray mixtures do not stick readily to the smooth leaf-surface of peas, but gather in drops and roll off. A small amount of common soap dissolved and added to the mixture will usually cause it to spread readily and stick to the foliage. In addition to soap, flour paste was tried as a spreader in the above tests.

The flour paste has been used as a spreader in experiments conducted by the Bureau of Entomology, especially with certain contact insecticides where the addition of soap produced a chemical change. It is prepared by taking four pounds of cheap flour and adding cold water to make a thin, smooth batter. This is diluted with water to make four gallons and heated until it boils, and added to 100 gallons of spray mixture.

In our tests the flour paste did not prove as good a spreader as the soap.

The field was examined two days after the treatments were made, and the results were as follows:

"Black Leaf 40," two teaspoonfuls in one gallon of water with paste spreader.—All aphids hit by the spray were killed. Many live aphids were found on portions of the plants not coated with the spray. The material did not spread as well as where soap was used in place of the paste. More material was also used in attempting to thoroughly cover the foliage. No injury was observed from the spray.

"Black Leaf 40," two teaspoonfuls in one gallon of water with soap at the rate of 4 pounds to 100 gallons.—Very few live aphids could be found. The material spread well on the foliage. The spray, did not injure the foliage.

"Black Leaf 40," one teaspoonful in one gallon of water, soap at the rate of four pounds to 100 gallons.—This treatment was just as efficient as where twice the amount of "Black Leaf 40" was used.

"Scalecide," one part to fifty parts of water.—This spray did not spread as well as the "Black Leaf 40" with soap, and caused considerable injury to the foliage.

There were two varieties of peas in the field, Thomas Laxton and Sutton's Excelsior. No aphids were observed on the former, while the latter was generally infested and scattered areas were quite badly infested.

The vines were more or less lodged and nearly covered the ground. Most of the pods had been formed and the largest of them would be ready to pick within a week.

If the aphids had been observed at the time they first appeared, when the vines were smaller, the spray could have been applied more thoroughly with much less material. The injury to the vines in driving through the field would have been much less.

The owner at this time was very busy picking strawberries besides looking after other work which would have been somewhat neglected if he had stopped to spray the peas. The owner was afraid that many of the pods which were nearly ready to pick and which would develop in spite of the aphids, would be injured. Peas were selling at that time for about eleven dollars a barrel and the owner did not care to risk losing any of the earliest peas in order to save those to be harvested later when the price might be much less.

While the tests with "Black Leaf 40" were quite satisfactory, the owner, under the circumstances, decided not to spray the remainder of the infested field, though we are certain that it would have paid him well to do so. At the market price, a slight increase in yield, which was reasonably certain if the aphids were killed, would more than offset the cost of the treatment.

THE DYING HICKORY TREES.

In southwestern Connecticut and in adjoining portions of New York State during the past two or three years many hickory trees have died and many more have been injured. Though this condition is the result of a number of contributing causes, the chief one seems to be a small beetle known as the hickory bark beetle or bark borer, *Scolytus quadrispinosus* Say.

This beetle is black and about one-fourth of an inch long. The end of the abdomen is truncated strongly beneath and in the male bears four tubercles or spines, thus suggesting the specific name. The hairs upon the head form a veritable brush, which it has been suggested may be useful in cleaning out the galleries. During July and August the beetles tunnel in the new growth at the axils of the compound leaves, causing them to break off. Many drop to the ground, giving the tree a scorched appearance. Later, in the main trunk, the parent beetles make short, straight tunnels longitudinally just under the bark, and the female lays eggs in shallow pockets along the sides of this tunnel which is called the brood gallery or nuptial chamber. On hatching from these eggs the minute larvæ or grubs each make separate tunnels extending at right angles from the brood chamber, and therefore cut across the grain partly in the wood and partly in the inner bark or cambium. By the time the grubs are mature the side tunnels are often longer than the brood gallery, and they increase in breadth as they extend from it and as the grubs become larger; but they never intersect. Each grub keeps its own separate gallery. This necessitates that the end galleries be deflected away from the central ones so that they are not strictly at right angles with the brood chamber. The grubs pupate in the burrows and the adults emerge through small round holes in the bark, a badly infected tree appearing as though it had been punctured with bird shot.