State of Connecticut

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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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APPROVED BY

THE BOARD OF CONTROL

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CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF.

SEPTEMBER 30, 1913

BOARD OF CONTROL.

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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 outside 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.

State of Connecticut

REPORT

OF

The Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

FOOD PRODUCTS AND DRUGS, 1913

BEING PART I OF THE ANNUAL REPORT OF 1913

SECTION 1

DIABETIC FOODS

: P. Lombard
?5-1925

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 manufac-

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

turers, we believe, have been misled by those who should know better,—the physicians."*

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

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* 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, ruta-bagas, 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

Date of Analysis.	(See page 14.)	Manufacturer and Brand.
		Flours and Meals.
1910	43	Acme Mills Co., Portland, Ore., Acme Diabetic Flour
....	30	Amthor & Co., Halle, Weizen-Protein
1906	8	Herman Barker, Somerville, Mass., Barker's Gluten Food "A"
1912	16	" " " " " " "
1906	8	" " " " " " "B"
1913		" " " " " " "
1906	8	" " " " " " "C"
1913		" " " " " " "
1907	10	Bischof & Co., London, Gluten Flour
1906	8	Callard, Stewart & Watt, London, Casoid Flour
1909	19	" " " " " "
1912	16	Cereo Co., Tappan, N. Y., Soy Bean Gruel Flour
1913		" " " " " " "
1906	8	Farwell & Rhines, Watertown, N. Y., Cresco Flour
1913		" " " " " "
1913		" " " " " "
1904	7	" " " " Gluten Flour
1906	8	" " " " " "
1906	8	" " " " " "
1909	19	" " " " " "
1913		" " " " " "
1913		" " " " " "
1904	7	Farwell & Rhines, Watertown, N. Y., Special Diabetic Food
1906	8	" " " " " " "
1906	8	" " " " " " "
1906	8	" " " " " " "
1913		" " " " Special Dietetic Food
1910	34	Gericke, Potsdam, Aleuronat
1913		Golden Rod Milling Co., Portland, Ore., Acme Special Flour
1913		O. B. Gilman, Boston, Mass., Gluten Flour
1909	19	Karl Goldscheider, Carlsbad, Conalbin-Mehl No. 1
1910	34	Gumpert, Berlin, Ultramehl
1908	37	Hazard's Wheat Protein
1906	8	Health Food Co., New York, Almond Meal
1913		" " " " "
1911	14	" " " C B X Cold Blast Flour, 25% Protein
1906	8	" " " Glutosac Gluten Flour

OF DIABETIC FOODS.

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.	
..	....	...	...	9.4	1.1	9.4	0.8	77.4	1.9	71.4	7	364
..	....	...	...	8.6	1.1	84.1	...	4.8	1.4	....	110	368
..	....	...	...	10.1	0.2	85.4	0.0	3.7	0.6	*4.5	143	362
..	363	125	156	7.4	0.4	86.9	0.2	4.6	0.5	Trace	115	370
..	....	...	...	10.1	0.2	84.4	0.0	4.7	0.6	*6.0	113	362
..	381	100	119	6.3	0.4	85.1	0.4	7.2	0.6	3.7	74	375
..	....	...	...	9.7	0.2	82.5	0.0	6.8	0.8	*8.3	78	364
..	385	100	118	5.7	0.4	84.1	0.6	8.6	0.6	3.4	62	377
..	....	...	...	10.1	1.3	79.8	0.2	5.0	3.6	....	106	372
..	907	150	75	10.0	2.5	85.6	1.4		0.5	0.0	377+	353
..	907	150	75	10.3	2.5	82.5	3.1		1.6	....	171+	357
..	352	50	65	4.9	4.4	45.7	1.9	22.6	20.5	0.6	23	458
..	467	50	49	4.2	4.2	43.1	2.2	24.9	21.4	Trace	21	465
..	....	...	...	12.7	0.5	11.1	0.0	74.8	0.9	....	7	352
..	454	9	9	12.7	0.4	18.1	0.4	67.4	1.0	57.2	8	351
..	2321	50	10	....	...	20.1	...	....	....	....	?	...
..	....	...	...	....	...	9.4	...	....	....	much	?	...
..	....	...	...	12.7	0.4	11.4	0.3	74.3	0.9	*71.5	7	351
..	....	...	...	13.3	0.5	10.8	0.1	74.3	1.0	*72.0	7	349
..	....	...	...	10.7	0.5	12.0	76.3		0.5	....	7+	358
..	2330	115	22	8.3	0.6	43.1	0.2	46.6	1.2	38.1	11	370
..	509	15	13	8.6	0.5	46.3	0.6	42.9	1.1	32.8	12	367
..	....	...	...	....	...	13.5	...	....	...	much	?	...
..	....	...	...	12.0	1.9	14.3	1.4	67.4	3.0	*58.3	8	354
..	....	...	...	10.3	1.6	14.2	1.1	70.0	2.8	*62.1	8	362
..	....	...	...	12.4	1.3	12.8	0.6	70.3	2.6	....	8	358
..	445	10	10	9.6	1.8	27.5	1.7	56.6	2.8	40.0	9	362
..	....	...	...	9.3	0.9	83.4	3.1		3.3	....	171+	376
..	....	...	...	10.0	0.7	15.8	0.7	71.4	1.4	57.9	7	361
..	454	11	11	8.7	1.0	47.3	0.6	40.4	2.0	31.4	13	369
..	....	...	...	9.4	0.5	10.9	78.8		0.4	....	7+	362
..	....	...	...	6.6	2.9	36.5	9.4		44.6	....	56+	585
..	....	...	...	7.0	0.6	41.8	0.3	49.1	1.2	....	11	374
..	....	...	...	8.5	6.4	50.6	2.9	16.0	15.6	*7.2	33	407
..	469	100	97	7.9	6.3	50.3	2.8	17.9	14.8	Trace	30	406
..	2350	75	15	8.7	0.5	10.1	0.2	79.6	0.9	68.9	7	367
..	...	...	...	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

Date of Analysis. (See page 14.)		Manufacturer and Brand.
		Flours and Meals. *(cont.)*
1909	19	Health Food Co., New York, Glutosac Gluten Flour ....
1911	38	" " " " " " ....
1913		" " " " " " ....
1913		Health Food Co., New York, Pronireu (Gluten Griddle Cake Flour) ....
1906	8	" " " Protosac Gluten Flour.......... ....
1913		" " " " " " ....
1913		" " " Protosoy Soy Flour ....
1906	8	" " " Pure Washed Gluten Flour ....
1913		" " " " " " " ....
1892–6	30	R. Hundhausen, Hamm, Aleuronat (pure) ....
1892–6	30	" " " (less pure)............................
1906	8	Jireh Diabetic Food Co., New York, Diabetic Flour..........................
1906	8	" " " " " " ....
1913		" " " " Flour ....
1913		" " " " Patent Barley........................
1913		" " " " " Cotton Seed Flour ....
1913		" " " " " Lentils Flour ....
1913		" " " " Protein Flour.........................
1913		" " " " Soja Bean Flour ....
1906	8	" " " " Wheat and Barley Flour...............
1906	8	" " " " " " " " ....
1906	8	Johnson Educator Food Co., Boston, Mass., Educator Standard Gluten Flour
1911	14	" " " " " " "
1911	38	" " " " " " "
1904	39	The Kellogg Food Co., Battle Creek, Mich., 20% Gluten Meal ....
1909	19	" " " " " " ....
1912	16	" " " " " " ....
1906	8	The Kellogg Food Co., Battle Creek, Mich., 40% Gluten Flour ....
1906	8	" " " " " " ....
1909	19	" " " " " " ....
1912	16	" " " " " " ....
1913		" " " " " " ....
1909	19	" " " " " " Self-Raising
1909	19	" " " 80% Gluten..................
1912	16	" " " " " ....
1913		Eugene Loeb, New York, Gluten Cracker Meal..............................
1913		" " " Imported Gluten Flour............................

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.	
..	....	...	...	8.0	1.1	35.3	55.0		0.6	....	10+	367
..	....	...	...	8.7	...	36.6	...	....	....	....	?	...
..	847	35	19	8.2	1.4	39.9	0.7	47.5	2.3	36.9	11	370
..	855	30	16	8.8	4.9	37.3	0.5	47.3	1.2	37.7	11	349
..	....	...	...	10.6	0.7	36.6	0.3	50.9	0.9	*50.0	10	358
..	839	40	22	8.0	0.9	42.7	0.3	46.4	1.7	36.3	11	372
..	500	50	45	3.0	5.0	42.3	5.4	24.5	19.8	Trace	21	446
..	....	...	...	6.2	0.8	62.4	0.2	29.5	0.9	*27.5	18	376
..	889	50	26	6.1	0.5	80.3	0.4	11.1	1.6	7.0	48	380
..	....	...	...	8.5	0.9	86.1	...	4.0	0.5	....	133	365
..	....	...	...	9.1	1.2	77.7	0.2	10.6	1.2	....	50	364
..	....	...	...	9.3	1.3	14.3	1.0	71.9	2.2	*66.6	7	365
..	....	...	...	11.0	1.3	12.1	1.1	72.7	1.8	....	7	355
..	1144	30	12	7.6	1.4	14.4	1.4	72.9	2.3	60.9	7	370
..	475	25	24	5.0	1.1	11.4	0.7	80.2	1.6	67.8	7	381
..	495	20	18	7.4	5.5	49.1	4.0	21.3	12.7	6.0	25	396
..	469	25	24	5.9	2.5	27.3	3.3	59.8	1.2	42.6	9	359
..	1124	50	20	7.3	1.7	31.4	0.9	56.7	2.0	48.5	9	370
..	457	30	30	4.4	4.6	42.3	4.7	25.8	18.2	0.0	21	435
..	....	...	...	9.7	1.5	11.8	1.6	73.5	1.9	*66.2	7	358
..	....	...	...	9.5	1.6	11.3	1.4	74.4	1.8	....	7	359
..	....	...	...	11.3	1.0	26.4	0.4	59.2	1.7	*56.8	9	358
..	1358	38	13	7.3	0.8	40.1	0.2	50.2	1.4	40.9	11	374
..	....	...	...	8.8	...	40.1	...	....	....	....	?	...
..	....	...	...	10.5	1.0	15.8	0.4	71.7	0.6	57.4	7	355
..	....	...	...	8.9	1.1	21.0	68.2		0.8	....	8+	364
..	428	25	26	9.8	1.4	27.5	0.1	60.7	0.5	49.6	8	357
..	....	...	...	10.5	0.5	40.3	0.2	47.3	1.2	*46.9	11	361
..	....	...	...	8.5	1.4	38.4	0.1	50.4	1.2	*50.0	11	366
..	....	...	...	7.9	1.2	39.0	50.1		1.8	....	11+	373
..	320	50	71	9.7	1.4	47.0	0.2	40.8	0.9	31.9	13	359
..	414	50	55	8.0	1.2	43.7	0.2	46.0	0.9	40.5	11	367
..	....	...	...	8.8	1.3	38.7	50.2		1.0	....	11+	365
..	....	...	...	7.2	0.6	78.8	12.5		0.9	....	42+	373
..	425	60	64	9.1	0.6	81.3	0.2	7.9	0.9	6.2	67	365
..	134	15	51	9.7	1.0	27.8	0.3	53.5	7.7	40.2	10	394
..	....	...	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

Date of Analysis.	(See page 14.)	Manufacturer and Brand.
		Flours and Meals. *(cont.)*
1913		Eugene Loeb, New York, Pure Gluten Flour ....
1913		" " " Whole Wheat Flour ....
1913		E. Loeb & Co., New York, Gluten Flour ....
1913		Thos. Martindale & Co., Philadelphia, Special Gluten Flour ....
1913		Mayflower Mills, Fort Wayne, Ind., Bond's Diabetic Flour ....
1906	8	Theo. Metcalf Co., Boston, Mass., Soja Bean Meal, 5.5% Starch ....
1906	8	" " " " " 7.6% " ....
1913		" " " " " 18.0% " ....
1906	8	" " Vegetable Gluten, 20.0% " ....
1913		" " " " 8.1% " ....
1901–2	44	H. Niemöller, Gütersloh, Roborat ....
1913		Pieser-Livingston Co., Chicago, Gluten Flour ....
1913		" " " " " ....
1904	7	Pure Gluten Food Co., New York, Gum Gluten Flour ....
1911	14	" " " " " " " ....
1902–3	9	Pure Gluten Food Co., New York, Gum Gluten Ground ....
1904	39	" " " " " " " ....
1906	8	" " " " " " " ....
1901	9	" " " " " " Self-Raising ....
1906	8	" " " " " " " ....
1906	8	Pure Gluten Food Co., New York, Hoyt's Gum Gluten ....
1901	36	" " " " Plain Gluten Flour ....
1911	36	" " " " Pure Gluten Flour ....
1911	38	" " " " " " " ....
1913		Rademann's Nährmittelfabrik, Frankfurt, Diabetiker Mehl ....
1895	1	Ralston Health Food Co., Gluten Flour ....
1902–3	9	" " " " " ....
1913		Sprague, Warner & Co., Chicago, Richelieu Gluten Flour ....
1913		G. Van Abbott & Sons, London, Almond Flour ....
1913		" " " Gluten Flour ....
1913		" " " Gluten Semola ....
1911	38	Wilson Bros., Rochester, N. Y., Gluten Flour, ½ Standard ....
1911	38	" " " " " " ....
1913		" " " " " " ....
1913		" " " " " Self-Raising, ½ Standard ....
		Protein Preparations.
1912	17	The Bauer Chemical Co., Berlin, Sanatogen ....
1900–1	97	Eiweiss-Extrakt Co., Altona, Germany, Soson ....

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.	
..	423	20	21	10.1	0.6	40.3	0.3	46.3	2.4	39.6	11	368
..	424	10	11	11.1	1.1	14.6	0.5	70.5	2.2	54.6	8	360
..	453	50	50	9.8	0.5	43.9	0.3	44.4	1.1	39.8	12	363
..	900	30	15	8.2	0.6	40.3	0.3	49.1	1.5	41.4	11	371
..	1445	30	9	9.4	0.6	40.2	0.2	48.3	1.3	40.6	11	366
..	....	...	...	7.8	4.4	39.9	3.9	24.9	19.1	*9.0	21	431
..	....	...	...	....	...	36.8	...	....	....	....	?	...
..	453	50	50	6.5	4.1	41.0	3.4	25.0	20.0	....	21	444
..	....	...	...	7.9	0.7	61.4	0.3	28.1	1.6	*26.8	19	372
..	453	50	50	7.6	0.5	80.4	0.2	9.8	1.5	5.9	54	374
..	....	...	...	9.5	1.4	82.3	0.2	2.9	3.7	....	183	374
..	....	...	...	8.5	0.6	43.3	0.1	46.2	1.3	38.4	11	370
..	1358	43	14	8.7	0.6	41.8	0.2	47.3	1.4	36.5	11	369
..	...	...	...	....	...	54.3	...	....	....	....	?	...
..	464	15	15	8.1	1.0	38.3	0.2	50.8	1.6	42.4	10	371
..	....	...	...	11.9	0.9	26.8	59.0		1.4	....	9+	356
..	....	...	...	10.6	0.8	44.1	0.4	42.8	1.3	30.0	12	359
..	....	...	...	6.9	1.0	50.1	0.5	39.6	1.9	*38.6	13	376
..	....	...	...	9.8	3.8	31.5	0.3	53.2	1.4	....	10	351
..	....	...	...	10.8	4.5	37.9	0.5	45.3	1.0	*42.9	12	342
..	....	...	...	11.2	1.0	31.8	0.3	54.1	1.6	*52.0	10	358
..	...	...	...	9.9	0.6	53.6	0.2	34.5	1.2	....	15	363
..	....	...	...	....	...	37.9	...	....	....	....	?	...
..	....	...	...	9.1	...	39.3	...	....	....	....	?	...
..	246	20	37	9.6	0.8	37.9	0.2	50.7	0.8	46.8	11	362
..	....	...	...	12.8	0.6	15.0	0.6	69.0	2.0	....	8	354
..	...	...	...	11.9	0.9	15.8	70.9		0.5	....	7+	351
..	1357	69	23	8.7	0.5	49.7	0.2	39.7	1.2	31.6	13	368
..	480	48	45	4.0	3.0	24.6	1.9	7.9	58.6	0.0	67	657
..	902	144	72	10.2	0.8	75.1	0.4	12.6	0.9	12.4	42	359
..	....	60	...	10.1	2.8	51.4	0.4	32.4	2.9	28.2	16	361
..	....	...	...	11.1	...	19.9	...	....	....	....	?	...
..	....	...	...	9.7	...	19.5	...	....	....	....	?	...
..	....	...	10	11.0	1.2	20.8	0.3	64.6	2.1	54.6	8	361
..	1296	25	9	12.2	4.6	17.4	0.3	63.5	2.0	51.8	8	342
..	200	190	431	10.0	5.6	80.1	4.2		0.1	....	126+	338
..	....	...	...	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

Date of Analysis.	(See page 14.)	Manufacturer and Brand.
		Protein Preparations. *(cont.)*
1902	29	Krecke & Co., Salzuflen, Energin ....
1913		Menley & James, New York, Glidine ....
1899–1900	28	Plasmon Co., London, Plasmon, (average 9 analyses)........
1901	36	" " " ....
1908	11	" " " ....
1909	19	" " " ....
1898–1900	27	Troponwerke, Mülheim, Tropon, (average of many analyses)........
1901	36	" " " ....
		Soft Breads.
1913		Ferguson Bakery, Boston, Mass., Gluten Bread........
1892	26	Frank & Co., Bockenheim, Protein-Roggenbrot ....
1892	26	" " Protein-Weizenbrot ....
....	23	Fritz, Vienna, Aleuronatbrot ....
1910	20	" " Kleberbrot, Schwarz ....
1910	20	" " Litonbrot ....
1910	20	Fromm & Co., Dresden, Conglutinbrot ....
1910	20	" " " Litonbrot ....
1910	20	Gericke, Potsdam, Doppel-Porterbrot ....
1910	34	" " " " ....
1910	34	" " Dreifach-Porterbrot ....
1910	34	" " Einfach-Porterbrot........
1910	34	" " Sifarbrot ....
1910	34	Karl Goldscheider, Carlsbad, Sinamylbrot ....
1910	34	Gumpert, Berlin, Diabetiker-Doppel-Schwarzbrot........
1910	34	" " " " " ....
1910	34	" " " " -Weissbrot........
1910	34	" " " Einfach-Schwarzbrot........
1910	34	" " " " -Weissbrot........
1910	34	" " Ultrabrot........
1892	22	F. Günther, Frankfurt, Kleberbrot ....
1906	8	Health Food Co., New York, Glutosac Bread........

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.	
..	....	...	...	9.1	1.0	83.8	0.3	1.3	4.5	....	408	381
..	284	150	240	5.7	0.9	91.4	0.2	1.0	0.8	0	530	377
..	....	...	...	11.9	7.5	70.2	9.7		0.7	....	55+	326
..	....	...	...	8.5	7.4	75.0	8.9		0.2	....	60+	337
..	128	35	124	12.4	7.7	70.3	9.2		0.4	....	58+	322
..	....	...	...	10.9	7.6	78.7	0.0		2.7	....	....	339
..	....	...	...	9.3	1.2	86.6	2.7		0.2	....	196+	359
..	....	...	...	9.2	0.8	88.5	1.2		0.3	....	442+	362
1	476	20	19	37.2	1.7	24.2	0.2	33.6	3.1	25.2	16	259
..	....	...	...	32.0	2.8	23.7	2.3	33.0	6.2	....	16	283
..	....	...	...	31.9	2.7	23.4	2.2	33.5	6.3	....	16	284
..	....	...	...	35.5	1.3	15.6	0.2	46.6	0.8	....	11	256
1	114	...	...	....	...	21.5	...	48.6	....	....	11	...
1	229	...	...	....	...	38.6	...	15.4	....	....	34	...
1	273	...	...	....	...	18.3	...	47.3	....	....	11	...
1	355	...	...	....	...	35.8	...	14.3	....	....	37	...
1	145	...	...	38.6	...	26.9	...	35.1	....	....	15	...
..	....	...	...	38.9	1.1	21.9	36.7		1.5	....	14+	248
..	....	...	...	35.1	1.3	30.7	0.4	26.0	6.5	19.8	20	285
..	....	...	...	30.5	1.6	17.8	48.2		1.8	....	11+	280
..	....	...	...	39.6	2.2	37.3	0.6	15.0	5.3	12.3	35	257
..	....	...	...	39.1	3.5	28.2	4.4	20.2	4.6	17.3	26	235
..	....	...	...	25.6	1.6	18.5	0.5	42.0	11.8	39.4	13	348
..	....	...	...	27.9	1.6	15.9	42.0		12.7	....	13+	346
..	....	...	...	23.7	2.3	18.8	0.4	39.4	15.4	36.8	13	371
..	....	...	...	30.1	1.4	15.6	49.5		3.4	....	11+	291
..	....	...	...	29.4	1.5	16.2	46.4		6.5	....	11+	309
..	....	...	...	27.9	3.1	28.2	0.8	7.8	32.2	6.8	68	434
..	....	...	...	33.7	2.4	17.2	0.7	45.5	0.5	....	12	255
..	....	...	...	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

Date of Analysis. (See page 14.)	Manufacturer and Brand.
	Soft Breads. *(cont.)*
1906 [8]	Health Food Co., New York, Protosac Bread
1892–6 [31]	R. Hundhausen, Hamm, Aleuronatbrot, low gluten
1906 [8]	Jireh Diabetic Food Co., New York, Whole Wheat Bread
1913	" " " " " " " (not fresh)
1913	Eugene Loeb, New York, P. & L. Genuine Gluten Bread
1910 [24]	Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Grahambrot
1910 [20]	" " " " Schwarzbrot (dry)
1910 [24]	" " " " "
1910 [24]	" " " " "
1910 [20]	" " " " Weissbrot (dry)
1910 [24]	" " " " "
1910 [20]	" " " "D-K" Brot (dry)
1892 [26]	" " " Erdnuss-Brot
1910 [24]	" " " Litonbrot
1894 [22]	Schelte, Münster, Aleuronatbrot
1910 [20]	Seidl, München, Aleuronatbrot
1910 [20]	" " Kleberbrot
1899 [33]	Troponwerke, Müllheim, Tropon-Brot
	Hard Breads and Bakery Products.
1907 [10]	Bischof & Co., London, Diabetic Gluten Bread
1907 [10]	" " " Essentiel Bread for Super Alimentation
1910 [13]	Brusson Jeune, Villemur, France, Gluten Bread
1912 [16]	" " " " " "
1909 [19]	Callard, Stewart & Watt, London, Almond Biscuit, Plain
1909 [19]	" " " " Almond Shortbreads
1906 [8]	" " " " Casoid Biscuits No. 1
1909 [19]	" " " " " " "
1913	" " " " " " "
1908 [12]	" " " " " " No. 2
1909 [19]	" " " " " " "
1908 [12]	Callard, Stewart & Watt, London, Casoid Biscuits No. 3
1909 [19]	" " " " " " "
1908 [12]	" " " " " Dinner Rolls
1909 [19]	" " " " " " "
1909 [19]	" " " " " Lunch Biscuit

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.	
..	....	...	...	27.3	1.4	32.5	0.2	37.0	1.6	*33.1	14	292
..	....	...	...	39.6	1.6	17.3	0.6	40.6	0.3	....	13	234
..	....	...	...	39.2	1.8	9.4	0.6	48.6	0.4	*43.8	11	236
1	....	...	10	21.8	2.5	12.4	0.6	62.0	0.7	44.9	9	304
1	321	10	14	31.4	1.6	10.4	0.3	53.7	2.6	44.2	10	280
..	....	...	...	31.7	1.8	9.8	2.1	49.4	5.1	45.6	11	283
1	196	...	...	....	...	37.8	...	33.3	....	....	16	...
..	....	...	...	29.1	1.9	14.5	1.4	50.5	2.5	45.8	10	283
..	....	...	...	33.6	1.9	14.9	47.6		1.9	....	11+	267
1	128	...	...	....	...	43.4	...	28.1	....	....	19	...
..	....	...	...	33.8	1.9	23.3	0.4	40.1	0.5	37.0	13	258
1	217	..	...	....	...	12.3	...	58.9	....	....	9	...
..	....	...	...	24.6	3.8	33.6	5.5	19.7	12.8	....	27	328
..	....	...	...	42.6	2.4	30.2	0.7	21.6	2.5	17.5	25	230
..	....	...	...	38.8	1.3	18.3	0.9	40.1	0.6	....	13	239
1	164	...	...	28.0	...	21.9	...	47.3	0.3	....	11	280
1	138	...	...	24.2	...	18.6	...	54.4	0.7	....	10	298
..	....	...	...	42.1	...	19.5	...	....	....	....	?	...
..	....	...	...	7.4	4.7	73.1	0.0	14.3	0.5	....	37	354
..	....	...	...	7.3	4.8	26.6	0.1	59.6	1.6	....	9	359
1	30	10	150	7.8	1.1	32.1	0.2	57.0	1.8	49.8	9	373
1	34	10	133	12.7	0.8	37.3	0.3	47.1	1.8	40.1	11	354
..	....	...	...	3.7	3.2	28.3	36.8		28.0	....	14+	512
..	....	...	...	4.2	3.5	19.5	20.7		52.1	....	26+	630
..	....	...	...	7.8	3.9	63.0	8.0		17.3	*8.1	66+	444
..	....	...	...	7.2	2.5	64.8	8.7		16.8	....	61+	445
54	226	150	300	4.8	3.4	66.8	0.4	5.8	18.8	4.0	91	460
..	....	...	...	....	...	58.1	...	....	....	0.0	?	...
..	....	150	...	7.5	3.6	57.8	5.6		25.5	....	95+	483
..	....	...	...	....	...	54.7	...	....	....	Trace	?	...
..	....	150	...	7.9	5.0	54.3	7.8		25.0	....	68+	473
..	....	...	...	....	...	80.8	...	....	....	†3.3	?	...
..	....	150	...	7.0	1.8	78.0	2.1		11.1	....	252+	420
..	....	...	...	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

Date of Analysis.	(See page 14.)	Manufacturer and Brand.
		Hard Breads and Bakery Products. *(cont.)*
1909	19	Callard, Stewart & Watt, London, Casoid Rusks
1909	19	Callard, Stewart & Watt, London, Cocoanut Biscuit+Saccharin
1909	19	" " " " Ginger Biscuit+Saccharin
1909	19	" " " " Kalari Batons
1913		" " " " " "
1909	19	" " " " " Biscuits
1909	19	" " " " Prolactic Biscuit
1913		Charrasse Biscuits Croquettes au Gluten
1913		" Biscottes Lucullus
1913		" Gluten Exquis Biscuits aux Amandes
1913		" Gluten Fleur de Neige Pain
1913		" Mignonettes au Gluten
1913		" Pain de Gluten
1913		" Tranches Grillées pour Potage
1892	26	Frank & Co., Bockenheim, Erdnuss-Kakes
1910	20	Fritz, Vienna, Braunes Luftbrot "B"
1910	20	" " Mandelbrot
1913		Fromm & Co., Dresden, Almond-form Wafers with Chocolate
1913		" " Butterbrezeln
1913		" " Crackers
1913		" " Eierbiscuit
1910	20	" " Eiweissbrot
1913		" " Hazelnuss-Stangen
1913		Fromm & Co., Dresden, Luft Bread
1913		" " Makronen
1913		" " Salz-Stangen
1913		" " Stangenin
1910	20	" " Uni Bread
1913		" " " "
1910	20	Gericke, Potsdam, Doppel-Porterzwieback
1910	24	" " " "
1910	20	" " Mandelbrot
1910	20	" " Porterbiskuits
1910	20	" " Porterzwieback
1910	20	" " Sifarbiskuits
1910	24	Groetzsch, Frankfurt, Diabetiker-Salzbrezeln

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.	
..	....	...	...	5.4	4.5	37.0	20.8		32.3	....	25+	522
..	....	...	...	2.6	3.1	16.6	16.4		61.3	....	38+	684
..	....	...	...	2.5	3.7	17.1	18.1		58.6	....	29+ (?)	668
..	....	...	...	8.1	4.4	52.9	0.9		33.7	....	589	519
30	320	150	213	4.5	5.2	43.2	0.7	7.4	39.0	0	69	553
..	....	...	...	6.3	3.7	56.9	1.7		31.4	....	312+	517
..	....	...	...	6.3	4.0	42.9	19.3		27.5	....	27+	496
97	194	135	316	7.3	0.5	34.3	0.2	52.3	5.4	30.6	10	395
37	530	95	81	7.5	1.8	11.4	0.2	73.4	5.7	59.2	7	391
24	189	150	360	5.3	1.6	18.1	0.6	50.6	23.8	25.5	10	489
21	146	115	357	6.1	2.3	35.9	0.4	42.8	12.5	25.1	12	427
47	116	90	352	8.2	2.1	40.1	0.3	43.6	5.7	27.3	12	386
15	481	150	141	8.1	2.1	40.8	0.2	43.5	5.3	27.2	12	385
sliced bread	81	60	336	7.7	2.3	40.6	0.3	45.5	3.6	28.8	12	377
..	....	...	...	6.4	2.7	32.2	3.1	36.5	19.1	....	15	447
1	29	...	...	....	...	42.6	...	19.8	....	...	27	...
1	45	...	...	....	...	15.4	...	23.1	....	....	23	...
54	125	65	236	2.6	1.0	4.8	0.3	62.3	29.0	14.0	8	529
18	123	35	129	6.3	2.0	12.3	0.2	62.7	16.5	43.1	8	449
23	91	25	125	7.4	3.4	12.9	0.2	68.4	7.7	58.2	8	395
8	80	35	198	7.7	1.3	18.8	0.2	60.6	11.4	37.5	9	420
1	13	...	...	....	...	45.5	...	37.5	....	....	14	...
15	104	35	153	5.2	2.9	13.4	1.7	60.8	16.0	0.0	9	441
18	263	135	233	8.3	8.9	50.9	0.2	30.7	1.0	23.4	17	335
24	159	65	185	6.0	3.0	14.1	1.3	56.2	19.4	0.0	9	456
36	156	35	102	6.2	3.6	13.0	0.4	61.2	15.6	39.1	9	437
42	161	35	99	6.6	1.6	14.0	0.4	64.4	13.0	51.6	8	431
1	12	...	...	....	...	71.3	...	8.6	....	....	62	...
18	272	135	225	8.1	5.6	71.7	3.5	9.4	1.7	2.9	56	340
13	72	...	...	....	...	19.1	...	41.0	....	....	13	...
..	....	...	...	4.9	1.7	34.2	39.7		19.5	....	13+	471
12	94	...	...	....	...	16.2	...	43.3	....	....	12	...
10	31	...	...	....	...	16.1	...	63.0	....	....	8	...
13	69	...	...	....	...	26.4	...	72.0	....	....	7	...
6	64	...	...	....	...	20.2	...	35.3	....	....	15	...
..	....	...	...	14.0	3.3	36.3	17.1		29.3	....	31+	477

TABLE I.—ANALYSES

Date of Analysis.	(See page 14.)	Manufacturer and Brand.
		Hard Breads and Bakery Products. *(cont.)*
910	34	Groetzsch, Frankfurt, Diabetiker-Salzbrezeln
1910	34	" " Pfeffernüsse
1910	34	" " "
1910	34	Gumpert, Berlin, Diabetiker-Stangen
1910	34	" " Doppel-Diabetiker-Zwieback
1892	24	F. Günther, Frankfurt, Aleuronat-Kakes
1892	24	" " " "
1897	25	" " " "
1913		Health Food Co., New York, Alpha Best Diabetic Wafer
1906	8	" " " Diabetic Biscuit
1913		" " " " "
1913		" " " Gluten Nuggets
1906	8	" " " Glutona
1906	8	Health Food Co., New York, Glutosac Butter Wafers
1906	8	" " " " Rusks
1906	8	" " " " Wafers, Plain
1906	8	" " " " Zwieback
1906	8	" " " No, 1 Proto Puffs
1913		" " " " " "
1911	14	Health Food Co., New York, No. 2 Proto Puffs
1913		" " " " " "
1906	8	" " " Protosac Rusks
1913		" " " Protosoy Diabetic Wafers
1906	8	" " " Salvia Sticks
1912	41	Heintz Food Co., Chicago, Gluten Biscuits
1913		" " " " "
1913		" " " Glutin Biscuits
1892–6	31	R. Hundhausen, Hamm, Aleuronatzwieback, high gluten
1892–6	31	" " " low gluten
1894	22	" " Aleuronat-Biskuits
1891	22	" " " -Kakes
1912	16	Huntley & Palmer, London, Akoll Biscuits
1913		" " " " "
1906	8	Jireh Diabetic Food Co., New York, Diabetic Biscuits
1906	8	" " " " " "
1906	8	" " " " " Rusks
1913		" " " " Diatetic Biscuits
1913		" " " " " Rusks
1906	8	" " " " Wheat Nuts
1906	8	" " " " " "

OF DIABETIC FOODS.—*Continued.*

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.
	gms.	cts.	cts.	%	%	%	%	%	%	%	gms.	
..	....	...	...	5.3	1.6	34.5	0.3	22.9	35.4	....	23	548
..	....	...	...	25.2	2.8	38.7	9.3		24.0	....	57+	408
..	....	...	...	15.2	2.6	39.2	0.7	10.3	32.0	....	51	486
..	....	...	...	5.5	2.9	31.1	11.0		49.5	....	48+	614
..	....	...	...	4.6	2.5	32.5	0.8	27.6	32.1	27.1	19	529
..	....	...	...	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
..	....	...	...	4.5	1.5	15.3	70.0		8.7	....	8+	420
17	88	50	258	4.9	3.6	66.1	0.5	11.3	13.6	Trace	47	432
..	....	...	...	4.7	3.1	28.1	0.3	54.8	9.0	*51.1	10	413
22	321	25	35	8.9	2.5	25.0	0.2	54.2	9.2	46.5	10	400
77	360	35	44	5.7	2.8	30.2	0.2	48.3	12.8	38.6	11	429
..	...	...	...	4.8	2.5	22.1	0.3	58.5	11.8	*54.9	9	429
..	....	...	...	4.7	3.8	27.6	1.6	49.4	12.9	*41.2	11	424
..	....	...	...	4.5	2.7	36.5	0.9	51.6	3.8	*42.5	10	387
..	....	...	...	6.1	3.5	29.4	1.5	49.9	9.6	*41.6	11	404
..	....	...	...	7.6	2.5	32.5	1.2	49.3	6.9	*40.9	11	389
..	....	...	...	8.6	1.3	75.9	0.1	13.1	1.0	*9.9	40	365
10	141	35	113	7.2	2.7	76.3	0.2	10.7	2.9	4.3	50	374
..	161	25	71	8.2	1.8	52.4	0.2	35.9	1.5	27.2	15	367
8	119	25	95	7.9	2.5	56.6	0.2	30.7	2.1	19.0	17	368
..	....	...	...	5.9	2.0	40.9	0.5	48.7	2.0	*43.9	11	376
43	168	40	108	3.9	5.0	43.1	1.9	21.2	24.9	4.7	25	481
..	....	...	...	6.6	7.5	39.2	1.9	24.0	20.8	*18.7	22	440
..	....	...	...	....	...	13.1	...	....	....	....	?	...
28	278	25	41	6.4	3.5	12.8	1.3	57.7	18.3	21.4	9	447
26	259	25	44	7.3	3.0	14.5	1.0	67.0	7.2	45.5	8	391
..	....	...	...	8.5	2.6	66.2	17.7		5.0	....	30+	381
..	....	...	...	6.5	1.6	22.9	0.8	59.6	8.6	....	9	407
..	....	...	...	6.6	4.7	24.8	0.5	52.2	11.2	....	10	409
..	....	...	...	3.4	1.1	20.1	1.2	64.8	9.4	....	8	424
..	113	22	88	9.3	3.9	53.2	0.4	6.3	26.9	Trace	84	480
58	302	70	105	7.2	3.4	54.5	0.7	6.8	27.4	Trace	78	492
..	....	...	...	6.3	2.0	14.8	0.9	72.3	3.7	*65.4	7	382
..	....	...	...	8.9	2.3	13.1	1.2	70.6	3.9	....	7	370
..	....	...	...	8.7	3.1	14.6	0.9	67.7	5.0	....	8	374
42	460	30	30	5.4	2.0	13.2	1.2	70.8	7.4	49.6	7	403
17	231	30	59	5.4	1.9	14.9	1.1	68.0	8.7	47.0	8	410
..	....	...	...	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	25	" " " " " " "
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	29	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
12	208	30	65	8.4	2.4	35.9	0.3	45.8	7.2	37.5	12	392
23	259	25	44	4.8	2.7	26.4	0.3	49.8	16.0	37.8	11	449
..	....	...	...	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

Date of Analysis.	(See page 14.)	Manufacturer and Brand.
		Hard Breads and Bakery Products. *(cont.)*
1910	20	Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Zwieback.............
1910	34	" " " " " ....
1893	92	" " " Erdnuss-Biskuits.................
1910	34	" " " Käsestangen.....................
1913		" " " " ....
1910	20	Rademann's Nährmittelfabrik, Frankfurt, Sanitätszwieback.................
1897	95	Schelle, Braunschweig, Aleuronat-Kakes ....
1910	20	Seidl, München, Kleberzwieback..
1913		Roman Uhl, Karlsbad, Carlsbad-Water Biscuits, "Sprudel" Brand ....
1913		G. Van Abbott & Sons, London, Caraway Biscuits for Diabetics............
1913		" " " Diabetic Rusks for Diabetics...............
1913		" " " Euthenia Biscuits..........................
1913		" " " Gluten Biscottes or Rolls..................
1913		" " " Gluten Bread or Slices.....................
1913		G. Van Abbott & Sons, London, Gluten Butter Biscuits for Diabetics........
1913		" " " Ginger Biscuits for Diabetics...............
1913		" " " Midolia Biscuits...........................
1913		" " " Walnut Biscuits for Diabetics..............
		Breakfast Foods.
1913		Brusson Jeune, Villemur, France, Farine au Gluten ....
1910	18	" " " " Gluten Semolina ....
1913		Farwell & Rhines, Watertown, N. Y., Barley Crystals ....
1913		" " " " Cresco Grits.........................
1908	31	Hazard's Wheat Protein Breakfast Food ....
1913		Health Food Co., New York, Manana..
1913		Jireh Diabetic Food Co., New York, Whole Wheat Farina ....
1913		" " " " Frumenty............................
1911	14	The Kellogg Food Co., Battle Creek, Mich., Granola ....
1904	39	Pure Gluten Food Co., New York, Gum Gluten Breakfast Food ....
1906	8	" " " " " " " " ....
1911	14	" " " " " " " " ....
1911	14	" " " " " " Granules..................
1901	36	" " " " Pure Gluten Breakfast Cereal ....

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.	
14	110	...	...	....	...	16.4	...	37.6	....	....	14	...
..	....	...	...	9.4	2.2	25.2	51.3		11.9	47.0	10+	413
..	....	...	...	1.9	2.7	34.8	...	39.1	21.5	9.0	14	489
..	....	...	...	6.9	2.2	11.2	50.5		29.3	....	10+	511
8	49	35	324	6.7	3.8	9.3	0.1	46.4	33.7	38.0	11	524
10	96	...	...	....	...	17.5	...	58.4	....	....	9	...
.	....	...	...	4.9	1.3	19.9	63.1		10.8	....	8+	429
11	108	...	...	6.3	...	14.8	...	66.6	7.8	....	8	396
8	170	30	80	8.1	1.7	10.0	0.2	74.8	5.2	55.6	7	386
36	330	72	100	6.7	3.6	35.6	0.7	15.9	37.5	8.6	33	544
14 slices	60	48	363	10.8	1.2	70.9	0.3	16.0	0.8	12.6	33	355
13	256	84	149	5.5	3.4	35.8	1.4	13.2	40.7	6.9	40	562
12	251	72	130	10.5	2.4	51.6	0.2	33.0	2.3	29.8	16	359
12 slices	216	72	151	10.6	2.0	54.1	0.2	30.9	2.2	27.4	17	361
mostly broken	195	60	140	6.1	3.0	44.1	0.9	12.7	33.2	9.0	40	526
31	423	72	77	4.1	3.4	34.6	1.8	16.7	39.4	10.9	32	560
52	517	36	32	6.0	4.3	17.6	4.1	31.6	36.4	13.4	16	524
29	223	60	122	4.4	2.9	20.9	2.3	12.3	57.2	Trace	41	648
..	246	25	46	10.9	0.6	33.9	0.2	53.8	0.6	48.8	10	356
..	209	30	65	9.7	0.7	17.2	0.3	71.6	0.5	64.9	7	360
..	904	25	13	9.9	1.2	11.5	0.9	75.2	1.3	62.7	7	359
..	898	25	13	11.1	0.6	17.8	0.5	68.6	1.4	54.1	8	358
..	....	...	...	8.5	0.7	40.1	49.7		1.0	....	13+	368
..	188	25	60	10.2	2.4	37.6	1.1	46.8	1.9	31.0	11	355
..	703	15	10	6.2	1.8	12.9	2.2	74.6	2.3	59.5	7	371
..	674	15	10	6.2	1.4	12.3	1.1	77.3	1.7	65.4	7	374
..	370	10	12	6.1	2.3	13.9	0.6	76.3	0.8	45.2	7	368
..	....	...	...	9.5	0.9	54.4	0.5	33.9	0.8	30.4	16	360
..	....	...	...	9.1	1.1	53.4	0.3	34.5	1.6	*31.0	15	366
..	465	20	20	7.5	1.2	37.8	0.4	51.8	1.3	37.9	10	370
..	457	20	20	7.5	1.5	45.5	0.3	43.6	1.6	32.3	12	371
..	....	...	...	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.—ANALYSE

Date of Analysis.	(See page 14.)	Manufacturer and Brand.
		Macaroni, Noodles, etc.
1910	13	Brusson Jeune, Villemur, France, Pâtes aux Oeufs Macaroni ....
1910	13	" " " " " " " Nouillettes.............
1913		" " " " Petites Pâtes au Gluten................
1910	13	" " " " Vermicelle au Gluten ....
1913		Jireh Diabetic Food Co., New York, Macaroni........... ....
1913		Eugene Loeb, New York, Home Made Noodles..................
1906	9	Pure Gluten Food Co., New York, Gum Gluten Macaroni ....
1911	14	" " " " " " Noodles...............
1901	8	The Marvelli Co., Detroit, Mich., Macaroni..............................
1912	16	" " " " " Spaghetti..............................
		Peanut Butter.
1899	4	Atlantic Peanut Refinery, Philadelphia ....
1913		J. W. Beardsley's Sons, New York, Acme Red Brand ....
1913		Beech-Nut Packing Co., Canajoharie, N. Y..................................
1913		A. C. Blenner & Co., New Haven (Distributed by) ....
1913		D. W. Brooke, Newark, N. J........................ ....
1913		Dillon & Douglass, New Haven (Distributed by), Perfection ....
1913		H. J. Heinz Co., Pittsburgh, Pa...
1913		The Kellogg Food Co., Battle Creek, Mich.....................................
1913		" " " " " ....
1913		Francis H. Leggett & Co., New York, Premier ....
1913		MacLaren Imperial Cheese Co., Detroit, Mich., Eagle ....
1913		Nut Products Co., New Haven, Penolia ....
1899	4	Peanolia Food Co., New Haven, Peanolia .. ..
1913		S. S. Pierce Co., Boston, Acharis Brand ....
		Average...........
		Almond Paste.
1902–3	8	Chapman, Chicago ....
1902–3	8	Henry Heide, New York..
1902–3	8	Spencer, New York ....
		Average...........
		Nuts.
1913		California Paper Shell Almonds, edible portion (Sold by Chas. Lawrence Co. Boston)..
1913		Jireh Diabetic Food Co., New York, Diatetic Pine Nuts (Pignolias)..........
1913		The Kellogg Food Co., Battle Creek, Mich., Pine Nuts.........................
		Malted Nuts.
1901	26	The Kellogg Food Co., Battle Creek, Mich., Malted Nuts ....
1913		Nashville Sanitarium-Food Co., Nashville, Tenn., Malted Nut Food..........

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.	
..	220	45	93	8.8	0.7	13.9	Tr.	76.2	0.4	69.2	7	364
..	231	30	59	8.7	0.7	14.4	Tr.	75.7	0.5	68.9	7	365
..	259	25	44	9.0	0.8	18.6	0.2	70.4	1.0	61.2	8	365
..	449	45	45	8.0	0.8	18.4	Tr.	72.4	0.4	65.8	7	367
..	437	25	26	8.8	1.1	16.9	0.9	71.4	0.9	58.8	7	361
..	130	20	70	9.8	1.0	41.8	0.2	41.7	5.5	36.7	13	384
..	....	...	...	10.3	0.7	41.4	0.3	46.3	1.0	*46.2	11	360
..	118	15	58	8.3	1.1	36.6	0.2	51.4	2.4	42.0	10	374
..	....	...	...	13.4	0.5	20.7	64.8		0.6	....	8+	347
..	....	...	...	....	...	15.5	...	....	...	....	....	...
..	....	25	50	2.1	4.0	28.7	2.3	16.5	46.4	6.2	32	598
..	416	25	27	2.2	4.4	28.2	1.7	15.2	48.3	4.0	35	608
..	109	10	42	2.0	3.5	29.4	1.9	16.6	46.6	4.5	32	613
..	126	10	36	2.9	4.0	29.7	1.2	14.3	47.9	4.6	37	607
..	171	10	27	1.8	3.8	29.5	1.5	14.9	48.5	4.3	36	614
..	666	23	16	1.8	4.4	29.1	1.8	20.1	42.8	4.8	26	582
..	90	10	50	3.0	3.9	28.9	1.7	15.2	47.3	4.0	35	592
.	92	15	74	3.6	3.3	30.6	1.5	12.2	48.8	3.2	43	610
..	311	30	44	3.1	3.0	28.1	1.4	14.7	49.7	3.4	36	619
..	469	23	22	2.1	4.0	29.7	1.7	18.8	43.7	6.5	28	587
..	199	10	23	1.5	3.8	32.1	1.7	16.0	44.9	4.3	33	597
..	218	13	27	2.4	3.9	27.9	1.5	13.0	51.3	3.9	41	625
..	....	25	50	2.0	6.0	29.9	2.1	13.3	46.7	5.6	40	593
..	231	25	49	1.7	3.7	28.7	3.0	14.6	48.3	5.1	19	608
..	....	...	...	*2.3*	*4.0*	*29.3*	*1.8*	*15.4*	*47.2*	*4.6*	*34*	*604*
..	....	...	...	23.7	1.4	13.1	36.3		25.5	11.3	15+	427
..	....	...	...	22.0	1.6	12.7	43.7		20.0	small	12+	406
..	....	...	...	27.0	1.7	13.5	31.6		26.2	very small	17+	416
..	....	...	...	*24.2*	*1.6*	*13.1*	*37.2*		*23.9*	....	*15+*	*416*
..	177	13	35	3.5	3.5	18.4	3.0	16.3	55.3	0	33	637
..	242	40	75	2.0	4.6	39.7	0.9	3.4	49.4	0	156	617
..	451	75	75	2.6	4.5	38.0	1.1	4.2	49.6	....	126	615
..	....	...	...	2.6	2.2	23.7	43.9		27.6	....	12+	519
.	....	...	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

Date of Analysis.	(See page 14.)	Manufacturer and Brand.
		Other Nut Preparations.
1906	8	The Kellogg Food Co., Battle Creek, Mich., Almond Butter (Sanitas)........
1908	37	" " " " " " " ....
1913		" " " " Nut Bromose (Meltose and Nuts)
1906	8	" " " " Nut Butter (Sanitas)............
1906	8	" " " " Nut Meal " ....
1906	8	" " " " Nuttolene " ....
1906	8	" " " " Protose " ....
1913		Nashville Sanitarium-Food Co., Nashville, Tenn., Nut Butter...............
1913		" " " Nutcysa ....
1913		" " " Nutfoda ....
		Chocolate.
1913		Brusson Jeune, Villemur, France, Chocolat with Added Gluten à la Vanille..
1913		Fromm & Co., Dresden, Conglutin-Diabetiker-Schokolade.................
1910	34	Groetzsch, Frankfurt, Essschokolade (Orange).........................
1910	34	" " Kochschokolade ....
1901	40	Plasmon Co., London, Plasmon Chocolate...... ....
1903	6	" " " " ....
1910	20	Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Chokolade ....
1913		" " " " " ....
1898	39	Troponwerke, Mülheim, Tropon-Chokolade............................
1899	33	" " " " ....
		Cocoa.
1913		Charrasse Gluto-Cacao ....
1906	8	Jireh Diabetic Food Co., New York, Diabetic Cocoa.....................
1906	8	" " " " " " ....
1903	6	Plasmon Co., London, Plasmon Cocoa ....
1913		Rademann's Nährmittelfabrik, Frankfurt, Diabetiker-Cacao ....
1913		Callard, Stewart & Watt, London, Casoid Chocolate Almonds ....
		Miscellaneous Products.
1913		Gustav Muller & Co., New York, Dr. Bouma Sugar-Free Fat-Milk ....
1900	47	Rose's Diabetesmilch, 5%..
1900	42	" " 10%..
1913		D. Whiting & Sons, Boston, Sugar-Free Milk (ave. 3 analyses) ....
1913		Health Food Co., New York, Kaffeebrod ....
1911	15	The Kellogg Food Co., Battle Creek, Mich., Sanitas Meltose ....

OF DIABETIC FOODS.—*Concluded.*

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.	
..	....	...	...	0.9	2.9	22.6	3.9	8.2	61.5	*3.7	65	677
..	....	...	...	2.3	3.0	21.7	11.5		61.5	...	46+	686
..	221	30	61	14.0	1.5	17.1	1.2	39.4	26.8	3.2	13	467
..	....	...	...	0.2	2.9	28.8	3.7	13.9	50.5	*9.1	38	625
..	....	...	...	3.0	2.2	29.0	2.0	12.1	51.7	*8.9	44	630
..	....	...	...	55.2	2.2	12.7	1.8	6.3	21.8	....	84	272
..	....	...	...	62.2	1.5	22.6	0.9	3.6	9.2	....	147	188
..	473	17	16	1.9	2.9	28.0	1.6	13.0	52.6	3.8	41	637
..	411	15	17	57.0	1.8	12.9	1.0	6.3	21.0	Trace	84	266
..	440	15	15	62.3	1.6	20.8	0.5	6.8	8.0	Trace	78	182
..	250	90	163	2.6	3.2	15.9	2.2	26.4	49.7	9.2	20	617
..	96	40	189	4.0	5.4	17.6	1.2	32.7	39.1	4.3	16	553
..	....	..	...	4.6	2.3	10.8	4.4	17.2	60.7	12.0	31	658
..	....	...	...	10.9	6.7	25.3	5.9	26.1	25.1	15.9	20	432
..	....	...	...	....	...	21.1	...	....	....	....	?	...
..	....	...	...	3.5	2.5	20.2	0.7	48.0	25.1	Trace	11	499
..	....	...	...	....	...	16.1	...	9.6	....	....	55	...
..	99	45	206	2.5	3.2	17.5	2.3	16.9	57.6	3.8	31	656
..	....	...	...	1.7	1.6	18.2	2.7	49.9	25.9	....	11	506
..	....	...	...	1.8	...	18.4	...	....	....	....	?	...
..	....	...	...	6.4	6.7	21.5	3.1	40.1	22.2	16.3	13	446
..	....	...	...	3.1	4.3	20.6	3.6	50.6	17.8	*32.6	10	445
..	....	...	...	7.3	3.9	19.1	3.4	47.9	18.4	*29.0	11	431
..	....	...	...	8.9	6.6	52.8	20.9		10.8	5.1	25+	392
..	258	80	141	5.2	5.9	17.6	3.0	44.7	23.6	10.7	12	462
..	107	50	212	3.5	3.1	22.3	3.2	16.1	51.8	Trace	33	620
	(14.5 oz.)	30	...	91.8	0.5	2.4	...	....	5.3	....	....	57
..	....	...	...	92.5	0.2	1.1	...	1.2	5.0	....	442	54
..	....	...	...	86.3	0.2	2.3	...	1.2	10.0	....	442	104
	(8 oz.)	25	...	86.4	0.7	5.7	...	Tr.	7.2	....	....	88
..	351	15	19	4.5	2.2	12.9	6.4	72.5	1.5	10.1	7	355
..	....	...	....	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	Carbo-hydrates
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

	Carbohydrates %
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*

* Includes fiber.

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.

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 *Almond-form 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.

	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
[46]	" " Zwieback	22	24
[47]	Salus (Braunschweig). Brot	35	15
[46]	" " Schwarzbrot	35	15
[46]	" " Weissbrot	38	14
[47]	Seidl (München). Aleuronatbrot	47	11
[46]	" " Kleberbrot	50	11
[47]	" " "	54	10
[46]	" " Kleberzwieback	45	12
[47]	" " "	67	8
[46]	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.—

Manufacturer or Agent and Brand.
Alfonso & Hipolito Sancho Vinos de Jerez Amontillado Don Quixote (Wm. J. Sheehan Co., New Haven, Agts.)
Brotherhood Wine Co., New York City. Sunnyside Claret
" " " " Riesling
" " " " Vin-Crest Brut
*California Wine Association, New York City. Riesling
* " " " " " Zinfandel
*Calwa Distributing Co., New York City. "Calwa" Brand Greystone (Light Hock Type).
* " " " " " " La Loma (Burgundy Type)
* " " " " " " Vine Cliff (Riesling)
* " " " " " " Winehaven (Table Claret)
H. T. Dewey & Sons Co., New York City. Ives Claret
" " " " Moselle Type
" " " " Old Burgundy Type
" " " " Ruby Claret
†Pedro Domecq's Manzanilla Sherry
Empire State Wine Co., Penn Yan, N. Y. Dry Catawba
" " " " " State Seal Champagne
Los Angeles Co., Boston, Mass. California Chasselas
" " " " "
" " " " Gutedel
" " " " "
Monticello Wine Co., Charlottesville, Va. Extra V. Claret
" " " " Norton's Virginia
" " " " Virginia Claret
" " " " Virginia Hock
Pleasant Valley Wine Co., Rheims, N. Y. Claret
" " " " " Dry Catawba
" " " " " Great Western Extra Dry
M. Schreiber, Baden, Austria. Diätetischer Rothwein (E. Loeb & Co., New York, Agts.).
" " " " Weisswein (" " " ").
William J. Sheehan Co., New Haven, (Agts.). California Cabernet
" " " " " Hock
" " " " " Riesling
" " " " " Zinfandel
Urbana Wine Co., Urbana, N. Y. Gold Seal Brut
" " " " " " Absolutely Dry
" " " " " Sparkling Red, Special Dry
" " " " " " " Absolutely Dry

* Sold by M. Zunder & Sons, New Haven.
† Sold by Chris. Xander, Washington, D. C.

WINES.

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.	
0.98977	20.60	1.23	0.43	$14.50 per 12 bott.
0.99466	11.87	0.16	3.31	4.50 per 12 qts.; $ 1.25 per gall.
0.99329	12.37	0.34	1.56	5.00 per 12 qts.; 1.50 per gall.
0.99736	12.24	1.66	0.32	20.00 per 12 bott.; 22.00 per 24 ½ bott.
0.99298	11.31	0.10	5.30	4.00 per 12 qts.
0.99454	11.62	0.16	3.31	4.25 per 12 qts.
0.99290	11.81	0.19	2.79	5.00 per 12 qts.
0.99439	11.27	0.14	3.79	7.00 per 12 qts.
0.99294	10.90	0.17	3.12	9.00 per 12 qts.
0.99500	11.46	0.14	3.79	5.00 per 12 qts.
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.
0.99001	8.37	0.14	3.79	Same as Ives Claret.
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.
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.
0.98558	20.86	0.32	1.63	1.25 per full qt.
0.99059	12.80	0.15	3.53	
0.99666	12.39	1.51	0.35	
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	
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	
0.99456	12.80	0.25	2.12	4.00 per 12 qts.; $5.00 per 24 pts.
0.99560	12.57	0.37	1.43	5.00 per 12 qts.; 6.00 per 24 pts.
0.99275	12.54	0.20	2.65	3.00 per 12 qts.; 4.00 per 24 pts.
0.99312	12.60	0.22	2.41	4.00 per 12 qts.; 5.00 per 24 pts.
0.99464	11.22	0.29	1.83	
0.99054	12.02	0.18	2.94	
1.01008	12.33	4.36	0.12	15.00 per 24 pts.
0.99484	11.21	0.15	3.53	13.75 per 12 qts.; $14.75 per 24 pts.
0.99533	10.48	0.11	4.82	14.75 per 12 qts.; 15.75 per 24 pts.
0.99499	11.49	0.31	1.71	6.00 per 12 bott.; $7.00 per 24 ½ bott.
0.99322	11.21	0.14	3.79	5.00 per 12 bott.; 6.00 per 24 ½ bott.
0.99180	11.15	0.14	3.79	6.00 per 12 bott.; 7.00 per 24 ½ bott.
0.99485	11.32	0.16	3.31	6.50 per 12 bott.; 7.50 per 24 ½ bott.
1.00082	12.14	2.30	0.23	
0.99301	12.65	0.54	0.98	15.00 per 12 qts.; $17.00 per 24 pts.
1.00608	11.26	2.86	0.19	
0.99486	11.98	0.29	1.83	15.00 per 12 qts.; 17.00 per 24 pts.

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

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.

est 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.

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

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.
Infant Foods.		gms.
"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
Breads, Crackers and Pastry. *(cont.)*		gms.
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)

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

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

Food.	Per cent. Carbohydrates.	Weight of food containing same amount of carbohydrates as 10 gms. wheat bread.
Jellies.		gms.
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)		(X–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)		(X–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 100 c.c.	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	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 $\frac{4}{5}$, 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.

State of Connecticut

REPORT

OF

The Connecticut Agricultura[l] Experiment Station

NEW HAVEN, CONN.

FERTILIZERS, 1913

BEING PART II OF THE ANNUAL REPORT OF 1913

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

* A sample sent by the manufacturer was analyzed.

methods of the American Association of Official Agricultural Chemists.

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,

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

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.

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

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

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 $\frac{1}{50}$ inch, "fine," and that coarser than $\frac{1}{50}$ 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 constituents 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. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
	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.—*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.		
			%	%		
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. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
			%	%		
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. Found.	Per cent. of Nitrogen. Guaranteed.	Cost per ton.	Nitrogen costs cents per pound.
			%	%		
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. Nitrogen. As Ammonia.	Water-Soluble Organic.	Active Insoluble Organic.	Inactive Insoluble Organic.	Total found.	Total guaranteed.	Phosphoric Acid. Found.	Guaranteed.	Mechanical Analysis. 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.		Dealer's cash price per ton.	Valuation per ton.
Nitrogen.		Phosphoric Acid.					
Found.	Guaranteed.	Found.	Guaranteed.	Finer than 1-50 inch.	Coarser than 1-50 inch.		
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 seçond 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.			
			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.
1.79	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 Maure	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.*

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.
0.22	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
....	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
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
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
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
....	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
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
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
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
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
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
....	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
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
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
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
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
....	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
....	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
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
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
....	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
0.42	0.20	1.58	2.20	2.06	6.37	2.44	1.07	9.88	9.0	8.61	8.0	6.09	6.09	6.0	2737
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
....	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
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
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
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
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
....	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
....	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
....	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
....	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
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.*

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.
....	0.10	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
....	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
....	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
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
....	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
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
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
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
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
....	....	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
....	....	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
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
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
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
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
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
....	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
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
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
....	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
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
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
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
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
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
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
....	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
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.*

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.
....	....	....	3.86	4.94	....	....	....	7.15	5.0	....	4.0	....	5.19	6.0	**2870**
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**
....	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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
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**
....	....	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**
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**
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**
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**
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**
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.			
			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.
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.*

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.
1.08	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
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
....	0.20	2.46	2.66	2.06	3.87	12.87	1.57	18.31	12.0	16.74	....	....	....	....	2877
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
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
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
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
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
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
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
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
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
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
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
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
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
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
....	....	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
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
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
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
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
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
....	....	....	2.34	2.47	....	....	....	9.80	9.0	...	....	....	6.29	6.0	2943
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
....	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
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
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
....	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
....	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
....	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
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
....	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
....	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
....	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
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. As Nitrates.	Nitrogen. As Ammonia.	Nitrogen. Organic.	Total Nitrogen. Found.	Total Nitrogen. Guaranteed.	Phosphoric Acid. Water-soluble.	Phosphoric Acid. Citrate-soluble.	Phosphoric Acid. Citrate-insoluble.	Total. Found.	Total. Guaranteed.	So-called "Available." Found.	So-called "Available." Guaranteed.	Potash. Found. As Muriate.	Potash. Found. Total.	Potash. Guaranteed.	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.*

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.
0.67	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
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
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
....	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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
....	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
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
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
....	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
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
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
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
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.			
			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.
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 "quick-lime," "stone lime," "burned lime" or "mason's lime." This

HOME MIXTURES—ANALYSES.

Station No.	Nitrogen.				Phosphoric Acid.				Potash.		Valuation per ton.
	In Nitrates.	In Ammonia.	Organic.	Total.	Water-soluble.	Citrate-soluble.	Citrate-insoluble.	Total.	As Muriate.	Total.	
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.

	1814	1922	1923	2183	2633	2965	1660	1662	1919	2488
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

2633 and **2965** bought of Edison Portland Cement Co., 1133 Broadway, New York. Sent by Apothecaries Hall Co. This limestone is finer than any other which we have examined.

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.

INDEX.

State of Connecticut

REPORT

OF

The Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

THIRTEENTH REPORT OF THE STATE ENTOMOLOGIST, 1913

W. E. BRITTON, PH.D.

BEING PART III OF THE ANNUAL REPORT OF 1913

THIRTEENTH REPORT

OF THE

STATE ENTOMOLOGIST

OF

CONNECTICUT

FOR THE YEAR 1913

BY

W. E. BRITTON, PH.D.

Station Entomologist

New Haven, Conn.

1914

CONTENTS

Note Regarding Authorship.

For bibliographical purposes, all articles and notes in this report should be credited to W. E. Britton, except where otherwise stated.

Illustrations.

Plates VIII, b, IX, b, and XI, a, are from photographs by W. E. Britton; all others by B. H. Walden.

The following illustrations have previously appeared in the publications of this Station.

Plate V, a, b, and c, and Plate VI, in Bull. 177, 1913.

Plate IX, a, in the Report for 1903.

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. (1/8 inch) to 8 mm. (1/3 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 cater-

pillars 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.

* 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.

Where there are many brood galleries in the main trunk of a tree the effect is the same as girdling, and the tree soon dies. In this manner thousands of trees have been killed in the vicinity of New York City, and in Connecticut, particularly in Fairfield County. The trouble is not a new one as it has been frequently recorded as occurring periodically in some portion of the country at least since 1872. For instance in 1901, 110 hickory trees died on the Hillhouse place in New Haven. The pest then subsided leaving a few trees which remain to this day, uninjured. On the Station grounds three trees died in 1912, and though we suspected the hickory bark borer to be the cause of their death, on cutting the trees, few of these bark borers could be found in them. Some other borers were present and sections of the wood were placed in breeding cages. Later we obtained a large number of specimens of a weevil or snout beetle, *Magdalis olyra* Hbst. Dr. Hopkins writes that these are rarely found in the same trees with the hickory bark borer.

It is apparent, therefore, that while most of the trees are killed by the hickory bark borer, some trees die from other causes, probably drought being an important factor. Usually those trees standing on dry knolls or ledges are the first to go.

Badly infested trees cannot recover and should be removed. Dr. Hopkins recommends that all infested trees be disposed of between October 1st and May 1st, so as to kill the over-wintering beetles. This can be done by peeling, or by using the wood as fuel. If the outer portion is allowed to remain upon the logs during the following summer, the beetles will escape and may attack other trees. All dead trees should therefore be cut at the end of the season, and dead branches and tops of living trees should be removed and destroyed.

If a tree is not infested, but in danger from surrounding conditions, it may be worth while to spray the bark of choice trees on trunk and branches in early spring with lead arsenate, one pound in five gallons of water. After the growth has been formed for the season, say about July 1st, thoroughly spraying the foliage with the same mixture may prevent damage to the leaf stems. There are a number of secret preparations on the market claimed to penetrate the burrows and to kill the beetles without injuring the trees. Most of these preparations have not been tested except by their manufacturers, and it is now too early to pass judgment upon them. As a rule these materials of great penetrative power are dangerous on account of injuring the trees, and it is usually wise to "beware of all secret preparations."

THE PEAR MIDGE.

Contarinia (*Diplosis*) *pyrivora* Riley.

Infested fruit from Cannon Station, Mystic and Watertown, received about June 1st, contained the larvæ of this insect. In each case the young pears dropped freely and a remedy was requested. This insect is of peculiar interest to the fruit growers of Connecticut, because it was first described from material gathered in 1884, in the orchard of Coe Bros., Meriden, Conn., by the late Dr. John B. Smith, who as an assistant to Dr. C. V. Riley, then Government Entomologist at Washington, had been sent to investigate the trouble reported by Mr. Coe in correspondence with Dr. Riley. Dr. Smith found that the insect belonged to the order diptera (two-winged flies) and to the family Cecidomyidæ (gall midges).

Larva, pupa and adult were described by Dr. Riley in the report of the Commissioner of Agriculture for 1885, page 287, though at that time it was thought it might prove to be the European species *D. nigra* Meig., the type of which was not available, if in existence. At that time the pear midge was supposed to be an introduced insect, was not known to occur elsewhere in America, and seemed to be confined to a very small region in the vicinity of Mr. Coe's orchard. Both Dr. Smith and Dr. Riley urged that the American Pomological Society, or some other organization, make an effort to stamp it out. This urgent advice apparently was not followed, though Mr. Coe had attempted to destroy his entire crop of pears in 1883, hoping in this way to get rid of the pest. In a few years the insect appeared elsewhere. In 1891 it was discovered at Catskill, N. Y., and in three localities in New Jersey, and is now known to be distributed in the Northeastern United States and in Central Europe. Several accounts of this insect have appeared in various reports of state entomologists and in entomological journals and bulletins.

The adult is a small two-winged fly which lays its eggs in the clusters at blossoming time, or even earlier. Dr. Felt has found the larvæ at the base of the calyx at the time the petals fall,* and they soon work their way into the young fruit. The infested pears can nearly always be detected on account of their more globular, and later lop-sided shape, while the normal-shaped fruits are free from maggots. The infested pears usually crack open after a rain and thus allow the maggots to escape before the pears drop. When fully grown the maggots are about 3 mm. (one-eighth of an inch) in length. They go into the ground and form minute oval cells in which they pupate, and from which the adults emerge the following spring. There is one brood each year.

This insect has done considerable damage locally, especially in the New England states, New York and New Jersey. Certain varieties seem to be injured more than others, particularly Bosc, Bartlett and Seckel, in the order named. Dr. Smith states† that the insect has been gradually worked out in New Jersey and maintains itself in only a few places near Newark and New Brunswick.

No remedial treatment is known other than gathering and destroying the infested pears before the maggots leave them. This is comparatively simple because the infested pears are so easily distinguished from the healthy fruit. Cultivating the soil during the month of June would doubtless destroy many of the larvæ in the cells. Young pears infested by the maggots are shown on plate VII, d and e.

THE WEST INDIAN PEACH SCALE IN CONNECTICUT.

Aulacaspis pentagona Targ.

This insect was discovered this fall in Greenwich, Conn., on Chinese privet, *Ligustrum ibota,* by Mr. Walden. It had not previously been recorded from Connecticut, though fifteen years ago Cooley reported the species from Jamaica Plain, Mass.,‡ where it had been collected on different species of *Prunus,* growing on the grounds of the Arnold Arboretum. Though it is called the West Indian Peach Scale this species does not confine its attacks to peach trees but infests a great variety of plants belong-

* Report N. Y. State Entomologist, 28, p. 97, 1912.

† Insects of New Jersey, p. 729, 1909.

‡ Canadian Entomologist, XXX, p. 232, 1898.

ing to widely different botanical families. A full list of food plants was given by Webster* in 1898 and a partial list will be found in Mrs. Fernald's Catalogue of the Coccidæ of the World, page 235. The insect is now known to occur in China, Japan, Ceylon, Hawaiian Islands, New Zealand, Australia, Brazil, Panama, West Indies, South Africa, Italy, Switzerland and England. In the United States it has been reported from California, Florida, Georgia, Washington, D. C., Ohio, Massachusetts and now from Connecticut.

Dr. H. T. Fernald states† that this scale has been found abundantly on flowering cherry imported into Massachusetts. I now believe that it was present on weeping cherry imported from Japan three years ago into one of our Connecticut nurseries. We did not attempt to identify it at the time, but ordered the trees fumigated with hydrocyanic acid gas, to kill the scales which were present in moderate numbers on the twigs. These trees were planted out and were clean when afterward examined.

It is probable that the West Indian Peach Scale will not prove a destructive pest in this State. According to the published statements of Newell and Rosenfeld‡ it has been injurious in a few instances in Louisiana, but has not seemed to spread to new localities. Moreover, from the records of the effect of low temperatures on this insect§ it is doubtful if it will survive our severest winters. The winter of 1912-1913, was a comparatively mild one, and evidently the scale did survive it and spread over the plants in a small block of privet. Greenwich is on Long Island Sound and minimum temperatures are there much higher than in most inland towns.

This scale is circular, and larger and more strongly convex than most other armored scales found in Connecticut. It is closely related to the rose scale, *Aulacaspis rosæ* Bouche, but may be distinguished from it by the larger number of circumgenital pores in the female, when examined under a compound microscope. The rose scale is commonly found on roses and blackberry plants, and the exuviæ are light yellow. In *A. pentagona*

* Canadian Entomologist, XXX, p. 79, 1898.
† Journal of Economic Entomology, Vol. III, p. 275, 1910.
‡ Ibid, Vol. I, p. 153, 1908; Vol. III, p. 215, 1910.
§ Ibid, Vol. I, p. 258, 1908.

the exuviæ are orange-yellow and many of the scales are more or less covered by the epidermal tissues of the plant and therefore of the same color, making it much less conspicuous. When not covered by the bark of the host plant the scales are white and conspicuous like the rose scale. Where the scales have died and fallen from the twigs, the ventral scales remaining are also white and conspicuous. An infested privet twig is shown on plate VIII, a.

If the West Indian Peach Scale withstands our winters and infests and injures trees and shrubs, it is probable that a thorough spraying with a modern contact insecticide like the lime-sulphur wash or one of the oil mixtures, will serve to hold it in check.

MOSQUITO CONTROL WORK IN CONNECTICUT IN 1913.

In the report of this Station for 1912, page 283, it was stated that legislation would be sought providing for the control of mosquito breeding places and three bills were introduced.

One bill carrying an appropriation and providing for the drainage of large marsh areas under state supervision was finally passed by the house and senate, with the appropriation reduced to $10,000.00 for the biennial period. This measure was vetoed by Governor Baldwin after the adjournment of the session in June.

The amendment to Section 2526 of the General Statutes was defeated.

The following important measure was enacted, and is now a part of the statute law of the State.

An Act Concerning Public Health and the Control of Mosquito Breeding Places.

Chapter 143 of Public Acts of 1913.

Section 1. *Public nuisance.* Any accumulation of water in which mosquitoes are breeding is hereby declared to be a public nuisance.

Sec. 2. *Authority to abolish.* When it has been brought to the attention of a health officer or board of health, through the complaint of any citizen, or when discovered by any inspector or agent of said health officer or board of health, that rain water barrels, tin cans, bottles or other receptacles, or pools near human habitations are breeding mosquitoes, it shall be the duty of said health officer or board of health to investigate and to cause such breeding places to be abolished, screened, or treated in such manner as to prevent the breeding of mosquitoes. The health officer, or any inspector or agent employed by him, shall have the right to enter any premises in performance of his duties under this act.

Approved May 29, 1913.

Examinations of Suspected Breeding Areas Made on Request of Health Officers.

At the request of Dr. Edgar Adams Wilson, Town Health Officer of Meriden, on June 23, I inspected a swampy area near the Undercliff Tuberculosis Sanatorium in Meriden. Dr. Williams of the sanatorium accompanied me and I tested the water in many places, especially around the margins of the woodland area where many red maple trees and various shrubs of a semi-aquatic nature, grow in the water. The water did not appear to be more than a foot deep, and was discolored by the dead leaves.

Mosquitoes fairly swarmed over this area. A number of adults, collected from my coat, and those reared from wrigglers dipped from the stagnant pools, proved to be *Culex cantans* Meig., a species which flies only a short distance, though far enough to annoy the patients at the sanatorium, where, according to Dr. Williams, mosquitoes had been quite troublesome.

Though the water was tested at many points, only a few wrigglers were found, but I am reasonably certain that this area, of perhaps an acre in extent, is a breeding place. Probably earlier in the season and at various other times during the summer, one would find larvæ much more abundant. There were certain mosquito enemies in some portions of the pool, but in bunches of grass and in the shallow water wrigglers were present. I was informed that this pool is on land owned by the City of Meriden, and that it does not belong to the sanatorium.

Draining is a simple remedy and was promptly advised. A ditch was once cut, running in a northeasterly direction through the adjoining pasture, but had become partly filled. If this ditch could be deepened to about two feet, it would probably drain the entire area. It would not need a long ditch, as the pasture slopes away rapidly, and a depression further down the slope could be made to hold water if needed as a drinking place for the cows pastured there.

A report to this effect was sent to Dr. Wilson, and duplicate copies furnished the sanatorium and Mr. C. E. Hoadley, County Health Officer of New Haven County.

Later I was assured that an attempt would be made to carry out these recommendations.

On August 19, at the suggestion of Dr. E. C. M. Hall, Health Officer of East Haven, an examination was made of a certain area along the shore, between Momauguin and Silver Sands, just east of the area drained by the Anti-Mosquito Committee in 1912. Mr. Ripley made the examination and found that a portion of the area contained pools filled with wrigglers. A brief report containing the facts was at once sent to Dr. Hall.

Examination of Other Areas.

In coöperation with the Anti-Mosquito Committee and the City Park Department, we examined the ditches cut in 1912 in the salt marshes about New Haven, to see if they were in good condition to do active work, and also the pools in the public parks which in 1913 as in 1912, were kept oiled by the Park Department. Some of these areas were inspected several times. once in June and two or three times in July and August, and reports made to the proper authorities. In the parks the particular sections given most attention were Beaver Pond Park, Edgewood Park, and the meadows at the foot of East Rock. At Beaver Pond Park we found larvæ of the malarial mosquito late in the summer, and it will be very difficult to entirely prevent breeding here until some comprehensive system of improving this area is carried out. Oiling alone, though a benefit, will not do it.

At the base of East Rock there was little breeding except around the dump, near the corner of Willow and Mechanic Streets, where larvæ of the salt marsh mosquito and other species of *Culex* were very abundant.

The pools in Edgewood Park were kept oiled and were not found to breed mosquitoes except at a few places. This does not, however, apply to the main stream of West River, the conditions of which are described in the following chapter.

West River Responsible for a Scourge of *Culex pipiens* in New Haven.

On August 5, Mr. L. B. Ripley, who had been sent to examine the pools in Edgewood Park, reported that he found wrigglers in the margins of the main stream (West River) especially in the coves, or where choked by vegetation or rubbish the water remained quiet. Small pools under the Whalley Avenue Bridge, existing on account of low water were literally alive with *Culex* larvæ.

On August 11, Mr. Ripley examined the stream above the bridge and found wrigglers very abundant, particularly between Blake Street and Valley Street bridges, through West Rock Park. With one dip of the ladle, which holds about a gill, 200 wrigglers were taken. From a further investigation we found that the west branch of the river, as far as the Pond Lily Company's dye works, was filled with wrigglers. Little or no breeding could be detected in the other branches of West River, where the water was clear.

The west branch receives the waste from the dye works and further down the stream the refuse from the Joseph Parker and Sons paper mills and the factories of the Geometric Tool Co., and of the Greist Mfg. Co. The dye stuffs in the stream discolor the water, often making it look like ink. It was a season of extreme drought and the water was unusually low, and therefore was nearly stagnant, and completely so in many pools which would be connected with the stream in high water, but in low water entirely separate. The dye stuffs had apparently either killed or driven away the fish, and mosquitoes were breeding here intensively—literally by millions. The wrigglers clustered around stones, sticks, dead leaves or any other objects in the water and they were visible from the banks at a distance of perhaps fifteen feet. Up to this time West River had not even been suspected of breeding mosquitoes.

This discovery explained a great mystery. Annually, for at least three years, in the entire western portion of the City of New Haven there has been a scourge of rain-barrel mosquitoes, *Culex pipiens* Linn., beginning the latter part of July and ending only on the approach of cold weather. The mosquitoes were very abundant in 1912 and fairly swarmed into cellars to hibernate, but they were probably worse in 1913, or would have been, if control measures had not been adopted. In fact the writer has never seen them so abundant anywhere as they were in the western part of New Haven about August 1, 1913.

In 1912 when the Anti-Mosquito Committee of the Civic Federation caused all known breeding places in and about New Haven to be drained or oiled for the season, salt marsh mosquitoes were scarce, yet rain-barrel mosquitoes were abundant and many citizens who had contributed toward the mosquito campaign fund complained. They had given good money but there were still just as many mosquitoes.

Much searching was therefore done for rain-water barrels, though a thousand of them could not produce as many mosquitoes as this stream furnished. They fairly swarmed in protected corners of buildings, under verandas, and in shrubbery. They were innocuous during the day but as soon as it was dark they began to sing and to bite. Many were small and readily entered houses through the meshes of the screens. Unless the windows were kept entirely closed, or mosquito bars placed over the beds it was impossible to sleep at night.

Now the origin of the mosquito outbreak was no longer a mystery. What to do was the next question. The condition of West River was reported by telephone to the offices of the Board of Health and the Superintendent of Parks on August 12, and a formal letter was sent to each on August 14. On August 21, a meeting of the Board of Health was held and the matter considered. The writer, in company with a committee of the Edgewood Civic Association, consisting of Messrs. Chas. E. Brown, Geo. W. Crane and Carleton H. Stevens, attended this meeting, explained the situation and urged prompt action.

Considerable time must necessarily elapse before the Board could notify all property owners to abate this nuisance. The Board, under the new law becoming effective August 1, given on page 242, clearly had the right to abate the nuisance, but of course must go about it in a legal manner. Immediate relief was demanded. As a remedy, flushing the stream by opening the gates above was the simplest; but there was a serious drought and water was very low and could not be wasted. Hence the oiling method was chosen.

The Executive Board of the Anti-Mosquito Committee, therefore, voted to appropriate a sum of money, not to exceed $50.00, toward the cost, the remainder to be collected from interested persons. The writer was asked to take charge of the oiling work, which was started the next day, August 22. He was fortunate in being able to obtain the services of Mr. James E. Hitchcock, who was employed by the Anti-Mosquito Committee on the work in 1912. During the next few days the entire surface of the river, where mosquito wrigglers could be found, was sprayed with oil from a point opposite Ramsdell Street, near the Pond Lily dye works, eastward to the Whalley Avenue bridge, a distance of nearly one and one-half miles of the winding course of the stream. Also the canal near the paper mills and many detached pools that in high water are connected with the river, were treated. The winding course of the stream, with its brush-grown banks and its rough and irregular bed, partially filled with vegetation and rubbish, made the oiling work difficult and expensive.

Kerosene was used because it could be purchased immediately. Six barrels of crude oil, donated by the Geometric Tool Co., was also applied and gave excellent results. The oil was spread by means of two "double forester" pumps, one the property of the Civic Federation and the other kindly loaned for the purpose by the State Forester. See plate X.

The Park Department oiled the edges of the stream through Edgewood and West Rock Parks, but in the latter not enough oil was used and the work had to be done over by Mr. Hitchcock, the Park Department furnishing two men to help.

The entire cost of this work amounted to $125.31, and was nearly covered by local contributions of money, labor and oil.

The treatment was effective. We examined the stream and could find few live wrigglers but thousands of dead ones floated down. A day or two after the work was finished rain carried off most of the oil and later one small brood of mosquitoes developed and the adults emerged, but were not a great nuisance because of the cooler weather and many of the larvæ were washed down stream by heavy rains in September and October. The myriads of adults which had emerged before oiling gradually disappeared and on the approach of winter, hibernating adult rain-barrel mosquitoes were much less abundant than in 1912. Apparently these mosquitoes were a nuisance nearly a mile distant from West River.

Unless some remedial action is taken, the condition may and probably will exist in West River each season of scant rainfall, as long as the pollution is allowed to continue. Once the pollution stops the stream can again be stocked with fish, and there will be no more mosquitoes from it. The bed should be cleared of rubbish, and straightened. I understand that the City Board of Health has already warned the property owners abutting the stream that the nuisance must be abated.

Adults, larvæ and pupæ were sent to Dr. L. O. Howard at Washington, who kindly confirmed our identification; it was the rain-barrel mosquito, *Culex pipiens* Linn.

Other Similar Outbreaks.

Howard, Dyar and Knab record a similar outbreak near Urbana, Ill., where a creek is practically stagnant in late summer. At a certain point this creek receives the waste from a slaughter house, and for some distance below was so charged with decomposing animal matter that no fish could live in it, though it contained millions of wrigglers of rain-barrel mosquitoes. Adults covered the trees and bushes along the banks, but their presence was felt only for a short distance, and few of them reached the town perhaps a mile away. They continued to reproduce until cold weather.*

Another interesting outbreak of rain-barrel mosquitoes which occurred in 1913 in Greenwich, Conn., was described to me in a letter by Mr. Edwin M. Skinner, President of the United States Drainage and Irrigation Co., of New York City. Just north of the village of Mianus, there is a dam six or eight feet above tide level, formerly used to furnish power for the Palmer Bros., gas engine plant, but now abandoned for another site where steam is used. About 500 yards north of the Palmer dam, is another dam about six feet high, where a grist mill used to stand but of which only the sluiceway and part of the water wheel remain. These dams are not used but on account of sewage emptying into the river above and between them, they are allowed to remain rather than permit the sewage to be exposed.

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* The mosquitoes of North and Central America and the West Indies, Vol. I, p. 135, 1912.

A short distance above the second dam there is a mill where lap-robes and cheap plush goods are made from cow-hair and low grade wool. A cheap grade of oil is used in spinning the raw wool and cow-hair, and the product is washed with water from the river which again flows into the stream. Probably dye stuffs are also used and emptied into the river. These waste materials, together with the sewage held back by the dams, probably destroyed the fish and furnished an ideal breeding place for rain-barrel mosquitoes. The stream flow was slight in the period of drought, and the water was stagnant and slimy and thickly filled with wrigglers. The river is about 100 feet wide by the grist mill dam and perhaps 150 feet broad at the Palmer dam and literally filled with larvæ.

Above the woolen mill is another dam, above which the water is pure and sweet. The health officer ordered the gates lifted at this upper dam and all the wrigglers were washed into Long Island Sound the same day that they were discovered.

Cutting and Maintaining Ditches in 1913.

In New Haven the Anti-Mosquito Committee collected a small amount of money in 1913, and with it kept clear the ditches cut in the salt marshes in 1912. Similar maintenance work has also been done at Shippan Point, Darien, South Norwalk and Fairfield.

Considerable draining and filling has been done in the town of Greenwich, little of it, however, applying to the salt marsh. Many fresh water pools and swamps, which have in previous years been breeding places of malarial mosquitoes and various species of *Culex,* have been eliminated throughout an area extending along the coast and about two and one-half miles inland or as far as the village of Glenville. The north line of this area is parallel with the north town line.

ENTOMOLOGICAL FEATURES OF THE SEASON.

Following the mild weather, the spring of 1913 was cool and with abundant rainfall during May. In June, July and August the rainfall was much below the normal, resulting in a severe drought in which many native trees and plants were vitally injured, and cultivated crops reduced in yield. Heavy rains came in September.

The climatic conditions cannot fail to effect insect life, though less directly than plant life. Many hickory trees have died. chiefly from the attacks of the hickory-bark borer, particularly in the southwestern corner of the State. In some localities oaks have died, but these trees, like the hickories, have evidently been injured by freezing or drought or both, and were attacked afterward by various bark beetles.

White grubs have been comparatively scarce and except in one or two cases, have not been reported as damaging crops.

The Colorado potato beetle, too, was not abundant and nearly all larvæ that we observed carried Tachinid parasite eggs.

The apple-tree tent-caterpillar was more abundant than we have ever seen it and roadsides and neglected apple trees and bushes were stripped. The damage was apparently greater inland than along the coast. Cocoons gathered at Stonington were strongly parasitized.

The forest tent-caterpillar was also more common than usual, though not very destructive.

Cutworms were not particularly abundant.

Aphids caused much damage, especially the rosy and green apple aphids, and the cabbage and pea aphids.

One of the chief features of the season is the discovery of new territory infested by the brown-tail moth. The scouting in the previous winter shows that insect to have spread much farther westward than was supposed.

The gypsy moth is now almost eradicated at both Stonington and Wallingford, the only two infestations found in the State.

The more important of these insects are treated in some detail in the separate articles and notes of this report.

MISCELLANEOUS INSECT NOTES.

The Dying Oak Trees.—On September 24, 1912, the writer was called to examine some oak trees which were dying on a large place owned by Mr. Mallory in the extreme southwest corner of Greenwich, just over the line from Port Chester, N. Y. The trees began dying in July, after having made their season's growth, and were mostly chestnut oaks; a few white oaks and a few of another kind, possibly black oaks, had also died. As the trees all stood upon a ledgy knoll, the extreme drought seemed largely responsible for their death, though bark borers were at work in them. Another visit was made to this place August 5, 1913, in company with Dr. G. P. Clinton, botanist of this Station, Mr. H. W. Merkel of the New York Zoological Park, and Messrs. F. A. Bartlett of the Frost and Bartlett Co. of Stamford. More trees had died and one white oak had just been cut upon which the writer observed winter injury in 1912. In 1913 borers were at work under the bark where none were found the preceding year. Plate XII, b, shows the appearance of a piece of bark from a chestnut oak which had just been felled. The larger galleries were made by a common flat-headed borer, *Chrysobothris femorata* Fabr., and the smaller ones by the two-lined chestnut borer, *Agrilus bilineatus* Web. Both kinds of larvæ were present in the burrows.

From other trees examined and reported, our opinion is confirmed that the trouble is due, not primarily to insects but to winter and drought injury, followed by these borers which are well known to attack weakened and unthrifty trees.

Flight of Spruce Bud Moth, *Tortrix fumiferana* Clem.—A brief note in the report of this Station for 1912, page 291, mentions this moth as being unusually common in 1912, but it was even more abundant in 1913. Swarms appeared the last day of July and newspapers in different parts of the State commented upon it the following morning. The following appeared in the *Hartford Courant* of August 1st: "The city was infested last night by a scourge of moths which appeared suddenly and in great numbers. In some parts of the city the insects were so numerous last night that they completely covered the windows and screen doors of lighted restaurants and stores. The moths are spotted with gray and a dirty shade of brown."

On the day that this item appeared a reporter on one of the New Haven daily papers telephoned to this office for information, and stated that he observed the moths to be very abundant around the lights at the corner of Chapel and York streets. Mr. Ripley was sent to obtain adults which we at once recognized as the spruce bud moth. Hundreds of them had been at this corner, many had been crushed on the sidewalk, and some were resting upon the poles and on the walls of the adjoining buidings. In a few days, however, all had disappeared.

The larva of this insect, in a spruce twig, was received from Mr. E. Kent Hubbard, Jr., of Middletown, who had collected it in the Maine woods. Several adults were received at this office August 2, collected around lights at New London by Dr. Chas. B. Graves, and August 4, by John H. Osgood at Putnam.

Parsley Stalk Weevil, *Listronotus latiusculus* Boh.—On August 16, Dr. Clinton brought in some parsley plants from the vegetable farm of A. N. Farnham of New Haven, which had been injured by this insect. The crown of each plant had been tunneled by the larva, as shown on plate XI, b, and the plants though alive were sickly and wilted. Mr. Lowry visited the place August 18, and obtained more material. On some of the plants the tunnels showed on the outside, and two and three larvæ are sometimes found in the same plant. The infested plants usually decay just below the surface of the ground, though the root below the point of attack may remain sound for a time. The infested plants at Mr. Farnham's were all growing in cold frames. It is doubtful if there is any practicable remedy, though carbon disulphide injected into the soil might kill the larvæ. An account of this insect may be found in Bulletin 82 of the Bureau of Entomology, page 14, U. S. Department of Agriculture. The insect has not previously been reported from Connecticut.

The Cottony Maple Scale, *Pulvinaria vitis* Linn.—This insect attacks many different trees and shrubs but is chiefly a pest of soft maple shade trees. In Connecticut it has seldom been injurious and usually a few specimens only are found on a tree. At Sound Beach, Stamford, the silver maples on several streets in a certain locality are now badly infested. The underside of nearly all branches are lined with scales and the trees more or less injured. Some of these trees were sprayed last spring with the miscible oils which seem to be effective. This insect is known in literature as *Pulvinaria innumerabilis* Rathvon, but studies by Professor J. G. Sanders* showed it to be identical with the European *P. vitis,* under which name it must now be known.

* Journal of Economic Entomology, Vol. II, p. 433, 1909.

Abundance of *Omphalocera dentosa* Grote.—This insect was described and illustrated in the report of this Station for 1911, page 292, as a pest of barberry hedges. It has apparently been more abundant and has done more damage in 1913 than in any preceding year since our observations began. Hedges of Japanese barberry (*Berberis Thunbergii* D. C.) and of the common barberry (*Berberis vulgaris* Linn.) were attacked. A tall hedge of common barberry was practically defoliated at the top and the larval webs were so numerous as to render it unsightly. In inspecting nurseries, the work of this insect was noticed at New Canaan, Stratford and New Haven. Purple-leaved barberry plants in a New Haven nursery were nearly stripped of their leaves but contained a mass of old webs. The writer also noticed barberry bushes growing by the roadside in North Guilford, which had lost nearly all of their leaves from the attacks of this insect.

The Eggs of *Hemerocampa definita* Pack., and Their Resemblance to Gypsy Moth Eggs.—Occasionally we find the egg-clusters of this tussock moth, which is apparently not very common, and they are often mistaken for those of the gypsy moth. Though there is great variation, certain egg-clusters are about the same size, shape and color as gypsy moth egg-clusters, but the hairs are somewhat coarser, more crinkled, the whole cluster more loosely constructed, and the eggs more exposed. As a rule, also, the eggs of *Hemerocampa* are deposited on a network of silk on or near the old cocoon, which is often on a leaf which is also fastened to the twig by silk threads. Gypsy moth eggs are usually laid on a solid surface, except in case of great abundance. In two apple orchards near Gales Ferry, Mr. Caffrey found some of these egg-clusters fastened directly to the bark and greatly resembling gypsy moth eggs. There is a difference in the micropylar structure of the eggs of these two moths, which will generally serve to fix their identity, but even entomologists have been mistaken regarding them. *Hemerocampa definita* is a near relative of the White Marked Tussock Moth, described in the report of this Station for 1905, page 230; it is, however, much less common and its eggs are shown on plate XII, a, of this report. Mr. Caffrey found *H. definita* fairly common in the northern part of the State, and we have records of its occurrence in Thompson, Putnam, Union, Stafford, Willington, Mansfield, Somers, Enfield, Coventry, Ellington, Manchester, Tolland, Bolton, Eastford, Ashford and Ledyard. The eggs have been found in Connecticut on apple, cherry, poplar, willow, rose, plum, hawthorn, alder, lilac and birch.

Cocoons of the Promethea Moth, *Callosamia promethea* Drury.—Each year the cocoons of this moth are sent in by correspondents who think that it may be some important pest. During the past year specimens have been received from Elliotts, Collinsville, Guilford, Lebanon, New Canaan, West Haven and twice from Wallingford. The cocoons hang from the lower branches of sassafras, tulip, wild cherry and occasionally peach and plum trees. Each cocoon is usually rolled in a leaf with a strong silk fastening around the petiole, as is shown on plate IX, c, so that it is difficult to tear it from the tree. The adult moth is one of our larger species of night-flying moths. The female resembles the Cecropia moth, though smaller, and the male is nearly black.

Subsidence of the San José Scale.—This insect, which for fifteen years has been a serious enemy of fruit trees, seems to be now on the wane. Many old apple trees badly injured a few years ago, and which have not been sprayed, are taking on new vigor and seem to show only a slight scale infestation. We had supposed this to be result of lady beetles, two species of which commonly feed upon the San José Scale. Specimens of scale gathered this fall by Mr. Davis show many holes from which small hymenopterous parasites have emerged. We have not reared the adult parasite but it is probably a species already known, and may be the same that has been cleaning up the orchards in Pennsylvania.

Galls on Gooseberry.—While inspecting imported nursery stock in East Haven, April 23, Mr. Walden was asked to look at some unthrifty gooseberry plants in a neighboring yard owned by Mr. Eugene Wilson. Many of these plants were dead, and some of the living and dead plants had curious galls near their tips, much resembling the illustrations of galls on currants in England, caused by the currant mite, *Eriophyes ribis* Nal., and known as "Big Bud."* We were unable to find any statement to the effect that this mite attacks the gooseberry in England, but it does injure black and red currants. No mites or other animal life could be found in these galls, which may be those of the gooseberry gall midge *Rhopalomyia grossulariæ* Felt. described and figured by Professor J. S. Houser of the Ohio Station.† The owner was advised to cut off and burn all twigs showing these galls. See plate XI, a.

Abundance of Spittle Insects.—Everyone is more or less familiar with the small masses of "spittle" or froth on the stems of grass, caused by small immature sucking insects of the family Cercopidæ, often called "spittle insects" or "frog hoppers." These insects were unusually abundant in 1913, and nearly every stalk of grass, in some fields, carried a mass of froth. One's clothes would become soaked in walking through the grass.

These insects are supposed to cause some injury, but the matter is not well understood, and not one life history of a single American species has ever been worked out.

Interesting Pupa Cells of the Clover Weevil, ***Phytonomus punctatus*** **Fabr.**—On May 17, Mrs. Robert F. Mitchell sent to the office some of the pupa cases of this insect which were very abundant in the soil of her garden in New Haven. These were placed in a breeding cage and in a few days the adults began to emerge. The clover weevil is rarely injurious in Connecticut, though the larvæ feed upon clover leaves. The pupa cells are small lace-like oval cases, about three-sixteenths of an inch in length, pale green in color, and are shown with larva and pupa on plate VII, c.

Birch Leaf Skeletonizer, ***Bucculatrix canadensisella*** **Chamb.**—The injury by this insect, which was so conspicuous in the State in 1910 and which has somewhat subsided, is still apparent. Though present over the entire State as in 1911 and 1912, the center of attack has moved westward, and seemed to be the most serious in the northwestern portion of the State where yellow and black birches were attacked. A full account of this insect is given in the report of this Station for 1910, page 701.

* Theobald, Insect Pests of Fruit, p. 240, 1909.

† Houser, Journal of Economic Entomology, Vol. V, p. 180, 1912.

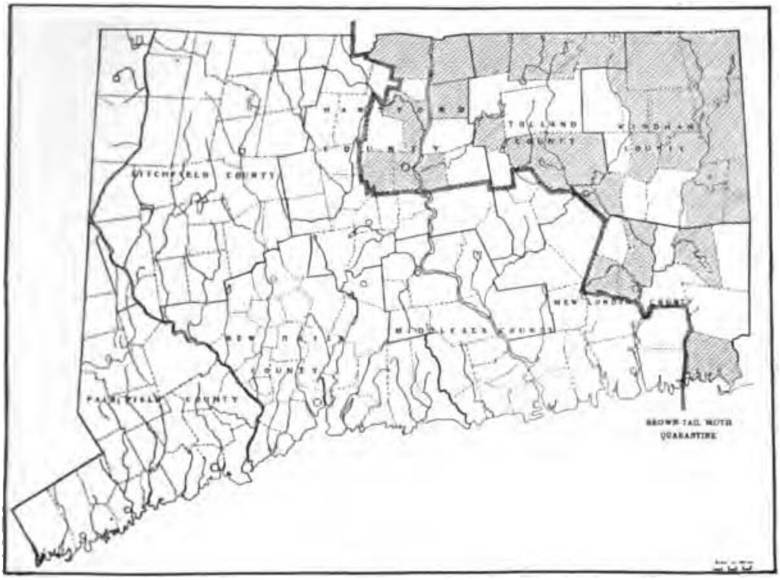
Elm Leaf Beetle, *Galerucella luteola* Müll.—In some of the shore towns and cities, and especially where spraying has been practiced for several years, this pest was rather scarce during the past summer. On the other hand it was extremely abundant in certain inland towns, particularly in Litchfield County. The writer also observed many unsprayed elms in Woodbury which lost nearly all their leaves in July from the attacks of the larvæ, aggravated no doubt by the severe drought. Trees in the vicinity which had been sprayed remained in good condition.

The Poplar Sawfly, *Trichiocampus viminalis* Fallen. During the past three or four years the larvæ of this sawfly have been rather common on Carolina poplars near the Station, and late in August may be seen crawling down the trunks of the trees presumably to seek a place in which to pupate. The full-grown larva is four-fifths of an inch long, orange-yellow, marked with black spots, and bearing whitish hairs. There are two broods each year, the larvæ of the first brood appearing in June. These caterpillars feed upon the leaves and may be poisoned by spraying the tree with lead arsenate in case they should become destructively abundant. The adult is a small four-winged fly.

The Linden Borer, *Saperda vestita* Say. Larvæ of this beetle were rather common in young linden trees in one nursery this year. They tunnel under the bark and in the wood at the base. Decay often starts involving the entire stem, the leaves shrivel and the tree dies and breaks off. Trees in all stages of injury were found. Mr. Lowry captured an adult beetle in Wallingford, June 23. Where this borer causes damage, the only remedy is to examine the trees in May and September and to dig out the larvæ or kill them in the burrows with a wire, or by injecting a few drops of carbon disulphide and closing the opening.

Abundance of Tarnished Plant Bug, *Lygus pratensis* Linn. The tarnished plant bug was unusually abundant in 1913, and injured many different plants by sucking the sap from the bud or leaf stem causing that part to "blast" or wilt. Several complaints were received regarding injury to Dahlia buds, and in Litchfield potatoes were damaged by this insect. It is doubtful if a satisfactory remedy exists.

PLATE I.



a. Map showing quarantine line and present distribution in Connecticut.

b. Winter nests on pear trees in Hartford.

THE BROWN-TAIL MOTH.

PLATE II.

Winter nests cut from pear tree in Hartford; center nest shows old egg-mass on leaf; natural size.

THE BROWN-TAIL MOTH.

a. Leaves of California privet, drawn together.

b. Larva on gooseberry.

A LEAF-FOLDER *Archips rosana* Linn.

PLATE IV.

a. Larvæ and pupa.

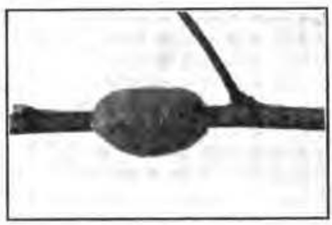
b. Adults, female above.

c. Pupa case and adult.

A LEAF-FOLDER *Archips rosana* Linn. All figures twice natural size.

a. Nest in apple-tree.

b. Adults, female above. Natural size.

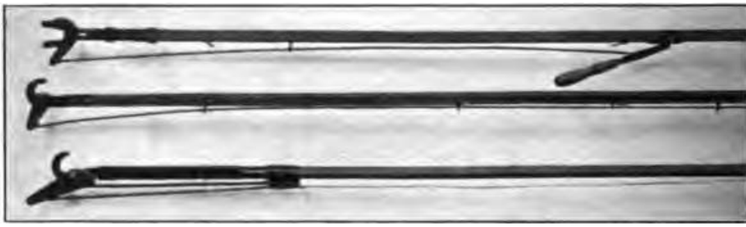


c. Egg-mass on twig. Natural size.

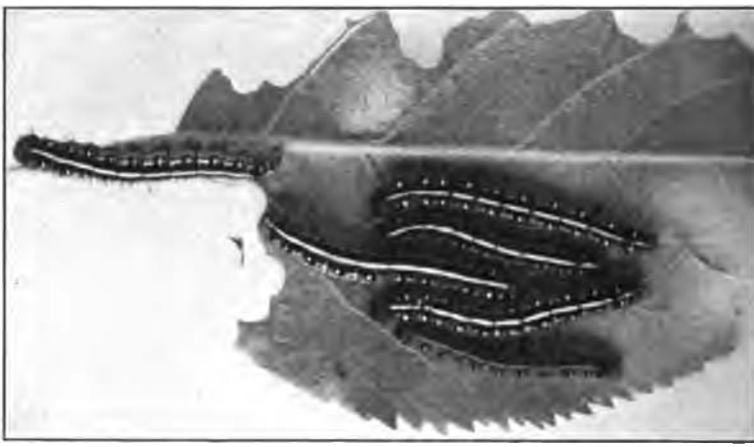
d. A consignment of imported stock in a Connecticut nursery.

APPLE-TREE TENT-CATERPILLAR; IMPORTED NURSERY STOCK.

PLATE VI.



a. Tree pruners for clipping off egg-masses.



b. Caterpillars. Natural size.

c. Cocoons. Natural size.

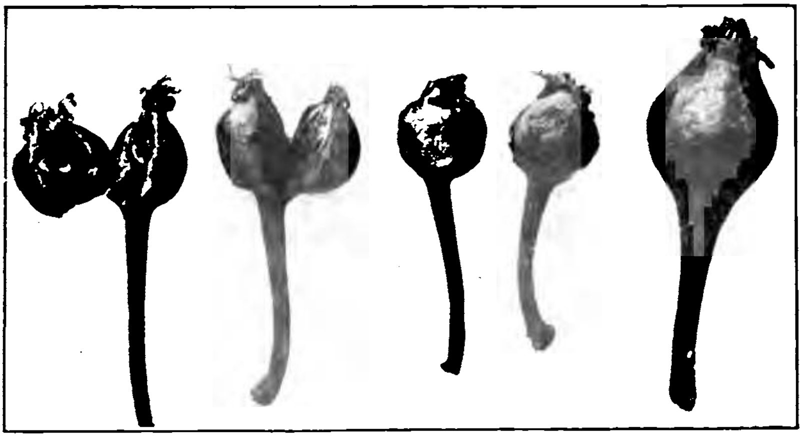
APPLE-TREE TENT-CATERPILLAR.

a. West Indian peach scale. Twice enlarged.

b. *Otiorhynchus sulcatus* Fabr. Larva, pupa and adult. Twice enlarged.

c. Clover weevil, larva, pupa and pupa cases Twice enlarged.

d. Pear midge. Young pear showing maggots inside. Three times enlarged.



e. Pear midge. Infested pears, natural size.

PEAR MIDGE AND OTHER INSECTS.

PLATE VIII.

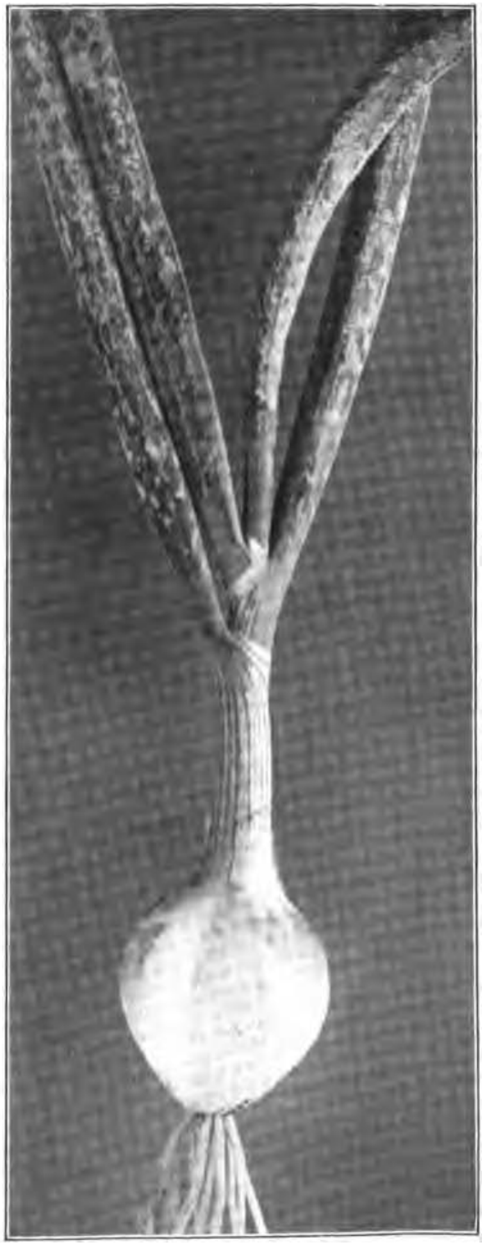
a. View on Station grounds.

b. Spraying onions at Wethersfield.

CONTROL OF ONION THRIPS.

a. Immature thrips much enlarged.

c. Cocoon of Promethea moth. Natural size.



b. Onion plant injured by thrips. Natural size.

ONION THRIPS AND COCOON OF PROMETHEA MOTH.

PLATE X.

a. Oiling canal near paper mill.

b. A disconnected pool filled with wrigglers.

MOSQUITO-BREEDING PLACES.

a. Galls on gooseberry.

b. Parsley plants injured by weevil.

GOOSEBERRY GALLS AND PARSLEY STALK WEEVIL.

Both natural size.

PLATE XII.

a. Egg-clusters of *Hemerocampa definita* Pack. Natural size.

b. Large galleries were made by *Chrysobothris femorata* Fabr. and small ones by *Agrilus bilineatus* Web. Natural size.

TUSSOCK MOTH EGG-CLUSTERS; WORK OF BORERS IN OAK BARK.

State of Connecticut

REPORT

OF

The Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

FOOD PRODUCTS AND DRUGS, 1913

BEING PART IV OF THE ANNUAL REPORT OF 1913

SECTION 2 OF PART I

CORRECTIONS.

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 IV.

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

SECTION 2 OF PART 1

BY JOHN PHILLIPS STREET.*

Section 1, printed as Part I of the Annual Report, contained the analyses of 136 diabetic foods, twelve peanut butters, seventeen saccharin preparations and thirty-eight wines, 203 samples in all. The other samples of foods and drugs examined during the past year are herewith reported.

Of the 734 samples collected by the station agent, 477 were passed and twenty-six were adulterated, below standard, misbranded or short weight. The Dairy and Food Commissioner has also sent in 999 samples, chiefly milk, vinegar and turpentine. Of these 424 were adulterated, misbranded or below standard. Besides the above, 169 samples have been examined for city and health officials and other individuals, making a total of 1902 samples from all sources.

I. FOOD PRODUCTS.

BREAD.

The present examination of this important food product concerns chiefly its water-content and the variations in weight of loaves from the same baking. All the samples baked in Connecticut were bought from the bakeries producing them, and were

* The analytical work herein reported was done jointly with E. M. Bailey, C. B. Morison, C. E. Shepard and G. L. Davis.

TABLE I:—

Station No.	Bakery.	Weight of Individual Loaves. oz.	Average Weight of Loaf. oz.
	Five-Cent Loaves.		
	Bridgeport:—		
974	S. R. Adams. (Honey-B.)	13.69, 13.72, 14.04	13.82
972	" " (Tip-Top)	13.79, 14.25, 13.62	13.89
975	Engel's Jefferson Bakery	13.44, 13.09, 13.26	13.26
1030	Federal Biscuit Co.	14.64, 14.78	14.71
971	German-American Bakery	13.97, 14.07, 13.16	13.73
976	J. Goldmunz	12.73, 12.52	17.07
969	The Mohican Co.	16.90, 17.28, 17.04	12.63
970	The Public Market Co.	13.69, 13.55, 13.37	13.54
1031	A. Soderholm (Butter-Krust), sold by L. S. Martin	11.92, 13.12	12.52
1032	P. Sorenson	13.79, 13.30	13.55
	Ave. 10 Bridgeport samples	....	13.87
	Hartford:—		
979	Baggish Bros.	16.86, 16.05	16.46
982	Boston Branch Grocery	15.34, 13.44	14.39
988	Raffaelle Dimeio	14.71, 15.28	15.00
981	Hartford Market Co.	19.12, 18.55	18.84
986	Fred Lenz	15.34, 15.63	15.49
983	Newton, Robertson & Co.	13.90, 14.04	13.97
987	O. K. Bakery	13.16, 12.77	12.97
977	" " (Tip-Top)	13.65, 12.59	13.12
978	Pilgard's Grocery	17.64, 19.65	18.65
985	Preissner Bros.	15.03, 14.71	14.87
984	Vienna Bakery	13.93, 14.71	14.32
980	Werder's Bakery	15.10, 15.49	15.30
	Ave. 12 Hartford Samples	...	15.28
	New Haven:—		
956	J. G. Beck	13.72, 14.53, 14.07	14.11
950	W. Bertram. (Cream)	12.77, 13.33, 12.70	12.93
963	Blanchard's Bakery	14.36, 13.83, 13.51	13.90
958	Cedar Hill Bakery	13.93, 13.62, 13.23	13.59
964	Elm City Bakery	12.45, 12.24, 12.42	12.37
954	L. L. Gilbert Bakery Corp. (Swiss Milk)	13.19, 13.79, 12.91	13.30
952	" " " (Tip-Top)	13.58, 14.04, 13.40	13.67
947	M. Hessler	13.79, 14.22, 14.14	14.05
865	E. W. Hoffmann. (Milk)	15.10, 15.77, 14.71	15.19
953	Lamond and Koebler. (Peerless Home-Made)	12.77, 13.51, 13.37	13.22
945	F. J. Markle Co.	13.83, 12.91, 12.73	13.16
959	Minery's Bakery. (Pure Milk)	13.76, 13.30, 13.65	13.57
957	The Mohican Co.	15.06, 14.92, 15.31	15.10
955	New England Bakery	15.24, 15.31, 15.45	15.33
960	Mrs. E. J. Root's Bakery. (Famous Home-Made)	14.43, 14.46, 14.29	14.39
961	A. Silver	15.38, 15.52, 16.51	15.80
962	S. S. Thompson Co. (Butter)	13.90, 14.53, 14.14	14.19
951	White House Bakery	11.64, 11.96	11.80
946	White Rose Bakery	14.29, 14.07, 14.29	14.22

BREAD.

Per cent. of Water in Individual Loaves.	Composition of Average Loaf. In Original Material. Water.	Ether Extract.	Ash.	Protein (N x 6.25).	Carbohydrates including Fiber.	In Water-free Material. Ether Extract.	Ash.	Protein (N x 6.25).	Carbohydrates including Fiber.	Average Dry Matter per Loaf.	Cost per Pound of Bread.
35.46, 35.90, 35.78	35.71	1.01	1.52	9.21	52.55	1.57	2.36	14.33	81.74	8.88	5.8
29.97, 33.71, 29.61	31.10	1.23	1.48	9.90	56.29	1.78	2.15	14.37	81.70	9.57	5.8
33.78, 33.30, 34.08	33.72	1.56	1.64	9.62	53.46	2.35	2.47	14.52	80.66	8.79	6.0
33.05, 33.68	33.37	1.24	1.19	8.39	55.81	1.86	1.79	12.59	83.76	9.80	5.4
35.71, 35.58, 34.16	35.15	0.37	1.26	9.30	53.92	0.57	1.94	14.34	83.15	8.90	5.8
30.19, 28.72	29.46	0.45	1.75	10.66	57.68	0.64	2.48	15.11	81.77	8.91	6.3
33.57, 33.17, 32.86	33.20	2.71	0.88	8.85	54.36	4.06	1.32	13.25	81.37	11.38	4.7
30.11, 30.77, 30.31	30.40	2.00	1.25	9.92	56.43	2.87	1.80	14.25	81.08	9.42	5.9
33.81, 35.08	34.45	0.60	1.41	9.99	53.55	0.91	2.15	15.25	81.69	8.21	6.4
31.73, 35.27	33.50	3.04	1.28	9.38	52.80	4.57	1.92	14.11	79.40	9.01	5.9
....	33.01	1.42	1.37	9.52	54.68	2.12	2.05	14.21	81.62	9.29	5.8
33.24, 34.19	33.72	0.09	1.57	10.29	54.33	0.14	2.37	15.52	81.97	10.91	4.9
33.82, 31.70	32.76	3.27	1.51	9.87	52.49	5.01	2.25	14.68	78.06	9.67	5.6
27.97, 30.12	29.05	0.09	1.61	11.54	57.71	0.13	2.27	16.26	81.34	10.64	5.3
38.40, 37.02	37.71	0.99	1.11	9.42	50.77	1.59	1.78	15.12	81.51	11.73	4.2
33.40, 33.56	33.48	1.80	1.56	9.76	53.40	2.71	2.35	14.67	80.27	10.30	5.2
31.43, 31.69	31.56	1.47	1.42	10.01	55.54	2.15	2.07	14.63	81.15	9.56	5.7
31.34, 30.00	30.67	1.82	1.45	10.48	55.58	2.63	2.09	15.12	80.16	8.99	6.2
37.68, 30.13	33.91	1.02	1.58	10.48	53.01	1.54	2.39	15.86	80.21	8.66	6.1
31.67, 31.93	31.80	1.90	1.06	9.75	55.49	2.79	1.55	14 30	81.36	12.72	4.3
34.47, 32.16	33.32	1.22	1.55	9.97	53.94	1.83	2.32	14.95	80.90	9.92	5.4
36.29, 37.05	36.67	1.36	1.52	8.94	51.51	2.15	2.40	14.12	81.33	9.07	5.6
33.59, 35.17	34.38	1.54	1.57	9.67	52.84	2.35	2.39	14.74	80.52	10.04	5.2
....	33.25	1.39	1.46	10.01	53.89	2.08	2.19	15.00	80.73	10.18	5.3
37.62, 36.11, 34.77	36.17	1.19	1.60	9.63	51.41	1.86	2.51	15.09	80.54	9.04	5.7
36.72, 35.93, 35.92	36.19	0.72	1.52	9.45	52.12	1.13	2.38	14.81	81.68	8.25	6.2
33.19, 32.37, 32.76	32.77	2.63	1.58	9.83	53.19	3.91	2.35	14.62	79.12	9.34	5.8
33.21, 36.35, 35.30	34.95	1.38	1.35	9.33	52.99	2.12	2.08	14.34	81.46	8.84	5.9
33.09, 31.60, 32.69	32.46	2.12	1.37	9.68	54.37	3.14	2.03	14.33	80.50	8.35	6.5
37.19, 35.31, 36.57	36.36	1.15	1.37	9.83	51.29	1.81	2.15	15.45	80.59	8.46	6.0
40.07, 39.31, 39.20	39.53	0.53	1.45	9.34	49.15	0.88	2.40	15.45	81.27	8.27	5.9
31.65, 32.20, 32.17	32.01	1.30	1.40	9.80	55.49	1.91	2.06	14.41	81.62	9.55	5.7
37.00, 36.90, 36.17	36.69	1.12	1.38	9.53	51.28	1.77	2.18	15.05	81.00	9.62	5.3
37.04, 38.17, 37.64	37.62	0.79	1.33	8.81	51.45	1.27	2.13	14.12	82.48	8.24	6.0
35.85, 37.08, 36.80	36.58	0.62	1.42	9.48	51.90	0.98	2.24	14.95	81.83	8.34	6.1
37.84, 36.18, 38.04	37.35	1.52	1.34	8.98	50.81	2.43	2.14	14.33	81.10	8.50	5.9
32.21, 34.86, 32.43	33.17	0.91	1.21	9.39	55.32	1.36	1.81	14.05	82.78	10.09	5.3
36.48, 35.58, 36.05	36.04	3.55	0.85	9.37	50.19	5.55	1.33	14.65	78.47	9.81	5.2
33.36, 34.87, 34.22	34.15	1.68	1.40	9.06	53.71	2.55	2.13	13.76	81.56	9.48	5.6
30.34, 29.59, 31.22	30.38	0.33	1.53	10.64	57.12	0.47	2.20	15.28	82.05	11.00	5.1
33.65, 33.49, 34.01	33.72	1.08	1.53	9.21	54.46	1.63	2.31	13.89	82.17	9.40	5.6
31.57, 33.32	32.45	2.72	1.26	9.36	54.21	4.03	1.87	13.85	80.25	7.97	6.8
32.68, 32.29, 31.55	32.17	4.10	1.68	9.80	52.25	6.04	2.48	14.45	77.03	9.64	5.6

TABLE I:—

Station No.	Bakery.	Weight of Individual Loaves. oz.	Average Weight of Loaf. oz.
948	Winslow's Bakery, Inc.	14.53, 14.07, 13.93	14.18
966	Ye Olde Time Bakerie	13.37, 14.00, 13.58	13.65
	Ave. 21 New Haven Samples	....	13.89
	New London:—		
998	C. and C. Bakery. (Matchless)	15.52, 14.50	15.01
996	Domestic Bakery	13.83, 13.62	13.73
999	Gager-Crawford Co.	14.53, 13.72	14.13
1003	A. Gordon	14.74, 14.04	14.39
1000	New England Bakery	13.58, 13.58	13.58
997	O. K. Bakery. (Peerless)	12.59, 12.35	12.47
	Ave. 6 New London Samples	....	13.89
	Norwalk:—		
1024	Deklyn's Bakery	12.91, 12.59	12.75
1029	Rundle Bakery	13.69, 13.44	13.57
	Ave. 2 Norwalk Samples	....	13.16
	Norwich:—		
993	The Mohican Co.	13.86, 13.47	13.67
994	O'Connor's Bakery. (Home-Made)	12.95, 13.26	13.11
995	Providence Bakery	14.18, 14.96	14.57
	Ave. 3 Norwich Samples	...	13.78
	South Norwalk:—		
1028	Rundle Bakery, E. Norwalk (Sold by C. A. Lane)	14.57, 13.51	14.04
1027	Owens' Bakery	13.79, 14.07	13.93
1025	John P. Raihi's Bakery	13.02, 13.72	13.37
	Ave. 3 South Norwalk Samples	....	13.78
	Stamford:—		
1005	Andrew Davey	13.02, 13.05	13.04
1010	O. K. Bakery	14.29, 13.79	14.04
1007	Marsh Baking Co. (Butter.) Sold by Samuel Price Co.	12.20, 12.38	12.29
1004	Stamford Bakery,	11.92, 12.10	12.01
1011	West Park Bakery	13.33, 13.09	13.21
	Ave. 5 Stamford Samples	....	12.92
	Waterbury:—		
1023	Bouffard's Bakery	13.26, 14.53	13.90
1013	P. Hock	13.86, 15.34	14.60
1020	Joslin's Bakery	11.71, 11.39	11.55
1015	Kelly's Bakery	16.97, 16.05	16.51
1017	The Mohican Co.	16.40, 16.12	16.26
1014	O'Brien's Bakery. (Gold-Medal)	13.97, 13.97	13.97
1019	Penner & Bohn	13.93, 13.86	13.90
1016	Raymond Bros.	14.11, 14.14	14.13
1021	Trott's Bakery	14.00, 14.36	14.18
1022	Waterbury Market Co.	13.23, 12.91	13.07
	Ave. 10 Waterbury Samples		14.21

BREAD.—*Continued.*

Per cent. of Water in Individual Loaves.	Composition of Average Loaf. In Original Material. Water.	Ether Extract.	Ash.	Protein (N x 6.25).	Carbohydrates including Fiber.	In Water-free Material. Ether Extract.	Ash.	Protein (N x 6.25).	Carbohydrates including Fiber.	Average Dry Matter per Loaf.	Cost per Pound of Bread.
35.56, 35.08, 33.78	34.81	0.72	1.53	10.01	52.93	1.10	2.35	15.36	81.19	9.24	5.6
34.19, 35.30, 32.75	34.08	1.80	1.41	9.41	53.30	2.73	2.14	14.28	80.85	9.00	5.9
....	34.75	1.52	1.41	9.52	52.80	2.33	2.16	14.59	80.92	9.06	5.8
37.68, 36.34	37.01	0.52	1.58	10.15	50.74	0.83	2.51	16.11	80.55	9.45	5.3
35.05, 35.42	35.24	4.37	1.54	9.14	49.71	6.75	2.38	14.11	76.76	8.89	5.8
36.64, 37.41	37.03	1.32	1.20	8.95	51.50	2.09	1.91	14.21	81.79	8.90	5.7
28.55, 27.70	28.13	0.90	1.66	11.76	57.55	1.25	2.31	16.36	80.08	10.34	5.6
35.75, 38.43	37.09	1.57	1.42	8.62	51.30	2.50	2.26	13.70	81.54	8.55	5.9
32.23, 31.20	31.72	0.92	1.57	10.11	55.68	1.35	2.30	14.81	81.54	8.52	6.4
....	34.37	1.60	1.50	9.79	52.74	2.44	2.29	14.92	80.35	9.11	5.8
31.83, 31.67	31.75	1.22	1.65	10.42	54.96	1.78	2.42	15.27	80.53	8.70	6.3
32.40, 33.21	32.81	0.64	1.49	10.08	54.98	0.95	2.22	15.00	81.83	9.11	5.9
....	32.28	0.93	1.57	10.25	54.97	1.36	2.32	15.14	81.18	8.91	6.1
35.68, 35.40	35.54	0.82	1.54	9.02	53.08	1.27	2.39	13.99	82.35	8.81	5.9
29.58, 29.00	29.29	1.88	1.13	9.58	58.12	2.66	1.60	13.55	82.19	9.27	6.1
33.64, 34.95	34.30	0.84	1.39	9.77	53.70	1.28	2.12	14.87	81.73	9.57	5.5
....	33.04	1.18	1.35	9.46	54.97	1.76	2.02	14.13	82.09	9.22	5.8
35.40, 34.63	35.02	0.44	1.37	9.67	53.50	0.68	2.11	14.88	82.33	9.12	5.7
34.32, 35.13	34.73	0.48	1.35	9.72	53.72	0.74	2.07	14.89	82.30	9.09	5.8
34.85, 34.92	34.89	2.13	1.44	9.49	52.05	3.27	2.21	14.59	79.93	8.71	6.0
....	34.88	1.02	1.38	9.63	53.09	1.56	2.13	14.79	81.52	8.97	5.8
33.98, 35.22	34.60	0.72	1.54	9.76	53.38	1.10	2.35	14.93	81.62	8.53	6.1
33.06, 32.61	32.84	1.05	1.51	9.92	54.68	1.56	2.25	14.78	81.41	9.43	5.7
35.86, 34.78	35.32	0.15	1.33	10.03	53.17	0.23	2.05	15.51	82.21	7.95	6.5
34.16, 33.45	33.81	0.22	1.80	8.94	55.23	0.33	2.72	13.51	83.44	7.95	6.7
33.19, 35.10	34.15	0.79	1.48	9.05	54.53	1.20	2.25	13.74	82.81	8.70	6.1
....	34.14	0.59	1.53	9.54	54.20	0.88	2.32	14.50	82.30	8.51	6.2
32.61, 33.24	32.93	0.89	1.28	9.87	55.03	1.33	1.91	14.72	82.04	9.32	5.8
37.17, 38.27	37.72	1.04	1.13	8.73	51.38	1.67	1.81	14.02	82.50	9.09	5.5
31.82, 29.61	30.72	1.33	1.53	10.28	56.14	1.92	2.21	14.84	81.03	8.00	6.9
34.35, 32.91	33.63	1.44	1.51	10.25	53.17	2.17	2.28	15.44	80.11	10.96	4.8
31.36, 32.86	32.11	0.65	1.45	9.80	55.99	0.96	2.14	14.43	82.47	11.04	4.9
32.36, 31.76	32.06	1.20	1.28	9.49	55.97	1.77	1.88	13.97	82.38	9.49	5.7
32.18, 29.75	30.97	2.36	1.25	9.76	55.66	3.42	1.81	14.14	80.63	9.60	5.8
34.86, 35.41	35.14	0.73	1.47	10.30	52.36	1.13	2.27	15.88	80.72	9.16	5.7
33.27, 34.20	33.74	1.81	1.38	9.47	53.60	2.73	2.08	14.30	80.89	9.40	5.6
32.98, 30.67	31.83	0.90	0.83	11.36	55.08	1.32	1.22	16.66	80.80	8.91	6.1
....	33.09	1.24	1.31	9.93	54.43	1.85	1.96	14.84	81.35	9.50	5.7

TABLE I:—

Station No.	Bakery.	Weight of Individual Loaves. oz.	Average Weight of Loaf. oz.
	Loaves of Varying Prices.		
1001	(3 cts.) The Mohican Co., New London	11.85, 12.45	12.15
968	(4 cts.) N. Jevolino, New Haven	15.13, 15.13	15.13
967	" Wm. McLeman, New Haven	13.16, 13.62, 13.97	13.58
949	" F. Pfrommer, New Haven	11.75, 11.96, 11.57	11.76
991	(8 cts.) A. Jacobson, Norwich	24.34	24.34
990	" Chas. Stelan, Norwich	29.66	29.66
1012	" J. O'Brien, Waterbury. (Gold Medal)	19.05	19.05
	Bread not made in Connecticut.		
989	(10 cts.) Dexter's Mother's Bread, Springfield, Mass. (Cash Grocery, Hartford)	27.44	27.44
1002	(5 cts.) Dexter's Five-Cent Bread, Springfield, Mass. (L. C. Gadbois, New London)	13.47, 13.44	13.46
1018	(5 cts.) Dexter's Five-Cent Bread, Springfield, Mass. (H. R. Hotchkiss, Waterbury)	13.97, 13.40	13.69
973	(5 cts.) Fleischmann's Peter Pan Bread, New York. (Village Store Co., Bridgeport)	13.23, 13.40, 12.84	13.16[2]
1009	(5 cts.) Shults Bronx Bread, New York. (Brown Bros., Stamford)	12.03, 12.80	12.42[3]
1008	(5 cts.) Ward's Dainty Maid Bread, New York. (Brown & Webb, Stamford)	12.45, 13.12	12.79[3]
992	(5 cts.) Ward's Tip Top Bread, So. Providence, R. I. (R. F. Smith, Norwich)	13.47, 13.93	13.70
1026	(5 cts.) Ward's Tip Top Bread, Bronx, N. Y. (A. F. Beckman & Co., So. Norwalk)	13.23, 13.16	13.20
1006	(5 cts.) Ward's Tip Top Bread, New York. (W. W. Waterbury, Stamford)	13.05, 13.26	13.16[3]
	Maximum of all samples	19.65[1]	18.84[1]
	Minimum " "	11.39[1]	11.55[1]
	Average " "	....	13.98[1]

[1] 5 cent loaves only. [2] Guaranteed weight 13 oz. [3] Guaranteed weight 12 oz.

brought promptly to the laboratory, where they were weighed at once and a quarter-section taken for analysis, thus insuring the proper relation between crust and crumb. The quarter-section was weighed, cut into thin slices, and dried in the air over steam pipes until dry enough for grinding.

Two hundred and one loaves, representing the product of seventy-nine Connecticut, one Springfield and three New York

BREAD.—*Continued.*

Per cent. of Water in Individual Loaves.	Composition of Average Loaf. In Original Material. Water.	Ether Extract.	Ash.	Protein (N x 6.25).	Carbohydrates including Fiber.	In Water-free Material. Ether Extract.	Ash.	Protein (N x 6.25).	Carbohydrates including Fiber.	Average Dry Matter per Loaf.	Cost per Pound of Bread.
34.02, 31.69	32.86	0.54	1.38	9.54	55.68	0.80	2.06	14.21	82.93	8.16	3.9
31.61, 36.18	33.95	0.08	1.46	11.07	53.44	0.12	2.21	16.76	80.91	10.00	4.2
31.00, 34.35, 31.80	32.38	1.62	1.47	9.35	55.18	2.40	2.17	13.83	81.60	9.18	4.7
32.84, 34.98, 33.31	33.71	0.76	1.44	9.64	54.45	1.15	2.17	14.54	82.14	7.80	5.4
31.64	31.64	0.31	1.67	9.76	56.62	0.45	2.44	14.28	82.83	16.64	5.3
29.36	29.36	0.12	1.00	10.13	59.39	0.17	1.42	14.34	84.07	20.95	4.3
32.90	32.90	1.22	1.23	9.45	55.20	1.82	1.83	14.08	82.27	12.78	6.7
38.45	38.45	0.36	1.50	9.28	50.41	0.58	2.44	15.08	81.90	16.89	5.8
36.98, 37.76	37.37	0.44	1.70	9.40	51.09	0.70	2.71	15.01	81.58	8.43	5.9
37.86, 37.49	37.68	0.29	1.77	9.41	50.85	0.47	2.84	15.09	81.60	8.53	5.8
35.08, 33.67, 33.50	34.08	0.60	1.45	10.69	53.18	0.91	2.20	16.22	80.67	8.67	5.1
32.97, 31.39	32.18	0.58	1.62	10.35	55.27	0.86	2.39	15.26	81.49	8.42	6.4
31.15, 32.14	31.65	0.83	1.45	10.21	55.86	1.21	2.12	14.94	81.73	8.74	6.3
35.08, 35.43	35.26	0.84	1.33	9.60	52.97	1.30	2.05	14.83	81.82	8.87	5.8
33.60, 32.48	33.04	0.92	1.60	9.81	54.63	1.37	2.39	14.65	81.59	8.84	6.1
27.82, 38.32	33.07	0.82	1.35	9.22	55.54	1.23	2.02	13.77	82.98	8.81	6.1
	39.53	4.37	1.80	11.76	58.12	6.75	2.72	16.76	83.76	12.72[1]	6.9
	28.13	0.08	0.83	8.39	49.15	0.12	1.32	12.59	76.76	7.95[1]	4.2
	33.80	1.21	1.42	9.73	53.84	1.83	2.15	14.69	81.33	9.24[1]	5.7

bakers, were examined. Moisture was determined in every loaf, the other ingredients only in a single loaf unless some abnormality in this loaf was noted. The analyses, reported in Table I, are calculated to the average water-content of the loaves purchased from each particular baker. In 193 cases the loaves cost five cents, in three four cents, in three eight cents, and in one each three and ten cents.

Weight of Loaves.

The five-cent loaves ranged in weight from 11.39 to 19.65 ozs., average 13.98 ozs. Six of these weighed less than 12 ozs., twenty-five from 12 to 13 ozs., eighty-two from 13 to 14 ozs., forty-two from 14 to 15 ozs., 18 from 15 to 16 ozs., eight from 16 to 17 ozs., three from 17 to 18 ozs., one from 18 to 19 ozs., and one over 19 ozs. The two three-cent loaves weighed 11.85 and 12.45 ozs.; of the four-cent loaves three weighed from 11.6 to 12 ozs., three from 13.2 to 14 ozs., and two 15.2 ozs.; the three eight-cent loaves weighed 19.1, 24.3 and 29.7 ozs.; the ten-cent loaf, 27.4 ozs.

A similar investigation was made by the writer in New Jersey in 1895. At that time forty loaves, costing four or five cents, weighed from 12.7 to 21.8 ozs., average, 16.4 ozs. In other words, in 1895 in New Jersey 58 per cent. of the five-cent loaves weighed over 16 ozs. and 83 per cent. over 15 ozs., while in 1912 in Connecticut only 7 per cent. weighed over 16 ozs. and only 16 per cent. over 15 ozs. Assuming similar conditions in these two states, the average weight of the five-cent loaf has shrunk since 1895 from 16.4 to 14 ozs., or 15 per cent.

Variations in Weight of Loaves from Same Bakery.

In fifty-three instances two, and in twenty-seven, three, five-cent loaves were bought of the same baker at the same time, and represented the same baking. The average variation in weight of loaves from the same baker was 0.53 oz. These variations are summarized as follows:

7 from 0 to .125 oz.
15 from .13 to .25 oz.
23 from .26 to .50 oz.
15 from .51 to .75 oz.
9 from .76 to 1.00 oz.
8 from 1.01 to 1.25 ozs.
3 from 1.50 to 2.00 ozs.

In other words, the product of 26 per cent. of the bakers varied less than 0.25 oz., 56 per cent. less than 0.50 oz., and 75 per cent. less than 0.75 oz., while with 11, or 14 per cent. of the bakers, the variation exceeded 1 oz. The analyses of the samples indicated that these variations were seldom due to differences in moisture-content, but rather to irregularities in the loaves themselves.

Chemical Composition of Bread.

The samples showed wide variations in all their ingredients. The maxima, minima and averages are given in the following tabulation:

	Max.	Min.	Ave.
Water	39.53	28.13	33.80
Ether Extract	4.37	0.08	1.21
Ash	1.80	0.83	1.42
Protein	11.76	8.39	9.73
Carbohydrates and Fiber	58.12	49.15	53.84
Dry Matter per five-cent loaf, oz.	11.73	7.95	9.24

The moisture-content of the individual loaves ranged from 27.70 to 40.07 per cent.; twenty-two contained from 27.7 to 30.9, eighty-four from 30 to 32.9, sixty-nine from 33 to 35.9, and twenty-six over 36 per cent. In some instances, at least, the bread contained excessive water. This is shown more strikingly when the actual amount of dry matter per loaf is considered. In the five-cent loaves this ranged from 7.95 to 12.72 ozs., average, 9.24 oz. Four bakers supplied less than 8 ozs. of dry matter per loaf, seventy-three from 8 to 10 ozs., twelve from 10 to 12 ozs., and one over 12 ozs.

The ether extract (fat) also showed a wide range, from 0.08 to 4.37 per cent. These differences are largely due to the methods of the bakers. In some cases only flour, yeast and salt are used, while in others milk, butter, lard and sugar, either alone or in combination, are employed. The variations in fat are also due in part to the fact, noted by several investigators, that in the process of baking a part of the fat is either destroyed or rendered non-extractable by ether. In three samples the amount of fat found is much lower than could have resulted from the use of any brand of flour.

The variations in ash, protein and carbohydrates are due in part to differences in moisture content, but even more to the materials used.

Bread of Different Cities.

Table II shows the average composition of the five-cent loaves produced in nine Connecticut cities. The average weight of the loaf ranged from 12.92 to 15.28 ozs., Stamford showing the lightest and Hartford the heaviest loaf, a difference of 2.36 ozs.

TABLE II:—AVERAGE COMPOSITION OF FIVE CENT LOAVES OF BREAD SOLD IN DIFFERENT CITIES.

City.	Bakeries represented.	Average Weight.	Composition of Average Loaf. In Original Material. Water.	Ether Extract.	Ash.	Protein (N x 6.25).	Carbohydrates including Fiber.	In Water-free Material. Ether Extract.	Ash.	Protein (N x 6.25).	Carbohydrates including Fiber.	Average Dry Matter per Loaf.	Cost per Pound of Bread.
		oz.										oz.	cts.
Bridgeport	10	13.87	33.01	1.42	1.37	9.52	54.68	2.12	2.05	14.21	81.62	9.29	5.8
Hartford	12	15.28	33.25	1.39	1.46	10.01	53.89	2.08	2.19	15.00	80.73	10.20	5.3
New Haven	21	13.89	34.75	1.52	1.41	9.52	52.80	2.33	2.16	14.59	80.92	9.06	5.8
New London	6	13.89	34.37	1.60	1.50	9.79	52.74	2.44	2.29	14.92	80.35	9.11	5.8
Norwalk	2	13.16	32.28	0.93	1.57	10.25	54.97	1.36	2.32	15.14	81.18	8.91	6.1
Norwich	3	13.78	33.04	1.18	1.35	9.46	54.97	1.76	2.02	14.13	82.09	9.22	5.8
South Norwalk	3	13.78	34.88	1.02	1.38	9.63	53.09	1.56	2.13	14.79	81.52	8.97	5.8
Stamford	5	12.92	34.14	0.59	1.53	9.54	54.20	0.88	2.32	14.50	82.30	8.51	6.2
Waterbury	10	14.21	33.09	1.24	1.31	9.93	54.43	1.85	1.96	14.84	81.35	9.50	5.7
Average of all samples		13.98	33.80	1.21	1.42	9.73	53.84	1.83	2.15	14.69	81.33	9.24	5.7

per loaf, or 1.69 ozs. of dry matter. The average Hartford loaf also contained more protein and fat and almost as much carbohydrates as that sold in Stamford. Of course these averages are not necessarily conclusive for those cities in which only a few samples were taken. However, in each town all the more representative bakeries were visited, and the averages as given probably reflect quite accurately the existing conditions in the cities named.

Cost of Bread.

The bread cost from 4.2 to 6.9 cents per lb., with an average of 5.7 cents. The average cost per lb. in the three-cent loaf was 3.9 cents, in the four-cent, 4.8 cents, in the five-cent, 5.8 cents, in the eight-cent, 5.4 cents, and in the ten-cent, 5.8 cents. The cheapness of the three- and four-cent loaves indicated, therefore, a real saving, as far as quantity is concerned, because the relative decrease in price was greater than the decrease in weight. The data for the eight-cent loaves are limited to three samples, but these indicate that this sized loaf is a cheaper purchase than the five-cent loaf, about double the weight of bread being furnished for an increase in price of but 60 per cent.

The average cost per lb. in the five-cent loaves in the different cities ranged from 5.3 to 6.2 cents, Hartford showing the lowest and Stamford the highest cost. On the average, the cost per pound of bread in Hartford was 0.4 cent lower than in any of the other cities. Bridgeport, New Haven, New London, Norwich, South Norwalk and Waterbury showed very similar costs, while in Norwalk the cost was almost as high as in Stamford.

Guaranteed Weight.

Fleischmann's Peter Pan Bread, claiming a weight of 13 ozs., weighed 12.84, 13.23 and 13.40 ozs. *Shults Bronx Bread,* claiming 12 ozs., weighed 12.03 and 12.80 ozs. *Ward's Dainty Maid Bread,* claiming 12 ozs., weighed 12.45 and 13.12 ozs. *Ward's Tip Top Bread,* claiming 12 ozs., weighed 13.05 and 13.26 ozs. There appears to be no difficulty, therefore, in the bakers maintaining the weight claimed.

CANDY.

One hundred and eighty-nine samples were examined, mostly of the cheaper sorts. These included the following:

35 Mixed chocolates and chocolate creams.
14 Caramels.
25 Marshmallows.
11 Marshmallows in combination.
12 Wafers and mottoes.
8 Molasses kisses.
6 Fudge.
13 Jelly Beans.
20 Gum Drops.
11 Licorice Lozenges.
4 Coated peanuts.
30 Miscellaneous.

The examination was directed chiefly to determine added mineral matter and coal-tar dyes, and the accuracy of the weight claimed for the various candies.

Mixed Chocolates and Chocolate Creams.

Thirty-five samples were examined. The fat in the coating ranged from 28.58 to 49.64 per cent.; the ash in the coating from 0.72 to 2.26 per cent. The fat appeared in all cases to be cocoa fat and no mineral adulterant was detected.

The cost of the samples ranged from fourteen to seventy cents per pound.

TABLE III:—MIXED CHOCOLATES AND CHOCOLATE CREAMS.

Sample No.	Brand, or Dealer.	Weight. Claimed.	Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Analysis of Chocolate Coating. Fat.	Babyro-Refraction @ 40° C.	Melting Point of Fat.	Ash.
		gms.	gms.	cts.	cts.	%	°	°C.	%
1137	Russell's Chocolates (Cambridge, Mass.)	227	234	35	68	32.76	45.2	28–33	1.57
1138	H. D. Foss & Co.'s Chocolates (Boston, Mass.)	227	251	30	54	35.71	45.5	28–32	1.52
1139	Barr's Saturday Candy	454	433	29	30	34.27	45.5	30–35	1.28
1140	Lenox Necco Sweets, Chocolates (Boston, Mass.)	227	241	25	47	40.65	45.5	30–35	1.78
1141	Violet Assort, Chocolates (Touraine Conf. Co., Boston, Mass.)	454	430	29	31	35.63	45.0	29–32	1.38
1142	Assorted Bon Bons & Chocolates (Mirror Candies, N. Y.)	454	457	29	29	30.91	42.5	29–32	1.17
1370	Lowney's Cameo Assort. Chocolates (Boston, Mass.)	227	235	25	48	33.26	46.0	33–35	2.26
1371	Sparrow's Empress Chocolates (Boston Conf. Co.)	227	226	35	70	36.29	42.0	29–32	1.48
1372	*Bradley & Smith's Chocolate Creams	227	225	10	19	31.46	46.5	29–31	1.05
1381	Assorted. Olympia Candy Co., New Haven	227	215	10	21	35.78	43.0	33–35	1.60
1382	Assorted. Sold by Shartenberg & Robinson, New Haven	227	238	8	15	36.67	40.0	34–36	1.70
1407	*Kibbe Co.'s, Chocolate Creams (Springfield, Mass.)	227	218	10	21	35.65	46.0	33–36	1.78
1409	Dorothy Chocolates Assorted	227	233	25	49	33.42	45.5	29–32	1.24
1412	Chocolate Creams. Olympia Candy Co., Stamford	227	225	10	20	37.21	44.0	28–32	1.34
1419	Chocolate Creams. Wm. Matthews, Glenbrook	227	236	13	25	32.57	45.0	30–32	1.46
1423	Chocolate Creams. Eagle Candy Co., Stamford	227	210	10	22	31.48	45.0	30–33	1.38
1436	Bell's Chocolates	227	218	10	21	32.69	45.0	28–31	1.17
1441	Sold by Norwalk Candy Co. (Columbus, N. Y.	227	217	10	21	35.29	40.5	30–33	1.10
1491	Sparrow's Chocolates (Boston Conf. Co.)	...	238	10	19	49.64	46.0	28–32	2.23
1492	Chocolate Creams. Olympia Candy Co., Bridgeport	227	238	10	19	30.52	46.0	31–34	0.83
1495	Sold by Atlantic Fruit Store, Bridgeport	227	232	10	20	37.09	46.0	30–33	1.32
1496	Sold by Musanti Conf., Bridgeport (Cambridge, Mass.)	227	229	20	40	39.89	46.0	31–34	1.12
1503	Howland's Dry Goods Store, Bridgeport	227	243	20	37	37.20	46.0	26–28.5	1.62
1517	Riker's Drug Store, Bridgeport	227	235	15	29	41.84	46.0	28–30.5	1.81
1519	Lane's Confectionery, Bridgeport	227	235	20	39	34.45	46.0	27.5–28	1.46
1520	Sold by 1367 Stratford Ave., Bridgeport	227	219	15	31	33.34	45.5	31–32	1.38
1526	Sold by Store, Cor. Stratford Ave. and E. Main St., Bridgeport	227	217	10	21	28.58	46.0	27–29	0.72
1527	Star Confectionery, Bridgeport	227	229	13	25	34.66	45.0	30.5–31	1.87
1539	Sold by G. N. Jensen, Hartford	227	238	10	19	41.12	46.5	33.5–35	1.51
1545	Schraft's Chocolates	227	227	20	40	35.48	46.5	30–32	1.31
1569	Morris, Hartford	227	230	10	20	35.39	45.0	31.5–32.5	1.43
1574	Darrow & Ruden, New York	454	470	15	14	32.09	46.5	29–31	1.17
1580	Sold by Kelly's Bakery, Waterbury	227	239	10	19	31.53	47.0	31–32	1.15
1582	Sold by M. Baz, Waterbury	227	247	10	18	40.44	47.0	31.34	1.63
1590	Raspberry Chocolate Cream, Delatour (Stamped on each candy)	227	236	20	38	33.18	46.5	31.5–32.5	1.31

* Statement of dealer.

In all but nine samples a correct weight of candy was delivered. *Barr's Saturday Candy* and *Touraine Violet Assorted Chocolates* contained 0.7 and 0.8 oz. less than the pound claimed. *Kibbe's Chocolate Creams, Bell's Chocolates* and chocolates sold by the store at *1367 Stratford Avenue, Bridgeport,* were each short 0.3 oz. on a half pound purchase. Chocolates sold by the *Norwalk Candy Co.* and the store at corner of *Stratford Avenue and E. Main Street, Bridgeport,* were each short 0.4 oz. in a half pound. Those sold by the *Olympia Candy Co., Stamford,* were short 0.42 oz. and those of the *Eagle Candy Co., Stamford,* were short 0.6 oz. in a half pound. Most of these shortages were apparently due to the practice of selling cardboard for candy.

Caramels.

Fourteen samples were examined. The ash ranged from 0.63 to 1.46 per cent. No adulteration was detected. In all but two of the samples the individual caramels were wrapped in oiled paper.

The cost ranged from 8 to 60 cents per lb.

TABLE IV:—CARAMELS.

Sample No.	Brand, or Dealer.	Weight. Claimed.	Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Ash.
		gms.	gms.	cts.	cts.	%
1392	* Cream. E. F. Hopton, Binghamton, N. Y.	227	291	5	8	0.48
1404	Standard. Lancaster, Pa.	227	236	12	23	1.44
1410	* Huyler's. New York. (Many with nuts)	227	228	30	60	1.13
1416	* Chocolate. Wardwell's Confectionery, Stamford	...	199	15	34	0.65
1420	* Assorted. (Columbia)	227	225	15	30	1.17
1429	* Assorted. Sold by F. W. Woolworth & Co., Stamford	227	225	5	10	0.63
1442	† Vanilla. Sold by Morelli & Carbonne, Norwalk	227	237	13	28	1.93
1500	* Vanilla. (Columbus), with nuts	227	230	13	26	1.46
1504	* Chocolate. Lane's Confectionery, Bridgeport	227	240	20	38	0.64
1506	* Chocolate. E. L. Graves, Bridgeport	227	222	15	31	1.18
1538	Chocolate. Capital Candy Co., Hartford	227	226	15	30	0.92
1542	* Assorted. Peterson's Candy Kitchen, Hartford	227	220	13	27	0.65
1570	* Chocolate. Sold by S. J. Rickman, Hartford	227	240	20	38	1.28
1572	† Vanilla. Sold by Sam Spalter, Hartford	227	211	10	22	1.67

* Wrapped in oiled paper. † Wrapped in brown oiled paper.

TABLE V:—

Sample No.	Brand, or Dealer.	Weight. Claimed.	Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Ash.	Nitrogen.
		gms.	gms.	cts.	cts.	%	%
1374	Hauff's Confectionery, New Haven............	227	232	25	49	0.73	0.38
1375	Extra Fine Marshmallows (Mirror Candies)....	227	237	20	38	0.55	0.37
1376	Athens Candy Kitchen, New Haven..........	227	211	13	28	0.31	0.47
1377	Grand 5 and 10 Cent Store, New Haven. (Brownish-yellow coating.)......................	227	228	5	10	0.49	....
1378	Marshmallow Santa Claus (surrounded by paper)	...	99	12	55	0.19	0.56
1379	S. S. Kresge, New Haven................ ...	227	272	5	8	0.31	6.41
1406	Boston Candy Kitchen......................	227	235	10	19	0.32	0.48
1607	House of Hasselbach, New Haven............	227	229	20	40	0.35	0.09
1417	Mason & Legenheimer, New York............	227	236	10	19	0.31	0.43
1427	Sold by J. R. Evans, Stamford................	227	221	5	10	0.58	0.42
1439	Henry Heide, New York....................	99	94	10	48	0.51	0.46
1440	Sold by Eagle Confectionery, Norwalk........	...	170	10	27	0.31	0.52
1499	Sold by Peter Arillo, Bridgeport..............	...	101	10	45	0.22	0.47
1505	Sold by E. L. Graves, Bridgeport.............	227	216	20	42	0.35	0.19
1514	S. S. Kresge, Bridgeport.....................	227	227	5	10	0.29	0.43
1523	5 and 10 Cent Store, 550 E. Main St., Bridgeport	227	206	5	11	0.34	0.44
1529	Star Confectionery, Bridgeport...............	227	224	10	20	0.25	0.64
1548	Palace of Sweets, Hartford..................	227	227	10	20	0.28	0.40
1552	Knorpp's Real German "Fairy Foam" Candies. (Babies.)................................	...	84	10	54	0.20	0.66
1556	Holdstock's, Hartford	227	213	15	32	0.21	0.42
1559	Hartford Candy Kitchen, Hartford............	227	225	10	20	0.32	0.42
1566	Brown, Thomson & Co., Hartford...........	227	280	10	16	0.21	0.28
1589	H. G. Woolworth Co., Waterbury............	227	229	5	10	0.25	0.37
1592	Palace Confectionery, Waterbury.............	227	240	10	19	0.19	0.51
1598	Angelus, Rueckheim Bros. & Eckstein, Chicago	86	111	10	41	0.29	0.47

No short weight was detected except in the vanilla caramels sold by *Sam Spalter, Hartford,* which were short 0.56 oz. in a half pound.

Marshmallows.

Twenty-five samples were examined. Many of the samples contained much adhering powder, consisting largely of corn starch. This ranged from 1 to 52 grams per pound. It was particularly large in *Mirror Extra Fine Marshmallows* and those sold by the *5 and 10 Cent Store, 550 E. Main Street, Bridgeport,* in which it amounted to nearly 2 ozs. in the pound. The ash ranged from 0.19 to 0.73 per cent., indicating no added mineral adulterant. The nitrogen found, except in *Hasselbach's* and possibly *Graves',* indicated the use of gelatin, the presence of which was confirmed by other tests as shown in the table.

MARSHMALLOWS.

Adhering Powder, per lb.	Amount of Solution on Standing 1 hr. in Cold Water.	Amount of Solution on Heating for 10 min.	Result on Cooling Heated Solution.	Precipitate with 95 per cent. Alcohol.	Precipitate with Picric Acid.
gms.					
17	Nearly complete	Turbid with foam....	Cons. gelat. ppt.....	Heavy.....	Heavy.
47	Very little.......	Turbid with foam....	Cons. gelat. ppt....	Heavy.....	Heavy.
5	Much...........	Nearly clear	Slight gelat. ppt....	Medium...	Heavy.
0	....	....	....	....	....
0	Very little.......	Nearly clear.........	Very slight gelat. ppt.	Small	Heavy.
8	Much...........	Slightly turbid.......	Cons. gelat. ppt....	Medium...	Heavy.
10	Very little.......	Slightly turbid.......	Medium gelat. ppt..	Heavy.....	Heavy.
..	Much...........	Turbid	Cons. gelat. ppt....	Heavy.....	Slight.
8	Much...........	Turbid	Cons. gelat. ppt....	Heavy.....	Heavy.
7	Little...........	Turbid	Cons. gelat. ppt....	Heavy.....	Heavy.
5	Much...........	Turbid with foam....	Slight gelat. ppt....	Heavy.....	Heavy.
9	Little...........	Nearly clear.........	Very slight gelat. ppt.	Heavy.....	Heavy.
4	Very little.......	Slightly turbid.......	Slight gelat. ppt....	Very heavy.	Heavy.
8	Little...........	Turbid	Cons. gelat. ppt....	Heavy.....	Slight.
18	Much...........	Turbid	Cons. gelat. ppt....	Heavy.....	Heavy.
52	Little...........	Sl. turbid with foam.	Slight gelat. ppt....	Medium...	Heavy.
6	Little...........	Turbid	Cons. gelat. ppt....	Very heavy.	Heavy.
6	Little...........	Turbid	Cons. gelat. ppt....	Heavy.....	Heavy.
0	Very little.......	Slightly turbid......	Very slight gelat. ppt.	Heavy.....	Slight.
1	Little...........	Clear, yellowish.....	No ppt	Heavy.....	Heavy.
6	....	....	....	....	....
11	....	....	....	....	....
2	....	....	....	....	....
5	....	....	....	....	....
4	....	....	....	....	....

The cost ranged from 8 to 55 cents per pound. This is doubtless to a large extent influenced by delicacy of flavor and fineness of texture, qualities which are not revealed by chemical analysis.

Five samples showed short weight. *Henry Heide's* were short 0.2 ozs. in 3.3 ozs., or 0.9 oz. in the pound. *Graves'* were short 0.4 oz., *Holdstock's*, 0.5 oz., *Athens Candy Kitchen, New Haven*, 0.56 oz., and *5 and 10 Cent Store, 550 E. Main Street, Bridgeport*, 0.74 oz., in the half pound. The last named firm in selling a "half pound" of marshmallows, actually delivered 6.4 ozs. of marshmallows with 0.9 oz. of adhering powdered sugar and corn starch.

Marshmallows in Combination.

Eleven samples were analyzed. The three samples coated with chocolate contained from 34.12 to 40.25 of cocoa fat in the coverings.

TABLE VI:—MARSHMALLOWS IN COMBINATION.

Sample No.	Brand, or Dealer	Weight.		Cost.		Ash.	Analysis of chocolate coating.		
		Claimed.	Found.	Per Package.	Per Pound.		Fat.	Butyro Refractive Index @ 40° C.	Melting Point of Fat.
		gms.	gms.	cts.	cts.	%	%	%	°C.
1387	Marshmallow Carmels. Olympia Candy Co., New Haven	227	226	13	26	1.41	......	....	......
1389	" " Chocolate Shop, New Haven	227	235	20	39	....	......	....	......
1402	" " Riker-Jaynes, New Haven	227	233	19	37	0.75	......	....	......
1430	" " Xanthos Candy Co., Stamford	227	229	13	26	1.01	......	....	......
1555	" " Holdstock's, Hartford	227	215	20	42	1.09	......	....	......
1385	Chocolate Marshmallow Sticks. Louis' Candy Store, New Haven	....	186	10	24	....	......	....	......
1408	* Chocolate Marshmallows. John Wilkinson, West Haven	227	240	20	38	1.58	36.37	46.0	31–35
1449	" " Olympia Candy Co., Bridgeport	227	221	13	27	1.35	34.12	45.0	28–30
1510	" " Cigars, Store, 1312 Stratford Ave. Bdg't.	....	192	10	24	....	......	....	......
1547	" " George Bros., Hartford	....	252	12	22	1.31	40.25	46.5	31–32.5
1576	" " Turkeys, Jim Tolisano, Hartford	....	180	10	25	....	......	....	......

* Statement of dealer.

TABLE VII:—WAFERS AND MOTTOES.

Sample No.	Brand, or Dealer.	Weight. Claimed.	Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Ash.	Polarization at 21° C. Direct.	Polarization at 21° C. After Inversion.	Insoluble Matter.	Colors.
		gms	gms	cts	cts	%	°V.	°V.	%	
1135	Boston Wafers (C. A. Briggs Co.)	...	111	5	20	0.05	98.0	—25.52	1.75	*Erythrosin, *Amaranth, *Naphtol Yellow S, *Orange I, Green (unidentified).
1136	" " Wintergreen (C. A. Briggs Co.)	...	109	5	21	0.07	98.0	—26.40	2.34	Not colored.
1373	Sultan Wafers, Cinnamon (Kibbe)	...	113	5	20	0.11	98.0	—15.40	6.83	*Erythrosin, *Amaranth.
1415	Mottoes, Olympia Candy Co., Stamford	227	193	20	42	0.13	99.0	— 7.92	7.51	*Erythrosin, Yellow (unidentified).
1507	" F. W. Woolworth & Co., Bridgeport	227	238	5	10	0.10	97.6	— 9.24	9.98	*Erythrosin, *Amaranth, *Napthol Yellow S, *Orange I, Natural Color (unidentified).
1512	" A. Rovegno, Bridgeport	227	230	10	20	0.07	100.0	—19.80	1.65	*Erythrosin, *Amaranth, *Napthol Yellow S, *Orange I.
1518	" Store, 939 E. Main St., Bridgeport	227	235	10	19	0.06	100.6	—19.80	2.77	*Napthol Yellow S, *Orange I.
1546	" George Bros., Hartford	227	236	10	19	0.08	102.4	—22.66	1.60	*Erythrosin, *Napthol Yellow S, *Orange I.
1550	" F. W. Woolworth & Co., Hartford	227	228	5	10	0.11	98.0	— 7.04	10.63	*Erythrosin, *Amaranth, *Orange I.
1558	" Brown, Thomson & Co., Hartford	227	228	10	20	0.07	102.4	—20.68	0.78	*Erythrosin, *Napthol Yellow S, *Indigo Carmine.
1560	" Domenico Mainello, Hartford	227	236	10	19	0.08	102.0	—22.44	0.81	*Erythrosin, *Orange I.
1596	" Star Confectionery, Waterbury	227	232	20	39	0.08	98.0	—19.80	1.19	*Erythrosin, *Napthol Yellow S.

* Permitted coal-tar colors.

The cost per pound ranged from 22 to 42 cents.

No marked shortage in weight was found except in *Holdstock's Marshmallow Caramels,* which were short 0.42 oz. in the half pound.

Wafers and Mottoes.

Twelve samples were examined. The ash was inconsiderable in all cases, ranging from 0.05 to 0.13 per cent. The samples contained considerable quantities of insoluble matter (starch), ranging from 0.78 to 10.63 per cent. *Kibbe's Cinnamon Sultan Wafers,* mottoes of the *Olympia Candy Co., Stamford,* and two samples of *Woolworth's Mottoes,* contained large quantities, from 6.83 to 10.63 per cent.

All but one of the samples contained artificial color. Erythrosin was detected in ten cases, amaranth in five, naphthol yellow S in six, orange I in seven, and indigo-carmine in one. One sample was probably colored with naphthol yellow, and one each with an unidentified green, yellow and natural color. In all cases where the color was positively identified it was one of the seven permitted coal-tar dyes. The green in *Brigg's Boston Wafers* and the yellow in the mottoes of the *Olympia Candy Co., Stamford,* and in those of the *Star Confectionery, Waterbury,* were not permitted dyes, but we failed to identify them.

The samples cost from 10 to 42 cents per lb. Of the nine samples sold for a definite weight, one-half pound, only one showed a material shortage. This was **1415**, *Olympia Candy Co., Stamford,* which was short 1.2 ozs. in the half pound.

Molasses Kisses.

Eight samples were examined. In seven of these the ash ranged from 0.20 to 0.92 per cent. *Joslin and Allen's Ta-To,* however, contained 3.78 per cent., an excessive amount. One sample was colored with amaranth, a permitted coal-tar color.

The cost ranged from 17 to 22 cents per pound.

All but two of the samples showed short weight, ranging from 0.2 to 1.5 ozs., in the half pound. The samples from *Joslin and Allen,* the store at *1367 Stratford Avenue, Bridgeport,* the *Bradley Smith Co.,* and from the *Olympia Candy Co.,* were short 0.5, 0.6, 0.6 and 1.5 ozs., respectively, in the half pound.

Fudge.

The six samples examined showed an ash ranging from 0.35 to 0.89 per cent. They cost from 10 to 44 cents per pound. Only one sample was materially short weight, *Hasselback's Marshmallow Fudge,* which was short 0.6 oz. in the half pound.

TABLE VIII:—MOLASSES KISSES AND FUDGE.

Sample No.	Brand or Dealer.	Weight. Claimed.	Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Ash.
	Molasses Kisses.	gms.	gms.	cts.	cts.	%
1393	The Runkle Co., Kenton, O.	227	221	10	21	0.73
1414	Olympia Candy Co., Stamford	227	185	8	20	0.92
1434	The Bradley-Smith Co., New Haven (Satin Puffs).	227	210	10	22	0.73
1445	H. E. Burdick, Woonsocket, R. I., (U. O. Z. Brand)	227	218	8	17	0.86
1530	*Sold by Store, 1367 Stratford Ave., Bridgeport	227	211	10	22	0.20
1568	†The Kibbe Co. (Delicious New Kings)	227	234	10	19	0.86
1577	Silver Bros., Hartford, (Silk Kisses)	227	226	10	20	0.61
1585	Joslin & Allen, Waterbury, (Ta-To)	227	212	10	21	3.78
	Fudge.					
1386	Chocolate, Sold by F.W. Woolworth & Co., N. Haven	227	228	5	10	0.64
1388	Marshmallow, House of Hasselbach, New Haven	227	210	20	44	0.78
1422	Nut, Eagle Candy Co., Stamford	227	220	10	21	0.56
1425	Sold by J. R. Evans, Stamford	227	231	5	10	0.79
1447	Sold by F. R. Starr, Norwalk	227	223	10	20	0.35
1594	Chocolate, sold by F. W. Woolworth & Co., Waterbury	227	227	5	10	0.89

* Contains amaranth. † Contain peanut butter.

Jelly Beans.

Thirteen samples were examined. The ash ranged from 0.12 to 0.47 per cent., giving no evidence of added make-weight.

Each sample contained bean-shaped candies of assorted colors, and to save time a composite sample of the colored beans was first examined. In this was found amaranth, erythrosin, napthol yellow S, and orange I, all permitted colors. At least one coal-tar color was found in each sample except **1400**, which contained cochineal and **1497**, probably cochineal also. In these two samples the other colors were not pronounced, and were not identified. **1513** contained cochineal and erythrosin. **1551**, *Woolworth's*, contained magenta, an unpermitted coal-tar color. **1544** contained charcoal.

The jelly beans cost from 10 to 21 cents per pound. *Bradley, Smith & Co's* (**1400**), *Woolworth's* and the *Hartford Candy Kitchen* samples, showed shortages in weight of 0.77, 0.74 and 0.77 oz. in the pound.

TABLE IX:—JELLY BEANS.

Sample No.		Brand or Dealer.	Weight. Claimed.	Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Ash.	Colors.
			gms.	gms.	cts.	cts.		
1380	Assorted.	*Bradley-Smith Co., New Haven ...	227	248	10	18	0.12	Permitted coal-tar
1400	"	" " "	454	432	20	21	0.16	Cochineal
1421	"	Eagle Candy Co., Stamford........	454	449	15	15	0.47	Permitted coal-tar
1438	"	F. W. Woolworth & Co., S. Norwalk	454	431	10	11	0.32	" "
1497	"	Store 1321 State st., Bridgeport.....	454	451	20	20	0.16	Cochineal
1513	"	Store 1312 Stratford ave., Bridgeport	454	451	15	15	0.16	Magenta
1541	"	H. W. Cleveland, Hartford	454	454	20	20	0.31	Permitted coal-tar
1544	Licorice	Peterson Candy Kitchen, Hartford..	227	218	8	17	0.31	Charcoal
1551	Assorted.	F. W. Woolworth & Co., Hartford..	454	450	10	10	0.34	Permitted coal-tar
1567	"	Hartford Candy Kitchen, Hartford..	454	432	20	21	0.21	" "
1575	"	Leroy Bros., Hartford	454	449	20	20	0.32	" "
1593	"	Palace Confectionery, Waterbury...	454	460	15	15	0.28	" "
1595	"	F. W. Woolworth & Co., Waterbury	454	453	10	10	0.20	" "

* Statement of dealer.

Gum Drops.

Twenty samples were examined. The ash ranged from 0.16 to 0.51 per cent. As with the jelly beans a composite sample of the gum drops was first tested for color. In this composite amaranth, erythrosin, naphthol yellow S and orange I, all permitted coal-tar colors, were detected. Individual dye tests to determine if any sample contained *only* natural color were not satisfactory because of the weakness of the color solution in many cases. No unpermitted coal-tar color was found in any of the samples.

The gum drops cost from 9 to 31 cents per pound.

Table X:—Gum Drops.

Sample No.	Dealer, or Brand		Weight.		Cost.		Ash.	Colors.
			Claimed.	Found.	Per Package.	Per Pound.		
			gms.	gms.	cts.	cts.	%	
1383	Assorted.	Fred Ross, New Haven	227	239	10	19	0.33	Permitted coal-tar
1384	"	Bijou Candy Store, New Haven	227	223	15	31	0.18	See text
1395	"	Grand 5 and 10 Cent Store, New Haven	227	222	10	20	0.33	" "
1396	"	W. J. Wulle, New Haven	227	248	10	18	0.23	Permitted coal-tar
1397	Black.	Greek-American Confectionery Co., New Haven	227	215	5	11	0.31	
1411	Assorted.	Star Confectionery, Stamford	454	458	15	15	0.36	Permitted coal-tar
1413	"	Wardwell's Confectionery, Stamford	227	224	15	30	0.17	See text
1431	"	Xanthos Candy Co., Stamford	227	230	10	20	0.34	" "
1433	"	L. Paganett, Stamford	227	226	10	20	0.45	" "
1435	"	New England Candy Co., South Norwalk	227	214	10	21	0.26	Permitted coal-tar
1444	"	Eagle Candy Co., Norwalk	227	237	8	15	0.51	" "
1501	"	E. L. Graves, Bridgeport	227	223	10	20	0.16	" "
1524	"	J. M. Calcatera & Son, Bridgeport	227	232	5	10	0.51	" "
1540	"	Hartford Market Co., Hartford	227	226	8	16	0.33	" "
1562	Pink.	J. R. Evans & Co., Hartford	227	242	5	9	0.27	" "
1571	Assorted.	H. Glasser, Hartford	227	238	15	29	0.30	" "
1578	"	Boston Grocery, Hartford	227	220	15	31	0.26	See text
1584	"	Joslin & Allen, Waterbury	227	227	10	20	0.27	Permitted coal-tar
1588	"	The Standard, Waterbury	227	239	5	9	0.33	" "
1591	"	N. G. Vose, Waterbury	227	238	10	19	0.51	See text

In only two samples was there a marked short-weight. The sample from the *Greek American Confectionery Co., New Haven,* was short 0.42 oz., and that from the *New England Candy Co., South Norwalk,* was short 0.46 oz. in the half pound.

Licorice Lozenges.

Eleven samples were analyzed. The ash was extremely variable, ranging from 0.43 to 2.41 per cent. All the samples, except **1418** and **1494**, contained carbon (charcoal) and in **1564** this amounted to 0.23 per cent.

TABLE XI:—LICORICE LOZENGES.

Sample No.	Brand, or Dealer.	Weight. Claimed.	Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Ash.
		gms.	gms.	cts.	cts.	%
1418	Henry Heide, New York	114	121	8	30	2.24
1448	" " " "	227	235	20	39	2.19
1521	" " " "	114	134	7	24	2.00
1528	" " " "	114	111	5	20	1.92
1536	"BSC"	170	172	10	26	2.36
1563	"BSC"	114	128	5	17	2.41
1537	Passa	...	108	5	21	1.02
1494	R. W. Ensign, Bridgeport	114	88	5	26	2.00
1522	5 & 10 Cent Store, Bridgeport	114	97	3	14	0.70
1557	N. Spector, Hartford	227	215	5	11	0.56
1564	J. R. Evans & Co., Hartford	114	118	3	12	0.43

The cost per pound ranged from 11 to 39 cents, four samples of the same make ranging from twenty to thirty-nine cents.

Three samples were short-weight, that of *R. W. Ensign,* by 0.9 oz., in a quarter pound, that of the *5 and 10 Cent Store, Bridgeport,* by 0.6 oz. in a quarter pound, and that of *N. Spector,* by 0.42 oz. in a half pound.

Coated Peanuts.

The four samples examined ranged in ash from 0.95 to 1.27 per cent. No arsenic was found in the coating of any sample. The samples cost from 10 to 19 cents per pound, and no short-weight was observed.

TABLE XII:—COATED PEANUTS.

Sample No.	Brand, or Dealer.	Weight. Claimed.	Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Ash.
		gms.	gms.	cts.	cts.	%
1450	J. Debarbieri, Bridgeport	227	236	10	19	0.95
1493	Musante Confectionery, Bridgeport	227	233	20	19	0.95
1509	F. W. Woolworth & Co., Bridgeport	227	237	5	10	1.07
1561	J. R. Evans & Co., Hartford	227	232	5	10	1.27

Miscellaneous Candies.

Thirty miscellaneous samples were examined.

Eight samples of candy toys and animals ranged in ash from 0.16 to 0.40 per cent. In every case a coal-tar color was detected. Of the permitted colors amaranth was found in every sample, erythrosin in one, orange I in three. The sample from the *Grand 5 and 10 Cent Store, New Haven,* certainly contained orange II, an unpermitted coal-tar color, as did also probably the sample of *Woolworth's.* Three other samples contained a yellow dye, which was not determined.

Six samples of lime drops and two of spearmint drops ranged in ash from 0.03 to 0.38 per cent. Only permitted coal-tar dyes were found in these samples, light green S. F. yellowish eight times and naphthol yellow S three times.

In the "peach stones" and "pink drops" amaranth and orange I were found; in the "red and yellow drops," amaranth, erythrosin and undetermined orange; in *Puritan Ribbon Candy,* erythrosin; in *Peterson's Green Drops,* light green S. F. yellowish and naphthol yellow S; in *Violante's Marbles,* erythrosin and an undetermined violet, in *Woolworth's Red Drops,* probably orange G.

Bradley Smith Co.'s Pink Drops were short-weight, 0.42 oz. in the half pound, *Pink Drops* sold at *1312 Stratford Avenue, Bridgeport,* were short 1.3 ozs. in the half pound, and *Puritan Ribbon Candy* was short 1 oz. in two pounds.

TABLE XIII:—MISCELLANEOUS CANDIES.

Sample No.	Brand, or Dealer	Weight. Claimed.	Weight. Found.	Cost. Per Package.	Cost. Per Pound.	Ash.	Colors.
		gms.	gms.	cts.	cts.	%	
1390	Candy Toys. Bradley Smith Co., New Haven	227	230	10	20	0.16	†Amaranth, undetermined yellow.
1391	" " Grand 5 & 10 Cent Store, New Haven	454	486	10	9	0.34	†Amaranth, †Orange I, Orange II.
1428	" " F. W. Woolworth & Co., Stamford	454	454	10	10	0.40	†Amaranth, †Erythrosin, †Or. I, Or. II (?).
1442	" " F. R. Starr, Norwalk	227	228	10	20	0.16	†Amaranth, undetermined yellow.
1508	" " F. W. Woolworth & Co., Bridgeport	227	246	5	9	0.16	†Amaranth.
1549	" " " " " Hartford	227	235	5	10	0.27	†Amaranth.
1554	" " Wilkinson, Hartford	227	225	15	15	0.21	†Amaranth, †Orange I.
1581	" " Kelly's Bakery, Waterbury	227	254	10	18	0.17	†Amaranth, undetermined yellow.
1405	Lime Drops. Boston Candy Kitchen, New Haven	227	235	10	19	0.09	†Light green S. F. y.
1432	" " Franklin's American Cuts, New York	...	122	10	37	0.13	†Light green S. F. y., †Napthol yellow S.
1437	" " F. W. Woolworth & Co., So. Norwalk	227	231	5	10	0.14	†Light green S. F. y.
1553	" " Wilkinson, Hartford	227	226	15	15	0.07	†Light green S. F. y.
1565	" " Morris, Hartford	227	223	8	16	0.17	†Light green S. F. y., †Napthol yellow S.
1579	" " Boston Grocery, Hartford	227	230	20	40	0.03	†Light green S. F. y.
1426	Spearmint Drops. J. R. Evans, Stamford	227	228	5	10	0.16	†Light green S. F. y.
1587	" " H. G. Woolworth Co., Waterbury	227	237	5	10	0.38	†Light green S. F. y., †Napthol yellow S.
1394	Peach Stones. Bradley Smith Co., New Haven	227	228	5	10	0.18	†Amaranth, †Orange I.
1597	" "	227	224	10	20	0.15	†Amaranth.
1401	Pink Drops. Bradley Smith Co., New Haven	227	215	10	21	0.15	†Amaranth, †Orange I (?).
1502	Red and Yellow Drops. Howland's, Bridgeport	227	253	10	18	0.05	†Amaranth, †Erythrosin, und'm'd orange.
1511	Pink Drops. Store, 1312 Stafford Ave., Bridgeport	227	190	5	12	0.07	†Amaranth.
1531	*Chocolate Cream Bars. Wm. Mayer, New Haven,	...	128	5	17	0.43	*
1532	Indian Strings. Wm. H. Luden	...	180	10	25	0.10	Not identified.
1533	Puritan Ribbon Candy. Weeks Bros. Co., Providence, R.I.	908	880	25	13	0.39	†Erythrosin.
1534	Bon Bons (Disk-like). Cummings Candy Kitchen, N.H'v'n	227	223	20	41	0.06	Not identified.
1543	Green Drops. Peterson's Candy Kitchen, Hartford	227	221	8	16	0.16	†Light green S. F. y., †Napthol yellow S.
1583	Marbles. Violante Bros., Waterbury	...	144	5	16	0.74	†Erythrosin, †undetermined violet.
1586	Red Drops. H. G. Woolworth Co., Waterbury	227	230	5	10	0.12	Orange G (?).
1758	German Chewing Candy. Push cart, Hartford	...	160	10	28	0.28	....
1719	Turkish Nugget Candy. Push cart, New Britain	...	212	10	21	0.43	....

* Coating contains 5.36% fat. Refract. Index at 40°, 39.5. Melting point, 26–27° C. Color a mixture of yellow and red shades, the former probably Orange I. † Permitted coal-tar colors.

Summary.

One hundred and eighty-nine samples were examined. No foreign fat was found in any of the chocolate coatings, and no added mineral matter except in one sample of molasses kisses, which contained 3.78 per cent. of ash.

All but two of the twenty-five marshmallows contained gelatine. In many of these the adhering powder, consisting of powdered sugar and starch, was excessive, in two cases amounting to 2 ozs. in the pound.

Four samples of wafers and mottoes contained from 6.83 to 10.63 per cent. starch. All but two of the twelve samples contained artificial colors, in three cases unpermitted coal-tar dyes.

All but two of the thirteen jelly beans contained coal-tar colors. One contained magenta, an unpermitted dye, and one contained charcoal.

None of the twenty samples of gum drops contained an unpermitted coal-tar color.

All but two of the eleven samples of licorice lozenges contained charcoal, in one case 0.23 per cent.

None of the four samples of coated peanuts contained arsenic in the coatings.

Of the eight samples of candy animals all contained coal-tar colors, two orange II, an unpermitted coal-tar color, and three an unpermitted yellow.

Thirty-five of the 189 samples showed short-weight, nine of the chocolates from 0.6 to 1.2 ozs. per pound, one caramels, 1.1 ozs. per pound, five marshmallows, 0.8 to 1.5 ozs. per pound, one marshmallow caramels 0.8 oz. per pound, one mottoes, 2.4 ozs. per pound, six molasses kisses from 0.4 to 3.0 ozs. per pound, one fudge, 1.2 ozs. per pound, three jelly beans, 0.74 to 0.77 oz. per pound, two gum drops, 0.8 to 0.9 oz. per pound, three licorice drops, from 0.8 to 3.6 ozs. per pound, and three miscellaneous samples, from 0.8 to 2.6 ozs. per pound.

DEHYDRO FOODS.

These foods are prepared chiefly for travelers or campers who wish to carry food in a concentrated form. A comparison of our analyses with the known composition of the specified vegetables shows that the claims of the manufacturer are essentially true for the peas, corn and cranberries. For the *Cream of Tomatoes* and *Cream of Potatoes* the claim is made that they contain "nothing but strictly fresh vegetables, flour and pure milk." The high protein and low fat percentages, however, indicate the use of skim milk or a skim milk powder. The description and analyses of the samples follow:

1639. *Dehydro Fresh Sweet Corn.* "The equivalent of six portions." Cost 10 cents per 4.4 ozs.

1640. *Dehydro Cream of Tomatoes.* "A most delicious cream soup." Cost 15 cents per 4.0 ozs.

1641. *Dehydro Select Quality Fresh Green Peas.* "The equivalent of five portions." Cost 15 cents per 3.1 ozs.

1642. *Dehydro Cream of Potatoes.* "A most delicious cream soup." Cost 15 cents per 4.2 ozs.

1643. *Dehydro Fresh Cranberries.* "The equivalent of one quart of fresh cranberries. Contents of this can will make six to eight portions." Cost 15 cents per 1.7 ozs.

All the above are made by the American Dehydrating Co., Waukesha, Wis., and are sold by John Gilbert and Son, New Haven.

Analyses of Dehydro Foods.

	1639	1640	1641	1642	1643
Water	6.72	6.45	10.40	4.69	7.07
Ash	2.44	8.79	2.69	6.06	2.02
Protein (N × 6.25)	12.50	27.44	22.00	24.38	4.06
Fiber	2.03	3.27	6.45	0.99	45.25
Nitrogen-free extract	70.41	52.08	56.63	63.59	33.40
Fat	5.90	1.97	1.83	0.29	6.20
Calories per 100 gms.	385	336	331	354	206

DIABETIC FOODS.

Since publishing Part I. of this report, in which the analyses of a large number of diabetic foods were given, we have received 24 additional samples, the analyses of which will be found in Table XIII a. Only three of these products, *Loeb's Gluten Luft Bread, P. and L. Genuine Gluten Bread,* and *Hoyt's Gum Gluten Flour,* have been examined by us before.

Loeb's Gluten Luft Bread showed 6.2 per cent. more protein and 4 per cent. less starch than our earlier analysis, showing a commendable effort to improve this relatively cheap aerated bread.

P. and L. Genuine Gluten Bread likewise shows a marked improvement, in spite of a considerably increased water content. Calculated to the same moisture basis as the sample reported in Part I, it would show 30.7 per cent. protein and 28.4 per cent. starch, an increase of 20.3 per cent. protein and a decrease of 15.8 per cent. starch.

Hepco Dodgers and *Hepco Flour* are soy bean preparations, and are characterized by their high protein and fat content, and the almost complete absence of starch. An investigation as to the nature of the carbohydrates of these and other soy bean preparations is now being taken up in this laboratory.

The various "Sanity" preparations were sent to us by a New York dealer in diabetic foods. A few are good, but most are objectionable when judged from the standpoint of their content of starch and other carbohydrates. *Echtes Mandelgebäck für Diabetiker* and *Pokorny's Echter Diabetiker Zwieback* are practically identical in composition; and are characterized by a very high fat content and a very low percentage of starch. *Diabetiker Bisquits* and *Saccharin-Oblaten* contain 35.4 and 27.1 per cent. of starch. The other "Sanity" baked preparations, however, show no especial suitability for the use of diabetics, as they contain from 55 to 75 per cent. of nitrogen-free extract, with from 42 to 59 per cent. of starch.

The four "Sanity" chocolate preparations contain but little starch, from a trace to 6.2 per cent. They do contain, however, considerable sugar, the *Mandel-, Nuss- und Schokolade Bonbons,* 18.60 per cent. as dextrose, the *Laevulose-Schokolade,* the *Mandel- u. Nussschokolade with Laevulose,* and the *Manit-Chocolate,* 17.55, 14.31 and 21.32 per cent. sugar as invert, respectively. The theory that levulose is less objectionable for diabetics than other forms of sugar is quite prevalent. However, the following comment on this subject by von Noorden, one of the most eminent authorities on diabetes, is worthy of close attention:—

"That levulose, milk sugar and inulin are more useful than the other carbohydrates is a common opinion, but the importance of their use in practise 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

TABLE XIIIa:—

Station No.	Manufacturer and Brand.
3265	Waukesha Health Products Co., Waukesha, Wis. Hepco Dodgers...............
3200	" " " " " Hepco Flour for Diabetics.....
3309	Loeb's Diabetic Food Bakery, New York. Gluten Luft Bread..................
3310	" " " " " P. and L. Genuine Gluten Bread......
3312	"Sanity," Prag. Aleuronat-zwieback für Diabetiker..........................
3311	" " Bretzels..
3313	" " Conglutin Mandelzwieback für Diabetiker..................
3325	" " Diabetiker-Bisquits ohne Mehl und ohne Zucker...... ... .
3314	" " Diabetiker-Cakes...... ....
3317	" " Echte Delikatess-Salzstangen für Diabetiker............. ......
3322	" " Echtes Mandelgebäck für Diabetiker............................
3315	" " Haferzwieback (ungesüsst) für Zucker- u. Magenkranke.........
3306	" " Karlsbader Curzwieback für Diabetiker, etc..................
3307	" " Pokorny's Echter Diabetiker Zwieback, ohne Mehl und ohne Zucker
3308	" " Saccharin-Oblaten ohne Zucker...............................
3316	Brah-Ma (mfr. name not given). Sent by Eugene Loeb, New York.. ....
3320	"Sanity," Prag. Diabetiker Mandel-, Nuss- und Schokolade Bonbons............
3324	" " Laevulose Schokolade..................... ....
3323	" " Mandel- u. Nussschokolade mit Laevulose für Diabetiker.......
3326	" " Manit-Chocolate ....
3486	Pure Gluten Food Co., New York. Hoyt's Gum Gluten Dainty Fluffs No. 1... ...
3487	" " " " " Hoyt's Gum Gluten Flour, Ground...........

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."

Hoyt's Gum Gluten Dainty Fluffs No. 1 contains 86 per cent. protein with only 5 per cent. starch. It is an aerated product somewhat similar to *Fromm's Uni Bread* and *Health Food No. 1 Proto Puffs*, although containing considerably more protein and less starch than either. Its claim that it "contains over 80 per cent. protein and less than 10 per cent. starch" is more than satisfied.

Hoyt's Gum Gluten Flour, Ground, is a type of the gluten flour which conforms to the U. S. standard of 35 per cent. protein. It contains over 41 per cent. protein, but an almost equal amount of starch.

Diabetic Foods.

Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Fat (Ether Extract).	Starch.	Polarization at 20° C.* Direct.	After Inversion.	Weight supplying same amount carbohydrates as 10 gms. wheat bread.	Calculated Calories per 100 gms.
%	%	%	%	%	%	%			gms.	
6.9	5.4	41.6	4.1	20.7	21.3	Trace.	....	...	26	441
4.6	5.1	42.9	4.2	22.4	20.8	Trace.	....	...	24	448
8.5	1.1	34.1	0.2	47.4	8.7	40.1	....	...	11	404
42.2	1.4	25.8	0.1	27.8	2.7	23.9	....	...	19	239
8.4	2.0	17.0	0.3	61.6	10.7	49.3	....	...	9	411
7.2	3.6	12.8	0.3	55.4	20.7	46.5	....	...	10	459
7.1	2.3	15.0	0.3	54.6	20.7	42.4	....	...	10	465
8.4	1.9	25.8	0.4	45.3	18.2	35.4	....	...	12	448
7.5	1.8	14.0	0.5	60.1	16.1	52.0	....	...	9	441
6.9	3.5	12.7	0.5	54.1	22.3	44.8	....	...	10	468
4.3	2.9	32.5	0.9	10.8	48.6	4.0	....	...	49	611
8.2	1.8	14.9	0.5	58.7	15.9	47.6	....	...	9	438
9.0	1.8	10.2	0.2	74.6	4.2	58.7	....	...	7	376
4.6	3.2	32.9	0.9	10.4	48.0	3.6	....	...	51	605
5.7	2.4	16.8	1.7	41.7	31.7	27.1	....	...	13	519
8.1	2.9	11.0	1.3	68.6	8.1	55.2	....	...	8	391
18.4	2.3	12.5	0.9	37.1†	28.8	Trace.	+10.2	+9.4	14	458
4.0	3.0	11.4	2.6	35.6‡	43.4	6.2	—5.0	—5.0	15	579
3.1	2.6	12.0	2.2	26.2§	53.9	4.3	—3.0	—4.0	20	638
4.2	2.5	10.0	1.7	37.9¶	43.7	4.8	—6.4	—6.6	14	585
7.2	0.9	86.0	0.3	5.0	0.6	5.0	....	...	106	369
8.5	1.0	41.4	0.3	47.4	1.4	40.4	....	...	11	368

* 6.5 gms. to 100 cc., read in 200 mm. tube. † 18.60% total sugars as dextrose. ‡ 17.55% total sugars as invert. § 14.31% total sugars as invert. ¶ 21.32% total sugars as invert.

Huckleberry Wine for Diabetics, probably the "Sanity" brand, contains 10.33 per cent. alcohol by volume, 0.135 per cent. invert sugar; it should be a very satisfactory preparation.

Kirschen mit Stein, made by Rud. Bernhard & Co., Bregenz-Lochan, contains 153 gms. of drained cherries and 54 gms. of juice. The edible portion of the cherries contains 3.77 per cent. invert sugar, and the juice 3.84 per cent. The sample contains saccharin and an unidentified color.

GELATINE.

Five samples were examined, all of which were sold as thickeners for ice cream. The U. S. Standard for gelatine requires not less than 15 per cent. of nitrogen and not more than 2 per cent. of ash.

TABLE XIV:—ICE

Sample No.	Brand.	Cost per lb. (in 5-10 lb. lots.)	Water.	Ash.	Organic Matter.
		cts.			
1689	Crandallo, The Crandall-Pettee Co., New York......	35	1.33	0.58	98.09
1690	Magic Ice Cream Powder, Royal Mfg. & Imp. Co., Kansas City, Mo.	100	15.41	6.65	77.94
1691	Creamthick, O. J. Weeks & Co., New York..........	25	12.97	3.77	83.26
1692	Snow, B. Heller & Co., Chicago....................	...	9.85	2.43	87.72
1694	National Cream Thickener, National Gum & Mica Co., New York	12	3.58	1.64	94.78
1695	Gum Powder, National Gum & Mica Co., New York	17	12.19	7.30	80.51
1697	Red Seal Purity Cream Powder, Warner-Jenkinson Co., St. Louis	30	5.52	1.57	92.91
1698	Golden Ice Cream Powder, J. Hungerford Smith, Rochester, N. Y.	42	5.07	2.14	92.79
1700	Velvet Special, Blanke Mfg. & Supply Co., St. Louis	35	2.40	1.41	96.19
1703	Cream-X-Celo, Edwin C. Ekert, Hanover, Pa........	28	5.03	1.53	93.44

1693. Gelatine. Milligan & Higgins Glue Co., New York. Price, 35 cents per pound.

1696. Crystal Flake Gelatine. Kingery Mfg. Co., Cincinnati, Ohio. Price, (?).

1699. 5 X I C Ground Gelatine. Essex Gelatine Co., Boston, Mass. Price, 32 cents per pound.

1701. No. 1 Granulated Gelatine. Hughes Gelatine Co., Detroit, Mich. Price, 30 cents per pound.

1702. No. 2 Gelatine. Hughes Gelatine Co., Detroit, Mich. Price, 26 cents per pound.

	1693	1696	1699	1701	1702
Ash	0.95	1.72	1.44	1.75	2.37
Nitrogen	15.40	15.12	15.46	15.00	15.24
Equal to Gelatine (N x 5.55)	85.45	83.92	85.80	83.25	84.58

All of the above samples comply with the U. S. Standard, except **1702**, which shows an excess of ash.

CREAM POWDERS.

Nitrogen.	Lime (CaO).	Cane Sugar.	Alcohol Precipitate.	Starch.	Remarks.
0	0.28	81.46	16.24	* Yes	Cane sugar and gum tragacanth....
0	2.72	0	72.42	0	Probably a sea weed or lichen preparation ....
0.60	1.39	0	73.59	Yes	" " " " "
0.25	0.87	41.01	47.10	Yes	A reducing sugar, starch and a sea weed or lichen preparation ....
0	....	61.05	22.18	0	Sugar and a sea weed or lichen preparation.......
0.16	3.25	0	73.54	0	Similar to 1690 and 1691........
0	0.62	47.76	43.22	† Yes	Cane sugar, corn starch and gum (tragacanth ?) ...
0	0.90	62.85	29.30	0	Cane sugar and a sea weed or lichen preparation, flavored with vanilla........
0	0.56	74.97	13.41	0	Cane sugar and gum tragacanth........
0.28	0.52	46.52	46.90	* Yes	Cane sugar and gum tragacanth........

* Probably chiefly from the gum. † Contains corn starch.

ICE CREAM POWDERS.

Ten preparations advertised to the trade as ice cream thickeners have been examined.

Seven of the samples contained from 41 to 81 per cent. cane sugar, while three contained none. Corn starch was found in **1697**, the small amounts of starch found in four other samples probably being a constituent of the gum used. Gum tragacanth was found in four samples, and in six the gelatinous principle was due to a seaweed or lichen. The amounts of nitrogen found were small, showing that no considerable quantity of gelatine was present in any of the samples.

As these preparations are chiefly used to give an appearance of superior quality to the ice cream their use must be deprecated.

The cost per pound, in five to ten pound lots, ranged from twelve cents to one dollar.

JELLY POWDERS.

A new examination of this class of preparations was made chiefly to determine the nature of the coloring matter used. As shown in our report for 1909 these powders contain on the average about 90 per cent. of cane sugar and 8 per cent. of gelatine, in which the consumer pays about twenty-two cents per pound for the sugar. If one wishes to use this sort of material in the preparation of desserts, economy would suggest the purchase of pulverized gelatine, to which flavoring and sweetening might be added at will. There is no mystery whatever in the compounding of these powders.

Six *Jell-O* and nine *Tryphosa* preparations were examined, the former made by The Genesee Pure Food Co., LeRoy, N. Y.; the latter by E. C. Rich, New York. They were as follows: **1061**, *Jell-O Orange;* **1062**, *Jell-O Lemon;* **1064**, *Jell-O Strawberry;* **1068**, *Jell-O Raspberry;* **1102**, *Jell-O Cherry;* **1103**, *Jell-O Coffee;* **1059**, *Tryphosa Vanilla;* **1060**, *Tryphosa Pineapple;* **1063**, *Tryphosa Wild Gherry;* **1065**, *Tryphosa Raspberry;* **1066**, *Tryphosa Chocolate;* **1067**, *Tryphosa Terpeneless Orange;* **1069**, *Tryphosa Peach;* **1070**, *Tryphosa Strawberry,* and **1071**, *Tryphosa Terpeneless Lemon.*

Of the six *Jell-O* preparations, one claimed artificial color, one artificial vegetable color and three both artificial color and flavor. Of the nine *Tryphosa* preparations one claimed artificial color, five vegetable color, and two (wild cherry and peach) artificial flavor and color.

The following tabulation shows our findings in these samples:

	Cost per package. oz.	Net Weight. cts.	Flavor.	Color.
Jell-O, Orange	10	3.5	....	†Cochineal.
" Lemon	10	3.6	....	†Vegetable.
" Strawberry	9	3.5	*Artificial.	†Cochineal.
" Raspberry	10	3.2	*Artificial.	†Cudbear.
" Cherry	9	3.6	*Artificial.	†Cudbear.
" Coffee	9	2.4	Natural.	Natural.
Tryphosa, Vanilla	9	5.0	Natural.	*Vegetable.
" Pineapple	9	5.0	Natural.	*Vegetable.
" Wild Cherry	8	7.4	*Artificial.	†Amaranth, Orange I.
" Raspberry	9	5.1	Natural.	†Probably Cudbear.
" Chocolate	9	6.9	Natural.	Natural.
" Terpeneless Orange	10	5.2	Natural.	†Vegetable.
" Peach	10	7.3	*Artificial.	†Vegetable.
" Strawberry	10	7.2	Natural.	†Amaranth.
" Terpeneless Lemon	10	7.4	Natural.	†Vegetable.

* Claimed on label. † Artificial color claimed.

From the above it is seen that in five instances the flavor was artificial as claimed. In only two brands was the color natural, in the coffee and the chocolate. In two cases the artificial color was cochineal, in three cudbear, in six a vegetable color, and in two a coal-tar color. All the colors used were permitted colors, and in all cases the samples were properly branded.

CANNED PUMPKIN.

Twenty-three samples of canned pumpkin were examined. The following summary shows the wide range in composition:

	Original Substance.			Water-free Basis.		
	Max.	Min.	Ave.*	Max.	Min.	Ave.*
Water	94.32	78.83	92.20	....	....	....
Ash	1.51	0.40	0.58	10.55	4.00	7.44
Protein (N x 6.25)	2.72	0.65	0.99	17.06	7.50	12.69
Fiber	3.51	0.81	1.23	22.63	7.80	15.77
Nitrogen-free Extract	13.01	3.23	4.74	78.40	52.75	60.77
Ether Extract	0.62	0.10	0.26	6.41	1.61	3.33
Starch	3.04	Trace	0.12	22.57	Trace	1.54

The composition of fresh pumpkin is as follows:†

	Original Substance.	Water-free Basis.
Water	93.1	...
Ash	0.6	8.7
Protein (N x 6.25)	1.0	14.5
Fiber	1.2	17.4
Nitrogen-free Extract	4.0	58.0
Ether Extract	0.1	1.4

In preparing canned pumpkin the pulp is cooked very little if of good consistency, but if too thin it is evaporated to some extent. For this reason the composition of the canned product should not be materially different from that of the fresh vegetable, and such we find to be the case when considering average composition. Individual samples, however, showed wide variations. Nos. **1760** and **1612** contained 78.83 and 86.53 per cent. of water, respectively, the increase in dry matter being primarily due to the increased starch content, 0.89 and 3.04 per cent., respectively. No. **1637** was unusually high in protein, ash, fiber

* Omitting Nos. 1095, 1760 and 1612.

† Atwater & Bryant, Off. Expt. Stat., Bull. 28, p. 68.

and fat, *due chiefly to the presence of many seeds and some rind.*

No. **1096** claimed on its label "3% cornstarch," but the analysis showed no more than the normal amount of starch. Nos. **1095, 1760** and **1612,** however, contained excessive starch, which in the last named sample made up over 22 per cent. of the dry matter.

All but one of the samples were packed in No. 3 cans, which according to Bitting should contain at least 32 ounces; no sample contained materially less than this amount. Seven samples claimed on the label a definite weight; in four cases this claim was satisfied, while in two cases there was a deficiency of 0.6 ounces and in one a deficiency of 2.4 ounces.

The cost of the pumpkin ranged from 7 to 16 cents. The sample containing many seeds, and distinctly inferior in quality, was among the highest priced brands.

The dry matter per can ranged from 1.88 to 4.63 ounces, the cost per pound of the dry matter ranging from forty-one cents to $1.28.

No. **1054** showed a badly corroded can, as did also No. **1629.** In the latter sample the pulp near the sides of the can was darkened by this corrosion. Pumpkin and squash have the power of dissolving tin in relatively large amounts, and should always be packed in enamelled cans. The only samples packed in cans of this kind were Nos. **1613** and **1628,** which likewise were the only samples showing no corrosion of the can.

TABLE XV.—BRANDS OF CANNED PUMPKIN.

1613. Pumpkin, (packed for) Acker, Merrall and Condit Co., New York.

1712. Greenwich Brand Pumpkin, (distributed by) Austin, Nichols & Co., New York.

1109 and 1729. J. R. Brand Pumpkin, (distributed by) Austin Nichols & Co., New York.

1754. Burt Olney's Golden Pumpkin, Burt Olney Canning Co., Oneida, N. Y.

1630. Supreme Brand Pumpkin, (distributed by) Burton & Davis Co., New York.

1111. Delft Brand Pumpkin, First Quality, Cherry Creek Canning Co., Cherry Creek, N. Y.

1095. Emerald Brand Pumpkin, Standard Quality, Cherry Creek Canning Co., Cherry Creek, N. Y.

1629. Lake Shore Pumpkin, The Cummins Canning Co., Conneaut, Ohio.
1096. Golden Pumpkin, Solid Dry Packed, "3% Corn Starch," W. H. Dudley & Co., New York, Boston, Philadelphia.
1637. Flag Brand Extra Dry Golden Pumpkin, Finest Quality, Fort Stanwix Canning Co., Rome, N. Y.
1055. Grandmother's Brand Pumpkin, (distributed by) The Great Atlantic & Pacific Tea Co., Jersey City, N. J.
1752. Pearl Drop Pumpkin, "Unsurpassed in Quality," Lee Canning Co., New York.
1056. Homes Sweetest Brand Pumpkin, First Quality, The Wm. McKinley Canning Co., Lenox, N. Y.
1608. Iron Mountain Brand Pumpkin, H. S. Mill Canning Co., Springtown, Pa.
1054. Sphinx Brand Pumpkin, (packed for) Miner, Read and Garrette, New Haven.
1097. Sunrise Pumpkin, (packed for) Miner, Read and Tullock.
1760. Oneida Community Quality Stewed Pumpkin, Oneida Community, Ltd., Kenwood, N. Y.
1753. Silver Key Brand Pumpkin, First Quality, Oswego Preserving Co., Oswego, N. Y.
1110. New York State Pumpkin Monroe Brand, (packed for) Rochester Preserving Co., Rochester, N. Y. "All goods bearing this brand are guaranteed equal in quality to any so called Extra Standards."
1612. White Rose Brand Pumpkin, (distributed by) Seeman Bros., New York.
1628. Robin Hood Brand Pumpkin, R. C. Williams & Co., New York.
1713. Empire Brand Golden Pumpkin, First Quality, Winters and Prophet Canning Co., Mount Morris, N. Y.

MISCELLANEOUS FOODS.

1072. *Trix,* The New England Cereal Co., South Norwalk, Conn. "Wheat, Rice, Barley. Triple Food, Triple Seal, Substantial." Guaranteed composition, "Water, 3.78; Ash, 1.70; Fat, 0.11; Protein, 12.31; Crude Fiber, 1.07; Carbohydrates, by difference, 81.03." Cost, 15 cents per 15.6 ounces.

1822. *Post Tavern Special,* Postum Cereal Co., Battle Creek, Mich. "A Food made of Wheat, Corn, Rice and Salt, skilfully blended." Cost, 15 cents per 28.7 ounces.

1126. *Bonano,* International Banana Food Co., Chicago, Ill. "Made from Bananas." Cost, 25 cents per 11.9 ounces.

1757. *The Original Cocoanut Cream Pudding, Lemon.* The Eugene Christian Food Co., New York. "Is a combination of four of the purest and most nutritious articles known to Food

TABLE XVI:—ANALYSES OF

Station No.	Brand.	Gross weight, gms.	Net weight, gms.	Net weight, oz.	Net weight, oz., Claimed.	Cost per can, cts.	Dry Matter, per can, oz.
1613	Acker, Merrall & Condit Co,	1079	938	33.1	....	15	1.88
1712	Greenwich Brand	1072	934	32.9	32.0	8	2.65
1109	J. R. Brand	1088	947	33.4	34.0	9	2.24
1727	" "	1075	946	33.4	34.0	9	2.19
1754	Burt Olney's Golden	1029	896	31.6	34.0	15	2.91
1630	Supreme Brand	1134	994	35.1	....	15	2.30
1111	Delft Brand	1127	970	34.2	....	7	2.00
1095	Emerald Brand	1185	1027	36.2	....	10	3.12
1629	Lake Shore	1122	983	34.7	....	9	3.51
1096	Dudley's Golden	1212	1068	37.7	....	10	3.77
1637	Flag Brand, Extra Dry	1148	997	35.2	34.0	15	3.74
1055	Grandmother's Brand	1097	941	33.2	....	10	2.80
1752	Pearl Drop	1107	971	34.3	32.0	10	2.45
1056	Homes Sweetest Brand	1063	917	32.3	....	10	2.35
1608	Iron Mountain Brand	1137	980	34.6	....	12	2.47
1054	Sphinx Brand	1128	984	34.7	....	10	3.07
1097	Sunrise	1129	984	34.7	....	10	2.79
1760	Oneida Community	712	606	21.4	....	16	4.53
1753	Silver Key Brand	1076	925	32.6	....	13	2.03
1110	Monroe Brand	1086	950	33.5	....	10	2.65
1612	White Rose Brand	1116	975	34.4	....	15	4.63
1628	Robin Hood Brand	1166	1001	35.3	32.0	15	2.21
1713	Empire Brand, Golden	1136	994	35.1	....	15	3.31
	Maximum (all)	*1212*	*1068*	*37.7*	....	*16*	*4.63*
	Minimum (all)	*712*	*606*	*21.4*	....	*7*	*1.88*
	Average (excluding 1095, 1760 and 1612)	*1110*	*966*	*34.1*	....	*11*	*2.67*

Chemistry." Cost, 10 cents per 7 ounces. It is essentially a carbohydrate preparation, containing nearly 80 per cent. of carbohydrates, of which over half is starch.

1821. *Instant Postum,* Postum Cereal Co., Battle Creek, Mich. "This is the regular Postum in a concentrated form, nothing added. A compound made of different parts of wheat and a small portion of New Orleans molasses." Cost, 30 cents per 4.5 ounces. The "concentration" of this food lies in the ash and carbohydrates, the protein content being extremely low. 100 gms. of the material yield 332 calories, of which 307 are derived from carbohydrates.

The following tabulation shows the composition of these five products:

CANNED PUMPKIN.

Cost of Dry Matter per pound, cts.	In Original Substance. Water.	Ash.	Protein (N x 6.25)	Fiber.	Nitrogen-free Extract.	Fat (Ether Extract).	Starch.	In Dry Matter. Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Fat (Ether Extract).	Starch.
128	94.32	0.40	0.65	1.21	3.26	0.16	0.04	7.04	11.44	21.30	57.40	2.82	0.70
48	91.94	0.60	0.92	1.08	5.30	0.16	0.20	7.44	11.41	13.40	65.76	1.99	2.48
63	93.30	0.57	1.03	0.88	4.09	0.13	Tr.	8.51	15.37	13.13	61.04	1.94	Tr.
66	93.43	0.57	0.92	0.81	4.16	0.11	0.07	8.68	14.00	12.33	63.32	1.67	1.07
82	90.80	0.58	1.23	1.84	4.96	0.59	0.25	6.30	13.37	20.00	53.91	6.41	2.72
104	93.46	0.47	0.89	1.48	3.45	0.25	Tr.	7.19	13.61	22.63	52.75	3.82	Tr.
56	94.16	0.46	0.76	1.11	3.23	0.28	0.03	7.88	13.01	19.01	55.31	4.79	0.51
51	91.38	0.51	0.86	1.24	5.87	0.14	0.71	5.93	9.98	14.38	68.09	1.62	8.26
41	89.88	0.83	1.31	1.29	6.49	0.20	0.15	8.20	12.94	12.75	64.13	1.98	1.48
42	90.01	0.52	1.02	1.09	6.85	0.51	0.16	5.20	10.21	10.92	68.57	5.10	1.60
64	89.38	1.12	1.38	1.71	5.79	0.62	0.07	10.55	12.99	16.10	54.52	5.84	0.66
57	91.56	0.61	0.92	1.34	5.42	0.15	0.18	7.23	10.90	15.88	64.22	1.77	2.13
65	92.86	0.42	1.07	1.41	3.80	0.44	0.14	5.88	14.99	19.75	53.22	6.16	1.97
68	92.73	0.53	1.24	1.34	3.89	0.27	0.15	7.29	17.06	18.43	53.51	3.71	2.06
78	92.85	0.60	0.86	1.42	4.11	0.16	0.12	8.39	12.03	19.86	57.48	2.24	1.68
52	91.16	0.62	1.03	1.26	5.76	0.17	0.28	7.01	11.65	14.25	65.16	1.93	3.17
57	91.95	0.59	1.08	1.21	4.92	0.25	0.05	7.33	13.42	15.03	61.12	3.10	0.62
57	78.83	1.51	2.72	3.51	13.01	0.42	0.89	7.13	12.85	16.58	61.46	1.98	4.20
102	93.78	0.47	0.59	0.94	4.12	0.10	0.10	7.56	9.49	15.11	66.23	1.61	1.61
60	92.10	0.53	0.94	1.17	5.11	0.15	0.12	6.71	11.90	14.81	64.68	1.90	1.52
52	86.53	0.54	1.01	1.05	10.56	0.31	3.04	4.00	7.50	7.80	78.40	2.30	22.57
109	93.73	0.46	0.88	0.78	3.90	0.25	0.26	7.34	14.04	12.44	62.20	3.98	4.01
73	90.56	0.76	1.07	1.23	6.19	0.19	0.12	8.05	11.33	13.03	65.58	2.01	1.27
128	*94.32*	*1.51*	*2.72*	*3.51*	*13.01*	*0.62*	*3.04*	*10.55*	*17.06*	*22.63*	*78.40*	*6.41*	*22.57*
41	*78.83*	*0.40*	*0.65*	*0.81*	*3.23*	*0.10*	*Tr.*	*4.00*	*7.50*	*7.80*	*52.75*	*1.61*	*Tr.*
66	*92.20*	*0.58*	*0.99*	*1.23*	*4.74*	*0.26*	*0.12*	*7.44*	*12.69*	*15.77*	*60.77*	*3.33*	*1.54*

	1072	1822	1126	1757	1821
Water	6.20	9.88	8.94	7.31	5.56
Ash	1.54	0.86	3.12	2.69	11.38
Protein (N x 6.25)	14.50	10.94	4.08	4.75	6.13
Fiber	0.27	0.28	3.83	0.31	0.09
Nitrogen free extract	77.34	76.97	79.59	79.60	76.78
Fat	0.15	1.07	0.44	5.34	0.06
Starch	48.56	69.30	24.83	44.96	....
Calories per 100 gms.	369	361	339	385	332

1756. *Klim,* Merrell-Soule Co., Syracuse, N. Y. "For all cooking where milk is needed." Cost 25 cents per 15.8 ounces. The material is a desiccated skim milk and showed the following composition: Water, 2.56; ash, 8.10; protein (N x 6.25), 36.31; fiber, 0.26; nitrogen-free extract, 50.54, and fat, 2.23 per cent.; Calories, 367 per 100 gms.

1952. *Heintz Health Biscuits,* Heintz Food Co., Chicago, Ill. "Regulate Digestion. A safe and reliable remedy for constipation." Cost 25 cents per 6.2 ounces, or 64 cents per pound. The net weight was 2.8 ounces less than claimed. The analysis was as follows: water, 6.35; ash, 2.97; protein (N x 6.25), 5.31; fiber, 1.15; nitrogen-free extract, 77.15; fat, 7.07; starch, 27.06; Calories, 393 per 100 gms.

II. DRUG PRODUCTS.

CALOMEL.

(*Hydrargyri Chloridum Mite.*)

Twenty-two samples were tested for the presence of corrosive sublimate (mercuric chloride) with negative results.

The cost ranged from 20 to 40 cents per 2 ounces.

CHLOROFORM.

This is defined by the U. S. Pharmacopœia as "a liquid consisting of 99 to 99.4 per cent. by weight of absolute chloroform, and 0.6 to 1 per cent. of alcohol."

The twenty-one samples examined were very satisfactory, although judged by the strict requirements of the U. S. P. several showed the presence of slight impurities. In two samples the residue on evaporation was too high, and in three traces of water were found. The alcohol content ranged from 2.8 to 10.0 c c. per liter, in no case exceeding the maximum limits of the U. S. P. None of the samples contained acetone, chlorides or acidity, nor was water present in more than traces except in Nos. **1718**, **1610** and **1616.**

The cost ranged from 50 to 90 cents per 8 ounces.

TINCTURE OF OPIUM.

(*Laudanum*).

The U. S. Pharmacopœia requires that this tincture when assayed by the U. S. P. method shall contain in 100 c c. "not less than 1.2 nor more than 1.25 gms. of crystallizable morphine."

Eight samples were examined by this method, all but one showing a considerable deficiency in morphine.

The cost ranged from sixty cents to one dollar for 6 ounces.

The results of the assays are given on page 297.

TABLE XVII:—CHLOROFORM.

Sample No.	Place of Sampling.	Cost per 8 oz., cts.	Specific gravity @ 15° C.	Residue on evaporation. mgms. per 100 cc.	Alchohol, cc. per liter.	Organic Impurities.‡	Chlorinated Decomposition Products.§
1113	Bridgeport	50	1.490	1.8	10.0	Much	0
1114	"	50	1.491	2.0	6.5	"	0
1736	Hartford	50	1.497	2.4	4.0	Slight	0
1737	"	65	1.496	2.6	3.5	"	0
1738	"	75	1.491	3.0	8.5	Considerable	0
1739	"	50	1.492	5.0	7.0	"	Faint
1705	Meriden	75	1.496	10.8	4.5	Much	Opalescent
1706	" (Powers-Weightmann-Rosengarten Co.)	75*	1.494	1.0	6.0	Slight	0
1717	New Britain	60	1.495	1.6	5.5	"	Faint
1718	"	75	1.492	1.2	7.5	Much	"
1040	New Haven	80	1.498	1.0	2.8	Slight	0
1041	"	50	1.497	1.0	2.8	Considerable	0
1042	"	55	1.493	3.0	6.5	Much	Faint
1725	New London	75	1.493	31.4	4.8	Considerable	"
1726	"	65	1.492	1.4	7.0	"	"
1730	Norwich	90	1.492	6.4	8.3	"	"
1610	South Norwalk	80	1.491	2.8	9.0	Very much	0
1615	Stamford	40†	1.492	5.2	6.0	Considerable	0
1616	"	50	1.491	3.2	9.0	Slight	0
1632	Waterbury	50	1.493	5.0	7.5	"	Faint
1633	"	60	1.497	0.6	3.0	"	0

* Pound. † 6 oz. ‡ Slight, considerable, much, etc., are terms used with reference to the color of 2 cc. of $\frac{N}{1000}$ iodin diluted to 15 cc. with water; slight is the color which approximately matches this. § The blank used was 2 cc. concentrated sulphuric acid + 15 cc. water + 5 drops silver nitrate; faint opalescence indicates a test clear when viewed horizontally but slightly turbid when viewed at an angle.

Station No.	Place of purchase.	Cost per 6 oz. cts.	Crystallizable Morphine per 100 cc. gms.	Per Cent. of U. S. P. Minimum.
1112	Bridgeport	60	.9706	80.9
1734	Hartford	75	.6845	57.0
1735	"	75	.9504	79.2
1038	New Haven	75	.9956	83.0
1039	" "	90	1.1922	99.4
1606	" "	90	.8842	73.7
1618	Stamford	65	.7722	64.4
1631	Waterbury	100	.8770	73.1

FOOD AND DRUG PRODUCTS EXAMINED FOR THE DAIRY AND FOOD COMMISSIONER.

Nine hundred and ninety-nine samples were examined for the Dairy and Food Commissioner. Since the details regarding them in many instances were not supplied to us, only a brief summary of the results is here given.

Of the whole number of samples examined, 559 were not found to be adulterated, 15 were legally labeled compounds, while 424 were adulterated, misbranded, or below standard.

In connection with these samples the chemists of the station have been called on for court testimony in sixteen instances.

Butter and Butter Substitutes. Of seventy-four samples examined seven were butter, twenty-five renovated butter and forty-two oleomargarine. Three of the latter were colored with annatto.

Candy. The sample tested contained no sulphites.

Abizol. This material was found in a Bridgeport candy factory, where it was claimed to be used as a hardener. It was found to consist chiefly of sulphurous acid (24.41 per cent.) together with sulphite salts.

Color. This color sold to a manufacturer of "soft drinks" proved to be Tropeolin O, an unpermitted coal-tar color.

Cheese. Twelve samples were examined in a study of the losses in weight of this material when stored in an ice box at 49° Fahr., and in an open closet at 60-66° Fahr. The samples were weighed daily for seven days and the following losses were shown:

Losses of Weight in Cheese,

	In Ice Box Original Weight.	Weight after 7 days.	Loss.	In Closet Original Weight.	Weight after 7 days.	Loss.
	gms	gms.	gms.	gms.	gms.	gms.
Fromage de Camembert	283	255	28	279	229	50
MacLaren's Nippy Cheese	105	105	0	106	105	1
Sap Sago Swiss Spalty	113	111	2	113	104	9
Isigny Type Cheese	478	408	70	507	405	102
" " "	298	247	51	264	196	68
Chiffeman's Camembert	307	293	14	313	279	34
Shefford Snappy Cheese	94	93	1	90	90	0
Star Brand Cream Cheese	92	91	1	96	92	4
International Welsh Rabbit Cheese	91	91	0	96	95	1
Liederkranz Cheese	130	127	3	124	118	6
MacLaren's Deviled Cheese	109	109	0	110	109	1
Cow Brand Neufchatel Cheese ..	74	74	0	74	72	2

It will be noted that in eight of the brands the losses were trifling both in the ice box and the closet. The *Fromage de Camembert,* covered simply with thin paper and packed in a wooden box, lost 9.9 per cent. in the ice box and 17.9 per cent. in the closet. The other brand of *Camembert,* wrapped in tin foil, showed losses of only 4.6 and 10.9 per cent., respectively. The samples of *Isigny* cheese were simply wrapped in thin paper. The larger one showed losses of 14.6 and 20.1 per cent., and the smaller, losses of 17.1 and 25.8 per cent. in the ice box and closet, respectively. These results on a limited number of brands for a relatively short time indicate that if a cheese is properly packed the losses in weight will be relatively small under the usual methods of sale, especially when the cheese is kept under refrigeration.

Incidentally a partial analysis was made of these samples as follows:

	Water.	Protein.	Fat.	* Undetermined.
Fromage de Camembert (Casino) ...	48.80	19.69	25.68	5.83
MacLaren's Nippy Cheese	29.32	26.88	38.63	5.17
†Sap Sago Swiss Spalty	32.28	52.79	2.80	12.13
‡Isigny Type Cheese	62.97	21.92	9.86	5.25
‡ " " "	61.68	22.39	11.19	4.74
Le Delicieux Camembert	50.77	18.38	26.47	4.38
Shefford Snappy Cheese	30.90	26.31	39.38	3.41
Cream Cheese Star Brand	38.06	12.71	47.25	1.98
International Welsh Rabbit Cheese ...	34.61	25.00	35.25	5.14
Liederkranz Cheese (Monroe)	54.13	16.32	26.38	3.17
MacLaren's Deviled Cheese	35.71	25.58	33.75	4.96
Cow Brand Neufchatel Cheese (N. Y.)	46.73	19.11	31.88	2.28

* Chiefly ash. † Made from skim milk. ‡ Made from partly skimmed milk. None of the cheeses contained boric acid.

Cream. Of fourteen samples of cream, eleven were of standard quality, one contained only 12.5 per cent. fat, and two samples from Waterbury contained sucrate of lime.

Honey. The two samples examined showed no adulteration.

Ice Cream. Nineteen samples from Stamford were tested for fat and artificial color. The fat ranged from 6 to 12.75 per cent., seven samples showing less than 8 per cent. Two samples were colored with acid magenta, an unpermitted coal-tar color.

Milk. Four hundred and twelve samples were examined. Of these 155 conformed to the legal standards, while 70 were deficient only in solids-not-fat. One hundred and eighty-five samples were below standard in solids, 93 in fat, and 249 in solids-not-fat, 257 samples failing to meet the legal requirements in one or more particulars. Eight samples were skimmed, 106 were watered, 6 both watered and skimmed, and 4 were watered and contained formaldehyde.

The watered samples were taken in Collinsville, Bloomfield, North Branford, North Haven, Norwalk, Milford, Middletown, Newington, Cromwell, Greenwich, Orange, Wallingford, Danbury, Waterbury, Cornwall Bridge, Sharon, Bridgeport, Canaan, Windsor, Manchester, West Haven, Lakeville, Durham, South Manchester, Torrington, Norfolk, Bethlehem, Ridgefield, Avon, Westbrook, Stafford Springs and Goshen. The skimmed samples were taken in Cornwall Bridge, Sharon, Bridgeport, Wethersfield, Waterbury, Thompsonville and Fairfield. The skimmed and watered samples were taken in Greenwich, Sharon and Waterbury. The watered samples also containing formaldehyde were taken in Waterbury.

Skim Milk. Three samples sold as skim milk contained 9.21, 9.20 and 9.47 per cent. solids and 0.15, 0.18 and 0.60 per cent. fat.

Temperance Drinks. Fifty-one samples were examined chiefly for the presence of saccharin and artificial color. The manufacturers of "soft" drinks sold in this state apparently make but little effort to label their products honestly, in fact they are often not labeled at all. Saccharin is widely used, as well as permitted and unpermitted coal-tar colors. Of the fifty-one samples, only sixteen, chiefly ginger ales, were not found adulterated; two were legally labeled compounds; nineteen contained saccharin, six saccharin and a permitted coal-tar color, one saccharin and an unpermitted coal-tar color, and one saccharin and both a permitted and unpermitted coal-tar color; four others contained a permitted, one an unpermitted, and one both a permitted and unpermitted coal-tar color.

Vanilla Extract. A sample of *Alliance Brand* was not found to be adulterated.

Vinegar. This is another food product which is grossly adulterated. Many dealers also sell distilled vinegar as cider or wine vinegar, and compound vinegar as pure cider vinegar. No attempt was made to make a complete analysis of the vinegars, which is essential for the certain detection of adulteration, only acidity, solids and ash being determined. Of 169 samples examined 100 met the legal requirements for acidity and solids for cider vinegar; eight distilled, one malt, two sugar or syrup, three wine, two wood acid and five compound vinegars, were sold under the proper designation. Eight samples of distilled vinegar were sold as wine vinegar, three distilled as cider vinegar, ten compound vinegars as cider vinegar and one compound as syrup vinegar. Eight samples were sold as red vinegar, for which there is no standard in this state. Two cider vinegars were below standard in acidity, three in solids, six in both acidity and solids, and one in ash; two distilled vinegars, two compound vinegars, one wine and one syrup vinegar were below standard in acidity.

Hydrogen Peroxide. Thirty-two samples were examined, ten in bulk, and the remainder in original bottles. While many of the samples exceeded the U. S. P. requirements for acidity, only four were materially below the standard of 3 per cent. peroxide by volume. The deficient samples were *Hydrogen Peroxide,* prepared for East Side Pharmacy, Derby, *Hydro-Oxide,* made by the National Peroxide Co., N. Y., *Hydrogen Peroxide,* prepared for The City Pharmacy, Stamford, and an unnamed sample from a Greenwich druggist, whose name was not supplied to us; these contained 1.67, 1.91 and 2.08 of hydrogen peroxide, respectively, or 55.7, 63.7, 88.7, and 69.3 per cent. U. S. P. strength.

As a number of the brands examined were not included in our inspection of 1909, the analyses of the samples bearing brand names are given below.

Manufacturer and Brand.	Hydrogen peroxide.	Acidity, 25 cc. H_2O_2 = cc. $\frac{N}{10}$ KOH.
American Druggist's Syndicate	3.62	1.65
" " "	3.65	2.90
" " "	3.63	2.95
Aerozone. Lehn & Fink, New York	3.21	3.55
Albany Chemical Co., Albany, N. Y.	3.03	3.05
" " " " "	2.98	3.25
" " " " "	3.02	3.50
" " " " "	2.99	3.25
Prep. for the City Pharmacy, Stamford	2.66	3.20
Earle & Co., New York	2.94	2.70
" " " "	3.04	2.05
Dist. by East Norwalk Pharmacy, E. Norwalk	2.91	2.90
Prep. for East Side Pharmacy, Derby	1.67	2.25
Hydro-Oxide, National Peroxide Co., New York	2.96	2.50
Hydro-Oxide, National Peroxide Co., New York	1.91	1.75
Prep. for The Nicholas & Harris Co., New London	3.05	2.50
Parola. American Peroxide & Chem. Co., Long Island City, N. Y.	3.09	2.75
Parola. American Peroxide & Chem. Co., Long Island City, N. Y.	2.78	2.25
Prep. for Radom's Pharmacy, New Britain	2.96	3.40
Rexall	2.79	3.10
Pyro-Oxygen. The Arthur Chem. Co., New Haven	2.88	3.30
Pyro-Oxygen. The Arthur Chem. Co., New Haven	2.89	3.80
Prep. for Schieffelin & Co., New York	2.81	2.25

Tincture of Iodine. Thirty-nine samples were examined of which nine showed a deficiency greater than 5 per cent. of the 6.86 gms. of iodine required for 100 c c. The results may be summarized as follows:

Number.	Gms. Iodine per 100 cc.	U. S. P. Strength.
21	6.86–8.44	100 –123
9	6.52–6.85	95 – 99.9
5	6.17–6.51	90 – 94.9
3	5.83–6.05	85.3– 88.2
1	5.38	77

The following samples showed a deficiency greater than 5 per cent.

Druggist.	Gms. Iodine per 100 cc.	U. S. P. Strength.
J. H. Clampett, Bridgeport	6.17	90.0
Jennie Hamilton, Bridgeport	5.87	85.6
White's Pharmacy, Bridgeport	6.29	91.7
Joseph H. Lutz, New Britain	6.40	93.3
Ellis Pharmacy, Stamford	6.05	88.2
Clifford Pharmacy, South Norwalk	5.85	85.3
E. T. Vance, Ansonia	5.38	77.0
Mahoney's Corner Drug Store, Shelton	6.44	93.9
H. Monroe, Guilford	6.27	91.4

Turpentine. One hundred and sixty-eight samples were examined, of which eight contained from 9 to 80 per cent. of mineral oil. The names of the brands and of the dealers selling these samples were not supplied to us.

MISCELLANEOUS MATERIALS SENT BY PRIVATE INDIVIDUALS.

Milk. Of the sixty-two samples tested only twenty-eight were unadulterated and of standard quality. Twenty-two samples were watered, four were skimmed, three were below standard in solids and three in both solids and fat. One sample was too badly curdled to analyze, and one sample sent from Waterbury contained formaldehyde.

Cream. Twelve samples were tested. Seven exceeded the legal standard, ranging from 20.5 to 52 per cent. of fat. Four samples, below standard, contained 9.82, 10.48, 12.48 and 12.72 per cent. of fat. One sample sent from Waterbury contained sucrate of lime as a thickener.

Human Milk. The sample analyzed contained 10.73 per cent. solids, 1.08 protein, 1.80 fat, 0.24 ash and 7.61 (sugar) by difference.

Butter. Of six samples examined five were genuine, while one was renovated butter.

Vinegar. Of sixteen samples examined eight satisfied the legal standard for solids and acidity. Three samples each were low in solids and acidity, and two samples were low in both respects.

Asparagus. A sample of *Humbert & Andrews' Acme Brand Asparagus* contained sodium fluoride, a new adulterant for this State and a particularly poisonous one.

Near Beer. Two samples of *Jean Hornig's Carbonated Quaker Beer,* "A Substitute for Ale or Lager. Not Intoxicating," contained 3.65 and 3.37 per cent. of alcohol by volume.

Buckwheat Flour. Three samples from the same source, but sent in by the wholesaler, the retailer and the consumer were examined. The retailer's sample contained 1.36 per cent. ash and 0.12 per cent. insoluble in acid (sand), while the other two samples contained 1.71 and 1.64 per cent. ash, and 0.54 and 0.53 per cent. sand, respectively.

Candy. A sample of "Girl's Head" mixed chocolates was examined. The chocolate coatings contained no other fat than cocoa fat; no paraffin was detected; and no glucose in the sugar fillings. In the caramels glucose was found.

A sample of marshmallows contained 39.7 mgms. of vanillin and 10.6 mgms. of coumarin in two of the candies. The candy was so overflavored as to be practically uneatable.

Cider. A sample of supposed sweet cider contained 1.65 per cent. alcohol by volume, and a sample of hard cider 6.95 per cent.

Color. A dry color intended for use in foods was found to be Tropeolin O, an unpermitted coal-tar color.

Gelatine. Two samples contained 15.14 and 15.37 per cent. nitrogen, and 1.32 and 1.31 per cent. ash, satisfying the U. S. Standard for that product.

Grape Juice. A sample of the home-made product contained 0.60 per cent. alcohol by volume.

Honey. The three samples examined were not found to be adulterated.

Ice Cream. The eleven samples examined contained from 4.0 to 14.5 per cent. of fat; no starch was found in any of the samples. Six samples contained coal-tar colors, four amaranth and two erythrosin, both permitted dyes when declared.

Molasses. The two samples examined were not adulterated.

Olive Oil. The sample examined contained no cotton seed or sesame oil.

Sugar. The two samples of granulated sugar examined contained no adulteration.

Vanilla Extract. Two samples were analyzed. *Highly Concentrated Extract Vanilla Compound,* made by The Bacorn Co., Elmira, N. Y., had a specific gravity at 15.5° C. of 1.02487, and contained 27.11 per cent. ethyl alcohol by volume, 0.499 per cent. vanillin, 0.104 coumarin, normal lead No. 0.23, resins, very slight, caramel, present. It proved to be a compound extract consisting of vanillin, tonka extract, and a small amount of vanilla extract, colored with caramel. It was not correctly labeled. The other sample of vanilla extract, no brand name, contained no coumarin.

Wheat Flour. Two samples were received, about which complaint had been made as to the presence of greenish-blue specks in the flour. The samples were branded *"Our National Golden Rod Flour, A. F. C. & Co."* The flour bag was blue lined, and it was at first thought that the specks were due to fragments of this paper lining. The lining appeared intact, however, and our final conclusion was that the specks were due to particles of the coal-tar dye mechanically attached to the lining and thus distributed throughout the flour. We were unable to identify the dye with certainty.

Whisky. Two samples suspected of containing "knock-out" drops contained neither chloral hydrate nor wood alcohol.

Wine. One sample examined contained 0.52 gm. of acetic acid per 100 c c. of wine. Another sample of home-made wine was found to be an acid wine with low extract and no appreciable amount of sugar.

Alcohol. The sample examined contained 93.6 per cent. ethyl alcohol, and no wood alcohol.

Alloy. A mass of about twenty-five pounds found in an old barn contained antimony and tin and a small amount of lead.

Ammonia, C. P. The sample, sent by The New Haven Gas Light Co., showed a specific gravity at 15° C. of 0.896, equal to 29.69 per cent. NH_3; 10 c c. gave a residue of .0003 gm. at 100° C. There was a very slight trace of chlorides and of empyreumatic substances; no coloration was produced by neutralization with nitric or sulphuric acids. The sample proved to be of a high degree of purity.

Arctic Chemical Compound. This material, made by the Arctic Chemical Cooler Co., New York City, is intended for refrigeration purposes and claims to effect a considerable saving in ice. The material came to us in two portions, one a dirty-white crystalline material, the other pale pink crystals. The former contained 59.08 per cent. chlorin, equivalent to 97.49 per cent.

common salt; the latter proved to be essentially sodium sulphate, containing possibly some iron-ammonium sulphate; no manganese was detected.

Arsenate of Lead. A sample of *Swift's Arsenate of Lead,* made by the Merrimac Chemical Co., contained 42.20 per cent. water, 37.81 lead oxide and 17.67 arsenic oxide, or on the water-free basis 65.42 per cent. lead oxide and 30.57 per cent. arsenic oxide.

Babbitt's Pure Lye. This proved to be a soda lye and contained no appreciable amount of potash.

Cocaine, Heroin and Morphine. Seventeen samples of these drugs were analyzed in connection with the police crusade against their sale in New Haven. One sample was a mixture of cocaine and B-eucaine with milk sugar. Another sample suspected of being cocaine gave reactions for alkaloids, but too faint for identification. Nine samples proved to be heroin and five morphine. Another sample suspected to be morphine was milk sugar. The examination of these samples, and the testimony given in court in connection with them, resulted in the conviction of distributors of these drugs in New Haven, the most notable of whom was Geo. D. Farovid, a New Haven druggist, who had been convicted a few years previously for selling cocaine. The direct result of this New Haven campaign was the passage of a stringent law by the last legislature regarding the sale of narcotic drugs in this State.

Cow's Stomach. The contents of the stomach of a cow, suspected of having been poisoned by Paris green, showed neither copper nor arsenic.

Disinfectant. The use of this material was reported to have caused gangrene. It proved to be a crude preparation of coal- or wood-tar origin, containing a mixture of phenol and creosote. Commenting on the use of phenol the U. S. Dispensatory, 19th Ed., p. 930, says, "Moreover, in numerous cases the local use of phenol has been followed by severe local symptoms, especially gangrene, so that care is essential."

Emmenagogues. Two samples of materials, intended to cause abortion, were examined for the State Board of Pharmacy Commissioners. A liquid preparation contained pennyroyal and cotton root, with no aloes or ergot. A sample of pills contained savin, hellebore and an iron salt.

Hair Dyes. A partial examination was made of two solutions submitted by a New Haven physician. One solution was an organic tincture, the other an alkaline solution of a chromium salt, probably alkaline chrome hydrate; no acetate of lead was detected.

Linseed Oil Soap. A sample of *Charter Oak Linseed Oil Soap* showed no free alkali

Rubber Nipple. The sample was submitted on the supposition that a child had been poisoned by its use. Human saliva extracted no color or antimony from the nipple.

Soluble Sulphur Compound. This material was made by the Niagara Sprayer Co., Middleport, N. Y. A solution of 10 pounds to 50 gallons of tap water showed the following analysis:

	With heat.	In the cold.
Total Sulphur	56.4	56.3
Lime	none	...
Magnesia	none	...
Sodium oxide	35.8	35.5
Potassium oxide	0.97	0.93
Chlorine	trace	...
Insol. in water	3.7	3.9
Insol. on ignition (iron)	2.6	...

Turpentine. The two samples examined were pure gum turpentine.

Worm Remedy for Hogs and Cattle. The material consisted chiefly of sodium chloride (93.34 per cent.), with some iron and charcoal.

TABLE XVIII:—SUMMARY OF RESULTS OF EXAMINATION OF FOOD AND DRUG PRODUCTS, 1913.

	Not found Adulterated.	Adulterated or below standard.	Compound.	Total number examined.
Sampled by Station.				
Bread	201	..	..	201
Candy	*138	12	†39	189
Dehydro Foods	..	..	..	5
Diabetic Foods	..	..	..	161
Gelatine	4	1	..	5
Ice Cream Powders	..	..	..	10
Jelly Powders	2	..	13	15
Peanut Butter	12	..	..	12
Pumpkin, Canned	16	6	1	23
Wines	..	..	..	38
Miscellaneous Foods	7	..	..	7
Calomel	22	..	..	22
Chloroform	21	..	..	21
Laudanum	1	7	..	8
Saccharin Preparations	..	..	..	17
Total	424	26	53	734
Sampled by Dairy Commissioner.				
Abizol	..	..	..	1
Butter and Butter Substitutes	7	67	..	74
Candy	1	..	..	1
Cheese	12	..	..	12
Colors	..	1	..	1
Cream	11	3	..	14
Honey	2	..	..	2
Ice Cream	17	2	..	19
Milk	155	‡257	..	412
Skim Milk	3	..	..	3
Temperance Drinks	16	33	2	51
Vinegar	116	40	13	169
Vanilla Extract	1	..	..	1
Hydrogen Peroxide	28	4	..	32
Tincture of Iodine	30	9	..	39
Turpentine	160	8	..	168
Total	559	424	15	999
Sampled by Private Individuals.	72	80	..	169
Total from all sources	1055	530	68	1902

* Including 35 samples which were short-weight, and not classing as adulterated marshmallows, gum drops and jelly beans containing gelatine. † Containing permitted coal-tar colors, but not declared. ‡ Including 90 samples below standard in solids not fat.

TESTING OF BABCOCK-TEST GLASS WARE.

During the past year this laboratory has tested a large number of milk and cream bottles and pipettes used in making the Babcock test for fat in milk and cream. The following table summarizes the results of the tests:

	Total.	Broken.	Accurate.	Inaccurate.
Pipette for cream	67	0	66	1
" " milk	41	1	40	0
Testing bottles, cream	40	0	40	0
" " milk	342	8	330	4
Totals	490	9	476	5

State of Connecticut

REPORT

OF

The Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

COMMERCIAL FEEDING STUFFS, 1913

BEING PART V OF THE ANNUAL REPORT OF 1913

PART V.

Commercial Feeding Stuffs.

By John Phillips Street.*

Under the Connecticut statutes the term "concentrated commercial feeding stuff" covers practically all feeds excepting hay and straw, whole seeds, unmixed meal made directly from any one of the cereals or from buckwheat, and feed ground from whole grain and sold directly from manufacturer to consumer.

Section 4592 requires that every package of concentrated commercial feeding stuff shall bear a statement giving the name and address of manufacturer or importer, the number of net pounds in the package, the name of the article and the percentages of protein and fat contained in it.

No registration of feeds or payment of analysis or license fees is required.

The penalty for violation of the statute is not more than $100 for the first offense and not more than $200 for each subsequent offense.

The law authorizes this station to take samples from any manufacturer, or dealer, in a prescribed fashion, and requires the station to analyze annually at least one sample of each brand which it has collected and to publish these analyses "together with such additional information in relation to the character, composition and use thereof as may be of importance."

The dairy and food commissioner is charged with the enforcement of the statute.

Inspection of 1913.

In compliance with the above requirements the following report has been prepared. The utmost brevity of discussion is made necessary by the limit imposed by law on the size of the report.

* The chemical work here reported has been done by Messrs. Morison, Shepard and Davis; the microscopical examination by Mr. Street.

During the fall of 1913 the station sampling agent visited 52 towns and villages of this state and collected 189 samples of feeds. The results of the examination of these samples are here discussed, and the chemical analyses are given in Table IV.

The analyses of 48 samples sent by individuals are also separately reported.

The official samples may be grouped as follows:

No.		No.	
19	Cotton seed meal	1	Buckwheat middlings
2	Cotton seed feed	1	Malt sprouts
2	Linseed meal, new process	7	Dried brewers' grains
10	Linseed meal, old process	6	Dried distillers' grains
1	Wheat bran	2	Alfalfa meal
1	Wheat feed	5	Dried beet pulp
1	Wheat gluten feed	9	Corn and oat feeds
18	Corn gluten feed	4	Wheat and corn cob feeds
1	Corn gluten meal	6	Horse feeds
18	Hominy feed	24	Dairy and stock feeds
1	Hominy and corn cob feed	22	Molasses feeds
2	Corn meal	21	Poultry feeds
5	Rye middlings and feed	—	
		189	total

Comments on Analyses.

Of the 189 official samples, 31 were below guaranty in some particular; 10 in protein, 18 in fat, and 3 in both protein and fat. The tabulation given below shows the individual brands which were deficient.

Cotton Seed Meal averaged one per cent. less protein than last year, with an increased price of $2.32 per ton.

Royal Feed, a mixture of cotton seed meal and cotton seed hulls, about half and half, contained only a little over half as much protein as high-grade meal, and sold for only $6.45 per ton less. Assuming $35 as the average ton price for good cotton seed meal, in this feed the purchaser would pay about $23 per ton for the hulls, certainly an excessive price when malt sprouts sells for $26, or dried brewers' grains for $28.

New Process Linseed Meal showed about two per cent. less protein than in 1912, at $6.50 less per ton. *Old Process Linseed Meal* contained 1.68 per cent. less protein, with the selling price $2.20 lower.

TABLE I.—FEEDS BELOW GUARANTY.

Station No.		* Deficiency in Protein.	* Deficiency in Fat.
		%	%
3139	Amer. Cotton Oil Co.'s Prime Cotton Seed Meal......	....	0.82
3134	Bunch's Old Gold Brand Cotton Seed Meal............	1.99	....
3186	Southern Cotton Oil Co.'s Bonita Brand Cotton Seed Meal..	1.74	....
2153	Royal Feed	2.06	....
3111	Mann Bros. Linseed Meal............................	1.50	....
3110	Cedar Rapids Gluten Feed..........................	1.37	....
3119	Cream of Corn Gluten Feed..........................	....	0.26
3017	Staley's Gluten Feed................................	....	0.30
3130	" " "	....	0.85
3034	Bufceco Hominy Feed................................	...	0.58
3072	" " "	....	0.39
3117	" " "	....	0.62
3049	Wirthmore Hominy Feed..............................	....	1.03
3089	Mystic Milling Co.'s Hominy Feed...................	....	0.84
3189	Blue Ribbon Hominy Feed............................	....	0.67
3199	Quinebaug Buckwheat Middlings......................	9.50	2.43
3040	Milwaukee Grains & Feed Co.'s Malt Sprouts..........	....	0.69
3193	Buckeye Gluten Feed................................	....	1.32
3054	Eagle 3 D Distillers' Grains........................	1.87	....
3103	" " " "	2.49	....
3062	Hatch's Horse Feed..................................	2.19	0.28
3018	Maz-All Feed..	1.19	....
3030	Schumachers' Calf Meal..............................	2.12	....
3050	Biles Ready Ration..................................	....	0.90
3094	" " "	....	0.29
3171	Allneeda Horse and Mule Feed.......................	....	1.58
3068	Braue's Mixed Feed with Molasses....................	3.56	1.99
3155	Peerless Dairy Feed	....	3.30
3081	H. O. Dry Poultry Mash..............................	4.06	....
3096	Puritan Laying Mash.................................	....	1.84
3148	" " "	....	2.10

* A deficiency of less than 1 per cent. of protein and 0.25 per cent. if fat is not noted.

Gluten Feed. The chief differences in the ten brands are shown in the percentages of protein and ash, the former ranging from 21.6 to 26.3, the latter from 0.9 to 5.2 per cent. These differences are probably due in large part to the use or exclusion of the "steep liquor," a by-product of glucose manufacture. The decreased percentage of protein as a rule is not reflected in a lowered cost per ton. The five brands, analyzed both this year and last, contained 1.3 per cent. less protein this year, with an increased price of 55 cents per ton.

Hominy Feed contained about the same amount of protein as last year, but cost nearly $2.50 per ton more.

Star Feed. The single sample contained 2.76 per cent. less protein and 1.15 per cent. less fat than an average hominy feed, but cost slightly more. Under no circumstances can this feed be considered an economical purchase.

Rye Products. The samples of feed and middlings showed about the same composition as last year, but were $2.25 per ton cheaper.

Buckwheat Middlings. The sample was far below the standard of the middlings generally sold by this mill, showing a shortage of 9.50 per cent. protein and 2.43 per cent. fat. These deficiencies are due to the unusual presence of excessive hulls, the crude fiber amounting to over 20 per cent., more than double the quantity found in previous inspections of this brand.

Malt Sprouts. The single sample was of average composition, and $2 lower in price than last year.

Dried Brewers' Grains. The seven samples were likewise of standard composition and the price was $1.18 less than in 1912. The relative cheapness of this most excellent feed cannot be overemphasized.

Dried Distillers' Grains. The samples of *Ajax Flakes* and *Eagle 3D Grains* showed little variations from previous years either in composition or cost; two of the samples of the latter brand, however, failed to meet the protein guaranty. *Hiquality Spirits Grains* is another high-grade product selling at the same price as the brands just mentioned, although containing 5 per cent. more protein. *Buckeye Gluten Feed* is not a "gluten feed" as generally understood by the trade and the cattle feeder. It contained about 10 per cent. less protein than the other brands of distillers grains, and sold for $10 less per ton.

Provender and Corn and Oat Feeds. The samples were of normal composition, the higher percentages of fiber in most of the proprietary mixtures indicating that they were not mixtures of whole corn and oats of good quality, but rather that either low-grade oats or excessive oat hulls had been used. As has been stated many times, it is hard to understand why feeders will buy such feeds as these, for from $28 to $40 per ton, when cotton seed meal, gluten feed, dried brewers' grains and malt sprouts may be bought for the same price or less, and especially when an abundant supply of carbohydrates and roughage can be cheaply raised on the farm.

The *Wheat and Corn Cob Feeds* showed the usual composition and cannot be considered an economical purchase when sold for only a few dollars less per ton than standard wheat feed.

Proprietary Horse, Dairy and Stock Feeds. These require no special comment further than to call attention to the fact that while some of the brands are made from excellent materials and show intelligence in their compounding, still others are very ordinary mixtures of very ordinary materials sold at an excessively high price. The horse feeds are fairly uniform in composition, at prices from $32 to $40 per ton. Among the dairy and stock feeds, however, we find feeds containing from 8 to 11 per cent. protein selling for $28 to $31, some containing 10 to 26 per cent. for $32 to $34, and others containing from 11 to 25 per cent. for $35 to $37. In other words the selling price as a rule bears no relation whatever to the composition of the feed. The feeder should understand that there is no mystery in the compounding of these feeds. They are made from well-known materials of varying value and digestibility. When standard feeds of quite as good if not better feeding value, may be secured at prices often no higher and generally much lower than those asked for these special mixtures, the feeder may well hesitate before purchasing the latter if he wishes to run his dairy or stock farm on an economical basis.

Proprietary Poultry Feeds. Certain brands, such as *Purity Poultry Mash, Puritan Laying Mash* and *H.-O. Dry Poultry Mash,* showed wide differences in composition among different samples of the same brand. In other cases the guaranty was an imperfect indication of the quality of the feed, so great was the over-run, especially of protein. Guaranties are meant to convey certain definite information, and, while a deficiency is much more to be deplored than an excess, an over-run of from 8 to 3 per cent. protein, which we find in two of the brands, is also objectionable. It may mislead the careful feeder in compounding his rations, and may cause him to depend on a similar excess in future purchases, an expectation the manufacturer is not legally bound to satisfy.

Molasses Feeds.

Twenty-two samples of this class of feeds were examined. In general they consisted of corn, oats, alfalfa or dried beet pulp, with from 15 to 60 per cent. or more of molasses. In one brand peat was substituted for feed.

The analyses of these feeds presented some difficulties. Previous experience had shown us that it was impossible to determine accurately the fat in the usual way in such mixtures. Accordingly 2 gms. of material were washed with about 200 cc. of water at room temperature, the insoluble residue dried and then extracted with anhydrous ether as usual. Seventeen of the samples showed an increased ether extract by this method, ranging from 0.04 to 1.47 per cent., the increase being most marked where alfalfa was a constituent of the feed. On the other hand five samples gave slightly higher ether extracts without previous extraction with water; these apparently contained some ingredient soluble in both cold water and ether. It is evident from the above results that the use of the conventional method for determining fat in cattle feeds is generally unjust to molasses feeds. The results given in our general tables were secured by the modified method.

The aqueous extract of these feeds was also determined, and in it the soluble ash and nitrogen. (See Table II.) The extract ranged from 14.96 to 62.76 per cent., and in all cases is somewhat higher than the amount of molasses solids that was present. For instance, the writer has shown* that 8.65 per cent. of dried beet pulp is soluble in cold water. It is apparent therefore, that the two samples of *Dried Beet Pulp and Molasses* examined this year did not contain over 10 per cent. of molasses solids. On the other hand the aqueous extracts from the two samples of *Molassine Meal,* 59.92 and 62.76 per cent., are practically all molasses, as peat, their other ingredient, is insoluble in water. So we may say that these feeds contain from 10 to 60 per cent. of molasses solids.

Unusually large amounts of the nitrogen of these feeds were soluble in water, or rather in the aqueous saline solution, as the feeds contained considerable water-soluble potassium and other salts. The soluble nitrogen ranged from 0.28 to 1.24 per cent., or from 12.2 to 82.4 per cent. of the total nitrogen of the feed. This presents another analytical difficulty. This soluble nitrogen undoubtedly is in part derived from the molasses itself and is probably not of a protein nature. The amount of soluble nitrogen precipitated by zinc sulphate ranged from 0.07 to 0.30 per cent.,

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* Rept. New Jersey Expt. Station, 1906, p. 44.

or from 8.5 to 41.8 per cent. of the total soluble nitrogen. This indicates what a small proportion of the soluble nitrogen is protein nitrogen, and how unjustified is the use of the conventional protein factor in feeds of this class. In the *Molassine Meal,* for instance, only 8.5 and 9.3 per cent. of the soluble nitrogen is precipitated by zinc sulphate. While our results show that this feed contains only 0.63 per cent. of protein, yet using the

TABLE II.—MOLASSES FEEDS.

Station No.	Brand	Soluble in Cold Water.				Percentage Solubility in Cold Water.			Fat.	
		Total Extract.	Ash.	Protein (N x 6.25).	Carbohydrates.	Ash.	Protein (N x 6.25).	Carbohydrates.	In Original Material.	In Water-Extracted Material.
3171	Allneeda Horse and Mule Feed......	35.24	5.78	3.00	26.46	80.0	33.3	44.7	1.01	1.92
3056	Sucrene Dairy Feed	26.24	4.06	3.13	19.05	51.2	18.9	41.1	6.49	6.24
3097	" " "	25.76	4.72	3.50	17.54	58.6	21.2	36.4	4.97	5.15
3068	Braue's Mixed Feed with Molasses...	39.80	5.26	2.88	31.66	71.5	33.9	48.7	0.56	2.03
3155	Peerless Dairy Feed................	31.52	4.44	4.88	22.20	58.7	24.4	46.6	3.55	3.70
3067	Commonwealth Alfalfa and Molasses.	43.64	6.44	4.25	32.95	74.5	40.9	66.1	0.60	0.94
3063	Missouri Horse and Mule Feed......	29.08	4.06	3.00	22.02	76.3	30.0	40.0	3.69	4.02
3093	Boggs' Competition Horse Feed......	19.80	2.08	2.25	15.47	72.2	20.5	23.0	3.28	2.79
3190	H. & S. Horse, Mule and Dairy Feed.	32.08	3.72	2.00	26.36	45.8	12.2	51.3	3.53	4.21
3137	Husted Molasses Feed..............	27.88	4.66	4.25	18.97	68.1	18.7	38.9	3.83	4.01
3013	Dried Beet Pulp and Molasses.......	14.96	1.70	1.88	11.38	45.5	21.2	19.1	0.71	0.38
3090	" " " " "	18.64	1.64	1.75	15.25	35.9	19.3	25.7	0.76	0.50
3038	Molassine Meal....................	62.76	7.14	7.38	48.24	87.6	82.0	79.5	0.41	0.74
3129	" "	59.92	6.42	6.75	46.75	86.1	82.4	79.3	0.48	0.72
3135	Omaha Alfalfa Meal and Syrup.......	53.00	6.90	6.13	39.97	73.2	59.5	75.1	0.19	0.76
3123	June Pasture Alfalfa Meal with Molasses..........................	48.84	7.98	7.75	33.11	82.3	60.8	69.7	0.27	0.85
3124	Peter's King Corn Sugar Feed.......	35.40	5.18	5.50	24.72	81.8	48.9	43.1	1.18	1.95
3086	Green Cross Molasses Horse Feed...	23.20	3.28	3.88	16.04	66.5	36.5	26.4	2.65	2.87
3087	Quaker Molasses Dairy Feed........	27.48	3.52	4.50	19.46	52.4	27.0	39.3	4.76	4.80
3113	" " " "	28.44	3.70	3.88	20.86	49.5	24.5	42.2	4.31	4.72
3166	Purina Dairy Feed....	31.28	5.24	5.00	21.04	69.0	26.2	47.9	2.75	3.24
3167	Purina Molasses Feed..............	23.92	4.00	4.50	15.42	78.7	39.6	25.6	2.31	2.26

conventional factor we are obliged to report 8.60 per cent. protein. It is obviously improper to use this factor with feeds like *Molassine Meal,* and yet with our present knowledge we feel obliged to adopt the conventional method for the present inspection. The difficulty is increased by the fact that in two samples of pure alfalfa meal we found 33.6 per cent. of soluble nitrogen, so that we are not justified in attributing all of the soluble nitrogen in the molasses feeds to molasses.

Formerly in the examination of feeds much stress was placed on the fact that in certain feeding stuffs a considerable part of the nitrogen existed in the amid form, and was not regarded as useful for feeding purposes as protein nitrogen. In recent years but little attention has been paid to this fact, and it is a serious question, especially in view of the increasing use of these molasses feeds, whether more attention should not be given to this phase of the feeding problem. In Table III will be found a compilation of analyses made by the writer at the New Jersey station from 1892 to 1899 showing the proportion of protein nitrogen in certain feeds.

TABLE III.—PROPORTION OF NITROGEN IN PROTEIN FORM IN FEEDS.

No. of Analyses.		Per Cent.	No. of Analyses.		Per Cent.
2	Alfalfa hay	82.0	4	Oats, ground	86.1
2	Timothy hay	93.9	7	Corn and oats	95.7
4	Corn stalks	87.0	3	Oat chop	95.0
9	Corn fodder	88.7	5	Corn meal	96.5
1	Mangel wurzels	47.4	8	Gluten meal	98.1
4	Sugar beets	41.3	11	Gluten feed	94.3
28	Cotton seed meal	96.6	5	Hominy feed	93.1
1	Cotton seed feed	93.0	2	Rye bran	84.6
3	Linseed meal, n. p.	94.0	2	Buckwheat middlings	94.4
33	" " o. p.	94.0	11	Dried brewers' grains	94.8
18	Wheat bran	86.9	1	Dried distillers' grains	93.7
14	Wheat middlings	85.8	3	Malt sprouts	73.9

The amounts of soluble ash in the molasses feeds were also very large, ranging from 1.64 to 7.98 per cent. or from 35.9 to 87.6 per cent. of the total ash. This again is chiefly due to the added molasses, which is relatively rich in potassium salts.

UNOFFICIAL SAMPLES.

Forty-eight samples sent in by individuals have also been analyzed in part. The station is not responsible for the sampling, but only for the accuracy of the analysis of these samples.

COTTON SEED MEAL. Three samples of *Dixie Brand,* Humphreys Godwin Co., Memphis, were guaranteed 38.62 per cent. protein; **3299,** sent by G. T. Soule, New Milford, contained 37.63 per cent., **3363**, sent by H. B. Coger, Botsford, contained

40.38 per cent., and **3491**, sent by The C. W. Campbell Co., Westerly, contained 39.13 per cent. Another sample of the same brand, guaranteed 41 per cent. protein, sent by The Coles Co., Middletown, contained 37.94 per cent.

Six other samples credited to Humphreys Godwin Co. were analyzed. **3298**, sent by D. W. Ives, Wallingford, guaranteed 41 per cent. protein, **3361**, sent by H. E. Meeker, Danbury, guaranteed 38.62 per cent. protein, **3328**, sent by Spencer Bros., Suffield, and **3359** and **3492**, sent by The Coles Co., Middletown, without guaranty, and **3369**, sent by Spencer Bros., guaranteed 40.63 per cent. protein, contained 39.38, 42.25, 42.63, 38.63, 41.31 and 42.50 per cent., respectively.

3335, sold by Buckeye Cotton Oil Co., Cincinnati, Ohio, sent by H. H. Waldron, Bethlehem, and **3360**, sent by Apothecaries Hall Co., Waterbury, guaranteed 38.62 per cent. protein, contained 40.06 and 38.50 per cent., respectively.

6171, *Dirigo Brand,* W. Newton Smoth, Baltimore, Md., guaranteed 41 per cent. protein, sent by Norwich Grain Co., Norwich, contained 39.06 per cent.

3003, sent by The Coles Co., Middletown, without guaranty, contained 43.19 per cent. protein.

3004, *Bonita Brand,* Southern Cotton Oil Co., Charlotte, N. C., guaranteed 38.62 per cent. protein, sent by Apothecaries Hall Co., Waterbury, contained 39.50 per cent.

3266, *Owl Brand,* F. W. Brode and Co., Memphis, guaranteed 38.62 per cent. protein, sent by R. H. Ensign, Simsbury, contained 39.63 per cent.

3267, *Forfat Brand,* Humphreys Godwin Co., guaranteed 38.62 per cent. protein, sent by W. E. Wheelock, Quinebaug, contained 37.88 per cent.

3297, J. E. Soper and Co., Boston, guaranteed 40.63 per cent. protein, sent by C. O. Bidwell, Thompsonville, contained 41.81 per cent.

3001, sent by Apothecaries Hall Co., Waterbury, without guaranty, contained 40.63 per cent. protein. **3002**, bought through this dealer by H. H. Waldron, Bethlehem, and sent without guaranty, contained 40.69 per cent.

3334, Southern Cotton Oil Co., Charlotte, N. C., guaranteed 38.62 per cent. protein, sent by H. H. Waldron, Bethlehem, contained 39.50 per cent.

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	OIL SEED PRODUCTS.	
	Cotton Seed Meal.	
3139	Prime. American Cotton Oil Co., Albany, Ga. ..	*Hartford:* G. M. White & Co...
3074	Owl Brand. F. W. Brode & Co., Memphis, Tenn.	*Stamford:* W. L. Crabb........
3112	Buckeye. Buckeye Cotton Oil Co., Cincinnati, O.	*Torrington:* F. U. Wadhams ...
3125	" " " " "	*Waterbury:* Spencer Grain Co..
3142	" " " " "	*Hartford:* Smith, Northam & Co.
3170	" " " " "	*Middletown:* Meech & Stoddard.
3134	Old Gold Brand. T. H. Bunch Comm. Co., Little Rock, Ark..	*Hartford:* Trout Brook Ice & Feed Co..................
3037	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn..	*Meriden:* Meriden Grain & Feed Co. ....
3092	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn..	*New Milford:* G. T. Soule. ....
3104	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn..	*Winsted:* E. Manchester & Sons
3116	Dixie Brand. Humphreys, Godwin Co., Memphis, Tenn..	*Litchfield;* Litchfield Grain Co..
3024	Forfat Brand. Humphreys, Godwin Co., Memphis, Tenn....................................	*Wallingford:* E. E. Hall ....
3162	Forfat Brand. Humphreys, Godwin Co., Memphis, Tenn....................................	*Willimantic:* H. A. Bugbee ....
3088	Selden. Memphis Cottonseed Products Co., Memphis, Tenn.	*New Milford:* G. T. Soule......
3055	Pilgrim Brand. J. E. Soper Co., Boston	*Bridgeport:* Vincent Bros.......
3159	" " " " "	*Willimantic:* E. A. Buck.......
3105	Pioneer. J. E. Soper Co., Boston	*Winsted:* E. Manchester & Sons
3120	Bonita Brand. Southern Cotton Oil Co., Charlotte, N. C.	*Thomaston:* L. E. Blackmer....
3186	Bonita Brand. Southern Cotton Oil Co., Charlotte, N. C.	*Yantic:* A. R. Manning ....
		Average guaranty ....
		Average of these 19 analyses....
		Average digestible ....
	Cotton Seed Feed.	
3027	Royal Feed. Southern Fibre Co., Portsmouth, Va.	*Meriden:* A. Grulich...........
3153	" " " " " "	*Manchester:* Little & McKinney.
		Average guaranty ....
		Average of these 2 analyses.....
	Linseed Meal, New Process.	
3160	American Linseed Co., Chicago.................	*Willimantic:* W. D. Grant......
3187	" " "	*Yantic:* A. R. Manning........
		Average guaranty ....
		Average of these 2 analyses.....
		Average digestible ....
	Linseed Meal, Old Process.	
3014	American Linseed Co., New York	*Branford:* S. V. Osborn ....
3019	" " "	*East Haven:* F. A. Forbes.....
3025	" " "	*Wallingford:* E. E. Hall ....
3126	" " "	*Waterbury:* Spencer Grain Co..

SAMPLED IN 1913.

Station No.	Pounds per Hundred. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
3139	8.21	5.70	37.75	10.90	30.26	7.18	35.00
3074	7.20	5.78	42.19	8.33	26.28	10.22	34.00
3112	6.50	6.15	43.25	8.60	28.23	7.27	37.00
3125	7.13	5.80	38.88	11.00	29.34	7.85	36.00
3142	7.00	5.83	39.00	10.83	30.09	7.25	38.00
3170	7.03	5.90	41.00	9.30	29.57	7.20	33.50
3134	7.54	5.38	36.63	12.05	30.52	7.88	36.00
3037	7.48	6.28	41.31	8.93	28.37	7.63	36.00
3092	8.14	5.98	40.75	9.20	28.38	7.55	35.00
3104	7.83	5.88	38.88	8.93	29.20	9.28	35.00
3116	7.80	6.38	40.00	9.65	27.88	8.29	36.00
3024	8.00	5.73	38.63	10.85	27.49	9.30	34.00
3162	8.36	5.70	40.19	10.15	27.93	7.67	34.00
3088	8.21	6.10	41.88	8.70	26.74	8.37	35.00
3055	7.23	5.75	40.75	10.25	27.15	8.87	37.00
3159	7.57	5.73	39.38	9.95	29.47	7.90	36.00
3105	7.73	6.13	41.81	10.18	27.07	7.08	35.00
3120	7.06	5.88	39.50	9.78	29.46	8.32	36.00
3186	8.42	6.08	36.88	11.80	28.58	8.24	35.00
....	....	....	**38.98**	....	.....	**6.05**	.....
....	**7.60**	**5.90**	**39.93**	**9.97**	**28.53**	**8.07**	**35.45**
....	....	....	**33.5**	**3.5**	**22.3**	**7.6**	.....
3027	8.38	4.20	21.88	25.38	35.80	4.36	28.00
3153	8.02	3.95	19.94	25.85	38.47	3.77	30.00
....	....	....	**22.00**	....	.....	**4.00**	.....
....	**8.20**	**4.07**	**20.91**	**25.61**	**37.14**	**4.07**	**29.00**
3160	8.75	5.48	36.25	9.45	37.42	2.65	35.00
3187	9.15	5.50	35.69	8.93	38.08	2.65	34.00
....	....	....	**36.00**	....	....	**2.00**	.....
....	**8.95**	**5.49**	**35.97**	**9.19**	**37.75**	**2.65**	**34.50**
....	....	....	**30.2**	**6.8**	**30.2**	**2.4**	.....
3014	9.57	5.27	34.13	9.03	36.32	5.68	36.00
3019	8.76	4.83	32.63	8.68	36.77	8.33	36.00
3025	8.67	5.13	32.75	8.85	36.68	7.92	36.00
3126	8.65	5.40	34.38	8.70	35.18	7.69	38.00

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	OIL SEED PRODUCTS.—*Continued.*	
	Linseed Meal, Old Process.—Continued.	
3118	Guy G. Major Co., Toledo, O.	*Torrington:* D. L. Talcott
3111	Mann Bros. Co., Buffalo, N. Y.	*Winsted:* Platt & Coe
3069	" " " "	*New Canaan:* C. H. Fairty
3066	Metzger Seed and Oil Co., Toledo, O.	*Greenwich:* J. P. Johnstone
3028	Midland Linseed Products Co., Minneapolis, Minn.	*Meriden:* A. Grulich
3132	Midland Linseed Products Co., Minneapolis, Minn.	*Unionville:* F. D. Lawton & Son
		Average guaranty
		Average of these 10 analyses
		Average digestible
	WHEAT PRODUCTS.	
3070	Bran. (No tags.)	*Springdale:* Monroe & Palmer
		Digestible
3194	Occident Wheat Feed. Russell Miller Mill. Co.	*Meriden:* A. Grulich
		Digestible
3195	Atlantic Gluten Feed. Atlantic Starch Works, Westport	*Middletown:* Meech & Stoddard.
		Guaranty
		Digestible
	MAIZE PRODUCTS.	
	Gluten Feed.	
3011	Buffalo. Corn Products Refining Co., New York	*Branford:* S. V. Osborn
3021	* " " " " " " "	*North Haven:* Coöperative Feed Co.
3060	" " " " " " "	*Norwalk:* Holmes, Keeler, Kent Co.
3085	" " " " " " "	*Danbury:* F. C. Benjamin & Co.
		Average guaranty
		Average of these 4 analyses
		Average digestible
3110	Cedar Rapids. Douglas & Co., Cedar Rapids, Ia.	*Winsted:* Platt & Coe
		Guaranty
		Digestible
3158	Clinton. Clinton Sugar Refining Co., Clinton, Ia.	*Stafford Springs:* G. L. Dennis
3185	" " " " " " "	*Yantic:* A. R. Manning
		Average guaranty
		Average of these 2 analyses
		Average digestible
3071	Cream of Corn. American Maize Products Co., New York	*Stamford:* W. L. Crabb
3119	Cream of Corn. American Maize Products Co., New York	*Torrington:* D. L. Talcott
		Average guaranty
		Average of these 2 analyses
		Average digestible
3156	Crescent. Corn Products Refining Co., New York	*Broad Brook:* Broad Brook Mill Co.
		Guaranty
		Digestible
3051	Globe. " " " " " "	*Ansonia:* Ansonia Flour & Grain Co.

* Statement of dealer.

SAMPLED IN 1913—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
3118	8.91	5.65	32.00	9.83	36.70	6.91	39.00
3111	9.53	4.98	32.50	8.48	36.66	7.85	38.00
3069	9.54	4.98	33.38	8.28	36.14	7.68	37.00
3066	9.42	5.54	31.56	9.50	36.47	7.51	38.00
3028	9.41	5.27	33.13	8.23	35.79	8.17	34.00
3132	9.81	5.05	32.81	8.98	35.21	8.14	36.00
....	....	....	**32.20**	....	.....	**5.60**	.....
....	**9.23**	**5.21**	**32.92**	**8.86**	**36.19**	**7.59**	**36.80**
....	....	....	**29.3**	**5.1**	**28.2**	**6.8**	.....
3070	8.89	6.85	15.31	8.70	55.46	4.79	31.00
....	....	....	....	....	.....	....	.....
3194	10.21	4.78	18.06	7.45	54.12	5.38	30.00
....	....	....	....	....	.....	....	.....
3195	6.25	0.90	33.25	0.73	58.16	0.71	31.00
....	....	....	**28.00**	....	.....	**0.50**	.....
....	....	...	....	....	.....	....	.....
3011	10.30	4.58	24.25	7.20	50.31	3.36	31.00
3021	9.12	3.89	24.56	7.05	52.49	2.89	30.00
3060	9.89	2.95	26.25	7.10	51.30	2.51	33.00
3085	10.13	4.35	25.75	6.53	50.66	2.58	32.00
....	....	....	**23.00**	....	.....	**2.00**	.....
....	**9.86**	**3.94**	**25.20**	**6.97**	**51.19**	**2.84**	**31.50**
....	....	....	**21.4**	**6.1**	**46.1**	**2.3**	.....
3110	9.26	0.90	21.63	7.98	56.58	3.65	33.00
....	....	....	**23.00**	....	.....	**2.00**	.....
....	....	....	**18.4**	**6.9**	**50.9**	**3.0**	.....
3158	8.99	0.98	25.13	7.49	54.12	3.29	32.00
3185	8.49	1.00	24.50	8.28	54.07	3.66	32.00
....	....	....	**20.00**	....	.....	**3.00**	.....
....	**8.74**	**0.99**	**24.82**	**7.88**	**54.09**	**3.48**	**32.00**
....	....	....	**21.1**	**6.9**	**48.7**	**2.8**	.....
3071	7.12	3.36	25.50	6.58	54.95	2.49	34.00
3119	7.77	2.98	26.25	7.60	53.16	2.24	33.00
....	....	....	**24.00**	....	.....	**2.50**	.....
....	**7.44**	**3.17**	**25.88**	**7.09**	**54.05**	**2.37**	**33.50**
....	....	....	**22.0**	**6.2**	**48.6**	**1.9**	.....
3156	8.94	4.00	25.63	6.55	52.54	2.34	32.00
....	....	....	**23.00**	....	.....	**2.00**	.....
....	....	....	**21.8**	**5.7**	**47.3**	**1.9**	.....
3051	10.09	5.18	25.31	7.70	49.73	1.99	31.00

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	MAIZE PRODUCTS.—*Continued.*	
	Gluten Feed.—Continued.	
3095	Globe. Corn Products Refining Co., New York	*Canaan:* Ives & Pierce
3107	" " " " " " "	*Winsted:* E. Manchester & Sons
		Average guaranty
		Average of these 3 analyses
		Average digestible
3169	Hubinger. J. C. Hubinger Bros. Co., Keokuk, Ia.	*New Haven:* Crittenden-Benham Co.
		Guaranty
		Digestible
3198	Queen. Corn Products Refining Co., New York	*Danielson:* Young Bros. Co.
		Guaranty
		Digestible
3017	Staley's. A. E. Staley Mfg. Co., Decatur, Ill.	*East Haven:* F. A. Forbes
3130	" " " " " " "	*Bristol:* Eaton Bros.
		Average guaranty
		Average of these 2 analyses
		Average digestible
3099	Union. Union Starch and Refining Co., Edinburg, Ind.	*Norfolk:* A. P. Curtiss
		Guaranty
		Digestible
	Gluten Meal.	
3178	Diamond. Corn Products Refining Co., New York	*Westerly:* C. W. Campbell Co.
		Guaranty
		Digestible
	Hominy Feed.	
3041	Homco. American Hominy Co., Indianapolis, Ind.	*Hamden:* I. W. Beers
3183	" " " " " "	*Yantic:* A. R. Manning
		Average guaranty
3034	Bufceco. Buffalo Cereal Co., Buffalo, N. Y.	*Meriden:* Meriden Grain & Feed Co.
3072	" " " " " "	*Stamford:* W. L. Crabb
3117	" " " " " "	*Litchfield:* I. T. Dickenson
		Average guaranty
3049	Wirthmore. Chas. M. Cox Co., Boston	*Plainville:* F. B. Newton
3075	" " " " "	*Stamford:* H. M. Kent Co.
3102	" " " " "	*New Hartford:* Wallace Case
		Average guaranty
3149	Success. Deutsch & Sickert Co., Milwaukee, Wis.	*So. Manchester:* G. W. Strant
		Guaranty
3020	Evans. Evans Milling Co., Indianapolis, Ind.	*North Haven:* Coöperative Feed Co.
		Guaranty
3152	Badger. Chas. A. Krause Mill. Co., Milwaukee, Wis.	*Manchester:* Little & McKinney
		Guaranty
3044	Steam-Cooked. Miner-Hillard Mill. Co., Wilkes-barre, Pa.	*Cheshire:* G. W. Thorpe
3115	Steam-Cooked. Miner-Hillard Mill. Co., Wilkes-barre, Pa.	*Litchfield:* Litchfield Grain Co.
3144	Steam-Cooked. Miner-Hillard Mill. Co., Wilkes-barre, Pa.	*Hartford:* Smith, Northam Co.
		Average guaranty

Sampled in 1913—*Continued.*

Station No.	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
	Pounds per Hundred.						
3095	10.48	3.63	23.75	7.23	52.88	2.03	31.00
3107	9.30	3.90	26.00	6.95	50.01	3.84	32.00
....	....	....	23.00	....	.....	2.00	.....
....	9.96	4.24	25.02	7.29	50.87	2.62	31.33
....	....	....	21.3	6.3	45.8	2.1	.....
3169	9.46	1.60	22.75	6.93	54.59	4.67	30.00
....	....	....	23.00	....	.....	2.00	.....
....	....	....	19.3	6.0	49.1	3.8	.....
3198	8.56	3.10	21.94	6.55	56.69	3.16	31.00
....	....	....	20.00	....	.....	2.00	.....
....	....	....	18.6	5.7	51.0	2.6	.....
3017	8.70	4.28	25.50	6.73	52.59	2.20	30.00
3130	9.38	4.60	25.13	6.35	52.89	1.65	32.00
....	....	....	23.0	....	.....	2.50	.....
....	9.04	4.44	25.32	6.54	52.73	1.93	31.00
....	....	....	21.5	5.7	47.5	1.6	.....
3099	8.24	2.38	25.06	7.06	54.32	2.94	33.00
....	....	....	24.00	....	.....	3.00	.....
....	....	....	21.3	6.1	48.9	2.4	.....
3178	7.92	0.98	41.25	2.45	45.66	1.74	38.00
....	....	....	40.00	....	.....	1.50	.....
....	....	....	34.7	....	40.2	1.7	.....
3041	9.06	2.23	10.31	5.08	66.48	6.84	32.00
3183	9.41	2.50	10.63	5.54	64.50	7.42	32.00
....	....	....	9.50	....	.....	7.00	.....
3034	8.80	2.70	11.38	5.05	65.65	6.42	33.00
3072	9.26	2.45	10.88	4.90	65.90	6.61	34.00
3117	9.45	2.55	11.13	4.98	65.51	6.38	30.00
....	....	....	10.00	....	.....	7.00	.....
3049	9.14	2.68	10.88	5.08	65.75	6.47	32.00
3075	8.88	2.53	10.63	4.90	65.21	7.85	32.00
3102	10.15	2.53	10.63	3.80	65.04	7.85	32.00
....	....	....	9.50	....	.....	7.50	.....
3149	9.77	3.03	11.63	5.05	62.93	7.59	35.00
....	....	....	11.00	....	.....	7.00	.....
3020	9.38	2.59	11.25	5.05	63.47	8.26	31.00
....	....	....	10.00	....	.....	7.50	.....
3152	9.11	2.82	10.94	5.30	65.28	6.55	34.00
....	....	....	10.00	....	.....	6.00	.....
3044	8.54	2.82	11.56	4.79	65.79	6.50	31.00
3115	9.79	2.73	11.25	5.03	64.89	6.31	33.00
3144	8.95	2.75	11.38	3.93	66.75	6.24	34.00
...	....	....	10.00	....	.....	5.00	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	MAIZE PRODUCTS.—*Continued.*	
	Hominy Feed.—Continued.	
3089	Mystic Milling Co., Sioux City, Ia.	*New Milford:* G. T. Soule
		Guaranty
3065	Patent Cereal Co., Geneva, N. Y.	*Greenwich:* J. P. Johnstone
		Guaranty
3189	Blue Ribbon. J. E. Soper Co., Boston	*Norwich:* Chas. Slosberg
		Guaranty
3154	Acme. Suffern-Hunt Mills, Decatur, Ill.	*Rockville:* Edward White
		Guaranty
		Average guaranty of all
		Average of these 18 analyses
		Average digestible
	Hominy Feed and Corn Cob.	
3108	Star Feed. Toledo Elevator Co., Indianapolis, Ind.	*Winsted:* Platt & Coe
		Guaranty
	Corn Meal.	
3057	Ground by E. L. Oviatt, Milford	
3100	Ground by A. P. Curtiss, Norfolk	
		Average of these 2 analyses
		Average digestible
	RYE PRODUCTS.	
3133	Feed. H. D. Stone Co., Rochester, N. Y.	*Unionville:* F. D. Lawton & Son
3138	Feed. Washburn-Crosby Co., Minneapolis, Minn.	*Hartford:* G. M. White & Co.
3150	Middlings. " " " " "	*So. Manchester:* G. W. Strant
3163	Middlings. Miner-Hillard Mill. Co., Wilkesbarre, Pa.	*Willimantic:* H. A. Bugbee
3168	Feed. Boutwell Milling and Grain Co., Troy, N. Y.	*New Haven.* Crittenden-Benham Co.
	BUCKWHEAT PRODUCTS.	
3199	Middlings. Quinebaug Grist Mill, Danielson	*Danielson.*
		Guaranty
	BREWERY AND DISTILLERY PRODUCTS.	
	Malt Sprouts.	
3040	Milwaukee Grains and Feed Co., Milwaukee, Wis.	*Hamden:* I. W. Beers
		Guaranty
		Digestible
	Dried Brewers' Grains.	
3058	Bull Brand. Farmers Feed Co., New York	*Norwalk:* Holmes, Keeler & Kent Co.
3091	" " " " " " "	*New Milford:* G. T. Soule
		Average guaranty
3039	Crown. Milwaukee Grains and Feed Co., Milwaukee, Wis.	*Hamden:* I. W. Beers
3184	Crown. Milwaukee Grains and Feed Co., Milwaukee, Wis.	*Yantic:* A. R. Manning
		Average guaranty
3012	*Providence Brewing Co., Providence, R. I.	*Branford:* S. V. Osborn
3083	" " " " "	*Danbury.* F. C. Benjamin & Co.
3145	" " " " "	*Thompsonville:* G. C. Phelps
		Average guaranty
		Average of these 7 analyses
		Average digestible

* Statement of dealer.

SAMPLED IN 1913—*Continued.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
3089	9.21	2.25	10.69	4.95	66.74	6.16	34.00
....	....	....	**11.00**	....	.....	**7.00**	.....
3065	10.21	2.60	10.75	5.10	64.54	6.80	36.00
....	....	....	**10.00**	....	.....	**7.00**	.....
3189	8.09	2.78	11.25	5.03	66.52	6.33	33.00
....	....	....	**10.00**	....	.....	**7.00**	.....
3154	9.24	2.65	10.94	4.80	64.69	7.68	32.00
....	....	....	**9.30**	....	.....	**7.10**	.....
....	....	....	**9.94**	....	.....	**6.73**	.....
....	**9.25**	**2.62**	**11.01**	**4.91**	**65.31**	**6.90**	**32.78**
....	....	....	**7.2**	**3.3**	**58.1**	**6.3**	.....
3108	9.02	2.13	8.25	10.00	64.85	5.75	33.00
....	....	....	**7.00**	....	.....	**5.50**	.....
3057	11.35	1.18	9.06	2.08	73.22	3.11	34.00
3100	11.63	1.19	9.69	1.90	71.89	3.70	35.00
....	**11.49**	**1.18**	**9.38**	**1.99**	**72.55**	**3.41**	**34.50**
....	....	....	**6.3**	....	**66.7**	**3.1**	.....
3133	10.68	3.18	15.31	4.53	63.38	2.92	31.00
3138	10.75	3.60	17.81	5.33	59.39	3.12	27.00
3150	11.03	4.40	17.31	6.00	57.69	3.57	33.00
3163	10.89	3.60	16.25	3.83	62.09	3.34	29.00
3168	10.20	3.58	16.00	4.15	62.85	3.22	28.75
3199	10.68	3.65	23.25	20.03	36.68	5.71	32.00
....	....	....	**32.75**	....	.....	**8.14**	.....
3040	9.74	7.05	26.69	12.08	43.13	1.31	26.00
....	....	....	**25.00**	....	.....	**2.00**	.....
....	....	....	**21.4**	**4.1**	**29.8**	**1.3**	.....
3058	7.66	3.39	27.00	13.13	42.15	6.67	30.00
3091	7.78	3.04	29.25	12.03	40.70	7.20	28.00
....	....	....	**27.23**	....	.....	**6.30**	.....
3039	7.45	3.38	29.13	10.43	43.23	6.38	28.00
3184	7.65	3.33	27.75	14.63	40.62	6.02	28.00
....	....	....	**25.00**	....	.....	**5.00**	.....
3012	7.16	3.47	28.63	14.03	41.11	5.60	28.00
3083	7.89	3.38	25.88	13.78	43.21	5.86	28.00
3146	7.26	3.60	26.56	15.03	41.26	6.29	30.00
....	....	....	**25.00**	....	.....	**5.00**	.....
....	**7.55**	**3.37**	**27.74**	**13.30**	**41.75**	**6.29**	**28.57**
....	....	....	**22.5**	**6.5**	**23.8**	**5.6**	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand	Retail Dealer.
	BREWERY AND DISTILLERY PRODUCTS.—*Continued.*	
	Dried Distillers' Grains.	
3101	Ajax Flakes. Ajax Mill. and Feed Co., Hammond, Ind.	*New Hartford:* Wallace Case..
		Guaranty
		Digestible
3193	Buckeye Gluten Feed. The Dewey Bros. Co., Blanchester, O.	*Meriden:* A. Grulich
		Guaranty
		Digestible
3054	Eagle 3D Grains. The Dewey Bros. Co., Blanchester, O.	*Bridgeport:* Vincent Bros.
3103	Eagle 3D Grains. The Dewey Bros. Co., Blanchester, O.	*Winsted:* E. Manchester & Sons
3131	Eagle 3D Grains. The Dewey Bros. Co., Blanchester, O.	*Bristol:* Goodsell Bros.
		Average guaranty
		Average of these 3 analyses
		Average digestible
3016	Hiquality Spirits Grains. Donahue-Stratton Co., Milwaukee, Wis.	*East Haven:* F. A. Forbes
		Guaranty
		Digestible
	MISCELLANEOUS FEEDS.	
	**Alfalfa Feeds.*	
3023	Pioneer Alfalfa Meal. Kornfalfa Feed Mill. Co., Kansas City, Mo.	*North Haven:* Coöperative Feed Co.
		Guaranty
3106	Alfalfa. Park & Pollard Co., Boston	*Winsted:* E. Manchester & Sons
		Guaranty
	**Dried Beet Pulp.*	
3043	Continental Sugar Co., Findlay, O.	*Cheshire:* G. W. Thorpe
3161	Menominee River Sugar Co., Menominee, Mich.	*Willimantic:* H. A. Bugbee
3177	Michigan Sugar Co., Saginaw, Mich.	*Westerly:* C. W. Campbell Co..
3114	Owosso Sugar Co., Lansing, Mich.	*Torrington:* F. U. Wadhams
3173	West Bay City Sugar Co., Bay City, Mich.	*Middletown:* Meech & Stoddard.
		Average guaranty
		Average of these 5 analyses
		Average digestible
	PROPRIETARY MIXED FEEDS.	
	Corn and Oat Feeds, and Chop Feeds.	
3052	Bufceco Chop Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Shelton:* Ansonia Flour & Grain Co.
		Guaranty
3098	Provender. Ground by A. P. Curtiss, Norfolk..	
3188	Haskell's Stock Feed. W. H. Haskell & Co., Toledo, O.	*Norwich:* Chas. Slosberg
		Guaranty
3015	De-Fi Feed. The H. O. Co., Buffalo, N. Y.	*Guilford:* Norton & Roberts
		Guaranty
3136	Imperial Steam-Cooked Feed. Imperial Grain and Mill. Co., Toledo, O.	*Hartford:* Trout Brook Ice & Feed Co.
		Guaranty

* See also Molasses Feeds, page 330.

SAMPLED IN 1913—*Continued.*

Station No.	Pounds per Hundred. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
3101	7.24	2.73	30.63	11.75	36.02	11.63	35.00
....	....	....	**30.00**	.....	.....	**11.00**	.....
....	....	....	**22.4**	**11.2**	**29.2**	**11.0**	.....
3193	9.85	3.50	19.69	13.03	50.25	3.68	25.00
....	....	....	**20.00**	.....	.....	**5.00**	.....
....	....	....	**14.4**	**12.4**	**40.7**	**3.5**	.....
3054	7.18	5.03	28.13	7.90	38.32	13.44	25.00
3103	7.10	4.57	27.51	8.80	38.64	13.38	34.00
3131	6.03	1.70	31.88	13.73	32.98	13.68	35.00
....	....	....	**30.00**	.....	.....	**10.00**	.....
....	**6.77**	**3.77**	**29.17**	**10.14**	**36.65**	**13.50**	.....
....	....	....	**21.3**	**9.6**	**29.7**	**12.8**	.....
3016	6.17	1.54	35.94	10.80	30.51	15.04	35.00
....	....	....	**30.00**	.....	.....	**10.00**	.....
....	....	....	**26.1**	**10.3**	**28.7**	**14.3**	.....
3023	8.52	9.55	15.63	26.53	36.76	3.01	32.00
....	....	....	**12.00**	.....	.....	**1.00**	.....
3106	7.46	9.40	14.50	30.63	36.17	1.84	32.00
....	....	....	**12.00**	.....	.....	**1.50**	.....
3043	8.81	3.23	8.75	19.43	58.86	0.92	31.00
3161	7.38	2.68	8.19	19.58	61.58	0.59	29.00
3177	9.15	3.05	7.94	20.39	58.20	1.27	30.00
3114	8.68	2.95	8.50	19.73	59.41	0.73	29.00
3173	7.26	3.20	8.69	19.78	60.18	0.89	29.00
....	....	....	**8.00**	.....	.....	**0.50**	.....
....	**8.26**	**3.02**	**8.41**	**19.78**	**59.65**	**0.88**	**29.60**
....	....	....	**5.4**	**16.6**	**54.3**	.....	.....
3052	8.38	3.39	9.06	10.60	63.61	4.96	31.00
....	....	....	**7.00**	.....	.....	**3.00**	.....
3098	12.09	1.63	10.00	3.68	68.55	4.05	35.00
3188	7.58	3.80	9.88	8.75	63.16	6.83	33.00
....	....	....	**8.00**	.....	.....	**4.00**	.....
3015	9.28	3.50	9.00	14.75	60.14	3.33	30.00
....	....	....	**8.00**	.....	.....	**3.00**	.....
3136	9.93	1.70	9.50	3.58	71.00	4.29	40.00
....	...	....	**9.00**	.....	.....	**4.00**	.....

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS

Station No.*	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS.—*Continued.* *Corn and Oat Feeds, and Chop Feeds.—Continued.*	
3174	Korn-Oato Feed. Meech & Stoddard, Middletown	*Middletown:* Meech & Stoddard.
		Guaranty
3197	Mystic Feed. Mystic Mill. and Feed Co., Rochester, N. Y.	*Danielson:* Young Bros. Co.
		Guaranty
3151	Boss Feed. Quaker Oats Co., Chicago	*So. Manchester:* G. W. Strant
		Guaranty
3192	Victor Feed. Quaker Oats Co., Chicago	*New Haven:* R. G. Davis
		Guaranty
	Wheat and Corn Cob Feeds.	
3172	Holstein Feed. Indiana Milling Co., Terre Haute, Ind.	*Middletown:* Meech & Stoddard.
		Guaranty
3109	Sterling Feed. Indiana Milling Co., Terre Haute, Ind.	*Winsted:* Platt & Coe
3157	Sterling Feed. Indiana Milling Co., Terre Haute, Ind.	*Broad Brook:* Broad Brook Mill. Co.
		Average guaranty
3029	Kennebec Feed. J. E. Soper Co., Boston	*Meriden:* A. Grulich
		Guaranty
		Average of these 4 analyses
		Average digestible
	**Horse Feeds.*	
3036	Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Meriden:* Meriden Grain & Feed Co.
3140	Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Hartford:* G. M. White & Co.
		Average guaranty
		Average of these 2 analyses
3077	Algrane Horse Feed. The H. O. Co., Buffalo, N.Y.	*Ridgefield:* S. D. Keeler
		Guaranty
3062	Hatch's Horse Feed. Holmes, Keeler, Kent Co., So. Norwalk	*So. Norwalk.*
		Guaranty
3042	†Peter's Arab Horse Feed. Peter's Mill. Co., Omaha, Neb.	*Cheshire:* G. W. Thorpe
		Guaranty
3181	Schumacher's Special Horse Feed. Quaker Oats Co., Chicago	*New London:* P. Schwartz Co.
		Guaranty
	**Dairy and Stock Feeds.*	
3080	Calf Meal. Blatchford's Calf Meal Factory, Waukegan, Ill.	*Ridgefield:* S. D. Keeler
		Guaranty
3121	Bufceco Creamery Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer
		Guaranty
3122	Bufceco Stock Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Thomaston:* L. E. Blackmer
		Guaranty
3026	Unicorn Dairy Ration, Chapin & Co., Hammond, Ind.	*Wallingford:* E. E. Hall
		Guaranty
3047	Wirthmore Balanced Ration. Chas. M. Cox Co., Boston	*Plainville:* Eaton Bros.
3145	Wirthmore Balanced Ration. Chas. M. Cox Co., Boston	*Thompsonville:* G. C. Phelps
		Average guaranty
		Average of these 2 analyses

* See also Molasses Feeds, page 330.
† On tag "Arab Balanced Horse Ration, G. E. Rarig, New York."

SAMPLED IN 1913—*Continued.*

Station No.	Pounds per Hundred. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
3174	8.96	3.38	7.31	14.38	62.59	3.38	28.00
....	....	....	**7.00**	.....	.....	**3.00**	.....
3197	8.85	3.55	9.69	11.13	62.61	4.17	32.00
....	....	....	**8.00**	.....	.....	**3.00**	.....
3151	9.25	2.85	8.38	9.53	66.42	3.57	33.00
....	....	....	**8.00**	.....	.....	**3.00**	.....
3192	8.82	4.43	9.00	11.33	61.60	4.82	31.00
....	....	....	**8.00**	.....	.....	**3.00**	.....
3172	8.88	4.75	11.38	18.43	52.98	3.58	24.00
....	....	....	**12.00**	.....	.....	**3.00**	.....
3109	9.02	3.55	10.06	16.08	58.13	3.16	28.00
3157	9.27	3.75	10.50	16.48	56.81	3.19	26.00
....	....	....	**9.80**	.....	.....	**2.75**	.....
3029	9.24	3.65	9.63	16.45	58.13	2.90	28.00
....	....	....	**9.80**	.....	.....	**2.75**	.....
....	**9.10**	**3.93**	**10.39**	**16.86**	**56.51**	**3.21**	**26.50**
....	....	....	**6.5**	**4.7**	**40.1**	**3.0**	.....
3036	9.16	3.69	11.38	9.88	61.00	4.89	34.00
3140	8.78	3.48	11.25	9.70	62.19	4.60	32.00
....	....	....	**10.00**	....	.....	**4.00**	.....
....	**8.97**	**3.58**	**11.32**	**9.79**	**61.59**	**4.75**	**33.00**
3077	8.92	3.95	13.25	9.33	60.52	4.03	36.00
....	....	....	**11.00**	....	.....	**4.00**	.....
3062	9.79	2.90	11.81	9.05	62.73	3.72	33.00
....	....	....	**14.00**	....	.....	**4.00**	.....
3042	10.99	4.33	10.50	7.60	64.48	2.10	40.00
....	....	....	**9.00**	....	.....	**2.00**	.....
3181	9.58	2.78	9.38	9.13	66.01	3.12	33.00
....	....	....	**9.25**	....	.....	**3.25**	.....
3080	10.75	5.08	26.13	6.80	46.16	5.08	70.00
....	....	....	**24.00**	....	.....	**5.00**	.....
3121	8.47	4.20	19.75	9.48	52.56	5.54	36.00
....	....	....	**18.00**	....	.....	**4.00**	.....
3122	9.32	3.43	10.19	8.50	64.06	4.50	34.00
....	....	....	**8.00**	....	.....	**4.00**	.....
3026	7.21	5.65	26.00	10.15	45.55	5.44	33.00
....	....	....	**26.00**	....	.....	**5.50**	.....
3047	8.72	5.45	25.50	8.63	46.47	5.23	35.00
3145	8.74	5.80	25.25	8.93	45.70	5.58	35.00
....	....	....	**25.25**	....	.....	**5.10**	.....
....	**8.73**	**5.62**	**25.38**	**8.78**	**46.08**	**5.41**	**35.00**

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS.—*Continued.* *Dairy and Stock Feeds.—Continued.*	
3179	Wirthmore Stock Feed. Chas. M. Cox Co., Boston	*Mystic:* Mystic Grain Co.......
		Guaranty ....
3143	White Cross Stock Feed. Albert Dickinson Co., Chicago	*Hartford:* Smith, Northam Co..
		Guaranty ....
3164	Grandin's Stock Feed. H. Grandin Mill. Co., Jamestown, N. Y............................	*New Haven.* Crittenden-Benham Co. ....
		Guaranty ....
3078	Algrane Milk Feed. The H. O. Co., Buffalo, N. Y.	*Ridgefield:* S. D. Keeler........
		Guaranty ... .
3046	New England Stock Feed. The H. O. Co., Buffalo, N. Y..	*Plainville:* Eaton Bros. ....
3127	New England Stock Feed. The H. O. Co., Buffalo, N. Y.	*Watertown:* M. D. Leonard Co.
		Average guaranty ....
		Average of these 2 analyses.....
3033	Larro-feed for Dairy Cows. Larrowe Mill. Co., Detroit, Mich..................................	*Meriden:* Meriden Grain & Feed Co. ....
3048	Larro-feed for Dairy Cows. Larrowe Mill. Co., Detroit, Mich..................................	*Plainville:* F. B. Newton.......
3061	Larro-feed for Dairy Cows. Larrowe Mill. Co., Detroit, Mich.	*Norwalk:* Holmes, Keeler, Kent Co. ....
		Average guaranty ....
		Average of these 3 analyses.....
3175	M. & S. Stock Feed. Meech & Stoddard, Middletown	*Middletown* ....
		Guaranty ....
3180	Yellow Tag Stock Feed. Miner-Hillard Mill. Co., Wilkesbarre, Pa..............................	*New London:* P. Schwartz Co. ..
		Guaranty ....
3018	Maz-All Feed. Quaker Oats Co., Chicago, Ill...	*East Haven:* F. A. Forbes......
		Guaranty ....
3030	Schumacher's Calf Meal. Quaker Oats Co., Chicago	*Meriden:* A. Grulich...........
		Guaranty ....
3022	Schumacher's Stock Feed. Quaker Oats Co., Chicago	*North Haven:* Coöperative Feed Co. ....
3073	Schumacher's Stock Feed. Quaker Oats Co., Chicago	*Stamford:* W. L. Crabb........
3084	Schumacher's Stock Feed. Quaker Oats Co., Chicago	*Danbury:* F. C. Benjamin & Co.
		Average guaranty ....
		Average of these 3 analyses.....
3050	Biles Ready Dairy Ration (Union Grains). Ubiko Mill. Co., Cincinnati, O......................	*Southington:* Lumber & Feed Co.
3094	Biles Ready Dairy Ration (Union Grains). Ubiko Mill. Co., Cincinnati, O.	*Canaan:* Ives & Pierce.........
		Average guaranty ....
		Average of these 2 analyses.....
	Molasses Feeds.	
3171	Allneeda Horse and Mule Feed. Allneeda Mills, E. St. Louis, Ill..............................	*Middletown:* Meech & Stoddard.
		Guaranty ....
3056	Sucrene Dairy Feed. American Milling Co., Peoria, Ill.	*Milford:* E. L. Oviatt..........

SAMPLED IN 1913—*Continued.*

Station No.	Pounds per Hundred. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
3179	8.22	3.28	10.25	8.90	62.47	6.88	31.00
....	....	....	**9.00**	....	.....	**4.00**	.....
3143	10.52	3.68	11.00	4.88	66.53	3.39	37.00
....	....	....	**10.00**	....	.....	**3.50**	.....
3164	7.42	4.65	9.38	11.08	61.95	5.52	31.00
....	....	....	**8.50**	....	.....	**3.50**	.....
3078	8.67	5.23	17.63	12.28	52.12	4.07	36.00
....	....	....	**14.00**	....	.....	**4.00**	.....
3046	8.24	4.03	10.88	9.15	62.78	4.92	32.00
3127	8.40	4.43	10.63	8.85	62.46	5.23	32.00
....	....	....	**9.00**	....	.....	**4.00**	.....
....	**8.32**	**4.23**	**10.76**	**9.00**	**62.62**	**5.07**	**32.00**
3033	8.36	5.35	20.75	12.63	49.22	3.69	36.00
3048	8.28	5.08	20.00	13.00	49.64	4.00	35.00
3061	8.49	4.90	19.38	13.42	49.90	3.91	34.00
....	....	....	**19.00**	....	.....	**3.00**	.....
....	**8.38**	**5.11**	**20.04**	**13.02**	**49.58**	**3.87**	**35.00**
3175	8.79	3.28	9.50	9.78	63.07	5.58	30.00
...	....	....	**9.00**	....	.....	**3.00**	.....
3180	8.51	3.05	10.00	8.58	64.87	4.99	30.00
....	....	....	**9.00**	....	.....	**3.00**	.....
3018	7.67	2.83	8.31	1.43	78.27	1.49	28.00
....	....	....	**9.50**	....	.....	**1.40**	.....
3030	8.89	3.58	16.88	2.25	60.20	8.20	35.00
....	....	....	**19.00**	....	.....	**8.00**	.....
3022	8.18	3.58	11.25	11.63	60.72	4.64	30.00
3073	8.92	3.95	11.38	9.00	62.59	4.16	32.00
3084	9.33	4.20	11.25	9.75	61.39	4.08	30.00
....	....	....	**10.00**	....	.....	**3.25**	.....
....	**8.81**	**3.91**	**11.29**	**10.13**	**61.57**	**4.29**	**30.67**
3050	8.11	5.43	24.13	10.88	45.35	6.10	35.00
3094	8.47	4.58	24.00	9.70	46.54	6.71	35.00
....	....	....	**24.00**	....	.....	**7.00**	.....
....	**8.29**	**5.00**	**24.07**	**10.29**	**45.94**	**6.41**	**35.00**
3171	10.22	7.26	9.00	12.40	59.20	1.92	33.00
....	....	....	**10.00**	....	.....	**3.50**	.....
3056	9.88	7.93	16.56	13.00	46.39	6.24	31.00

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand.	Retail Dealer.
	PROPRIETARY MIXED FEEDS.—*Continued.* *Molasses Feeds.—Continued.*	
3097	Sucrene Dairy Feed. American Milling Co., Peoria, Ill.	*Canaan:* Ives & Pierce
		Average guaranty
		Average of these 2 analyses
3068	Braue's Mixed Feed with Molasses. J. D. Braue, Jordan, N. Y.	*New Canaan:* C. H. Fairty
		Guaranty
3155	Peerless Dairy Feed. Clover Leaf Mill. Co., Buffalo, N. Y.	*Rockville:* Edward White
		Guaranty
3067	Alfalfa and Molasses. Commonwealth Feed Mills Co., St. Louis	*Greenwich:* J. P. Johnstone
		Guaranty
3063	Missouri Horse and Mule Feed. Commonwealth Feed Mills Co., St. Louis	*Greenwich:* J. P. Johnstone
		Guaranty
3093	Boggs Competition Horse Feed. Faramel Mfg. Co., Buffalo, N. Y.	*New Milford:* Geo. E. Ackley Co.
		Guaranty
3190	H. & S. Horse, Mule and Dairy Feed. Dwight E. Hamlin & Co., Pittsburg, Pa.	*New Haven:* R. G. Davis & Sons
		Guaranty
3137	Husted Molasses Feed. Husted Milling Co., Buffalo, N. Y.	*Hartford:* Trout Brook Ice & Feed Co.
		Guaranty
3013	Dried Beet Pulp and Molasses. Michigan Sugar Co., Alma, Mich.	*Branford:* S. V. Osborn
3090	Dried Beet Pulp and Molasses. Michigan Sugar Co., Croswell, Mich.	*New Milford:* G. T. Soule
		Average guaranty
		Average of these 2 analyses
3038	Molassine Meal. The Molassine Co., Boston	*Hamden:* I. W. Beers
3129	" " " " " "	*New Britain:* Stanley Svea Co.
		Average guaranty
		Average of these 2 analyses
3135	Alfalfa Meal and Syrup. Omaha Alfalfa Mill. Co., Omaha, Neb.	*Hartford:* Trout Brook Ice & Feed Co
		Guaranty
3123	June Pasture Alfalfa Meal with Molasses. M. C. Peters Mill. Co., Omaha, Neb.	*Waterbury:* Spencer Grain Co.
		Guaranty
3124	Peters' King Corn Sugar Feed. M. C. Peters Mill. Co., Omaha, Neb.	*Waterbury:* Spencer Grain Co.
		Guaranty
3086	Green Cross Molasses Horse Feed. Quaker Oats Co., Chicago	*Danbury:* O. H. Meeker, Est.
		Guaranty
3087	Quaker Molasses Dairy Feed. Quaker Oats Co., Chicago	*Danbury:* O. H. Meeker, Est.
3113	Quaker Molasses Dairy Feed. Quaker Oats Co., Chicago	*Torrington:* F. U. Wadhams
		Guaranty
		Average of these 2 analyses
3166	Purina Dairy Feed. Ralston Purina Co., St. Louis	*New Haven:* Crittenden-Benham Co.
		Guaranty
3167	Purina Molasses Feed, " " " "	*New Haven:* Crittenden-Benham Co.
		Guaranty

SAMPLED IN 1913—*Continued.*

Station No.	Pounds per Hundred. Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	Price per ton.
3097	9.54	8.06	16.50	12.58	48.17	5.15	29.00
....	....	....	**16.50**	.....	.....	**3.50**	.....
....	**9.71**	**8.00**	**16.53**	**12.79**	**47.27**	**5.70**	**30.00**
3068	9.75	7.36	8.50	7.33	65.03	2.03	34.00
....	....	....	**12.00**	.....	.....	**4.00**	.....
3155	10.95	7.56	20.00	10.08	47.71	3.70	30.00
....	....	....	**21.00**	.....	.....	**7.00**	.....
3067	10.06	8.64	10.38	20.15	49.83	0.94	34.00
....	....	....	**10.00**	.....	.....	**0.70**	.....
3063	11.09	5.32	10.00	14.50	55.07	4.02	36.00
....	....	....	**10.00**	.....	.....	**2.40**	.....
3093	11.03	2.88	11.00	4.60	67.21	3.28	38.00
....	....	....	**9.00**	.....	.....	**3.00**	.....
3190	8.68	8.12	16.38	11.25	51.36	4.21	36.00
....	....	....	**14.00**	.....	.....	**3.50**	.....
3137	10.02	6.84	22.69	7.65	48.79	4.01	34.00
....	....	....	**18.00**	.....	.....	**4.00**	.....
3013	9.36	3.74	8.88	17.80	59.51	0.71	28.00
3090	9.08	4.57	9.06	17.15	59.38	0.76	28.00
....	....	....	**9.00**	.....	.....	**0.50**	.....
....	**9.22**	**4.15**	**8.97**	**17.47**	**59.45**	**0.74**	**28.00**
3038	15.59	8.15	*9.00	5.83	60.69	0.74	40.00
3129	17.99	7.46	*8.19	6.65	58.99	0.72	40.00
....	....	....	**7.00**	.....	.....	**0.05**	.....
....	**16.79**	**7.81**	**8.60**	**6.24**	**59.83**	**0.73**	**40.00**
3135	10.08	9.43	10.31	16.20	53.22	0.76	32.00
....	....	....	**11.00**	.....	.....	**1.00**	.....
3123	10.34	9.70	12.75	18.83	47.53	0.85	39.00
....	....	....	**10.00**	....	.....	**0.50**	.....
3124	10.77	6.33	11.25	12.38	57.32	1.95	36.00
....	....	....	**9.00**	....	.....	**1.50**	.....
3086	10.24	4.93	10.63	10.50	60.83	2.87	35.00
....	....	....	**10.00**	....	.....	**3.00**	.....
3078	11.37	6.72	16.69	10.85	49.57	4.80	28.00
3113	9.87	7.48	15.81	12.65	49.47	4.72	29.00
....	....	....	**16.00**	....	.....	**4.00**	.....
....	**10.62**	**7.10**	**16.25**	**11.75**	**49.52**	**4.76**	**28.50**
3166	8.82	7.59	19.06	17.38	43.91	3.24	32.00
....	....	....	**16.50**	....	.....	**3.00**	.....
3167	11.01	5.08	11.38	9.88	60.34	2.31	34.00
....	....	....	**9.00**	....	.....	**1.50**	.....

* See page 315.

TABLE IV.—ANALYSES OF COMMERCIAL FEEDS

Station No.	Brand	Retail Dealer.
	PROPRIETARY AND MIXED FEEDS.—*Concluded.* *Poultry Feeds.*	
3053	Bufceco Poultry Feed. Buffalo Cereal Co., Buffalo, N. Y.	*Shelton:* Ansonia Flour & Grain Co.
		Guaranty
3182	Wirthmore Poultry Mash. Chas. M. Cox Co., Boston	*New London:* Beebe & Bragaw.
		Guaranty
3191	Globe Egg Mash. Albert Dickinson Co., Chicago	*New Haven:* R. G. Davis & Sons
		Guaranty
3128	Queen Poultry Mash. Albert Dickinson Co., Chicago	*Waterbury:* H. S. Coe & Co.
3141	Queen Poultry Mash. Albert Dickinson Co., Chicago	*Hartford:* Smith, Northam & Co.
		Average guaranty
		Average of these 2 analyses
3031	Purity Poultry Mash. Wm. S. Hills Co., Boston	*Meriden:* A. Grulich
3196	" " " " " "	*Putnam:* Bosworth Bros.
		Average guaranty
		Average of these 2 analyses
3045	Dry Poultry Mash. The H. O. Co., Buffalo, N. Y.	*Plainville:* Eaton Bros.
3081	" " " " " " "	*Ridgefield:* S. D. Keeler
		Average guaranty
		Average of these 2 analyses
3079	H. O. Poultry Feed. The H. O. Co., Buffalo, N. Y.	*Ridgefield:* S. D. Keeler
		Guaranty
3059	Hatch's Dry Mash. Holmes, Keeler, Kent Co., Norwalk	*Norwalk*
		Guaranty
3176	Poultry Mash. Meech & Stoddard, Middletown.	*Middletown*
		Guaranty
3147	Puritan Growing Mash. Mystic Mill. and Feed Co., Rochester, N. Y.	*Hazardville:* A. D. Bridge's Sons
		Guaranty
3096	Puritan Laying Mash. Mystic Mill. and Feed Co., Rochester, N. Y.	*Canaan:* Ives & Pierce
3148	Puritan Laying Mash. Mystic Mill. and Feed Co., Rochester, N. Y.	*Hazardville:* A. D. Bridge's Sons
		Guaranty
		Average of these 2 analyses
3032	Dry Mash. Park & Pollard Co., Boston	*Meriden:* Meriden Grain & Feed Co.
3076	" " " " " "	*Stamford:* H. M. Kent Co.
		Guaranty
		Average of these 2 analyses
3035	Growing Feed. Park & Pollard Co., Boston	*Meriden:* Meriden Grain & Feed Co.
		Guaranty
3165	Chicken Chowder Feed. Purina Mills, St. Louis	*New Haven:* Crittenden-Benham Co.
		Guaranty
3082	American Poultry Food. Quaker Oats Co., Chicago	*Danbury:* Keeler Grain Co.
		Guaranty
3064	V-B. Mash for Laying Hens. Vincent Bros., Bridgeport	*Greenwich:* J. P. Johnstone
		Guaranty

Sampled in 1913—*Concluded.*

Station No.	Pounds per Hundred.						Price per ton.
	Water.	Ash.	Protein. (N x 6.25.)	Fiber.	Nitrogen-free Extract. (Starch, gum, etc.)	Ether Extract. (Crude Fat.)	
3053	8.82	3.10	16.50	5.83	60.35	5.40	40.00
....	....	....	**15.00**	....	.....	**4.00**	.....
3182	9.78	3.85	14.13	6.85	62.02	3.37	42.00
....	....	....	**12.00**	....	.....	**3.00**	.....
3191	9.76	5.90	18.25	6.55	55.13	4.41	43.00
....	....	....	**16.00**	....	.....	**3.00**	.....
3128	9.20	7.00	11.00	6.73	62.46	3.61	42.00
3141	10.39	3.23	11.25	6.10	65.66	3.37	42.00
....	....	....	**11.00**	....	.....	**2.50**	.....
....	**9.79**	**5.11**	**11.13**	**6.41**	**64.07**	**3.49**	**42.00**
3031	8.83	8.08	17.13	9.80	51.44	4.72	45.00
3196	8.60	11.08	20.44	6.00	48.26	5.62	42.00
....	....	....	**17.00**	....	.....	**4.00**	....
....	**8.71**	**9.58**	**18.79**	**7.90**	**49.85**	**5.17**	**43.50**
3045	9.00	3.75	19.13	11.78	52.86	3.48	40.00
3081	9.80	4.60	14.94	11.28	55.96	3.42	45.00
....	....	....	**19.00**	....	.....	**3.50**	.....
....	**9.40**	**4.17**	**17.04**	**11.53**	**54.41**	**3.45**	**42.50**
3079	8.73	3.87	17.81	7.65	57.25	4.69	45.00
....	....	....	**17.00**	....	.....	**4.50**	.....
3059	9.81	6.03	17.88	9.08	52.71	4.49	38.00
....	....	....	**16.00**	....	.....	**4.00**	.....
3176	9.26	8.33	22.88	7.38	47.00	5.15	40.00
....	....	....	**12.00**	....	.....	**3.00**	.....
3147	9.96	5.00	22.25	5.99	53.47	3.33	45.00
....	....	....	**14.00**	....	.....	**3.00**	.....
3096	10.84	6.53	22.25	6.40	48.82	5.16	45.00
3148	9.14	7.25	26.13	8.30	44.28	4.90	45.00
....	....	....	**23.00**	....	.....	**7.00**	.....
....	**9.99**	**6.89**	**24.19**	**7.35**	**46.55**	**5.03**	**45.00**
3032	9.35	12.25	22.31	7.68	44.89	3.52	45.00
3076	9.69	11.28	22.13	6.08	47.39	3.43	45.00
....	....	....	**18.00**	....	.....	**3.50**	.....
....	**9.52**	**11.76**	**22.22**	**6.88**	**46.14**	**3.48**	**45.00**
3035	10.25	3.55	15.63	4.52	62.30	3.75	45.00
....	....	....	**10.00**	....	.....	**3.50**	.....
3165	9.07	7.43	20.25	7.93	50.39	4.93	44.00
....	....	....	**17.00**	....	.....	**5.00**	.....
3082	10.46	2.73	13.25	4.35	64.57	4.64	40.00
....	....	....	**12.00**	....	.....	**3.50**	.....
3064	9.69	3.64	20.81	8.70	52.44	4.72	44.00
....	....	....	**21.50**	....	.....	**4.90**	.....

3356, sent by Maine Experiment Station, for check analysis, contained 36.06 per cent. protein.

3554, bought through The Coles Co., Middletown, by J. A. Warner, Tylerville, without guaranty, contained 41.25 per cent. protein.

3553, S. P. Davis, Little Rock, Ark., guaranteed 41 per cent. protein, sent by G. T. Soule, New Milford, contained 39.63 per cent.

WHEAT PRODUCTS. **1818**, *Wheat Feed*, and **2286**, *Wheat Bran*, both sent by W. H. Lee, Orange, contained 18.00 and 15.38 per cent. protein, respectively. Two samples of *Cooked Wheat Feed*, sent by J. W. Varson, Bridgeport, contained 12.88 and 10.88 per cent. protein, and 3.06 and 1.93 per cent. fat, respectively.

CORN PRODUCTS. **2989**, *Buffalo Gluten Feed*, guaranteed 24 per cent. protein, sent by Jewett City Grain Co., Jewett City, contained 24.38 per cent. protein.

3357, *Miner-Hillard's Hominy Feed*, and **3358**, *Wirthmore Hominy Feed*, both sent by R. H. Ensign, Simsbury, without guaranty, contained 9.18 and 9.20 per cent. water, 11.25 and 11.00 per cent. protein, and 6.31 and 6.24 per cent. fat, respectively.

2392, *Corn Flour*, American Hominy Co., Terre Haute, Ind., sent by The Sperry and Barnes Co., New Haven, contained 6.25 per cent. protein.

1655, *Ground Corn Stalks*, sent by F. A. LaPlace, Hamburg, analyzed as follows:

Water	9.12	Fiber	14.74
Ash	4.70	Nitrogen-free extract	61.47
Protein	7.06	Fat	2.91

3362, *Corn Kernels*, sent by L. J. Robertson, Jr., Manchester Green. The field-cured material showed 5,367 lbs. of kernels and 1,482 lbs. per acre. Inasmuch as the kernels contained 20.56 per cent. moisture, the acre yield of dry grain was 4,264 lbs., or 4,958 lbs. on the basis of 14 per cent. moisture.

DISTILLERS' GRAINS. **3551**, Rye Distillers Grains, guaranteed 24 per cent. protein and 11 per cent. fat, sent by Wm. Horwitz, Fairfield, contained 7.45 water, 14.81 protein and 10.71 per cent. fat.

STOCK FEEDS. **1983**, *M. & S. Stock Feed*, made and sent by Meech and Stoddard, Middletown, guaranteed 9 per cent. protein and 3 per cent. fat, contained 6.54 per cent. water, 9.06 protein, 10.82 fiber and 4.84 fat.

2013, *Cremo,* sent by E. E. Hall, Wallingford, without guaranty, contained 19.75 per cent. protein.

BEEF SCRAP. **2010**, Shoemaker and Co., Philadelphia, **2011**, Swift and Co., Newark, N. J., and **2012**, Connecticut Fat Rendering Co., all sent by D. W. Meeker, West Cheshire, contained 57.38, 43.50 and 52.38 per cent. protein, respectively. Their respective guaranties for protein were 55, 50 and 45 per cent., and their selling prices, $3.10, $2.75 and $2.60 per 100 lbs.

GROUND BRUSH. **1656**, sent by F. A. LaPlace, Hamburg, showed the following compositions:

Water	39.30	Fiber	28.33
Ash	1.35	Nitrogen-free extract	27.30
Protein	2.62	Fat	1.10

The analysis of a similar material was reported last year, and it is unnecessary to repeat the comments made at that time.

COCOA SIFTINGS. **2759**, sent by L. M. Lee, New Preston, contained 17.50 per cent. protein and 26.58 per cent. fat. If obtained at a reasonable price this material would appear to have much merit as a stock feed.

PEANUT HEARTS, **2963**, N. E. Vending Co., New Haven, sent by A. B. Hall, Wallingford, contained 3.61 per cent. water, 34.25 per cent. protein and 43.41 per cent. fat. This is an exceedingly rich feed, and is sold at a reasonable price, $2 per hundred pounds.

BAKERY REFUSE. **3340**, *Crackers Refuse,* and **3339**, *Cookies Refuse,* both sent by C. M. Jarvis, Berlin, had the following composition:

	3340	3339
Water	9.03	6.30
Ash	1.62	1.73
Protein	12.69	13.88
Fiber	0.55	0.87
Nitrogen-free extract	72.59	55.75
Fat	3.52	21.47

GRASSES. Two kinds of North Carolina grass, **3332**, with broad leaves, and **3333**, with narrow leaves, both cut when the grass was in seed, were sent by G. D. Howell, Hartford. Their analyses follow:

	3332	3333
Water	6.18	6.61
Ash	8.82	3.56
Protein	6.25	4.69
Fiber	28.25	27.35
Nitrogen-free extract	47.10	55.88
Fat	3.40	1.91

Both grasses are inferior in feeding value to mixed meadow hay.

Meadow Hay, **3508,** sent by D. E. Mills, Bristol, had the following composition:

Water	4.33	Fiber	31.83
Ash	7.33	Nitrogen-free extract	48.34
Protein	5.63	Fat	2.54

A botanical examination of a two-pound sample of this hay showed the following number of heads of the grasses, etc., specified:

48 White bent
21 Italian rye grass
18 Perennial rye grass
16 Kentucky blue grass
15 Sweet vernal grass
14 Timothy
7 Rhode Island bent
7 Orchard grass
4 Tall oat grass
4 Meadow fescue
2 Bromus secalinus
1 Panic grass
1 Fowl meadow grass
1 Velvet grass
1 Wild oat grass
1 Rumex acetosella
1 Sorrel
2 Ferns
2 Cruciferous pods
1 Weeds

The above analysis may not give a correct idea of the composition of the herbage but only represents the species which could be identified by flower or seed at the time of cutting.

Weights of Bagged Feeds.

In answer to complaints as to probable shortages in the net weight of various feeds sold throughout the state, the sampling agent weighed over 200 bags of different feeds at various warehouses. In all cases the claimed weight was 100 lbs. As far as known the stock had not been on hand over six months. It was not practicable to empty the bags and secure an accurate net weight, so only gross weights are recorded, although an allowance of one pound for the empty bag would probably be reasonably accurate.

No. of Bags.	Feed.	Average Weight.	No. of Bags.	Feed.	Average Weight.
5	Cotton seed meal	101	10	Wheat mixed feed	100.35
10	Cotton seed meal	101.5	10	Wheat mixed feed	99.25
10	Linseed meal	99.3	5	Wheat mixed feed	101.7
10	Linseed meal	99.6	10	Gluten feed	100.4
10	Wheat bran	98.3	5	Gluten feed	101.3
10	Wheat bran	99.85	5	Gluten feed	99.2
10	Wheat bran	98.85	10	Hominy feed	99.8
7	Wheat bran	99.3	10	Stock feed	100.05
10	Wheat middlings	99.35	10	Stock feed	100.6
10	Wheat middlings	99.75	34	Stock feed	100.6
			10	Poultry mash	101.4

Nearly all the tags for cotton seed meal, which we have seen, are marked "100 lbs. gross, 99 lbs. net," while linseed meal tags are usually marked "100 lbs. gross." Such a system of tagging cannot be approved. A guaranteed gross weight is meaningless anyway and it is more than probable, should a purchaser wish a ton of any of the brands thus tagged, that he would receive only 20 bags, or a shortage of 20 lbs. per ton. Furthermore the above tabulation shows that the purchaser of the particular 20 bags of linseed meal would receive only 1,989 lbs. gross, or 1969 lbs. net.

The cotton seed meals weighed showed the weights claimed, but all the other feeds, except one lot of wheat feed, one of gluten feed and one of poultry mash, were short-weight from 0.4 to 2.7 lbs. per 100 pound bag. This shortage was especially marked in two lots of wheat bran.

Microscopical Examination of Feeds.

It does not seem necessary to report year after year the ingredients in well-known feeds which have been on the market for some time. The data given below, therefore, apply only to the feeds which are new this year or which we have not previously examined under the microscope.

Hatch's Horse Feed contains corn and oat products, and small amounts of a wheat product and cotton seed meal.

Arab Balanced Horse Ration (*Peter's Arab Horse Feed*) contains corn, oats, alfalfa and molasses.

Yellow Tag Stock Feed contains corn and oat products.

Maz-All Feed contains corn by-products; it is essentially a corn feed meal.

Allneeda Horse and Mule Feed contains corn, oats, alfalfa, a wheat product, molasses and salt.

Braue's Mixed Feed with Molasses contains oats, cracked corn, alfalfa and molasses.

Missouri Horse and Mule Feed contains alfalfa, corn, oats, a peanut product, molasses and salt.

Boggs' Competition Horse Feed contains crushed oats, cracked corn, wheat bran and molasses.

H. and S. Horse, Mule and Dairy Feed contains alfalfa, dried brewers' grains, distillery residues and molasses.

Molassine Meal is essentially peat and molasses, with probably fenugreek and traces of unidentified tissues.

Peter's King Corn Sugar Feed contains corn, oats, alfalfa and molasses.

Green Cross Molasses Feed contains corn, oats, cotton seed meal, alfalfa, oat products, molasses and salt.

Purina Dairy Feed contains dried brewers' grains, corn by-products, cotton seed meal, alfalfa, molasses and salt.

H.-O. Dry Poultry Mash contains oats and wheat products, corn, corn by-products and alfalfa.

Hatch's Dry Mash contains wheat bran, alfalfa, oats products and an animal product.

Average Composition of Fodders and Feeds.

The reports of this station from 1878 to the present time contain the analyses of many samples of fodders and feeds. Many of these reports are out of print and as a matter of convenience to feeders the following table of averages has been compiled. It includes 4,178 analyses of 436 different kinds of feeds.

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract [Fat].
	GRASSES.						
2	Agrostis vulgaris major (Tall Redtop)	66.7	2.0	2.0	11.9	16.6	0.8
2	" " minor (Fine Bent)	65.6	2.4	2.7	11.3	17.2	0.8
1	Andropogon dissitiflorus (Broom Grass)	64.5	1.3	2.2	13.0	18.3	0.7
1	" provincialis (Blue Stem)	73.1	1.6	2.2	8.5	14.0	0.6
1	" scoparius (Broom Grass)	57.1	1.7	1.7	16.2	22.7	0.6
2	Anthoxanthum odoratum (Sweet Vernal)	74.8	1.5	2.6	7.7	12.5	0.9
2	Arrhenatherum avenaceum (Tall Oat)	73.0	1.6	1.9	9.5	13.4	0.6
2	Avena flavescens (Yellow Oat)	68.4	1.5	2.2	10.7	16.4	0.8
1	Chrysopogon nutans (Indian Grass)	67.0	2.0	2.4	10.0	17.0	0.8
2	Dactylis glomerata (Orchard Grass)	73.8	1.6	2.1	9.5	12.2	0.8
1	Festuca ovina (Sheep's Fescue)	71.8	1.9	2.9	10.0	12.7	0.7
3	" pratensis (Meadow Fescue)	70.2	1.8	2.4	10.7	14.2	0.7
1	Glyceria nervata (Nerved Meadow)	74.9	1.8	2.6	8.4	11.8	0.5
1	Panicum agrostoides (Redtop Panic)	65.0	3.6	2.4	10.4	17.9	0.7
1	" crus-galli, v. hispidum (Barnyard grass)	80.5	1.4	1.4	6.8	9.6	0.3
1	" virgatum (Tall Panic)	65.2	1.9	3.7	10.4	18.0	0.8
2	Poa nemoralis (Wood Meadow)	65.5	1.8	3.0	11.8	17.0	0.9
2	" pratensis (Kentucky Blue)	71.4	1.8	2.6	9.4	14.0	0.8
1	" trivialis (Rough-stalked Meadow)	72.8	1.7	2.7	8.2	13.8	0.8
1	Sorghum halapense (Johnson Grass)	68.6	1.7	2.9	9.4	16.5	0.9
12	Corn (Maize) Fodder	83.6	1.1	1.3	4.8	8.9	0.3
1	Soy Bean Fodder	76.5	3.8	3.6	6.5	9.0	0.6
	SILAGE.						
1	Cabbage Silage	87.6	4.2	1.2	1.6	4.5	0.9
1	Clover and Oats Silage	....	....	3.5	....	....	1.3
6	Corn (Maize) Silage	80.9	1.2	1.5	6.1	9.8	0.4
	HAY AND DRIED COARSE FODDER.						
8	Alfalfa Hay	17.5	7.2	15.1	25.5	33.0	1.7
12	Black Grass Hay (Juncus gerardi)	9.3	7.3	7.9	25.5	47.5	2.5
1	Cat Tails, leaves only (Typha latifolia)	10.8	5.8	7.0	33.6	39.8	3.0
5	Creek Sedge Hay (Spartina stricta, v. glabra)	8.3	10.7	6.6	26.9	45.4	2.1
1	Fresh Water Cord Grass Hay (Spartina cynosuroides)	8.2	6.2	5.6	30.8	47.4	1.8
2	Goose Grass Hay (Triglochin maritima)	8.1	8.6	9.8	30.7	39.8	3.0
1	Larger Three Square (Scirpus olneyl)	9.5	8.2	10.1	25.1	45.3	1.8
6	Meadow Grass Hay (Mixed)	14.2	5.3	8.0	26.2	44.4	1.9
7	Meadow Grasses and Clover Hay	14.9	5.0	10.5	25.2	42.2	2.2
4	Red Salt Grass Hay (Spartina juncea)	9.1	7.5	5.4	26.7	48.7	2.6
1	Sea Club Rush Hay (Scirpus maritimus)	11.2	8.0	9.2	24.7	44.0	2.9
2	Snip Snap (Two Tail) Hay (Eleocharis rostellata)	8.4	10.1	8.8	24.4	45.9	2.4
1	Spike Grass Hay (Distichlis maritima)	9.2	7.0	5.4	26.4	49.4	2.6
2	Swamp Hay	14.3	7.0	7.0	24.7	45.3	1.7
4	Three Square Hay (Scirpus pungens)	8.1	8.3	7.4	25.7	48.0	2.5
6	Timothy Hay (Phleum pratense)	14.2	4.0	6.1	28.5	45.4	1.8

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Continued.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein (N x 6.25).	Fiber.	Nitrogen-free Extract.	Ether Extract (Fat).
	HAY AND DRIED COARSE FODDER.—CONTINUED.						
6	Timothy and Red Top Hay	14.9	5.1	7.0	26.6	44.4	2.0
3	White Bent Hay (Agrostis alba)	7.9	6.8	7.7	26.2	49.3	2.1
2	Wild Rice (Wild Oats) Hay (Zizania aquatica)	9.0	15.6	7.8	28.3	36.8	2.5
1	Wild Rye Grass Hay (Elymus virginicus)	6.9	7.1	7.6	32.0	44.3	2.1
1	Corn Fodder, dried	14.8	4.5	5.8	25.9	47.5	1.5
9	Corn Fodder, field-cured	36.5	2.7	4.2	16.6	38.4	1.6
1	Cornstalks, ground	9.1	4.7	7.1	14.7	61.5	2.9
1	Corn Stover, dried	14.3	4.4	6.5	28.3	45.0	1.5
48	Corn Stover, field-cured	40.6	3.8	3.9	19.9	31.0	0.8
1	Bean Pods and Leaves	6.0	8.8	5.9	26.4	51.9	1.0
1	Bean Stems	4.7	5.5	6.3	44.4	38.4	0.7
1	Buckhorn Fern (*Osmunda regalis*)	14.6	6.1	10.2	21.6	45.1	2.4
1	Carob Bean Husks	14.2	3.2	4.8	4.8	72.8	0.2
1	Millet Hay	14.3	6.5	6.3	27.9	43.6	1.4
1	Oats Hay	13.8	6.3	8.0	33.6	36.2	2.1
1	Pea Hay (*Lathyrus sylvestris*)	10.3	4.3	26.8	26.5	28.3	3.8
3	Rye Hay	10.0	4.4	5.9	38.0	40.4	1.3
1	Rye Straw	9.7	2.8	2.2	43.3	41.0	1.0
1	Wheat Hay	11.3	3.1	4.6	30.3	40.3	1.4
	ROOTS.						
2	Mangolds	92.1	1.0	1.8	0.8	4.2	0.1
1	Potatoes	78.0	1.0	2.2	0.3	18.4	0.1
1	Sugar Beets	84.4	1.1	1.7	0.9	11.8	0.1
1	Sweet Potatoes	73.4	1.1	1.3	0.9	23.0	0.3
1	Turnips	88.9	0.7	1.3	0.9	8.1	0.1
1	Yams	71.2	0.6	2.1	0.7	25.1	0.3
	GRAIN AND OTHER SEEDS.						
1	Beans	15.0	3.1	20.4	3.2	56.7	1.6
2	*Carum copticum* Seed	6.3	9.7	16.9	11.9	24.2	31.0
1	Carob Beans	12.8	3.3	15.0	7.2	59.9	1.8
136	Corn (Maize)	12.8	1.3	10.2	1.3	69.8	4.6
5	Oats	12.1	3.4	12.0	9.0	58.5	5.1
2	Sorghum Seed	15.9	2.0	7.9	2.6	68.2	3.4
3	Soy Beans	10.0	5.2	34.3	5.4	27.2	17.9
	OIL CAKE PRODUCTS.						
1	Cotton Seed Bran	12.0	2.2	6.4	30.8	47.3	1.3
6	Cotton Seed Feed Meal	9.5	4.3	20.7	22.1	39.0	4.4
2	" " " " (Royal Feed)	8.2	4.1	20.9	25.6	37.1	4.1
205	Cotton Seed Meal	8.5	6.5	41.9	7.7	26.4	9.0
4	Cotton Seed Meal, undecorticated	10.0	5.0	24.0	18.5	35.5	7.0
5	Flax Feed or Flakes	9.9	6.9	16.6	10.9	41.1	14.6
1	Flax Meal	11.2	5.2	40.4	7.6	32.6	3.0

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Continued.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract [Fat].
	OIL CAKE PRODUCTS.—CONTINUED.						
51	Linseed Meal, new process	10.6	5.8	37.0	8.5	35.4	2.7
96	Linseed Meal, old process	10.2	5.4	33.9	8.2	35.2	7.1
1	Peanut Bran	10.7	10.0	10.5	43.8	20.2	4.8
1	Peanuts, broken	7.3	6.0	22.9	13.7	17.7	32.4
1	Peanut Hearts	3.6	....	34.3	....	....	43.4
1	Peanut Meal	8.1	....	46.3	....	....	8.9
3	Peanut Refuse	4.0	5.4	24.5	6.1	26.6	33.4
1	Rape Seed Meal	9.5	13.9	21.9	14.4	24.7	15.6
	ALFALFA PRODUCTS.						
12	Alfalfa Feed or Meal	9.1	9.5	15.9	26.6	36.8	2.1
3	Alfalfa and Molasses	10.2	9.2	11.1	18.4	50.2	0.9
1	Alfalfa Screenings	8.0	7.1	30.0	14.9	32.9	7.1
	BARLEY PRODUCTS.						
2	Barley, damaged	9.7	2.2	11.8	5.9	68.5	1.9
3	Barley Feed	10.0	4.4	12.6	10.6	58.6	3.8
2	Barley Screenings	12.2	3.6	12.3	7.3	61.8	2.8
	BUCKWHEAT PRODUCTS.						
4	Buckwheat Feed	10.6	3.4	17.3	23.9	40.4	4.4
3	Buckwheat Flour	15.0	0.9	6.5	0.4	76.2	1.0
3	Buckwheat Hulls or Shucks	10.1	2.3	4.0	44.1	38.6	0.9
17	Buckwheat Middlings or Bran	13.1	4.8	29.4	6.4	38.7	7.6
	CORN PRODUCTS.						
2	Cerealine Feed No. 2	8.9	2.5	12.2	2.8	65.3	8.3
9	Corn Bran, or Sugar Feed	9.1	1.5	12.4	9.3	60.8	6.9
10	Corn Cob	8.3	2.0	3.0	29.7	56.4	0.6
1	Corn and Cob Meal	20.9	2.4	8.2	4.4	60.4	3.7
2	Corn Feed, or Screenings	9.8	1.3	8.9	9.4	68.3	2.3
1	Corn Feed, Glen Cove, wet	62.2	0.3	5.7	1.6	28.9	1.3
1	Corn Flour	13.1	0.6	5.8	0.4	77.6	2.5
2	Corn Germ Feed	9.7	1.5	11.1	10.4	57.4	9.9
4	Corn Germ Meal	9.8	2.7	21.6	9.3	46.3	10.3
101	Corn (Maize) Meal	13.3	1.3	9.6	1.9	70.0	3.9
6	Gluten Feed, Bay State	8.9	1.0	19.3	5.6	60.7	4.5
8	" " Buffalo (early analyses)	8.1	0.8	22.9	7.2	49.1	11.8
109	" " Buffalo (later analyses)	9.5	2.5	25.2	6.7	53.0	3.1
5	" " Cedar Rapids	8.1	1.1	20.8	7.0	57.6	5.4
5	" " Clinton	9.5	1.0	24.0	7.3	54.5	3.7
12	" " Cream of Corn	7.8	3.1	26.1	6.8	53.0	3.2
6	" " Crescent	8.9	4.8	26.2	6.6	51.0	2.5
5	" " Davenport	9.3	1.6	27.8	6.4	51.3	3.6
3	" " Diamond	9.7	2.1	24.9	6.3	53.8	3.2
3	" " Douglas (or Grand Rapids)	8.1	1.2	21.1	7.5	57.5	4.6
4	" " Flint	9.0	0.9	20.4	6.4	59.0	4.3

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Continued.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract (Fat).
	CORN PRODUCTS.—CONTINUED.						
1	Gluten Feed, Geneva	7.9	1.0	26.2	8.3	52.8	3.8
6	" " Glen Cove	8.2	0.7	26.0	5.2	53.9	6.0
65	" " Globe	9.1	3.0	26.8	7.3	50.8	3.0
1	" " Golden	8.4	0.8	27.3	6.6	53.1	3.8
15	" " Hubinger (K. K.)	8.5	1.3	23.4	7.4	55.8	3.6
1	" " Illinois	11.2	1.0	20.9	6.5	57.3	3.1
2	" " Jenks	8.2	0.8	26.6	6.0	48.7	9.7
2	" " Marshalltown	8.2	2.1	27.7	7.1	51.3	3.6
1	" " Michigan	10.2	0.9	19.5	6.0	57.5	5.9
5	" " National Starch Co.	8.7	0.6	25.4	5.9	56.3	3.1
1	" " New England	9.0	1.0	24.9	7.4	54.2	3.5
8	" " Pekin	8.7	1.4	26.2	7.5	52.8	3.4
1	" " Piel Bros.	9.3	0.9	23.6	5.7	57.9	2.6
8	" " Queen	9.6	1.3	23.2	6.7	56.6	2.6
3	" " Rockford	8.5	0.8	26.0	6.8	54.5	3.4
4	" " Staley's	9.5	4.0	24.9	6.3	52.4	2.9
2	" " Union	8.7	1.5	23.2	6.9	55.7	4.0
16	" " Warner	9.7	1.7	23.8	7.3	54.3	3.2
7	" " Waukegan	9.2	1.1	26.6	6.8	52.4	3.9
1	" " Western	8.7	1.9	22.6	6.4	57.2	3.2
3	Gluten Meal, Atlas	6.5	1.7	36.6	11.5	28.3	15.4
28	" " Chicago	10.1	1.3	36.3	1.8	47.0	3.5
5	" " Cream (early analyses)	7.8	0.7	36.2	1.4	39.2	14.7
17	" " " (later analyses)	9.8	1.0	35.3	1.7	49.3	2.9
1	" " Diamond	7.9	1.0	41.3	2.4	45.7	1.7
2	" " King (early analyses)	7.7	0.8	33.6	1.6	39.4	16.9
2	" " " (later analyses)	8.8	0.8	33.4	1.6	53.0	2.4
304	Hominy Meal, Feed or Chop	9.6	2.6	10.7	4.6	64.5	8.0
19	Hominy and Corn Cob (Star Chop or Feed)	9.4	2.6	8.9	9.4	63.6	6.1
1	Maizo Red Dog Flour	9.0	2.0	9.8	1.9	70.3	7.0
1	Pop Corn Waste	10.5	1.7	11.6	2.3	69.3	4.6
1	Starch Feed, Glen Cove, wet	66.5	0.3	6.0	2.0	22.5	2.7
1	" " " " dried	11.2	0.5	21.1	3.2	60.7	3.3
1	" " kiln-dried	9.2	0.6	17.1	5.7	59.0	8.4
1	Sugar Meal, Buffalo, wet	62.9	0.2	3.3	2.0	27.5	4.1
1	" " " kiln-dried	11.5	1.2	21.8	5.2	49.2	11.1
	CORN AND OAT PRODUCTS.						
113	Corn and Oats (Provender)	11.3	2.1	10.0	4.8	67.6	4.2
7	Corn and Oat Feeds (no brands)	9.9	3.2	8.1	11.2	63.8	3.8
1	Acme Feed	11.2	2.5	8.0	6.9	67.5	3.9
1	Adrian Chop Feed	8.0	3.2	8.7	7.4	66.8	5.9
16	Boss Corn and Oats (or Chop) Feed	9.7	4.2	8.8	10.4	62.6	4.3
2	Bufceco Chop Feed	8.7	3.3	9.4	9.3	64.2	5.1
12	Buffalo Corn and Oats (or Chop) Feed	9.7	3.2	8.7	9.6	64.5	4.3
2	Champion Bell Fodder	8.9	3.6	9.5	13.2	61.0	3.8
1	Defiance Corn and Oat Feed	9.9	4.4	9.4	13.5	59.6	3.2

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Continued.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract [Fat].
	CORN AND OAT PRODUCTS.—CONTINUED.						
12	De-Fi Corn and Oat (or De-Fi) Feed	8.7	4.2	8.9	14.5	60.5	3.2
1	Dickinson's Stock Feed	9.7	2.8	7.8	11.5	63.9	4.3
2	Durham Corn and Oat (or Durham) Feed	10.1	4.5	8.3	11.8	60.1	5.2
1	Eclipse Feed	11.1	3.2	9.9	7.7	63.5	4.6
3	Excelsior Corn and Oats (Stock or Chop) Feed	9.8	5.1	8.7	11.2	60.0	5.2
1	Friends Concentrated Dairy Feed	....	....	6.6	....	....	3.1
9	Haskell's Stock Feed	8.3	3.1	9.6	7.4	65.2	6.4
3	Husted Corn and Oats	10.8	2.5	9.6	4.3	68.0	4.8
3	Imperial Steam-cooked Feed	9.2	1.8	9.9	3.3	71.5	4.3
1	Iroquois Chop Feed	8.8	3.2	10.1	8.7	64.2	5.0
6	Korn-Oato	9.2	3.2	7.5	12.3	64.8	3.0
2	Lenox Feed	9.7	2.6	8.4	7.8	68.1	3.4
6	Monarch Chop Feed	10.3	3.1	8.5	9.6	64.5	4.0
2	Mystic Feed	9.4	3.5	10.3	10.0	62.7	4.1
1	Niagara Special Feed	11.4	3.7	8.9	12.6	58.0	5.4
2	Pearl Cooked Horse and Cow Feed	10.2	3.2	10.5	6.3	62.8	7.0
1	Pearl Cooked Oat Feed	9.0	3.1	9.4	7.7	64.7	6.1
1	Quaker Corn and Oat Feed	11.5	2.7	8.0	10.7	63.7	3.4
1	Regal Chop Feed	8.9	3.4	8.6	10.6	64.2	4.3
36	Victor Corn and Oat (or Victor) Feed	9.6	3.7	8.8	11.3	62.7	3.9
2	White Diamond Feed	9.3	2.9	9.0	7.3	68.2	3.3
2	Winner Chop Feed	8.7	3.3	9.3	8.9	63.7	6.1
	OAT PRODUCTS.						
1	Oat Chaff	7.8	7.5	5.1	28.5	49.5	1.6
10	Oat Feed (no brands)	7.8	4.9	9.2	20.0	54.9	3.2
14	Oats, Ground	10.2	3.3	11.8	10.7	59.3	4.7
10	Oat Hulls	6.7	5.9	6.4	24.7	53.2	3.1
4	Oat Middlings	7.7	3.7	18.3	6.2	56.6	7.5
1	Crescent Oat Feed	6.4	5.6	7.3	23.2	54.3	3.2
1	Jim Dandy Feed	7.3	5.6	7.6	23.1	53.8	2.6
2	Joliet Oat Feed	8.8	5.2	8.4	21.2	53.5	2.9
1	Oatena	7.1	4.8	8.8	16.2	59.1	4.0
1	Pillsbury's Oat Feed	8.1	6.9	7.1	24.8	51.1	2.0
6	Quaker Oat Feed	7.6	5.2	11.7	16.8	55.1	3.6
3	Royal Oat Feed	7.7	7.5	6.5	25.3	51.0	2.0
4	Vim Oat Feed	8.5	6.0	8.1	23.4	51.2	2.8
	RICE PRODUCTS.						
2	Rice Bran, or Feed	10.6	8.5	12.3	8.3	48.6	11.7
2	Rice Flour, Refuse	7.7	9.9	10.2	15.8	47.6	8.8
1	Rice, Ground	9.3	0.6	7.8	0.1	81.8	0.4
	RYE PRODUCTS.						
7	Rye Bran	11.8	3.4	15.0	3.1	63.9	2.8
51	Rye Feed	11.6	3.6	15.4	4.0	62.4	3.0

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Continued.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract [Fat].
	RYE PRODUCTS.—CONTINUED.						
3	Rye, Ground	12.7	2.1	10.7	2.0	70.5	2.0
16	Rye Middlings	10.6	3.6	16.4	4.3	61.8	3.3
	WHEAT PRODUCTS.						
405	Wheat Bran	10.3	6.3	15.9	9.5	53.3	4.7
544	Wheat Feed (Mixed Feed)	10.5	5.5	16.8	7.5	55.0	4.7
2	Wheat Flour	12.8	1.0	13.2	0.7	70.7	1.6
2	Wheat, Ground	12.8	3.7	14.7	4.3	61.1	3.4
449	Wheat Middlings	10.8	4.4	17.6	6.2	56.0	5.0
11	Wheat and Corn Product (Colonial Middlings)	10.0	3.5	14.1	5.4	60.6	6.4
1	Wheat and Oats	9.6	3.6	12.9	7.4	61.9	4.6
1	Wheat Shreds	7.1	1.8	11.1	1.9	76.2	1.9
7	Red Dog Flour	10.9	2.6	17.8	2.1	62.0	4.6
1	Atlantic Gluten Meal, extra strong	7.9	1.8	68.9	5.8	15.0	0.6
6	" " "	8.4	2.3	47.6	3.9	35.7	2.1
11	" " "	6.2	1.0	32.0	1.1	59.0	0.7
	WHEAT AND CORN COB PRODUCTS.						
8	Blue Grass Mixed Feed	9.8	4.0	11.5	14.8	56.9	3.0
1	"C" Mixed Feed	8.1	4.7	13.8	13.5	56.3	3.6
7	Dairy Winter Mixed Feed	10.2	5.1	12.0	14.4	54.9	3.4
2	Eclipse Mixed Feed	8.4	4.6	12.5	15.9	55.2	3.4
2	Holstein Mixed Feed	9.0	4.7	11.6	18.0	53.3	3.4
4	Indiana Mixed Feed	9.9	4.9	11.5	15.1	55.4	3.2
12	Jersey Mixed Feed	9.9	4.6	11.6	14.6	56.2	3.1
3	Kennebec Feed	9.6	3.7	10.0	15.4	58.2	3.1
4	Sterling Mixed Feed	9.0	3.9	10.4	15.3	58.1	3.3
	BREWERY AND DISTILLERY PRODUCTS.						
5	Brewers' Grains, wet	77.6	1.1	5.0	3.4	11.7	1.2
35	" " dried	7.8	3.5	27.4	13.0	41.5	6.8
1	Distillery Grains, wet	77.7	0.5	6.0	2.8	10.6	2.4
2	Malt Hulls	8.6	9.1	12.6	22.5	45.8	1.4
39	Malt Sprouts	9.9	5.9	25.8	12.0	44.9	1.5
21	Ajax Flakes	7.2	2.4	31.4	12.0	34.0	13.0
1	A 1 Distillers' Grains	7.5	2.2	21.6	11.7	46.4	10.6
8	Biles' Fourex Distillers' Grains	8.0	2.2	31.2	12.1	33.4	13.1
1	Biles' Rye Distillers' Grains	6.3	1.2	15.7	13.6	55.2	8.0
1	Biles' Twoex Distillers' Grains	8.3	2.8	28.1	11.0	38.5	11.3
1	Buckeye Gluten Feed	9.9	3.5	19.7	13.0	50.2	3.7
1	Climax Distillers' Grains	7.4	2.6	32.6	11.0	34.3	12.1
1	Connecticut Gluten Feed	8.1	4.0	26.3	8.6	41.2	11.8
9	Continental Gluten Feed	7.1	4.0	29.1	9.3	37.8	12.7
1	Corn Distillers' Grains	6.5	1.8	27.6	14.7	36.1	13.3
2	Corn Protegran	7.7	3.1	30.3	9.7	36.6	12.6
1	Dearborn Distillers' Grains	6.3	1.9	24.8	12.5	45.0	9.5

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Continued.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract [Fat].
	BREWERY AND DISTILLERY PRODUCTS.—CONTINUED.						
1	Dewey Bros.' Distillers' Grains	9.1	3.8	23.2	10.3	45.0	8.6
5	Eagle 3 D Grains	7.4	3.9	28.1	10.0	38.3	12.3
1	Hall's A A A A Distillers' Grains	7.2	1.9	30.6	11.7	36.1	12.5
1	Hiquality Distillers' Grains	6.2	1.5	35.9	10.8	30.5	15.1
1	Husted Distillers' Grains	7.3	1.4	31.3	11.1	36.7	12.2
1	Protein Corn Distillers' Grains	11.8	1.9	26.6	10.2	39.3	10.2
	PROPRIETARY DAIRY AND STOCK FEEDS.						
2	Algrane Milk Feed	8.7	5.1	18.4	12.2	52.0	3.6
3	Badger Dairy Feed	10.5	7.4	18.0	12.1	48.2	3.8
1	Badger Stock Feed	10.5	6.6	13.3	14.9	51.4	3.3
1	Bibby's Oil Cake Feed	7.0	8.7	20.3	8.7	47.0	8.3
20	Biles' Union Grains Ready Ration	8.7	5.8	23.9	9.3	44.8	7.5
16	Blatchford's Calf Meal	10.1	4.9	25.9	5.1	49.1	4.9
2	Blue Ribbon Dairy Feed	8.1	7.0	24.4	10.8	45.8	3.9
2	Bonnie Dairy Feed	11.0	3.1	18.5	6.3	56.7	4.4
1	Braue's Mixed Feed with Molasses	9.8	7.4	8.5	7.3	65.0	2.0
2	Bufceco Creamery Feed	8.6	4.3	19.3	9.5	52.7	5.6
5	Bufceco Stock Feed	9.6	2.9	9.3	8.0	65.2	5.0
11	Buffalo Creamery Feed	9.6	4.0	20.1	10.6	50.6	5.1
2	Buffalo Dairy Feed	7.6	3.3	14.3	13.6	56.7	4.5
1	Buffalo XXX Stock Feed	9.2	3.9	10.1	11.8	59.6	5.4
1	Calf Laval Feed	11.2	4.2	20.4	6.8	47.5	9.9
1	Chester Stock Feed	10.8	2.7	12.9	9.3	60.1	4.2
1	Columbia Cured Feed for Horses and Cattle	11.4	5.5	15.1	7.4	54.9	5.7
6	Daisy Dairy Feed	8.4	7.8	16.0	13.7	51.5	2.6
1	Daniels' Stock Feed	12.5	2.1	9.9	4.8	67.2	3.5
1	Derby Stock Feed	8.7	3.6	12.0	10.8	58.4	6.5
1	Diamond Stock Feed	9.5	3.0	11.6	9.2	60.2	6.5
2	Economy Feed	8.1	3.1	11.1	14.2	58.3	5.2
1	Electric Stock Feed	9.7	6.8	15.3	9.6	56.2	2.4
1	Empire State Cow Feed	9.8	8.7	14.3	15.8	47.7	3.7
1	Empire State Dairy Feed	7.4	2.2	29.5	12.9	36.4	11.6
1	Germaline	7.8	3.8	12.8	5.1	68.5	2.0
2	Grandin's Stock Feed	8.1	4.1	10.3	8.6	62.1	6.8
2	Great Western Dairy Feed	8.9	6.5	10.6	20.8	50.5	2.7
1	Green Diamond Sugar Feed	9.4	6.7	12.8	9.7	59.4	2.0
1	Green Meadow Dairy Feed	17.7	10.9	11.3	15.0	44.5	0.6
1	Gregson Calf Meal	7.8	5.7	28.0	4.7	47.0	6.8
1	Hall's Dairy Ration	9.3	8.5	18.1	7.9	45.8	10.4
2	Hammond Dairy Feed	9.8	7.3	14.8	9.9	54.7	3.5
1	Henkel's Fine White Feed	10.4	3.7	16.5	4.5	61.2	3.7
21	H. O. Dairy Feed	8.7	3.9	18.6	12.6	51.8	4.4
1	H. O. Milk Feed	10.0	4.7	13.8	12.5	54.9	4.1
1	Husted Dairy Feed	9.5	6.0	22.5	6.5	50.1	5.4
3	Husted Molasses Feed	10.7	6.9	21.9	7.7	48.6	4.2
1	Husted Stock Feed	7.9	3.3	9.6	8.6	65.0	5.6

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Continued.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract [Fat].
	PROPRIETARY DAIRY AND STOCK FEEDS.—CONTINUED.						
4	Larro-Feed for Dairy Cows	8.3	4.9	19.9	12.9	50.2	3.8
7	Lenox Stock Feed	11.3	2.9	9.0	9.5	63.2	4.1
1	Marsden Corn Feed	6.5	5.3	4.4	37.0	46.1	0.7
1	Maz-All Feed	7.7	2.8	8.3	1.4	78.3	1.5
1	Matchless Stock Feed	9.5	4.1	9.8	10.5	59.0	7.1
2	Mayflower Stock Feed	10.0	3.5	10.0	6.0	64.8	5.7
6	Molac Dairy Feed	10.6	6.5	16.9	11.7	50.1	4.2
5	Molasses Beet Pulp, Dried	8.4	4.6	9.2	16.8	60.4	0.6
2	Molassine Meal	16.8	7.8	8.6	6.2	59.9	0.7
1	M. & S. Stock Feed	8.8	3.3	9.5	9.8	63.0	5.6
2	Mueller's Molasses Grains	14.9	6.7	16.6	9.4	50.1	2.3
11	New England Stock Feed	8.8	3.8	9.9	10.4	62.3	4.8
1	Peerless Dairy Feed	11.0	7.8	20.1	10.2	47.2	3.7
1	Peter's King Corn Sugar Feed	10.8	6.3	11.3	12.4	57.2	2.0
1	Presto Molasses Feed	13.2	6.5	14.4	6.8	56.0	3.1
2	Proteina	9.7	2.2	23.8	8.9	46.4	9.0
3	Protena Dairy Feed	8.9	7.2	19.7	16.3	43.8	4.1
1	Purina Dairy Feed	8.8	7.6	19.1	17.4	43.9	3.2
3	Purina Molasses Feed	11.0	5.4	11.8	9.7	59.2	2.9
2	Purity Special Stock Feed	7.9	3.4	10.2	8.6	65.4	4.5
36	Quaker Dairy Feed	8.1	5.1	13.5	16.3	53.4	3.6
5	Quaker Molasses Dairy Feed	9.5	7.3	15.9	12.7	50.5	4.1
7	Schumacher's Calf Meal	8.9	3.4	19.1	2.4	58.2	8.0
1	Schumacher's Starch Feed	9.3	4.8	12.7	9.8	58.8	4.6
35	Schumacher's Stock Feed (Corn, Oats and Barley)	9.4	4.1	11.5	10.3	60.3	4.4
1	Star Cotton Feed	8.5	2.8	10.9	9.0	62.6	6.2
4	Sterling Stock Feed	9.5	4.1	10.9	9.0	61.6	4.9
15	Sucrene Dairy Feed	10.6	7.5	16.8	10.7	50.2	4.2
1	Sugared Dairy Feed	10.4	6.0	17.8	10.8	49.9	5.1
1	Sugarota Calf Meal	9.7	4.3	26.6	4.6	48.7	6.1
3	Sugarota Dairy Feed	10.2	6.9	15.9	15.6	46.1	5.3
2	Sugarota Milk Meal	7.9	8.3	25.2	11.6	43.7	3.3
11	Unicorn Dairy Ration	8.0	4.0	26.5	9.2	45.7	6.6
2	Vincent Bros.' (V-B) Dairy Feed	8.6	3.6	19.8	8.7	54.5	4.8
1	Weiss' Alfalfa Stock Feed	10.9	5.3	12.1	11.7	57.2	2.8
3	White Cross Stock Feed	10.0	3.0	10.4	4.3	68.2	4.1
5	Wirthmore Balanced Ration Feed	8.4	5.2	26.0	8.7	46.3	5.4
7	Wirthmore Stock Feed	8.3	3.4	10.2	7.9	62.9	7.3
1	Yellow Tag Stock Feed	8.5	3.1	10.0	8.6	64.8	5.0
2	Zenith Stock Feed	10.2	3.3	11.3	5.3	64.5	5.4
	PROPRIETARY HORSE FEEDS.						
5	Algrane Horse Feed	8.8	3.9	11.3	10.0	61.6	4.4
1	Allneeda Horse and Mule Feed	10.2	7.3	9.0	12.4	59.2	1.9
4	Blomo Feed	15.6	8.8	15.9	10.5	48.3	0.9
1	Boggs' Competition Horse Feed	11.0	2.9	11.0	4.6	67.2	3.3
5	Bonnie Horse Feed	10.3	2.7	11.7	6.6	64.5	4.2

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Continued.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract [Fat].
	PROPRIETARY HORSE FEEDS.—CONTINUED.						
3	Bufceco Horse Feed	9.2	3.5	11.4	9.6	61.8	4.5
13	Buffalo Horse Feed	10.8	3.2	12.1	8.8	61.3	4.8
1	Corno Horse and Mule Feed	11.1	4.2	10.3	13.8	56.8	3.8
1	Daisy Horse Feed	7.4	7.5	12.9	13.6	56.8	1.8
1	Green Cross Molasses Horse Feed	10.2	4.9	10.6	10.5	60.9	2.9
1	Hatch's Horse Feed	9.8	2.9	11.8	9.1	62.7	3.7
1	Hexagon for Horses	9.2	4.3	8.5	13.8	58.7	5.5
27	H. O. Horse Feed	9.7	3.2	12.5	9.7	60.5	4.4
1	H. & S. Horse, Mule and Dairy Feed	8.7	8.0	16.4	11.3	51.4	4.2
2	Husted Horse Feed	10.4	3.8	12.1	8.1	60.7	4.9
1	Husted Molasses Horse Feed	10.6	5.0	10.3	6.2	64.1	3.8
2	Husted Steam-cooked Feed	9.9	2.2	10.6	4.9	67.8	4.6
1	Missouri Horse and Mule Feed	11.0	5.3	10.0	14.5	55.2	4.0
4	Molac Molasses Horse Feed	10.8	5.8	12.9	12.9	54.7	2.9
2	Mueller's Molasses Feed for Horses	15.5	6.2	16.3	8.5	51.7	1.8
1	Peter's Arab Horse Feed	11.0	4.3	10.5	7.6	64.5	2.1
4	Schumacher's Special Horse Feed	8.9	3.4	9.5	8.2	66.3	3.7
7	Sucrene Horse Feed	11.4	6.6	13.8	9.0	56.1	3.1
2	Sucrene Horse and Mule Feed	10.2	6.9	10.4	9.6	59.5	3.4
1	Sugared Horse Feed	9.9	5.5	14.8	11.9	54.1	3.8
2	Sugarota Horse Feed	9.8	7.3	13.1	18.0	47.2	4.6
1	Ubiko Horse Feed	8.5	3.6	20.4	9.3	51.0	7.2
2	Vincent Bros.' (V-B) Horse Feed	9.2	2.9	11.3	7.4	64.3	4.9
	PROPRIETARY POULTRY FEEDS.						
1	Algrane Poultry Feed	9.6	3.8	15.9	7.0	58.8	4.9
19	American Poultry Feed	10.5	3.0	13.6	4.6	62.6	5.7
1	Bonnie Dry Mash	9.7	5.6	16.1	7.1	57.0	4.5
3	Bonnie Poultry Feed	10.6	4.8	17.0	5.6	58.0	4.0
2	Bufceco Poultry Feed	9.0	3.0	16.8	5.4	60.5	5.3
8	Buffalo Poultry Feed	10.7	3.1	16.4	4.8	60.2	4.8
2	Cyphers Laying Food	12.4	2.9	15.2	3.4	62.4	3.7
1	Daniels' Poultry Feed	10.8	14.0	9.6	3.5	58.8	3.3
1	Every Morning Mash Feed	9.9	8.9	19.6	10.3	45.8	5.5
1	Gem Poultry Feed	6.8	27.0	12.1	7.6	43.0	3.5
1	Globe Egg Mash	9.8	5.9	18.3	6.5	55.1	4.4
1	Hatch's Dry Mash	9.8	6.0	17.9	9.1	52.7	4.5
2	H. O. Dry Poultry Mash	9.4	4.2	17.0	11.5	54.4	3.5
23	H. O. Poultry Feed	9.7	3.1	17.3	5.1	59.5	5.3
1	H. O. Scratching Feed	12.1	2.3	11.9	2.7	67.3	3.7
2	Husted Alfalfa Poultry Meal	11.8	4.8	12.2	13.8	54.1	3.3
1	Husted Laying Mash	10.6	3.9	17.3	5.1	57.6	5.5
3	Husted Poultry Feed	10.4	3.7	14.1	7.0	60.3	4.5
1	M. & S. Poultry Mash	9.3	8.3	22.9	7.4	47.0	5.1
7	P. & P. Dry Mash Feed	9.5	11.8	20.3	6.5	48.4	3.5
2	P. & P. Fattening Feed	9.6	3.5	11.0	6.2	65.6	4.1
6	P. & P. Growing Feed	10.8	5.7	15.3	3.5	60.5	4.2

TABLE V —AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Continued.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878-1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract [Fat].
	PROPRIETARY POULTRY FEEDS.—CONTINUED.						
1	Perfection Mash Mixture	6.3	23.3	18.1	7.7	40.0	4.6
1	Purina Chick Feed	11.2	3.3	12.4	4.4	63.4	5.3
3	Purina Chicken Chowder Feed	9.9	7.0	18.5	7.2	53.5	3.9
2	Purina Mill Feed Mash	10.5	4.9	16.1	8.9	57.3	2.3
1	Puritan Growing Mash	10.0	5.0	22.3	6.0	53.4	3.3
2	Puritan Laying Mash	10.0	6.8	24.2	7.4	46.6	5.0
4	Purity Poultry Mash	8.9	9.8	19.4	6.9	49.4	5.6
4	Queen Poultry Mash	10.6	4.5	11.6	6.8	62.9	3.6
1	Red Comb Meal Mash	11.0	5.3	14.8	7.5	58.7	2.7
1	Reliable Dry Mash Feed	11.4	5.8	10.7	4.1	65.5	2.5
1	Rellom Mash	9.0	7.7	24.2	7.9	44.7	6.5
1	Success Poultry Feed	12.0	4.0	13.4	4.4	61.9	4.3
1	Sugarota Scratch Feed	10.3	1.5	10.3	2.0	71.9	4.0
4	V-B. Dry Mash for Laying Hens	9.3	7.6	21.6	8.9	47.6	5.0
1	V-B. Growing Feed	6.9	8.1	20.0	5.1	53.9	6.0
1	Wirthmore Growing Feed	10.9	2.0	12.9	2.9	68.2	3.1
3	Wirthmore Poultry Mash	9.7	3.7	13.5	7.1	62.2	3.8
1	Wonder Poultry Feed	10.1	4.6	21.3	13.8	43.3	6.9
1	Wyandotte Poultry Feed	12.0	13.3	9.1	3.6	59.8	2.2
24	Animal Meal (much bone)	6.4	41.9	36.0	....	....	11.2
1	Cracklings	21.8	....	46.8	....	....	13.5
1	Fish Meal	10.2	31.4	54.7	....	....	2.0
1	Meat Scrap (mostly meat)	7.4	4.7	66.3	....	....	15.0
29	Meat Scrap (meat and bone)	8.2	26.6	47.9	....	....	13.8
	CONDIMENTAL STOCK AND POULTRY FEEDS.						
2	Banner Stock Food	10.4	13.9	23.3	17.6	28.9	5.9
1	Baum's Poultry Food	7.0	16.7	19.5	15.4	32.6	8.9[1]
1	Baum's Stock Food	9.3	12.3	25.8	19.4	25.1	8.1[2]
1	Benjamin's Food for Horses and Cattle	6.9	5.5	27.8	7.6	45.9	6.3
1	Benjamin's Poultry Food	7.1	5.4	29.2	8.4	42.9	7.0
1	Concentrated Egg Producer	10.1	23.6	14.2	3.4	44.9	3.8
2	Concentrated Feed for Horses	12.5	16.9	14.1	3.9	49.5	3.1
1	Hess' Poultry Panacea	7.0	35.7	11.9	5.2	37.8	2.4
1	Imperial Egg Food for Poultry	3.5	57.0	9.7	5.9	22.5	1.4
1	International Poultry Food	6.8	7.9	14.9	14.0	49.6	6.8
1	International Stock Food	6.1	12.5	14.3	14.5	47.9	4.7
1	Myers' Royal Horse and Cattle Spice	6.1	20.3	17.8	5.8	47.9	2.1
1	Myers' Royal Poultry Spice	6.2	17.0	18.2	7.9	45.4	5.3
2	Nutriotone	6.8	20.5	20.6	6.0	40.0	6.1[3]
1	Orange Electric Food	6.8	4.0	15.1	7.8	58.9	7.4[4]
1	Pasture Stock Food	6.6	12.8	17.1	6.6	53.6	3.3
1	Poultriotone	6.3	18.5	16.9	7.5	47.3	3.5
1	Pratt's Animal Regulator	6.6	12.4	9.7	3.1	63.8	4.4
1	Pratts' Poultry Food	7.0	6.3	14.9	6.0	56.9	8.9[5]
1	Sturtevant's Medicated Meal	6.3	8.9	24.1	11.0	39.1	10.6[6]

[1] 6.7% Sulphur. [2] 3.9% Sulphur. [3] 0.8% Sulphur. [4] 0.4% Sulphur. [5] 0.8% Sulphur. [6] 2.9% Sulphur.

TABLE V.—AVERAGE COMPOSITION OF FODDERS AND FEEDS.—*Concluded.*

ANALYZED AT THE CONNECTICUT EXPERIMENT STATION, 1878–1913.

Number of Analyses.	Material.	Water.	Ash.	Protein [N x 6.25].	Fiber.	Nitrogen-free Extract.	Ether Extract [Fat].
	CONDIMENTAL STOCK AND POULTRY FEEDS.—CON'D.						
1	Triplex Poultry Food	5.8	40.9	18.0	4.6	25.3	5.4[1]
2	Wilbur's Horse and Cattle Food	8.7	10.2	19.6	9.3	47.4	4.8
	MISCELLANEOUS PRODUCTS.						
3	Aloras	11.2	4.9	16.6	7.0	54.3	6.0
5	Apple Pomace	73.8	1.1	1.5	5.3	16.7	1.6
1	Brush, Ground	39.3	1.4	2.6	28.3	27.3	1.1
1	Clover Meal, Pioneer	8.4	6.8	9.5	28.3	44.6	2.4
1	Cocoa Siftings	....	....	17.5	....	....	26.6
1	Cornaline (Coffee Hulls)	6.8	0.9	2.6	64.0	25.4	0.3
4	Cracker Waste	9.2	2.3	10.5	0.6	65.6	11.8
1	Force Screenings	11.3	2.0	10.3	0.5	74.1	1.8
2	Gee's Germ Middlings (Screenings)	7.0	11.7	14.6	9.8	50.2	6.7
1	Gee's Ground Oil Cake Compound (Screenings)	11.4	4.9	14.8	8.9	53.1	6.9
1	Herrings, Salt	52.9	18.9	18.1	....	0.9	9.2
1	Milk Albumen, Bent's	9.5	27.8	46.0	1.5	13.9	1.3
1	Molasses, Extra Vim	25.7	6.2	2.9	....	65.2	....
1	Pea Meal	12.4	3.7	23.1	8.9	50.7	1.2
1	Peas and Beans, Ground	14.0	2.7	20.3	18.4	43.0	1.6
2	Sugar Beet Pulp, wet	90.9	0.5	0.9	2.1	5.5	0.1
14	" " " dried	8.4	3.2	8.7	19.3	59.6	0.8
1	Vegetable Ivory Dust	18.7	1.1	3.4	7.5	68.6	0.7

[1] 0.9% Sulphur.

State of Connecticut

REPORT

OF

The Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

REPORT OF THE PLANT BREEDER

H. K. HAYES

SEVENTH REPORT OF THE STATE FORESTER

WALTER O. FILLEY

BEING PART VI OF THE ANNUAL REPORT FOR 1913

CONCLUSION

CONNECTICUT

AGRICULTURAL EXPERIMENT STATION

REPORT OF THE PLANT BREEDER

1913

H. K. HAYES

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NEW HAVEN, CONN.
May, 1914

PART VI.

Report of the Plant Breeder.

H. K. Hayes.

THE CORN PLANT AND SEED SELECTION.

The objects of this paper are, first, to give the results of a series of tests of the commercial value of first generation crosses, and second, to compare the yields of shelled corn of several of the more important Connecticut varieties when grown in the same season under uniform conditions.

Among field plants, the production of seed generally depends on a union of the male reproductive cell, contained in the pollen grain, with the female reproductive cell—the egg cell.

The pollen grains of corn are produced in the tassel and each thread of the silk ends in a female reproductive cell which is attached to the cob. To produce seed the male reproductive cell must pass down along the silk and fuse with this female cell. This process is called "fertilization"; if pollen and silk are borne by the same plant it is "self-fertilization," and if by different plants, "cross-fertilization."

Each variety of corn has "characters," such as color, shape and size of seeds, length of ears and row number, height of plants, time of maturity, etc., which distinguish it from other varieties.

The plant does not acquire these characters during growth. They were all contained potentially in the two cells just noticed, from whose union the individual grew; they are its "inheritance."

The full development of these inherited characters, however, depends on external conditions, such as soil, moisture, fertility and sunlight, which, taken together, are called "environment."

Both inheritance and environment must do their part if large yields of any crop are to be secured. The best of culture will not make profitable a variety with a poor inheritance; an excellent inheritance may be neutralized by an unfavorable environment. It follows that no variety will prove equally valuable under all of our various Connecticut conditions of soil and climate.

In the last fourteen years we have learned much about the inheritance of characters. We now know that in a large measure each character is inherited independently. The first generation of a cross may have some characters resembling one parent, some resembling the other parent and some of intermediate appearance. In the following generation, however, there is a recombination of characters and consequently a greater variability.

Nearly all corn varieties are in a complex hybrid condition due to the constant cross-fertilization of the plant, which continues this variation. Because some of these characters are more desirable than others, selection is of value in separating the desired characters from the undesirable. As the only correct way to determine the breeding value of an individual plant is to grow and examine its progeny, many corn growers have used the "ear-to-row" method of breeding. By this method each row of the breeding plot is grown from a single selected ear and at maturity the row yields are compared and selection continued from the better yielding row or rows. Other methods of seed selection, such as saving seed from those stalks which under competition give the better yields, or from the better plants at husking, are of value, but the desired results are not obtained so quickly as by the ear-to-row breeding method.

Another feature of the corn plant is that self-fertilization, i. e., the pollination of the silks of a plant by its own pollen grains, causes a loss of vigor. If several different ears of the same variety are self-fertilized and this self-fertilization continued for a number of years, each line will gradually become more uniform in type. In the earlier years, the decrease in vigor due to self-fertilization is often very great, but gradually an end point is reached beyond which there is no further loss of vigor due to this cause. An examination of these several self-fertilized lines will show that some have desirable characters, such as straight rows, good-shaped cobs, etc., while others may have irregular rows and cobs with large butts. Self-fertilization, therefore, tends to uniformity of type in each line, but this uniformity is obtained by a sacrifice of vigor, although some isolated lines are more vigorous than others.

Any system of selection of corn, if long continued, tends toward a uniformity of type, and if too close a uniformity is obtained, loss of vigor generally results. The comparatively small yields of the Hopson's Longfellow and the Illinois High and Low Protein types of our experiments may, in part, be attributed to the close selection they have undergone.

Selection, however, has an important place in corn breeding and probably many of our best Connecticut varieties could be further improved in this way. After two varieties have been sufficiently improved by selection, an increased yield can be frequently obtained by a first generation cross between these varieties. This is due to the increased stimulus to development which is often obtained in the first generation of a cross between pure types.

In general, the first generation cross between two varieties is more vigorous than the average of the parents, although a few exceptions to this rule have been noted. Many results have also been reported in which the cross is more vigorous than either parent.

The results of a series of such crosses as we have made are given in detail in this paper as a contribution toward the determination of what crosses, if any, are valuable for Connecticut. These results show that the commercial growing of a particular first generation cross should not be taken up until the cross has proved its value in actual competition with the parental varieties.

VARIETIES USED IN THE EXPERIMENTS.

To determine which varieties should be used in the experiments was not easy and we do not claim that we have included all of the better ones. As far as possible, varieties were selected which had been grown under the same conditions for a number of years and which were believed to be among the better varieties of the State.

The following descriptions give the name of the corn, the selection number under which it appears in our tables, the name of the grower from whom the seed was obtained, and some facts about its previous history.

Yellow Flints.

Longfellow, No. 1. From George A. Hopson, Wallingford, Conn.

This variety has been grown by Mr. Hopson for the last six years and is a uniform type with a small cob averaging about 10 inches in length. Selection by the ear-to-row method was practiced for two years, and in other years the seed was selected at husking time. The original seed was obtained from the Longfellow family of Groveland, Mass., and was introduced to the trade about thirty years ago by Mr. Gregory of Marblehead as one of his specialties, and called "Longfellow corn." In all probability the many strains of Longfellow now grown are descendants of the variety produced by the Longfellow family.

Longfellow, No. 21. From S. D. Woodruff & Sons, Orange, Conn.

This is a large flint variety and the ears have a characteristic appearance, averaging about 10 inches in length. The cobs are over-large at the butt and consequently the ears are somewhat difficult to husk. It has been grown on the same kind of land for about eight years and seed has been saved from the better ears.

Canada Improved Flint, No. 2. From O. S. Olmsted, Hazardville, Conn.

This was produced several years ago by crossing a yellow Canada variety with Nantucket Top Over, and selection has been practiced at harvest. The ears are of medium size, cylindrical, and well filled out at the tip and butt, and average about 8 inches in length.

Improved Canada, No. 3 and No. 20. From N. Howard Brewer, Hockanum, Conn.

This type has been grown on the Brewer farm for many years and for the last eight years selection of seed has been made by picking out those stalks which, under competition, gave the better yields. The ears are of uniform appearance but vary considerably in length, averaging from 8 to 10 inches. The stalks are of good size.

Canada Flint, No. 9. From M. C. Hayes, Granby, Conn.

Canada Flint has been grown on the same farm for over twenty years and seed has been saved at husking time from those stalks which produced two good ears. The ears average about 7 inches in length and are of uniform appearance. Under good conditions nearly every stalk produces two ears and many stalks produce three ears.

Canada Flint, No. 23. From Thomas Griswold & Sons, Wethersfield, Conn.

This variety has been grown at the Griswold farm for four years and the better ears have been selected for planting. They average about 8 inches in length and are of good shape.

Yellow Flint, No. 26. From E. E. Burwell, New Haven, Conn.

This has been grown in New Haven for more than twenty-five years. The cob is small with a good butt, but does not tip out very well. The variety is vigorous and the ears average about 10 inches in length.

Newgate Flint, No. 10. From F. B. Walker, Granby, Conn.

This variety is the result of a cross which was made about eight years ago. The ears are somewhat variable in length and have a small cob.

Davis Flint, No. 8. From Perley Davis, Granby, Mass.

This is a uniform variety with good-sized kernels and ears about 9½ inches in length. Selection by the ear-to-row method of breeding has been practiced by Mr. Davis, resulting in corn of a uniform appearance. There is a slight color to the outer hull which makes the kernels dark yellow.

White Flints.

Rhode Island White Flint, No. 28. Obtained through the kindness of S. C. Damon of the Rhode Island Experiment Station, Kingston, R. I.

Selection by the ear-to-row method has been practiced for several years, which, as Mr. Damon informs us, was of considerable value in improving the yield, but in later years selection has simply kept the variety in a state of improvement. The ears are of uniform appearance, averaging about 8 inches in length and well filled on tip and butt.

Sanford's White Flint. From F. S. Platt and Company, New Haven, Conn.

The ears are tapering, with small tips, and average about 9 inches in length.

Smut Nose White Flint. Obtained through George A. Hopson, Wallingford, Conn.

This variety has been grown in Wallingford for several years. It receives its name from a slight color of the outer hull. The ears are about 9½ inches in length, well filled out at tip and butt, and cylindrical in shape.

Mammoth White Flint. From O. S. Olmsted, Hazardville, Conn.

This is a large, vigorous flint. Some stalks produce two ears, which average over 12 inches in length. The butts are large and the tips do not fill out well. This corn is used by Mr. Olmsted for silage.

Leamings and other Yellow Dents.

Stadtmueller's Leaming, No. 14. From F. H. Stadtmueller, Elmwood, Conn.

This has been grown by Mr. Stadtmueller for about eight years. The ear-to-row method of breeding was used for two years and seed selection at husking has been practiced in other years. The cobs are of medium size, somewhat tapering, and the seeds are not very long. The corn has a vigorous habit and will give good results under various conditions. The ears average about 18 rows and are of medium size.

Leaming, No. 19. From W. O. Burr, Fairfield, Conn.

This has been grown by Mr. Burr for a number of years and seed selection has been made at husking. It matured late in our tests, but it grows to a large size and might prove valuable for silage.

Dibble's Yellow Dent, No. 16. From C. L. Howes, Stamford, Conn.

Selection has been practiced for two years by the ear-to-row method of breeding. The ears are cylindrical, of medium length, and average about 18 rows.

Brewer's Dent, No. 18. From N. Howard Brewer, Hockanum, Conn.

It produces ears of good length, cylindrical shape and straight rows. It is a selection from Reid's Yellow Dent. With us it has proved too late for a husking corn. Mr. Brewer grows it on strong, heavy land, while our tests have been made on light loam.

Early Dent, No. 15. From Wayne Holcomb, East Granby, Conn.

It has been grown on the Holcomb farm for over twenty years. The ears have been selected at husking from two-eared stalks and, as far as possible, dissimilar ears have been selected, presumably to avoid too close inbreeding. Many of the ears have a sharp point on the seed at the place of attachment of the silk. This variety has been grown on light sandy loam and matures early. The average number of rows on the ear is 12 to 14.

Early Dent, No. 24. From Thomas Griswold & Sons, Wethersfield, Conn.

This variety has been grown on the Griswold farm for four years or more and the better ears have been selected for seed. It is an early maturing dent, averaging from 12 to 14 rows to the ear. The ears are somewhat conical.

White Cap Yellow Dent.

Tyler Dent, No. 25. From W. D. Hall, Wallingford, Conn.

This is an early dent of medium size and good vigor. The cap of the seeds is white and there is some variation in the intensity of the yellow color underneath the cap. The ears fill out well at the tip, but the butt of the cob is over-large.

White Dents.

Illinois High Protein, No. 20. Obtained through the courtesy of L. H. Smith, from the Illinois Experiment Station, Urbana, Illinois.

For over ten years the Illinois Station has selected for high protein content, and the variety now averages about 14 per cent. protein.

Illinois Low Protein, No. 21. The same variety as above, selected for low protein by the Illinois Station, averages between 8 and 9 per cent. protein.

COMPARISON OF COMMERCIAL VARIETIES AND FIRST GENERATION CROSSES BETWEEN THEM.

In order to make a number of crosses with the use of a single isolated breeding plot, several varieties as females were crossed with a single male variety. In general the following methods were used in our tests:

Average seed ears of the different varieties were given a number and stored in our seed room. A sufficient amount of seed of the male variety for every other row of the breeding plot was obtained by mixing a small quantity of kernels from each of the ears to be used as the male parent. Two or three selected ears from each female parental variety were given a variety number. If the variety was given No. 3, the different ears were designated as 3—1, 3—2, etc. A small quantity of seed of each female ear was then planted in the breeding plot and all of the female varieties were detasseled before the pollen appeared. The crosses were then numbered 3—1 × 14, 3—2 × 14, etc., No. 14 representing the male parent. At maturity a number of seed ears of each cross were harvested and also a number of ears of the male parent.

Row tests were then made the following year and comparative results obtained by growing the cross, the female parental remnant ear, a mixture of a small quantity of seed of the several male remnant ears, and a mixture of seed from the male ears of the breeding plot. Thus in each test two male rows were grown, one row from a mixture of seed from two-year old ears and one row from a mixture of seed of one-year old ears, which were grown on the same land as the crossed seed, also one row from a mixture of ears of each cross, and one row from the remnants of each female two-year old parental seed ear.

This method was used to determine whether, in general, different ears of the same variety would give like results, and also to show the degree of correlation between the yield of the female remnant ears and their respective crosses.

Nearly perfect stands of corn were obtained by planting from four to six seeds in each hill and later thinning the hills to three stalks. After each variety was harvested and the resulting ears weighed, a basket of each was weighed and stored in the crib to further dry. These baskets were reweighed about January first and the yield reduced according to the shrinkage. As a further correction of the yield, each basket of corn was shelled, and corrections made for variations in shelling capacity.

The Stadtmueller's Leaming Crosses at Mount Carmel in 1912.

The corn plot in 1912 was grown at our experimental farm in Mount Carmel on land which had not been cultivated for a number of years and which grew a hay crop in 1911 which was scarcely worth harvesting. The land was given a light coat of manure in the fall of 1911, plowed, and the following spring an average dressing of fertilizer was applied broadcast. The corn was planted about May 15 in hills 3½ feet each way and fifty hills in length. The summer of 1912 was very dry, the old turf did not decompose, and consequently the corn made a small growth.

Table I gives the results obtained from the crosses in which Stadtmueller's Leaming was used as the male parent. The order of planting is given and also the crib-cured yield of the respective rows.

In this table are seven cases in which a row from a mixture of seeds from the original 1910 Stadtmueller's Leaming ears was grown beside a row produced from a mixture of seeds of the 1911 ears which were grown in the breeding plot.

The two-year old seed yielded more than the one-year old in four tests and less in the other three. The total yield from the seven rows grown from the 1910 seed was 344.1 pounds, while the 1911 seed gave a yield of 325.4 pounds. If we discard rows 29 and 30, in which the large difference in yield is certainly not due to the age of the seed, the yield from the one-year old and two-year old seed is nearly the same. Thus we may conclude that carefully stored two-year old seed does not necessarily give a smaller yield than one-year old seed similarly handled.

TABLE I.—YIELD OF CRIB-CURED CORN ON PLOT IN WHICH STADTMUELLER'S LEAMING WAS THE MALE PARENT. LENGTH OF EACH ROW 162 FEET.

Variety.	Selection No.	Row No.	Yield in Pounds.
Brewer's Dent	18—1	1	30.0
Brewer's Dent × Leaming	18—1×14	2	33.6
Brewer's Dent	18—2	3	37.6
Brewer's Dent × Leaming	18—2×14	4	45.6
Stadtmueller's Leaming, 1911 Seed	14—2	5	38.9
Stadtmueller's Leaming, 1910 Seed	14—3	6	37.7
Burr's Leaming × Stadtmueller's Leaming	19—1×14	7	45.7
Burr's Leaming	19—1	8	50.4
Burr's Leaming × Stadtmueller's Leaming	19—3×14	9	46.4
Burr's Leaming	19—3	10	61.1
Stadtmueller's Leaming, 1910 Seed	14—4	11	47.7
Stadtmueller's Leaming, 1911 Seed	14—5	12	43.1
Dibble's Dent × Stadtmueller's Leaming	16—3×14	13	43.7
Dibble's Dent	16—3	14	52.4
Dibble's Dent × Stadtmueller's Leaming	16—5×14	15	45.6
Dibble's Dent	16—5	16	46.4
Stadtmueller's Leaming, 1911 Seed	14—6	17	50.8
Stadtmueller's Leaming, 1910 Seed	14—7	18	48.5
Holcomb's Early Dent × Stadtmueller's Leaming	15—5×14	19	47.3
Holcomb's Early Dent	15—5	20	49.8
Holcomb's Early Dent × Stadtmueller's Leaming	15—6×14	21	57.8
Holcomb's Early Dent	15—6	22	55.1
Stadtmueller's Leaming, 1910 Seed	14—8	23	52.7
Stadtmueller's Leaming, 1911 Seed	14—9	24	50.4
Ill. High Protein × Stadtmueller's Leaming	20—1×14	25	52.8
Ill. High Protein	20—1	26	42.1
Ill. High Protein × Stadtmueller's Leaming	20—2×14	27	55.6
Ill. High Protein	20—2	28	36.1
Stadtmueller's Leaming, 1911 Seed	14—10	29	44.5
Stadtmueller's Leaming, 1910 Seed	14—11	30	56.8
Ill. Low Protein × Stadtmueller's Leaming	21—2×14	31	51.8
Ill. Low Protein	21—2	32	37.8
Ill. Low Protein × Stadtmueller's Leaming	21—1×14	33	53.2
Ill. Low Protein	21—1	34	45.5
Stadtmueller's Leaming, 1910 Seed	14—12	35	49.6
Stadtmueller's Leaming, 1911 Seed	14—13	36	53.1
Mammoth Flint × Stadtmueller's Leaming	5—1×14	37	59.6
Olmsted's Mammoth Flint	5—1	38	40.4
Mammoth Flint × Stadtmueller's Leaming	5—2×14	39	51.8
Olmsted's Mammoth Flint	5—2	40	48.7
Stadtmueller's Leaming, 1911 Seed	14—14	41	44.6
Stadtmueller's Leaming, 1910 Seed	14—15	42	51.1
Davis' Flint × Stadtmueller's Leaming	8—2×14	43	43.2
Davis' Flint	8—2	44	37.7
Newgate Flint × Stadtmueller's Leaming	10—1×14	45	48.7
Newgate Flint	10—1	46	38.6
Leaming × Watson's White Flint (self pollinated 3 yrs.)	14×No. 5	47	55.8
Stadtmueller's Leaming, 1910 Seed	14—16	48	39.6

Seven tests in the table give an opportunity to compare the yield from the remnants of two ears of each female variety with the respective cross between each female ear and the male parent. In five out of the seven tests the highest yielding cross was produced from the highest yielding female ear, and in two cases opposite results were obtained.

It is also of interest to note that there is a gradual increase of yield from Row 1 to Row 18, presumably due to differences in the land. This is clearly brought out by examination of the respective yields of Stadtmueller's Leaming, Rows 5, 6, 11, 12, 17 and 18.

TABLE II.—COMPARATIVE YIELD OF FIRST GENERATION HYBRIDS AND THEIR PARENTS.

Variety.	Date of Silking.	Date of Maturity.	Height of Plants in Inches.	Yield in Bushels of Shelled Corn per acre.	Comparative Yield in per cent.
Stadtmueller's Leaming	Aug. 15	Sept. 22	88.9	38.9	100.0
Brewer's Dent	" 21	Oct. 5	88.9	38.2	98.2
Cross	" 17	Oct. 3	92.2	40.2	103.3
Stadtmueller's Leaming	" 14	Sept. 17	90.1	42.5	100.0
Burr's Leaming	" 16	Oct. 1	101.1	54.6	133.2
Cross	" 15	Sept. 26	94.3	46.5	108.7
Stadtmueller's Leaming	" 12	" 18	92.3	48.3	100.0
Dibble's Dent	" 14	" 23	97.8	50.2	103.9
Cross	" 15	" 21	95.5	45.4	94.0
Stadtmueller's Leaming	" 11	" 16	93.0	51.4	100.0
Holcomb's Early Dent	" 2	" 9	82.4	53.3	103.7
Cross	" 10	" 11	87.8	53.4	103.9
Stadtmueller's Leaming	" 11	" 17	92.1	50.3	100.0
Ill. High Protein	" 15	Oct. 3	98.6	39.7	78.9
Cross	" 15	Sept. 23	99.4	55.1	109.5
Stadtmueller's Leaming	" 12	" 18	91.5	50.1	100.0
Ill. Low Protein	" 15	Oct. 1	95.4	42.3	84.4
Cross	" 12	Sept. 21	93.5	53.3	106.4
Stadtmueller's Leaming	" 12	" 16	91.3	49.2	100.0
Mammoth White Flint	" 12	" 18	89.3	49.8	101.2
Cross	" 12	" 16	90.5	56.6	115.0
Stadtmueller's Leaming	" 12	" 18	85.1	49.4	100.0
Davis' Flint	July 31	" 5	71.8	40.6	82.1
Cross	" 31	" 7	80.2	46.5	94.1
Stadtmueller's Leaming	Aug. 12	" 18	85.1	49.4	100.0
Newgate Flint	July 31	" 3	72.5	42.1	85.2
Cross	Aug. 8	" 12	78.2	50.6	102.4
Stadtmueller's Leaming	" 12	" 19	85.1	49.4	100.0
S. L. × No. 5, White Flint (inbred 3 yrs.)	" 5	" 5	81.7	55.8	112.9

Table II is a condensed report of the crosses and parents and gives the date of silking, the date of maturity, height of plants, yield in bushels of shelled corn, and comparative yield. As the Stadtmueller's Leaming variety was grown with each cross, this variety has been used as the standard of comparison for the computation of comparative yields.

There is considerable variation in the time of maturity. In all nine tests the crosses are of intermediate habit, three of the crosses maturing later and six earlier than the average of the parents. The average time of maturity of the parents and crosses is, however, nearly the same, if we consider all nine tests together.

In height of plants again, there is an intermediacy of habit, though there are two crosses (Brewer's Dent × Leaming and Illinois High Protein × Leaming) in which the cross surpasses either parent. The average height of the crosses is 90.2 inches and of the parents 89.3 inches.

As shown in the last column of the table there are five crosses which gave a better yield than either parent, one which equalled the better parent, one which gave a larger yield than the average of the parents, one which yielded less than the parental average, and one which yielded less than either parent.

The largest increase over either parent was 13.8 per cent., which was obtained in the Mammoth White Flint × Leaming cross. The only other significant increases in yield, both being over 6 per cent. larger than the better parents, are in the crosses between Stadtmueller's Leaming and the Illinois High and Illinois Low Protein types. The cross between Newgate Flint and Leaming is also a good one, as a slight increase of yield over the better parent was obtained, together with a week's earlier maturity.

The Davis' Flint × Leaming cross, which gave a slight increase in yield over the parental average, matured nearly as early as the Flint parent and twelve days earlier than the Leaming.

The Burr's Leaming × Stadtmueller's Leaming and Dibble's Dent × Leaming crosses both gave a smaller yield than the average of the parents. The Burr's Leaming parent did not mature until October 1, a date much too late to be safe for a husking corn in Connecticut. Dibble's Dent gave a good yield but the cross yielded less than either parent.

Further discussion of results will be made after the presentation of our other data.

TABLE III.—YIELD OF CRIB-CURED CORN IN 1912 ON PLOT IN WHICH HOPSON'S LONGFELLOW WAS USED AS THE MALE PARENT. LENGTH OF EACH ROW 162 FEET.

Variety.	Selection No.	Row.	Yield in Pounds.	Variety.	Selection No.	Row.	Yield in Pounds.
Olmsted's Canada Flint..	2—1	1	23.6	Hayes' Canada Flint....	9—3	26	53.8
Canada Flint×Longfellow	2—1×1	2	30.9	Hopson's Longfellow, 1910 Seed............	1—10	27	35.6
Olmsted's Canada Flint..	2—2	3	29.5	Hopson's Longfellow, 1911 Seed............	1—11	28	37.0
Canada Flint×Longfellow	2—2×1	4	30.9	Holcomb's Early Dent × Longfellow...........	15—1×1	29	52.1
Hopson's Longfellow, 1910 Seed.............	1—2	5	29.8	Early Dent.............	15—1	30	46.1
Hopson's Longfellow, 1911 Seed.............	1—3	6	29.8	Holcomb's Early Dent × Longfellow...........	15—2×1	31	43.1
Newgate Flint × Longfellow.................	10—3×1	7	40.4	Early Dent.............	15—2	32	50.1
Newgate Flint...........	10—3	8	42.1	Hopson's Longfellow, 1911 Seed............	1—12	33	37.4
Newgate Flint × Longfellow.................	10—4×1	9	35.1	Hopson's Longfellow, 1910 Seed............	1—13	34	37.4
Newgate Flint...........	10—4	10	36.4	Olmsted's Mammoth Flint × Longfellow...	5—2×1	35	56.1
Hopson's Longfellow, 1911 Seed.............	1—4	11	32.2	Mammoth Flint.........	5—2	36	58.9
Hopson's Longfellow, 1910 Seed.............	1—5	12	31.7	Olmsted's Mammoth Flint × Longfellow........	5—3×1	37	44.0
Brewer's Flint × Longfellow..................	3—1×1	13	34.8	Mammoth Flint.........	5—3	38	57.6
Brewer's Flint..........	3—1	14	41.7	Dibble's Dent × Longfellow................	16—1×1	39	48.1
Brewer's Flint × Longfellow.................	3—2×1	15	44.5	Dibble's Dent..........	16—1	40	65.1
Brewer's Flint..........	3—2	16	49.1	Stadtmueller's Leaming × Longfellow........	14—1×1	41	53.9
Hopson's Longfellow, 1910 Seed.............	1—6	17	39.8	Stadtmueller's Leaming.	14—1	42	66.7
Hopson's Longfellow, 1911 Seed.............	1—7	18	36.1	Brewer's Dent × Longfellow................	18—5×1	43	48.9
Davis' Flint × Longfellow	8—2×1	19	41.6	Brewer's Dent..........	18—5	44	50.6
Davis' Flint............	8—2	20	38.1	Hopson's Longfellow, 1910 Seed............	1—14	45	27.7
Hopson's Longfellow, 1911 Seed.............	1—8	21	39.3	Hopson's Longfellow, 1911 Seed............	1—15	46	28.7
Hopson's Longfellow, 1910 Seed.............	1—9	22	35.6	Hopson's Longfellow × Stadtmueller's Leaming	1—1×14	47	61.0
Hayes' Short Canada Flint × Longfellow.........	9—1×1	23	44.8	Hopson's Longfellow...	1—1	48	28.5
Hayes' Canada Flint.....	9—1	24	41.3				
Canada Flint × Longfellow.................	9—3×1	25	53.3				

The Hopson's Longfellow Crosses at Mount Carmel in 1912.

The tests reported in Tables III and IV, in which Hopson's Longfellow was used as the male parent and standard of comparison, were made under the same conditions as the previous crosses of Tables I and II.

Table III gives the row yields and the order of planting. There are seven cases in which row yields from 1910 seed are compared with 1911 seed. In two cases the results are the same, in one case the two-year old seed gave a slightly greater yield, and in four cases the one-year old seed gave the greater yield. The total yield from the two-year old Longfellow seed for the seven rows was 237.6 pounds, and from the one-year old seed 240.5 pounds. The difference, 2.9 pounds in seven rows, is much too small to have any significance.

Of the six tests, in which the remnant of two ears each of the female parents are compared with their respective crosses, there are four cases in which the better yielding female ear gave the better yielding cross. There seems to be a distinct positive correlation between the yields of the Newgate Flint, Brewer's Flint, and Hayes' Flint parental ears and their respective crosses, and an equally large negative correlation in the case of Holcomb's Dent parental ears and crosses.

In considering the date of maturity (Table IV) we find that some crosses are earlier and some later than the parental average. Time of maturity is an inherited character, but somewhat dependent on environmental conditions. The average date of maturity of the parents and crosses for the ten tests is nearly the same.

Height of plants was generally intermediate in these crosses. Two of them slightly exceeded the taller of the parents, while seven were slightly taller and one was slightly shorter than the parental average. The average height of the parents was 76.7 inches and of the crosses 80.4 inches.

The comparative yield given in the last column of the table shows that the Longfellow gave a smaller yield than any of the other varieties, with the exception of Olmsted's Canada Improved. The yield of the Davis' Flint parent was, however, only slightly greater than the Longfellow. The other varieties show from 29 to 98 per cent. greater yield than the Longfellow.

It is, of course, not reasonable to expect an early variety to give as large a yield as a later one and, other conditions being equal, there is a distinct correlation between yield and time of maturity. As four of the female parental types are much later in maturity than the Longfellow parent and as the cross is in general intermediate in time of maturity, it is hardly reasonable,

TABLE IV.—COMPARATIVE YIELD OF FIRST GENERATION HYBRIDS AND THEIR PARENTS.

Variety	Date of Silking.	Date of Maturity.	Average Height of Plants in Inches.	Yield of Bushels Shelled Corn per acre.	Comparative Yield in per cent.
Hopson's Longfellow.....	July 29	Sept. 3	65.0	30.3	100.0
Olmsted's Canada........	" 26	Aug. 27	59.9	29.9	98.7
Cross....................	" 28	" 29	63.8	31.4	103.6
Hopson's Longfellow.....	" 30	Sept. 3	66.7	29.2	100.0
Newgate Flint	" 29	Aug. 29	73.9	39.9	136.6
Cross....................	" 29	" 30	72.7	38.4	131.5
Hopson's Longfellow.....	" 30	Sept. 1	70.4	35.5	100.0
Brewer's Flint........ ...	Aug. 1	" 8	81.4	46.1	129.9
Cross....................	" 2	" 6	77.1	40.3	113.5
Hopson's Longfellow.....	July 31	" 3	72.2	38.2	100.0
Davis' Flint..............	" 29	Aug. 28	77.3	38.6	101.0
Cross....................	Aug. 2	Sept. 6	74.1	42.3	110.7
Hopson's Longfellow.....	July 31	" 1	72.6	37.4	100.0
Hayes' Flint	" 29	" 1	74.1	48.3	129.1
Cross....................	" 30	Aug. 29	75.4	49.8	133.1
Hopson's Longfellow.....	" 31	" 30	72.4	37.4	100.0
Holcomb's Dent..........	Aug. 2	Sept. 2	85.5	48.4	129.4
Cross....................	" 2	" 3	86.2	48.3	129.1
Hopson's Longfellow.....	July 30	Aug. 30	71.3	37.4	100.0
Mammoth White Flint....	Aug. 7	Sept. 15	93.6	55.6	148.6
Cross....................	" 2	" 12	86.2	49.4	132.1
Hopson's Longfellow.....	July 30	Aug. 30	71.3	32.8	100.0
Dibble's Dent............	Aug. 5	Sept. 14	98.8	64.8	197.5
Cross....................	" 8	" 12	88.2	49.0	150.6
Hopson's Longfellow.....	July 30	Aug. 30	71.3	32.8	100.0
Stadt. Leaming...........	Aug. 8	Sept. 14	99.0	65.1	198.4
Cross....................	July 31	Aug. 31	92.4	54 5	166.1
Reciprocal Cross.........	Aug. 2	Sept. 9	....	71.6	218.2
Hopson's Longfellow.....	July 30	Aug. 30	65.6	32.8	100.0
Brewer's Dent...........	Aug. 12	Sept. 23	93.5	49.2	150.0
Cross....................	" 5	" 12	87.5	50.0	152.4

even with an extra stimulus to development, to expect the cross to give as large a yield as the later parent.

Of the ten tests, four gave a slightly larger yield than the better parent, five an increase over the parental average, and one a slight decrease from the parental average.

The beneficial crosses were Olmsted's Flint × Longfellow, which gave 3.6 per cent. increase over the better parent, the Davis' Flint × Longfellow with a 9.7 per cent. increase, the Hayes' Flint × Longfellow with a 4 per cent. increase, and the Brewer's Dent × Longfellow with a 2.4 per cent. increase over the Dent parent and a gain of eleven days in time of maturity.

The Dibble's Dent × Longfellow was the only cross which gave a decrease over the average of the parents. It is a peculiar coincidence that Dibble's Dent also gave negative results when crossed with Stadtmueller's Leaming.

Tests at Bloomfield in 1913.

Several of the crosses and parents which were grown at Mount Carmel in 1912 and 1913 were planted at the Windsor Tobacco Growers' Corporation, in Bloomfield, Conn., on land which was used for tobacco the previous season. Our thanks are due to the Corporation for the use of about an acre of land for the tests.

Many sections of Connecticut suffered severely in 1913 for lack of rainfall, and in no section of the State was this condition more apparent than in Bloomfield. During the early part of the season the rainfall was normal, but from the time of the appearance of tassels on the early varieties until late in the fall, the crop suffered severely.

The results obtained are presented in Table V. Sixty hills from each plot were harvested, husked, and the corn stored in baskets until the last of December, when it was weighed and the yield determined. As the earlier varieties had a more favorable growth period than the later ones, the comparative yields are of little value.

One of the most interesting features of the test was apparent to all who saw the corn in the field, i. e., the fact that the Dents did not suffer so severely for lack of moisture as the Flints. Stadtmueller's Leaming and Mammoth White Flint have about the same height and mature at about the same time under fairly favorable conditions (see 1912 tests), yet in extreme dry weather the Leaming grew much taller than the Mammoth Flint and gave nearly twice as large a yield.

The average yield of the Longfellow, Brewer's and Newgate Flint varieties was 25.6 bushels of shelled corn per acre. The average yield of the Holcomb's Early Dent, Griswold's Early Dent and Tyler Dent, which mature about the same time as the above flints, was 33 bushels. Observation showed that the early dents withstood the dry weather much better than the early flints.

Of the Stadtmueller's Leaming crosses, Newgate Flint × Leaming and Early Dent × Leaming proved better than their

TABLE V.—COMPARATIVE YIELD OF FIRST GENERATION CROSSES AND THEIR PARENTS. BLOOMFIELD, 1913.

Variety.	Bushels Shelled Corn per acre.
Stadtmueller's Leaming (male parent)	24.2
Brewer's Dent	15.1
Brewer's Dent × Stadtmueller's Leaming	22.4
Low Protein	15.0
Low Protein × Stadtmueller's Leaming	21.5
High Protein	14.4
High Protein × Stadtmueller's Leaming	23.6
Holcomb's Early Dent	24.0
Early Dent × Stadtmueller's Leaming	27.0
Newgate Flint	24.4
Newgate Flint × Stadtmueller's Leaming	28.4
Mammoth White Flint	12.7
Mammoth White Flint × Stadtmueller's Leaming	21.6
Hopson's Longfellow (male parent)	24.5
Brewer's Dent	15.1
Hopson's Longfellow × Brewer's Dent	19.5
Mammoth White Flint	14.7
Mammoth White Flint × Longfellow	25.7
Brewer's Flint (male parent)	26.0
R. I. White Flint × Brewer's Flint	27.9
Hall's Tyler Dent	33.7
Hall's Tyler Dent × Brewer's Flint	35.7
*Griswold's Early Dent	41.3
Griswold's Early Dent × Brewer's Flint	37.1

*End plot grew beside a flint variety which was planted about 2 weeks after the dent.

parents. The Newgate Flint × Leaming cross also proved to be a good one in the 1912 test.

The Brewer's Dent × Leaming, High Protein × Leaming and Low Protein × Leaming crosses, which gave an increase over the better parent in 1912, gave an increase over the average of the parents in this test but slightly less than the Leaming parent. This may be explained by the fact that the Leaming matured earlier than either the crosses or female parents and consequently suffered less from the drought.

Brewer's Dent × Longfellow gave about the same yield as the parental average. Mammoth White Flint × Longfellow gave an increase over the better parent.

The Rhode Island White Flint × Brewer's Flint and Hall's Tyler Dent × Brewer's Flint crosses yielded more than their parents, and the Griswold's Early Dent × Brewer's Flint cross more than the parental average. The comparatively large yield of Griswold's Early Dent variety may partly be explained by the fact that it was the end plot of our test and was planted ten days earlier than the commercial field at its side.

The average yield of bushels of crib-cured shelled corn of the three male parents was 24.9, of the female parents 21.0, and of the crosses 26.4, or an increase of 14.9 per cent. in favor of the crosses over the average of the parents.

Tests at Mount Carmel in 1913.

The same plot on which corn was grown in 1912 was used for the tests in 1913.

Previous tests indicated that highly selected varieties which matured at about the same date and gave about the same yield, if differing in other characters, would prove the better parents for a first generation cross. Accordingly, as far as possible, such selected varieties were used in this test.

The season was fairly favorable at Mount Carmel, as we were fortunate in having showers to tide over the dry weather period. A moderate dressing of manure and fertilizers was used on the corn plot.

Table VI gives the order of planting and row yields of the parents and crosses. The Brewer's Flint parent was grown for comparison with each cross. In each test three female remnant ears and their crosses were compared with one-year old and two-year old Brewer's Flint seed. As a further attempt to obtain accurate results, the crosses and parents were separated by discard rows which were not used in the computations.

Of the six tests of one and two-year old Brewer's Flint seed, there were three rows in which the 1911 seed gave a slightly greater yield and three cases in which the 1912 seed proved superior. The total yield of the six rows from the two-year old

TABLE VI.—YIELD OF CRIB-CURED CORN IN 1913 ON PLOTS 1 AND 2 IN WHICH BREWER'S FLINT WAS USED AS THE MALE PARENT. LENGTH OF EACH ROW 162 FEET.

Variety.	Selection No.	Row No.	Yield in Pounds.	Variety.	Selection No.	Row No.	Yield in Pounds.
Brewer's Flint.	20 discard	1	43.7	Burwell's Flint × Brewer's Flint.	26—3×20	34	67.0
" " 1911 Seed	20—1	2	48.6	Burwell's Flint × Brewer's Flint.	26×20 discard	35	66.2
" " 1912 Seed	20—2	3	52.2	Griswold's Dent.	24 discard	36	64.1
Woodruff's Longfellow.	21 discard	4	40.6	" "	24—1	37	60.9
" "	21—1	5	48.1	" "	24—2	38	35.6
" "	21—2	6	53.6	" "	24—3	39	58.3
" "	21—3	7	42.3	" "	24 discard	40	52.7
" "	21 discard	8	49.6	Griswold's Dent × Brewer's Flint.	24×20 discard	41	57.9
Woodruff's Longfellow × Brewer's Flint.	21×20 discard	9	62.0	Griswold's Dent × Brewer's Flint.	24—1×20	42	66.3
Woodruff's Longfellow × Brewer's Flint.	21—1×20	10	61.1	Griswold's Dent × Brewer's Flint.	24—2×20	43	66.2
Woodruff's Longfellow × Brewer's Flint.	21—2×20	11	59.9	Griswold's Dent × Brewer's Flint.	24—3×20	44	64.6
Woodruff's Longfellow × Brewer's Flint.	21—3×20	12	57.5	Griswold's Dent × Brewer's Flint.	24×20 discard	45	69.8
Woodruff's Longfellow × Brewer's Flint.	21×20 discard	13	61.6	Brewer's Flint, 1911 Seed.	20—5	46	57.5
R. I. White Flint.	28 discard	14	53.2	Brewer's Flint, 1912 Seed.	20—6	47	55.7
" " "	28—1	15	64.0	Brewer's Flint.	20 discard	48	54.9
" " "	28—2	16	60.4	" "	20 discard	1	43.7
" " "	28—3	17	55.3	Brewer's Flint, 1912 Seed.	20—7	2	59.3
R. I. White Flint × Brewers.	28×20 discard	18	67.5	Brewer's Flint, 1911 Seed.	20—8	3	58.1
R. I. White Flint × Brewers.	28—1×20	19	65.8	Sanford's White Flint.	22 discard	4	54.7
R. I. White Flint × Brewers.	28—2×20	20	62.1	" " "	22—1	5	66.0
R. I. White Flint × Brewers.	28—3×20	21	64.4	" " "	22—2	6	57.4
R. I. White Flint × Brewers.	28×20 discard	22	62.0	" " "	22—3	7	51.9
Brewer's Flint.	20 discard	23	64.0	" " "	22 discard	8	55.7
" " 1912 Seed	20—3	24	62.0	Sanford's White × Brewer's Flint.	22×20 discard	9	56.5
" " 1911 Seed	20—4	25	58.8	Sanford's White × Brewer's Flint.	22—1×20	10	56.0
Burwell's Flint.	26 discard	26	59.2	Sanford's White × Brewer's Flint.	22—2×20	11	59.6
" "	26—1	27	68.2	Sanford's White × Brewer's Flint.	22—3×20	12	57.3
" "	26—2	28	63.8	Sanford's White × Brewer's Flint.	22×20 discard	13	57.8
" "	26—3	29	64.7	Griswold's Canada.	23 discard	14	55.1
" "	26 discard	30	62.6	" "	23—1	15	60.6
Burwell's Flint × Brewer's Flint.	26×20 discard	31	65.4				
Burwell's Flint × Brewer's Flint.	26—1×20	32	66.7				
Burwell's Flint × Brewer's Flint.	26—2×20	33	64.6				

TABLE VI.—YIELD OF CRIB-CURED CORN IN 1913 ON PLOTS 1 AND 2 IN WHICH BREWER'S FLINT WAS USED AS THE MALE PARENT. LENGTH OF EACH ROW 162 FEET—*Continued.*

Variety.	Selection No.	Row No.	Yield in Pounds.	Variety.	Selection No.	Row No.	Yield in Pounds.
Griswold's Canada.....	23—2	16	56.8	Smut Nose White × Brewer's Flint......	30—3×20	34	59.3
" "	23—3	17	56.6	Smut Nose White × Brewer's Flint......	30×20 discard	35	65.4
" "	23 discard	18	61.9	Hall's Tyler Dent	25 discard	36	45.5
Griswold's Canada × Brewer's Flint.......	23×20 discard	19	57.9	" " "	25—1	37	52.0
Griswold's Canada × Brewer's Flint.......	23—1×20	20	57.9	" " "	25—2	38	68.1
Griswold's Canada × Brewer's Flint.......	23—2×20	21	60.3	" " "	25—3	39	69.0
Griswold's Canada × Brewer's Flint.......	23—3×20	22	57.7	" " "	25 discard	40	45.9
Griswold's Canada × Brewer's Flint.......	23×20 discard	23	63.6	Tyler Dent × Brewer's Flint...............	25×20 discard	41	65.4
Brewer's Flint, 1911 Seed	20—9	24	62.0	Tyler Dent × Brewer's Flint.......	25—1×20	42	68.0
" " 1912 Seed	20—10	25	60.2	Tyler Dent × Brewer's Flint..............	25—2×20	43	69.5
Smut Nose White Flint	30 discard	26	54.0	Tyler Dent × Brewer's Flint..............	25—3×20	44	65.8
" " " "	30—1	27	50.8	Tyler Dent × Brewer's Flint..............	25×20 discard	45	55.2
" " " "	30—2	28	63.6	Brewer's Flint, 1912 Seed..............	20—11	46	54.3
" " " "	30—3	29	69.7	Brewer's Flint, 1911 Seed..............	20—12	47	59.8
" " " "	30 discard	30	44.1	Brewer's Flint........	20 discard	48	49.1
Smut Nose White × Brewer's Flint.......	30×20 discard	31	76.1				
Smut Nose White × Brewer's Flint.......	30—1×20	32	63.5				
Smut Nose White × Brewer's Flint.......	30—2×20	33	60.7				

seed was 344.8 pounds and from the one-year old seed 343.7 pounds.

There seems to be no very close correlation in these tests between the slight variations in yield of the female remnant ears and their respective crosses. In three of the five cases in which the cross proved better than either parent, the yield of each female ear remnant was less than its respective cross. In the two opposite cases one of the three female remnant ears slightly exceeded its cross. All who have had experience in plot test work know that many variations occur which cannot be explained entirely by the reproductive capacity of the seed.

Of the three ears of Rhode Island White Flint, obtained through the kindness of Mr. S. C. Damon of the Rhode Island

Experiment Station, 28—1 and 28—2 were from detasseled stalks which had been pollinated by another selected strain of the same variety, while 28—3 was from a crop rotation plot. It is of interest to note that the yields from 28—1 and 28—2 exceeded

TABLE VII.—COMPARATIVE YIELD OF FIRST GENERATION HYBRIDS AND THEIR PARENTS. MT. CARMEL, 1913.

Variety.	Date of Silking.	Date of Maturity.	Yield of Bush. Shelled Corn per acre.	Comparative Yield in per cent.
Brewer's Flint	July 26	Aug. 27	53.7	100.0
Woodruff's Longfellow	" 29	Sept. 5	50.0	93.1
Cross	" 30	Aug. 30	62.4	116.2
Brewer's Flint	" 28	" 27	63.9	100.0
R. I. White Flint	" 22	" 22	65.3	102.2
Cross	" 25	" 27	69.9	109.4
Brewer's Flint	" 28	" "	63.9	100.0
Burwell's Flint	" 26	" "	70.8	110.8
Cross	" "	" "	71.5	111.9
Brewer's Flint	" 28	" 31	59.2	100.0
Griswold's Early Dent	" "	" 26	54.2	91.5
Cross	" 27	" 28	69.3	117.0
Brewer's Flint	" 28	" 27	61.2	100.0
Sanford's White Flint	" 31	Sept. 6	60.4	98.7
Cross	" 29	Aug. 30	60.7	99.2
Brewer's Flint	" 28	" 27	65.5	100.0
Griswold's Canada Flint	" 26	" "	62.3	95.1
Cross	" 25	" "	62.3	95.1
Brewer's Flint	" 28	" "	65.5	100.0
Smut Nose White Flint	" 27	" "	67.4	102.9
Cross	" "	" "	65.6	100.2
Brewer's Flint	" 26	" 28	60.5	100.0
Hall's Tyler Dent	" 27	" 27	67.4	111.4
Cross	" "	" "	73.0	120.6

that obtained from 28—3, while the crosses gave nearly equal results.

Table VII is a condensed report of the crosses and parents. Little can be said of the time of maturity, as all matured at about the same date. Sanford's White Flint and Woodruff's Longfellow were, however, about a week later than the other varieties and crosses, and Rhode Island White Flint matured about a week earlier.

Of the eight crosses, five gave a larger yield than the better parent, one an intermediate yield, and two the same yield as the poorer parent; 4.9 per cent. was, however, the largest decrease from the better parent, while increases of from 7 to 17 per cent. were obtained in favor of the crosses over the better parent. The highest yield was 73 bushels per acre, which was obtained in the cross between Hall's Tyler Dent and Brewer's Flint, an increase of 9 per cent. over the Dent parent and 20.6 per cent. over the Flint parent.

Sweet Corn Varieties and Crosses in 1913.

In 1912 Stowell's Evergreen Sweet corn was crossed with Golden Bantam and Country Gentleman. The tests reported in Table VIII, for 1913, are a comparison of the yields of the original parent ears of 1911 with the crosses made in 1912.

Two tests were made of each cross, one at the Station grounds in New Haven and the other at the experimental farm in Mount Carmel. The conditions at Mount Carmel were fairly good, while the crops in New Haven suffered severely for lack of rain.

Each test in New Haven consisted of a plot containing forty-two hills, and at Mount Carmel the size of each plot was twenty-four hills. The data for the New Haven plot were taken by Mr. Veitch.

The Golden Bantam × Stowell's Evergreen cross was intermediate in time of maturity although somewhat earlier than the average of the parents.

At the Station test the length of ears of the cross slightly surpassed either parent, while at Mount Carmel the length of ears of the cross was nearly equal to the Evergreen parent and considerably greater than the Golden Bantam parent.

Tested at the Station, the cross outyielded either parent in number of ears, while at Mount Carmel the cross nearly equalled the Golden Bantam in number of ears produced and gave a large increase over the Evergreen parent.

The number of rows per ear was also of intermediate habit and was the only character studied which did not surpass the parental average.

The Golden Bantam has a very fine flavor as a table variety. In cooking tests the Golden Bantam parent was generally considered to have a better quality than the other varieties or crosses.

The Golden Bantam × Stowell's Evergreen cross had a better quality than the Evergreen parent but was not equal to the Bantam parent.

The general faults of the Golden Bantam are small ears and yellow seeds. For this reason it is seldom seen in the market. The size of the ears of the cross between Golden Bantam and Evergreen was good and the cross had good vigor. The ears

TABLE VIII.—SWEET CORN VARIETIES AND CROSSES IN 1913.*

Variety.	Place of Test.	Average Date of Maturity.	Average length of Ear in inches.	Average rows of Ear.	Number of Ears.
Golden Bantam.............	Mt. Carmel	Aug. 16	6.0	8.1	109
Golden Bantam × Stowells..	"	" 23	7.4	10.7	103
Stowells × Golden Bantam..	"	" 22	7.6	10.5	107
Stowells' Evergreen.........	"	" 31	7.8	13.6	86
Golden Bantam.............	Station Grounds	Aug. 6	7.3	....	80
Golden Bantam × Stowells..	"	" 15	7.5	....	96
Stowells' Evergreen.........	"	" 27	7.0	....	57
Country Gentleman	Mt. Carmel	....	7.2	....	105
Country Gent. × Stowells ...	"	....	7.6	....	103
Stowells' Evergreen.........	"	....	7.8	....	86
Country Gentleman	Station Grounds	Aug. 25	7.0	....	78
Country Gent. × Stowells...	"	" "	7.2	....	87
Stowells' Evergreen.........	"	" 27	7.0	....	57

* In the crosses the female parent appears first.

bore a mixture of yellow and white kernels. This cross might prove valuable as a market variety if the general consumer were acquainted with its good qualities.

The Country Gentleman × Stowell's Evergreen cross gave good results in the Station test and, if we consider the average length of ear and ear number under one heading, an increased yield of about 16 per cent. was obtained in favor of the cross over either parent. At Mount Carmel the cross was of intermediate habit in ear length and number of ears but, in both characters, nearly equalled the better parent. Considering both ear length and number of ears together, we find that the cross surpassed either parent in yield by about 4 per cent.

The Country Gentleman is a crooked-rowed variety and the Stowell's Evergreen has straight rows. The cross produced ears which had straight rows like the Evergreen parent, but the kernels of the cross were somewhat smaller than those of the Evergreen variety.

GENERAL CONSIDERATION OF THE VARIETIES AND THEIR CROSSES.

In some characters, as we have already explained, the cross resembles one parent, in other characters the other, while by far the larger number of characters are of intermediate habit.

Characters which Show Dominance.

Cob Color. If we cross a variety which is pure for the character red cobs with a white-cobbed variety, the First Generation Cross will have red cobs. Thus the cross between Tyler Dent, which breeds true for red cobs, and Brewer's Flint, a white-cobbed variety, produced all red cobs.

Colored Pericarp. Similarly a cross between a pure variety which has a colored pericarp (outer hull) and a colorless pericarp variety will have a colored pericarp in the First Generation. Such a cross was Davis' Flint × Longfellow, in which the Davis' Flint parent had a slight color in the outer hull.

Straight Rows. In the cross between Country Gentleman (irregular rows) and Stowell's Evergreen (straight rows) there was a dominance of the straight-rowed character.

Tillering. One difference between Flint and Dent races is that almost, if not all, flint varieties have the habit of producing numerous basal tillers, while dents produce few tillers. A cross between a dent and flint resembles the dent parent in tillering habit, although the cross produces a few more tillers than the pure dent.

Protein Content. The inheritance of protein in the first generation cross is of especial interest. By several years of selection, the Illinois Experiment Station was able to produce strains which contained higher and lower protein content than the average of corn races. Thus Illinois High Protein gives an average of about 14 per cent. protein (dry basis) and Illinois Low Protein an average of about 9 per cent., while ordinary field varieties average from 11 to 12 per cent.

As a result of the close selection which the High and Low Protein races have undergone, the yields have been somewhat decreased. Through the kindness of the Illinois Experiment Station we obtained a few ears of their High and Low Protein races for the purpose of determining their value as parents in producing first generation crosses and also to determine the inheritance of protein in the cross. Mr. C. D. Hubbell and Mr. G. L. Davis analyzed the ears reported in Table IX, under the direction of Mr. J. P. Street, Station chemist.

TABLE IX.—INHERITANCE OF PROTEIN IN THE FIRST GENERATION CROSSES BETWEEN ILL. LOW AND ILL. HIGH PROTEIN AND STADTMUELLER'S LEAMING.

Variety.	No Ears Analyzed.	Variation in Ears in Protein Content.	Average Protein Content, Dry Basis.
Illinois High Protein......	19	11.95—17.10	14.87
Stadt. Leaming 1910 seed..	13	7.75—16.28	11.85
Cross	12	9.25—14.68	11.85
Illinois Low Protein	16	6.81—11.56	9.41
Stadt. Leaming 1911 seed..	14	8.21—15.94	12.19
Cross	9	7.69—11.86	9.18

In order to offset the effect of off-pollination (if any), a number of ears of each parent and of the crosses were artificially hand-pollinated. This was accomplished by covering both tassel and ear with a Manila paper bag and then dusting the pollen from the tassel over the silk, the bag remaining on the ear until maturity.

There seems to be a complete dominance of Low Protein over High Protein. Thus in the cross between High Protein and Leaming, the High Protein gave an average of 14.87 per cent. protein (dry basis), the Leaming an average of 11.85 per cent. protein, and the cross 11.85 per cent. protein. The cross Low Protein × Leaming gave an average of 9.18 per cent. protein, the Leaming parent 12.19 per cent. protein, and the Low Protein parent 9.41 per cent. protein. If Low Protein were a desirable character such a cross as the above would be a favorable one, as an increase of yield over the Leaming parent was obtained (see Table II) together with a low protein content.

These results indicate the proper procedure for the production of High Protein corn. Two High Protein races should be isolated, and if possible from varieties which are somewhat dissimilar in character but which mature at about the same season. A first generation cross between such varieties would have high protein content together with high yielding capacity.

Variable Characters in the Cross.

Endosperm Color. The immediate resulting color of a cross between yellow and white varieties of corn, no matter which is the female parent, is yellow. If this seed is used the next year, the generation in which the stimulus to development may be expected, ears will be obtained which contain both yellow and white seeds. Such results were obtained in the Rhode Island White Flint × Brewer's Flint cross.

In general, the difference between dent and flint corn is due to the position in which the soft starch is formed. In dent corn the soft starch is produced at the top of the seed and, on drying, an indentation is made. In flint corn, on the contrary, the soft starch is surrounded by the hard or corneous starch. In the greater number of cases a cross between dent and flint races will be no more variable than the parents and of intermediate character. Floury races contain only a small amount of hard starch and the first generation of a cross between flour and flint corn produces ears which contain both floury and flinty seeds.

If the dent and flint parents of a cross differ very greatly in the average amount of soft starch produced in the seed, the cross may appear somewhat more variable than the parents.

Intermediacy of Characters.

By far the greater number of characters are of an intermediate habit in the cross.

Number of Rows. A number of examples of the row number of parents and crosses are given in Table X. There is a greater apparent variability in races which produce many rows than in eight-rowed races. The first generation of a cross is, however, no more variable than the average of the parents. In our tests the average number of rows per ear of the cross has been slightly less than the average of the parents. Thus the average number of rows of the seven crosses of Table X is 10.9 and of the parents 11.8. Number of rows per ear is the only character which we have studied in which the crosses average less than the parents.

TABLE X.—INHERITANCE OF ROW NUMBER IN THE FIRST GENERATION CROSSES.

Variety.	No. of rows per Ear.										Average. Rows.
	6	8	10	12	14	16	18	20	22	24	
Brewer's Flint...........	10	304	8								7.9
Griswold's Dent.........			11	55	49	15	2				13.1
Cross		34	60	58	2						10.5
Brewer's Flint...........	10	304	8								7.9
Hall's Tyler Dent........			6	57	54	21					13.3
Cross		21	61	51	8						10.6
Hopson's Longfellow	20	100									7.6
Holcomb's Early Dent ...			15	103	84	28	9				13.2
Cross		64	115	64							10.0
Hopson's Longfellow	20	100									7.6
Brewer's Dent...........				3	10	29	33	23	5	2	17.6
Cross		1	25	71	19	1					11.8
Stadtmueller's Leaming ..				1	7	35	57	22	9	3	17.9
Davis' Flint		50	8								8.2
Cross		6	43	24	5						10.7
Stadtmueller's Leaming ..				1	7	35	57	22	9	3	17.9
Olmsted's Mammoth Flint		26	4	1							8.4
Cross		1	7	23	4						11.7
Stadtmueller's Leaming ..				1	7	35	57	22	9	3	17.9
Walker's Newgate Flint..	45	83									7.2
Cross		10	41	41	2						10.7

Shelling Yield. Shelling yield, that is, the amount of shelled corn produced by each pound of corn on the ear, is of intermediate habit in the crosses, although some variations were observed. The shelling capacity of the crib-cured corn of our Mount Carmel 1912 and 1913 tests varied from 0.79 in Illinois High Protein to over 0.86 in several flints and Holcomb's Early Dent. The average shelling capacity for the crosses was 0.8364, for the male parents 0.8363, and for the female parents 0.8277.

For explanation of "shelling capacity" see page 382.

Date of Maturity. This is, in general, an intermediate character, although in some cases the cross matured earlier and in other cases later than the parental average. Thus our crosses generally gave a greater shrinkage in drying than the earlier parent and less shrinkage than the later maturing parent.

Height of Plant. This was intermediate in the crosses, although their average height slightly exceeded the average of the parents. In a few crosses in which the parents were of about the same height, the average height of the cross slightly exceeded the average height of either parent.

A study of the above results indicates the appearance of each character when the parents differ in several important characters. Thus if one wishes to grow yellow flint corn and yet get the vigor due to crossing he must use yellow flint parents. A medium early variety can be obtained in a cross by using medium early parents or by a cross between a very early and a later variety. In a similar manner we must consider how each character is inherited and then choose parental varieties which will give the desired appearance in the cross.

The important feature of our tests is not, however, the appearance of any special character but the question of whether first generation crosses are of sufficiently greater vigor than their parents to pay for producing first generation hybrid seed.

By actual test, twenty-one first generation crosses have given larger yields than either parent, eleven a larger yield than the average of the parents, and seven a smaller yield than the parental average. The largest decrease in yield from the average of the parents was 7.9 per cent., which was obtained in the cross between Burr's Leaming and Stadtmueller's Leaming. The greatest increase over the better parent (17 per cent.) was obtained at Mount Carmel in 1913 for the Griswold's Early Dent × Brewer's Flint cross.

The Stadtmueller's Leaming crosses, at Mount Carmel in 1912, gave an increase over the parental average of 6.4 per cent., the Hopson's Longfellow crosses an increase over the parents of 13.2 per cent., the Bloomfield crosses an increase over the parents of 14.9 per cent., and the crosses at Mount Carmel (1913) an increase of 8.3 per cent. over the average of the parents. These results seem sufficiently convincing and show that the commercial production of first generation hybrid corn seed would aid in materially increasing our yields of corn.

All tests so far reported clearly prove that a cross between a highly selected variety and a poor yielding one cannot be expected to exceed the better parent and that highly selected varieties will prove the better as parents. The only way of determining what varieties to use for producing first generation seed is to compare the yields of both parents and cross under similar conditions.

ADVANTAGEOUS CROSSES.

The Mammoth White Flint × Stadtmueller's Leaming cross matured at about the same time as the parents and gave 13.8 per cent. more shelled corn than either parent. Under average conditions of fertility and rainfall this cross is a good one.

The cross between Illinois High Protein and Leaming matured a few days later than the Leaming parent and gave 9.5 per cent. more shelled corn than either.

The Newgate Flint × Leaming cross matured a week earlier than the Leaming parent and gave 17 per cent. more corn than the flint parent and 2.4 per cent. more corn than the Leaming. This cross gave good results under the dry weather conditions at Bloomfield.

The cross between Hopson's Longfellow and Brewer's Dent deserves mention as it gave a slightly larger yield than the Dent, with the benefit of eleven days' earlier maturity.

If one desires to grow a large yellow flint, the cross between Woodruff's Longfellow and Brewer's Flint should prove a good one, as an increase of 16.2 per cent. over the better parent was obtained.

The cross between Rhode Island White Flint and Brewer's Flint grew to medium height and gave an increase of 7.2 per cent. over the better parent.

At our Mount Carmel test, Griswold's Early Dent × Brewer's Flint gave 17 per cent. more corn than either parent.

The highest yield, 73 bushels of crib-dried shelled corn, which was obtained at Mount Carmel in 1913, was from the cross between Hall's Tyler Dent and Brewer's Flint. This cross grew to a slightly greater height than the dent parent, giving an increase of 9.2 per cent. in yield over the dent and 20.6 per cent. more corn than the flint parent.

COMPARISON OF VARIETIES.

In many of the western states, where corn is the main crop, there are a few highly selected varieties which have proved their value. Under these conditions it is possible to recommend a definite variety.

Connecticut has a large number of varieties which often have local names and which differ from each other in only a few minor points. For this reason it is almost impossible to name any one variety which will prove the best for a given section. It would, without doubt, be of benefit to Connecticut agriculture if there were fewer varieties and if these were more systematically improved by seed selection. A brief résumé of the varieties which we have grown will be given and an attempt made to classify them according to time of maturity and yield.

The comparative time of maturity would probably not vary greatly under different environmental conditions, while the yielding capacity would show wide variations under such conditions. Our results are a statement of the comparative time of maturity and yield, under the conditions of our Mount Carmel tests.

The results presented in Table XI show the variations in shelling capacity and shrinkage of corn varieties. These were determined by storing a basket of each variety and reweighing and shelling it about January first. The shelling capacity is the amount of shelled corn produced by each pound of ear corn. As the legal weight in Connecticut of a bushel of corn on the ear is 70 pounds and of a bushel of shelled corn is 56 pounds, the standard shelling capacity is 0.8.

The varieties which we have grown varied from 0.79 shelling capacity in Illinois High Protein to a shelling capacity in Newgate Flint of 0.869. In comparing the yield of two varieties it is of considerable importance to determine their shelling capacity.

Variations in shrinkage are also of interest in this connection. Of course the most accurate method is to determine the percentage of moisture of a representative sample, by chemical test. For ordinary purposes, however, fairly accurate results can be obtained by weighing a representative sample of each variety at husking time and then reweighing the samples after the corn is crib-cured. Table XI shows a variation from 8 to 33 per cent. in the shrinkage of our varieties. In general, the amount of shrinkage is dependent on the time of maturity, although largecobbed varieties may be expected to shrink more than varieties with small cobs.

Our varieties are placed in four classes for date of maturity, the earlier varieties of each class being placed first. Each class will then be rearranged according to yield, the better yielding ones being placed first.

TABLE XI.—PER CENT. SHRINKAGE AND SHELLING CAPACITY OF THE VARIETIES GROWN AT MT. CARMEL.

1913 Varieties.	Per cent. Shrinkage.	Shelling Capacity.
Rhode Island White Flint	.15	.858
Smut Nose White Flint	.17	.865
Sanford's White Flint	.17	.815
Griswold's Canada Flint	.16	.846
Brewer's Improved Flint	.18	.839
Burwell's Flint	.17	.852
Woodruff's Longfellow	.21	.824
Griswold's Early Dent	.11	.826
Hall's Tyler Dent	.16	.842
1912 Varieties.	**Per cent. Shrinkage.**	**Shelling Capacity.**
Hopson's Longfellow	.08	.840
Olmsted's Canada Improved	.16	.859
Newgate Flint	.12	.869
Brewer's Flint	.18	.842
Davis' Flint	.09	.859
Hayes, Flint	.14	.856
Holcomb's Early Dent	.15	.865
Mammoth White Flint	.23	.798
Stadtmueller's Leaming	.21	.810
Dibble's Dent	.23	.834
Burr's Leaming	.28	.809
Illinois High Protein	.26	.790
Illinois Low Protein	.33	.830

The *very early* varieties were Rhode Island White Flint, Olmsted's Canada Flint, Davis' Flint, Newgate Flint, Hayes' Flint and Hopson's Longfellow. Classified according to yield, the list reads: Rhode Island White Flint, Hayes' Flint, Newgate Flint, Davis' Flint, Olmsted's Canada Flint and Hopson's Longfellow.

The *early* varieties were Griswold's Early Dent, Hall's Tyler Dent, Burwell's Yellow Flint, Smut Nose White Flint, Griswold's Canada Flint and Brewer's Improved Flint. According to yield, the list reads: Hall's Tyler Dent, Burwell's Yellow Flint, Smut

Nose White Flint, Brewer's Flint, Griswold's Canada Flint, Griswold's Early Dent.

The *medium* varieties were Sanford's White Flint, Woodruff's Longfellow, Mammoth White Flint, Stadtmueller's Leaming and Dibble's Dent. According to yield, the list reads: Dibble's Dent, Stadtmueller's Leaming, Mammoth White Flint, Sanford's White Flint and Woodruff's Longfellow.

The *late* varieties were Brewer's Dent, Illinois Low Protein, Illinois High Protein, and Burr's Leaming. Of the late varieties, Burr's Leaming gave the best yield, followed by Brewer's Dent and the Protein strains.

CONCLUSION.

There are many corn varieties in Connecticut and under the conditions of our experiments some proved much better yielders than others. It is not profitable to grow a poor yielding variety if a better one can be obtained. Each grower should therefore determine by actual test whether the variety which he is using is giving him the best possible return for his money.

It would be of advantage to Connecticut agriculture if there were fewer varieties and if these were more carefully improved by seed selection. A variety which has never been improved by the ear-to-row method of breeding will frequently give an increase in yield of from 10 to 20 per cent. by the use of this method. The Station will be glad to coöperate with any corn grower who wishes to improve his variety by systematic breeding.

An increased yield can often be obtained by taking advantage of the extra stimulus to development of a first generation cross. In general, first generation crosses may be expected to give a larger yield than the average of the parents; however, a cross is of no advantage unless it exceeds the better parent. The better results can be expected from a cross between two highly selected varieties. The only sure method of determining the yielding value of a cross is to grow and compare its yield with both parents.

In nearly all reported tests there have been some crosses which gave a sufficiently better yield than any of the parent varieties to more than pay for the trouble of producing crossed seed.

THE "STEWART CUBAN" VARIETY OF TOBACCO.

By H. K. Hayes.

Most of the tobacco now raised under shade in Connecticut is a Cuban type, first grown in this country in 1904 from seed which was brought from Cuba by Mr. William Hazlewood of New York City. The plants in this first crop were very variable in their characters. Hasselbring's* experiments, which have been corroborated by our own,† show that these variations are largely the result of a mixture of seed of various types of tobacco. Cuban growers save seed from the suckers which grow from the base of the harvested stalks without any selection, and such seed, of course, gives a variable progeny.

The better plants of the 1904 Connecticut-grown Cuban were selected and seed was produced under Manila paper bags to prevent crossing. A row of from 200 to 300 plants of each type was grown in each succeeding year until 1909. Each year the different selections were harvested separately and a comparative sorting test was made (see Stewart‡) and one line known as 13-29 proved its superiority. A considerable number of seed plants were saved in 1909 and the seed used for commercial planting in 1910 at the Windsor Tobacco Growers' Corporation in Windsor. This gave a crop of uniform appearance in which no considerable variations were noted. A large quantity of seed was saved from one section of the field but the seed heads were not specially protected as there seemed little danger that crossing would take place under the shade.

The seed collected in 1910 gave good results in 1911 and was again used in 1912 and 135 acres were grown by the Windsor Corporation. The crop of 1912 was a good one and appeared very uniform, but when clearing the field in the fall a workman

* Hasselbring, H. Types of Cuban Tobacco. The Botanical Gazette, Vol. 53, 113-126; 1912.

† Hayes, H. K. Variation in Tobacco. The Journal of Heredity, Vol. 5, No. 1; 40-46; 1914.

‡ Stewart, J. B. The Production of Cigar Wrapper Tobacco Under Shade in the Connecticut Valley. U. S. Dept. Agr. Bu. Plant Ind. Bull. 138, pp. 31.

discovered that one of the plants he had just cut down bore a large number of unpicked leaves and showed no signs of a flower head. This plant was brought to the attention of the manager, Mr. J. B. Stewart, who recognized in it the ideal tobacco plant. A systematic search of the standing tobacco on the plantation discovered two other such plants. These plants were carefully transplanted and brought to our Station greenhouse. One of them survived and bore 72 leaves, blossoming about January first. Considerable seed was saved from the terminal and sucker blossoms of this plant and was turned over to Mr. Stewart in 1913. This was sown in a section of a seed bed. The seed germinated well and about one-third of an acre, 3,720 plants, were set out under shade.

These plants came true to the new type in all external characters and differed from the normal Cuban in having leaves of a somewhat lighter green shade and in being nearly free from basal suckers. This last is a distinct merit because the present Cuban type of tobacco must be suckered, at considerable expense, when the plants are from one to three feet high. The new type showed no signs of blossoming during the normal period of growth, whereas the normal Cuban variety produces a terminal blossom after producing from 16 to 25 leaves on the main stem. Of the twenty plants of the 1913 crop brought to our greenhouse in New Haven, all but eight were injured during transportation. The eight uninjured plants commenced to blossom about the first of November, the range of leaf counts being from 62 to 80 with the greater number around 70. These data show that this new type is breeding true, and unless it behaves in a manner different from other mutations it should breed true in successive generations.

It has been named the "Stewart Cuban," and in the account of experiments which follows the normal Cuban type is called the Hazlewood Cuban.

The Stewart Cuban was set about 14 inches apart in the row, harvested in the usual manner, and compared with the Hazlewood Cuban from the same field. The season of 1913 was very dry in midsummer and the Stewart Cuban rows were watered once for about half their length, the water being brought to the field in a water wagon. Thus one-half of the Stewart Cuban had an advantage over the Hazlewood type. The seasonal conditions, on the other hand, were decidedly in favor of the normal type as, other things being equal, it takes more water to develop a plant which produces 60 leaves than one which produces only 30 leaves.

Comparative Yield.

Four pickings of the Hazlewood type and six of the Stewart Cuban were made.

The yield of the Hazlewood was to the yield of the Stewart as 100 to 194. That is, from an equal number of plants, 100 pounds of cured leaf of the Hazlewood were obtained and 194 pounds of Stewart Cuban.

Comparative Leaf Length.

This was determined as the leaf was sized. The percentage weights of the leaves in the crop of the lengths named are given in Table I.

TABLE I.

Percentage Weights of the Leaves of the Lengths Named.

	Comparative leaf lengths (inches) in per cent.								
Variety.	11	12	13	14	15	16	17	18	20
Hazlewood Cuban	6.4	8.8	15.9	21.0	23.0	15.4	8.2	1.3	
Stewart Cuban	1.4	4.4	11.5	16.6	24.0	21.8	14.4	5.4	0.5

For the comparative leaf lengths, the last picking of the Hazlewood Cuban (140 pounds per acre) was not used, but all six pickings of the Stewart Cuban were used.

This table shows that the leaves of the Stewart Cuban average somewhat larger than those of the Hazlewood Cuban. Both produced the largest percentage of leaves in the 15-inch class, but the Hazlewood type produced the second largest amount in the 14-inch class, and the Stewart Cuban its second largest percentage in the 16-inch class. The Hazlewood Cuban yielded a much larger percentage of short leaves of 11- and 12-inch length than the new type.

Counts made in the field showed that an average of 31 leaves per plant were harvested from the Stewart Cuban, while about 18 leaves were picked from the Hazlewood variety.

Comparative Sorting Test.

The Stewart Cuban after being fermented in bulk was sorted and compared with Hazlewood Cuban grown on the same field. The following grades were used in the sorting:

L. Thin, light-brown leaves, uniform color. L. V. Thin, greenish-brown leaves, uniform color. V. Thin, greenish-brown leaves, non-uniform color. L. L. 1 Thin, light-brown leaves, slight yellow spots. K. Thin, light-brown leaves, non-uniform colors. L. M. Medium weight, reddish-brown leaves, uniform color. M. D. Medium weight, greenish, dark-brown leaves, uniform color. D. W. Dark, heavy leaves. B. Seconds with one good side.

TABLE II.

Comparative Sorting Test.

The percentage weight of each grade is given in the table under the heading "Percentage Classes."

Variety.	Percentage Classes. L.	L. V.	V.	L. L. 1.	K.	L. M.	M. D.	D. W.	B.
Hazlewood Cuban ...	20.0	22.0	3.8	15.9	9.0	13.0	4.5	3.3	8.5
Stewart Cuban	16.6	23.3	14.5	19.6	12.4	2.5	3.1	1.7	6.3

TABLE III.

Comparison between the Third Picking of Hazlewood Cuban and the Fifth and Sixth Pickings of Stewart Cuban.

Variety.	Percentage Classes. L.	L. V.	V.	L. L. 1.	K.	L. M.	M. D.	D. W.	B.
Hazlewood Cuban	5.9	23.7	6.8	10.0		29.4	12.0	8.9	3.3
Stewart Cuban	2.1	27.4	23.9	12.9	12.1	1.8	7.8	3.6	8.4

Table II gives the results of the comparative sorting test. The fourth picking of the Hazlewood Cuban was tied up without being sorted and was not used in the computations, while all six pickings of the Stewart Cuban were sorted. The Stewart Cuban gives 74 per cent. of its leaves in the first four grades of the table, the better grades, and the Hazlewood Cuban 61.7 per cent. in these grades. This is certainly a good showing when one remembers that the fourth picking, the dark heavy leaves of the Hazlewood Cuban, were not sorted and not used for these percentage comparisons.

Table III gives a comparison of the percentage of the different grades of the third picking of the Hazlewood Cuban and the fifth and sixth pickings of the Stewart Cuban. 66.3 per cent. of these pickings of the Stewart Cuban are contained in the four better grades, L., L. V., V. and L. L. 1, while the third picking of the Hazlewood type produced only 46.4 per cent. of its tobacco in these grades. The grades L. M., M. D. and D. contain the medium and dark wrappers, which do not sell for so high a price as the light wrappers. The Hazlewood Cuban produced 50.3 per cent. of its leaves in these grades, while the two upper pickings of the Stewart Cuban produced only 13.2 per cent. of its leaves in these grades.

These results certainly indicate that this new type may become of great commercial value.

Production of Seed.

We have had a number of requests for seed of this new type but are not able to supply any seed from the very small stock. It seems advisable to give the tobacco a thorough test this coming season on a somewhat larger scale before it is introduced or in any way recommended to growers. If the Stewart Cuban gives good results this coming season it may then be recommended for extended use.

As this type does not blossom during the normal season of growth it is very difficult to obtain large quantities of seed. Seed has been sown in sterilized soil about January first in the greenhouse and from 200 to 300 plants have been started in pots. These plants will be set out about June first in our garden. These should produce seed in August, and if the new type proves valuable in the second year test we may then have a limited quantity of seed to distribute to the shade growers of the Valley.

Conclusion.

The Stewart Cuban is the result of the selection of a sudden large variation which appeared in 1912 in a field of Cuban shade-grown tobacco. This type bred true in 1913, and when compared with the normal Hazlewood Cuban gave an increase in packed yield of about 90 per cent. The quality of the cured leaves was also very satisfactory.

THE SHRINKAGE OF TOBACCO LEAVES IN CURING AND FERMENTATION.

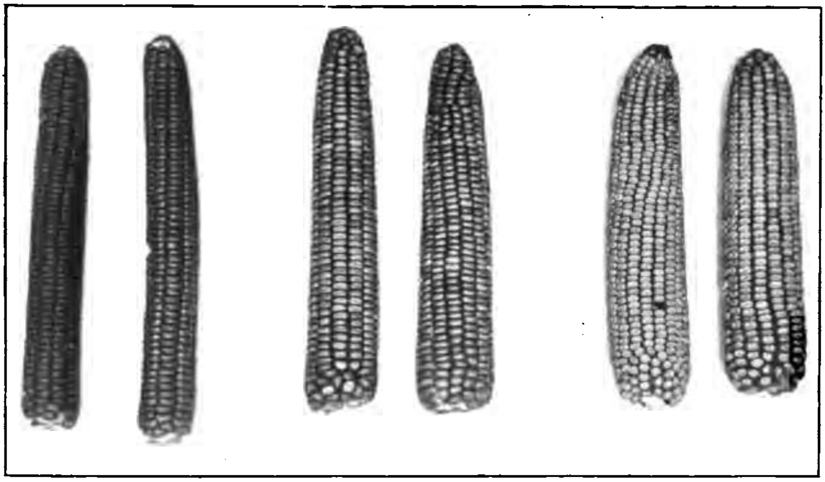
To get an approximate idea of the decrease in size of leaves during curing and fermentation, the outline of such of the middle leaves of 150 outdoor Havana plants as were ready to harvest was carefully traced in pencil on a sheet of paper. The leaves were then strung and hung in the barn to cure. After curing, tracings were again made. The same leaves were then fermented in bulk for a period of about seven weeks and their outline again carefully traced. The length, breadth and area of the tracings appear in the table.

	Length.	Breadth.	Area.
Green leaves	19.5 inches	8.5 inches	116.6 sq. inches
Cured leaves	17.8 "	6.8 "	83.5 " "
Fermented leaves	17.5 "	6.7 "	

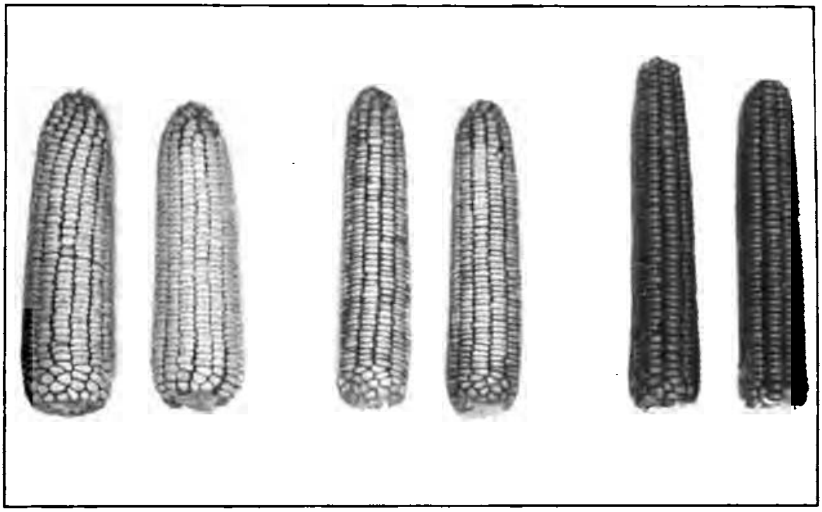
The results show a large shrinkage in the leaf as a result of the curing but only a slight decrease in the size of the cured leaf after fermentation.

The leaves which had an average length of 19.5 inches when green were 17.8 inches in length when fermented, a decrease of 10.4 per cent. The measurements also show a decrease of 20.8 per cent. in average breadth due to shrinkage in curing and fermentation. The area of the cured leaves is 28.4 per cent. smaller than of the same leaves when green.

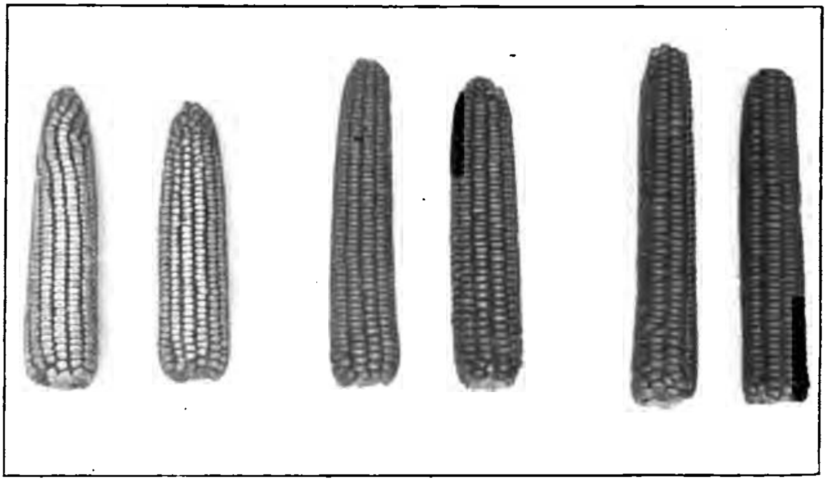
a. Breeding plot for production of cross-bred seed. Plant the parent varieties in alternate rows, and detassel all of one variety. The seed of the detasseled variety will be cross pollinated. (Photo by Moss.)



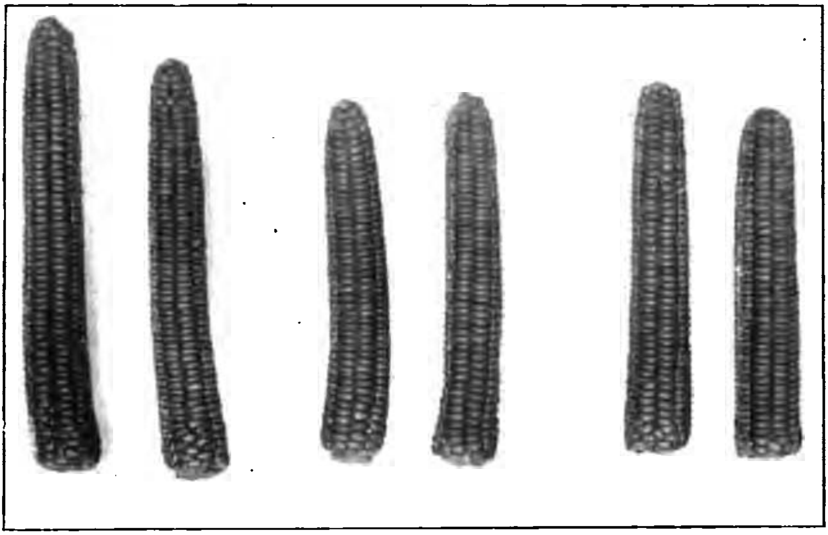
b. At the left and right of the photograph are shown respectively Hopson's Longfellow and Brewer's Dent. The two central ears represent the first generation cross. The cross was intermediate in time of maturity and gave 2.4 per cent. more shelled corn than the Dent parent and 52 per cent. more than the Flint parent.



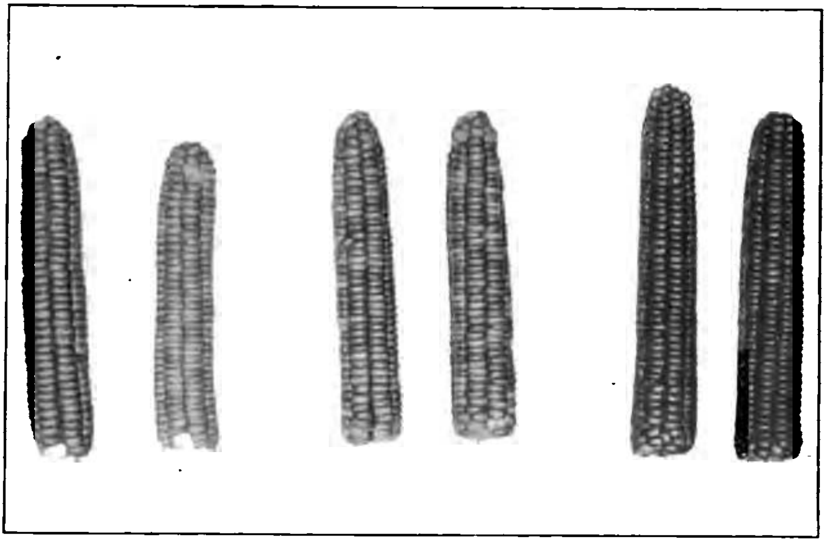
a. At right Brewer's Flint, at left Hall's Tyler Dent and cross in center. The cross yielded 9 per cent. more shelled corn than the Dent and 20 per cent. more than the Flint and proved the most productive of all varieties or crosses at the Mount Carmel test in 1913.



b. Griswold's Early Dent at left, Brewer's Flint at right and cross in center. The cross yielded 17 per cent. more shelled corn than the better parent.

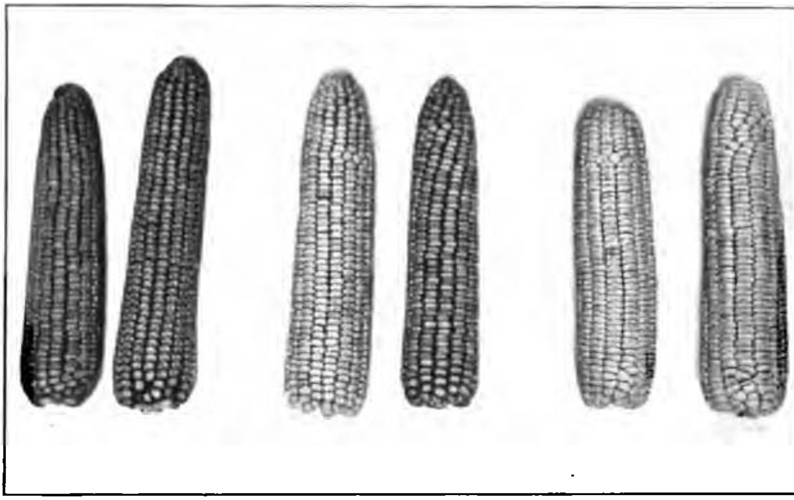


a. The two central ears represent the cross between Brewer's Flint, at right and Woodruff's Longfellow, at left. The parents are both yellow Flints. The cross exceeded either parent in yield.



b. R. I. White Flint at left, Brewer's Flint at right and cross in center. The cross contains both yellow and white seeds and exceeded either parent in yield.

PLATE XVI.



a. At left Stadtmueller's Leaming, at right Illinois Low Protein and cross in center. The cross gave 6.4 per cent. more shelled corn than the better parent.

b. 16-inch Light Wrappers of the fourth picking of Stewart Cuban.

The "Stewart Cuban" shade grown tobacco at Windsor, August 18. These plants have produced over thirty leaves to the stalk and two pickings have already been made.

Forestry Publication No. 10

A PRELIMINARY WORKING PLAN

FOR THE

PORTLAND STATE FOREST

BY

WALTER O. FILLEY

AND

ALBERT E. MOSS

BEING THE

SEVENTH REPORT OF THE STATE FORESTER

NEW HAVEN, CONN.

MAY, 1914

CONTENTS.

FORESTRY PUBLICATION, No. 10

SEVENTH REPORT

OF THE

State Forester of Connecticut

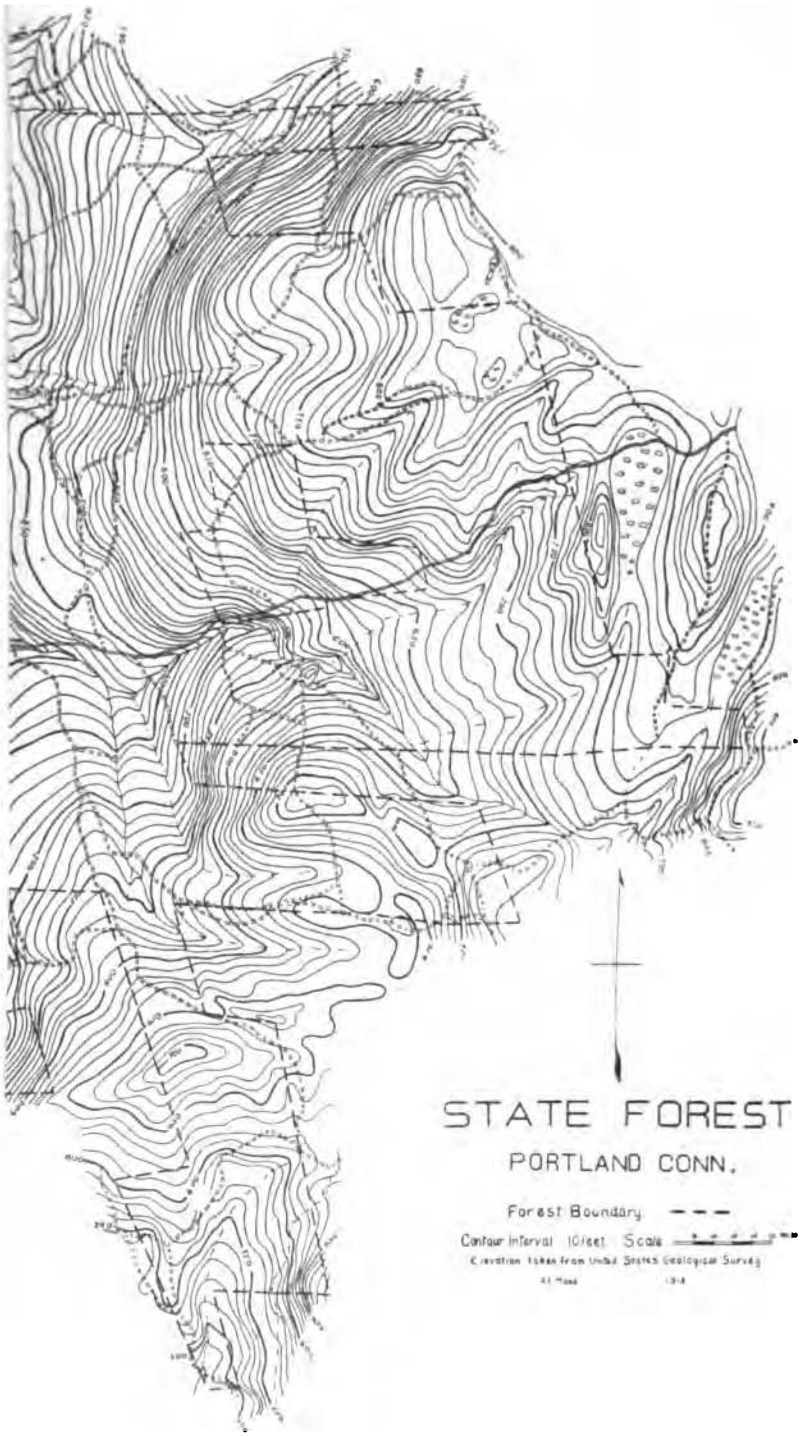
WALTER O. FILLEY
Station Forester

The Station Forester is *ex-officio* State Forester and State Forest Fire Warden, and the work of the Forestry Department was described in detail in the Station report for 1912. It has been continued and extended along the same lines during 1913, but a summary of the routine work of the Department oftener than once in two years seems unnecessary. There are usually several projects uncompleted at the close of each year upon which only a report of progress can be made. This report for 1913 is therefore confined to the most important completed work of the year, which was a preliminary working plan for the Portland State Forest.

With the establishment of the State Forest at Portland, the need became apparent for a working plan upon which systematic forest management might be based. The preparation of such a plan was at first delayed for lack of an accurate map of the tract, and even when such a map was available, further postponement was necessitated by the pressure of other work. The plan now presented should be considered only as of a preliminary nature, to serve as a basis for future work, but lacking much which should be found in a complete working plan. In view of the small area, however, and the probability of its early increase beyond the present boundaries, a more complete plan is hardly necessary or desirable at present. Specific recommendations have been made for a period of six years only, with the expectation that during that time further data will be gathered, especially concerning growth and yield. The preparation of a more complete plan for a longer period would then be possible, including such additional areas as may have been secured in the meantime.

A transit survey with distances chained, made in 1908 and 1909, was the basis for the accompanying maps. The mapping of types and age classes was done in the summer of 1912 by Mr. S. V. Klem. Under his direction also, an estimate of the yield was obtained by the strip method, in which the diameters of all trees on strips four rods wide were measured, as well as the heights of average trees. By means of volume tables given in U. S. Forest Service Bulletin 96, the yield of these strips was calculated and applied to the entire areas of corresponding types and age classes. As stated elsewhere, the estimates thus obtained are probably conservative. Only ten per cent. of the entire stand was actually measured and, on account of the great variety of conditions, it was difficult to locate strips which would give good averages. Some of the younger stands were not estimated at all, although they would undoubtedly cut several cords to the acre. Recent cuttings indicate that the estimate was low throughout.

In spite of its many shortcomings, the present plan provides a foundation for future work. Most of the data it contains will be essential to a revised plan, and can easily be extended to cover additional areas as they are acquired. Furthermore, it will serve as a guide for the use of visitors, and should add considerably to the interest and value of a visit to the Portland Forest.



STATE FOREST
PORTLAND CONN.
Forest Boundary
Contour Interval 10 feet Scale

A PRELIMINARY WORKING PLAN FOR THE PORTLAND STATE FOREST.

By W. O. Filley and A. E. Moss.

PART I—DESCRIPTION.

SIZE AND LOCATION.

The Portland State Forest comprises 1070 acres of land lying east of the Connecticut River in the northern part of Middlesex County, Connecticut, mostly in the town of Portland but extending into the adjoining town of Chatham. It is more or less broken by private holdings, one small farm and the Portland Water Company's reservoir breaking into the western edge so as to give the tract roughly the form of a letter U over a mile and a half wide and with its arms extending for two miles toward the Connecticut River. This form will doubtless remain practically unchanged, but additional land is being acquired from time to time, and it is expected that the forest will eventually include at least 1500 acres. For administration purposes, 2000 or even 2500 acres would be more satisfactory.

Located within five miles of the geographic center of the state, it is fairly accessible from all points. The Middletown railroad station, with trains from five directions, is barely seven miles distant, while the stations at Cobalt and Portland on the Air Line Division are nearer, but less convenient. The trolley line from Middletown to Portland ends at Gildersleeve, which is but four miles from the tract, and the end of the South Glastonbury line from Hartford is within five miles. Should a line eventually be built to connect these two points it will pass within two miles of the state land. Thus from the point of view of accessibility, the area was well chosen and for this as well as other reasons is well adapted for the purpose of demonstrating forestry practise.

PHYSIOGRAPHY.

Topography: The tract is close to the western edge of the eastern highland region of the state, with its eastern boundary following the crest of a ridge extending north and south parallel to the Connecticut River, but nearly four miles east of it. The highest altitude within the forest is 840 feet above sea level at a point on this ridge called Meshomasick Mountain. Three-quarters of a mile west of the ridge the altitude is 400 feet, and from that point the slope is gradual down to less than 300 feet at the western boundary.

Drainage: On the tops of the ridges swampy areas are found, due to irregularities in composition of the underlying rock, the softer portions of which have eroded, leaving hard ledges or dams at the natural drainage points. The remainder of the area is well drained as a whole, with slopes varying from medium to steep along the main ridge to the east, but with gentle slopes through the central and western portions. The streams are permanent and a number of very good springs exist within the forest. On the main ridge the drainage is to the southwest, the upper stream valleys being controlled by hard ledges having this general direction. On the lower slopes, these ledges are cut through and the drainage is to the west. There are four distinct drainage systems separated by low rounded ridges. Two of these form the water-shed of the Portland reservoir, which lies just outside the forest boundary. A third drains west and southwest until it joins the stream below the reservoir, while the fourth is drained by a brook flowing west into the Connecticut, parallel to the reservoir drainage but independent of it.

The soil is mostly sandy loam and is characteristic of a glaciated region. On the higher ridges, it is shallow and all but lacking in places. On the benches it is deeper and richer, while in the lowlands it has greater depth but is more sandy, being almost pure sand in many places. There are a number of areas toward the eastern boundary where the ground is entirely covered with large irregular-shaped boulders of granite. These are usually at the foot of rock outcrops or in the stream beds.

The climate of the region is temperate with moderate winters, as a rule. Late spring frosts are sometimes experienced in the valley region, but the location of the forest is sufficiently high above the river to escape most of the killing frosts. Rainfall is fairly well distributed throughout the year, and averages about 47 inches. Of recent years, a number of drought seasons have been experienced which have unfavorably affected tree growth. In some cases winter conditions have been such as to cause a lack of moisture in the ground, and "winter injury" to trees has very probably resulted. Lack of moisture during the growing seasons has also brought about a weakened condition of some trees. Normally, however, climatic conditions are such as to favor the growth of both hardwoods and conifers in this region, and it is within the range of many southern as well as northern species.

HISTORY.

As this was one of the earliest settled regions of the state, the original timber was undoubtedly cut in colonial times. On account of the floods and supposed unhealthiness of the river valley, the early settlers seem to have chosen the uplands for cultivation. This statement is confirmed by the abandoned roads and farmhouse sites throughout the hill region. Much of the mountain land now included in the State Forest was once cleared for cultivation, but was soon abandoned and has since reverted to forest growth. The nearby river made a good market for oak in the form of ship timber and piling, and other species were in demand for lumber, charcoal and fuel. As a result, the forests of this region have been cut over a number of times, and to-day are mostly even-aged coppice with many older trees of poor form and species scattered throughout.

The first purchases for the State Forest were made in 1903 when about 700 acres were acquired in lots varying from five to ninety acres in size. Most of the timber holdings in the region are in the form of small woodlots, which made it difficult to secure title to a large, continuous area. Most of the early purchases consisted of land with good growing timber, but a large part of the land since secured has been bought from lumbermen after being cut over. Under private ownership, cuttings usually followed the original lot lines. Thus two adjoining lots can often be distinguished by the difference in age classes, but since the natural soil and type divisions seldom agree with lot boundaries there is often considerable variation in the growth and quality of timber on a lot. For this reason, lot boundaries will probably be ignored in the future unless they conform approximately with the boundaries of types. So far as possible, the natural forest types, as determined by topography and soil conditions, will be followed in dividing the area into sub-compartments.

The total expenditure by the State in the purchase of land at Portland from January 1, 1903, to September 30, 1913, amounted to $2,425.41. According to the deeds 1150 acres were secured, but an actual survey showed a total of only 1070 acres. On this basis the average cost of purchase has been $2.27 per acre. During the same period, the expense of management was as follows:

	Total.	Per acre.
Survey	$ 384.93	$ .36
Taxes	649.84	.61
Protection	276.57	.26
Cuttings	2,175.36	2.03
Planting	1,352.95	1.26
Supervision and miscellaneous	1,508.60	1.41
Gross expenses	$6,348.25	$5.93
Receipts	1,067.95	1.00
Net expenses	$5,280.30	$4.93
Purchase	2,425.41	2.27
Total net cost	$7,705.71	$7.20

If every portion of the tract is considered to have shared both receipts and expenditures equally (as it would in a complete rotation under management), the average expense per acre for management was $5.93. Adding to this the average cost for purchase gives $8.20 as the gross cost per acre. Cultural operations including cuttings and plantings have so far been confined to a little more than half the area (618 acres), and the cost of these operations has been $3,528.31. Receipts from sales of wood from the same area have amounted to $1,067.95. The net cost of the cultural operations is therefore $2,460.36. This averages $3.98 per acre for the area directly benefited. If figured for the entire forest, the net cost of cultural operations is reduced to $2.30 per acre. Since the average returns from the entire area amounted to $1.00 per acre, the net cost of management was $4.93 per acre, making the total net cost including purchase $7.20 per acre for the 1,070 acres.

The work of the first decade has been largely experimental and without a definite or comprehensive plan. Improvement cuttings in the form of thinnings have been made in various parts of the tract. Timber damaged by fire or disease has been removed in some sections, and several areas have been cut clear on account of such damage, or because the species was slow-growing and undesirable. On these areas conifers were planted, mostly white pine, since this species promises the most profitable yield in the shortest growing period.

SOCIAL AND INDUSTRIAL CONDITIONS.

The present agricultural population of the region is mostly located along the edge of the valley to the west. Tobacco is the main crop on the valley lands, but back in the hills the crops are more diversified. Numerous feldspar quarries furnish employment for a portion of the population, and make it difficult to secure local labor for woods work. During the winter season it is possible to secure choppers from the Italian colony in Glastonbury, where the fruit industry furnishes them employment the balance of the year. To attract labor from other regions would be out of the question unless permanent employment could be assured.

In the near-by city of Middletown with its suburb of Portland, there is a considerable demand for lumber and wood for use in manufacturing and the building trades. Being situated on the river, however, the local demand for lumber is largely supplied from outside by means of water transportation. Fuel in the form of coal is supplied in the same manner. This makes the demand for cordwood for fuel purposes very small. The larger part of the wood cut in the region is turned into charcoal. A number of brick yards within ten miles use a large quantity of cordwood, but the distance is too great to allow wood on the state land to be profitably disposed of in this way.

PRESENT STAND.

Type Classification.

For the purpose of this plan the following six forest types have been distinguished:

Chestnut	28.4	acres
Oak	231.1	"
Chestnut and oak	577.2	"
Mixed hardwoods	172.8	"
White pine	46.0	"
Old field	14.6	"
	1070.1	"

The composition of the present stand has been used as the basis for type classification. In most cases, these types are evidently transitional rather than permanent. Probably the only natural or climax type on the forest is the stand of mixed hardwoods found along one of the mountain streams.

Type Descriptions.

The chestnut type comprises stands in which more than seventy-five per cent. of the trees are chestnut. The determination of this type is complicated by infections of chestnut blight (*Endothia gyrosa var. parasitica*) which have killed many chestnut trees and thus considerably reduced the percentage of this species in many stands. For this reason, many of those where chestnut formerly predominated must now be classed as of another type. Because of the continued spread of the disease, only stands having a sufficient proportion of the species to make its continued predominance probable are classed as of the chestnut type. Consequently this type is only found on first quality sites where the percentage of other species is small and the disease has not caused great damage as yet.

The oak type is characteristic of the poorer sites, especially the rocky ridges. It includes stands in which sixty per cent. or more of the trees are some species of oak.

The chestnut and oak type is the most extensive in the forest at present, and includes all stands in which the principal species are chestnut and oak in nearly equal proportions. Many of these stands were second and third quality chestnut before the percentage of this species was reduced by disease.

The mixed hardwood type appears mostly along the brooks and bottom-lands where there is considerable moisture. It is made up of oak, chestnut, tulip, ash, birch and other hardwoods with no one species predominating. The composition varies considerably, the species found in the swampy areas of the bottom-lands being different from those found on better drained sites. Along one of the mountain streams it might almost be classed as a northern hardwood type since it contains species typical of northern regions, such as beech, birch, and hard maple. The area is not great enough, however, to warrant classing it as a separate type.

The white pine type, consisting almost entirely of white pine, is found in one volunteer stand only in the forest. The balance of the type consists of plantations made since the tract was acquired by the State. These plantations include other species of conifers besides white pine, but not in sufficient quantity to warrant distinguishing another type.

The old field type comprises areas formerly pastured or cultivated which are naturally reverting to forest, but upon which true forest conditions are not completely established.

Age Classes.

As clear cutting has usually been the practise in the past, most of the present stands are even-aged. The range in age is probably from one to seventy-five years although there are doubtless single trees of greater age. Table I, which shows the area and volume of each compartment by ten year age classes, indicates that the greater part of the forest is less than forty years old. In fact, nearly one half the growth is of less than thirty years. This includes about fifteen acres of old field which is not even-aged, but has been abandoned less than thirty years. Nearly one-fourth the area has not been cut clear of recent years and is therefore many-aged, with the entire range of age classes represented in most cases.

Volume.

It was not practicable or desirable to make an accurate estimate of present yield, and the figures given in Table I are only approximate. They are stated in cords, since most of the stand would be sold as cordwood if cut at the present time. The estimates are undoubtedly conservative, for they are based on a strip survey of less than ten per cent. of the area estimated. It is probable that the estimate would underrun the actual cut by as much as twenty-five per cent.

The estimated total yield is 10,462 cords, which is only 9.8 cords per acre. The average yield for all stands more than twenty years old is 17 cords per acre and for the stands over forty (including the many-aged stands) the average yield is 19.8 cords.

Growth.

Chestnut has formed so large a part of the total stand in the past, and its future is now so uncertain on account of the blight, that detailed growth studies were considered impracticable. Such

TABLE I.—AREA AND VOLUME BY

Compartment.	1-10 Years. Area Acres.	11-20 Years. Area Acres.	11-20 Years. Volume Cords.	21-30 Years. Area Acres.	21-30 Years. Volume Cords.	31-40 Years. Area Acres.	31-40 Years. Volume Cords.
I	37.4	48.1	....	19.7	227	25.9	259
II	86.	80.0	....	36.7	247	99.0	1332
III	12.4	33.8	43	69.0	1097	43.1	672
IV	1.6	10.9	....	....	....	18.0	249
V	45.	62.0	....	23.0	411	....	....
	182.4	234.8	43	148.4	1982	186.0	2512

studies will be made in the future for stands in which it is anticipated that the present type will be maintained, or to prove the undesirability of maintaining the present type on account of its slow growth.

Chestnut Blight.

The presence of the chestnut bark disease, or chestnut blight, on the State Forest was first discovered in the spring of 1910. Older infections were afterward found on adjoining property, and it seems probable that the disease was at work in the region as early as 1906. A survey made in 1911 indicated that it was present in most of the chestnut stands throughout the State land, and experiments in control were begun in the fall of that year. Sub-Compartments A, B, C, D, E and H of Compartment 1 were thoroughly inspected and all infected trees marked for cutting. During the following winter all such marked trees were removed, the brush and bark being destroyed by burning. All wood which could not be disposed of in the form of peeled ties, posts, etc., was burned for charcoal. An adjacent tract was also inspected, and all infected trees counted but not removed, thus serving as a check on the experiment in controlling the spread of the disease by cutting.

This work has been repeated during the two succeeding winters, but the results of the three seasons' work are not very encouraging. In fact, the last inspection after two years' work showed more increase in the number of infected trees on the area from

COMPARTMENTS AND AGE CLASSES.

41-50 Years.		50+ Years.		Many-Aged.		Old Field.	Total.	
Area Acres.	Volume Cords.	Area Acres.	Volume Cords.	Area Acres.	Volume Cords.	Area Acres.	Area Acres.	Volume Cords.
16.9	351	6.8	108	4.4	15	....	159.2	996
....	...	12.9	285	102.9	1850	....	417.5	3714
13.5	323	....	...	99.2	1989	14.6	285.6	4124
21.5	435	....	...	12.4	296	....	64.4	980
....	...	10.3	135	3.4	102	....	143.7	648
			...	10.3				
51.9	1109	30.0	528	222.3	4288	14.6	1070.4	10462

which they had been removed, than on the check area where the infected trees were left. There seems to be no evidence that the careful removal of all trees which show evidence of infection on a definite area will check the spread of the disease on that area. If the work could be carried out over a larger area, better results might be secured, but the irregular spreading throughout a region which seems characteristic of the fungus, indicates the impracticability of such work. It is too expensive for private owners, or even for the State unless complete elimination of the disease could be assured.

The experimental work along this line will probably be continued, as the presence of the blight-killed timber is undesirable and its removal by damage cuttings will benefit the remaining stand. The disease causes the greatest damage in young stands of small merchantable value. In such cases, a damage cutting would not be warranted and clear cutting followed by planting will be a more profitable operation. The possibility of sprout regeneration from the stumps of diseased trees is rather doubtful, for although the stumps sprout well in many cases, most of the young sprouts are usually infected and killed within three years. Further information regarding the chestnut blight may be obtained from Bulletin 178 or the Annual Report of the Connecticut Agricultural Experiment Station for 1912.

PART II—MANAGEMENT.

OBJECT.

To improve the condition of the present stand when possible; to remove the present stand when necessary, replacing it with a better one; and in the shortest possible time, to establish a satisfactory rotation which will assure a maximum annual yield in the future.

The State Forest at Portland was established with two aims in view. One was to furnish a demonstration of the best forestry practise for the benefit of other forest land owners. The other was to develop a future supply of timber of size and quality best suited to the needs of the community, and eventually to assure the State a satisfactory revenue from its investment. Since the future aim can only be attained in such measure as the present aim is fulfilled, the latter might be considered as of most immediate importance. Present practise, however, must be largely governed by present conditions, such as the existing stand, market prices, damage by fungus, insects and fire, but no matter what operations the exigencies of the present day demand, the effect on future conditions must be considered, and all operations must be, so far as possible, in accordance with future aims. Hence, the present object of management must be sufficiently comprehensive to include the needs of the future as well as those of the present. It must also be sufficiently flexible to permit changes in methods of management on account of unforeseen conditions, both physical and economic.

The production of saw timber is more desirable for many reasons than the production of cordwood. It requires a longer investment, but the ultimate returns are greater. The present stand, however, being composed mostly of slow-growing hardwoods is not suitable for this purpose, and will be converted as soon as possible into a more rapid growing coniferous type. Pine will be planted on all shallow soils, as well as on all ridges and steep slopes where practicable. Hardwoods will be retained only on deep bottom-lands and on swamp areas. In such locations, the policy will be to improve the composition of the stands by means of improvement cuttings which will favor tulip, ash and red oak over other species. If sufficient reproduction is not secured naturally it will be supplemented by planting.

SILVICULTURAL TREATMENT.

Cutting.

For the scope of the present plan, the only cuttings necessary in the *pine type* will be improvement cuttings or cleanings to remove undesirable trees of other species which may be overtopping and injuring the pine. The one mature stand will probably need little attention for a number of years. Eventually, natural reproduction may be secured in it by making a reproduction cutting, removing enough trees to make openings in which seed from the remaining trees will germinate.

In the *hardwood types,* the cuttings made during the next five years will be of two kinds: (1) Clear cuttings where the present growth is undesirable, and another type is to be established by planting; (2) damage cuttings where the removal of trees infected with chestnut blight will leave a sufficient stand to justify a partial cutting instead of a clear cutting. Such cuttings will be practically reproduction cuttings in some cases.

Rotation.

To obtain the best results with the present hardwood stands, a rotation of seventy to one hundred years seems necessary. The longer time would be required in the oak type while the shorter rotation would probably be sufficient for mixed hardwood stands on the better sites. If chestnut coppice could be depended upon for the future, the chestnut type might be handled on a rotation of less than seventy years. Under existing conditions, at least seventy years will probably prove necessary for all hardwood types. Available yield tables indicate a fifty-year rotation as most profitable for white pine. Although a longer period may later prove desirable, for the present, fifty years will be considered the rotation to be established for the pine type. Until complete growth studies have been made no regulation of the yield can be attempted. The cutting policy for the next five years will largely be determined by the necessity for damage and removal cuttings as a result of the chestnut blight devastation. This work will be done under direction of the warden except where cordwood can be sold to advantage on the stump. Where ties, posts or poles can be cut, they can usually be sold more profitably after cutting. Brush and tops will be disposed of by burning when necessary to lower the cost of planting, or to reduce the fire danger.

The limited market for small materials prevents cutting when most desirable in many cases, and will probably retard the transformation in type to a certain extent. On the other hand, the spread of the chestnut blight will hasten the cutting of many immature stands and their regeneration by planting with conifers.

Planting.

The plantations thus far established have been very successful but rather expensive on account of the brush being piled and burned. The removal of brush makes planting easier and reduces the fire danger, but is not a necessary operation, and the results seldom justify the expense. Future plantings, like most of those in the past, will be of conifers. With the present available funds, not more than thirty acres a year can be planted. This is enough to cover the area now owned inside the rotation, but if it proves possible to increase the area to more than 1500 acres it will be necessary to increase the amount of planting done each year.

Most of the planting will be for the purpose of replacing with better species, undesirable stands which have been clear cut. As further purchases of cut-over lands are made, the policy will be to assure a satisfactory stand by planting, rather than to trust to natural regeneration. The small area of old field type must be planted in the near future, as well as any land of similar type which may later be acquired. There will also be occasion for under planting, as well as group planting in openings, where conditions make desirable a gradual conversion of type, or the supplementing of natural reproduction. The species so far used have been white and red pine and Norway spruce. These will be used in the future, together with Scotch pine and European larch. White pine will probably continue to be the principal tree in plantations but the other species will be mixed with it according to the site; spruce and larch on the better soils, with red pine or Scotch pine on the poorer. On sites suited for hardwoods, ash, red oak and other desirable species may be planted to supplement natural reproduction, and in case the chestnut blight disappears, the planting of chestnut may again be practicable.

In planting conifers, transplant stock will be used in most cases, the three-year stock once transplanted being the most satisfactory for the purpose. Larger stock is not only too expensive, but harder to handle. It may be used to advantage, however, for filling failures in the plantations. Two-year Scotch pine seedlings can be used successfully in most cases, and are less expensive to handle than older stock of this species. Where hardwoods are planted, one-year seedling stock will be used. On cut-over land, or wherever existing tree growth will permit, coniferous stock is planted with a spacing of six by six feet. This requires twelve hundred trees to the acre on open land, but the number is considerably reduced where natural growth can be taken advantage of. The object of close planting is to cause the crowns of the trees to meet and form a complete forest cover in a very few years, thus preventing the development of underbrush and other vegetation which is intolerant of shade. As a result of the lack of light in a crowded stand, intolerant trees lose their lower limbs at an early age, and the trees grow up toward the light with straight clean boles free from large side branches which would form bad knots in the mature trees. Where there are many failures in a plantation, it is therefore desirable to fill the blanks within a year or two in order that there may be no large gaps in the crown cover. In time, a crowded stand will need a thinning in which those trees promising the best future development may be favored.

ADMINISTRATION.

Since its establishment, this forest has been under the supervision of a local warden or ranger who receives an annual retainer for keeping a general oversight of the tract at all times. He has charge of all cutting and planting operations, being paid by the day when so employed. No more extensive organization is practicable at the present time. With the enlargement of the area and the development of a more valuable type of forest, it may become possible and desirable to employ one man throughout the year as a ranger under the direction of the warden. His primary duty would be to protect the forest from fire and trespass, but when not directly employed in this way he could be kept busy chopping, improving roads, making fire lines, etc. It would be desirable to have such a man reside at a point where he could overlook most of the forest, but as there are few houses so located, the building of a lookout tower, or even a shack on a high point, might be necessary.

FIRE PROTECTION.

The fire hazard is not great on account of the location of the forest, and a comparatively small amount of protection work is necessary. The few fires occurring in the past have been due to carelessness, either on the forest or outside. The railroad is too far away to be considered as a source of fire danger, and on account of the steep grades, there is very little travel over the highways which cross the tract. This reduces the chance for fires due to carelessness on the part of the traveling public. The State land is posted against fishing and hunting, as is most of the adjoining land, so that danger of fires from this source is also reduced to a minimum. Carelessness and lawlessness must be reckoned with, however, and during certain seasons of the year it will probably be necessary to patrol the forest as a measure of protection. Such work can be done by the ranger as already suggested. The posting of fire-warning notices along the highways will also help to educate the public to the need of care with regard to fire.

The greatest danger from fires originating outside the forest would naturally be from the direction of the prevailing winds, which are westerly. The region directly west of the forest is farming land, however, with very little wooded area, and there is practically no danger of fires on that side except along the highway. Both to the north and to the south of the State land there are extensive forest areas, and there is liability of fire starting in either direction. Fortunately highways break these forest areas, and since the general slope of the country is to the west, a smoke to the north or south would be visible before the fire could gain much headway. The practically unbroken forest stretching to the eastward for several miles might prove a great source of fire danger, except for the fact that the prevailing winds are in the opposite direction.

As a protective measure the numerous logging roads already existing throughout the tract should be improved by cutting out the brush and removing the rocks where necessary to make them passable. They can then be kept in usable condition at small expense, and will not only serve as fire lines, but make all parts of the forest easily accessible for logging as well as fire fighting purposes. At first this work will be done only where it seems most necessary for protection from fire, but eventually a complete system of roads and trails will be established. Springs, and holes in brooks near the roads will be deepened to provide available water sources in case of fire. Where these are not located on the roads, trails will be made to them, and guide signs put up for the benefit of fire fighters. Fire fighting equipment will be provided at the most practicable point, probably at the house of the warden or ranger. This equipment will consist of bucket pumps, canvas water bags, galvanized iron buckets, axes, rakes, shovels, etc. In case of a fire the ranger will call on the local fire warden for assistance. It will be desirable to have the ranger or the forest warden appointed a district fire warden for the town, so that he may have power to summon assistance and assume charge of the fire fighting, both on the State land and in the surrounding region.

DIVISION OF AREA.

For management purposes the forest has been divided into compartments and sub-compartments. This division is somewhat arbitrary on account of interior holdings which do not belong to the State. While it is not necessarily permanent, and will be subject to change with new acquisitions of land, it is in accordance with a definite system which can be followed in future revisions of the working plan.

The compartments are based primarily on topography and are usually separated by ridges, streams or public roads which form easily recognized boundaries. So far as possible, they form working units the entire area of which can be logged in one direction. Five compartments have been made of the present area. Future acquisitions will probably be added to these, although the formation of new compartments may prove necessary. Those now established, however, will probably be maintained.

Sub-compartments are subdivisions of the compartments, based on forest types and age classes. Sub-compartments consist of individual stands which differ from adjoining stands in type or age class, and a single sub-compartment usually contains only one type and only one age class. In this plan it was thought best to class as a single sub-compartment some stands differing in age but which would eventually be thrown together by removing the present growth. Some of the present sub-compartments, therefore, will be found to contain several age classes. The sub-compartment boundaries are indicated only by the lines of difference between types and age classes in most cases. These boundaries are not permanent, but will be subject to revision from time to time.

A detailed description of the five compartments will be found in Part 3, following, and a brief description of each sub-compartment with such recommendations for future management as present conditions suggest. The operations recommended for the next six years are given in the following table:

TABLE II.—TREATMENT RECOMMENDED.

Year.	Sub-Compartment.	Area.	Condition 1914.	Recommendation.
1914	3 G (part)	8.7 Acres	Cleared	Plant pine
1914	1 G (part)	5. "	"	" "
1915	2 B	20. "	"	" "
1915	2 C	20. "	Partly cleared	Finish clearing
1916	2 C	20. "	" "	Plant pine
1916	3 A	53. "	Chestnut blight	Damage cuttings with group planting of pine
1916	2 H	30.4 "	" "	Clear cut
1917	2 H	30.4 "	" "	Plant pine
1917	2 G	29.5 "	Inferior species	Clear cut
1918	2 G	29.5 "	" "	Plant hardwoods and pine
1918	2 L	34. "	Chestnut blight	Cut, leaving ash and tulip for natural reproduction
1919	2 L	34. "	" "	Plant pine and hardwoods
1919	1 E	16.9 "	" "	Clear cut, leaving oak standards
1920	1 E	16.9 "	" "	Plant pine
1920	2 M	12.9 "	" "	Damage cutting and group planting of pine

REVISION OF WORKING PLAN.

This plan being intended to cover a period of six years only, it should be revised at the end of that time.

PART III—COMPARTMENTS AND SUB-COMPARTMENTS.

COMPARTMENT I.

This compartment consists of three separate areas lying north of the reservoir and west of a road which turns north near its head. These areas are practically continuous, being separated only by small private holdings. A ridge crosses the compartment from southwest to northeast, reaching a height of 140 feet above the level of the pond. A small semi-permanent brook flows parallel with but north of this ridge and empties into the main brook three-quarters of a mile below the pond. Northwest of this brook an elevation of 180 feet above the pond is reached.

There are a number of low rocky outcrops which cross the drainage, making swamp areas which are flooded at certain seasons. The ridges have medium to gentle slopes with few boulders, except in certain well-defined areas where they are very numerous. The soil is medium to deep clay loam with good humus conditions, as this compartment has not been burned in a number of years. The greatest fire danger is to the north, since on this side there is an unbroken timber area for at least one mile, while the roads form fire lines to the east, south and west.

The compartment is made up of twelve separate lots which had been cut over from time to time by former owners. The resulting stand is entirely coppice, and while the age varies greatly, the composition denotes the soil and moisture conditions fairly accurately. Of recent years, inferior species in the mixture have increased as a result of the poor cordwood market which has necessitated the use of a selection system in cutting, only the better trees being cut for special purposes. At the present time, there are limited areas of very good chestnut and oak stands, but the area as a whole will require clear cutting and a substitution of more valuable species, such as pine, by planting. At the time of this change, a number of lots may be wholly or partially combined to make a new sub-compartment based on soil and topographic conditions, instead of on present age class and lot lines. Adjoining land will be purchased as it is placed on the market, in order to secure a solid holding, but not to extend present boundaries to the north or west.

This compartment is well situated as to market, being easily accessible to the railroad and having a limited local demand for cordwood. The system of log roads is well developed and in good condition. With the exception of Sub-Compartment 1 G and the southern portion of 1 F, all material will pass out over one main road which follows the drainage to the west and offers a down grade almost the entire distance to market. The individual lots are rarely so rocky as to make logging difficult, and in no case is there an inaccessible area. The time of cutting for the sub-compartments will depend upon when the youngest age class becomes merchantable and the oldest age class begins to deteriorate.

COMPARTMENT 2.

This compartment extends north of the Portland-Marlborough road with the eastern boundary along the top of Meshomasick Mountain and the western boundary nearly due north from the Anderson farm. The boundaries are irregular, due to following old lot lines.

The general slope is to the west with a permanent stream along the western edge and a branch of the same closely following the northern edge. The slopes are gentle to steep with a few very rocky areas, both outcrops and loose boulders. The latter are especially numerous near the top of the mountain. The soil is shallow on the ledges but very deep and fine on the benches and in the valleys. The humus is deep except over a limited area where a surface fire in 1908 destroyed the old accumulations. The greatest fire danger is to the north and east where unbroken forest areas extend for some distance.

This land was bought in the form of small lots from time to time, and comprises some eighteen separate holdings. This has resulted in a large number of age classes, as every lot has been handled without regard to the adjoining land. The effect of market conditions is also apparent in clear cuttings for coal and cordwood near the market, and selection cuttings for poles and ties on the more remote areas. The compartment will be divided into sub-compartments of about thirty acres, each of which will comprise similar topographic and soil conditions. These, while more or less arbitrary in shape, will be fairly uniform in size, because in changing the species, planting will be necessary, and thirty acres a year is as much as the present biennial appropriation will permit.

The tracts requiring immediate attention are those situated on the lower levels near the brook. At present these contain a large percentage of chestnut which is diseased to a considerable extent, and will have to be cut within the next five years in order to save the growth already on the ground. As the slope increases and the soil becomes more shallow, oak crowds out the chestnut and forms an almost pure stand. The soil on the comparatively gentle slope near the top of the ridge is shallow, with large areas of rock outcrop which makes a site very unfavorable for many native species, and has resulted in a stand of scarlet oak and pitch pine. There is a good stand of chestnut at the bottom of a small drain where the soil is a little deeper.

This area forms a logging unit from which all material will pass out over the Marlborough road, or that which crosses the pine plantations. There is a well-defined system of logging roads which will require a certain amount of repair work, but on the whole are in good condition, and this renders the entire tract readily accessible.

COMPARTMENT 3.

The east and west boundaries of Compartment 3 are practically southerly extensions of the east and west boundaries of Compartment 2. It lies south of the highway to Marlborough and includes the greater part of the drainage area of the south brook which empties into the reservoir. This brook forks, making three distinct drainage systems within the area. The valleys, while shallow as a whole, are very rocky, being filled with fields of loose rocks. The slopes are generally moderate with only a few portions that are steep. The soil is medium to deep, except near the stream beds and the tops of the higher ridges where the rock approaches the surface. The humus is medium over the entire area with the exception of an area near the southern border which was burned in 1913. This fire approached from the south, crossing Compartment 4, and was checked by the town wardens along a road within Compartment 3. Much of the standing timber on the area burned over was either injured or killed and the forest floor was destroyed. The greatest fire danger is to the south and east as the highways to the southwest and north form a slight fire protection.

This compartment is of especial interest because of a well defined "Northern Hardwoods" area along the stream and in a site so rocky as to make it almost inaccessible. The remainder of the stand shows chestnut and oak on the better sites, with mixed hardwoods in the damp situations and scarlet oak on the ridges. A portion of the area is pasture reverting to woodlot in which pine and chestnut have seeded to a large extent. In most portions, a series of thinnings and damage cuttings will be carried out, followed by planting of conifers. Group planting with the object of establishing seed trees of more valuable species will be attempted on areas too rocky to be fully restocked by planting.

Selection cuttings will be made in the oak stands, for the present, with tie stock as the principal product. Diseased chestnut will be removed on the stands which are of merchantable size and the areas under-planted with pine to fill the openings. In these selection cuttings, the brush will be lopped and left on the ground. A portion of the area in which the fire damage was the greatest will be cut clear and planted. Permanent sample plots have been established on this compartment, which will necessitate the handling of these tracts for a time as maintenance of the experiments requires.

COMPARTMENT 4.

Compartment 4 extends south from Compartment 3 in a narrow tract and is only separated from the latter compartment because it forms a separate logging unit. It lies along both sides of a small stream which drains to the south and west. The northern portion of 4 occupies the divide between this stream and that which crosses 3 from the south. This divide has a number of ledge outcrops with a relatively shallow soil. The intermediate benches have medium to deep soil but the stream beds have numerous boulders and less depth of soil. The slopes on the north side are gradual but those on the south tend to be steep.

An abandoned highway crosses from southwest to northeast which at present is used entirely as a wood road. The fire which burned a number of hundred acres of woodland in the spring of 1913 crossed this compartment but only burned the area north of this road. On the burned area the humus and litter conditions are poor. South of the road the humus is medium to deep with good forest litter. The greatest fire danger is to that portion of the compartment which is south of the highway, as in this direction there is a long, unbroken stretch of woodland.

The ridges are forested with scarlet oak and inferior quality chestnut, with chestnut and red oak on the benches. The bottom-land has tulip, maple, oak, hickory and chestnut. A few scattering pine seed trees occur on this area with very good pine reproduction under the hardwoods as a result. This compartment has a direct road to the river and material taken out will be hauled over it. For the present the area will be left as it is, but in the 5-10 year period thinnings will possibly be made to secure natural reproduction of pine, tulip, ash and oak. Under-planting will be required in some situations.

COMPARTMENT 5.

This compartment extends west from Compartment 3 and lies along a low ridge south of the reservoir. It drains both into the reservoir and into the brook below the dam. The slopes are gentle, with deep, fine soil over a large part. Boulders and rock outcrops only appear along the south side in a limited area. As there have been no recent fires in this compartment, good humus is found over the greater part of it. There is a series of very good springs along the foot of the slope near the east edge. At least one of these springs will be cleaned out and developed as a water supply for fire protection. The area is protected on the north by the reservoir and on the west by open land, but toward the south and east there is more or less fire risk.

Logging on this area will be to the highway near the reservoir, or to a cross road west of it. Much of the land has been cut over within the last few years and will be left to grow naturally for the present. Thinnings with under-plantings may be made on the eastern sub-compartments later. Portions of the chestnut stands were thinned a number of years ago. Dense brush occurs in the openings and in swamp areas, but this will be shaded out by future tree growth. Chestnut and oak form the largest portion of the stand, but maple, tulip, ash and hickory occur on suitable sites. Natural reproduction of the more valuable species will be secured where possible.

DESCRIPTION OF SUB-COMPARTMENTS.

Sub-Compartment 1A comprises 19.1 acres chestnut and oak type. Soil medium depth and fine. Three age classes represented. 31-40 year class is in good growing condition, and is a typical mixture of chestnut and oak on the flats, with the percentage of oak increasing on the ridges. 11-20 and 1-10 year classes are chestnut and oak sprouts, much diseased. A portion of the stand has been thinned for sample plots. Damage cuttings have removed the diseased chestnut. To be clear-cut and planted when 11-20 year class reaches merchantable size.

Sub-Compartment 1B comprises 27.8 acres mixed hardwoods. Soil moist and rocky. Four age classes represented but with same general form. Mixture is maple, birch, oak, tulip, ash and elm. The stand is in good growing condition but the older age classes have been slightly culled. Originally clear-cut and later culled, very little chestnut being left. To be clear-cut and planted in the 5-10 year period, leaving tulip reproduction and seed trees.

Sub-Compartment 1C comprises 28.4 acres chestnut type. Soil deep and fine. Four age classes represented. The south portion is even-aged tie and pole size chestnut, very little diseased. The remainder has been culled, leaving a more or less uneven stand containing much diseased chestnut. Stand has been culled and damage cuttings have removed a large part of the chestnut except the older age class. To be clear-cut and planted when the market conditions warrant cutting of chestnut.

Sub-Compartment 1D comprises 13.2 acres of chestnut and oak type. Soil is fair to medium in depth. Two age classes are represented. Dense chestnut and oak coppice with oak of fair growth and chestnut much diseased. Stand was clear-cut. Will be left for 10-15 years when present stand will be removed, planting with pine.

Sub-Compartment 1E comprises 16.9 acres of chestnut and oak type. Soil is shallow and rocky. Three age classes are represented. 11-20 year class is oak and chestnut, badly diseased and of inferior quality. 21-30 year class culled, with stands of inferior formed trees and poor species. 41-50 year class is coppice, slow-growing and defective. Stand was clear-cut and portion culled. To be clear-cut and planted, leaving oak standards for increased growth.

Sub-Compartment 1F comprises 14.6 acres chestnut and oak type. Soil medium deep and swampy. Two age classes represented, 11-20 year chestnut and oak with tulip, birch and maple in moister places. 31-40 year pole chestnut with good form. Stand was culled. Will be left as it is for next 5-10 years.

Sub-Compartment 1G comprises 28.2 acres pine and spruce type. Soil fine to deep sandy loam. This stand was planted in spring seasons of 1913-14 with red pine, white pine and Norway spruce. Field was originally cultivated, later reverted to forest, then was clear-cut and planted.

Sub-Compartment 1H comprises 10.1 acres chestnut and oak type. Soil is shallow and fine. Stand is 11-20 year oak coppice with scattering clumps of badly diseased chestnut. Some natural pine reproduction. Area was clear-cut. Will be left as it is for 10-15 years and planted at the same time as Sub-Compartment 1D.

Sub-Compartment 2A comprises 16 acres of chestnut and oak type. Soil medium deep and rocky. Two age classes of coppice, in fair condition. Area was clear-cut. To be left for 15-20 years, then clear-cut and planted.

Sub-Compartment 2B comprises 20.1 acres chestnut and oak type. Soil is medium deep and moist. Three age classes are represented. This stand will be cut during the winter of 1913-14, and planted with pine in 1915.

Sub-Compartment 2C comprises 20.1 acres chestnut and oak type. Soil medium to deep. Three age classes are represented. 1-10 year class clear-cut with much slash remaining. The 11-20 year class is coppice with scattering over-story. Many-aged class culled; a mixed stand, birch, hickory and oak. Area has been logged, leaving the culled trees. To be clear-cut and planted.

Sub-Compartment 2D comprises 17.8 acres pine. Soil deep and moist. There are two plantations, one six and the other three years old. The older plantation is white pine, the younger white and red mixed. Area was cleared of timber before planting.

Sub-Compartment 2E comprises 30.6 acres chestnut and oak. Soil shallow and dry. Two age classes represented. 11-20 year ridge type of slow growth but in fair condition. 31-40 year class is on lower slope and of slightly open growth. Some natural pine reproduction. Stand to be cut when merchantable and area replanted.

Sub-Compartment 2F comprises 22.5 acres chestnut and oak. Soil is medium to deep. Present stand 1-10 year coppice, much brush on ground. Clear-cut two years ago. To be left until underbrush is smothered, then clear and plant.

Sub-Compartment 2G comprises 29.5 acres mixed hardwoods. Soil is deep and moist. Four age classes are represented. 1-10 and 11-20 year classes are small, dense coppice of inferior species. 21-30 year chestnut and oak with tulip and ash. 31-40 year swamp hardwoods of value only as cordwood. The better species have been clear-cut. To be cleared and planted within five years.

Sub-Compartment 2H comprises 30.4 acres chestnut and oak. Soil medium to deep. Four age classes are represented. 1-10 and 11-20 year classes are of inferior species with much underbrush. 21-30 year class and many-aged stands are chestnut and oak in which the chestnut is badly diseased. Formerly clear-cut or culled. To be cleared and planted.

Sub-Compartment 2I comprises 31 acres chestnut and oak. Soil medium to shallow. Three age classes represented. 11-20 year class in fair condition with large percentage of oak. 21-30 and 31-40 year classes are in fair condition but of slow growth with large percentage of oak. Area was clear-cut and coaled. To be cleared and planted in 10-15 year period.

Sub-Compartment 2J comprises 52.9 acres chestnut and oak. Soil shallow and rocky. Three age classes represented. 11-20 year chestnut and oak coppice, fair condition, slow growth. 31-40 year chestnut and oak, dense but small size. Many-aged chestnut and oak culled, leaving over-mature trees more or less decayed. Area was clear-cut in the even-aged stands, remainder being culled for tie material. Selection system to be used at present, but to be replanted eventually.

Sub-Compartment 2K comprises 47.8 acres oak. Soil medium to shallow. Four age classes represented. In fair condition. Scattering chestnut badly diseased. Portion has been thinned, leaving almost pure oak. Area has been clear-cut, thinned and a portion culled. To be cut clear during 5-10 year period and planted.

Sub-Compartment 2L comprises 34 acres chestnut and oak. Soil fine, deep and moist. Two age classes represented. 21-30 year class is mixed stand of hickory, chestnut, oak, tulip, ash, maple and birch. Very rapid growing. 31-40 year chestnut and oak. Disease has changed this stand from pure chestnut into chestnut and oak type. Area was formerly clear-cut and culled. To be cut, leaving tulip and ash, and planted to pine and hardwoods during next five years.

Sub-Compartment 2M comprises 12.9 acres chestnut and oak type. Soil is medium to deep. One age class, 31-40 years. Stand of chestnut, oak and tulip. Formerly clear-cut. To be thinned if condition of chestnut warrants; otherwise clear-cut.

Sub-Compartment 2N comprises 51.8 acres oak type. Soil is shallow with many ledges. Two age classes represented. 11-20 year class on the best soil is largely oak, making good growth. Remainder of stand is over 70 years of age and is in poor condition. Has been culled for ties. To be handled by selection system.

Sub-Compartment 3A comprises 3 acres chestnut and oak type. Soil is deep. Three age classes represented. Present stand consists of chestnut, oak, birch and pine. A portion of stand is tie size, many trees being diseased. A few pine seed trees on this area are rapidly restocking the northwest portion with natural seedlings. Area formerly clear-cut and a portion cultivated. Damage cutting to be made removing diseased chestnut, followed by pine planting in openings.

Sub-Compartment 3B comprises 14.6 acres old field, originally cleared and used as a pasture. Soil is deep. Scattering chestnut, birch, maple and cedar have seeded in. To be planted with pine.

Sub-Compartment 3C comprises 26.5 acres mixed hardwoods. Soil is medium to deep and moist. Three ages represented. 21-30 year class has largest area; dense stand of good form. 11-20 year and many-aged classes are also represented. A few standards are scattered over the area. This area has been logged and coaled. To be thinned and handled by selection system with group planting.

Sub-Compartment 3D comprises 36.6 acres chestnut and oak type. Soil is medium to shallow, rocky. Four age classes are represented; all chestnut and oak coppice, good form, even-aged, with a few scattering trees left over from previous rotation. Formerly clear-cut. Will eventually be clear-cut and replanted.

Sub-Compartment 3E comprises 23.6 acres mixed hardwoods. Soil is shallow, rocky and moist. Three age classes represented. Many-aged class containing maple, birch and oak is of northern hardwood type. Formerly clear-cut. To be handled by selection system with group planting and natural reproduction.

Sub-Compartment 3F comprises 95.1 acres oak type. Soil medium to shallow, rocky. Three age classes are represented. Present stand of oak, chestnut, tulip, beech, birch, maple, hickory and ash is of slow growth with much inferior material. Has been culled and logged, slower growing oaks being left. To be handled by the selection system with group planting of conifers in openings.

Sub-Compartment 3G comprises 36.5 acres oak. Soil medium to shallow. Two age classes represented. Chestnut and oak coppice under 20 years of age. Fire damage in spring of 1913. Has been clear-cut and culled. To be cleared and planted.

Sub-Compartment 4A comprises 41.6 acres chestnut and oak type. Soil shallow, rocky. Four age classes are represented. Main part of stand is oak with scattering chestnut. Formerly cut for cordwood and coal. Burned over in 1913 without killing the trees. Some pine reproduction. To be cut so as to favor pine where possible, during 10-15 year period.

Sub-Compartment 4B comprises 12.9 acres mixed hardwoods. Soil moist, rocky. Three age classes from 31-40 years to many aged represented. Stands consist of hickory, tulip, maple, ash, oak and chestnut. Good form and mature. Area will be handled to secure natural regeneration.

Sub-Compartment 4C comprises 10.6 acres chestnut and oak type. Soil medium to shallow. Two age classes represented. 1-10 and 41-50 years; chestnut and oak of inferior growth. Has been culled for ties and poles. To be left until merchantable.

Sub-Compartment 5A comprises 6.6 acres chestnut and oak. Soil medium to deep. Two age classes represented. 11-20 year chestnut and oak, medium growth, fair condition. 61-70 year mature chestnut and oak. Formerly cut for wood. To be planted when cleared after 11-20 year class becomes merchantable.

Sub-Compartment 5B comprises 10.1 acres mixed hardwoods. Soil deep and moist. Two age classes represented. 11-20 year dense, much brush, fairly rapid growth. 61-70 year over-mature ash, maple, tulip, hickory, oak and chestnut. Formerly clear-cut. To be held until 11-20 year class is merchantable and then plant.

Sub-Compartment 5C comprises 56.9 acres chestnut and oak. Soil medium to deep. Four age classes represented. Chestnut and oak coppice of different ages but same form; fairly rapid growth. Very little disease. Formerly clear-cut. A portion of the 21-30 year class thinned very heavily for increased growth. To be replanted at the end of the rotation.

Sub-Compartment 5D comprises 25.4 acres mixed hardwoods. Soil moist and deep. Three age classes represented. Larger portion is dense stand of inferior species 1-10 years old. 11-20 year class is similar but slightly older. 51-60 year class mature birch, maple, tulip and ash. This area was logged and coaled. To be clear-cut and planted when the 1-10 year class becomes merchantable. 51-60 year class to be thinned for natural reproduction.

Sub-Compartment 5E comprises 27.6 acres chestnut and oak. Soil medium to deep. Two age classes represented. 1-10 year class over-mature when cut with no coppice resulting. Inferior species seeding in. 11-20 year class chestnut and oak coppice, fair growth, very dense. Formerly logged and cordwood removed. To be clear-cut and replanted when merchantable.

Sub-Compartment 5F comprises 16.9 acres mixed hardwoods. Soil medium to deep. Two age classes represented. 11-20 and 21-30 years. The stands consist of oak, chestnut, maple, tulip and hickory. Very rapid growing. Was cut for cordwood. Reproduction cuttings favoring ash, tulip and oak will be made.

FOREST FIRES IN CONNECTICUT DURING 1913.

TABLE I.—SUMMARY BY COUNTIES.

County.	Total No. fires.	Causes. Unknown.	Railroad.	Careless.	Incendiary.	Fireworks.	Brush burning.	Acres burned.	Estimated damage to standing timber.	Estimated damage to forest products and buildings.	Cost of fighting.	Cost of protection.
Fairfield	63	28	25	9	1	...	...	2,851	$ 6,411.00	$ 453.00	$ 589.99	$194.75
Hartford	132	45	44	30	2	4	7	7,211	24,412.00	1,979.50	1,684.85	192.96
Litchfield	152	41	74	24	3	1	9	4,492	11,155.00	199.50	2,241.40	68.14
Middlesex	43	20	16	4	2	...	1	2,934	4,688.00	1,620.00	567.64	134.61
New Haven	87	41	18	16	1	3	8	1,938	2,875.00	240.00	553.59	51.25
New London	42	19	5	16	...	1	1	1,051	1,775.00	1,728.00	330.33	6.20
Tolland	86	33	34	10	6	...	3	2,198	28,625.00	1,524.00	925.36	12.33
Windham	90	18	50	14	1	...	7	1,676	7,718.00	727.00	1,171.91	24.67
TOTAL	695	245	266	123	16	9	36	24,351	$87,659.00	$8,471.00	$8,065.07	$684.91

TABLE II.—NUMBER OF FIRES BY MONTHS.

County.	Total number.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Fairfield	63	0	1	6	24	18	0	2	4	0	0	5	3
Hartford	132	1	0	4	36	25	14	13	21	0	5	11	2
Litchfield	152	1	0	12	43	43	9	15	21	0	2	6	0
Middlesex	43	0	4	5	5	10	1	5	8	0	0	3	2
New Haven	87	0	0	6	34	21	1	9	4	0	0	8	4
New London	42	0	0	1	10	11	1	5	10	0	0	2	2
Tolland	86	1	0	10	28	23	8	5	6	0	1	4	0
Windham	90	0	2	4	32	23	3	10	9	1	0	4	2
TOTAL	695	3	7	48	212	174	37	64	83	1	8	43	15

TABLE III.—NUMBER AND AREA OF FIRES.

	All fires.	Fires less than 100 acres in extent.	Fires 100 or more acres in extent
Number	695	615	50
Total acreage burned	24,352	9,118	15,234
Average acreage per fire	35.2	14.8	306.5

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