State of Connecticut
PUBLIC DOCUMENT No. 24

Forty-first Annual Report

OF

The Connecticut Agricultural Experiment Station

Being the annual report for the year ended October 31

1917

and including Bulletins Nos. 196 to 206

PRINTED BY ORDER OF THE LEGISLATURE

NEW HAVEN
PUBLISHED BY THE STATE
1918

TABLE OF CONTENTS.

CORRECTION.

It is stated on page 167 of Bulletin 200 (being the Food and Drug Report of this Station for 1917), that the Calomel Tablets numbered 11609 were made by the Tailby-Nason Company.

This statement is incorrect and was based on misinformation given to this Station. The name of the manufacturer cannot be ascertained, but the aforesaid company is not responsible for them.

E. H. JENKINS, Director.

Report of the Board of Control

OF

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

To His Excellency, Marcus H. Holcomb, Governor of Connecticut:

As required by law, the Board of Control of The Connecticut Agricultural Experiment Station herewith respectfully presents its annual report for the year ended October 31, 1917.

The following minute, adopted by the Board, records the death of one of its members:

Professor H. W. Conn, for ten years a member and the vice-president of the Board of Control of this Station, died at his home in Middletown, Connecticut, April 18, 1917.

Professor Conn was the professor of biology in Wesleyan University and the director of the State Board of Health Laboratory, which he organized in 1905 and of which he continued to be the director until the time of his death.

Perhaps his highest public service was rendered by his studies on milk and its various preparations, from the standpoint of the sanitarian and the humanitarian. He was especially interested in all means of protecting infant life by reasonable control of the milk supply, and gave time and talents without reserve to the work. In 1911 he was appointed by the New York Milk Committee as a member of the National Commission on Milk Standards and retained that position as long as he lived.

The members of this Board desire to place on its records their appreciation of Dr. Conn's faithful and efficient service as a member of their organization, and their recognition of the wider public service which he rendered to the State and to the whole country as a specialist whose interests were not bounded by his laboratory but embraced the every-day needs of the whole community, with a special regard to the most needy and helpless portion of it.

Legislation Affecting the Station.

The General Assembly, at its last session, increased the biennial appropriation to the Station for current expenses by $2500 and to the State Entomologist by $4000.

It also appropriated $40,000 for the suppression of the gipsy and brown-tail moths and for inspection of imported nursery stock, $15,000 for the control of the white-pine blister rust, $5,000 for the purchase of land for State forests, and $9,000 for the Forest Fire Warden service.

A special appropriation of $28,000 was also made to the Station for the building of a heating plant.

The General Assembly also added considerably to the duties of the Station by the following Acts:

Chapter 23 provides that the Director shall have charge of all matters pertaining to the official control of insects or diseases which are, or threaten to be, serious pests, and gives him power, with approval of the governor, to make rules for the destruction of infested stock and to prohibit or regulate transportation of plants which may carry dangerous pests. He may also establish quarantines against other States or section of this State, after giving a public hearing on the matter.

Chapter 262 authorizes the Director to investigate and control the white-pine blister rust or currant rust and to destroy all pines, gooseberries, or currants infected with the disease. He may designate districts within which all wild species which are liable to infection may be destroyed.

Chapter 402 amends Chapter 264 of the Acts of 1915 and places the work of drainage of marshes for mosquito elimination in charge of the Director, wherever the State is to bear a share of the expense. It provides for due notice in advance to property owners whose land is to be ditched, for hearings in case of grievance, for assessment of benefits and damages, etc. It further provides that the Director shall maintain and keep in repair ditches, tide-gates, etc., which have been constructed hitherto with his approval, the State paying one-fourth and the town or borough three-fourths of this expense.

A special law also required the Director to assess damages resulting from the ditching of marsh land with each of eight citizens of Branford who made a claim to the Assembly for

damages. In case of disagreement, an arbitrator was to be appointed and the decision of two of the three was to be final. One-half of any assessed damage was to be paid by the State and one-half by the town of Branford.

The work on the suppression of the gipsy and brown-tail moths, on the inspection of imported nursery stock, and on the control of the white-pine blister rust will be reported by those members of the staff to whom the work was assigned, when the entire work of the calendar year is completed.

The Act providing for a heating plant did not make the appropriation available until October 1, 1917, which exposed us to the danger of being obliged to close the institution at any time during the winter when our worn-out heater might give out completely.

Arrangement was finally made by which we were able to begin construction on July 8th. Various delays in the work will make it impossible to provide heat until the latter part of November. This results in much discomfort and a large expense for heating with gas, but we hope with no other material loss.

The new building is a one-story structure of brick and concrete, provided with a coal capacity of 180 tons and an 88 horse-power tubular boiler which supplies heat to all the Station buildings, the condensed water returning by gravity.

Under the powers granted by Chapter 23, it has not yet been necessary for the Director to order destruction of stock or establish quarantines of any kind.

Under the provisions of Chapter 262, the Director appointed Dr. Britton to have charge of the fall inspection of pines and *ribes* in all nurseries and to help, as far as possible, in the spring inspection; Dr. Clinton to have entire charge of all botanical studies relating to the nature and spread of the pine blister rust, and Mr. Stoddard to work under his direction on botanical studies; Mr. Filley to have charge of the work of scouting and destroying the blister rust and to employ the necessary laborers, with the assistance of Mr. Moss. Mr. Filley also kept the accounts of all expenses incurred in the work.

Under the requirements of Chapter 402, the director had to supervise during the summer both the ditching and other work of mosquito elimination on 600 acres of salt marsh, and the clearing and maintenance of ditches and culverts on 4108 acres of marsh previously drained.

As authorized by law, Mr. B. H. Walden was appointed the director's deputy to take immediate charge of the work. The law was not effective until May 16, 1917, by which time much of the spring clearing should have been done. It was extremely difficult to get labor of any kind to do the necessary work and almost impossible to get efficient labor. There was also much delay and added difficulty with labor because the work cannot be carried on steadily to a conclusion but has to be suspended during certain perigee tides.

Under such conditions work was greatly delayed and much not wholly unreasonable irritation developed among marsh-owners, because of the trampling of marsh grass by the workers, which would have been avoided if the work could have been seasonably finished.

Finally, the special Act above referred to made necessary an examination of eight different tracts of land in company with their owners, and considerable correspondence and conference. This having proved ineffective, an arbitrator was agreed upon at the last moment, all the tracts were again examined, damages were fixed by the agreement of the arbitrator and the owner of the land, and within the prescribed time the findings were filed by the Director with the Superior Court.

The Commission of Public Health, acting for the Board of Health Council, finding it desirable to locate in New Haven the Bureau of Laboratories of the Council, and having asked whether it would be possible for the Station to provide adequate quarters, this board arranged to give the Council, for a nominal rental, the use of the first floor and basement of what was formerly the botanical laboratory building. The Bureau of Laboratories took possession on September first. The arrangement is proving to be mutually satisfactory.

As the work of the different departments, so far as ready for publication, will be described in the forthcoming bulletins, we give here only a brief summary of the work of each.

Botany.

Dr. Clinton in Charge.

The principal projects have been: Studies of the effects of various fungicides on fungous diseases, and their injurious action, if any, on peaches and apples; the effect of different

fertilizers on the health, longevity and production of peach trees; a study of the nature and methods of spread of peach yellows; control of black rust of cherry; selection and spraying experiments with muskmelons; effects of different fertilizers on the diseases of certain vegetables; special studies of downy mildew and certain heteroeceous rusts.

Special studies of the white-pine blister rust have occupied much of the time of this department.

Studies of the causes and prevention of the partial failure of tobacco crops on certain areas in tobacco plantations have been continued.

This department has also co-operated with the County Farm Bureau in demonstrations of potato spraying.

Chemistry.

Mr. Street in Charge.

The work required by Statute has involved examination of 595 fertilizers, 259 feeds, 675 farm products, 1350 foods and drugs, and 1412 pieces of Babcock glassware. Expert evidence in court has been required in 7 cases. Some co-operative work has been done on analytical methods.

The chemist in charge has also been called upon for much public service, because of his experience in matters relating to food control. Thus, he is serving as a member of the National Committee to establish food definitions and standards, of the Committee on Revision of Analytical Methods of the American Association of Official Agricultural Chemists, as chairman of the Committee of the American Public Health Association on Nostrums, and as expert of the American Medical Association on diabetic foods. During the year he has prepared a book on The Composition of Certain Patent and Proprietary Medicines, published by the American Medical Association.

Entomology.

Dr. Britton in Charge.

The inspections required examination of 84 nurseries covering 1461 acres of land planted to nursery stock, 682 cases of imported stock, and 473 apiaries containing 4506 colonies.

The work on suppression of the gipsy moth has been actively carried on through the year. 6182 egg masses have been found and destroyed, more than 17,000 trees banded, 37,800 larvae found and destroyed, and 91 of the worst infestations sprayed with lead arsenate.

The mosquito control work, to which reference has been made, was in immediate charge of Dr. Britton's assistant, Mr. Walden.

A study of the very destructive European pine sawfly has been made and the results have been prepared for publication. Means have been devised for destroying a subtropical cockroach which was ruining roses and Easter lilies in one of the large greenhouses of the State. Various studies of other insects of economic importance are being made.

The Hymenoptera of Connecticut (Bulletin 22 of the Connecticut State Geological and Natural History Survey), a volume of 824 pages, 15 text figures and 10 plates, prepared by a number of contributors, under the direction of Dr. Britton, has been issued.

A check list of Connecticut Insects has been prepared by Dr. Britton and awaits publication.

Considerable progress has been made also on the Hemiptera of Connecticut, under Dr. Britton's direction. Even where written by other authors, these publications involve much work by the staff in preparing plates, indexing, proof-reading and typing.

Forestry.

Mr. Filley in Charge.

From the Mount Carmel grounds about 43,500 pine transplants have been supplied to the State forests.

About 52,000 two- and three-year old transplants are ready for setting next spring.

Observations have been begun on the pine stands of A. D. Bridge Sons Co., of Hazardville, to determine if possible the cause of the increasing weakness of mature trees, shown in loss of needles and ultimate death of the trees.

The work on the white-pine blister rust required the attention of the Forester for most of the spring and summer. During May

and June eight men scouted sixty-eight pine plantations, covering 1100 acres. During July and August seven men scouted the State for infected *ribes*, in an endeavor to find by this means infected pines. As a result, eighteen pine infections were discovered.

In 35 towns, most of them east of the Connecticut River, *ribes* infections were found, but no serious pine infection, except at Pomfret.

In the region about Norfolk the native pine is most seriously threatened. Here, in the last two years, the gangs of men employed by Mr. Filley have endeavored to destroy all *ribes* on an area of 4300 acres. In addition, 600 acres were scouted for infection on pine. This is more expensive and probably less effective than work on *ribes*.

It is clear that on such badly infected areas a large proportion of the work of eradication must be done by private owners, with such co-operation as the State can supply.

A bulletin on the blister rust has been prepared, but, owing to difficulty in getting it approved by the Bureau of Plant Industry, under the co-operative agreement, its publication is postponed.

Plant Breeding.

Mr. Jones in Charge.

The investigations on the laws of inheritance in maize and tobacco, which have been carried on for years and which have contributed much of value to our knowledge of these laws, are still continued, being supported by the Federal grant made exclusively for research work.

The production of improved varieties of tobacco, by the crossing of good varieties and continued selection from their offspring, has now fixed several selections which are to be finally tested as to their merits by growing them on a considerable scale.

Of more immediate practical interest are the co-operative tests of the most promising corn varieties, made at Storrs and at Mount Carmel. These have now yielded results which justify recommendations to farmers, regarding choice of varieties for planting in 1918 and regarding sources of seed.

Protein Research.

Dr. Osborne in Charge.

The Station's support of this work comes from the Federal research fund, known as the Adams Fund, but because of the value of the work, the Carnegie institution has for years contributed generously to its support.

The scope and results of this investigation cannot here be adequately set forth. It is enough to say that it is a fundamental study of nutrition, specially in relation to the efficiency of the protein components of food. The results are being published in technical journals, and it is intended shortly to issue a bulletin giving a popular account of some of the facts regarding feeding which these investigations have established.

Some further idea of the Station's work may be gathered from the following statistics:

Number of letters written	9,898
Public addresses	79
Papers in scientific journals	15
Papers in other journals	15
Specimens of insects and fungi identified for inquirers	485
Specimens added to herbarium	656
Samples of seed tested	112

The annual field meeting was held, as usual, at the Mount Carmel farm, on August 21, 1917, and brought together between four hundred and five hundred people. This experiment field which is used by all departments, has proved to be of very great service and is efficiently managed by Mr. Hubbell.

Changes in the Station Staff.

Mr. H. F. Huber, the vegetable expert, resigned on March 1, 1917, to take a position in New Jersey. Mr. W. C. Pelton has been appointed in his place and will shortly enter on his work here.

Miss Florence McCormick was appointed as botanical assistant, to be principally employed in studies of the pine blister rust, and began her work here in May, 1917.

Mr. Waldo L. Adams was engaged as assistant chemist on May 1, 1917.

Mr. M. D'Esopo was engaged as assistant chemist on April 19, 1917.

Publications.

During the time covered by this report the Station has issued four bulletins of the regular series and one bulletin of immediate information, aggregating 62 pages, with 26 figures and plates, and the annual report of 472 pages, with 20 plates.

All of which is respectfully submitted.

George A. Hopson,
Secretary.

New Haven, Conn., Oct. 31, 1917.

REPORT OF THE TREASURER, 1917.

E. H. JENKINS, in account with THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION for the fiscal year ended September 30, 1917.

RECEIPTS.

Balance on hand, October 1, 1916 (Analysis Fees)		$199.27
State Appropriation (Agriculture)	$17,500.00	
State Appropriation (Food)	2,500.00	
State Appropriation (Insect Pest)	4,000.00	
United States Appropriation (Hatch)	7,500.00	
United States Appropriation (Adams)	7,500.00	
Analysis Fees	9,197.25	
Sale of Automobile to State Forester	125.00	
Connecticut Agricultural College	600.00	
Miscellaneous Receipts	163.81	
Lockwood Trust Income (including sale of wood and Mt. Carmel Farm produce, $1,710.05)	10,910.05	
		$59,996.11
		$60,195.38

DISBURSEMENTS.

E. H. Jenkins, director, salary	$2,800.00
E. H. Jenkins, treasurer, "	400.00
V. E. Cole, salary	1,018.51
L. M. Brautlecht "	613.50
J. P. Street, "	2,600.00
T. B. Osborne, "	2,400.00
E. M. Bailey, "	1,845.00
C. B. Morison, "	1,435.00
C. E. Shepard, "	1,127.50
W. E. Britton, "	2,600.00
G. P. Clinton, "	2,600.00
E. M. Stoddard, "	1,487.50
W. O. Filley, "	2,400.00
A. E. Moss, "	1,825.00
E. L. Ferry, "	1,320.00
H. F. Huber, "	625.00
D. F. Jones, "	1,537.50
W. L. Adams, "	541.67
Michael D'Esopo, "	402.78
B. H. Walden, "	125.00
A. J. Wakeman, "	208.33
C. S. Leavenworth, "	116.66
Florence McCormick, "	409.88

Hugo Lange, salary	$971.25	
V. L. Churchill, "	997.50	
William Veitch, "	735.00	
Etta L. Avery, "	504.00	
C. D. Hubbell, "	840.00	
G. E. Graham, "	892.50	
L. S. Nolan, "	90.00	
Mrs. L. D. Kelsey	441.00	
Henry Kiley	819.00	
Frank Sheldon	819.00	
O. J. Welch	819.00	
T. F. Barrows	478.50	
Joseph Leschke	425.00	
Labor	3,990.82	
Publications	1,157.39	
Postage	278.25	
Stationery	410.88	
Telephone and Telegraph	182.45	
Freight and Express	165.90	
Gas, Electricity and Kerosene	894.18	
Coal	410.90	
Water	120.20	
Chemicals and Laboratory Supplies	1,154.85	
Agricultural and Horticultural Supplies	150.81	
Miscellaneous Supplies	741.02	
Fertilizers	950.85	
Feeding Stuffs	413.01	
Library and Periodicals	559.86	
Tools, Machinery and Appliances	1,146.97	
Furniture and Fixtures	399.22	
Scientific Apparatus	332.41	
Live Stock	2.50	
Traveling by the Board	284.39	
Traveling by the Staff	1,000.77	
Gasoline for Automobiles	321.41	
Traveling in connection with Adams Fund Investigations	125.67	
Insurance	638.78	
Insect Pest Appropriation to State Entomologist	4,000.00	
Contingent	254.99	
New Buildings	23.73	
Betterments	150.66	
Repairs	207.82	
Total Disbursements		$59,741.27
Balance on hand, Sept. 30, 1917 (Analysis Fees)		454.11
		$60,195.38

NEW HAVEN, CONN., Oct. 24, 1917.

THIS IS TO CERTIFY that we have audited the accounts of Mr. E. H. Jenkins, Treasurer of The Connecticut Agricultural Experiment Station, for the fiscal year ending September 30th, 1917, and have found them correct.

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

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 196 NOVEMBER, 1917

ECONOMY IN FEEDING THE FAMILY

I

Some Essential Facts Regarding Nutrition

By JOHN PHILLIPS STREET and E. H. JENKINS

CONTENTS

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

OFFICERS AND STAFF.

BOARD OF CONTROL.

His Excellency, Marcus H. Holcomb, *ex-officio, President.*

James H. Webb, *Vice President*.....Hamden
George A. Hopson, *Secretary*.....Wallingford
E. H. Jenkins, *Director and Treasurer*.....New Haven
Joseph W. Alsop.....Avon
Wilson H. Lee.....Orange
Frank H. Stadtmueller.....Elmwood

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Protein Research.	T. B. Osborne, Ph.D., D.Sc., *Chemist in Charge.* Miss E. L. Ferry, M.S., *Assistant.*
Botany.	G. P. Clinton, Sc.D., *Botanist.* E. M. Stoddard, B.S., *Assistant Botanist.* Florence A. McCormick, Ph.D., *Scientific Assistant.* G. E. Graham, *General Assistant.*
Entomology.	W. E. Britton, Ph.D., *Entomologist; State Entomologist.* B. H. Walden, B.Agr., *First Assistant.* Q. S. Lowry, B.Sc., I. W. Davis, B.Sc., } *Assistants.* M. P. Zappe, B.S., Miss G. A. Foote, B.A., *Stenographer.*
Forestry.	Walter O. Filley, *Forester; also State Forester and State Forest Fire Warden.* A. E. Moss, M.F., *Assistant State and Station Forester.* Miss E. L. Avery, *Stenographer.*
Plant Breeding.	Donald F. Jones, M.S., *Plant Breeder.* C. D. Hubbell, *Assistant.*
Vegetable Growing.	W. C. Pelton.

Economy in Feeding the Family.

This country is at war for the defense, both of our civil institutions and of our public and private property. It is a war which will be decided not, like most previous wars, by generals and armed men alone, but by the great home army of producers and savers. Its outcome depends largely on efficient production on the farm and self-denial in the home.

For the first time in our history the food supply of the country is not sufficient to meet the demands for it and those in authority call on the whole population to reduce to the utmost their use of wheat, beef, pork, sugar and animal fats.

This reduction is quite possible if done reasonably. A sudden and very radical change of diet, however, if not wisely made, may result in harm to many individuals.

It is most urgent that those who provide the food of families should have a clearer understanding of the principles of nutrition, of the amount of food necessary for health and efficiency and of the most economical methods of buying and preparing food. At present, there is much more thought, care and skill shown in selecting the rations of dairy stock and swine than in selecting the rations for human beings.

This and the following bulletins are meant to help in the diffusion of this necessary knowledge. We are aware that the same ground has been covered in many respects more fully and adequately in various books, but the fact that these are not so likely, as are our station bulletins, to reach the families of this state justifies our attempt.

There is also much work of our own station which is directly useful at this time and will here be noticed. This was one of the first of the stations to undertake the examination of foods. For many years its chemical department has been engaged in their analysis and in finding and exposing inferior and adulterated foods.

The researches of Osborne conducted here for many years on the constitution of the protein bodies and the later studies of Osborne and Mendel on animal nutrition have shown that many former assumptions regarding the role of proteins in food were far from the truth and have prepared the way for a great advance in the economy of feeding particularly in the use of proteins.

Preliminary to any comparison of different kinds of food material, a brief statement is needed regarding

The Uses of Food.

Food has two distinct uses. It builds the body up to its adult size and from day to day repairs the wear and tear which life involves; for the body is a machine which only can be repaired while it is running and when it stops can never be started.

Food is the Builder and Repairer.

The other use of food is to furnish power sufficient to run this machine at the required rate of speed. Food is the fuel which gives power to the body, just as coal is the fuel which gives power to the steam engine.

Food is the source of all the body's Energy.

The Chemical Composition of Food.

The nutriment in human food chiefly consists of proteins, carbohydrates, fats and mineral matters along with certain unidentified bodies (vitamines) which are present in very small amounts but are of great importance. Most foods also contain water and vegetable foods contain woody fiber besides, which has no nutritive value for human beings.

Proteins, of which the white of eggs, the curd of milk and gluten of wheat are types, are very complex substances, each being an aggregation of fifteen or more complex bodies (amino-acids) all of them containing nitrogen as a characteristic ingredient, so that foods which contain much protein are commonly called nitrogenous foods. Such foods are fish, eggs and meats of all kinds. Protein is also an important ingredient of milk and with fat makes up most of the substance of cheese.

Important sources of protein are poultry, fish, eggs, milk, cheese, dried beans and dried peas.

It appears that the animal proteins, poultry, fish, eggs and milk, are more valuable as food than those of vegetables and among the vegetables themselves there are great differences. For this reason *milk or meat, in moderate quantities, should make a part of the daily ration, especially that of children.*

Fats scarcely need definition. *Butter, oleomargarine, lard and vegetable oils consist chiefly of fats; and cream, milk, cheese, and certain fish, like salmon, are rich in fat.* Fats are a more costly part of the ration than the other group of energy producers, the carbohydrates.

Carbohydrates are compounds of carbon, hydrogen and oxygen. Common examples are starch and sugar. While there are other carbohydrates than these, starch and sugar make up the bulk of the carbohydrates in human food.

Rice, potatoes, bread, macaroni and corn are all important sources of carbohydrates. They contain protein and fat as well, but their main constituent is starch.

Mineral matters, or ash, are such things as salt, phosphates, etc., which are found in most foods in small amount and which remain as ashes if the food is completely burned. They are necessary to the body, but in a mixed diet rarely need consideration.

"It is evident," says Lusk, "that the science of nutrition includes something more than the production of energy from fats, carbohydrates and protein. There must be certain salts and certain qualities of protein in the diet and there must be minute quantities of vitamines."

Concerning vitamines we have not yet very certain knowledge, but that they are growth-promoting substances and necessary in food seems certain. In a mixed diet containing both animal and vegetable food, probably vitamines are never deficient.

The Special Uses of the Proteins, Carbohydrates and Fats of the Food.

Proteins: To meet the first named use of food; namely, to build and repair the body, is the chief use of the proteins. They are the flesh builders. No other food ingredient can take their place.

One-fifth of the water-free substance of an active man consists of body proteins which are built and repaired from the proteins of the food.

An adult at very moderate work must have for his support at least 75 grams or 2¾ ounces of protein daily.

To meet the second requirement; namely, to supply the power and heat on which life and ability to work depend, is the chief use of the fat and carbohydrates, though the proteins may join in this work when supplied in excess.

Power and heat are produced in the body in the same way as in the furnace of a steam boiler; namely, by the combustion of fuel. Fat, sugar, starch, etc., are chiefly used for fuel. They are burned in the body, forming carbonic acid and water, which are given off in the breath or through the skin and kidneys: But in the process energy is developed which shows itself in forms of work—the unconscious work of the heart and of the muscles which control breathing and do the other housework of the body —as well as in conscious work of all kinds. Incidentally much more than enough heat is produced to keep the body temperature at about 98°F.

Just as coal in the steam engine is burned chiefly to furnish power to the machinery, so food is burned to do the work of the body.

When eaten in quantity more than sufficient to supply energy the fats may also take part in the formation of body fats which serve as stored fuel for emergencies.

How the Quantities of Food Ingredients and Their Energy Are Expressed.

The quantities of protein, fat and other substances which make up a given article of food can be given in weight, ounces or grams, but are usually given in percentages—that is, in parts per 100.

Energy, however, cannot be directly expressed in terms of weight or per cent. Yet we must have an accurate measure of it in order to state at all accurately the amount of energy which the body needs, or a given food supplies. *This measure of energy is the Calory.*

As the foot is a standard for measuring length, so the calory is a standard for measuring heat energy. *A calory is the quantity of heat required to raise the temperature of a kilogram of water one degree Centigrade (or to raise the temperature of about four pounds of water 1°Fahr.)* This quantity can be very accurately determined in any food by means of an elaborate apparatus called a calorimeter. Many careful experiments with a great number of food ingredients have shown that an ounce of pure protein or of a pure carbohydrate will yield 116 calories or heat units and an ounce of pure fat 264 calories; that is, a given amount of fat has about 2.25 times as much heat value as the same amount of either protein or carbohydrates.

Otherwise stated, one gram of either protein or carbohydrates yields 4.1 calories and one gram of fat yields 9.3. For general use these values may be simplified to 4 and 9.

It appears that proteins and carbohydrates have the same value for energy production, and fats have more than twice this value. The carbohydrates and fat are to a certain extent interchangeable in the diet; that is, in his diet one may get from fat more or less energy, or capacity to do work, according to his taste, or for reasons of economy.

The above explanation will make clear the meaning of the printed analyses of food. For example, the average composition of bread in the Connecticut market as shown by our recent analyses is:

	Per cent. (Parts per 100.)
Water	33.8
Ash	1.4
Protein	9.7
Carbohydrates	53.8
Fat	1.3
	100.0

Calories in 100 grams, 266.

The calories as thus calculated:

Protein and carbohydrates, $[(9.7+53.8)=63.5]\times 4=254.0$.

Fat, $1.3\times 9=11.7$.

Total, 265.7.

To calculate the calories in an ounce, multiply the calories in one gram by 28.4.

How Many Calories Does the Body Need Every Day?

The amount of fuel needed to run any kind of machinery of course depends on the amount of work which it is doing. The same is true of the human being. When more work or harder work is done, more energy, that is, more food, is needed.

It is clear then that the number of calories required in the day's ration varies with the amount of physical exertion. The age, sex and body weight also influence the food requirement. For instance, there are many adults who sit at their work and whose physical exercise is limited to their daily walk to and from work. These require about 2,500 calories daily. Those who chiefly stand during their working hours require 3,000. When the muscular work is constant but not heavy, 3,300 calories. Farmers need 3,500, stone masons and lumberman 4,500 to 5,000, and so on.

The following table summarizes these calory requirements from the standpoint of age and of occupation:

Approximate Number of Calories Required Daily.

Based on Age.		Based on Occupation.	
1 yr.	950	Clerk at desk	2,250
2 yrs.	1,100	Professional man, machinery watcher	2,500
3— 4 yrs.	1,300	Man at light muscular work	2,800
5— 6 yrs.	1,400	Bakers, dentists, shop-keepers, conductors	3,000
7—10 yrs.	1,500	Carpenters, painters	3,300
11—14 yrs.	1,600	Farmers	3,500
15—16 yrs.	2,100	Excavators	4,000
17—18 yrs.	2,250	Stone masons	4,500

A ration may contain, however, the proper number of calories and yet be a very poor ration if the protein, fat and carbohydate are not supplied in proper relative amounts. For instance, 0.7 lb. of butter, or 1.2 lbs. of American cheese, or 1.3 lbs. of sugar, would each yield 2,500 calories, yet it is apparent that none of these foods used alone, even in these amounts, would constitute a proper ration.

The normal man of sedentary habits, or performing light labor, should receive each day 2.6 oz. of protein, 1.8 oz. of fat and from 14 to 18 oz. of carbohydrates, yielding 2,500 calories. In the selection of food these relations must be kept in mind.

The average American dietary contains an excess of protein; that is, *we eat and in the body destroy more protein than the body needs to repair its tissues.* This excess protein has no greater fuel value than so much sugar and starch, and when we remember the difference in cost the great economic waste in this excess consumption of meat and other protein foods is apparent. *A properly constituted ration should contain from one-eighth to one-sixth of its calories in protein.*

A typical ration containing 1,000 calories is given by Lusk as follows:

	Ounces	Calories
Cooked Beans	7⅜	400
Pork	1	234
Bread	2 1-3	180
Butter	½	103
Milk	5	100
Coffee	5	——
Total		1,017

In this ration the protein yields nearly one-sixth of the calories, and the balance is therefore correct. In normal times such a ration would supply one-third the daily need of a man at light work at a cost of 4.25 cents, including the cost of fuel. It shows how cheaply one can supply his body with all of the needed nutriment when normal prices prevail.

How Shall This Knowledge of Calories Be Applied in the Preparation of the Daily Meal?

It would be most fortunate if tables showing the composition of our staple foods could be in every home.* However, even were this the case, many would have great difficulty in making the proper calculations from them.

Gephart and Lusk have greatly simplified this problem. Their extensive study of the standard portions served in a series of chain restaurants in New York City gives us just the data we require. It is quite probable that these portions represent closely

* Such tables by Atwater and Bryant are given in Bulletin 28 of the Office of Experiment Stations.

The tables are also contained in the Report of the Storrs Agricultural Station 1899, p. 111, a limited number of copies of which are available for distribution in this State.

CALORIES YIELDED BY STANDARD PORTIONS OF FOOD.

Food.	Weight of Portions.	Calories in Protein.	Calories Total.
	ozs.		
Apple, baked..	.4	1.4	137.2
" " and cream.....	.8	5.8	393.7
*Bacon, broiled	6.5	70.2	760.8
*Baconandeggs	8.5	**148.1**	818.1
Bananas ,sliced	3.5	5.6	91.5
†Beans, Boston baked.....	9.0	**102.1**	509.4
†Beef, corned beef hash with poached egg.....	6.25	**157.3**	680.0
†Beef, corned beef hash, browned....	7.0	**97.5**	538.3
†Beef, creamed chipped.....	10.0	**160.1**	536.3
†Beef, roast, cold.....	5.5	**155.7**	464.2
†Beef, roast, and mashed potatoes.....	10.5	**141.8**	539.6
Bread and butter, ¾ in. slice 1 tsp. butter	2.75	28.0	202.0
Bread, hot corn	5.5	60.5	474.1
Cakes, wheat, and syrup....	6.5	49.9	476.2
Cantaloupe....	4.5	4.1	37.4
Chicken croquette and French fried potatoes....	6.5	**77.5**	499.7
†Chicken hash.	6.5	**97.1**	468.1
Cocoa.....	9.0	32.9	256.7
†Codfish, creamed, on toast.....	9.5	**155.6**	567.8
Coffee, cup, cream and sugar.....	11.5	27.5	202.9
Corn, stewed..	2.5	7.0	54.5
Corn flakes and milk.....	9.0	**54.7**	237.5
Corn starch with cream...	6.0	27.4	239.3
Crackers, graham.....	2.0	21.4	230.1
Crackers, soda, and milk....	10.5	**71.6**	397.4
Cream.....	8.5	35.5	515.9
Cream of wheat	7.0	**32.9**	135.2
Crullers.....	4.0	46.0	457.0
Custard, cup...	7.0	**53.4**	234.1
Eclair, chocolate.....	2.5	19.2	193.4
†Eggs, boiled (2).....	4.5	**92.8**	391.0
†Eggs, creamed on toast.....	9.0	**146.6**	663.9
†Eggs, fried (2)	6.0	**105.8**	527.8
†Fish cakes and poached egg.	9.0	**129.5**	603.8
†Frankfurts and potato salad.....	10.0	**114.0**	619.8
Grape fruit.....	7.0	6.3	79.0
*Ham, broiled.	9.0	**158.0**	936.7
*Ham and eggs	10.0	**181.9**	842.6
Ice cream, vanilla.....	5.0	21.9	233.7
*Lamb chops (2).....	5.5	**146.5**	852.9
*Liver and bacon.....	9.0	**177.5**	797.2
†Macaroni and cheese.....	9.0	**69.5**	382.8
Maple flakes with milk...	9.0	**64.0**	283.4
Milk.....	16.0	**79.0**	312.8
Muffins, corn..	3.5	35.9	352.3
Oatmeal and cream.....	10.0	47.1	396.3
†Omelet, plain.	6.0	**117.2**	529.5
Oysters, raw...	3.5	**32.0**	64.9
Pie, apple.....	5.0	20.9	343.1
Pie, mince....	6.0	45.9	401.1
Potatoes, French fried.	5.0	31.8	329.8
Pudding, bread custard.....	7.0	**56.8**	371.4
Pudding, rice, cold.....	8.0	**43.6**	275.4
Pudding, apple tapioca.....	8.0	29.4	225.5
Rhubarb, stewed.....	4.0	4.0	95.0
Rice, boiled....	6.0	17.0	135.6
†Salad, crab meat.....	8.5	**140.9**	437.7

CALORIES YIELDED BY STANDARD PORTIONS OF FOOD—Continued.

Food.	Weight of Portions.	Calories in Protein.	Calories Total.
	ozs.		
†Salad, potato.	10.0	50.9	448.3
Sandwich, club	4.5	**111.3**	438.6
" fried egg.	5.0	**59.8**	276.0
" ham.....	2.0	**48.4**	212.1
" roast beef hot.....	3.5	**69.3**	263.9
Sandwich, Swiss cheese.	2.0	**51.5**	258.5
Sausage, country.....	3.0	**57.6**	243.9
Sausage and fried potatoes	6.0	71.5	521.7
Shredded wheat and cream...	6.0	56.4	494.5
Shreddedwheat and milk.....	10.0	**81.2**	404.5
Soup, bean, with croutons	10.5	**42.5**	180.8
†Soup, split pea	9.0	**45.9**	241.1
†Soup, vegetable.....	9.5	35.1	206.1
*Steak, Hamburger.....	10.0	**147.9**	723.8
*Steak, small.	10.0	**237.5**	1032.8
†Stew, beef....	16.5	**148.4**	641.4
†Stew, lamb....	15.0	**146.8**	622.2
Toast, buttered	2.5	42.7	311.3
Toast, milk....	8.0	**59.4**	333.5
Tomatoes, sliced.....	5.0	**6.7**	32.2
Tomatoes, sliced, with lettuce.....	4.5	8.2	52.1
†Veal cutlet and tomato sauce.....	13.0	**177.8**	897.8
Watermelon...	38.0	27.6	244.3

* Potatoes and bread and butter served.

† Bread and butter served.

enough the amounts served in the average home, to be a useful guide in making up rations and in substituting cheaper for more expensive foods.

The foregoing table is an abridgment of their tables, somewhat simplified and recalculated in common terms.‡ The first column gives the food served, an asterisk (*) indicating that bread and butter and potatoes were served with it, and a dagger (†) that bread and butter were served; the second column gives the approximate weight of the portion in ounces; the third column, the calories yielded from the protein in the portion; and the fourth column the total calories yielded.

Two important points must be kept in mind in using this table. A considerable portion of the protein in the ration should come

‡ Anyone interested in the facts which they give will find the full compilation in a pamphlet of 84 pages, Analysis and Cost of Ready-to-Serve Foods, by Gephart and Lusk, published by the American Medical Association, 535 N. Dearborn St., Chicago, Ill.

from animal sources, such as poultry, milk, fish or eggs; and about 15 per cent. of the total calories should be derived from the protein. The name of the dish will generally indicate whether animal protein is present, and in the protein calories column full faced type is used where at least 15 per cent. of the total calories is derived from protein.

To illustrate the practical use of the table: portions of Boston baked beans, chicken croquettes, creamed codfish on toast, two fried eggs (all four served with bread and butter) and cream, wheat cakes with syrup, and crullers, all yield about 500 calories per portion, and approximately five portions of each of these would be necessary to supply the daily requirement of 2,500 calories. These seven foods may be divided into two groups. The first four derive at least 15 per cent. of their calories from protein, and in all but the baked beans this protein is chiefly from an animal source; the last three foods are all deficient in protein. It is obvious, therefore, that cold roast beef, creamed codfish and fried eggs might be interchanged in the daily ration without disturbing the balance and at the same time supplying proper nutriment. In other words, five portions of any of these three foods served with bread and butter would provide sufficient protein and calories for the daily need of a light worker. Five portions of baked beans would not do this, for while the total nutriment would be sufficient, no animal protein would be supplied. Five portions of either cream, or wheat cakes, or crullers, would be unsatisfactory because in each case too little protein would be provided.

Of course, the foregoing illustration is not meant as a suggestion to limit one's daily food to cold roast beef, creamed codfish and fried eggs, served with bread and butter. Such a ration would be adequate, and probably for a limited time might be satisfactory, but personal taste must rule in suggesting modifications of this ration which will increase variety and palatability and which will furnish bulk, a characteristic wanting in many American meals and one most essential to health.

The foregoing table may also be used to determine whether the daily food (ration) is adequate or excessive.

To illustrate, there follows a day's bill of fare of one of the Station staff and the corresponding energy value (calories) as given in the table:

	Calories In Protein.	Total.
Breakfast;		
One cup coffee with cream and sugar	27.5	202.9
One apple	1.4	137.2
Oatmeal and milk	50.2	281.0
One thick slice rye bread and butter	28.0	202.0
Dinner		
Bean soup with croutons	42.5	180.8
Roast beef and mashed potatoes	141.8	539.6
Stewed corn	7.0	54.5
Apple tapioca pudding	29.4	225.5
Supper		
Macaroni and cheese	69.5	382.8
Two slices rye bread and butter	56.0	404.0
Apple sauce	2.8	274.4
Chocolate layer cake	20.7	218.3
	476.8	3103.0

It appears that the calories in the protein of the ration make 15.4 per cent. of the total calories, which is near to the standard 15. The total calories, however, considerably exceed the standard of 2,500.

Considering, however, that the portions given in the table are restaurant portions and rather larger on the average than a man at light work takes at his own table, the ration seems satisfactory. On the "meatless" days creamed codfish, fish cakes and poached egg, or plain omelet will be substituted for roast beef or any other meats.

The foregoing discussion concerns the principles of nutrition and may be helpful as a general guide to the housewife in the control of diet. On her, in the final analysis, depends very largely the efficiency of the community.

Her first problem is to supply enough palatable and nutritious food for the family. It is false economy at this time in any way to make the diet less efficient.

The next problems are—to save the family expense and to lessen the home demand for such foods as wheat, beef and pork, sugar and fats, which are needed to send abroad to our own and our allies' armies. In families with very small incomes the first

of these two problems is the more pressing; in families with larger incomes patriotism requires personal sacrifice in the matter of family expense, when it is necessary for a great national work. For instance, families with very limited means cannot substitute poultry and eggs for beef or pork, when the former are more expensive. The well-to-do can and should do this, so far as practicable.

Economies are to be effected by personal instead of telephone marketing, by getting a variety of food which includes a liberal supply of vegetables, by skill in adapting the diet to personal differences in taste and in efficiency of digestion, as well as in the preparation of attractive and appetizing dishes.

If any very radical change in diet is to be made, it should be brought about gradually. A sudden or violent change is likely to produce disturbance of digestion and temporarily, at least, impair efficiency. Many people, for instance, would be seriously affected if rye or corn bread were eaten to the exclusion of wheat bread, for a period of two weeks, and would be prejudiced against any use of them forever afterwards. If, however, either rye or corn breal is used at first quite sparingly and not continuously, it may come to be regarded rather as a grateful change and as a delicacy than as the outward and visible sign of an inward and spiritual resignation to the physical hardship of wartime. The use of these wheat substitutes, therefore, begun in this way, is more likely in the end to lessen the family consumption of wheat, than a more sudden and radical change. It may, indeed, create a tolerance for and a liking of them which will outlast the war and be of considerable economic advantage.

Feeding a family has a psycological side which is often overlooked. The mental attitude of the family, as well as the cookbook, needs to be studied.

The following books treat of the various phases of the science of nutrition and can be recommended to those who wish to become more fully acquainted with the subject:

Mendel, L. B.	Changes in the Food Supply and their Relation to Nutrition. Yale University Press, New Haven	$0.50
Lusk, Graham.	The Basis of Nutrition. Yale University Press, New Haven	.50

Sherman, H. C.	Chemistry of Food and Nutrition. MacMillan, N. Y.	1.50
Stern & Spitz.	Food for the Worker. Whitcomb & Barrows, Boston	1.00
Green, Mary.	Better Meals for Less Money. Henry Holt & Co., N. Y.	1.25
Rose, Mary S.	Feeding the Family. MacMillan, N. Y.	2.20
Rose, Mary S.	Laboratory Handbook for Dietetics. MacMillan, N. Y.	1.10
Gephart & Lusk.	Analysis and Cost of Ready-to-Serve Foods. Amer. Med. Assn., Chicago.	

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ECONOMY IN FEEDING THE FAMILY

II

The Cereal Breakfast Foods

By JOHN PHILLIPS STREET

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Cereal Breakfast Foods.

The cereal foods occupy a very important place in the diet of the American family, both in sickness and in health. Vegetable foods supply about 95 per cent. of the carbohydrates in the average dietary, and the cereal foods themselves supply fully 55 per cent. Grains in the raw state are unattractive to the taste and are somewhat difficult of digestion, and for this reason cereals are generally cooked before eating. The oldest method of cooking them was by parching, and in the early days the Scotchman's oatmeal and the Indian's maize were prepared in this way. The next development was porridge, in which the grain was boiled or steamed with water, milk or meat stock, and thus rendered more palatable. Porridge, however, requires long cooking, its keeping qualities are poor, and it is far from being a convenient food preparation. In spite of these disadvantages—and the necessary long cooking is by no means an unqualified disadvantage—porridge has enjoyed a wide use and popularity, and the modern cereal breakfast food is its lineal descendant.

A generation ago practically the only cereal foods on the market were wheat flour, corn meal, hominy and hulled corn; barley, rye and rice finding only a very limited use. At the present time we find an almost endless number and variety of specially prepared breakfast foods offered for our use. Many of the brands, however, are exploited by extensive and expensive advertising and live only so long as a fluctuating public taste demands them. Some endure but for a season, while others have taken a fixed place in the long list of American food materials.

Types of Cereal Breakfast Foods.

However, while the brand names of the foods may change, the types of cereal breakfast foods which they represent persist from year to year. There are four main types of these foods: those in which the grain is simply husked and more or less crushed or ground; those which have been steamed or partially cooked at the factory and then ground or rolled and dried; those which have

been cooked by dry heat only, such as puffed rice or wheat; and those in which more or less of the insoluble starch has been converted into soluble form by the action of barley malt, as in the so-called malted foods.

The grains used in this country in these products are oats, wheat, corn, rice, and less commonly barley and rye. Although the various flours, starches, and edible cereal pastes (noodles, macaroni, vermicelli and spaghetti) are in a sense cereal breakfast foods, they will not be discussed at this time.

Oats is characterized by its high protein and fat content; wheat, rye and barley by high protein and moderate fat; corn by its relatively high fat; while rice is distinctly low in protein, and in the polished form almost free from fat, fiber and ash. These characteristics of the individual grains greatly affect the composition of the breakfast foods made from them, as will be shown later. In the preparation of certain breakfast foods the grain is used in its entirety; in others more or less of the germ is removed, thus materially reducing the percentage of fat; in others the ground product is thoroughly bolted to remove most of the fiber; while in still others the use of heat or a malting process materially alters the form of carbohydrates present. To certain of the "ready-to-eat" brands, salt, sugar, syrup, or honey has been added, thus increasing the ash or carbohydrates and decreasing the relative percentages of the other ingredients. In general, however, the composition of the finished breakfast food closely follows that of the parent grain.

Barley is not a popular breakfast cereal in this country, and when used it is usually in the form of "pearled" barley with a much lower content of fiber and considerably less of all the other ingredients, except carbohydrates, than the unhulled, untreated grain.

The germ of the corn kernel is rich in fat, which tends to become rancid on keeping, and more or less of it is generally removed in the preparation of corn breakfast foods. Hominy, samp and cerealine are names used quite loosely for corn products, which differ little from one another in composition, save that hominy generally carries a little more fat. They are all essentially carbohydrate foods. The toasted and flaked corn preparations are steamed and rolled grains, which have been

cooked longer, and to which salt and a sweetening material are commonly added.

In the oatmeal of our forefathers much of the hull or husk remained in the ground product, but with modern improved processes more of the fibrous hull is removed. The germ is not removed from the oat preparations. In the crushed or flaked oat foods the grain is more or less cooked with steam, and while still moist rolled into thin flakes and dried. Such products are, of course, only partially cooked, and further cooking is necessary before using.

The rice foods come to us either flaked, or as "puffed" rice. In the latter form the rice has been treated by a special process of cooking with dry heat, the resultant product resembling somewhat popcorn in flavor and texture.

In the preparation of wheat breakfast foods the germ, as a rule, is not removed, and save in farina and the gluten preparations more or less of the bran and middlings are retained. In certain products the whole grain, bran and all, is used. The unground wheat grain is seldom used as breakfast food, except in the "puffed" products (prepared similarly to puffed rice), and in frumenty, in which the husked grain is boiled with milk and spices. The latter preparation has but a restricted use in this country. Where the grain is only moderately crushed and the bran not removed, the product is known as cracked wheat or wheat grits. The flaked wheat foods are prepared in the same way as rolled or flaked oats. Shredded wheat is prepared by a special process and represents the whole grain. The gluten breakfast foods are characterized by a very high protein content and contain only about half the starch usually found in wheat foods. They are intended primarily for those to whom much starch in the diet is objectionable, but as a rule the extent to which the starch has been removed falls far short of the manufacturer's claims.

In the so-called malted foods advantage is taken of the diastatic power of barley malt, the diastase of malt imitating the action of the ferments of the saliva and pancreatic juice. Generally the amount of malt added is not sufficient to convert more than a part of the starch into soluble forms. Analysis shows that in many of these foods the soluble carbohydrates

exist largely in the form of dextrin and suggests the possibility of glucose or some other soluble dextrin-containing carbohydrate being added. Furthermore, it must not be forgotten that the treatment of starch with dry heat also produces dextrin, as illustrated in the case of ordinary toast. It is evident, therefore, that many of these "malted" foods are not deserving of the name.

Still another group of breakfast foods now quite widely used includes the various laxative preparations. These usually consist chiefly either of wheat bran or some inert material, such as agar-agar or Iceland moss. In some instances fruits and nuts are used and occasionally an oil, such as olive oil, or linseed oil.

Composition of Cereal Foods.

Aside from the constituent grains and the method of manufacture, the cereal breakfast foods are of two general classes, those which are either raw and which need prolonged cooking or which have been cooked to some extent and need further treatment before use, and those which are "ready-to-eat." Pearled barley, hominy, samp, corn meal, oat flakes, cracked wheat and farina are types of the first class, while among the "ready-to-eat" preparations we find such products as cerealine, corn flakes, rice flakes, wheat flakes, puffed rice, shredded wheat, Grape-nuts and some of the various "malted" foods. Table I, pages 32 to 39, gives the analyses of 130 of these products examined in this laboratory between 1909 and the present time, 32 being analyses just made. In addition to the chemical composition the claimed weight of the package (which was generally found to be correct) is given together with the calories yielded by one-fourth pound of the food, and the cost per package, per pound and per 100 calories. The costs are based on New Haven prices maintaining on September 26th of this year. These costs will be discussed in more detail later.

Comparative Food Value of the Cereal Breakfast Foods.

In order that the relative composition of these foods may be shown more clearly, an abridged table, Table II has been prepared, in which the average data for the different types are given, grouped under the two headings, "to be cooked" and "ready-to-serve." See pages 24 and 25.

Among the foods requiring further cooking the superiority, from a nutritive standpoint, of the oat meals is apparent at a glance. They contain from 50 to 100 per cent. more protein and from three to nine times as much fat as the other "to-be-cooked" products. In fact, they are the only breakfast foods, aside from certain laxative preparations, that contain any considerable percentage of fat, and indeed for this reason they have been criticized as "heating" foods and undesirable for use in hot weather and by people suffering from certain types of disease. An average serving of rolled oats, however, contains only about 1 1-3 ozs. of the dry cereal, and a daily consumption of this amount for four months would supply only about as much fat as 2-3 lb. of butter. The "heating" effect of oat preparations, therefore, obviously may be neglected except under most unusual conditions. If oatmeal supplies so little fat in the ordinary dietary, it is apparent that the amounts supplied by the other "to-be-cooked" cereals is almost negligible. This further emphasizes the fact that, while these foods contain important percentages of protein, they are, with the exception of the oatmeals, essentially carbohydrate foods.

While among the "ready-to-eat" preparations considerable variations are shown in all the ingredients except the carbohydrates, the most striking differences, as we have shown elsewhere, are in the amounts of carbohydrate rendered soluble in water by the various manufacturing processes. Only about 10 per cent. of the carbohydrates of flaked rice, *Shredded Wheat* and *Triscuit* are water-soluble, raising a serious question as to the desirability of the extensive use of such foods in the dietaries of young children. Flaked wheat shows only about 15 per cent., while on the other hand, flaked corn shows 26, puffed rice 32, puffed wheat 27 and *Grape-Nuts* 36 per cent. of water-soluble carbohydrates.

From a nutritive standpoint, the table shows that these types of breakfast foods, excepting possibly the oatmeals and *Holland Rusk*, are practically interchangeable. While one-quarter of a pound of oatmeal or Holland Rusk yields 430 calories, the same quantity of each of the other foods listed yields approximately the same number of calories, 400. For all practical purposes, therefore, it may be assumed that one ounce of any of the commonly used breakfast foods yields about 100 calories. An attempt has been made in the table to indicate in terms of familiar

TABLE II.—AVERAGE COMPOSITION AND COSTS OF

Type.	Pounds per hundred.		
	Protein.	Fat.	Carbohydrates.
To Be Cooked.			
Corn meal	7.5	0.8	78.7
Hominy and samp	7.9	0.7	76.9
Oat meal (Bestovotes)	16.2	6.6	63.1
Oats, rolled	15.6	6.6	64.4
Groats, Robinson's	12.8	8.6	67.7
Farina	10.9	1.3	74.4
Wheat, flaked	11.1	2.1	73.4
Wheat, cracked	9.3	2.3	73.3
Post Tavern Porridge	10.3	0.8	74.5
Ready To Serve.			
Corn flakes	6.9	0.3	78.6
Corn, puffed	8.7	0.3	78.5
Rice flakes	10.0	0.4	81.3
Rice, puffed	7.6	0.2	79.5
Wheat flakes	9.3	1.1	80.5
Wheat, puffed	13.1	1.8	70.2
Wheat, shredded	11.0	1.4	75.0
Triscuit	11.0	1.4	73.9
Force	10.6	1.1	73.7
Grape-Nuts	11.5	0.6	74.2
Holland Rusk	12.1	5.1	70.4
Kellogg's Krumbles	12.0	1.2	72.3

measure the volume of the different foods weighing one ounce and yielding 100 calories. For instance, 1 *Shredded Wheat* biscuit, 2½ *Triscuits*, 2/5 cup rolled oats, 1¼ cups corn flakes, or 4 heaping tablespoonfuls of *Grape-Nuts* each yields 100 calories and weighs about one ounce.

DIGESTIBILITY OF THE CEREAL BREAKFAST FOODS.

The value of a food depends not only upon the amounts of nutrients present but also upon their digestibility. Experiments with healthy men have shown that partially cooked wheat preparations have the highest digestibility and those made from unbolted wheat the lowest. Experiments at the Maine Experiment Station with rolled oats, rolled wheat, corn meal, hominy and certain

TYPICAL BREAKFAST FOODS IN PACKAGE FORM.

Cost.			Calories per ¼ lb.		Necessary to yield 100 Calories.	
Per pound.	Per 100 calories.	Per serving.	Total.	From protein.	Volume.	Weight.
cts.	cts.	cts.				oz.
8	0.50	0.81	402	34	1/5 cup*	1
10.5	0.66	1.01	401	39	1/6 "	1
10	0.58	0.74	430	73	1/5 "	0.9
9	0.56	0.75	432	71	2/5 "	1.1
50	2.74	3.50	456	59	1/5 "	0.9
13.5	0.86	1.31	403	49	1/4 "	1
10	0.61	0.64	408	50	1/2 "	1
15.5	0.97	1.80	401	42	3/10 "	1
10	0.63	0.89	396	47	1/5 "	1
18	1.18	0.97	394	31	1 1/4 "	1
37.5	2.33	1.83	402	39	1 1/3 "	1
30	1.78	1.37	422	45	1 1/3 "	1
56	3.50	2.45	400	34	1 1/4 "	1
30	1.78	1.46	422	42	1 "	1
60	3.76	1.99	399	60	2 "	1
16	0.98	1.00	408	50	1 bisc.	1
20	1.24	1.50	403	50	2 1/2 bisc.	1
17.5	1.10	1.40	397	48	1 cup	1
16	1.01	1.16	398	52	4 tablesp.	1
29	1.69	.....	430	55	.....	.....
16	1.01	2.05	398	54	1 cup	1

* A cup equals ½ pint.

specially prepared brands, showed that in general about 90 per cent. of the organic matter was digested. The general conclusion from these experiments was that rolled wheat showed the highest and the corn products the lowest digestibility, oats occupying an intermediate position. When the actual nutrients are compared with the total nutrients it is seen that the relation previously noted still maintains; that is, the oat preparations provide the largest amounts of digestible protein and fat, followed by wheat, rye and barley, while the corn and rice products supply but relatively small amounts of these elements and relatively large amounts of carbohydrates. Other Maine experiments bring out the interesting fact that the processes to which certain products

have been subjected during their manufacture, while converting a part of the starch into soluble carbohydrates, have at the same time diminished the digestibility of the protein. For instance, rolled wheat showed 85 per cent. protein digestibility, while *Force* and *Grape-Nuts* showed but 76 and *Shredded Wheat* only 58. These and other experiments show that the raw cereals, if sufficiently cooked, are as quickly and as easily digested as the best malted cereals, and more quickly than the ordinary prepared cereals and a large majority of the so-called malted cereals.

The Cooking of Breakfast Foods.

The proper cooking of any food is a very important factor in its digestibility. Aside from the usefulness of heat in sterilizing food, the main purposes of cooking are to improve the food's appearance and flavor, to break down certain refractory elements and to convert the nutrients into more assimilable forms.

The manufacturing processes used in these foods—crushing, rolling, steaming, parching, puffing or shredding—all to a greater or lesser degree rupture the cells of the grain, and thus render the cell contents more susceptible to the action of the digestive juices of the body. As a rule, however, even some of the "ready-to-eat" foods come to us in a form which requires more cooking before their nutrients can become entirely available to the body. In the average home the over-cooking of cereals is most unsual; on the other hand, undercooking is all too common. This tendency is fostered by the claims of the breakfast food label, and we have offered to us "15-minute" oat flakes and similar alluring and alleged time-conserving preparations. The consumer has no way of knowing how much of the needed cooking has been performed by the manufacturer, and he may safely assume that the directions accompanying the food underestimate rather than exaggerate the time necessary for proper preparation. Frequently the prepared foods are condemned as indigestible simply because the cooking period has been too limited; but theoretically there is no reason why, if properly cooked, they should not be quite as digestible as cereals cooked entirely in the home. No hard and fast rule can be laid down as to the proper cooking period for the various cereals, but generally speaking the

greater the amount of husk or hull present the longer the food should be cooked.

Cost of Cereal Breakfast Foods.

In Table I the cost of the foods is shown on the basis of the package, the pound and the 100 calories. The cost is omitted in a number of instances, either because the food could no longer be found in this State or because, with the present greatly increased prices of all commodities, it was unsafe to assume any price for these without a direct inspection of the package as to its net contents. Omitting such unusual preparations as *Colax* and *Sea Moss Farina,* both in a sense medicine rather than food, the cost per pound ranges from 6.5 cents in a wheat bran to 76 cents in *Dieto Rusks.* Of the preparations requiring cooking, the corn products are the cheapest, followed by oats, with the wheat foods the most expensive. (*Robinson's Groats* is an imported food primarily intended for invalid use, and its high cost removes it from the category of family breakfast foods.) The specially prepared foods cost from two to seven times as much per pound as the simple cereal preparations, such as oatmeal, farina and hominy.

In a consideration of cost, however, composition must not be overlooked, and judged on this basis oatmeal is by far the cheapest of all the cereal breakfast foods. Nor must we forget that while we pay very much more for the prepared than for the uncooked foods, this price is in part justified by their convenience, and the saving in both time and fuel by the shortening of the home-cooking period. In hotels, hospitals and large establishments where a fire is kept throughout the day for other purposes, the prolonged cooking required by the raw cereals may be effected with practically no expense. In households where a gas stove is used exclusively for cooking, and then only at specified and limited times, it is indeed a question whether the "ready-to-eat" brands may not in many cases be the more economical purchase.

The Increased Cost of Cereal Foods.

In the case of 22 brands we have full data as to the size of the package and its cost for both the years 1909 and 1917. By referring to Table III it will be seen that in nearly every case the net

TABLE III.

Comparative Package Weights and Prices.

Brand.	1909.			1917.		
	Weight oz.	Cost cts.	Cost per lb. cts.	Weight oz.	Cost cts.	Cost per lb. cts.
Hominy	30	10	5.5	24	18	12
Hominy	31	6	3	74	43	9.5
Kellogg's Toasted Corn Flakes	10	10	16.0	8	11	22.0
Post Toasties	10	10	15.0	8	11	22.0
Quaker Toasted Corn Flakes	10	8	12.0	8	7	14.0
Quaker Yellow Corn Meal	46	12	4.0	24	12	8.0
Hornby's Oats	28	15	8.5	20	15	11.0
Quaker Oats	24	10	6.5	20	10	8.0
Quaker Puffed Rice	7.5	10	21.5	4	14	56.0
Cream of Wheat	28	15	8.5	28	22	12.5
Force	12	15	18.5	10	11	17.5
Grape-Nuts	16	12	12.0	13	13	16.0
Hecker's Farina	16	10	10.0	16	14	14.0
Holland Rusk	7	10	24.0	6	11	29.5
Malt Breakfast Food	30	15	8.0	28	22	12.5
Pettijohn's Breakfast Food	23	11	7.5	24	18	12.0
Premier Farina	16	10	10.0	16	14	14.0
Quaker Cracked Wheat	30	15	8.0	26	25	15.5
Saxon Wheat Food	25	15	9.5	26	22	13.5
Shredded Wheat	13	12	14.5	12	12	16.0
Triscuit	13	10	12.5	9.5	12	20.0
Wheatena	25	15	9.5	19	18	15.0
Ave. 6 corn products	..	..	**9.3**	..	..	**14.6**
Ave. 2 oat products	..	..	**7.5**	..	..	**9.5**
Ave. 13 wheat products	..	..	**11.7**	..	..	**16.0**
1 rice product	..	..	**21.5**	..	..	**56.0**

weight of the package has been reduced and in many instances the cost of the package increased. Hominy that in 1909 averaged 4 cents per lb. now costs 11 cents, corn flakes have increased from 14 to 19 cents, rolled oats from 7.5 to 9.5 cents, puffed rice from 21.5 to 56 cents, *Grape-Nuts* from 12 to 16 cents, farinas from 9.5 to 14 cents, cracked wheat from 8 to 15.5 cents and *Triscuit* from 12.5 to 20 cents per lb. Of the brands listed *Force* is the only one which costs no more per pound to-day than in 1909. On the average the corn products in the eight years advanced 57, oats 27, wheat 37 and rice 162 per cent. These startling increases emphasize the importance of intelligent buying of these widely used foods.

TABLE IV.

Weights of One Serving of Food, Calories Yielded, and Cost.

Food.	Weight of 1 cup (½ pint) of dry food.	Weight of one serving.	Total calories.	Per serving.	Per 100 calories.
	oz.	oz.		cts.	cts.
Corn.					
Corn flakes, Jersey	0.95	0.95	99	1.07	1.08
" " Kellogg's	0.78	0.78	76	1.07	1.40
" " Post Toasties	0.90	0.90	89	1.24	1.39
" " Quakers	*0.90	0.90	90	0.79	0.88
" " Washington Crisps	0.67	0 67	65	0.67	1.03
Corn meal, in bulk	5.40	1.62	163	0.71	0.44
" " Quaker	5.40	1.62	163	0.81	0.50
Corn puffs, Quaker	0.78	0.78	78	1.83	2.33
Hominy, Hecker's Cream	6.03	1.51	152	1.13	0.75
" Sunbeam	5.93	1.48	145	0.88	0.54
Roman Meal	5.40	1.62	161	1.00	0.63
Oats.					
Groats, Robinson's Patent	4.48	1.12	128	3.50	2.76
Oat Meal, in bulk	5.50	1.38	156	0.61	0.39
" " Bestovotes	4.76	1.19	128	0.74	0.58
" " Keen & Robinson's	5.54	1.39	156	1.91	1.22
" " McCann's	6.00	1.50	171	1.79	1.04
Oats, rolled, in bulk	2.50	1.25	140	0.55	0.39
" " Bufceco	2.68	1.34	145	0.67	0.46
" " Hecker's	2 68	1.34	142	0.67	0.46
" " Hornby's	*2 68	1.34	146	0.92	0.63
" " Leggett's	*2 68	1.34	142	1.01	0.71
" " Purity	2.68	1.34	140	0.67	0.46
" " Quaker	*2.68	1.34	144	0.67	0.47
" " Scott's	3.28	1.64	187	1.38	0.74
Rice.					
Rice, head, in bulk	7.00	1.75	175	1.31	0.75
" small, in bulk	7.00	1.75	175	1.09	0.63
" broken, in bulk	7.00	1.75	175	0.88	0.50
" flakes, Kellogg's	0.73	0.73	77	1.37	1.78
" puffed, Quaker	0.70	0.70	70	2.45	3.50
Wheat.					
Farina, Cream of Wheat	6.21	1.55	155	1.21	0.78
" Crystal Wheat	*6.05	1.51	154	1.37	0.89
" Hecker's Cream	*6.05	1.51	151	1.32	0.88
" Mother's Wheat Hearts	5.78	1.45	145	0.73	0.50
" Quaker (F. S.)	5.68	1.42	141	0.99	0.69
" Vitos	6.17	1.54	160	0.82	0.53
" Wheatena	*6.05	1.51	159	1.42	0.89
Wheat, cracked, Quaker	6.20	1.86	186	1.80	0.97
" flakes, Alber's	2.05	1.03	105	0.64	0.61
" flakes, Kellogg's	*0.78	0.78	82	1.46	1.78
" puffed, Quaker	0.53	0.53	54	1.99	3.62
Force	1.28	1.28	127	1.40	1.10

* Estimated from weight of similar preparations.

TABLE IV—*Continued.*

WEIGHTS OF ONE SERVING OF FOOD, CALORIES YIELDED, AND COST.

Food.	Weight of 1 cup (½ pint) of dry food.	Weight of one serving.	Total calories.	Per serving.	Per 100 calories.
Wheat—Continued.	oz.	oz.		cts.	cts.
Grape-Nuts (4 heap. tablespoonfuls)	1.16	1.16	115	1.16	1.01
Kellogg's Krumbles	2.05	2.05	204	2.05	1.01
Pettijohn's Breakfast Food	*2.05	2.05	208	1.54	0.74
Ralston Wheat Food	4.80	1.20	121	1.13	0.94
Shredded Wheat (1 biscuit)	1.00	1.00	102	1.00	0.98
Triscuit (3 biscuits)	1.20	1.20	121	1.50	1.24
Miscellaneous.					
Fruit Nut Cereal	4.13	1.16	117	1.52	1.30
Post Tavern Porridge	5.68	1.42	141	0.89	0.63

* Estimated from weight of similar preparations.

SUGGESTIONS AS TO PURCHASE.

In order to make a fair comparison of cost we must not lose sight of the fact that many of these foods are served in the dry condition as purchased, while others, such as oatmeal, farina and hominy, during the cooking process absorb large amounts of water. It is obviously unfair, therefore, to compare the nutrient value of one pound of raw oatmeal with one pound of corn flakes. To obviate this difficulty Table IV has been prepared showing the weights in ounces of the average individual serving for most of these foods. In preparing this table the cup (½ pint) has been taken as the unit of measure, and it has been assumed that an average serving of corn flakes, corn puffs, rice flakes, puffed rice, wheat flakes, puffed wheat, *Krumbles,* and *Force,* is one cup, that of corn meal and cracked wheat 3/10 cup, of oatmeal, hominy, rice, farina and *Ralston Wheat Food* ¼ cup, of rolled oats and flaked wheat ½ cup, of *Shredded Wheat* 1 biscuit, of *Triscuit* 3 biscuits and of *Grape-Nuts* 4 heaping tablespoonfuls. In some cases these servings may be somewhat excessive but they are at least comparative. Where the food was available we have weighed one cupful in each case and the weights are shown in the table. In certain cases an assumed weight has been used based on the known weight of a similar preparation.

Table IV also shows the number of total calories yielded by these servings, as well as the cost per serving and cost per 100 calories.

The main facts in this table are shown graphically and perhaps more clearly in the charts on pages 40 to 43. The one chart shows the relative cost of the foods per serving, the other the relative cost per 100 calories. In the main these two charts show similar results, the differences arising not so much from variations in composition as from the variations in weight of servings of the respective foods. The serving basis is perhaps the more popular way to consider the cost of these foods, but the 100 calories basis is clearly the more exact and the more scientific. Our consideration, therefore, will be on the latter basis.

The relative cheapness of the uncooked cereals is apparent, oats and corn showing the lowest costs and rice and wheat the highest. The highest priced foods under each cereal (excepting *Robinson's Groats* already referred to), are the "ready-to-eat" preparations, and among these there is a wide range of cost. Of the flaked foods, corn flakes are the cheapest, followed by wheat and rice; the puffed cereals show about the same relative cost. The most obvious facts shown by the charts are the cheapness of the rolled oat preparations, and that corn puffs, puffed rice and puffed wheat are clearly among the luxuries of the breakfast table.

TABLE I.—CEREAL

Date of Analysis.	Brand.	Water.	Fat.
	Barley Preparations.		
1913	Farwell & Rhines' Barley Crystals	9.9	1.3
1909	Quaker Scotch Brand Pearled Barley	12.1	0.9
	Corn (Maize) Preparations.		
1909	Cerealine	11.2	0.4
1909	E-C Corn Flakes, Toasted	12.1	0.3
1909	F. S. Granulated Hominy	13.3	1.0
1917	Hecker's Cream Hominy	11.7	0.4
1909	H-O New Process Hominy	11.3	0.3
1916	Jackson's Roman Meal	8.5	3.4
1917	Jersey Corn Flakes	7.7	0.3
1909	Kellogg's Toasted Corn Flakes	11.7	0.2
1909	Korn Kinks	12.0	0.4
1909	Nichols' Snow White Samp	13.4	0.3
1909	Post Toasties	11.7	0.3
1909	Quaker Best Yellow Corn Meal	12.3	0.8
1917	Quaker Corn Puffs	12.0	0.3
1909	Quaker Toasted Corn Flakes	11.6	0.4
1909	Ralston Hominy Grits	11.3	2.9
1909	Street's Perfection Hominy	12.4	1.3
1917	Sunbeam Pearl Hominy	14.3	0.6
1917	Washington Corn Crisps	12.1	0.2
	Oat Preparations.		
1917	Bestovotes	11.0	6.6
1917	Bufceco Rolled Oats	11.1	6.8
1909	Grandmother's Crushed Oats	10.7	6.5
1909	Health Brand White Oats	10.9	7.8
1917	Hecker's Cream Oat Meal	11.5	5.6
1909	Hornby's Steam Cooked Oat Meal	10.6	6.7
1917	Keen & Robinson's Granulated Scotch Oatmeal	10.4	9.1
1909	Leggett's Premier 15 Minute Oat Flakes	11.3	5.4
1917	McCann's Irish Oat Meal	9.2	8.7
1909	Mother's Crushed Oats	10.9	6.1
1909	Paw-Nee Rolled Oats	10.8	6.7
1917	Purity Rolled Oats	13.5	6.1
1909	Quaker Oats	10.8	6.0
1917	Robinson's Patent Groats	8.4	8.6
1917	Scott's Porage Oats	10.1	9.6
1909	Sovereign 15 Minute Oat Flakes	10.8	5.8
1909	White Rose Rolled Oats	10.3	8.0
	Rice Preparations.		
1915	Comet Cereal	11.3	0.3
1909	Cook's Flaked Rice	12.6	0.1
1909	Cook's Malto Rice	11.3	0.2
1915	Kellogg's Toasted Rice Biscuit	5.0	0.3

BREAKFAST FOODS.

Pounds per hundred.					Calories per ¼ lb.	Cost in 1917.			Net weight of package.
Crude fiber.	Protein (N×6.25).	Ash.	Carbohydrates other than fiber.	Starch.		Per package.	Per pound.	Per 100 calories.	
						cts.	cts.	cts.	ozs.
0.9	11.5	1.2	75.2	62.7	410	.....	.....	.....	32*
0.3	9.5	1.0	76.2	69.2	401	.....	.....	.....	18*
0.1	6.9	1.5	79.9	60.2	401	.....	.....	.....	10*
0.2	6.6	2.2	78.6	61.3	393	.....	.....	.....	10*
0.2	8.0	0.4	77.1	75.7	399	.....	.....	.....	74*
0.5	9.8	0.3	77.3	71.2	402	18	12	0.75	24
0.2	8.0	0.4	79.8	74.4	404	.....	.....	.....	30*
5.0	13.3	3.7	66.1	37.4	398	25	10	0.63	40
0.3	8.5	0.9	82.3	64.7	418	10	18	1.08	9
0.2	6.4	2.7	78.8	55.5	392	11	22	1.40	8
0.1	7.4	2.2	77.9	66.3	394	.....	.....	.....	8*
0.5	7.8	0.3	77.7	78.2	394	.....	.....	.....	32*
0.2	6.6	1.8	79.4	53.9	396	11	22	1.39	8
0.2	7.5	0.5	78.7	75.7	402	12	8	0.50	24
0.1	8.7	0.4	78.5	43.2	402	14	37.5	2.33	6
0.0	6.8	1.3	79.9	68.3	398	7	14	0.88	8
0.4	9.0	1.0	75.4	70.9	416	.....	.....	.....	30*
0.1	7.9	0.4	77.9	74.5	406	.....	.....	.....	31*
0.3	9.4	0.4	75.0	70.8	392	43	9.5	0.54	74
0.2	7.8	2.9	76.8	59.5	389	10	16	1.03	10
1.0	16.2	2.1	63.1	55.1	430	17	10	0.58	24
1.0	15.1	2.0	64.0	55.6	432	10	8	0.46	20
0.6	14.9	1.9	65.4	59.1	434	.....	.....	.....	28*
1.0	13.8	2.0	64.5	58.8	438	....	....	....	32*
0.9	15.6	1.8	64.6	56.7	424	10	8	0.48	20
0.8	16.1	1.7	64.1	59.2	436	14	11	0.63	20
0.8	13.7	1.9	64.1	57.0	449	110	22	1.22	80
0.6	17.2	1.8	63.7	56.6	425	15	12	0.71	20
0.3	15.1	1.8	64.9	56.8	455	95	19	1.04	80
0.9	15.6	1.6	64.9	58.4	431	9	7	0.42	20*
0.8	15.8	1.9	64.0	59.7	434	.....	.....	.....	25*
1.0	16.3	2.0	61.1	57.4	417	10	8	0.48	20
0.9	15.9	1.9	64.5	56.7	429	10	8	0.47	20
0.7	12.8	1.8	67.7	60.5	456	50	50	2.74	16
0.4	13.3	1.7	64.9	56.8	456	25	13.5	0.74	30
0.9	16.5	2.0	64.0	58.0	428	....	....	....	34*
0.7	14.3	1.9	64.8	59.0	432	....	....	....	30*
0.2	7.2	0.3	80.7	....	405	....	....	....	16*
0.2	7.8	0.4	78.9	78.2	397	....	....	....	15*
0.1	7.6	0.6	80.2	74.1	403	....	....	....	17*
0.2	10.1	3.7	80.7	57.4	418	15	40	2.39	6

* Net weight of package at date specified in the first column.

TABLE I.—CEREAL

Date of Analysis.	Brand.	Water.	Fat.	Crude fiber.	Protein (N x 6.25).	Ash.	Carbohydrates other than fiber.	Starch.	Calories per ¼ lb.	Cost in 1917. Per package.	Per pound.	Per 100 calories.	Net weight of package.
										cts.	cts.	cts.	ozs.
	Rice Preparations—Continued.												
1915	Kellogg's Toasted Rice Flakes	4.7	0.4	0.2	10.0	3.4	81.3	55.7	422	15	30	1.78	8
1909	Milk Rice	12.3	0.2	0.2	6.9	3.2	77.2	62.6	387	....	....	....	8*
1909	Quaker Puffed Rice	12.2	0.2	0.1	7.6	0.4	79.5	61.8	400	14	56	3.50	4
	Rye Preparation.												
1915	Kellogg's Toasted Rye Flakes	8.1	1.5	0.6	11.4	2.2	76.2	45.7	416	15	30	1.80	8
	Wheat Preparations.												
1917	Alber's Wheat Flakes Mush	11.5	2.1	0.3	11.1	1.6	73.4	59.2	408	15	10	0.61	24
1913	Brusson Farine au Gluten	10.9	0.6	0.2	33.9	0.6	53.8	48.8	407	....	....	....	9*
1910	Brusson Gluten Semolina	9.7	0.5	0.3	17.2	0.7	71.6	64.9	411	....	....	....	30*
1915	Cero-Vita	4.6	0.7	0.3	8.9	3.5	82.0	52.3	423	15	30	1.77	8
1917	Cinnamon Rusks	9.9	7.2	0.2	10.3	0.7	71.7	49.5	449	18	21	1.17	14
1909	Cream of Wheat	13.1	0.9	0.2	11.5	0.6	73.7	71.1	399	22	12.5	0.78	28
1913	Cresco Grits	11.1	1.4	0.5	17.8	0.6	68.6	54.1	409	....	....	....	32*
1914	Crystal Wheat	9.5	2.0	1.7	11.3	1.9	73.6	....	408	20	14.5	0.89	22
1914	Dieto Rusks	6.4	9.1	1.0	15.9	1.5	66.1	52.1	469	60	76	4.05	13
1909	Force	10.7	1.1	1.1	10.6	2.8	73.7	59.9	397	11	17.5	1.10	10
1917	F S Farina (Quaker Farina)	13.7	0.9	0.2	10.2	0.4	74.6	63.9	397	10	11	0.69	14.5
1909	Grandmother's A. & P. Farina	12.9	0.6	0.1	10.8	0.6	75.0	71.7	398	....	....	....	16*
1911	Granola	6.1	0.8	0.6	13.9	2.3	76.3	45.2	421	20	24.5	1.46	13
1914	Granose Biscuit	11.3	1.6	1.8	10.3	3.9	71.1	....	389	15	60	3.86	4
1915	Granose Flakes	6.0	3.9	0.5	10.3	3.9	75.4	55.5	432	15	40	2.31	6
1909	Grape Nuts	10.3	0.6	1.5	11.5	1.9	74.2	36.3	398	13	16	1.01	13
1909	Hecker's Farina	12.7	0.7	0.1	10.0	0.6	75.9	71.2	400	14	14	0.88	16
1909	Holland Rusk	11.0	5.1	0.1	12.1	1.3	70.4	55.8	430	11	29	1.69	6
1914	Hoyt's Gum Gluten Breakfast Food	6.5	0.9	0.3	45.4	0.6	46.3	39.2	429	35	35	2.04	16
1914	Hoyt's Gum Gluten Granules	6.6	0.7	0.5	42.7	0.7	48.8	41.9	425	35	35	2.06	16
1913	Jireh Frumenty	6.2	1.7	1.1	12.3	1.4	77.3	65.4	427	....	....	....	24*
1913	Jireh Whole Wheat Farina	6.2	2.3	2.2	12.9	1.8	74.6	59.5	424	....	....	....	24*
1912	Kellogg's Breakfast Toast	7.7	1.9	0.3	13.6	1.6	74.9	57.4	424	20	35.5	2.09	9
1917	Kellogg's Krumbles	10.0	1.2	1.9	12.0	2.6	72.3	59.0	398	8	16	1.01	8
1915	Kellogg's Toasted Wheat Biscuit	5.8	1.4	1.5	14.2	2.4	74.7	45.8	421	12	19	1.13	10
1915	Kellogg's Toasted Wheat Flakes	5.2	1.1	1.2	9.3	2.7	80.5	57.0	422	15	30	1.78	8
1915	Kellogg's Zwieback	6.2	1.6	0.2	14.3	1.6	76.1	60.4	384	25	28.5	1.86	14
1909	Leggett's Premier Farina	14.1	0.9	0.1	11.1	0.5	73.3	71.0	395	....	....	....	16*
1909	Malt Breakfast Food	9.6	1.5	1.0	13.8	1.4	72.7	53.5	411	22	12.5	0.76	28
1914	Manana Gluten Breakfast Food	7.6	2.0	1.7	42.6	2.5	43.6	29.9	415	25	40	2.41	10
1909	Mapl-Flake	10.8	1.2	1.2	9.3	2.8	74.7	58.3	396	....	....	....	11*
1917	Mother's Wheat Hearts	13.5	1.1	0.2	10.7	0.4	74.1	65.0	399	15	8	0.50	29
1909	Pettijohn's Breakfast Food	10.3	2.0	2.0	9.1	1.7	74.9	64.0	405	18	12	0.74	24
1909	Pillsbury's Best Cereal	11.3	0.7	0.1	11.5	0.5	75.9	74.1	407	....	....	....	32*
1909	Quaker Cracked Wheat	11.7	2.3	1.7	9.3	1.7	73.3	63.6	401	25	15.5	0.97	26
1917	Quaker Puffed Wheat	11.5	1.8	1.6	13.1	1.8	70.2	29.5	399	15	60	3.76	4
1909	Quaker Wheat Berries	9.8	2.0	1.2	14.0	1.4	71.6	57.1	412	....	....	....	8*
1909	Ralston Health Food	12.4	1.7	1.1	11.9	1.4	71.5	64.4	399	....	....	....	29*
1917	Ralston Wheat Food	11.9	1.8	0.8	11.3	1.1	73.1	62.8	404	22	15	0.94	24

BREAKFAST FOODS—*Continued.*

* Net weight of package at date specified in the first column.

TABLE I.—CEREAL

Date of Analysis.	Brand.	Water.	Fat.
	Wheat Preparations—Continued.		
1915	Sanitas Granuto	4.9	1.7
1909	Saxon Wheat Food	9.8	1.7
1909	Shredded Wheat Biscuit	8.5	1.4
1909	Street's Perfection Farina	13.1	1.1
1909	Triscuit	10.3	1.4
1917	Vitos	11.6	1.0
1909	Wheatena	10.4	2.8
1909	Wheatlet	12.2	1.6
1909	Zest	10.7	1.2
	Wheat Bran.		
1914	Ballard's Obelisk Sanitary Edible Bran	11.5	5.4
1917	Culp's Capitol Health Bran	11.2	4.3
1914	Health Food Co.'s Wheat Bran	11.6	4.1
1914	Jireh Wheat Bran	11.1	4.8
1914	Johnson's Educator Wheat Bran	11.6	4.7
1914	Kellogg's Sterilized Wheat Bran	9.6	5.2
	Wheat Bran Biscuit and other Laxative Preparations.		
1914	Bran Biskue	8.5	13.1
1917	Bran-eata Biscuit	9.8	0.9
1917	Bran Zos	11.9	2.5
1914	Brose Good Health Breakfast Food	10.1	4.3
1917	Cerag	9.2	0.9
1910	Cerena	7.2	11.4
1914	Christian's Laxative Bread	9.9	1.4
1909	Christian's Laxative Cereal Flakes	13.0	1.4
1914	Colax	13.1	0.8
1914	Dietetic Bran Biscuit	9.3	5.0
1914	Educator Bran Cookies	7.1	14.5
1914	Educator Bran Meal	11.8	2.8
1915	F. B. A. Laxative Health Biscuit	11.1	1.7
1917	Fruit Nut Cereal	7.3	1.2
1914	Good Health Biscuit (Kellogg)	10.9	1.2
1914	Health Food Wafers	9.7	7.9
1917	India (Digestive) Biscuit	8.7	2.2
1915	Laxa	6.6	2.8
1914	Laxative Biscuit (Kellogg)	9.4	10.8
1914	Mansfield's Agar Agar Wafers	7.9	12.0
1914	Oval Digestive Biscuit (H. & P.)	8.8	16.3
1915	Uncle Sam Health Food	6.3	24.4
1917	Zim	13.2	1.7
	Miscellaneous Preparations.		
1914	Dieto Nut Cereal	5.0	18.4
1914	Dieto Wheat and Barley Cereal	6.8	2.2
1906	Jireh Wheat Nuts	7.6	15.6

BREAKFAST FOODS—*Continued.*

Pounds per hundred.					Calories per ¼ lb.	Cost in 1917.			Net weight of package.
Crude fiber.	Protein (N x 6.25).	Ash.	Carbohydrates other than fiber.	Starch.		Per package.	Per pound.	Per 100 calories.	
						cts.	cts.	cts.	ozs.
0.4	10.1	1.3	81.6	43.4	437	20	23	1.32	14
0.5	12.8	0.8	74.4	69.6	416	22	13.5	0.81	26
2.6	11.0	1.5	75.0	63.1	408	12	16	0.98	12
0.1	10.3	0.5	74.9	71.1	401	....	....	....	16*
1.7	11.0	1.7	73.9	60.8	403	12	20	1.24	9.5
0.2	11.1	0.5	75.6	68.7	417	15	8.5	0.51	28
0.6	11.3	0.7	74.2	69.8	420	18	15	0.89	19
0.3	12.8	0.8	72.3	66.2	406	....	....	....	28*
1.2	9.0	2.6	75.3	60.1	398	....	....	....	11.5*
5.6	17.3	4.5	55.7	....	390	25	9.5	0.61	42
8.2	13.4	5.3	57.6	....	369	15	8.5	0.58	28
8.2	14.3	5.6	56.2	....	364	10	12.5	0.86	13
6.3	16.8	4.3	56.7	....	385	10	6.5	0.42	24
7.8	15.4	6.1	54.4	....	368	15	12	0.82	20
8.5	16.3	6.0	54.4	....	377	25	23.5	1.56	17
2.2	12.1	3.1	61.0	....	469	15	15	0.80	16
3.6	9.1	4.4	72.2	21.0	381	15	24	1.57	10
3.8	13.2	3.0	65.6	46.2	386	15	12	0.78	20
3.1	14.4	2.6	65.5	....	410	20	20	1.22	16
2.0	11.3	3.6	73.0	20.8	....	15	24	....	10
2.4	27.8	4.9	46.3	25.1	456	25	25	1.37	16*
1.3	10.0	2.8	74.6	....	401	25	30	1.87	13*
1.0	10.4	1.7	72.5	61.2	393	....	....	....	21*
0.1	1.1	2.1	82.8	....	....	100	26.7	....	6
1.7	9.9	5.0	69.1	....	413	25	38	2.30	10.5
1.5	8.9	3.3	64.7	....	486	25	50	2.57	8
3.8	12.3	2.9	66.4	....	389	20	7.5	0.48	42
0.7	6.1	3.1	77.3	....	398	....	....	....	....
2.4	13.5	3.2	72.4	36.5	405	15	21	1.30	11
1.5	7.7	4.2	74.5	....	389	15	40	2.57	6
1.4	10.0	5.3	65.7	....	427	15	17.5	1.03	13.5
5.2	12.8	5.0	66.1	....	383	25	33	2.15	12
6.6	12.4	5.0	66.6	....	....	50	106	....	7.5
2.4	16.7	3.0	57.7	....	451	....	....	....	3
0.8	7.1	2.3	69.9	....	475	23	73.5	3.87	5
0.5	7.8	2.1	64.5	....	499	15	30	1.50	8
4.0	21.3	3.1	40.9	....	538	28	25	1.16	18
1.5	7.4	2.0	74.2	6.2	391	15	20	1.28	9
1.2	21.6	2.0	51.8	39.5	525	30	34	1.62	14
2.0	11.6	1.7	75.7	61.4	410	....	....	....	36*
1.0	19.0	2.3	54.5	50.1	496	30	30	1.51	16

* Net weight of package at date specified in the first column.

TABLE I.—CEREAL

Date of Analysis.	Brand.	Water.	Fat.
	Miscellaneous Preparations—Continued.		
1917	Malabar Manoca	13.3	0.1
1917	Post Tavern Porridge	12.7	0.8
1913	Post Tavern Special	9.9	1.1
1917	Sea Moss Farina	15.6	0.3
1917	Sunbeam Tapioca	13.5	0.1
1913	Trix	6.2	0.2

It appears from the facts given in this bulletin that cereal breakfast foods can be bought uncooked, partially cooked, or ready to serve. The difference in prices between the three kinds is in some cases very great, but in others so little that their extra cost probably is not more than the cost of fuel which would be used for cooking the raw meals.

The greater popularity of wheat foods is indicated by the fact that 48 wheat foods, besides 29 wheat laxative preparations have been found in one market, 18 of corn, 17 of oats, 7 of rice, 2 of barley and 1 of rye.

Attention is called to the relative food value and cost of these preparations and the more general use of oat and corn foods is suggested.

OATMEAL and "ROLLED OATS," sold in bulk or in various package forms, are the most nutritious and, considering their food value, the cheapest of the cereals. The uncooked oat preparations sell generally now for from 7 to 12 cents a pound. They contain from 1½ to 2 times as much protein, 3.9 times as much fat and 120 more calories—or heat producers—per pound than other commonly used cereals, and the ratio of protein to non-protein calories is what is required in a complete ration.

WHEAT, CRACKED or FLAKED, is, next to oats, the richest in protein, but one of the most expensive cereal foods. A very large number of preparations made from wheat are on the market, none of them probably superior, considering both cost and composition, to plain cracked wheat (easily made at home by crushing whole wheat very coarse in a coffee mill).

BREAKFAST FOODS—*Concluded.*

Pounds per hundred.					Calories per ¼ lb.	Cost in 1917.			Net weight of package.
Crude fiber.	Protein (N x 6.25).	Ash.	Carbohydrates other than fiber.	Starch.		Per package.	Per pound.	Per 100 calories.	
						cts.	cts.	cts.	ozs.
0.6	0.6	1.3	84.1	....	388	22	22	1.42	16
0.2	10.3	1.5	74.5	67.2	396	18	10	0.63	28
0.3	10.9	0.9	76.9	69.3	413	14	8	0.48	28
1.5	9.1	13.6	59.9	....	....	30	120	....	4
0.1	0.6	0.2	85.5	....	396	20	20	1.26	16
0.3	14.5	1.5	77.3	48.6	422	15	16	0.95	15

* Net weight of package at date specified in the first column.

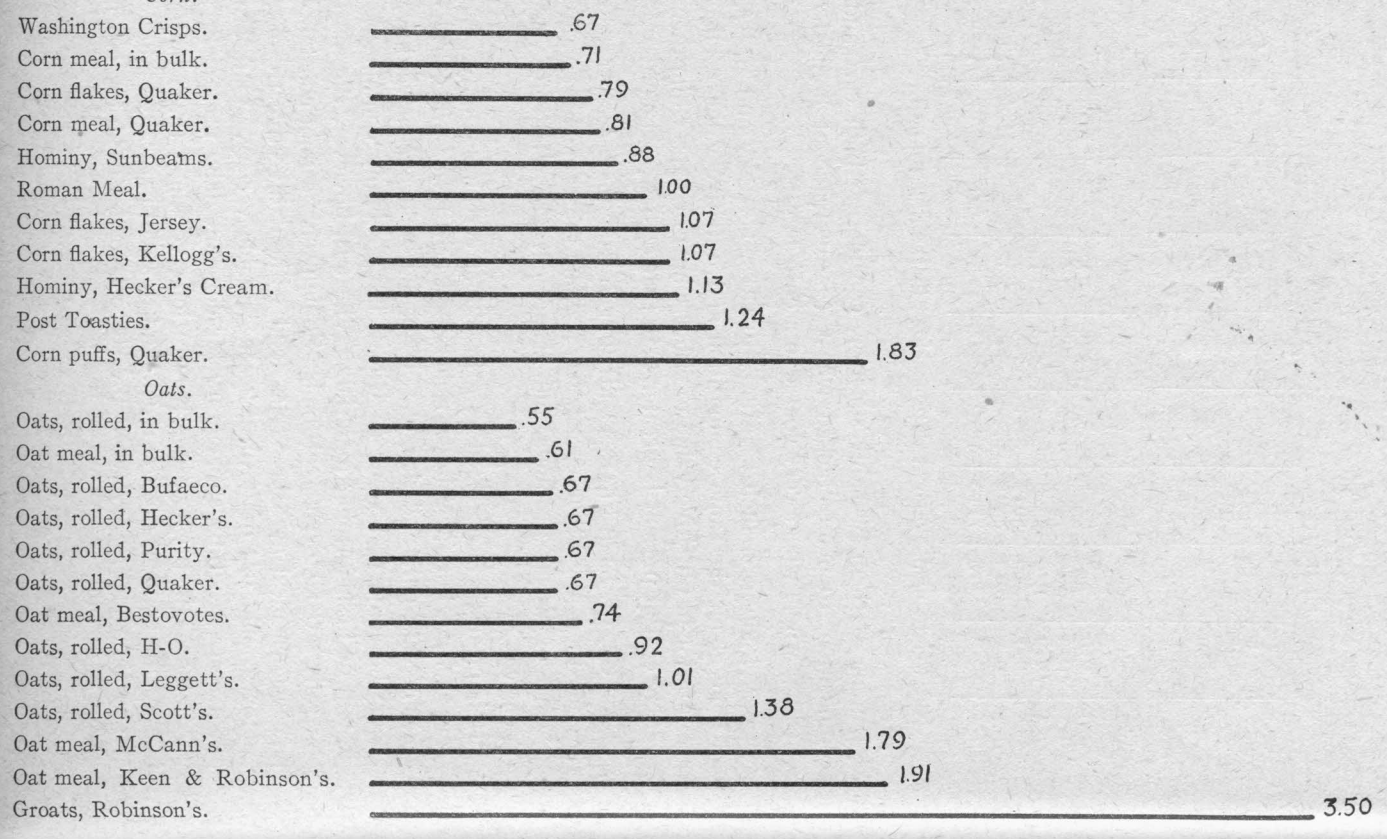
CORN PRODUCTS, such as MEAL, FLAKES, HOMINY and SAMP, all have about the same composition and nutritive value. They are inferior in nutritive value to either wheat or oats, while their average cost at present is greater than that of oat products.

RICE GRAIN, RICE FLAKES and PUFFED RICE, have less protein and fat than any other cereal, have about the same heat value as corn or wheat products and at present are relatively very expensive.

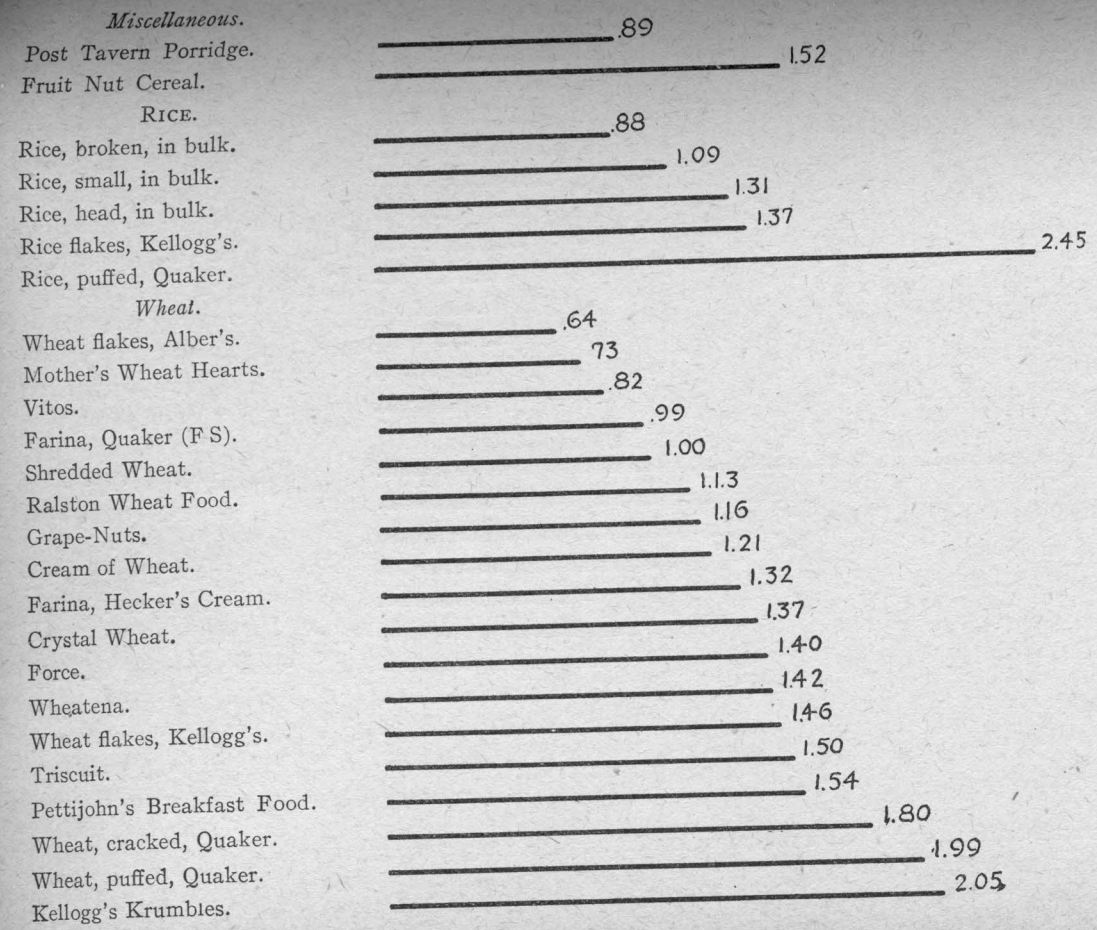
It is clear that oats used as a breakfast cereal, not only conserves wheat, but furnishes a richer food at a lower price. The other cereals, corn and rice, one cheap, the other expensive, have about the same fuel value as wheat, but generally contain less protein or flesh-forming material. Wheat is, however, the most generally satisfactory cereal food. Some people cannot constantly use corn meal as a breakfast food without digestive trouble, but occasional use of it furnishes acceptable variety. Oats are much more generally satisfactory for constant daily use.

All the grain preparations require long cooking; three hours in a double boiler is not too much, and this will naturally be done at any time in the day when the stove is being used for other purposes as well.

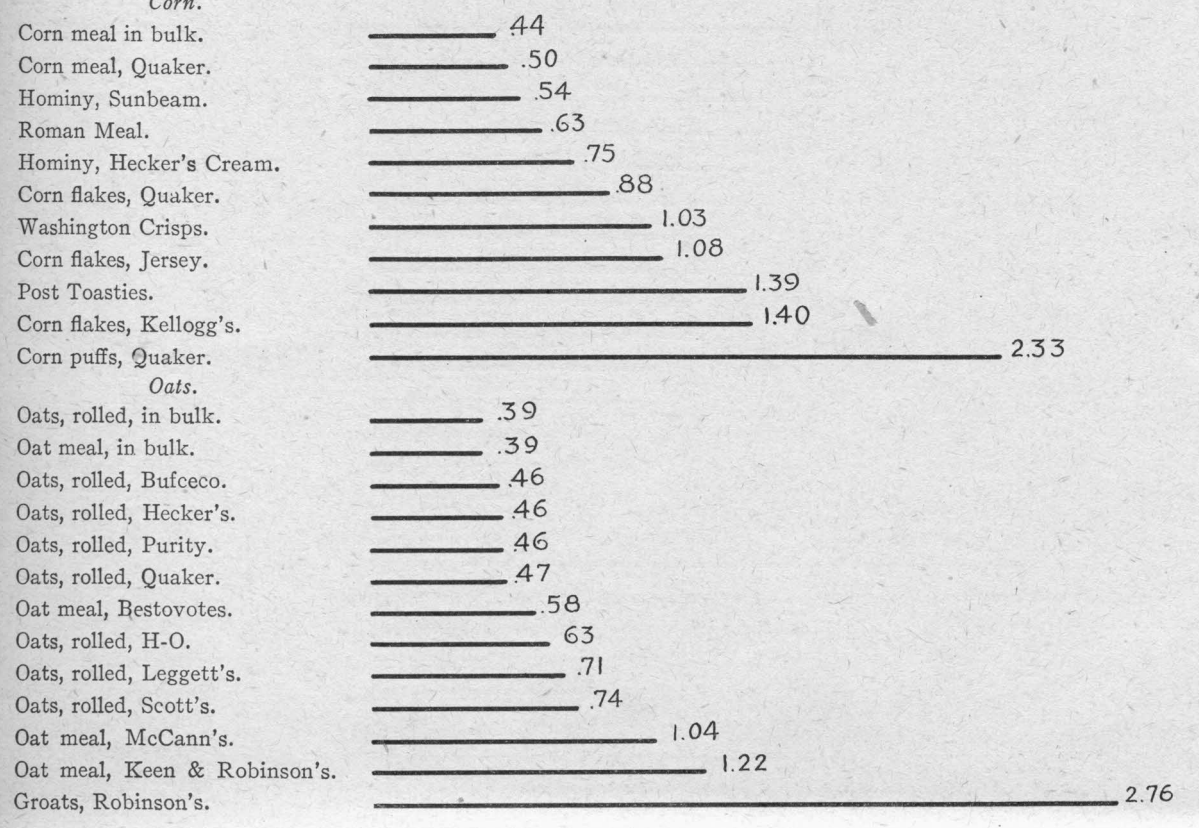
RELATIVE COST OF BREAKFAST FOODS PER SERVING (IN CENTS).



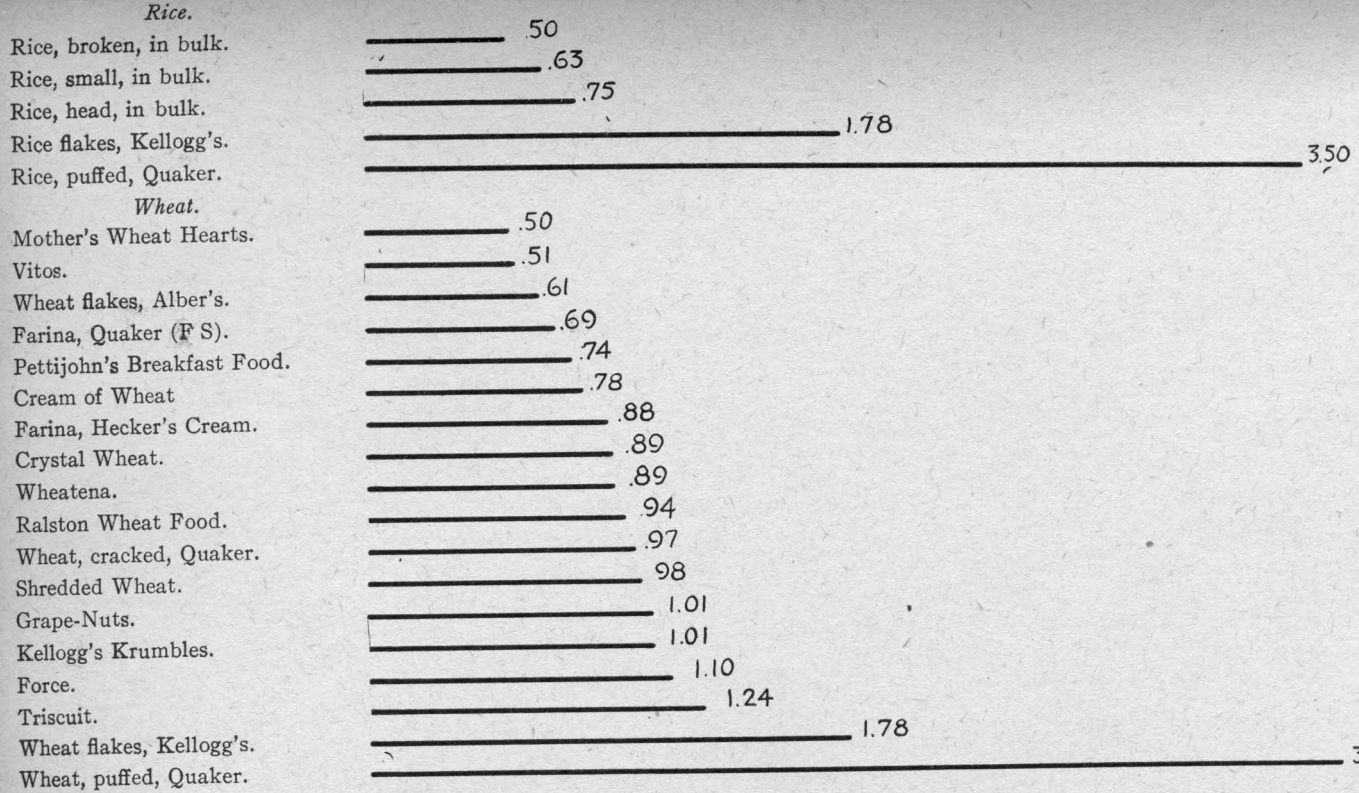
RELATIVE COST OF BREAKFAST FOODS PER SERVING (IN CENTS)—*Concluded.*



RELATIVE COST OF BREAKFAST FOODS PER 100 CALORIES (IN CENTS).



RELATIVE COST OF BREAKFAST FOODS PER 100 CALORIES (IN CENTS)—*Concluded.*



Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 198 NOVEMBER, 1917

Domestic Supplies of Potash

By E. H. JENKINS

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Domestic Supplies of Potash.

There is practically no commercial supply of potash salts which can be used to profit by farmers, and probably there will be no adequate supply while war lasts. A brief notice of the domestic supply, chiefly of various kinds of ashes, may, therefore, be helpful.

"Canada Hardwood Ashes."

The following statement shows the average composition of the so-called Canada Hardwood Ashes offered in Connecticut during the periods named, as determined by our analyses:

		Contained in the ashes, per cent.			
Period	No. of analyses	Water-soluble potash	Phosphoric acid	Lime	Valuation per ton*
1903 to 1906	72	4.74	1.35	30.00	$10.65
1907 to 1910	49	3.78	1.42	27.31	8.99
1911 to 1917	23	2.77	1.15	23.80	6.96

The figures show that Canada Ashes have decreased steadily in quality and value since 1900.

The average shipment of Canada Ashes at present has only two-thirds the value of the average shipment ten years ago. Many shipments are even less valuable and are neither hardwood ashes, nor even wood ashes in any fair meaning of the term. The reasons for this are variously given, but the fact, which alone concerns us, is indisputable. Unless buyers make a hard and fast agreement to pay on the basis of water-soluble potash, with a specified rebate for any deficiency, and have their shipments carefully sampled and analyzed, there can be no certainty of economy in their purchase.

Ashes From Household Fires.

The average of all our analyses of household wood ashes produced in this state shows 5.99 per cent. of water-soluble potash, 2.68 per cent. of phosphoric acid and 33.58 per cent. of lime; the extremes of potash being 2.93 and 7.51 per cent. The wide differences in composition are due partly to differences in the ash-content of the wood, partly also to the heat of burning. If the

* Based on values which obtained a few years ago; viz., potash as carbonate 7.7 cents and phosphoric acid 3½ cents per pound; lime 40 cents per 100 pounds.

heat is intense and long continued, especially if sand or earth adheres to the wood, more or less potash combines with silica and becomes insoluble.

A bushel of dry ashes from the stove or fireplace weighs about 48 pounds and may contain about 2.9 pounds of potash, 1¼ pounds of phosphoric acid and 16 pounds of lime, which, with the present prices of potash, would be worth 80 cents or more.

Seventeen hundred pounds, or about 35½ bushels, contain as much soluble potash (50 pounds) as 100 pounds of muriate of potash and in more desirable form, besides 45 pounds of phosphoric acid and 570 pounds of lime, in form of fine carbonate. No better fertilizer for clover or other legumes can be suggested.

Of course, these figures are only approximate, but show the wisdom of carefully collecting and saving in a dry place *all* the wood ashes from stoves and fireplaces, for use in garden and field. They are too often wasted by mixing with coal ashes, which are comparatively worthless, or thrown with wastes to be carted off to a dump.

Too much cannot be said of the value of the "open fire" in the house, whether in city or country. Aside from its value for heating and ventilation, it should be more used than it is as a "destructor" for many kinds of wastes, recovering from them the most of what has any value. A hot fire will dry and consume, with no annoyance, much of the kitchen waste of the day, or if the waste is buried at night in the hot ashes, it will dry and be consumed in the next fire. Besides the satisfaction of not burdening others with one's own waste, there is satisfaction in the saving of some valuable material which would otherwise be lost. While the amount of potash in the wastes themselves is relatively very small, the per cent. of potash in *their ashes* is, in some cases, surprisingly large. For example, recent tests at this station show the following percentages of potash and phosphoric acid in the *ashes* of certain common vegetable wastes:

	Potash	Phosphoric acid
Apple parings	11.74	3.08
Banana stalks, yellow	49.40	2.34
" " red	46.64	3.04
" skins	41.76	3.25
Grape fruit skins	30.64	3.58
Lemon skins	31.00	6.30
Orange skins	27.04	2.90

	Potash	Phosphoric acid
Peanut shells	6.45	1.23
Potato peelings	27.54	5.18
Corn cobs	17.25	3.14
Cigar ashes	16.81	2.57

There are other wastes which have very little potash in their ashes. Among these are:

	Potash	Phosphoric acid	Lime
Egg shells	0.29	0.43	52.12
Dry leaves	0.51	0.38	1.58

The Ashes of Corn Cobs.

The percentage of potash in corn cobs is quite small, about 0.45 per cent., but the ashes of corn cobs which are sometimes available where corn is shelled on the farm are a source of potash worth considering. An analysis made here some time ago showed:

Water-soluble potash	21.13%
Phosphoric acid	4.01

Ashes from Brush Heaps.

When land is cleared for cultivation or pasture, or extensive orchard pruning and cutting of worthless trees has been done, the ashes from the brush heaps will probably have nearly the same composition as that of those produced in witch-hazel factories. (See below.) Canadian analyses show 10.3 per cent. of potash in the ashes of blackberry canes, 13 per cent. in those of gooseberries and 7.9 in those of raspberries. The effect of these ashes is often seen for years in increased production on spots where brush was burned.

Salt Marsh and River Meadow Hay as a Source of Potash.

While no one would think of burning salt marsh hay for the potash in it, we call attention here to its composition, to show that the use of the herbage from salt marshes, either for feed or for litter, brings very considerable amounts of potash, as well as other plant food, to the land from the sea. Analyses made here some years ago showed that the following quantities (expressed in pounds) of plant food were carried to the farm from the salt marsh per ton of hay of the kinds named:

	Nitrogen	Phosphoric acid	Potash
Black grass (*Juncus gerardi*)	23.8	5.0	42.0
Salt grass (*Spartina juncea*)	17.4	5.4	14.0
Three-Square (*Scirpus americanus*)	23.8	5.0	30.2
Creek sedge (*Spartina glabra*)	21.8	7.4	21.2

Hay from these grasses carries besides from 12 to 90 pounds of salt, or an average of 54 pounds per ton.

Small fruits, such as raspberries and currants, which are abundantly mulched with marsh grasses, scarcely need other fertilizers, and the coarser grasses should be used abundantly as litter and composted with manure.

River meadows, where the tall "bent" grasses grow every year with no fertilizer other than that supplied in the spring freshets, yield about as much nitrogen and phosphoric acid, but less potash than the marsh grasses. The following figures from one of our previous reports show this.

In one ton of hay of the grasses named are the following number of pounds of the three plant foods under discussion:

	Nitrogen	Phosphoric acid	Potash
Black bent (*Panicum virgatum*)	29	7	10
Blue bent (*Andropogon provincialis*)	21	6	11
Indian grass (*Sorghastrum nutans*)	20	10	19
Poverty grass (*Andropogon scoparius*)	11	5	11

Ashes From Brick-Kilns.

In normal years about two hundred million brick are made in Connecticut, but in 1916 and 1917 probably not more than half or two-thirds of that number yearly, because of bad weather and scarcity of labor. From 200 to 250 cords of woods are used in burning a million brick, so that this year's consumption of wood in Connecticut brick-kilns will be at least 22,500 cords. If the wood weighs 3,250 pounds per cord and contains 0.75 per cent. of ash, with 6 per cent. of potash in the ashes, the total amount of potash contained in the wood burned would be 16.45 tons; as much as is contained in 32.9 tons of muriate of potash.

The actual yield of water-soluble potash from the ashes which can be raked from the kilns after firing is, however, quite disappointing. This is explained by the facts that a part of the ashes is carried away by the strong draft and scattered through the kiln or into the air and that the intense heat fuses the carbonate of potash with the silicate in the clay and makes much of it insoluble in water and a part insoluble even in acids.

Six analyses of brick-kiln ashes gave us an average of 1.58 per cent. of potash and 1.70 of phosphoric acid.

A careful test which we made at the brick-kilns of Stiles & Son, at North Haven, with the kind co-operation of the owners, gave the following result: The kiln had 26 arches and contained about 780,000 brick. Three of the arches were raked clean. The screened ashes weighed 388 pounds, or 3,362 pounds for the kiln. The amount of wood burned in the kiln was, approximately, 182 cords, so that a cord of wood left 18.5 pounds of ashes in the arch. The ashes contained

	Per cent.
Total acid-soluble potash	2.44
of which, water-soluble	1.30
Lime	37.42
Magnesia	3.84
Phosphoric acid	1.91
Moisture	0.16

A cord of wood such as is burned there is stated to weigh about 3,250 lbs. The amount of pure ash in it will not be far from 24.4 lbs., containing perhaps 1.5 lbs. of potash. But apparently, there was recovered in the kiln ashes only 0.45 lbs., or less than one-third, in acid-soluble form.

Ashes From Factories.

Witch-Hazel Stills. There are five or more factories in this state where witch-hazel, or black birch, brush is distilled. The brush is then burned to make steam. When coal is not used with the brush, the ashes are of excellent quality, as appears in the following analysis, made some time ago:

	Per cent.
Total potash	5.09
Water-soluble potash	4.61
Phosphoric acid	4.52
Lime	37.75
Magnesia	4.68

An analysis of the ashes, recently made, showed 4.47 per cent. of water-soluble potash and 4.95 of phosphoric acid.

Brass Mills. Four analyses of the ashes of wood used in muffles at the brass mills of this state contained the following percentages:

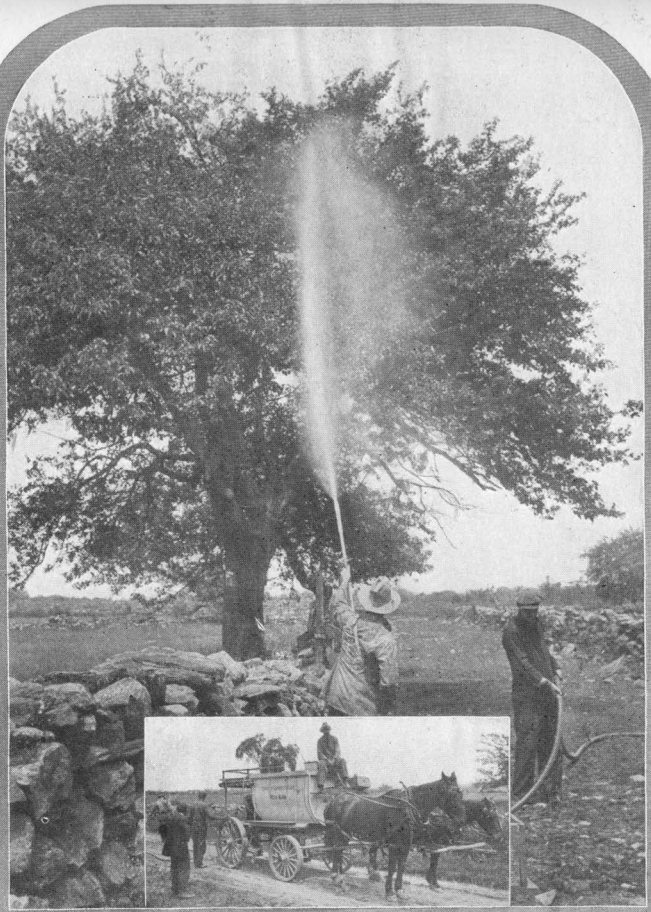
	Average	Extremes
Water-soluble potash	4.35	2.9— 6.1
Phosphoric acid	2.64	1.9— 3.4
Lime	36.00	25.4—47.4

Connecticut Agricultural Experiment Station

E. H. JENKINS, Director

SPRAY CALENDAR

W. E. BRITTON, Entomologist



NEW HAVEN, CONN.

BULLETIN 199

G. P. CLINTON, Botanist

Smoke-House. Corn cobs or hickory wood have been most commonly used on farms for smoking meats. The average of three analyses is

	Per cent.
Total potash	7.72
Phosphoric acid	1.48
Lime	41.78

The Ashes of Seaweeds.

The burning of kelp and other seaweeds, for the extraction of potash, iodine and bromine, has long been practiced on the coasts of the British Isles. It has not, to our knowledge, been done to any extent in this country.

The analyses of seaweeds in our Bulletin 194 show that the *pure* ash of kelp and rockweed may contain not far from 9 per cent. of potash, and that of the eel-grass only 3 per cent.

For farm use there is probably no economy in drying and burning seaweeds for the sake of the potash. It will probably pay better to haul wet rockweed or kelp directly to the land, and eel-grass, after draining and drying, to the pig-pen or cow stables for litter, as suggested in the Bulletin.

The Potash in Farm Manure.

Farm manure is commonly regarded as distinctly a nitrogenous manure, for its nitrogen content proclaims itself in various ways. But manure contains as much potash as nitrogen and often more, and more than one-half of this potash is contained in the urine. The same is true of the nitrogen. Yet on many farms the liquid manure is allowed to run to waste, or at any rate no great pains are taken to absorb and hold it. More attention is paid to the solid than to the liquid part of the manure.

There would be less loss of fertilizer value if all of the urine were saved and litter and dung thrown away than if all the solids of the manure were saved and all the liquid wasted.

The value of manure depends both on the character of the feed and on the meat or milk production of the animals.

A ton of farm manure from cows, hogs or steers will contain on the average from 9½ to 13 pounds of potash. It may contain considerably more if pains are taken to prevent any loss of liquid.

DIRECTIONS FOR PREPARING INSECTICIDES AND FUNGICIDES.

FORMULAS FOR INSECTICIDES.

LEAD ARSENATE.

3 lbs. (Paste) or 1½ lbs. (Dry) Lead Arsenate.
50 gals. Water.

Spray upon foliage to kill all chewing insects. May be used with Bordeaux or with lime-sulphur mixture.

PARIS GREEN.

1 lb. Paris Green. 3 lbs. Lime.
100 gals. Water.

Spray upon foliage to kill potato beetle, elm leaf beetle, and all chewing insects. Commonly used with Bordeaux mixture.

POISONED BRAN MASH.

5 lbs. Wheat Bran. 4 oz. White Arsenic or Paris Green.
1 pt. Cheap Molasses. 1 Lemon. 7 pts. Water.

Scatter around in field to kill cut-worms, army worms and grasshoppers.

HELLEBORE.

Dust on the plants, or mix with water, 1 oz. in 2 gals. and spray. For currant-worm and other saw-fly larvae.

COMMERCIAL LIME-SULPHUR.

Winter Spray.

1 part lime and sulphur. 9 parts water.

Summer Spray.

1¼ to 1½ parts lime and sulphur. 45 to 50 parts water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

NICOTINE SOLUTION.

½ pint in 50 gals. Water.

Several solutions are now sold containing 40% or more of nicotine. Excellent for killing aphids and other sucking insects. Add soap for a spreader.

KEROSENE EMULSION.

2 gals. Kerosene. ½ lb. common soap.
1 gal. Water.

Dissolve the soap in hot water, add the kerosene, and churn together with pump until a white creamy mass is formed which thickens on cooling. Dilute nine times before using.

MISCIBLE OILS.

Several miscible oils are on the market, such as "Scalecide" and "Jarvis Compound." Are used to kill San José Scale, especially on old apple trees. Should be mixed 1 part in 15 parts water.

COMMON SOAP.

1 lb in 8 gals. Water.

Spray upon foliage to kill red spider, aphids and other sucking insects.

CARBON DISULPHIDE.

To kill insects infesting stored grain, in tight bins, use 1 lb. for about 40 bushels of grain. Expose for about 36 hours.

NAPHTHALENE.

Used in the form of moth-balls and "flakes" to keep clothes moths out of clothing. "Flakes" scattered around the borders of floors and shelves will drive away ants.

FORMALIN FLY POISON.

1 tablespoonful Commercial Formalin.
½ cup Sweet Milk. ½ cup Water.

Mix together and expose in a shallow plate with a slice of bread in it. Flies will drink the liquid, especially if no other moisture is accessible, and be killed.

HYDROCYANIC ACID GAS.

1 oz. Potassium Cyanide.
2 oz. Sulphuric Acid. 4 oz. Water.
For each 100 cu. ft. space.

For dormant stock place the acid and water in an earthen jar in the house, drop in the cyanide and close the house at once for half an hour. Ventilate for ten minutes before entering. In greenhouse use 1 oz. of cyanide for each 1000 cu. ft. of space.

FORMULAS FOR COMMON FUNGICIDES.

COMMERCIAL LIME-SULPHUR.

Winter Spray.
1 part lime and sulphur. 9 parts water.
Summer Spray.
1¼ to 1½ parts lime and sulphur. 45 to 50 parts water.

Use winter spray for San José scale and peach leaf curl; summer spray for fungi, to which, as needed, add lead arsenate to kill chewing insects.

BORDEAUX MIXTURE.

4 lbs. Copper Sulphate.
4 lbs. Fresh Lime. 40 to 50 gals. Water.

Dissolve the copper sulphate in hot water or from a coarse bag suspended in cold water; slake the lime separately and strain. Dilute the latter to about 20 gals., into which pour the copper sulphate, diluted to about 20 gals., stirring the mixture; dilute further to form the forty-five or fifty gallons; or dilute each to 25 gals., and pour together into barrel. Stock solutions of the copper sulphate and lime, rate 1 lb. to 1 gal. water, can be made separately and used as needed.

SELF-BOILED LIME-SULPHUR.

8 lbs. Fresh Whitewash Lime.
8 lbs. Fine Sulphur. 45 to 50 gals. Water.

Start the lime slaking, sift and thoroughly stir in the sulphur, using just enough water to prevent burning and allow to boil from heat of lime for fifteen minutes. Then dilute and apply.

FORMALIN.

A. 1 pt. (1 lb.) Formalin in 50 gals. water, for sprinkling grain to kill smut.

B. 1 pt. Formalin in 30 gals. water, for soaking tubers to prevent potato scab.

C. 1 pt. Formalin in 12½ gals. water, for soil treatment. Use two-thirds to 1 gal. for each square foot of surface treated; cover for 24 hours after treatment; air afterwards, and stir soil; allow 7-10 days before seeding and 10-14 days before transplanting in this soil.

FORMULAS FOR LESS-USED FUNGICIDES.

OTHER BORDEAUX MIXTURES.

Dilute Bordeaux Mixture. Use 1 lb. copper sulphate, 4 of lime, and make as above directed. For second and third sprayings of apples to lessen russeting of the fruit.

Soda Bordeaux Mixture. 4 lbs. copper sulphate, 1⅛ to 1½ lbs. soda lye, 50 gals. water. Use only enough lye to make the solution alkaline to test paper. Used sometimes for late spraying of grapes, etc., where spray sediment is objectionable.

Resin Bordeaux Mixture. Melt 5 lbs. resin with 1 pt. fish oil over fire, cool slightly, add 1 lb. soda lye, stirring. Add 5 gals. water and boil till the mixture will dissolve in cold water. Mix 2 gals. with 48 of Bordeaux mixture. Used sometimes on such glaucous plants as asparagus, cabbage, onions, etc., to make a more adhesive spray.

POTASSIUM SULPHIDE.

3 ozs. Potassium Sulphide. 10 gals. Water.

Used chiefly in greenhouses, or for powdery mildews.

AMM. SOL. COP. CARBONATE.

5 ozs. Copper Carbonate.
3 pts. Ammonia. 45-50 gals. Water.

Use *just enough* ammonia (if strong, dilute with several volumes of water) to dissolve the copper carbonate; then dilute to final volume. This fungicide is not as good as Bordeaux, but is used to avoid sediment on the foliage or fruit.

COPPER SULPHATE.

2 to 3 lbs. Copper Sulphate. 45-50 gals. Water.

Used chiefly as a winter spray. 1 lb. to 250 gals. water is sometimes used on foliage. Now rarely used.

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COPPER LIME-SULPHUR.

2 lbs. Copper Sulphate.
1½ gals. Com. Lime-Sulphur. 45-50 gals. Water.

Dissolve copper sulphate in part of the water, and then add with the lime-sulphur to the remainder. Apparently a good fungicide but likely to russet apples as does strong Bordeaux.

SULPHUR MIXTURE.

Various commercial forms of Sulphur as "Atomic Sulphur" and "Sulphur Paste," have fungicidal value, and have been used by us for summer spraying of peaches with little or no injury, at the rate of 8 lbs. to 45-50 gals. of water.

FORMALIN FUMES.

3 pts. Formalin. 23 ozs. Potassium Permanganate.
For each 1000 cu. ft. Space.

Place bulbs or tubers in 6 to 12 in. crates so fumes can get at them. To prevent injury to potatoes, fill space at rate of 167 bu. Place Formalin in large pail in cleared central space and drop in the crystals of potassium permanganate. Close room air-tight for 24 to 48 hours.

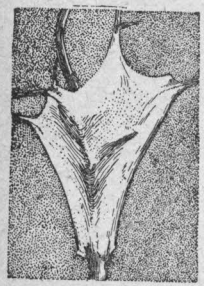
INSECT AND FUNGOUS PESTS OF CULTIVATED PLANTS.

Insects, etc.

APPLE.

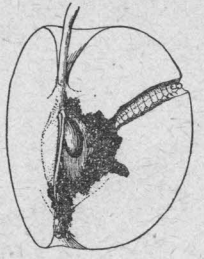
Bud-Moths: Case Bearers: Leaf Crumpler:—Small over-wintering caterpillars feed upon the unfolding leaves. Spray with lead arsenate as soon as leaf buds begin to open. Repeat a few days later, if necessary. Rept. 1909, p. 353.

Canker-Worms—During May small looping caterpillars devour the leaves and spin down on threads when disturbed. Spray foliage with lead arsenate before blossoms open, and again soon after they fall. In unsprayed orchards sticky tanglefoot bands should be placed around trunks of trees in October, kept sticky until January 1st, and again kept sticky during April and May. Rept. 1908, p. 777.



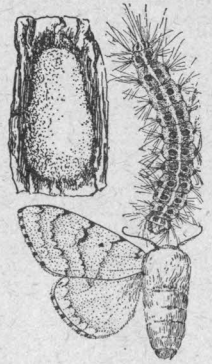
Tent-Caterpillar—During May the caterpillars form nests at the forks of the branches, and devour the leaves. Clip off and burn egg masses on twigs in winter. Remove nests with caterpillar brush. Spray with lead arsenate once before the blossoms open and again soon after they fall. Bull. 177, and Rept. 1913, p. 226.

Lesser Apple Worm—Larva feeds on exterior of nearly mature fruit, and often causes injury in storage. Spray as for Codling-Moth. Rept. 1910, p. 595.



Codling-Moth or **Apple-Worm**—Pink caterpillar tunnels inside the fruit, especially around the core. Spray with lead arsenate as soon as the blossoms fall. Repeat three or four weeks later. Keep foliage and fruit covered until fruit is nearly grown. Rept. 1910, p. 594.

Brown-Tail Moth: Fall Web-Worm—See Pear.



Gipsy Moth—Occurs in the United States only in south-eastern New England. Brownish hairy caterpillars defoliate trees in May and June. Band trees with tanglefoot, and with burlap, which should be examined each day to destroy caterpillars. From August to May egg-masses can be destroyed by soaking them with creosote. Spray foliage with lead arsenate. Bull. 186; Repts. 1905, p. 246; 1906, p. 235; 1907, p. 300; also placard.

Curculios—Grubs of both apple and plum curculios infest the fruit, making it gnarled and ill-shaped. Spray twice after blossoms fall as for Codling-Moth, and remove infested fruit in thinning. Rept. 1904, p. 219.

Green Fruit Worms: Palmer Worm: Leaf Roller—Caterpillars all feed upon foliage and immature fruit. Spray with lead arsenate, as for Codling-Moth.

Tussock Moths—Tufted caterpillars of several species feed upon the leaves in mid-summer. Spray with lead arsenate as for Codling-Moth. Rept. 1905, p. 230; 1907, p. 332; 1916, p. 105.

Yellow-necked Caterpillar: Red-humped Caterpillar—Feed in clusters and often strip young trees in fall. Hand-picking is easy method of control. Spray leaves with lead arsenate. Rept. 1901, p. 274.

Maggot or **Railroad Worm**—Maggots tunnel through the pulp of the ripening fruit of sweet and sub-acid varieties, especially those ripening early in the season. Destroy all infested fruit. Rept. 1910, p. 593.

Round-Headed Borer: Flat-Headed Borer—Grubs burrow in wood at base of trunks. Watch trees and dig out borers wherever sawdust appears. Paint trunk with lead arsenate and lime-sulphur. Rept. 1907, p. 333.

Leaf Hoppers—Whitish insects sucking sap from underside the leaves. Spray with nicotine solution, as for aphis.

Tarnished Plant Bug—Injures developing fruit by sucking sap, forming dimples. Spray with nicotine solution as for aphis.

Red Spider: Clover Mite—Cause much injury to leaves, especially in dry seasons. Spray with kerosene emulsion or nicotine solution as summer treatment. Eggs of latter species killed by lime-sulphur spray in winter.

Leaf-Blister Mite—See Pear.

Green and **Rosy Aphids**—Green aphids suck sap from the leaves and terminal shoots, causing leaves to curl and checking growth. Rosy aphids infest fruit clusters, checking development. Spray with nicotine solution ($\frac{1}{2}$ pint in 50 gallons water), either separately or in combination with lead arsenate, lime-sulphur or Bordeaux Mixture. Repts. 1903, p. 259; 1909, p. 343.

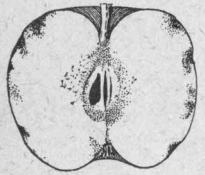
San José Scale—See Peach. Spray dormant trees with lime-sulphur or miscible oil. Bull. 165; Rept. 1904, p. 221.

Red Bugs—Two species of red leaf bugs suck the sap, causing leaves and fruit to become distorted. Spray with nicotine solution, as for aphis.

Woolly Apple Aphis—A bluish-white, cottony plant louse in colonies on bark, forming galls or swellings on twigs of small trees, and preventing wounds from healing; also on roots, forming galls, and destroying small feeding roots. Plant only clean or fumigated stock. Use tobacco dust in soil around trees. Spray above ground with kerosene emulsion.

Oyster-Shell Scale: Scurfy Scale—Scale insects with elongated or pear-shaped shells, on bark, suck sap from the twigs; the former about the same color as the bark, the latter light gray or whitish. Spray with nicotine solution; soap and water; or kerosene emulsion, about the second week in June. Bull. 143; Rept. 1903, p. 225.

Fungi, etc.



Baldwin Spot—Shows as small diseased masses of brownish tissue, usually a short distance beneath the skin; finally may appear at the surface as small, discolored, shrunken areas, then very similar in appearance to some of the fruit speck troubles. Not a fungous, but apparently a physiological disease. Thought by some to be due to unusual local loss of water; possibly may start from punctures of Rosy Aphis or similar puncturing insects. No remedy known.

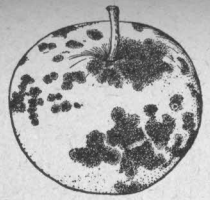
Cankers—Occur on branches and are caused chiefly by European canker fungus which eventually forms a cavity surrounded by concentric elevated rings of wood extending to bark, which each year is killed a little further, adding another ridge. Cut off infected branches, or cut out infected wood and bark; paint over cut surfaces. Keep orchard well sprayed and trimmed. Rept. 1903, p. 299.

Black Rot—Causes mature fruit to rot, eventually turning it black; forms small brown spots on leaves; does some damage through cankers on branches, which are eventually killed. Treat as for Scab; prune and burn all dead limbs and twigs; cut out and paint over large cankers when found. Rept. 1909–10, p. 590.

Fruit Specks—Form more or less numerous, small, brown or black spots, starting at surface of fruit and slowly working inward; the true Fruit Spot often has a pinkish or purplish border in light-skinned varieties. Due to various fungi. Usually controlled by spraying as for Scab. Rept. 1909–10, p. 590.

Rust—Shows as orange-colored blotches on leaves, eventually producing minute fringed clustered-cups imbedded on the under side; less frequent on fruit. Rust spreads to the apple from the *cedar-apples*, which appear in the early spring on the red cedar. All cedars near the orchard should be destroyed. There is great difference in the susceptibility of different varieties to this disease. Spraying is only partially successful in this state, as the leaves must be well coated continuously with spray from the time they begin to unfold, until the end of July. Repts. 1891, p. 161; 1909–10, p. 591.

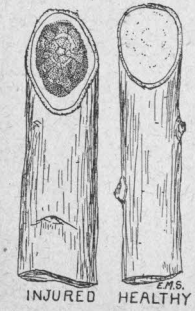
Scab—Produces "scabby spots" on fruit and leaves; rarely on twigs. Spray the unfolding leaves before the blossoms open, again after the petals fall, and follow with a third spraying about four weeks later. For first treatment, use strong Bordeaux, for second and third, weak Bordeaux or lime-sulphur. Rept. 1909–10, p. 591.



Sooty Blotch—Forms on fruit an olive-black superficial growth in distinct round colonies, or often merging together. Spray with Bordeaux as for Scab, or with lime-sulphur 1½ to 50. Repts. 1909–10, p. 592; 1911, p. 367.

Blight—See Pear.

Spray Injury—Takes the form usually of burn on leaves and russeting on fruit. Is most likely to occur after second and later sprayings. Worst in wet seasons. Spraying in bright sunshine may cause some scorch of fruit on sunny side. Varies greatly with different sprays. Avoid those known to be injurious or injurious combinations (as soap and lead arsenate); use Bordeaux only for *first* summer treatment or on varieties not especially subject to russeting. Rept. 1911, p. 360.



Winter Injury—Takes various forms from different conditions, such as imperfect fertilization or russeting of fruit following late spring frosts; sun scorch of trunks due to mild winter weather followed by sudden cold; bud and twig killing, frost cracks in trunks, blackened wood, dead roots, etc., following unusually cold winters or unfavorable environment. Set out only hardy varieties; avoid planting in wet ground or on hillsides with extreme south or southwest slopes. Head trees low; avoid late fertilization and cultivation; keep earth tight around trunks; use cover crops. Repts. 1903, p. 303; 1906, p. 310; 1914, p. 6.

Storage Rots—Are troubles caused by a variety of fungi. Store fruit, in a dry condition, in a cool well aired place. Do not store in too deep piles or too tight receptacles. Use poorer keeping varieties first, and sort over if necessary. Apples from well sprayed trees keep best. Rept. 1915, p. 426.

General Treatment for Apple Orchards.

For the general control of fungi and insects on apples in Connecticut we make the following recommendations:

(1) Winter treatment (spraying dormant trees) is necessary only in the case of the presence of the San José scale, or leaf-blister mite, when commercial lime-sulphur, 1–9, or miscible oils, 1–15, may be used.

(2) As a rule, three summer treatments with a fungicide are necessary to control the fungous diseases, and the last two of these should contain an insecticide. These sprayings should be made as follows: 1st, just before the blossoms open, on the young unfolding leaves (April 27th to May 10th, according to the season and variety); 2nd, as soon as all the blossoms have fallen (May 10th to 30th); 3d, about one month later (usually June 10th to 25th).

(3) Where fungi are not prevalent, especially scab, the first summer treatment may be omitted. Occasionally, perhaps in

alternative years, where fungi are quite inconspicuous, the fungicide may be entirely omitted, and only the two sprayings with lead arsenate for insects given.

(4) For fungicides, we recommend Bordeaux mixture of the 4–4–50 strength for the first spraying, and of the 1–4–50 for the second and third sprayings; or commercial lime-sulphur, used at a strength of $1\frac{1}{4}$ to $1\frac{1}{2}$ gallons per fifty gallons of water, for all three sprayings. The former has better fungicidal value, and the latter is less likely to produce spray injury, especially russeting of the fruit. Where fungi are prevalent, the former might be used, while with varieties russeting badly, as Baldwin, the latter is likely to prove more satisfactory; or use strong Bordeaux for first spraying and lime-sulphur for second and third.

(5) For the insecticide in the above, use lead arsenate, if in the paste form at the rate of three pounds per fifty gallons of the mixture, or if in the powder form one and one-half pounds per fifty gallons.

(6) If canker worms, tent-caterpillar, bud-moth, or brown-tail moth are causing damage, add lead arsenate to the first summer treatment, and if aphids are present nicotine solution should also be included. Nicotine solution may be added to any of the subsequent treatments to destroy aphids, red bugs, tarnished plant bug, etc.

ASH.

Insects.

Oyster-Shell Scale—See Apple.

ASPARAGUS.

Insects.

Asparagus Beetles, Common and **12-spotted**—Adults and larvae devour the foliage. Cut everything clean during the cutting season; afterward spray with lead arsenate. Repts. 1902, p. 172; and 1903, p. 276.

Asparagus Miner—Larvae tunnel under epidermis of stem near base, causing premature death of plant above ground. Burn infested stalks. Rept. 1906, p. 303.

Fungi.

Rust—Produces (most conspicuous stages) small reddish or black elongated pustules scattered over stems. In fall, carefully gather and burn all stems from affected beds and escaped plants in vicinity. In gathering for market cut below the ground, as protruding stems offer opportunity for development of first stage of the fungus. Spraying with Resin Bordeaux partially controls the disease, but this is difficult and expensive. Begin spraying the latter part of July and repeat about every 10 days until the middle of September. Thorough cultivation and fertilization, with plenty of humus in the soil, are advocated as beneficial. Grow varieties most resistant to the disease and select seed for new stock from resistant individuals if found. Repts. 1896, p. 281; 1904, p. 313.

ASTER.

Insects.

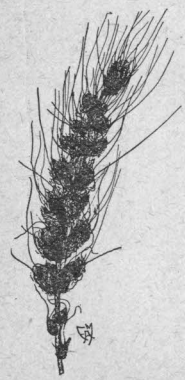
Blister Beetles—Three or four species feed upon the flowers, the black one being commonest. Practice hand-picking and cover choice plants with mosquito netting.

Fungi, etc.

Yellows—Shows in the yellowed and often imperfectly developed foliage and one-sided blossoms. A physiological trouble whose cause is not definitely known. Buy best seed; transplant only healthy plants and have soil conditions good. Repts. 1903, p. 306; 1914, p. 413 (26).

BARLEY.

Insects.



Army Worm—See Grass.

Fungi.

Rusts—See Oats and Wheat.

Smuts—Are of two kinds, covered and loose, both largely destroying the infected spikes and changing them into black, sooty structures, in the latter kind easily dissipated. Treatment, see Oats and Wheat. Rept. 1903, p. 306.

BEAN.

Insects.

Green Clover Worm—Occasionally green, wriggling caterpillars riddle the leaves in June and July. Dust string beans with air-slaked lime or other fine powder. Spray shell beans with lead arsenate. Rept. 1908, p. 828.

Weevils—Adults lay eggs in the pods in the field and continue to breed in the dried seed, finally rendering it unfit for food or for planting. Fumigate the seed with carbon disulphide, or heat in oven for 1 hour between 120° and 150° F. Bull. 195, p. 6.

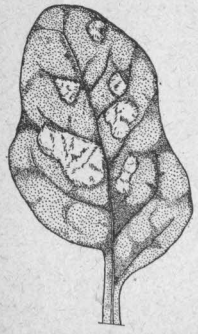
Fungi.

Anthracnose—Shows on leaves and pods as roundish discolored areas, often with a purplish border. Save seed from pods showing no spots and plant these by themselves, selecting each year seed from unspotted pods for the seed crop and using remainder for general crop. Destroy all infected seedlings. Where very troublesome spray with Bordeaux, beginning when plants are only a few inches high and repeating about every 10 to 14 days until pods are forming. Rotation and destruction of old vines may prove helpful in keeping the trouble in check.

Blight—Appears much like anthracnose, but with discolored areas usually having more of a translucent or watery character. Treat same as anthracnose. Repts. 1898, p. 262; 1903, p. 307.

Downy Mildew—Forms dense, white, woolly growths on pods and less luxuriantly on young stems and leaves of the Lima bean. As the fungus usually appears first and most vigorously in low moist places, the land used should be high or well drained. Serious only in years unusually moist after the middle of July. Spray with Bordeaux, beginning about the middle of July, and repeat every 10–14 days until the first part of September. Rept. 1905, p. 278.

Rust—Produces small, round, reddish or black, dusty outbreaks, usually on the leaves. Plant varieties not likely to rust. Burn the old infected plants in the fall. Rept. 1903, p. 308.



BEET-CHARD.

Insects.

Leaf-Miner—A small fly lays eggs in the leaves, and the larvae tunnel or mine between upper and lower surfaces. Practice clean cultivation. Destroy all infested leaves. Destroy all plants of the weed known as "lambs quarters" in which this insect breeds. Practice late fall plowing.

Fungi.

Leaf Blight—See Mangel. Rept. 1903, p. 309.

BEGONIA.

Eelworms.

Leaf-Blight Eelworm—Produces conspicuous dead areas on the leaves of Begonias (especially var. *Cincinnati*), ferns, etc. Spots vary in size and shape according to host and disposition of larger veins. Buy healthy stock only; keep infected plants by themselves and give them plenty of room; keep leaves as dry as possible and pick off and burn worst infected. Rept. 1915, p. 455.

BIRCH.

Insects.

Tussock Moths—See Apple, Hickory, and Horse Chestnut.

Birch Leaf-Skeletonizer or **Birch Bucculatrix**—Small greenish-yellow larvae feed upon both sides of the leaves in late summer, often entirely defoliating the trees. Spray with lead arsenate in July. Rept. 1910, p. 701.

Bronze Birch Borer—Grub makes spiral tunnel just beneath bark of upper main branches, ridges showing on outside. Cut and burn infested trees before May 1st.

BLACKBERRY.

Insects.

Blackberry Crown Borer—Larva tunnels in roots and at base of stem. Dig out and destroy.

Red-Necked Cane Borer—Larva tunnels in canes causing an irregular swelling or gall, often three inches in length. Cut and burn all infested canes in winter or early spring.

Blackberry Sawfly—Larvae devour leaves in June and first part of July. Spray about June 15th with lead arsenate. Rept. 1912, p. 236.

Fungi, etc.

Crown Gall—Forms hard galls or irregular excrescences on roots and lower parts of stems of blackberries, raspberries and several other hosts. Dig out and burn affected plants as soon as discovered. Never use infected stock for transplanting. A bacterial trouble. Rept. 1903, p. 354.

Leaf Spot—Forms on leaves small circular spots with whitish center and purplish border; also occurs on dewberry and raspberry. Not usually serious but where necessary it probably can be controlled by Bordeaux applied to the leaves, beginning before they have reached their full size. Rept. 1903, p. 309.

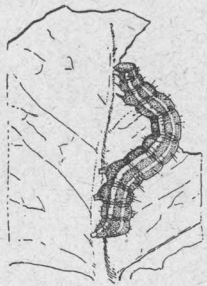
Orange Rust—Breaks out in spring or early summer as dusty masses of bright orange spores over the under side of the leaves. The fungus is perennial in the underground parts of the host, so that the disease appears year after year. Dig up and burn infected plants. Rept. 1903, p. 309.

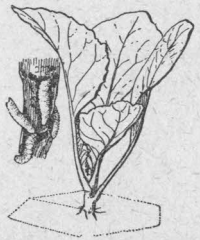
BOX.

Insects.

Leaf-Miner—A small two-winged fly lays eggs in the leaf and the larvae tunnel between the upper and lower surfaces. Destroy infested leaves. Fumigate the plants with hydrocyanic acid gas.

Oyster-Shell Scale—See Apple.





CABBAGE-CAULIFLOWER.

Insects.

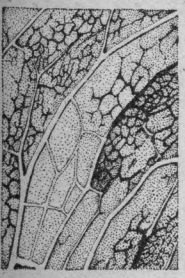
Cabbage Worm—Green worms feed upon leaves all through season. Spray unheaded plants with lead arsenate. Use insect powder or hellebore on headed plants. Bull. 190, p. 9; Rept. 1903, p. 271.

Cabbage Looper—Smooth looping caterpillars feed with cabbage worms late in summer, and require same treatment. Bull. 190, p. 12, Rept. 1910, p. 706.

Cabbage Maggot—Infests stems of early-set plants near surface of ground checking growth and often killing them. Practice crop rotation. Place hexagonal tarred paper disks around stems at setting time. Treat with carbolic acid emulsion. Bull. 190, p. 3; Repts. 1908, p. 832; 1914, p. 142; 1915, p. 114.

Cabbage Aphis—Sucks sap from the leaves. Spray with nicotine solution or kerosene emulsion. Bull. 190, p. 14.

Fungi, etc.



Black (Bacterial) Rot—Forms black lines in veins of leaves. In time leaves turn yellow and easily drop off, and interior of head develops a general soft rot. As the germs can be carried on the seed, avoid seed from infected fields. If in doubt, treat seed in formalin, 1 part to 240 of water for 15 minutes. Keep refuse from diseased plants out of manure; practice rotation; make seed bed in new soil if disease appears in old one. Rept. 1912, p. 345.

Club Root—Causes knob-like enlargements on the roots of cabbage and allied plants. The germ often becomes established in the soil; when possible avoid such land and the use of refuse from old plants on the soil. Be especially careful that the seed bed is not infected. Infected land, if used, should be treated in the fall with lime broadcast at the rate of 80 bushels per acre and worked in. Rept. 1903, p. 310.

Soft Rot—See Salsify. Report 1903, p. 311.

CARNATION.

Insects.

Green Fly or **Aphis**—Sucks sap from young leaves and buds. Fumigate greenhouse with tobacco, or spray with nicotine solution or with soap and water.

Fungi.

Leaf Mold and **Leaf Spot**—Are two troubles much alike in appearance, producing grayish spots with colored borders on stem, leaves and calyx. Treat as for Rust.

Rust—Produces small dusty pustules, more or less confluent, on the leaves and stems. Select, if feasible, only rust-resisting varieties. Spray in field with Bordeaux, adding 1½ lbs. soap to each 50 gallons (helps mixture to adhere to plants). Select for transplanting only hardy and rust-free specimens. Keep air of greenhouse as dry as is consistent with good growth. One or two sprayings with Soap or Resin-Bordeaux, after transplanting in greenhouse, may be given if desired; for repeated sprayings use potassium sulphide or weak copper sulphate. Rept. 1903, p. 312.

Stem Rot and **Wilt**—Cause the lower leaves first to turn yellow and dry up; then as the stem gradually rots off at its base, the whole plant becomes affected and finally dies. Select cuttings only from perfectly healthy plants, and if necessary start these in sterilized soil and replant out of doors in new land, avoiding excessive use of manure. If disease appears after setting out in the greenhouse, pull up infected plants upon appearance of first symptoms, make liberal application of lime, avoid over-watering, and see that roots are properly aerated. Repts. 1897, p. 175; 1903, p. 312.

CEDAR.

Insects.

Web-Worm—Small brown caterpillars feed upon the leaves which they web together. *Spray with lead arsenate.*

Fungi.

Cedar-Apple Rust—Appears in spring as conspicuous rounded galls with jelly-like horns bearing spores that carry the fungus to apple and related hosts. Cut off and burn all *cedar-apples*. See Apple Rust.

CELERY.

Insects.

Celery Caterpillar—Feeds upon the leaves of celery, parsley, fennel, carrot and parsnip. On the latter two plants lead arsenate may be used. On celery and parsley hand picking is perhaps the best remedy.

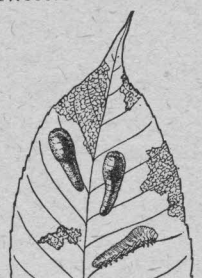
Fungi.

Leaf Blight and **Leaf Spot**—Are two diseases showing "rusty" spots on leaves and petioles; the latter trouble distinguished by the very minute black dots in the discolored spots (fig.), often progressing in stalks after storage. Spray the plants thoroughly in the seed bed with Bordeaux, as infected plants are often the means of introducing the trouble in the field. If necessary, continue the spraying after transplanting at intervals of about two weeks up to the middle of September. Before covering for bleaching, if leaf spot is abundant, dust with sulphur, and before final storage remove infected leaves and dust again. Rept. 1897, p. 167.

Soft (Heart) Rot—Shows as a soft rot of the tissues often confined to the heart. Do not plant in too wet soil, avoid land with green cover crops recently plowed in; in banking allow for proper aeration. See Salsify. Rept. 1914, p. 10.

CHERRY.

Insects.



Cherry or **Pear Slug**—Larvae eat away the green tissue from upper side of leaf. Spray with lead arsenate or with hellebore.

Canker Worms—See Apple.

Cherry Maggots or **Fruit Flies**—Larvae of two species infest maturing fruit. Sprinkle foliage with sweetened lead arsenate in early June to kill the adult flies.

Plum Curculio—See Plum.

Cherry Aphid—A brown aphid which sucks sap from under side of leaves causing them to curl. Spray with nicotine solution, soap and water, or kerosene emulsion.

Fungi.

Black Knot—Forms knot-like excrescences, usually several inches long, on twigs and branches. When planting, use only trees free from this trouble; in the orchard, cut off and burn all infected branches in late fall or winter, painting over large cut surfaces. Cutting *out* knots is rarely advisable, as new outbreaks usually result. In cutting off, cut several inches below the knot, to insure removal of the mycelial threads in

the tissues. Remove all knots each year until they fail to reappear. Spraying in spring and early summer with self-boiled lime-sulphur or atomic sulphur helps to keep new knots from fruiting, but is entirely secondary in importance to the removal of the knots. Rept. 1911, p. 399.

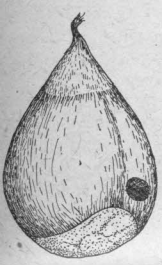
Brown Rot—See Plum. Rept. 1911, p. 402.

Leaf Spot—Shows as numerous, closely placed, purplish spots on leaves, which often have "Shotholes." Spraying, if begun on young leaves early in May, is effective but use the dilute Bordeaux, or better still, self-boiled lime-sulphur to avoid injury to the foliage. Give several sprayings at intervals of two weeks. This helps to keep down the brown rot also. Repts. 1895, p. 188; 1911, p. 401. Also known as Anthracnose.

Powdery Mildew—Develops a cobweb-like growth over the leaves; in fall forms numerous, minute, black fruiting-bodies, especially on under surfaces. Usually worst in young trees; controlled by spraying if necessary.

CHESTNUT-CHINQUAPIN.

Insects.



Canker Worms—See Apple.

Nut Weevils—Long-nosed snout beetles lay eggs in developing fruit and the grubs infest the nuts. Destroy all infested nuts. Fumigate nuts with carbon disulphide as for beans.

Two-lined Chestnut Borer—Long, slender, flat-headed larvae make sinuous tunnels under bark of weakened chestnut and oak trees. Badly infested trees should be removed and burned, or the bark removed before the insects mature and spread to other trees.

Fungi.

Bark Disease (Blight)—Forms cankers in the bark that eventually girdle infected limb and cause death of parts above. Spreads over tree so that usually it dies within two to five years. Rarely shade trees can be saved by carefully cutting out and painting over the cankers. For forest trees it is best to let the disease take its course, and remove at least the larger trees within a year or two after their death to prevent deterioration of the wood. Rept. 1912, p. 359; Bull. 178.

CHRYSANTHEMUM.

Insects.

Black Fly or **Aphis**—Sucks the juice from the young leaves and flower stems. Fumigate the house with tobacco; dip the plants in or spray them with soap and water or nicotine solution.

Fungi.

Powdery Mildew—Develops a white mealy or cobweb coating on leaves. Use good judgment in airing and watering, and if necessary, spray from time to time with potassium sulphide or paint heating pipes with sulphur.

Rust—*Appears as dusty reddish-brown outbreaks, about the size of a pin head, chiefly on under sides of leaves. Avoid worst rusting varieties. Start with cuttings free from rust. Destroy rusted leaves, especially on cuttings. Early sprayings with dilute copper sulphate, potassium sulphide, etc., may help to prevent the trouble from getting a start.* Rept. 1903, p. 315.

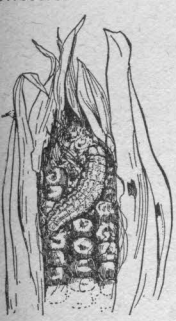
CINERARIA.

Insects.

Aphis or **Green Fly**—Sucks sap from the leaves and stems. Use nicotine solution, or soap and water, as a spray or dip.

CORN.

Insects.



Cut Worms—See Tomato.

Army Worm—See Grass.

Corn Ear Worm—Eats the immature kernels at the end of the ear. Dust with equal parts sulphur and powdered lead arsenate.

Fungi.

Leaf Blight—Kills parts of the leaves in August and September much like an early frost. Most injurious in wet late seasons. Plant early maturing varieties and stimulate growth by good fertilization and cultivation. Rept. 1903, p. 317.

Smut—Forms black dusty outbreaks that appear on various parts of the plant. It is especially injurious to certain varieties of sweet corn. Avoid the use of fresh manure on the land. Seed treatment is ineffective. The removal and destruction of spore masses is recommended by some writers.

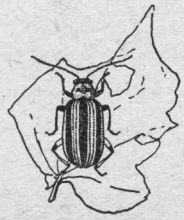
CRANBERRY.

Insects.

Fireworm or **Black-headed Cranberry Worm**—Small, pale green, black-headed caterpillars web the leaves and new shoots together and feed inside the nest. Spray with lead arsenate to kill the caterpillars. Flood the bog for three days to kill the pupae.

Yellow-headed Cranberry Worm—Small, green yellow-headed caterpillars injure plants in same manner as the preceding. Spray with lead arsenate. Keep bogs flooded until about May 20.

Cranberry Fruit Worm—Pale green larvae infest the berries. Flood the bog for about two weeks as soon as the fruit has been harvested. Destroy all infested berries.



CUCUMBERS.

Insects.

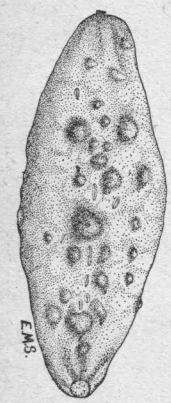
Striped Cucumber Beetle—Attacks young plants, eating the leaves. Larvae infest the main root or stem under ground, often killing the plant. Dust leaves with dry lead arsenate. Cover plants with screens. Rept. 1908, p. 807.

Melon Aphid—See Melon.

Fungi, etc.

Anthracnose—Produces prominent discolored spots, more or less merged, on leaves; occurs occasionally on fruit. Treatment is the same as for mildew. See Watermelon.

Downy Mildew—Forms discolored spots as in preceding, but beneath shows a minute thin growth of upright threads bearing dark colored spores. Repeated sprayings with Bordeaux about every 10 to 14 days during the season, beginning at least by middle of July, usually keeps this disease in check. The same fungus occurs on Melons. Rept. 1904, p. 329.



Mosaic and **White Pickle**—Are two very similar, if not identical, physiological diseases, showing in the former on the leaves as mottling of lighter or yellow-green areas scattered among the normally green tissues, and in the latter causing the fruit to become irregularly shaped, knobbed, and often mottled or whitish in color. Keep down sucking insects that may spread the disease, as it is infectious; pull up and destroy vines first showing it. Rept. 1915, p. 430.

Wilt—See Squash.

CURRANT.

Insects.

Currant Fruit Fly—Small maggots infest the berries, which color prematurely and drop. Destroy infested fruit.

Currant Worm—Devours foliage in May. Spray with hellebore or lead arsenate. Rept. 1902, p. 170.

Currant Borers—The larvae of two species of insects tunnel in the pith of the stems causing the leaves to droop and wilt. Destroy infested canes during May.

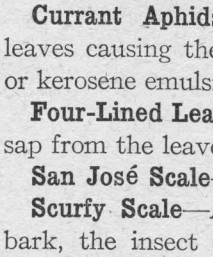
Currant Stem Girdler—Adults cut or girdle tip of new shoots after laying eggs in them. Cut and burn these tips at any time of year. Rept. 1896, p. 238.

Currant Aphids—Yellowish-green aphids on under side of leaves causing them to curl. Underspray with nicotine solution or kerosene emulsion.

Four-Lined Leaf-Bug—A yellow and black striped bug sucking sap from the leaves. Spray with nicotine solution.

San José Scale—See Peach.

Scurfy Scale—A conspicuous pear-shaped light-gray scale on bark, the insect sucking sap from twigs. Spray about second week in June with kerosene emulsion or nicotine solution. Bull. 143; Rept. 1903, p. 227.



Fungi.

Anthracnose and **Leaf Spots**—Cause spots on the leaves and usually their premature shedding; the former also spots the fruit of certain varieties. Spray with Bordeaux as the leaves unfold, and repeat at intervals of 10 to 14 days until fruit begins to turn.

If necessary continue spraying after harvest. Rake up and burn *leaves in fall.*

Blister Rust—Shows first as dusty orange-colored outbreaks about size of pinhead on lower surface of leaves, and later as short hair-like growths. Worst on black currants. Alternate host is white pine. Report presence to the Experiment Station. Rept. 1911-12, p. 347. See Pine.

CYCLAMEN.

Insects.

Leaf-Mite—Transparent microscopic mites cause leaves to curl, and plants do not blossom. Syringe under leaf surface strongly with water. Spray with, or dip plants in nicotine solution, 1 part in 400 parts of water. Rept. 1914, p. 176.

DAHLIA.

Insects.

Tarnished Plant Bug—Sucks the sap from the stems and buds causing them to fall. Spray with nicotine solution. Rept. 1904, p. 218.

Stalk Borer—Larva tunnels up and down inside the main stem, the top portion usually wilting and dying. Carefully make longitudinal slit in the stem and kill the borer.

EGG-PLANT.

Insects.

Flea Beetle—See Potato.

Colorado Potato Beetle—See Potato.

Fungi.

Fruit Rots—Caused by several fungi, the Gray Mold producing the most extensive rot. Spray with Bordeaux; pick off and carry away the rotting fruit.

ELM.

Insects.

Spiny Elm Caterpillar—Clusters of black spiny caterpillars often strip certain branches of elm, willow, and poplar. Remove and destroy entire cluster or spray with lead arsenate. Rept. 1906, p. 260.

Elm Leaf Beetle—Adult beetles eat holes through the leaves in May, and in June and July the larvae or grubs eat away the green tissues from the under surface. Spray with lead arsenate early in May to kill egg-laying beetles, or spray under surface of leaves with same mixture about June 1st, to kill the larvae. Yellow pupae at base of trees may be killed with kerosene emulsion or soap and water. Bull. 155; Rept. 1908, p. 815.

Canker Worms—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Leopard Moth—Larvae tunnels in branches under the bark, cutting deep galleries, often girdling the branch, which later breaks off and falls to the ground. Small trees may be examined and borers killed by injecting carbon disulphide, or by inserting a wire. Bull. 169; Rept. 1911, p. 317.

Elm Scale—A large brown soft scale, oval in shape with cottony marginal fringe, located especially in the cracks of the bark of trunk and lower branches, sucking the sap. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 235.

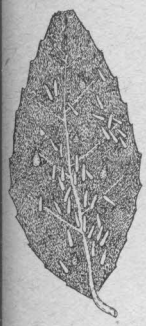
White Elm Scale—A whitish pear-shaped scale on twigs. Spray about June 10th with kerosene emulsion.

Elm Woolly Aphids—Several species curl the leaves, or form in cottony masses on the bark. Spray with kerosene emulsion.

Fungi.

Leaf Spot—Shows as black slightly elevated specks more or less thickly imbedded in the leaves and causing their premature fall. Not usually so injurious as to merit the expense of spraying with Bordeaux, which should start on the immature leaves. Rept. 1909-10, p. 717.

EUONYMUS.



Insects.

Euonymus Scale—The various species of Euonymus are attacked and often injured by this scale, which has narrow white (male) or pear-shaped gray or brown (female) shells. Cut and burn infested twigs. Cover and fumigate with hydrocyanic acid gas. Spray with nicotine solution or kerosene emulsion during June to kill young. Bull. 151; Rept. 1905, p. 240.

FERN.

Insects, etc.

Woolly Bears—Several kinds of light brown hairy caterpillars devour the fronds in late summer. Spray with lead arsenate.

Hemispherical Scale—Brown, oval convex scales on fronds of plants under glass. Apply soap and water or nicotine solution as a dip or spray. Bull. 151, p. 9; Rept. 1905, p. 239.

Leaf-Blight Eelworm—See Begonia.

GERANIUM.

Insects.

Greenhouse Leaf-Tyer—Small green wriggling caterpillars feed upon the leaves of plants under glass. Spray with lead arsenate.

White Fly—See Tomato.

Fungi.

Gray Mold Rot—Produces dead spots on leaves and blasts blossoms. Worst in poorly lighted and leaky greenhouses. Keep drippage off plants; avoid watering in cloudy or muggy weather; ventilate. Attacks as a semi-parasite a variety of greenhouse plants. Rept. 1903, p. 322.

GOOSEBERRY.

Insects.

Currant Worm—Devours foliage. Apply hellebore or lead arsenate early in season. Rept. 1902, p. 170.

Gooseberry Fruit-Worm—Feeds inside the berry. Destroy infested berries.

Currant Fruit Fly—See Currant.

Fungi.

Mildew—Forms a felt-like growth on fruit and leaves of young shoots. Worst on European varieties, also attacks currant, especially young shoots. Spray with potassium sulphide or other sulphur spray as soon as buds break, and repeat about every ten days until the end of June.

Blister Rust—*Not common as yet on cultivated varieties.* See *Currant.*

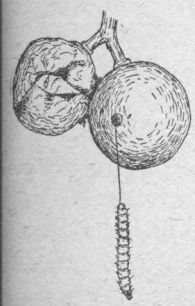
GRAPE.

Insects.

Grape Vine Flea Beetle—Adults and larvae devour the leaves. Spray with lead arsenate the latter part of June.

Rose Chafer—Long-legged brown beetles appear about June 15th and feed upon leaves, flowers and newly set fruit, often doing great damage. Cover choice plants with netting. Spray heavily with lead arsenate just before blossoms open and if necessary again after fruit has set. Rept. 1916, p. 111.

Grape Plume Moth—Small green spiny caterpillars web together the newly formed leaves at the tips of new shoots. Damage more apparent than real. Crushing by pinching these leaves is the best remedy. Rept. 1914, p. 190.



Grape Berry Moth—Larva feeds and develops inside the berries and is the cause of most wormy grapes. Spray with lead arsenate soon after fruit sets, and repeat twice at intervals of about ten days. Bag the clusters soon after the fruit sets.

Grape Root Worm—Adult beetles eat chain-like holes in leaves in July, and larvae or grubs devour the small feeding roots and eat channels in the bark of the larger roots and main stem underground, often causing great injury. Spray leaves with lead arsenate.

Sphinx and **Other Caterpillars**—Several species of horn worms as well as other kinds of caterpillars feed upon the leaves. Spray with lead arsenate or practice hand picking.

Grape Leaf-Hopper—Small, yellow and red-marked leaf-hoppers sucking sap from under side of leaves. Spray under surface with nicotine solution.

Grape Phylloxera—Sucks sap from roots and leaves, forming galls, and causing serious injury to European varieties. Graft on native species.

Fungi.

Black Rot—Causes reddish-brown spots on leaves; more rarely on stems; especially bad in rotting the berries, which finally become hard, shrunken and wrinkled, black mummies. This is one of the worst diseases of the grape and often difficult to control by spraying, which must be thorough, especially the first season. Begin spraying before blossoming time, about the last of May, with second application just after blossoming and subsequent sprayings at intervals of about 10-14 days. Use Bordeaux up to the last of July and then change to Soda Bordeaux or Amm. Sol. Cop. Carbonate, though usually the 4 or 5 sprayings with Bordeaux are sufficient. Repts. 1889, p. 174; 1890, p. 100.

Downy Mildew—Develops usually dense white patches of fruiting threads on under side of leaves and causes more or less discoloration on the upper; also occurs somewhat on stems and fruit. Treat as for black rot. Rept. 1893, p. 77.

Gray Mold—Causes rotting of ripening greenhouse grapes, covering them with a more or less conspicuous grayish mat of fruiting threads. Remove rotting grapes from the house. Use care in ventilating and watering. If necessary spray bunches several times with potassium sulphide.

Powdery Mildew—Produces a cobweb-like growth over upper surface of leaves; most conspicuous in the fall, when the minute, round, yellowish to black fruiting-bodies are found scattered over surface. Treat as for black rot. Potassium sulphide is also used effectively against this fungus. Rept. 1895, p. 185.

GRASS.

Insects.

White Grubs—White grubs are the larvae of June beetles, and when abundant in the soil and approaching maturity, cause much damage, especially in seasons following drought, by eating off the roots of grass, corn, strawberries, etc. Plow just before October 1st to expose insects. Harrow very thoroughly before planting. Rept. 1912, p. 288; 1915, p. 179.

Fall Army Worm—Attack similar to that of army worm but occurs in September instead of July, and is more apt to be confined to lawns and millet. The worm does not migrate in such great numbers from one field to another. Same remedies apply. Also practice late fall plowing. Rept. 1912, p. 284.

Army Worm—In certain seasons grasses and grains are stripped of leaves and heads during July by brown striped caterpillars, which when abundant move like armies from one field to another often causing great damage. Spray with lead arsenate, strips of grass or grain to protect fields not attacked. Plow deep furrows across line of march. Sprinkle migrating worms with kerosene. Use poisoned bran mash. Rept. 1914, p. 157.

HICKORY.

Insects.

Fall Web-Worm—See Pear.

Walnut Caterpillar—See Walnut.

Hickory Tussock Moth—White and black hairy caterpillars feed upon the leaves in late summer. Spray with lead arsenate. Rept. 1907, p. 332.

Hickory Bark-Beetle—Small black beetles breed under bark and the galleries soon girdle the tree. Adults emerge, leaving numerous round holes as if the bark had received a charge of bird shot. Beetles also feed at base of compound leaf stems causing them to break and fall in midsummer. Has killed thousands of trees in Atlantic States. Badly infested trees should be removed before May 1st, and burned or at least the bark removed. Spray healthy and slightly infested trees about June 1st, with strong

lead arsenate and nicotine solution. Repts. 1901, p. 267; 1914, p. 198.

Hickory Borer—Larvae tunnel deep into solid wood of trunk. Hunt for sawdust, find the burrow, inject carbon disulphide, and plug the entrance.

Nut Weevils—Larvae infest the fruit or nuts. See Chestnut.

Hickory Gall Aphid—Curious galls on the leaf stems often cause the leaves to fall in midsummer. Galls contain large numbers of aphids. Spray with nicotine solution just as new growth starts in spring.

HOLLYHOCK.

Fungi.

Rust—Appears as small, compact, reddish-brown outbreaks on both leaves and stems. After their death in fall, cut off the plants close to the ground, carefully gather up these and any rubbish that may contain spores, and destroy them. Spraying with Bordeaux is recommended by some as helpful in checking the rust; begin as plants push through ground. Rept. 1895, p. 188.

HOP.

Insects.

Hop-Vine Borer—Larva tunnels in tip, checking growth, and later in the stem above and below the surface of the ground. Crush larvae in the tips, remove soil from the base, and after leaving the main roots exposed for a week, apply wood ashes or ammoniated phosphate and hill up. The plants will make new roots.

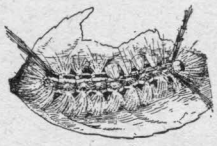
Hop-Vine Snout Moth—Green, white-striped larvae feed upon the leaves in June. Spray with lead arsenate while the larvae are small.

Hop-Merchants—Brown, spiny caterpillars of two species of tortoise-shell butterflies feed upon the leaves. Spray with lead arsenate.

Hop Aphid—Green aphids suck the sap from the under leaf surface. Spray with kerosene emulsion.

Fungi.

Powdery Mildew—Coats leaves and stems with whitish powdery growth, the mature fruiting bodies finally showing as loosely imbedded blackish specks. Found here so far only on ornamental varieties. Make several sprayings with commercial L. & S. Rept. 1911-12, p. 349.



HORSE CHESTNUT.

Insects.

White-Marked Tussock Moth—Tufted caterpillars devour leaves in midsummer. Spray with lead arsenate. Rept. 1905, p. 230; 1916, p. 105.

Fungi.

Leaf Spot—Forms extended reddish-brown areas on the leaves, frequently resembling sun scorch, but showing the fruiting stage as minute black dots in the dead tissues. This trouble can no doubt be controlled by spraying with Bordeaux, if the first application is made on the unfolding leaves and is followed by one or two subsequently on the mature leaves.

Insects.

HORSE RADISH.

Flea Beetle—Adults feed on the leaves, and larvae tunnel in the petioles. Spray with Bordeaux mixture and lead arsenate.

Insects.

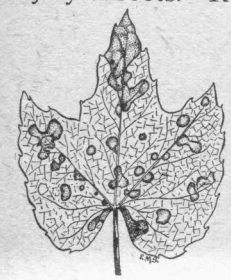
IRIS.

Iris Root Borer—Larva tunnels in the rootstocks injuring many plants. Destroy infested rootstocks. In bad infestations burn over the beds in winter to destroy the eggs. Rept. 1915, p. 189.

Fungi, etc.

Leaf Blight—Forms elliptical spots with purplish border; if abundant causes leaves to turn yellow and die prematurely; worst on German Iris. Keep foliage coated with Bordeaux or L. & S., beginning early; gather and burn infected rubbish in late fall.

Soft Rot—Attacks rootstocks destroying lower parts so that leaves turn yellow and die. Same bacterial disease described under Salisfy. Propagate only from healthy stock; plant in well drained soil; use only well rotted manure; prevent winter injury of roots. Rept. 1903, p. 327.



Fungi.

IVY, BOSTON.

Leaf Spot—Forms conspicuous brownish spots with purplish borders, which run together if abundant. Leaf stage of black rot of grape. Give several sprayings with commercial L. & S., beginning on unfolding leaves. Burn leaves in fall.

Insects.

KALE.

Turnip Aphid—See Turnip.

Fungi.

Black Rot—Rept. 1915, p. 431. See Cabbage.

Insects.

LARCH.

Larch Sawfly—Larvae defoliate trees in midsummer. Spray with lead arsenate. Rept. 1915, p. 125.

Woolly Aphid—White cottony tufts on the bark and at the lea whorls. Spray with kerosene emulsion.

Insects.

LETTUCE.

Aphid or **Green-Fly**—Sucks sap from leaves. Fumigate with tobacco or hydrocyanic acid gas. Spray with soap and water.

Fungi.

Drop—Causes sudden wilting of plants by infecting and rotting off leaves at surface of soil; often shows a white moldy growth over the basal parts. This may develop into a serious trouble in the greenhouse, as the fungus often becomes established in the soil, when the best remedy is to change the soil entirely or sterilize it by steam or formalin (formula C). Treat some days before using. Parsley is also subject to this disease in the greenhouse. *Rept. 1908, p. 863.*

Leaf Mold *and* ***Mildew*** *—The first produces a brownish and the second a white moldy growth in spots on the leaves. These diseases are held in check by sub-irrigation or care in watering and ventilating to keep plants and atmosphere as free from moisture as is consistent with good growth.*

Insects.

LILAC.

Lilac Borer—A white larva tunnels in the twigs. Cut and burn infested twigs Rept. 1905, p. 260.

Oyster-Shell Scale—See Apple.

San José Scale—See Peach.

Fungi.

Powdery Mildew—Forms whitish cobwebby coating on leaves, with mature stage finally abundant as black dots. Conspicuous and common, but hardly demands preventive treatment.

Insects.

LILY.

Aphid—Yellow plant lice with red markings, on under side of leaves. Spray with nicotine solution.

Stalk Borer—See Dahlia.

Insects.

LINDEN.

Canker Worm—See Apple.

White-Marked Tussock Moth—See Horse Chestnut.

Linden Borer—A white larva tunnels in wood at base of trunk. Dig out borer, or inject carbon disulphide. Rept. 1915, p. 186.

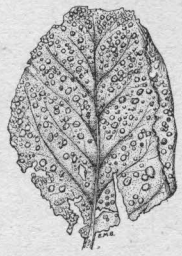
Insects.

LOCUST.

Locust Borer—Larvae tunnel in solid wood of trunk. Inject carbon disulphide into the burrow and close the entrance.

Fungi.

MANGEL.



Leaf Blight—Shows as grayish circular spots with purplish borders; when abundant causes premature death of leaves. Rotate; keep refuse out of manure piles; if necessary spray with Bordeaux before disease gets started. Rept. 1915, p. 432.

Root Rot—Rots off roots below ground, turning foliage yellow and often killing it. Not common, but injurious occasionally in low wet fields. Avoid wet ground; keep rotted plants out of manure. Rept. 1915, p. 433.

Insects.

MAPLE.

Maple Borer—Larva tunnels in spiral course upward around trunk or larger branches of sugar maple working in sapwood and cambium, often girdling the trees. Examine trees in September for sawdust. Find the burrow, inject carbon disulphide and plug the opening. Rept. 1907, p. 336.

White-marked Tussock Moth—See Horse Chestnut.

Other Tussock Moths—See Apple.

Canker Worms—See Apple.

Woolly Maple Leaf Scale—Cottony or woolly masses of wax, containing the females, eggs and sometimes larvae, appear on the under side of the leaves in midsummer; insects suck out the sap causing leaves to fall prematurely. Males and larvae enter crevices of bark of trunk and branches; larvae makes cases here and pass the winter. Attacks only sugar maples. Spray dormant trees with nicotine solution and soap. Burn all infested leaves. Bull. 151; Repts. 1905, p. 226; 1911, p. 345.

Cottony Maple Scale—Large, oval, brown soft scales on bark of branches of silver and red maples. Each scale in early summer develops a large cotton-like tuft of wax, nearly half an inch long, and soon after the young appear. Spray with miscible oils. Bull. 151; Repts. 1905, p. 237; 1913, p. 252.

Terrapin Scale—Small reddish-brown soft scales on small twigs of silver and red maples, sometimes killing the branches. Spray with kerosene emulsion. Bull. 151; Rept. 1905, p. 238.

Oyster-Shell Scale—See Apple.

Maple Aphids—Green Aphids are common on under surface of leaves of Norway and Sycamore Maples in June. Spray with nicotine solution or kerosene emulsion.

Fungi, etc.

Anthracnose—Causes more or less extended dead areas in the leaves, often hard to distinguish from the leaf scorch. Its appearance depends on character of season and is difficult to foretell but only occasionally serious. For this reason spraying of doubtful value in the long run, but when made should start on the unfolding leaves. Repts. 1903, p. 329; 1915, p. 436, unusual form.

Black (Tar) Spot—Forms slightly thickened black spots on the leaves, resembling finger prints. Cut-leaf maples are especially susceptible. Rake up and burn all leaves in the fall. Rept. 1908, p. 852.

Leaf Scorch—Causes more or less extended and irregular dead areas to appear suddenly, usually from the leaf margins inward. A physiological trouble due to sudden or excessive evaporation beyond the supply of water furnished by the roots, which is in turn due to abrupt changes in atmospheric conditions, drought, injury to roots, etc. Pruning, when necessary, watering or mulching, and stimulating root growth by nitrogenous fertilizers are probably best remedial measures. Rept. 1905, p. 267.

MARGUERITE.

Insects.

Marguerite Fly or **Leaf Miner**—A maggot tunnels between upper and lower leaf surfaces. *Spray every ten or twelve days with nicotine solution. Rept. 1915, p. 188.*

MELON (MUSK).

Insects.

Melon Aphid—Sucks the sap from the under side of the leaves, and when abundant causes much damage. Underspray the leaves with nicotine solution. Rept. 1908, p. 813.

Striped Cucumber Beetle—See Cucumber.

Fungi.

Anthracnose—Appears occasionally. See Cucumber and Watermelon.

Downy Mildew—Forms angular eventually brown spots in the leaves, often stunting or killing vines; most prominent just before melons ripen, later ones often not maturing or worthless because lacking flavor. It is questionable whether this trouble can be controlled effectively and profitably by spraying during a very moist season. During dry or semi-moist seasons, however, results are satisfactory, so we recommend spraying as one of the regular ooperations of melon growing. It should be started soon after the vines begin to run, at least by the middle of July, and the vines should be kept covered with the Bordeaux to the end of the season. Rept. 1904, p. 329.

Leaf Mold—Develops dead spots on the leaves very similar to those caused by downy mildew. Spray with Bordeaux on the first running vines and repeat every 10 to 14 days, making 4 or 5 applications according to season. Repts. 1895, p. 186; 1898, p. 225.

Wilt—See Squash.

MILLET.

Insects.

Fall Army Worm—See Grass.

NASTURTIUM.

Insects.

Aphid—Brown aphids cluster on stems and leaves sucking the sap. Spray with nicotine solution.

OAK.

Insects.

Canker Worms—See Apple.

Brown-Tail Moth—See Pear.

Orange-striped Oak-Worm—Black and orange striped caterpillars feed upon the leaves late in summer. Spray with lead arsenate.

Fungi.

White Heart Rot—Forms on trunks shelf fungi, often somewhat hoof-shaped, eventually with dark, creased and cracked, upper surface and rusty-brown, porous, fruiting, lower surface. Gains entrance through wounded and dead branches; causes white rot of heart wood and slow death of sapwood and bark. Break off and burn fruiting bodies; if feasible cut out diseased bark and sapwood, and dig out dead heartwood and fill cavity with cement. Occurs in other deciduous trees.

OATS.

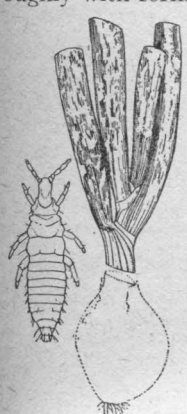
Insects.

Army Worm—See Grass.

Fungi.

Black Stem Rust—Forms, chiefly on leaf sheaths and stems, first the II stage as reddish pustules and later the III stage as elongated black outbreaks. Also occurs on wheat, rye, and other grasses as different strains. The I stage appears in spring on barberry leaves as cluster-cups but the fungus can skip this stage. Quite serious in regions where grain is grown extensively, and difficult to control. This and several related species are becoming more important here as more grain of various kinds is grown.

Smut—Destroys the grain, turning it into a black dusty mass of spores. Seed treatment will prevent this smut. Either soak the seed 8 to 10 minutes in water at 132–5° F., or sprinkle thoroughly with formalin (formula A), stirring the grain so that it is thoroughly wet, and leave in piles for several hours before drying out. Buy seed from smut-free fields.

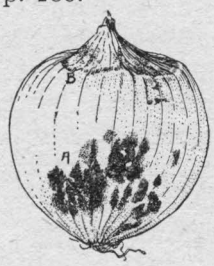


ONION.

Insects.

Thrips or **"White-Blast"**—Very small insects which feed upon the surface of the leaves, giving the field a whitish appearance. Burn all tops and refuse; burn over the grass land around the field to kill over-wintering insects. Spray with nicotine solution or kerosene emulsion. Repts. 1903, p. 266; 1913, p. 233.

Maggot—Infests the bulb of the young plant. Practice rotation of crops. Spray plants here and there over the field with sweetened lead arsenate to kill the adult flies. Rept. 1911, p. 286.



Fungi, etc.

Anthracnose (Black Spot)—Produces black circular spots on the bulbs, usually on white varieties after storing in the barn. Store onions as dry as possible and keep barn dry and cool. Avoid piling too deeply in bins. Possibly air-slaked lime mixed with sulphur scattered over them at time of storing may prove beneficial. See Stem Rot for treatment with formalin fumes. Fig. (A). Rept. 1889, p. 163.

Smut—Forms black dusty outbreaks on various parts of plants raised from seed; especially injurious to the very young seedlings. This fungus becomes established in the soil, hence infected land should be avoided or used only for transplanted onions. If, however, it is seeded, apply with the seed in drills per acre, 100 lbs. sulphur thoroughly mixed with 50 lbs. air-slaked lime. Formalin (1 lb. or 1 pt. to 12 or 15 gallons water) thoroughly sprinkled over the seed, before covered, by drip attachment to the seeder, is an even more desirable remedy. Rept. 1889, p. 129; 1895, p. 176.

Brittle—*Causes very young seedlings in the field to die suddenly; others show irregular curling and yellow spotting of leaves.* The cause of this trouble is not definitely known. It usually starts in fields in spots which enlarge year after year until the land is worthless for onions. Experiments indicate the value of treating the land, when the seed is sown, with formalin or with sulphur and lime, as for smut. Rept. 1906, p. 332.

Stem Rot—Causes rotting of bulbs at stem end, where they become soft and shrunken, sometimes showing beneath the layers a dense olive-brown growth of mold. This fungus in a moist season occurs on various parts of the plant in the field (possibly responsible for "blast" of seed onions), but does not usually appear as a serious trouble with the bulbs until some time after they have been placed in the barn. Treat same as for black spot. Late field spraying with Bordeaux shortly before pulling and again while lying in the field, combined with treatment by formalin fumes (See Fungicides) after storing, has given some indications of benefit. Fig. (B). Repts. 1903, p. 334; 1904, p. 321.

PAEONY.

Insects.

Rose Chafer—Adult beetles feed upon blossoms of white varieties. See Grape.

PALMS.

Insects.

Scales—Several kinds of white and brown scales infest the species of palms grown in greenhouses. Apply nicotine solution or soap and water as a spray or as a dip.

Fungi.

Anthracnose—Frequently causes leaves to die at tip. Fungus inconspicuous, may show as small black imbedded specks oozing pinkish masses of spores. Avoid infected stock or isolate it; pick off and burn worst infected leaves; keep leaves dry and house well ventilated. Rept. 1913, p. 18.

PARSLEY-PARSNIP.

Insects.

Celery Caterpillar—On both hosts. See Celery.

Parsley Stalk Weevil—Larva tunnels in crown of plant. No remedy other than to destroy infested plants. Rept. 1913, p. 252.

Fungi.

Drop—On Parsley. See Lettuce.

Soft Rot—On Parsnip. See Salsify.

PEA.

Insects.

Green Pea Aphid—Attacks the plants early in June and sucks the sap from the leaves and stems, often causing great injury. Early peas may mature a crop before aphis injures them. Spray vines with nicotine solution and soap. Brush the vines just before cultivating. Repts. 1899, p. 240; 1913, p. 235.

Pea Weevil—The adult lays eggs in the pods in the field and the larvae develop in the seed, emerging through round holes. Fumigate with carbon disulphide. Bull. 195, p. 5.

Fungi.

Leaf Spot and **Powdery Mildew**—The former shows as roundish spots on both pods and leaves; the latter, as a mealy or cobweb-

like coating on same. Neither seems to be sufficiently injurious here to warrant the expense of spraying.

PEACH.

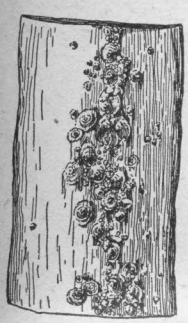
Insects.

Peach Saw-Fly—Larvae feed upon leaves in June and July. Spray with lead arsenate. Rept. 1907, p. 285.

Peach Borer—Larva tunnels in the base of the trunk. Dig out in late fall and early spring. Paint base of trunk with lead arsenate and lime-sulphur. Rept. 1909, p. 359.

Fruit Bark-Beetle or **Shot-Hole Borer**—Makes minute tunnels under the bark of branches and trunk. Burn infested trees and keep others thrifty. Rept. 1896, p. 240.

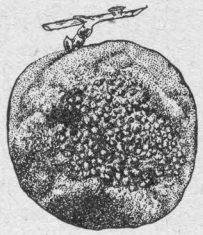
Plum Curculio—See Plum.



San José Scale—Minute scale insects, with circular shell, which suck the sap from twigs, fruit and leaves. On fruit a red spot surrounds each insect. Spray dormant trees with lime-sulphur. Bull. 165; Rept. 1901, p. 240.

Black and **Green Aphids**—Suck the sap from the leaves and shoots. Spray with nicotine solution.

Fungi, etc.

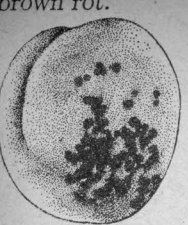


Brown Rot—Occurs on the young twigs, etc., but causes most serious injury to the fruit, rotting it about the time of its maturity. The rotten areas usually become covered with numerous pustules of dusty brownish spores; eventually the diseased fruits form hard mummies. These carry the fungus over the winter, and if half buried in the soil develop in early spring the mature stage, which causes infection of the blossoms, etc. Certain early varieties, like the Champion, are especially subject to rot. Spraying these apparently pays in this state. See general directions for treatment. This fungus occurs on plums and cherries and less commonly on pears and apples. Repts. 1909-10, pp. 607, 612; 1911, pp. 374, 391.

Crown Gall—See Plum.

Leaf Curl—Causes young leaves to become irregularly curled and swollen and finally to drop off; rarely on fruit. In April as soon as buds begin to swell, spray the trees thoroughly with commercial lime-sulphur 1-9. If more convenient this may be done in late fall and is claimed to be just as effective. Same treatment takes care of San José Scale. Repts. 1909-10, pp. 608, 612; 1911, p. 374; 1914, p. 19.

Powdery Mildew—Forms a grayish felt on young twigs and leaves. Prune off infected twigs. *Give winter treatment as for leaf curl, and, if necessary, summer treatment as for scab and brown rot.*



Scab—Produces roundish, olive-black spots on the fruit, discolored areas on the young twigs, and rarely "shot-holes" in the foliage. Two treatments with self-boiled lime-sulphur, atomic sulphur or sulphur paste upon the fruit after setting and when half grown (about the middle of May and June) will control this trouble. Repts. 1896, p. 269; 1909-10, pp. 608, 614; 1911, pp. 375, 391.

Spray Injury—Is more likely to occur with same treatment than on apple, which see. Avoid Bordeaux altogether. See (3) under general treatment following. Repts. 1900, p. 219; 1911, p. 372.

Winter Injury—Shows in various ways. In severe winters, especially when the ground is bare, the roots may be killed without injury to parts above the ground. In spring such trees put forth a scanty sickly foliage that soon drops. Often the injury occurs in the form of a "collar girdle" in the bark at the base of the tree. Sometimes it occurs above ground in the wood (shown by its blacker color), with or without injury to the bark. When the bark is not injured, severe pruning in spring will often save the trees. Nursery trees can sometimes be cut back to the snow line, below the injury, and an entirely new healthy trunk started. Avoid late applications of nitrogenous fertilizers and cultivation after middle of July. Mulch base of young trees in late fall with earth. Secure good drainage. See Apple. Repts. 1903, p. 341; 1908, p. 872.

Yellows—Causes premature ripening and red spotting of fruit with yellowish curled leaves, and in time spindling sprout growths in bunches on the trunk. This is claimed to be a contagious disease, but it is apparently physiological in nature. Little peach in this state is scarcely to be distinguished, showing chiefly in the small backward fruit. Root out and burn all trees as soon as found; prevent winter injury; be careful in selecting stock for planting. Repts. 1893, p. 92; 1908, p. 872.

General Treatment for Peach Orchards.

(1) Spraying of peaches while dormant is of value only in checking San José scale, mites and leaf curl. One application of commercial lime-sulphur, 1-9, either in late fall or early spring, will take care of all of these troubles at the same time. If the scale and the leaf curl are unusually prevalent, both applications will prove of value in controlling them.

(2) For the prevention of scab and rot of peaches, it is as a rule desirable to give three sprayings, as follows: 1st, shortly after the blossoms have fallen (May 15th to May 25th); 2nd, about three or four weeks later (June 5th to June 15th); and 3d, about one month later (July 5th to July 15th). If only two sprayings can be given, omit the first if spraying only for rot, and the last if spraying only for scab.

(3) On the whole, self-boiled lime-sulphur of the 8-8-50 formula seems to be the safest and most reliable peach spray. Fair results have been obtained with some of the commercial lime-sulphurs, and they are much more easily handled. There is, however, some danger of spray injury, especially with certain

brands. If commercial lime-sulphur is used, a strength of not greater than 1-150, without poison, is recommended. Atomic sulphur and sulphur paste have given good results.

(4) As lead arsenate has done little to prevent curculio injury, and as it seems to increase the danger of spray injury, we advise leaving it out unless there is considerable danger of sawfly injury, when it can be added in the second spraying the same as for apples.

PEAR.

Insects, etc.

Pear or **Cherry Slug**—See Cherry.

Codling-Moth—See Apple.

Brown-Tail Moth—Occurs in the United States only in eastern New England. Brown hairy caterpillars feed on leaves, and make winter nests on twigs, maturing about the middle of June. Cut and burn winter nests. Spray foliage as soon as blossoms fall, and also in August, with lead arsenate. Rept. 1910, p. 683; Bull. 182.

Fall Web-Worm—Makes nests on ends of branches of many kinds of trees in late summer, the brown, hairy caterpillars feeding inside the nests. Clip off and burn nests when small. Spray with lead arsenate. Rept. 1901, p. 270.

San José Scale—See Peach.

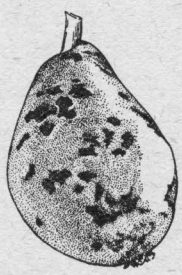
Pear Psylla—Small jumping plant lice suck sap from leaves and twigs, causing leaves to fall in midsummer. Spray with lime-sulphur in spring just before buds open. Spray infested trees with nicotine solution in July. Rept. 1903, p. 262.

Pear Thrips—A minute insect which feeds upon the unopened fruit buds destroying them so that fruit does not set. Spray with nicotine solution just as buds open, and again after blossoms fall.

False Tarnished Plant Bug—Punctures developing fruit causing it to be irregular and knotty. Spray with nicotine solution and soap.

Leaf Blister Mite—Attacks unfolding leaves of apple and pear; forms galls or blisters which become red and later brown. Causes many leaves to fall in July. Spray dormant trees with lime-sulphur in late fall or in spring. Rept. 1910, p. 700.

Fungi, etc.



Scab—Forms olive-black scabby spots on fruit and leaves, often causing the former to become distorted and cracked. The fungus lives over winter on the twigs. Certain varieties are not much injured, others, like Flemish Beauty, are very susceptible. Spray with Bordeaux on unfolding leaves before blossoms open, again after petals fall, and give the third spraying about two weeks later, using weak Bordeaux in last two treatments. Repts. 1894, p. 135; 1904, p. 323; 1911, p. 396.

Blight—Kills young twigs, the leaves suddenly turning black; also produces sunken dead areas on trunks. *This is a bacterial disease chiefly spread by bees during blossoming time, or by sucking insects. Winter-prune all diseased branches, cutting off several inches below the diseased area. Cut out cankered areas* and swab with disinfectant, paint exposed wood when dry. Several weeks after blossoming remove all young dead twigs. Use knife sterilized from time to time by wiping with a cloth saturated with carbolic acid or with corrosive sublimate (1-1,000). This disease occurs also on apple and quince. Rept. 1894, p. 113.

Leaf Blight—See Quince.

PHLOX.

Insects.

Red Spider—Injures leaves causing them to turn yellow. Spray with kerosene emulsion, or with nicotine solution and soap.

Fungi.

Powdery Mildew—Covers more or less completely leaves and young stems with grayish coating within which are finally imbedded numerous, small, blackish fruiting-bodies. Give several sprayings with commercial L. & S., starting before mildew gains much headway.

PINE.

Insects.

Sawflies—Larvae of several native and imported species feed upon the leaves. Spray with lead arsenate.

White Pine Weevil—Adult snout beetle lays eggs on leader in May and grubs feed and develop in it, causing it to wilt and die in midsummer. Leaders of ornamental trees may be protected by spraying them with lead arsenate or lime-sulphur. Jarring the adults into a net once a week during month of May, serves to greatly reduce the damage. Infested leaders should be cut and destroyed. Rept. 1911, p. 307.

Pine Leaf Scale—Whitish pear-shaped shells on leaves; small trees sometimes killed. Spray with nicotine solution or kerosene emulsion about the second week in June. Bull. 151; Rept. 1905, p. 240.

Pine Bark Aphid—White cottony or woolly objects on bark and sometimes on leaves, sucking out the sap. Spray with kerosene emulsion. Rept. 1911, p. 343.

Fungi, etc.

Blight (so-called)—Stunts the leaves and kills their tips inward, often suddenly, so that the tissues for a greater or less distance are reddish-brown. This is a physiological disease; not contagious; due to adverse weather conditions. Chief among these are severe winters, killing the leaves directly or indirectly through injury to roots; warm days, in late winter or early spring when ground is frozen, causing transpiration of water from the leaves that cannot be replaced; very late spring frosts, killing tips of new leaves; sudden changes, in summer from moist or muggy weather to bright sunshine resulting in excessive transpiration and injury; very dry summers. No effective remedy. Rept. 1907, p. 353.

Dampening Off—Caused here chiefly by Rhizoctonia fungus rotting base of the stem, the seedling falling over. Sometimes it creeps up the stem invading the base of the leaves which wither. Certain conifers more subject to attack then others. Avoid unnecessary watering; provide good ventilation; infected soil often can be helped by treatment with formalin before seeding

(see Fungicides, formalin C); spraying with Bordeaux effective in some cases. Repts. 1912, p. 348; 1915, p. 450.

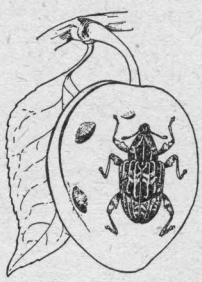
Stem Rusts—Form on the swollen stems temporary, but conspicuous, white, blister-like spore cups filled with a dusty orange-colored spore mass. The white pine blister rust, an imported species, spreads to the gooseberries and currants, and forms other less conspicuous leaf stages on these (*q. v.*). A very similar native species on two and three needle pines spreads to the leaves of the sweet fern. In either case infected pines should be destroyed, and watch kept of the alternate hosts, if they occur in the neighborhood. Seed beds should never be made in the vicinity of the alternate hosts, as infection takes place easily in the young pine seedlings. In white pine plantations pull out all currants and gooseberries including those in the immediate neighborhood (500 feet). Send any suspicious white pines or their alternate hosts to this Station for examination. Rept. 1912, p. 347.

PLUM.

Insects.

Plum Aphids—Suck sap from leaves. Spray with kerosene emulsion, nicotine solution or soap and water.

San José Scale—See Peach.



Plum Curculio—Grub infests the growing fruit, causing it to fall. Jar the trees each morning for six weeks after blooming and catch the beetles on sheets and destroy them. Spraying with lead arsenate during the same period is also advised. Rept. 1910, p. 609.

Fruit Bark-Beetle or **Shot-Hole Borer**—See Peach.

Fungi.

Black Knot—See Cherry.

Brown Rot—Thin fruit so it does not touch. Gather and destroy all mummies after harvest. Rather difficult to control by spraying, as spray does not readily adhere to the smooth fruit. First treatment with self-boiled lime sulphur, should be made on half grown fruit, second 14 days later, and last 10-14 days before picking. See Peach.

Crown Gall—Forms hard roundish knots one-half inch or more in diameter, near crown or on roots, less frequently on lower part of trunk. Do not plant infected trees. Remove knots when found and paint over cut surface. This is said to be very troublesome in some states, but here, as yet, little damage has resulted from it except possibly on blackberries and imported roses. It also occurs on peach, apple, raspberry, and various ornamental plants.

POPLAR.

Insects.

Poplar Tent-maker—Larvae feed on leaves and fold them together near ends of branches, forming nests. Spray with lead arsenate. Rept. 1911, p. 310.

Spiny Elm Caterpillar—See Elm.

Tussock Moths—See Apple, Hickory and Horse Chestnut.

Poplar Borer—Larvae make large galleries in wood of trunk. Dig out, or inject carbon disulphide into the burrow and close the opening. Rept. 1907, p. 336.

Poplar and **Willow Curculio**—Larva tunnels in smaller trunk and branches. Destroy badly infested trees. Cut out borers; inject carbon disulphide. Rept. 1907, p. 335.

Oyster-Shell Scale—See Apple.

Fungi.

European Canker—Forms sunken dead areas of varying extent in the bark. Importation from Europe; showing here most commonly on Lombardy and white poplars. If trees are badly injured cut down and burn; otherwise cut out diseased areas going into the healthy bark, scraping, and painting over exposed wood if surface is extended.

Rusts—Show on leaves as minute, powdery, yellow-orange pustules in II stage, and as slightly elevated reddish blisters in III stage. Have I stage, for different species, on larch and hemlock. Avoid planting near these hosts in nursery; rake up and burn infected leaves in the fall. Rept. 1915, p. 440.

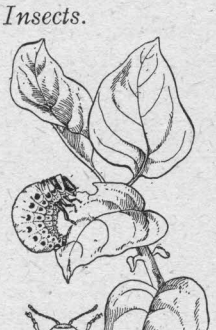
POPPY.

Insects.

Apids—Black aphids suck sap from stems and leaves. Spray with nicotine solution.

POTATO.

Insects.



Flea Beetle—Small black jumping beetles eat holes through the leaves. Spray heavily both upper and under leaf surfaces with lead arsenate. Rept. 1906, p. 271.

Colorado Beetle—Adults and larvae devour the leaves. Spray with lead arsenate as soon as injury is apparent. May be used in Bordeaux mixture. Rept. 1911, p. 311.

Three Lined Potato Beetle—Larvae feed upon the leaves and carry their black excrement on their backs. Spray with lead arsenate.

Stalk Borer—Larva tunnels inside the stalk. Burn infested vines.

Potato Aphid—Green aphids appearing in large numbers suck the sap from shoots and stems, causing much damage in 1917. Spray with soap and nicotine solution.

Fungi, etc.

Black Leg—Causes a black rot of stem below ground; plants more or less stunted

with yellowish curled foliage; occasionally rots tubers. Usually only scattered plants in the field, apparently not spreading to the healthy. Soaking seed in formalin as for scab said to be helpful. Rept. 1914, p. 21.

Blight or **Downy Mildew**—Causes a sudden blackening of the leaves, and often death of vines, from July to September in moist seasons; usually shows a slight whitish growth of fungus on the under side of the leaves; rots tubers. Spray with Bordeaux before the trouble appears, about July 1st, and keep vines well covered to the end of the season. Three to five sprayings by hand or five to seven by power sprayer are necessary. After last cultivation thoroughly ridge up the rows to help keep the spores from washing down to the tubers. Early varieties often escape blight by maturing before its appearance. Repts. 1904, p. 363; 1905, p. 304; 1909–10, p. 739; 1915, p. 470; 1916, p. 355.

Mosaic—Shows as a more or less conspicuous yellow-green mottling of the leaves. A physiological disease not well understood. New here but apparently not so injurious as in some other places. Do not save tubers for planting from hills showing this trouble.

Powdery Scab—Differs from common scab by smaller, more nearly circular and often powdery spots, with epidermis elevated at margins. Recently imported into Maine; rarely brought here on seed potatoes. Our experiments all indicate that this disease will not propagate in this state under ordinary conditions so it is no longer to be feared. Barely possible on cold wet soils in certain seasons infection might occur. If necessary, soak seed in formali as for common scab, and roll in sulphur afterwards. Fig. (A) Rept. 1915, p. 463.

Scab—Produces the common scabby appearance on surface of tubers. Soak seed tubers one and one-half hours in formali (formula B). Formalin fumes (see Fungicides) are often used when large quantitie are treated. Care in filling space sufficiently however, is necessary to avoid injury by "pitting" from absorption of fumes. Avoid planting on infected land, by systematic rotation. The use of lime, wood ashes and various barnyard manures will increase the amount o Scab. The same trouble occurs on beets and turnips. Fig (B). Repts. 1890, p. 81; 1891, p. 153; 1894, p. 118; 1895, p 166; 1896, p. 246; 1909–10, p. 744.

Tip Burn—Causes leaves to die at tip and margins and roll up often mistaken for true blight. This is a physiological trouble due to drought or sudden change from moist to very hot bright weather Cultivate thoroughly and often to conserve moisture. Spray with Bordeaux as for Blight, as this often helps to increase yield by lengthening life of leaves.

PRIVET.

Insects.

Privet Leaf Folder—Larvae web together terminal leaves and feed inside. Clip off and destroy infested shoots. Spray with lead arsenate. *Rept. 1913, p. 223.*

Privet *or* ***Lilac Borer***—*See Lilac.*

Fungi.

Anthracnose—Forms small cankers on stems causing parts above to wilt and die. Usually found in nurseries on recently transplanted European privet. Prune off and burn infected branches; if bad spray with Bordeaux. Rept. 1914, p. 22.

Winter Injury—Shows in spring by stems usually being killed down to base or snow line. Cut off dead stems below injury and a vigorous new growth will result if roots are not injured. Rept. 1904, p. 326.

QUINCE.

Insects.

Round-Headed Borer—See Apple.

Quince Curculio—Grubs infest growing fruit and adults feed upon it causing it to be knotty. Jar the trees same as for plum curculio. Spray with lead arsenate.

Aphid—See Apple.

Fungi, etc.

Black Rot—Rots the fruit, often beginning at the blossom end; also kills twigs and branches. In the fall or spring cut off and burn all dead branches. Give three sprayings, as for Leaf Blight, with Bordeaux mixture.

Blight—See Pear.

Leaf Blight—Forms rounded, often confluent, reddish-brown spots with central black dots on leaves and fruit, the former often shedding prematurely and the latter cracking irregularly. Spray with Bordeaux just before blossoms open, again soon after they fall, and follow with 1 or 2 additional treatments at intervals of about 2 weeks, according to the weather. This fungus also occurs on pear. Repts. 1890, p. 99; 1891, p. 150.

Rust—Produces small clustered cups, with fringed borders and filled with orange spores, on fruit, young twigs and less frequently on leaves. Cut off and burn infected twigs and fruit. Treat as for apple rust.

RADISH.

Insects.

Maggot—See Cabbage.

Aphid—See Turnip.

Fungi.

Club Root—See Cabbage.

RASPBERRY.

Insects.

Raspberry Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Cane Borer—Larva tunnels inside the canes. Cut and burn infested canes.

Fungi, etc.

Anthracnose—Shows as more or less confluent whitish spots, with purplish borders, on the stems. In spring, before buds swell, cut out and burn all badly infected canes and then spray with Resin Bordeaux. If disease is very bad, spray again when young shoots are about six inches high, and repeat in 10 to 14 days. Aim chiefly to cover the young shoots with the spray. After fruit is gathered, again remove any badly infected canes. Cultivate

ground thoroughly to promote vigorous growth of canes. Rept. 1899, p. 274.

Crown Gall—See Blackberry.

Rust—See Blackberry.

Wilt—Forms cankered areas on the canes causing the parts above to wilt. In the old canes and near the pruned ends, the fungus often develops a brownish coating of spores around each small imbedded fruiting receptacle. The green berries often dry up without apparent cause, due to inoculation by insects. Spraying has not proved very satisfactory. Old and diseased canes should be removed and burned after the fruiting season and again early in spring. Rept. 1906, p. 321.

Yellows—Causes foliage to become more or less crinkled, and mottled with a sickly yellowish color. Plants gradually become worthless. Spraying does not seem to help this trouble, which apparently is of similar nature to peach yellows. Dig out plants with the yellows. Propagate only from perfectly healthy ones.

RHODODENDRON.

Insects.

Rhododendron Lace Bug—This bug sucks the sap from the under side of the leaves, which are usually colored brown by its excrement. Spray with nicotine solution or kerosene emulsion. Rept. 1910, p. 708.

Fungi, etc.

Leaf Scorch—Shows as dead marginal areas of varying width usually appearing suddenly. Plant in shade; keep ground mulched; water if necessary in dry weather by soaking ground beneath mulch. Rept. 1914, p. 23.

ROSE.

Insects.

Rose Slug—Eats away the green portion of the leaves. Spray with hellebore, lead arsenate or nicotine solution.

Rose Chafer—See Grape.

Leaf-Hopper—Sucks the sap from the under side of the leaves. Spray with nicotine solution.

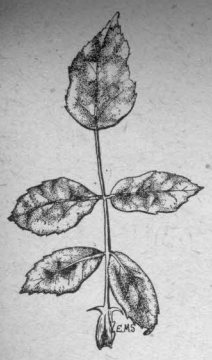
Rose Scale—Whitish circular shells on the stems contain insects which suck the sap. Cut and burn worst infested canes. Spray with nicotine solotion.

Aphid or **Green Fly**—Sucks sap from the leaves and stems. Spray with nicotine solution.

Fungi, etc.

Crown Gall—Occurs very frequently on rose roots, especially imported ones of Manetti stock. Inspectors now destroy all infected stock. There is some question how much infected plants eventually suffer. See Plum. Rept. 1911-12, p. 355.

Leaf Blotch—Forms large purple-black blotches on leaflets, which often turn yellow and fall off. For greenhouse treatment paint hot water pipes with mixture of sulphur and oil. Potassium sulphide or commercial lime and sulphur can be sprayed on the foliage. Spraying out of doors can be done with Bordeaux, if



there is no objection to the sediment on leaves. Rept. 1903, p. 355.

Mildew—Develops a white powdery or cobweb-like growth on the young leaves, which become more or less distorted and fall off. Tea roses especially susceptible. Treat same as for leaf blotch; or dust flowers of sulphur over the leaves; be careful in airing greenhouses. Rept. 1903, p. 356.

RUTABAGA, See TURNIP.

RYE.

Insects.

Army Worm—See Grass.

Wheat Midge—See Wheat.

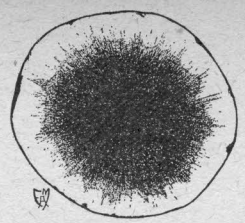
Fungi.

Ergot—Forms conspicuous, elongated, purplish sclerotia, usually one in the spike, most common in volunteer rye, but occasionally abundant in cultivated fields. Keep these sclerotia out of cattle feed as they may cause abortion and other troubles.

Powdery Mildew—Shows as a thick grayish felt on the leaves with fruiting bodies as blackish embedded specks. Causes premature death of leaves; often associated with rust. No practical remedy. Rept. 1909-10, p. 735.

SALSIFY.

Fungi, etc.



Soft Rot—Forms a soft rot of the interior tissues of the roots running down from the crown and turning them a darker color. Usually occurs after storage. Same bacteria cause soft rots in a variety of plants. Avoid contaminated manure and too much rotting humus in the fields; store under dry cool conditions, allowing sufficient ventilation. Rept. 1914, p. 25.

SNAPDRAGON.

Insects, etc.

Leaf Mites—Causes leaves to curl and plants do not blossom. Spray with nicotine solution. Rept. 1914, p. 176.

Root-Knot Eelworm—Causes irregular swellings on the roots where the eelworms are present, with resulting premature decay and sickly appearance of parts above ground. Worst in greenhouses and hot-beds as this far north the nematodes are killed in unprotected ground over winter. Attack roots of a great variety of cultivated plants. Purchase only healthy plants; change infected soil if possible, dry out thoroughly in sum-

mer, leave out doors over winter or sterilize with steam; avoid contamination of soil with infected refuse. Rept. 1915, p. 452.

Fungi.

Anthracnose—Shows as whitish spots with distinct purplish border on leaves and stems; spots often running together. Select seed and cuttings only from healthy stock; pick off and burn infected leaves. Spray with Bordeaux.

Rust—Forms reddish-brown, roundish pustules chiefly on under side of leaves causing tissues above to become yellow spotted. Recently appearing in greenhouses and causing more or less injury according to prevalence. Treat as for anthracnose.

SNOWBALL.

Insects.

Aphids—Suck sap from the leaves causing them to curl. Use nicotine solution as a spray or dip.

SOY BEAN.

Fungi, etc.

Bacterial Leaf Spot—Forms small, dark, reddish-brown angular spots frequently merging into larger areas. Certain varieties appear more susceptible than others, Ito San being one of the worst. Grow least susceptible varieties and if possible purchase seed from uninfected fields.

Crinkling Chlorosis—Shows as crinkling or yellowish-green mottling of leaves, or both together. Plants less vigorous than normal ones. Hollybrook variety apt to show trouble most. Treatment same as in preceding.

SPINACH.

Insects.

Spinach or **Beet Leaf-Miner**—See Beet.

SPIRAEA.

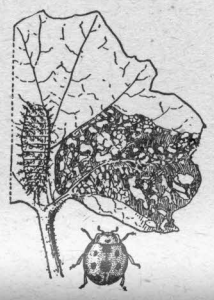
Insects.

Aphids—Suck sap from the new shoots. Use nicotine solution as a spray or dip.

SPRUCE.

Insects.

Spruce Gall Aphid—Forms galls at the base of the new growth on Norway and other spruces. Spray in the late fall or early spring with nicotine solution and soap or with kerosene emulsion. Rept. 1906, p. 302.



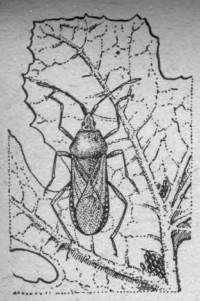
Spruce Bud Moth—Larva feeds on leaves of terminal shoots of the branches causing much damage. Spray with lead arsenate. Rept. 1912, p. 291.

SQUASH-PUMPKIN.

Insects.

Squash Lady-Beetle—Both adults and larvae devour the leaves. Spray with lead arsenate. Bull. 181, p. 11; Rept. 1908, p. 810.

Striped Cucumber Beetle—*See Cucumber.*



Squash Bug or ***"Stink Bug"***—A brown bug three fourths of an inch in length sucks the sap from the under side of the leaves, causing them to wilt and die. Spray with kerosene emulsion to kill the young. The old bugs may be trapped by placing boards or shingles on the ground, which should be visited each morning and the bugs killed. Rept. 1908, p. 811.

Squash-Vine Borer—Larva tunnels in the base of the stem, causing decay. Cut slits lengthwise in the stem and kill borers. Cover the joints of the vine with earth so that new shoots may be formed to support the plant. Grow a few early plants for traps, and destroy them. The main crop should be planted rather late. Rept. 1908, p. 806.

Fungi.

Anthracnose—See Watermelon.

Storage Rots—Caused by various fungi that are best held in check by storage under conditions with minimum of heat and moisture.

Wilts—Cause leaves of the plants to wilt and then dry up, sometimes all of the vine thus suddenly dying. If a cross section of the stem shows a slight milky and sticky exudation, it is caused by bacteria that clod up the water ducts. Fungi in the ducts or insects at the roots may cause similar trouble. Heavy manuring often develops these troubles. Spraying is of little value except as it may keep off insects which inoculate the plants with the bacteria. Use enough seed to allow for loss by wilt and pull up and destroy all the wilted vines as they appear. Rept. 1903, p. 359.

STRAWBERRY.

Insects.

Strawberry Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Strawberry Weevil—Small snout beetles; females cut off blossom buds of staminate varieties when ovipositing. Plant pistilate varieties in part. Spray with lead arsenate.

Strawberry Crown Borer—Grub tunnels and feeds in crown of plant. Practice crop rotation. Burn over infested field in fall.

Strawberry Flea Beetle—Adults eat holes through the leaves. Spray with lead arsenate.

Strawberry Leaf Roller—Larva rolls leaf and feeds inside. Spray with lead arsenate. Burn fields as soon as crop is harvested.

Strawberry Root Aphid—Sucks sap from leaves and roots, killing plants. Set clean plants on land not infested. Spray with nicotine solution.

Strawberry Whitefly—Sucks sap from leaves. Underspray with nicotine solution.

Fungi.

Leaf Spot and **Blotch**—Cause conspicuous discolored spots, the former usually with whitish centers and purplish borders, and the latter with dark centers. Glen Mary sometimes severely injured by latter fungus. Renew the beds frequently. In the late fall or early spring cut off leaves with mower, add a little straw where necessary, and burn over beds. Spray with Bordeaux two or three times before blossoming, beginning last of April and repeating weekly, and once after blossoming is over. Repts. 1903, p. 360; 1914, p. 5.

Powdery Mildew—Covers leaves (more frequently on under, but more conspicuously, when present, on upper surface) with cobweb-like growth, often causing them to become stiff and curled inward. When necessary, this can probably be controlled with Bordeaux if sprayed before abundant. Rept. 1905, p. 276.

SWEET PEA.

Fungi.

Dampening Off—Rots off stem just below ground causing vines to turn yellow and finally die. Plant in well drained soil; place well rotted manure deep in ground below the seed; avoid excessive watering; spray base of vines and ground with Bordeaux; change beds if appearing yearly. Rept. 1907, p. 359.

SWEET POTATO.

Insects.

Tortoise-Shell Beetles—Feed upon leaves. Spray with lead arsenate.

SYCAMORE.

Fungi.

Anthracnose—Kills young leaves in the spring; causes dead areas of irregular shape in tissues of older ones often following veins. If thought advisable to spray, use Bordeaux on the leaves as soon as showing and repeat when half grown.

TOBACCO.

Insects.

Tobacco or **Tomato Horn-Worms**—Large green caterpillars with horn on the tail devour the leaves. Practice hand picking or spray the plants with lead arsenate. Rept. 1906, p. 269.

Flea Beetle—Adults eat holes through the leaves. Spray upper and under surface heavily with lead arsenate. Rept. 1906, p. 271.

Cut Worms—See Tomato.

Fungi, etc.

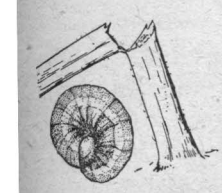
Calico—Causes the leaves to become irregularly mottled with a lighter green color and makes a very inferior tobacco. Frequently infected leaves finally show numerous, irregular, often merging, brown spots known as "rust." While calico is a physiological disease, due to injurious enzymes, it can be communicated to a healthy plant through contact with a very small amount of juice from a diseased plant. Care, therefore, is necessary after handling diseased plants in touching healthy ones. Never use tobacco water or tobacco stems on the seed beds. If calico shows in a seed bed, pull up all suspicious plants and those surrounding them. If troubled year after year, sterilize the seed beds or change them, and never make them on land used for tobacco the year before. When transplanting, wash the hands occasionally with soap and water. Repts. 1898, p. 242; 1899, p. 252; 1914, p. 357; Bull. 166, p. 10.

Dampening Off—Due to various fungi which rot off the seedlings close to the ground, and cause them to fall over. Keep air of beds as dry as consistent with good growth by care in watering and ventilating. If trouble starts in spots, take out all infected plants and refuse there.

Root Rot—Shows in seed beds by dwarfed "rosette" plants whose roots have been largely rotted off. Occasionally it does more or less damage in fields, especially in alkaline or water soaked soils; a short rotation is advisable in such cases. Sterilize seed beds with steam or treat with formalin (formula C). Repts. 1906, p. 342; 1907, p. 363.

TOMATO.

Insects.



Cut Worms—Eat off plant near ground or climb the plant and devour the leaves. Place around field poisoned bait or bran mash containing arsenic. Trap cut worms with small piece of board. Rept. 1906, p. 264; Bull. 190, p. 18.

Tomato or **Tobacco Horn-Worm**—See Tobacco.

Flea Beetle—See Potato or Tobacco.

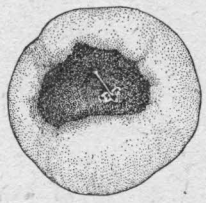
Stalk Borer—See Dahlia.

White-Fly—Sucks the sap from under side of leaves. Spray under side of leaves with soap and water. Fumigate greenhouses with hydrocyanic acid gas (1 oz. to 1,000 cubic ft.). Bull. 140; Rept. 1902, p. 148.

Fungi, etc.

Mosaic—Rept. 1908, p. 857. See Calico of Tobacco.

Leaf Spot—Produces on leaves and stems numerous, small, dark spots, often with white centers. Begin spraying with Bordeaux about the middle of July, making 3 or 4 applications at intervals of 10-14 days. This usually develops too late in the season here to cause serious damage.



Point Rot—Causes the green fruit to rot at bloom end, showing a large, firm, dark-brown area. Claimed to be a physiological trouble. Frequently bad in very dry seasons. In greenhouses sub-irrigation is said to prevent it. Spraying, apparently, is of little value. Considerable difference exists in varieties as to susceptibility.

Scab—Occurs most commonly in greenhouses, covering under surface of leaves more or less abundantly with an olive-brown

rowth which finally kills the tissue above. Spray with Bordeaux, icking ripe fruit before each of the later treatments.

Wilt—Occurs here chiefly in greenhouses; plants turn yellow nd wither up slowly; fungus may finally show on dead stem and uit as pinkish growth. Caused by fungus clogging ducts and utting off water supply to leaves; in young stage presence shown y blackened bundles where stems are cut across. Change soil if ppearing yearly; do not sow seeds from infected plants as they an carry the disease. Spraying of no value. Rept. 1903, p. 366.

TULIP TREE.

Insects.

Tulip Tree Scale—Large brown hemispherical soft scales on bark, sucking the sap, especially on lower branches. Spray with lime-sulphur when trees are dormant. Bull. 151; Rept. 1905, p. 239; 1912, p. 294.

TURNIP-RUTABAGA.

nsects.

Cut Worms—See Tomato.

Cabbage Maggot—See Cabbage.

Turnip Aphid—Green aphids on under side of leaves sucking. e sap. Underspray with soap and water or nicotine solution. ept. 1916, p. 98.

ungi, etc.

Club Root—See Cabbage.

Soft Rot—Causes an interior soft decay of roots, etc., of a variety of vegetables, such as turnips, salsify, parsnips, carrots, celery. Very wet seasons and imperfect storage conditions are usually the starting point of these troubles. Store under best possible conditions for keeping down heat and moisture. Keep contaminated refuse out of manure pile. Rept. 1914, p. 25.

Phoma Rot—Appears usually after storage, causing conspicuous, dry, sunken, subcircular, black spots scattered over roots. Fruiting pustules show as black dots. Store roots in cool dry place and not too deeply in the piles. Practice yearly rotation and keep refuse from manure pile. If necessary, use only artificial fertilizers. Rept. 1912, p. 355.

VIOLET.

Insects, etc.

Violet Sawfly—Larvae devour leaves. Spray with lead arsenate or hellebore.

Eelworms—Form galls on the roots. Plant in new soil or sterilize the old soil by steam. Add plenty of air-slaked lime to the soil. See Snapdragon.

Fungi.

Spot Disease—Shows as whitish round spots on the leaves. Spray field plants early in fall with Bordeaux. Select only best stock for greenhouse; remove *all* affected leaves before transplanting. When plants become established, spray again with Bordeaux. Be careful about watering plants, and, by proper ventilation and heat during September to November, keep atmosphere of house from ever becoming too moist.

WALNUT.

nsects.

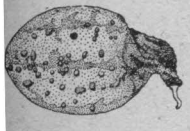
Walnut Caterpillar—Clusters of black caterpillars covered with hitish hairs strip the branches and finally the trees in August. pray with lead arsenate. Clip off twigs when caterpillars are mall, and kill by crushing. Rept. 1914, p. 191.

Walnut Weevil or **Curculio**—Adults feed at base of leaf stems. arvae tunnel in new shoots and infest the fruit of Persian and apanese walnuts. Spray with lead arsenate. Rept. 1912, p. 240.

Walnut Bud Moth—Larvae feed upon tender leaves and shoots, vebbing them together. Spray with lead arsenate. Rept. 1912, . 253.

WATERMELON.

Fungi,



Anthracnose—Shows as more or less abundant, dark, sunken spots or areas on the fruit. Also infects leaves in spots. Usually appears here too near end of season to cause sufficient injury to warrant spraying; spray also fails to adhere well to the fruit. Rotation and removal of rotting melons from field may possibly be helpful restrictive measures.

WHEAT.

Insects.

Army Worm—See Grass.

Hessian Fly—Maggots burrow in sheath of a leaf at base of stem, causing the stalks to turn yellow and die. Plant rather late—say about September 1st.

Wheat Midge—The fly lays eggs on the chaff and the maggots feed upon the developing kernels, so that the heads ripen early and produce no grain. Burn stubble before plowing. Plow infested fields deeply in the fall.

Green Bug or **Aphid**—Green aphids suck the sap from leaves. Destroy in early fall all volunteer wheat and oats. Practice crop rotation.

Fungi.

Black Stem Rust—See Oats.

Leaf Rusts—Form small, dusty, orange-colored outbreaks on leaves, etc., and later darker and firmer mature stage. Several closely related species on barley, rye, and wheat but quite distinct from the Black Stem Rust. Attempts are being made to secure resistant varieties to these various grain rusts. No effective treatment.

Loose Smut—Destroys entire head turning it into a dusty olive-black mass that is dissipated in time. Severe hot water treatment partially effective. See Oats.

Stinking Smut—Fills the apparently scarcely changed seeds with a dusty mass of spores. Spores often found more or less abundantly in middlings and other feeds containing wheat, and their presence in amount indicates poor quality, and may have some connection with complaints of injury to stock fed on these. Rept. 1909-10, p. 736.

Insects.

WILLOW.

Spiny Elm Caterpillar—See Elm.

Poplar Tent-Maker—See Poplar.

Poplar and **Willow Curculio**—See Poplar.

Aphids—Large reddish aphids congregate on twigs in fall, and suck the sap. Spray with kerosene emulsion or nicotine solution.

Oyster-Shell Scale—See Apple.

Fungi.

Rusts—Occur on the leaves; similar in appearance and closel related to those on poplar, *q. v.* The alternate host for one specie is the larch and apparently there is another whose alternate hos is not yet determined. Rept. 1915, p. 450.

MANUFACTURERS AND DEALERS IN SPRAY APPARATUS AND SUPPLIES.

Prospective purchasers should write to these firms for catalogues and prices.

MANUFACTURERS OF SPRAYING MACHINES.

Aspinwall Manufacturing Co., Jackson, Mich. (Hand and power potato sprayers.)

Barnes Mfg. Co., Mansfield, Ohio. (Hand and power sprayers.)

Bateman Mfg. Co., Grenloch, N. J. (Iron Age sprayers for hand and power.)

Bean Spray Pump Co., Lansing, Mich.; San Jose, Calif. (Hand and power outfits.)

Brackett, Shaw & Lunt Co., Somersworth, N. H., 62 No. Washington St., Boston, Mass. (Hand and power outfits.)

Brown Co., E. C., Rochester, N. Y. (Compressed air, hand and power outfits.)

Church, Stephen B., Seymour, Conn., 64 Pearl St., Boston, Mass. (Power and hand sprayers.)

Cushman Sprayer Co., St. Joseph, Mo. (Power outfits.)

Dayton Manufacturing Co., 2240 East Third St., Dayton, Ohio. (Hand sprayers.)

Deming Co., Salem, Ohio. (Hand and power outfits.)

Douglas, W. & B., Middletown, Conn. (Hand and power pumps.)

Field Force Pump Co., Elmira, N. Y. (Hand and power pumps.)

Fitzhenry Guptill Co., 135 First St., East Cambridge, Mass. (Power sprayers.)

Friend Mfg. Co., Gasport, N. Y. (Power and hand pumps.)

Goulds Mfg., Co., 58 Pearl St., Boston, Mass.; 16 Murray St., New York. (Hand and power sprayers.)

Hardie Mfg. Co., Hudson, Mich.; Hagerstown, Md. (Hand and power pumps.)

Humphryes Mfg. Co., Mansfield, Ohio. (Hand and power pumps.)

Hurst Mfg. Co., H. L., Greenwich, Ohio.

Leggett & Brother, 301 Pearl St.,New York. (Hand and power dusting machines.)

Myers & Brother, F. E., Ashland, Ohio. (Hand and power pumps.)

Niagara Sprayer Co., Middleport, N. Y. (Dusting machines.)

Rumsey Pump Co., Ltd., 49 Federal St., Boston, Mass. (Hand and power pumps.)

Spramotor Co., 107-109 Erie St., Buffalo, N. Y. (Hand and power outfits.)

MANUFACTURERS OF INSECTICIDES AND FUNGICIDES.

Blanchard Co., Jas. A., Hudson Terminal Bldg., 30 Church St., New York. (Insecticides and fungicides.)

Bowker Insecticide Co., 43 Chatham St., Boston, Mass., 1011 Fidelity Bldg., Baltimore, Md. (Insecticides and fungicides.)

Devoe & Raynolds Co., Inc., 101 Fulton St., New York. (Arsenical poisons.)

Frost Insecticide Co., 20 Mill St., Arlington, Mass. (Spray chemicals and apparatus.)

General Chemical Co., 25 Broad St., New York. (General insecticides and fungicides.)

Grasselli Chemical Co., 80 Maiden Lane, New York. (Insecticides and fungicides.)

Hemingway & Co., Inc., Bound Brook, N. J. (Arsenical poisons.)

Interstate Chemical Co., 12-20 Bay View Ave., Jersey City, N. J. (Insecticides and fungicides.)

Kentucky Tobacco Product Co., Louisville, Ky. (Nicotine solution.)

Lavanburg Co., Fred L., 100 William St., New York. (Arsenical poisons.)
Leggett & Brother, 301 Pearl St., New York. (Insecticides and fungicides.)
Mechling Bros. Mfg. Co., Line St., Camden, N. J. (Insecticides and fungicides.)
Merrimac Chemical Co., 33 Broad St., Boston, Mass. (Lead arsenate.)
National Color and Chemical Works, Selling Agents for Taylor Chemical Co., 59th St. & 11th Ave., New York. (Carbon disulphide.)
Niagara Sprayer Co., Middleport, N. Y. (Dusting materials.)
Pratt Co., B. G., 50 Church St., New York. (Miscible oils.)
Riches, Piver & Co., 30 Church St., New York. (Arsenical poisons.)
Robertson Co., The J. T., 147 Richmond Ave., Syracuse, N. Y. (Miscible oils.)
Roessler & Hasslacher Chemical Co., 100 William St., New York. (Cyanide.)
Sherwin-Williams Co., 601 Canal Road, Cleveland, Ohio. (Lime-sulphur and arsenical poisons.)
Thum Co., O. & W., Grand Rapids, Mich., 15 India St., Boston, Mass. (Tanglefoot.)
Vreeland Chemical Mfg. Co., 50 Church St., New York. (Insecticides and fungicides.)

CONNECTICUT DEALERS IN SPRAYING SUPPLIES.

Dealers in spraying materials can usually be found in each town. Some of the larger firms are mentioned below.

Apothecaries Hall Co., 24 Benedict St., Waterbury. (Wholesale druggists.)
Barnes Bros., Yalesville. (Insecticides and fungicides.)
Cadwell & Jones, 1084 Main St., Hartford. (Pumps, insecticides and fungicides.)
Grasselli Chemical Co., River St., New Haven. (Insecticides and fungicides.)
Henry & Son, W. A., Blue Hills Farm, Wallingford. (Friend sprayers.)
Jewell, Harvey, Cromwell (Agent for Hardie hand and power sprayers.)
Leete Co., The Chas. S., 299 State St., New Haven. (Wholesale druggists.)
Lightbourn & Pond Co., 39 Broadway, New Haven. (Pumps, insecticides and fungicides.)
Platt Co., The Frank S., 845-855 Dixwell Ave., New Haven. (Pumps, insecticides and fungicides.)
Sisson Drug Co., 729 Main St., Hartford. (Spraying machines and insecticides.)
Whittlesey Co., The Chas. W., 259-271 State St., New Haven. (Wholesale druggists.)

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 200 DECEMBER, 1917

BEING THE

Twenty-Second Report

ON

Food Products

AND

Tenth Report on Drug Products

By JOHN PHILLIPS STREET

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

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Twenty-Second Report on Food Products and Tenth Report on Drug Products, 1917.

By John Phillips Street.*

As the prevalence of food adulteration decreases, the food work done by the Station on its own initiative has less to do with that feature. During recent years we have paid more attention to the nutritive value of foods, especially those which are either new to this state or the analyses of which have not yet appeared in our published reports. Eventually these reports will contain the analyses of practically all foods sold in Connecticut under distinctive brand names.

Aside from investigations of this kind, during the past year the Station has devoted considerable time to a study of bread. This has dealt with the influence of certain "yeast foods" or "bread improvers," as well as a study of variations in the weights of loaves of bread due to inequalities in the working of the molding machines and scaling operations at the bakeries, and also of variations due to the drying out of the loaves between the time of baking and their purchase by the consumer. The methods of fat determination in bread have also been reviewed, and losses in fat heretofore attributed to losses during the baking process have been shown to be due almost entirely to failure of the official method to extract the fat.

The laboratory also has studied in some detail the method of drying vegetables by means of a current of unheated air from an electric fan, and analyses of 18 dried vegetables are given in this report.

* The analytical work herein reported was done mainly by the writer's assistants, E. M. Bailey, C. B. Morison and C. E. Shepard. Especial credit is due to Mr. Morison for his painstaking work in connection with the difficult analysis of the drugs from physicians' stocks.

Unfortunately the laboratory's work on the composition of proprietary medicines has been interrupted this year. However, the chief chemist has prepared a book entitled "The Composition of Certain Patent and Proprietary Medicines," which has been published by the American Medical Association. This compilation gives the analyses of 2800 brands of these medicines, and should prove of use to physicians, pharmacists, inspection officials and to the general public.

In addition to 536 samples collected by our own agent, 678 samples collected by the Dairy and Food Commission were examined. These were chiefly milk, vinegar, Hamburg steak, sausage, physicians' drugs and toilet preparations. Of the 678 samples, 334 were found to be adulterated or below standard, 118 of these, however, being milks which were deficient only in solids-not-fat.

One hundred and forty samples sent by private individuals were tested, 44 of these samples being adulterated or below standard.

During the past year much of the time of the chief chemist has been occupied with work in connection with food and drug control in other allied organizations. He has served as a member of the Joint Committee on Food Definitions and Standards, Associate Editor of the Journal of the Association of Official Agricultural Chemists, expert on diabetic foods for the Council of the American Medical Association, Vice Chairman of the Section of Food and Drugs, Chairman of the Committee on Nostrums, and Director of the American Public Health Association, Secretary of the New England Association of Food Inspection Officials, and Chairman of the Committee of the American Association of Dairy, Food and Drug Officials on Co-operation with the Hoover Food Administration.

CANNED BEANS.

Sixty-two samples of canned beans were analyzed, including 5 of red kidney, 23 of lima and 34 of string and wax beans. The brand names of these samples are given below:

Red Kidney Beans.

7995. Sunbeam Pure Food Kidney Beans, Austin, Nichols and Co., Dist., New York.

8099. Oak Orchard Brand Red Kidney Beans, Batavia Canning Co., Batavia, New York.

8010. Burt Olney's Red Kidney Beans, The Burt Olney Canning Co., Oneida, N. Y.

8084. Oneida Chief Brand Red Kidney Beans, The Burt Olney Canning Co., Oneida, N. Y.

8105. Van Camp's Red Kidney Beans, The Van Camp Packlng Co., Indianapolis, Ind.

Lima Beans.

8034. Medium Lima Beans, Acker, Merrall and Condit Co., New York.

8090. Valley Field Fresh Lima Beans, Austin, Nichols and Co., New York.

8022. Gold Rock Brand Small Tender Lima Beans, A. F. Beckman and Co., New York.

8049. Early Autumn Brand Lima Beans, Est. A. Brakeley, Bordentown, N. J.

7999. Luxury Lima Beans, Joseph Brakeley, Freehold, N. J.

8071. B. and M. Lima Beans (prepared by cooking dried lima beans), Burnham and Morrill, Portland ,Me.

8042. Essie Brand Fancy Quality Lima Beans, James Butler, New York.

8104. Lima Beans, Curtice Brothers Co., Rochester, N. Y.

8080. Davisco Brand Lima Beans, F. H. Davis and Co., New London, Conn.

8095. Harrison Brand Lima Beans Standard Quality, Lewis De Groff and Son, New York.

8082. Aurora Brand Fancy Medium Green Lima Beans, Geneva Preserving Co., Geneva, N. Y.

8075. Gold Leaf Green Lima Beans, Granger and Co., Buffalo, N. Y.

8001. Royal Seal Brand Soaked Lima Beans, Granger and Co., Buffalo, N. Y.

8096. Green Mountain Brand Lima Beans (prepared from dried lima beans), Green Mountain Packing Co., Portland, Me.

8009. Webster's Best Brand Lima Beans, The Lord-Webster Co., Baltimore, Md.

8094. Country Club Brand Lima Beans (prepared from dried lima beans), quality unsurpassed, Portland Packing Co., Portland, Me.

8086. Hart Brand Little Quaker Lima Beans, W. R. Roach and Co., Hart, Mich.

8100. Monroe Brand Lima Beans (equal in quality to any so-called Extra Standards), Rochester Preserving Co., Rochester, N. Y.

8103. Portia Brand Lima Beans, Seeman Bros., New York.

8031. White Rose Brand Small Lima Beans, Seeman Bros., New York.

8077. The Famous Royal Scarlet Brand Small Lima Beans, R. C. Williams and Co., New York.

8011. Brownie Brand Lima Beans (prepared from dried lima beans), D. E. Winebrenner Co., Hanover, Pa.

8047. Empire Brand Green Lima Beans, First Quality, Winters and Prophet Canning Co., Mount Morris, N. Y.

String and Wax Beans.

8033. Noreca Brand Extra Standard Quality String Beans, Acker, Merrall and Condit Co., New York.
8091. Meadow Brook Brand Cut Golden Wax Beans, The Burt Olney Canning Co., Oneida, N. Y.
8069. Oneida Chief Brand Cut Golden Wax Beans, The Burt Olney Canning Co., Oneida, N. Y.
8068. Oneida Chief Brand Refugee Beans, The Burt Olney Canning Co., Oneida, N. Y.
8043. Essie Brand Fancy Quality Stringless Beans, James Butler, New York.
8093. Health Brand Cut Wax Beans, Lewis De Groff and Son, New York.
8079. Shield Brand String Beans, J. S. Farren and Co., Baltimore, Md.
8007. Eagle Brand Refugee Beans, Fort Stanwix Canning Co., Rome, N. Y.
8076. Waldorf Brand Tiny Golden Wax Beans, Fort Stanwix Canning Co., Rome, N. Y.
7996. Fredonia Beauty Brand Fancy Refugee Beans, Fredonia Preserving Co., Fredonia, N. Y.
8074. Royal Seal Brand Cut Golden Wax Beans, Granger and Co., Buffalo, N. Y.
7994. Royal Seal Brand Cut Golden Wax Beans, Granger and Co., Buffalo, N. Y.
8081. Royal Seal Brand Cut String Beans, Granger and Co., Buffalo, N. Y.
8087. Iona Brand String Beans, The Great Atlantic and Pacific Tea Co., Jersey City, N. J.
7997. Sultana Brand String Beans, The Great Atlantic and Pacific Tea Co., Jersey City, N. J.
8050. Green Mountain Brand Cranberry Stringless Beans, Green Mountain Packing Co., Portland, Me.
8097. Helmet Brand Golden Wax Beans, The E. S. Kibbe Co., Hartford, Conn.
8098. Our Choice Cut Golden Wax Beans, Medina Canning Co., Medina, N. Y.
8101. Forest King Brand Cut Refugee Beans, W. H. Osborn Co., Honeoye Falls, N. Y.
7993. Silver Key Brand Golden Wax Beans, Standard Quality, Oswego Preserving Co., Oswego, N. Y.
8085. Hart Brand Little Dot String Beans Extra Quality, W. R. Roach and Co., Hart, Mich.
8045. Bridal Brand Cut Wax Beans, Thos. Roberts and Co., Philadelphia, Pa.

8014. Golden Wedding Cut Refugee Beans, Fine Quality, Rochester Preserving Co., Rochester, N. Y.
8032. White Rose Brand String Beans, Seeman Bros., New York.
8102. White Rose Yellow Wax Beans, Seeman Bros., New York.
8000. Extra Standard Stringless Beans, B. F. Shriver Co., Union Mills, Md.
8023. Epicure Cut Stringless Beans, Extra Quality, John S. Sills and Sons, New York.
8089. Hermitage Brand Extra Stringless Refugee Beans, Our Finest Quality, Stoddard, Gilbert and Co., New Haven.
8083. Hatchet Brand Extra Fine Refugee Beans, The Twitchell-Champlin Co., Portland, Me.
8106. Economy Brand Refugee String Beans, R. C. Williams and Co., New York.
8016. The Famous Royal Scarlet Brand Stringless Refugee Beans, R. C. Williams and Co., New York.
8070. Lusitania Brand String Beans, R. C. Williams and Co., New York.
8012. Conewago Brand Cut Refugee String Beans, D. E. Winebrenner Co., Hanover, Pa.
8046. Empire Brand Golden Wax Beans First Quality, Winters and Prophet Canning Co., Mount Morris, N. Y.

Tables I and II give the results of the physical examination of these samples, while Tables III and IV show the composition of both the drained beans and the separated liquor.

Physical Examination.

Proportion of Beans and Liquor. After weighing the sealed cans, they were opened and the liquor separated from the beans by draining through a colander.

The weight of drained beans in the red kidney beans ranged from 413 to 430 gms ; and that of the liquor from 178 to 205 gms. The liquor made up from 29.7 to 33.1 per cent. of the total weight of the can contents.

In the lima beans the variations in amounts of beans and liquor were much greater, the beans ranging from 297 to 413 gms.; and the liquor from 184 to 284 gms. The liquor made up from 31.3 to 48.9 per cent. of the total weight of the can contents, 9 of the 23 samples containing 40 per cent. or more of liquor.

The variations with the wax and string beans were likewise large. The weight of drained beans ranged from 240 to 376 gms., and that of the liquor from 203 to 323 gms. The liquor made up from 37.7 to 57.4 per cent. of the total net weight, 14 of the 34 samples containing 45 per cent. or more of liquor.

TABLE I.—RED KIDNEY AND LIMA BEANS.

Station No.	Brand.	Weight of Can and contents.	Weight of Beans and liquor.	Weight of Drained beans.	Weight of Liquor.	Per cent. liquor.	Weight of Contents. Claimed.	Weight of Contents. Found.	Cost per can.	Cost per lb. drained beans.	Size of beans.	Top of can above level of contents.
	Red Kidney Beans.	gms.	gms.	gms.	gms.		oz.	oz.	cts.	cts.		in.
7995	Sunbeam	728	619	414	205	33.1	20	21.9	10	10.9	...	1/4
*8099	Oak Orchard	699	591	413	178	30.1	19	20.9	10	10.9	...	3/8
8010	Bert Olney	718	615	427	188	30.6	20	21.7	10	10.7	...	9/16
8084	Oneida Chief	715	612	430	182	29.7	20	21.6	15	15.8	...	5/8
*8105	VanCamp	719	613	428	185	30.2	20	21.7	15	15.9	...	5/8
	Lima Beans.											
8034	Acker, Merrall & Condit	694	597	369	228	38.2	19	21.1	13	16.0	small	7/16
8090	Austin, Nichols & Co.	701	601	391	210	34.9	19	21.2	10	11.6	med.	7/16
*8022	Beckmann	697	577	345	232	40.2	19	20.4	15	19.7	"	1/4
8049	A. Brakeley	700	603	374	229	38.0	19	21.3	12	14.5	"	1/2
7999	J. Brakeley	697	598	413	185	31.3	19	21.1	12	13.2	"	7/16
8071	Burnham & Morrill	697	598	386	212	35.5	20	21.1	13	15.3	large	9/16
8042	Butler	688	588	338	250	42.5	19	20.8	15	20.2	small	9/16
8104	Curtice Bros.	679	578	363	215	37.3	20	20.3	12	15.0	med.	11/16
8080	Davis	694	595	384	211	35.5	20	21.0	15	17.7	small	7/16
*8095	De Groff	683	581	297	284	48.9	..	20.5	10	15.2	med.	1/4
8082	Geneva Pres. Co.	696	596	366	230	38.6	20	21.1	15	18.6	"	7/16
8075	Granger (Golf Leaf)	707	611	360	251	41.1	20	21.6	15	18.9	"	1/2
*8001	Granger (Royal Seal)	708	596	345	251	42.1	20	21.1	10	13.1	large	5/16
*8096	Green Mountain	711	607	399	208	34.3	20	21.4	13	14.7	"	1/4
8009	Webster's	689	598	355	243	40.6	20	21.1	12	15.4	med.	9/16
8094	Portland Pack. Co.	690	587	397	190	32.4	20	20.7	10	11.4	"	11/16
8086	Roach	715	615	369	246	40.0	20	21.7	17	20.9	small	3/8
8100	Rochester Pres. Co.	706	604	383	221	36.6	20	21.3	15	17.8	med.	1/2
8103	Seeman Bros. (Portia)	690	596	371	225	37.7	19	21.0	13	15.8	"	1/2
8031	Seeman Bros. (White Rose)	697	598	351	247	41.3	20	21.1	15	19.4	small	7/16
8077	Williams	688	592	391	201	34.0	20	20.9	15	17.4	"	9/16
8011	Winebrenner	686	590	347	243	41.1	20	20.8	10	13.1	large	1/2
*8047	Winters & Prophet	667	559	375	184	32.9	20	19.7	15	18.2	small	1/2

* In sanitary can.

From these data it appears that on the average the canned red kidney beans contain the least free liquor and the wax and string beans the most. The cut wax and string beans contained on the average 40.9 per cent. of free liquor, while the whole beans of this kind averaged 46.8 per cent.

Net Weight of Can Contents. All the samples but one bore a statement of net weight. Only one sample of lima and three of wax and string beans showed slight deficiencies of from 0.2 to 0.8 oz.

TABLE II.—WAX AND STRING BEANS.

Station No.	Brand.	Weight of Can and contents.	Weight of Beans and liquor.	Weight of Drained beans.	Weight of Liquor.	Per cent. liquor.	Weight of Contents. Claimed.	Weight of Contents. Found.	Cost per can.	Cost per lb. drained beans.	Size of beans.	Whole or cut.	Top of can above level of contents.
		gms.	gms.	gms.	gms.		oz.	oz.	cts.	cts.			in.
*8033	Noreca String	695	589	324	265	45.2	19	20.8	12	16.8	med.	whole	1/16
8091	Meadow Brook Wax	675	576	331	245	41.5	19	20.3	15	20.5	"	cut	7/16
8069	Oneida Chief Wax	683	585	344	241	41.2	18	20.6	15	19.8	"	"	3/8
8068	Oneida Chief Refugee	678	576	319	257	44.6	19	20.4	15	21.2	"	whole	5/8
*8043	Essie Stringless	686	581	337	244	42.0	19	20.5	17	22.9	small	"	1/8
*8093	Health Wax	672	565	331	234	41.4	19	19.9	15	20.5	large	cut	1/4
8079	Shield String	651	555	266	289	52.1	20	19.2	10	17.0	"	whole	9/16
*8007	Eagle Refugee	686	583	333	250	42.9	19	20.6	15	20.5	small	"	3/16
*8076	Waldorf Wax	684	582	280	302	51.9	19	20.5	15	24.3	"	"	3/16
*7996	Fredonia Refugee	680	573	346	227	39.6	20	20.2	15	19.7	"	"	1/4
*8074	Royal Seal Wax	669	568	344	224	39.4	19	20.0	10	13.2	large	cut	1/4
*7994	Royal Seal Wax	691	583	304	279	47.9	19	20.6	10	14.9	"	"	3/16
8081	Royal Seal String	684	577	345	232	40.2	19	20.3	12	15.7	med.	"	1/4
8087	Iona String	667	563	240	323	57.4	19	19.8	10	18.8	large	whole	9/16
*7997	Sultana String	686	577	356	221	38.3	19	20.4	8	10.2	"	cut	3/16
*8050	Green Mountain Stringless	691	594	357	237	40.0	19	21.0	13	16.5	"	"	1/16
*8097	Helmet Wax	699	593	311	282	47.6	19	21.0	15	21.8	small	whole	1/8
*8098	Medina Wax	678	572	341	231	40.4	19	20.3	10	13.3	med.	cut	1/4
*8101	Forest King Refugee	674	568	325	243	42.8	19	20.1	15	21.1	"	"	1/4
*7993	Silver Key Wax	645	539	336	203	37.7	19	18.7	13	17.6	large	whole	1/2
8085	Hart String	666	565	376	289	51.1	19	19.9	20	24.1	small	"	5/16
*8045	Bridal Wax	687	582	345	237	40.7	19	20.5	13	17.0	large	cut	3/16
8014	Golden Wedding Refugee	674	568	328	240	42.3	19	20.1	10	13.8	small	"	7/16
*8032	White Rose String	675	567	305	262	46.2	19	20.0	16	23.9	"	whole	1/4
*8102	White Rose Wax	684	580	334	246	42.4	19	20.4	15	20.3	"	"	1/4
8000	Shriver Stringless	663	561	304	257	45.8	20	19.8	10	15.0	mix.	"	1/2
8023	Epicure Stringless	683	575	351	224	39.0	20	20.3	15	19.4	large	cut	5/16
*8089	Hermitage Stringless	661	555	296	259	46.7	19	19.6	15	22.9	med.	whole	5/16
*8083	Hatchet Refugee	678	579	296	283	48.9	19	20.5	20	30.5	small	"	1/8
*8106	Economy String	668	567	274	293	51.7	19	20.0	12	19.8	large	"	3/16
*8016	Royal Scarlet Stringless	677	564	266	298	52.8	19	19.9	15	25.5	small	"	5/16
*8070	Lusitania String	659	562	287	275	48.9	19	19.8	12	19.0	large	"	5/16
*8012	Conewago String	687	581	360	221	38.0	20	20.5	10	12.6	"	cut	3/16
8046	Empire Wax	686	581	343	238	41.0	19	20.5	15	19.8	small	whole	3/8

* In sanitary can.

Fill of Cans. The distance between the level of the can contents and the top of the can ranged from 1/4 to 9/16 in. in the red kidney beans, from 1/4 to 11/16 in. in the lima beans, and from 1/16 to 5/8 in. in the wax and string beans. Nineteen of the 62 samples showed an air space of 1/2 in. or over.

Cost per Can. The cost of the red kidney beans ranged from 10 to 15 cents, that of the limas from 10 to 17 cents, and that of the wax and string beans from 8 to 20 cents per can.

TABLE III.—ANALYSES OF RED KIDNEY AND LIMA BEANS.

Station No.	Drained Beans. Water.	Total ash.	Protein. (N×6.25.)	Fiber.	Nitrogen-free extract.	Ether extract.	Sodium chlorid.	Bean ash.	Liquor. Water.	Solids.	Total ash.	Sodium chlorid.	Bean ash.	Acidity. cc N/10 NaOH per 100 cc.
Red Kidney.														
7995	70.14	1.42	7.27	1.24	19.38	0.55	0.51	0.91	88.06	11.94	1.78	0.99	0.79	
8099	71.22	1.42	6.38	1.28	19.17	0.53	0.46	0.96	88.61	11.39	1.82	0.99	0.83	24.0
8010	71.16	1.37	7.51	1.28	18.18	0.50	0.44	0.93	86.84	13.16	1.52	0.71	0.81	24.6
8084	71.27	1.39	6.71	1.26	18.84	0.53	0.66	0.73	86.26	13.74	1.56	0.70	0.86	28.8
8105	70.77	1.37	7.52	1.34	18.49	0.51	0.46	0.91	87.69	12.31	1.74	1.01	0.73	32.6
Ave.	**70.91**	**1.40**	**7.08**	**1.28**	**18.81**	**0.52**	**0.51**	**0.89**	**87.49**	**12.51**	**1.68**	**0.88**	**0.80**	22.2
														26.4
Lima.														
8034	77.07	1.35	5.34	1.41	14.45	0.38	0.69	0.66	93.63	6.37	1.79	1.10	0.69	
8090	72.92	1.55	5.87	1.42	17.95	0.29	0.65	0.90	91.53	8.47	2.00	1.05	0.95	16.6
8022	74.84	1.79	5.75	1.46	15.87	0.29	1.17	0.62	92.86	7.14	2.30	1.70	0.60	22.4
8049	74.46	1.43	5.92	1.57	16.30	0.34	0.66	0.77	93.67	6.33	1.73	0.94	0.79	15.4
7999	74.25	1.49	6.25	1.46	16.25	0.30	0.78	0.71	92.82	7.18	1.86	1.01	0.85	17.2
8071	74.45	1.45	5.97	1.61	16.20	0.32	0.63	0.82	88.86	11.14	1.68	0.81	0.87	23.4
8042	77.23	1.45	5.60	1.70	13.64	0.38	0.70	0.75	94.52	5.48	1.72	1.07	0.65	22.4
8104	71.20	1.66	7.86	1.78	17.19	0.31	0.55	1.11	91.43	8.57	1.93	1.09	0.84	13.4
8080	75.63	1.52	5.91	1.46	15.04	0.44	0.77	0.75	92.88	7.12	1.74	1.01	0.73	18.0
8095	75.11	1.01	5.38	1.41	16.80	0.29	0.41	0.60	93.77	6.23	1.25	0.71	0.54	15.8
8082	74.34	1.55	5.88	1.71	16.16	0.36	0.73	0.82	94.11	5.89	1.92	1.09	0.83	14.6
8075	74.11	1.54	6.24	1.64	16.05	0.42	0.66	0.88	91.47	8.53	1.67	1.02	0.65	19.2
8001	72.18	1.43	5.94	1.70	18.32	0.43	0.72	0.71	88.94	11.06	1.74	0.93	0.79	16.4
8096	71.87	1.59	6.14	1.67	18.38	0.35	0.32	1.27	86.61	13.39	1.91	1.14	0.77	20.6
8009	73.30	1.73	6.12	1.50	17.03	0.32	1.07	0.66	92.12	7.88	2.20	1.41	0.79	23.0
8094	72.68	1.37	6.94	1.49	17.01	0.51	0.43	0.94	90.95	9.05	1.57	0.81	0.76	18.0
8086	76.92	1.60	5.61	1.63	13.79	0.45	0.76	0.84	94.43	5.57	1.82	1.21	0.61	19.0
8100	74.99	1.75	6.14	1.33	15.46	0.33	0.86	0.89	91.21	8.79	2.04	1.37	0.67	10.8
8103	72.25	1.53	5.84	1.62	18.36	0.40	0.66	0.87	92.27	7.73	1.89	1.11	0.78	18.0
8031	76.34	1.45	5.39	1.74	14.73	0.35	0.76	0.69	94.60	5.40	1.73	1.04	0.69	19.4
8077	75.61	1.43	5.68	1.45	15.41	0.42	0.64	0.79	91.84	8.16	1.69	0.92	0.77	16.2
8011	72.38	1.52	6.74	1.69	17.27	0.40	0.76	0.76	90.96	9.04	1.90	1.03	0.87	19.2
8047	75.06	1.11	5 28	1.54	16.59	0.42	0.61	0.50	92.95	7.05	1.61	1.02	0.59	22.0
Ave.	**74.31**	**1.49**	**5.99**	**1.57**	**16.27**	**0.37**	**0.69**	**0.80**	**92.11**	**7.89**	**1.81**	**1.07**	**0.74**	14.0
														18.0

Cost per Pound of Drained Beans. The red kidney beans cost from 10.9 to 15.9 cents per pound of drained beans, the limas from 11.6 to 20.9 cents, and the wax and string beans from 10.2 to 30.5 cents. These wide variations in cost are influenced, of course, both by the cost per can and the proportion of drained beans present, and clearly indicate the possibilities of economy in a wise choice of brands. The apparently cheap brands are by no means always the most economical purchase, for very often their low cost is due to the relatively large amount of liquor sold with them.

TABLE IV.—ANALYSES OF WAX AND STRING BEANS.

Station No.	Drained Beans. Water.	Total ash.	Protein. (N×6.25).	Fiber.	Nitrogen-free extract.	Ether extract.	Sodium chlorid.	Bean ash.	Liquor. Water.	Solids.	Total ash.	Sodium chlorid.	Bean ash.	Acidity. cc N/10 NaOH per 100 cc.
8033	92.27	1.76	1.29	0.90	3.68	0.10	1.37	0.39	95.52	4.48	1.72	1.47	0.25	12.0
8091	93.59	1.03	1.16	0.86	3.28	0.08	0.76	0.27	97.05	2.95	1.01	0.83	0.18	6.7
8069	93.88	1.02	1.28	0.81	2.93	0.08	0.53	0.49	97.15	2.85	0.93	0.69	0.24	7.8
8068	93.77	1.25	1.18	0.77	2.94	0.09	0.84	0.41	96.72	3.28	1.15	0.88	0.27	7.4
8043	93.23	1.18	1.50	0.87	3.13	0.09	0.77	0.41	96.35	3.65	1.10	0.83	0.27	11.2
8093	90.42	1.67	1.43	1.26	5.10	0.12	1.30	0.37	96.07	3.93	1.70	1.42	0.28	9.6
8079	91.77	1.47	1.26	0.94	4.41	0.15	1.09	0.38	96.10	3.90	1.35	1.11	0.24	13.2
8007	93.60	1.30	1.25	0.81	2.96	0.08	0.92	0.38	96.53	3.47	1.25	1.00	0.25	10.8
8076	93.51	1.50	1.21	0.80	2.90	0.08	1.12	0.38	96.61	3.39	1.45	1.20	0.25	7.6
7996	93.01	1.29	1.39	0.87	3.35	0.09	0.83	0.46	96.61	3.31	1.14	0.86	0.28	10.0
8074	91.92	0.85	1.05	0.92	5.18	0.08	0.61	0.24	95.74	4.26	0.82	0.55	0.27	8.4
7994	89.76	1.46	2.07	1.00	5.63	0.08	1.13	0.33	94.32	5.68	1.43	1.20	0.23	9.2
8081	93.59	1.41	1.30	0.94	2.66	0.10	0.82	0.59	96.75	3.25	1.11	0.87	0.24	12.0
8087	90.81	1.73	1.55	1.21	4.56	0.14	1.31	0.42	96.41	3.59	1.77	1.48	0.29	7.9
7997	93.43	1.23	1.26	0.86	3.14	0.08	0.85	0.38	96.74	3.26	1.15	0.90	0.25	8.8
8050	91.20	1.48	1.41	1.07	4.73	0.11	1.11	0.37	95.10	4.90	1.47	1.19	0.28	11.4
8097	93.55	1.36	1.51	0.82	2.67	0.09	0.94	0.42	96.74	3.26	1.25	1.01	0.24	7.4
8098	92.37	1.14	1.53	0.97	3.89	0.10	0.75	0.39	96.89	3.11	1.08	0.81	0.27	8.8
8101	94.09	0.74	1.16	0.88	3.05	0.08	0.38	0.36	97.36	2.64	0.65	0.41	0.24	8.8
7993	90.81	1.38	1.96	1.28	4.45	0.12	0.93	0.45	95.86	4.14	1.42	1.05	0.37	16.0
8085	92.87	1.17	1.70	0.91	3.24	0.11	0.71	0.46	96.54	3.46	1.07	0.76	0.31	7.9
8045	91.97	1.14	1.38	1.06	4.37	0.08	0.79	0.35	96.56	3.44	1.10	0.85	0.25	9.0
8014	93.46	1.17	1.16	1.01	3.11	0.09	0.79	0.38	96.91	3.09	1.05	0.83	0.32	9.6
8032	94.54	0.94	1.15	0.75	2.52	0.10	0.58	0.36	97.35	2.65	0.85	0.61	0.24	7.6
8102	93.73	1.15	1.30	0.84	2.90	0.08	0.75	0.40	96.82	3.18	1.07	0.81	0.26	7.3
8000	92.06	1.02	1.31	0.96	4.53	0.12	0.61	0.41	95.95	4.05	0.96	0.67	0.29	10.4
8023	93.64	1.58	1.02	0.81	2.87	0.08	1.25	0.33	96.23	3.77	1.56	1.34	0.22	15.6
8089	93.24	1.29	1.21	0.89	3.26	0.11	0.91	0.38	96.07	3.93	1.29	1.04	0.25	9.8
8083	94.16	1.27	1.17	0.78	2.53	0.09	0.84	0.43	96.93	3.07	1.18	0.99	0.19	8.0
8106	93.40	1.37	1.19	0.80	3.15	0.09	1.04	0.33	96.55	3.45	1.36	1.15	0.21	8.2
8016	94.05	1.10	1.29	0.80	2.67	0.09	0.75	0.35	97.15	2.85	1.02	0.82	0.20	8.8
8070	92.37	1.00	1.40	0.97	4.13	0.13	0.62	0.38	96.98	3.02	0.95	0.70	0.25	9.8
8012	93.76	1.27	1.18	0.88	2.81	0.10	0.95	0.32	96.71	3.29	1.25	1.03	0.22	10.4
8046	93.35	1.02	1.30	0.81	3.44	0.07	0.65	0.38	96.57	3.43	0.99	0.69	0.30	9.8
Ave.	**92.85**	**1.26**	**1.34**	**0.92**	**3.53**	**0.10**	**0.87**	**0.39**	**96.47**	**3.53**	**1.20**	**0.95**	**0.25**	**9.6**

CHEMICAL COMPOSITION.

Inasmuch as the liquor accompanying the beans is usually thrown away, the composition of the beans themselves is of chief interest.

The following tabulation shows the maximum, minimum and average amounts of food ingredients contained in the different classes of beans:

	Red Kidney.			*Lima.*			*Wax and String.*		
In drained beans:	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.
Water	71.27	70.14	70.91	77.23	71.20	74.31	94.54	89.76	92.85
Protein	7.52	6.38	7.08	7.86	5.28	5.99	2.07	1.02	1.34
Fiber	1.34	1.24	1.28	1.78	1.33	1.57	1.28	0.75	0.92
Nitrogen-free extract	19.38	18.18	18.81	18.38	13.64	16.27	5.63	2.52	3.53
Ether extract	0.55	0.50	0.52	0.51	0.29	0.37	0.15	0.07	0.10
Ash, salt-free	0.96	0.73	0.89	1.27	0.50	0.80	0.59	0.24	0.39
Sodium chlorid	0.66	0.44	0.51	1.17	0.32	0.69	1.37	0.38	0.87
In liquor:									
Water	88.61	86.26	87.49	94.60	86.61	92.11	97.36	94.32	96.47
Ash, salt-free	0.86	0.73	0.80	0.93	0.54	0.74	0.37	0.18	0.25
Sodium chlorid	1.01	0.70	0.88	1.70	0.71	1.07	1.48	0.41	0.95

The brands of red kidney beans showed a remarkably uniform composition. On the average they contained about 29 per cent. of solids, one-fourth of which was protein, and the remaining three-fourths chiefly carbohydrates. The proportion of ether extract (fat) is almost negligible.

The lima beans on the average contained somewhat less solids than the red kidney beans, but the relative proportions of protein and carbohydrates were about the same. Five brands labeled "soaked beans" contained on the average about 2 per cent. more solids than the other brands, three-fourths of which was carbohydrates and one-fourth protein. Consequently these soaked beans contained somewhat more nutriment than the unsoaked varieties, but of course with less tenderness and flavor. On the other hand the soaked beans were considerably cheaper, costing on the average 11.2 cents per can and 13.5 cents per pound of drained beans, against 13.7 and 17.0 cents per pound, respectively, in the other brands.

The wax and string beans supply much less nutriment than either red kidney or lima beans, containing only about one-fourth as much solids, or 7.15 per cent. Furthermore, these beans generally contained more added salt than the other varieties, so so that the actual bean solids present averaged only 6.28 per cent.

The relative nutritive value of the three classes of beans is shown by the fact that on the average the drained solids in red kidney beans yield 108, lima beans 91 and wax and string beans 20 calories per 100 gms.

It is interesting to note that the liquor accompanying the

red kidney and the lima beans contained more nutriment than the drained wax and string beans themselves, and it is obvious that the housekeeper who discards the liquor of the two first-named varieties of beans throws away considerable valuable nutriment. The liquor of wax and string beans, on the other hand, is scarcely worth saving as it contains only 2.5 per cent. of salt-free solids.

Content of Tin.

Tin was determined in the solids and the liquor of all the samples, except in twelve liquors which were discarded by mistake. Table V shows the amounts found, expressed as mgms, per kilo or parts per million.

Table V.—Tin in Canned Beans (Mgms. per Kilo or Parts per Million.)

Number.	Tin. In solids.	Tin. In liquor.	Number.	Tin. In solids.	Tin. In liquor.	Number.	Tin. In solids.	Tin. In liquor.	Number.	Tin. In solids.	Tin. In liquor.
Red Kidney.			*Lima.*			*Wax or String.*			*Wax or String.*		
7995	117	32	8082	116	51	8069	338	62	8101	340	76
8099	204	26	8075	163	41	8068	368	77	7993	246	*
8010	164	35	8001	197	58	8043	382	104	8085	169	44
8084	108	40	8096	148	88	8093	106	32	8045	252	43
8105	210	26	8009	254	73	8079	577	69	8014	362	*
Lima.			8094	105	45	8007	348	*	8032	313	*
8034	157	49	8086	93	32	8076	410	98	8102	256	46
8090	121	73	8100	112	37	7996	430	*	8000	253	*
8022	224	116	8103	127	56	8074	199	52	8023	217	*
8049	123	54	8031	149	38	7994	196	*	8089	353	98
7999	118	70	8077	101	58	8081	381	91	8083	219	59
8071	147	102	8011	150	53	8087	283	54	8106	463	91
8042	163	34	8047	122	34	7997	425	*	8016	391	*
8104	129	35	*Wax or String.*			8050	311	75	8070	316	75
8080	121	48	8033	471	*	8097	630	121	8012	155	*
8095	116	63	8091	240	44	8098	272	54	8046	186	42

* Not determined.

The following is a summary of Table V:

	Red Kidney.			*Lima.*			*Wax and String.*		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.
In solids, mgms.	210	108	161	254	93	142	630	106	319
In liquor, mgms.	40	26	32	116	32	56	121	32	69

The above figures are in entire harmony with those reported by other investigators. Canned beans as a rule show relatively large amounts of tin, wax and string beans generally containing much more than either red kidney of lima beans. The degree of toxicity of tin is still a somewhat open question, but at any rate its presence in any considerable quantity in a food is objectionable. The source of this tin is of course, the tin container, the amount contained in the food depending in part on the age of the food and the storage temperature. In the case of beans, and similar slightly acid foods, the tin present in the canned product has been shown to be due in part in some cases to the amino bodies present. It has been erroneously assumed that the tin in canned foods was in solution. Bigelow* (*Research Laboratories, Nat. Canners' Asso., Bull. 2, Aug. 1914), however, has shown that the tin is largely, sometimes chiefly, in some insoluble form. Moreover we are not justified in assuming that all of the tin found in the liquor even is in a soluble form, for it is quite probable that much of this is present as a finely divided "insoluble oxid, hydrated oxid, or basic salt of tin." Furthermore it is possible that much of the tin seemingly in solution is in colloidal form.

The smallness of our samples prevented further investigation along these very interesting lines. Nevertheless the fact remains that a number of these samples contained excessive amounts of tin. If it is possible for one packer of red kidney beans to keep the tin in his product down to 108 mgms., there seems to be no justifiable reason why another's brand should contain 210 mgms. in the drained beans. Similarly with lima beans, one brand showed only 93 mgms., and ten others less than 125 mgms., while two brands contained 224 and 254 mgms. In spite of the fact that wax and string beans as a rule carry more tin than other beans, we find one brand with only 106 mgms. in the drained solids; on the other hand twelve brands contained from 300 to 400 mgms.; six brands from 400 to 600 mgms.; and one brand 630 mgms. If these large amounts of tin are due to storage conditions and the age of the sample, it would seem that the consumer should be provided with some protection against such a situation.

Acidity of Liquor.

It has been suggested that the tin content is measured largely by the acidity of the liquor. Our results, however, indicate that this is not the determining factor, as there is no close connection between the acidity of the bean liquor and the amount of tin present. The sample of red kidney beans showing the highest acidity contained the least tin, while the two brands of lima beans and the brand of string beans containing the most tin were all relatively low in acidity. The average acidity of the red kidney beans was 26.4, that of the lima beans 18.0, and that of the wax and string beans 9.6, while the last-named contained on the average twice as much tin in the solids as either the red kidney or lima beans.

EXPERIMENTS WITH BREAD.

These experiments have taken up the following points:

1. The advantages or disadvantages following the use of "yeast food" or "bread improvers," more particularly *Arkady Yeast Food.*
2. The losses of food nutriments in the baking of bread.
3. The determination of fat in bread.
4. A study of tolerances for the net weight of loaves of bread:
   a. Losses in weight due to drying out of the bread.
   b. Variations in weight of loaves due to bakery manufacturing conditions.

1. The Advantages or Disadvantages Following the Use of Yeast Foods or Bread Improvers.

The chief chemist of this Station has been charged by the Joint Committee on Food Definitions and Standards, with the collection of data relative to the preparation of a definition and the formulation of standards for bread. Incidental to this work it was deemed a matter of great importance to determine the role played in bread manufacture by the various "yeast foods" and "bread improvers," which are being brought more and more to the attention of bakers. These products are of two general classes: the malt preparations (extracts or flours), and the compounds which are alleged to supply to the yeast certain nutrients, which either stimulate the yeast or, by supplying particularly suitable food, increase its activity.

Five malt extracts, four malt flours and five samples of a yeast food were analyzed. These were as follows:

Malt Extracts.

9549. *Diamalt.*, The American Diamalt Co., Cincinnati, O.
9541. *Malt Extract*, Freihofer Baking Co., Philadelphia, Pa.
9546. *O. P. Malt*, Malt-Diastase Co., New York.
10004. *Roloco*, The Corby Co., Washington, D.C.
9453. *Malt Extract* (manufacturer unknown), used in test by S. S. Thompson Co., New Haven.

	9540	9541	9546	10004	9453
Alcohol by volume	3.20	3.20	5.20	*	*
Extract	75.41	75.72	74.42	76.92	76.92
Ash	1.47	1.63	1.85	0.87	1.83
Protein (N x 6.25)	5.63	7.63	6.75	3.44	6.44
Sugar solids+glycerin	68.31	66.46	65.82	72.61	68.65
Direct reducing sugars, as dextrose	41.70	41.02	40.04	*	*
Dextrin	21.05	22.04	20.78	*	*
Glycerin	0.12	0.12	0.12	*	*
Diastatic power (degrees (Lintner)	62.5°	105°	74°	*	*

* Not determined.

These samples are quite similar in composition, although No. **9541** shows a somewhat higher Lintner value than the other two brands tested.

Malt Flours.

9545. *Diasto Dry Malt*, Chas. E. Mechel, Milwaukee, Wis.
9543. *Maltora*, The Cabell Co., Baltimore, Md.
9544. *Malzo*, Advance Malt Products Co., Chicago, Ill.
9542. *Plymco*, Plymouth Milling Co., LeMars, Iowa.

	9545	9543	9544	9542
Water	6.02	7.91	9.94	11.15
Ash	2.21	2.34	1.63	0.36
Protein (N x 6.25)	15.38	14.81	14.06	8.94
Ether extract	2.51	2.62	2.12	0.55
Fiber	2.02	2.17	0.99	0.08
Nitrogen—free extract	71.86	70.15	71.26	78.92
Starch	44.38	46.01	48.60	72.17
Diastatic power	high	high	high	very low

The first three samples are very similar in composition. These three brands likewise all showed high diastatic power, No. **9544** being somewhat higher than the others. No. **9542** is a very different preparation both as regards composition and diastatic activity, the latter being extremely low.

Yeast Food.

9424, 9514. *Arkady Yeast Food*, Ward Baking Co., New York.

	9424	9514
Water	5.99	5.58
Ash	49.45	48.47
Protein (N x 6.25)	4.75	4.38
Carbohydrates	36.34	38.08
Fat	0.38	0.38
Ammonia	3.09	3.11
Potassium bromate	0.298	*
Calcium oxid	9.64	*
Sulphuric anhydrid	13.31	*
Sodium chlorid	present	present

* Not determined.

Three other samples contained 5.41, 5.37 and 6.52 per cent. of moisture.

The formula of this preparation as given by the manufacturer is as follows:

Calcium sulphate	25.0
Ammonium chlorid	9.7
Potassium bromate	0.3
Sodium chlorid	25.0
Patent wheat flour	40.0

Our two analyses satisfy this formula in all respects.

Baking Tests.

A series of baking tests were conducted to study the effect of *Arkady Yeast Food*, our experiments at this time being limited to this particular preparation for the following reasons: First, it has been specifically attacked both as to the purposes of its use and because of alleged objectionable mineral ingredients it introduces into the bread; second, because it represents a distinct type of these foods (*i.e.* it is largely a mineral food); third, because no question has been raised as to objectionable ingredients being introduced by malt extracts or malt flours; and fourth, because of the time and labor consumed it was necessary to limit our first experiments to a single preparation.

The method of conducting the tests was as follows: Batches of dough ranging from 78 to 709 lbs. were prepared under strict

supervision, generally either under that of the writer or some other official authority, in one series the baker's regular formula being used; in the other Arkady was introduced, the amount of sugar, salt, yeast and generally flour being reduced. The weighing of all the ingredients was supervised, as well as that of the dough during its various stages, and that of the finished bread. Samples of the various ingredients and the baked breads were taken for analysis, either in triplicate or quadruplicate. Every precaution was taken to avoid mechanical loss during the tests, the loaves being molded by hand and a record being kept of the weight of dusting flour used. A complete baking record was kept for each test.

Disinterested parties supervised the weighings and various operations in all the tests but four (the latter being conducted independently by the baker although the writer analyzed the materials and the breads). Similarly the materials and the breads were always analyzed by three, and sometimes by four, laboratories, in every case, except the tests referred to above, at least two official laboratories taking part in the analysis. The following tabulation shows the extent of official supervision in each test.

Test.	*Bakery.*	*Supervisors.*
1	Ward Bakery, New York	3 Government chemists and writer.
2	" " "	" " " " "
3	" " "	Writer.
4–7	" " "	No official supervision.
8	Thompson Bakery, New Haven,	Writer and his assistant.
9	" " "	Writer's assistant.
10	Washington Barracks, D.C.	U. S. Army officers.
11–12	Taggart's Bakery, Indianapolis	State chemist.

In each of the twelve tests samples of the baking materials and the breads were sent to the writer for analysis. Likewise all the analytical data obtained by the various analysts has been submitted to the writer, and while these will of course be presented to the Standards Committee, only the results of our own laboratory will be discussed here.

Table VI shows the composition of the various baking materials' and Tables VII to IX that of the breads, as determined in this laboratory. The analyses of the ingredients require no comment, except to call attention to the fact that actual analyses were made in all cases, except the oil and lard used. These were assumed

to be entirely fat, and even were this assumption not strictly correct, no error is introduced as in every comparative Non-Arkady and Arkady test equal amounts of these shortening materials were used.

TABLE VI. ANALYSES OF BAKING MATERIALS.

Material.	Baking test.	Water.	Ash.	Protein.	Carbohydrates.	Fat.
Flour, No. 1	1 & 2	12.49	0.50	10.72[1]	75.00	1.29
" No. 2	1 & 2	13.29	0.38	10.66[1]	74.56	1.11
" No. 3	3	12.89	0.46	11.00[1]	74.36	1.29
" "	4	13.20	0.40	10.66[1]	74.45	1.29
" "	5	13.29	0.40	10.94[1]	74.08	1.29
" "	6	13.40	0.45	10.89[1]	74.04	1.22
" "	7	13.03	0.49	11.00[1]	74.21	1.27
" No. 4	8	12.91	0.42	10.83[1]	74.74	1.10
" "	9	12.64	0.44	10.94[1]	74.86	1.12
" No. 5	10	12.82	0.53	11.69[1]	73.40	1.56
" No. 6	11	13.12	0.39	10.09[1]	75.31	1.09
" "	12	13.15	0.37	10.37[1]	74.98	1.13
Skim milk, condensed	1 & 2	30.97	1.97	8.29[2]	54.70	4.07
" " "	3–7	35.23	2.03	8.60[2]	49.79	4.35
" " "	11	32.14	2.03	8.93[2]	53.20	3.70
" " "	12	29.79	2.14	9.12[2]	54.82	4.13
Skim milk	8 & 9	91.68	0.69	2.81[2]	4.40	0.42
Yeast, Corby's	1–7	73.81	2.42	14.88[3]	8.60	0.29
" "	10	72.50	2.54	15.62[3]	9.03	0.31
" "	11	70.93	2.41	14.75[3]	11.44	0.47
" "	12	75.70	2.41	14.56[3]	6.87	0.46
Arkady Yeast Food	1 & 2	5.99	49.45	4.75[4]	36.34	0.38
" " "	3–7	5.41	...	...	...	..
" " "	8 & 9	5.37	...	...	...	...
" " "	10	5.58	48.47	4.38[5]	38.08	0.38
" " "	11 & 12	6.52	...	...	...	0.41
Roloco, Corby's	11 & 12	23.08	0.87	3.44[3]	72.61	0.00
Malt extract	8	23.08	1.83	6.44[3]	68.52	0.13
Sugar	all	0.03	...	...	...	...
Salt	all	0.11	99.89	...	...	...
Cotton seed oil (assumed)	...	...	...	...	...	100.00
Lard (assumed)	8 & 9	...	...	...	...	100.00

[1] N x 5.7.
[2] N x 6.38.
[3] N x 6.25.
[4] N x 6.25 (plus 3.09% ammonia as chlorid.
[5] N x 6.25 (plus 3.11% ammonia as chlorid.)

TABLE VII.—ANALYSES OF BREADS (1 *hr. after baking*).

Bread.	Baking test.	Water.	Ash.	Protein (N×5.7).	Carbohydrates.	Fat.
Non-Arkady	1	37.11	1.36	7.58	51.77	2.18
"	2	36.35	1.45	7.81	52.34	2.05
"	3	36.18	1.41	7.28	52.85	2.28
"	4	36.51	1.36	7.58	52.25	2.30
"	5	36.23	1.46	7.57	52.61	2.13
"	6	37.67	1.47	7.49	51.20	2.17
"	7	35.38	1.43	7.88	53.32	1.99
"	8	31.84	1.74	8.61	55.98	1.83
"	9	34.59	1.52	8.01	53.90	1.98
"	10	38.32	1.53	7.86	51.36	0.93
"	11	39.48	1.24	6.90	50.63	1.75
"	12	36.09	1.26	7.42	53.42	1.81
Average (omitting tests 8 and 11)*		**36.44**	**1.43**	**7.65**	**52.50**	**1.98**
Arkady	1	36.60	1.49	7.87	52.03	2.01
"	2	35.27	1.53	7.92	53.13	2.15
"	3	35.95	1.45	7.69	52.57	2.34
"	4	35.33	1.40	7.84	53.08	2.35
"	5	35.59	1.47	7.85	52.89	2.20
"	6	37.16	1.47	7.64	51.47	2.26
"	7	36.06	1.49	7.75	52.66	2.04
"	8	34.61	1.73	8.19	53.70	1.77
"	9	35.74	1.54	7.88	53.04	1.80
"	10	37.85	1.55	8.10	51.47	1.03
"	11	37.72	1.13	7.08	52.27	1.80
"	12	34.91	1.24	7.53	54.49	1.83
Average (omitting tests 8 and 11)*		**36.05**	**1.46**	**7.81**	**52.68**	**2.00**

* See page 119 for reasons for ommission.

TABLE VIII.—LIME, SULPHATES AND AMMONIA IN BREADS.
(*In Original Substance*).

Bread.	Sulphuric anhydrid. Method 1.*	Sulphuric anhydrid. Method 2.**	Lime (CaO).	Ammonia. (NH_3).	Bread.	Sulphuric anhydrid. Method 1.*	Sulphuric anhydrid. Method 2.**	Lime (CaO).	Ammonia. (NH_3).
	%	%	%	%		%	%	%	%
Non-Arkady 1	.089	.015	.022	.0008	Arkady 1	.097	.060	.051	.0019
" 2	.056	.016	.015	.0007	" 2	.074	.055	.042	.0053
" 3	.043	.011	.020	.0008	" 3	.058	.055	.049	.0053
" 4	.040	.015	.023	.0008	" 4	.075	.059	.041	.0041
" 5	.056	.014	.017	.0027	" 5	.106	.052	.055	.0036
" 6	.027	.009	.017	.0011	" 6	.070	.045	.050	.0052
" 7	.050	.019	.018	.0017	" 7	.067	.059	.039	.0062
" 8	.063	.024	.031	.0019	" 8	.075	.077	.050	.0071
" 9	.077	.020	.023	.0009	" 9	.102	.071	.047	.0037
" 10	.085	..	.009	.0017	" 10	.114	..	.044	.0087
" 11	.068	.015	.021	.0017	" 11	.083	.056	.041	.0062
" 12	.050	.020	.024	.0019	" 12	.093	.061	.036	.0069
Average	**.059**	**.016**	**.020**	**.0014**	**Average**	**.085**	**.059**	**.046**	**.0051**

* Bread ashed, then treated with HCl.
** Bread treated with HCl. direct without ashing.

TABLE IX.—BROMIN IN BREADS.
(*Parts of Br. per* 100,000 *parts of air-dry bread.*)

Non-Arkady.		*Arkady.*	
1	0.25	1	0.50
2	0.25	2	0.50
3	0.25	3	0.50
4	0.25	4	0.50
5	0.425	5	0.75
6	0.425	6	0.75
7	0.25	7	0.50
8	0.30	8	0.625
9	0.25	9	0.50
10	0.25	10	0.50
11	0.30	11	0.625
12	0.30	12	0.688
Average	**0.29**	**Average**	**0.58**

On the following pages will be found the formulas used, the baking record, and the dry matter found in the materials and the breads of each test. Test 8, made at the Thompson Bakery, New Haven, has been omitted throughout, as a mixing of the loaves of the baked bread after sampling, in this test gave absurd and impossible results. Similarly the results of test 11 are also omitted as during the shipment of the breads from Indianapolis, the package became broken and possibly some bread was lost.

TABLE X.—BAKING FORMULAS.

Material.	Tests 1–2. Non-Arkady.	Tests 1–2. Arkady.	Tests 3–7. Non-Arkady.	Tests 3–7. Arkady.	Test 9. Non-Arkady.	Test 9. Arkady.	Test 10. Non-Arkady.	Test 10. Arkady.	Tests 11–12. Non-Arkady.	Tests 11–12. Arkady.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Flour	425*	419*	215*	212*	218*	218*	50*	49*	208*	208*
Water	240	240	120	120	93	94½	26	26	115	118
Sugar	11	9	5½	4½	5	4	⅞	¾	...	...
Salt	7	6½	3½	3¼	4	3¾	⅞	¾	2 81/100	2 56/100
Cotton seed oil	10	10	5	5	..	..	..	..	2 1/100	2 81/100
Lard	..	..	..	..	4	4	..	..	...	...
Condensed skimmed milk	11	11	5½	5½	..	..	..	..	10	10
Skimmed milk	..	..	..	..	32	32	..	..	...	...
Yeast	5	2½	2½	1¼	2	1	½	¼	3	1½
Arkady	..	2⅛	..	2 1/16	..	1	..	..	...	...
Roloco	..	..	..	..	..	..	..	..	8	7

* Dusting flour was added in each test as follows:
Non-Arkady: 1, 3.75 lbs., 2, 2.5 lbs., 3, 1.75 lbs., 4, 3.25 lbs., 5, 1.75 lbs., 6, 2.25 lbs., 7, 2.25 lbs., 9, 3 lbs., 10, 0.5 lb., 11, 2.25 lbs., 12, 2.81 lbs.
Arkady: 1, 5.5 lbs., 2, 4.25 lbs., 3, 2.75 lbs., 4, 2.25 lbs., 5, 2.5 lbs. 6, 2.5 lbs., 7. 2.75 lbs., 9, 3.5 lbs., 10, 0.5 lb., 11, 2.25 lbs., 12, 2.38 lbs.

Baking Formulas.

No attempt was made to dictate the baking formula used, this representing in all cases for the Non-Arkady bread the regular formula used at the bakery where the test was being conducted. Accordingly we have formulas representing the practice in a large wholesale bakery, in two smaller high-class bakeries and in a Government barracks bakery. In every case modifications of the regular formula were made necessary in the Arkady doughs because of the use of that ingredient. The following decreased amounts were used in the Arkady doughs:

Tests 1-2. 6 lbs. flour, 2 lbs. sugar, 0.5 lb. salt, 2.5 lbs. yeast.
Tests 3-7. 3 lbs. flour, 1 lb. sugar, 0.25 lb. salt, 1.25 lb. yeast.
Test 9. 1 lb. sugar, 0.25 lb. salt, 1 lb. yeast.
Test 10. 1 lb. flour, 0.125 lb. sugar, 0.125 lb. salt, 0.25 lb. yeast.
Tests 11-12. 1 lb. Roloco, 0.25 lb. salt, 1.5 lbs. yeast.

Loss of Dry Matter in Baking Bread.

Table XI shows the amounts of dry matter introduced into the doughs by the ingredients used and the actual amounts recovered in the baked breads.

The results in Table XI may be summarized as follows:

Losses of Dry Matter.

	Pounds.		Per cent.		Less percentage loss shown by Arkady breads
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	
1	21.006	13.155	5.12	3.25	1.87
2	15.474	5.253	3.79	1.30	2.49
3	6.947	4.233	3.36	2.07	1.29
4	6.231	3.456	3.00	1.70	1.30
5	4.962	2.353	2.41	1.16	1.25
6	5.181	3.881	2.51	1.91	0.60
7	5.702	1.080	2.75	0.53	2.22
9	6.994	2.698	3.34	1.29	2.05
10	1.340	0.675	2.93	1.51	1.42
12	6.089	2.998	3.01	1.49	1.52
Average	.....	.....	**3.22**	**1.62**	**1.60**

In every test the Non-Arkady breads showed the greater loss in dry matter. This ranged from 1.340 to 21.006 lbs.; the Arkady breads showed losses of from 0.675 to 13.155 lbs.; in both cases the losses varying to a considerable extent with the amount of flour used. The percentage loss of dry matter in the Non-Arkady

BAKING RECORD.

	Test 3.		Test 4.		Test 5.		Test 6.		Test 7.	
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.
Temperature of flour	80.0	80.0	82.4	82.4	83.5	83.5	84.1	84.1	82.7	82.7
" water	50.0	50.0	49.0	49.0	49.0	49.0	46.0	46.0	49.0	49.0
" room	80.0	80.0	88.0	88.0	84.1	84.1	86.4	96.4	80.2	80.2
Started mixing	8.10	8.48	7.50	8.30	7.57	8.30	8.04	8.44	7.44	8.25
Finished mixing	8.25	9.02	8.01	8.45	8.07	8.42	8.17	8.56	7.57	8.36
Temperature of dough when mixed	81.2	81.0	81.0	81.6	80.9	80.8	81.0	81.9	80.9	80.4
Weight of dough when mixed, lbs.	355.5	352.0	354.75	350.5	354.0	350.25	354.5	349.75	355.5	351.75
First turn	10.55	11.32	10.31	11.15	10.37	11.12	10.47	11.26	10.27	11.06
Temperature at first turn	82.5	81.6	82.3	82.6	81.4	81.8	81.9	82.6	81.7	81.1
Second turn	12.25	1.02	11.46	12.30	11.52	12.27	12.02	12.41	11.42	12.21
Temperature at second turn	83.3	82.1	82.6	82.7	82.1	82.4	83.2	82.6	81.8	80.7
Dough ready for scaling	12.55	1.32	12.31	1.15	12.37	1.12	12.47	1.26	12.27	1.06
Weight of dough when scaled, lbs.	352.5	350.25	353.25	348.24	351.25	349.0	..	..	353.25	350.0
Dough in proof box	1.35	2.10	1.15	2.00	1.27	2.05	1.15	1.57	1.03	1.48
Number of loaves	211	205	212	208	204	206	210	208	207	207
Dough going to oven	2.32	3.04	2.18	3.15	2.34	3.10	2.32	3.04	2.12	3.09
Bread baked	3.14	3.48	2.43	3.50	3.03	3.40	2.54	3.29	3.05	3.41
Weight of bread 1 hr. old	313.5	313.0	317.25	309.5	315.5	312.5	322.75	317.5	311.75	318.0

BAKING RECORD.

	Test 1.		Test 2.		Test 9.		Test 10.		Test 11.		Test 12.	
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.
Temperature of flour	61.7	61.7	66.5	66.5	76.8	76.8	74.0	74.0	73.7	73.7	75.0	75.0
" " water	51.0	51.0	52.0	52.0	78.0	77.0	86.0	86.0	50.0	50.0	60.0	60.0
" " room	79.0	81.0	80.0	80.0	80.0	80.0	80.0	80.0	78.0	78.0	76.0	76.0
Started mixing	10.55	12.24	9.36	10.35	7.39	8.10	8.07	8.10	7.49	8.48	6.46	7.37
Finished mixing	11.08	12.38	9.50	10.50	7.47	8.18	8.30	8.33	8.20	9.08	7.07	8.03
Temperature of dough when mixed	81.9	81. 6	81.0	81.0	81.0	81.0	84.0	84.0	77.1	78.0	80.5	80.2
Weight of dough when mixed	704.19	695.94	704.24	699.25	357.5	358.0	78.75	77.5	340.5	344.25	343.75	344.75
First turn	1.35	2.54	12.20	1.20	10.32	11.03	10.59	11.01	11.00	11.38	9.42	10.35
Temperature at first turn	83.2	82.9	82.0	82.0	82.4	82.2	87.0	86.5	77.9	79.0	81.3	80.8
Second turn	2.35	3.54	1.20	2.20	11.32	12.03	11.59	12.01	12.30	1.08	10.42	11.35
Temperature at second turn	84.1	83.6	82.5	83.0	83.1	82.2	..	..	80.3	80.3	81.2	81.3
Third turn	3.20	4.39	2.05	3.05	..	..	..	..	..	..	..	..
Temperature at third turn	85.2	82.6	83.0	82.5	..	..	..	..	..	..	..	..
Dough ready for scaling	3.40	5.00	2.30	3.25	12.40	1.11	1.04	1.12	1.15	1.45	11.27	12.15
Weight of dough when scaled	698.	691.5	696.75	692.50	354.25	355.5	78.0	77.0	339.	343.	341.25	343.25
Dough in proof box	4.36	5.48	3.23	4.15	1.02	1.45	1.10	1.13	1.39	2.05	12.05	12.35
Number of loaves	410	413	410	415	312	315	35	35	..	..	..	..
Dough going to oven	5.30	6.45	4.21	5.15	2.05	3.05	2.25	2.33	2.28	3.05	12.54	1.36
Bread baked	6.00	7.15	4.52	5.46	2.25	3.35	3.55	4.03	3.02	3.45	1.29	2.10
Weight of bread 1 hr. old	618.75	618.50	616.75	614.75	309.25	321.25	72	71	303	306.75	307.5	305.5

Baking Record.

The baking record is given herewith in full, but the details will not be discussed here.

TABLE XI.—DRY MATTER IN MATERIALS AND BREAD.

	Test 1.		Test 2.		Test 3.		Test 4.		Test 5.	
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.
Flour	370.218	364.990	370.218	364.990	187.287	184.673	186.620	184.016	186.427	183.825
Sugar	10.997	8.997	10.997	8.997	5.499	4.499	5.499	4.499	5.499	4.499
Salt	6.992	6.493	6.992	6.493	3.496	3.247	3.496	3.247	3.496	3.247
Cotton seed oil	10.000	10.000	10.000	10.000	5.000	5.000	5.000	5.000	5.000	5.000
Condensed skim milk	7.593	7.593	7.593	7.593	3.562	3.562	3.562	3.562	3.562	3.562
Yeast	1.310	0.655	1.310	0.655	0.655	0.328	0.655	0.328	0.655	0.328
Arkady	....	1.998	....	1.998	...	1.005	...	1.005	...	1.005
Dusting flour	3.280	4.810	2.187	3.717	1.524	2.396	2.821	1.953	1.517	2.168
Total	410.138*	405.284*	408.035**	403.181**	207.023	204.710	207.653	203.610	206.156	203.634
Bread	389.132	392.129	392.561	397.928	200.076	200.477	201.422	200.154	201.194	201.281
Loss	21.006	13.155	15.474	5.253	6.947	4.233	6.231	3.456	4.962	2.353
Per cent. loss	5.12	3.25	3.79	1.30	3.36	2.07	3.00	1.70	2.41	1.16

* 0.252 lb. deducted for dough removed for fermentation test.

** 1.262 lb. deducted for dough removed for fermentation test.

TABLE XI.—DRY MATTER IN MATERIALS AND IN BREAD.—*Concluded.*

	Test 6.		Test 7.		Test 9.		Test 10.		Test 12.	
	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.	Non-Arkady.	Arkady.
Flour	186.190	183.592	186.986	184.376	190.445	190.445	43.590	42.718	180.648	180.648
Sugar	5.499	4.499	5.499	4.499	5.000	4.000	0.875	0.750	6.154†	5.384†
Salt	3.496	3.247	3.497	3.247	3.996	3.746	0.875	0.750	2.810	2.560
Cotton Seed Oil	5.000	5.000	5.000	5.000	4.000‡	4.000‡	..	..	2.810	2.810
Condensed Skim Milk	3.562	3.562	3.562	3.462	2.662	2.662	..	..	7.021	7.021
Yeast	0.655	0.328	0.655	0.328	0.550	0.275	0.13	80.069	0.729	0.365
Arkady	..	1.005	..	1.005	...	0.946	..	0.236	...	0.993
Dusting Flour	1.949	2.165	1.957	2.392	2.621	3.058	0.273	0.273	2.440	2.067
Total	206.351	203.398	207.155	204.409	209.274	209.132	45.751	44.796	202.612	201.848
Bread	201.170	199.517	201.453	203.329	202.280	206.435	44.411	44.121	196.523	198.850
Loss	5.181	3.881	5.702	1.080	6.994	2.698	1.340	0.675	6.089	2.998
Per cent loss	2.51	1.91	2.75	0.53	3.34	1.29	2.93	1.51	3.01	1.49

‡ Lard.
† Roloco.

breads ranged from 2.41 to 5.12 and in the Arkady breads from 0.53 to 3.25. Although there are considerable variations in the decreased losses of dry matter where Arkady was used, it is a striking fact that in every test the Arkady bread showed a lower loss, ranging from 0.60 to 2.49, average, 1.60 per cent.

In the first two tests the loaves of bread after baking were weighed on a Fairbanks scale. Although the accuracy of this scale and its weights were tested at the time of our test, it was realized later that an error might have been introduced, the scale not being sensitive to less than one-quarter of a pound. Any such error in weighing would probably be compensative and would have no serious effect on the results where losses as high as from 5 to 20 lbs. were shown. In the subsequent tests all the baked breads were weighed on a torsion balance sensitive to one gram. The uniformity of the results of all the tests indicates that the scale used in no way vitiated the conclusions from the first two tests.

The effect of the use of Arkady in conserving the dry matter of the dough is shown in the following summary where it is seen that not only does Arkady uniformly decrease the losses in dry matter attendant upon fermentation, but that an actual saving of original ingredients is also secured without in any way decreasing the food value of the bread (as will be shown on a later page).

SAVING IN DOUGH INGREDIENTS.

Test.	Arkady used.	Flour.	Sugar.	Salt.	Yeast.	Roloco.	Total.	Net saving in ingredients.	Saving in dry matter of dough.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	2.125	4.25	2.00	0.50	2.50	....	9.25	7.125	7.85
2	2.125	4.25	2.00	0.50	2.50	....	9.25	7.125	10.22
3	1.063	2.00	1.00	0.25	1.25	....	4.50	3.437	2.71
4	1.063	4.00	1.00	0.25	1.25	....	6.50	5.437	2.78
5	1.063	2.25	1.00	0.25	1.25	....	4.75	3.687	2.61
6	1.063	2.75	1.00	0.25	1.25	....	5.25	4.187	1.30
7	1.063	2.50	1.00	0.25	1.25	....	5.00	3.937	4.62
9	1.000	0.50	1.00	0.25	1.00	....	1.75	0.750	4.30
10	0.250	1.00	0.125	0.125	0.25	....	1.50	1.25	0.67
12	1.063	0.43	....	0.25	1.50	1.00	3.18	2.117	3.09
Totals	11.878	22.93	10.125	2.875	14.00	1.00	50.93	39.052	40.15

In other words in making 2,414 loaves of bread weighing 3,505 lbs.; the use of 11.878 lbs. of Arkady allowed the saving of 22.93 lbs. of flour, 10.125 lbs. of sugar, 2.875 lbs. of salt, 14.00 lbs. of yeast and 1.00 lb. of Roloco malt extract, or a total net saving in raw materials of 39.052 lbs. At the same time 40.15 lbs. of the dry matter of the dough was saved from unnecessary destruction by the yeast ferments. Calculating these results to the basis of 1,000 1.5 lb. loaves of bread, the saving in ingredients following the use of Arkady were as follows:

Saved.	*Used in Addition.*
9.50 lbs. flour	4.92 lbs. Arkady =
4.19 " sugar	1.23 " calcium sulphate
1.19 " salt	0.48 " ammonium chlorid
5.80 " yeast	0.01 " potassium bromate
0.41 " Roloco	1.23 " sodium chlorid (salt)
	1.97 " flour

In addition to the above, 16.63 lbs. of the dry matter of the dough was saved per thousand 1.5 lb. loaves. When one considers the millions of loaves of bread made annually such a conservation as is shown by these tests is well worthy of careful attention. Other questions, however, arise in this connection, viz.: is this conservation effected at a sacrifice of quality in the bread, and does the use of Arkady introduce into the bread any objectionable ingredients? These questions will now be discussed.

Composition of the Breads.

The criticism has been made that the use of Arkady enables the baker to use a lower grade of flour, and that in reality the main role played by its mineral salts, particularly the potassium bromate, is that of bleaching agents. The results of certain baking experiments submitted to us throw light on this point, and indicate quite clearly that the potassium bromate improves the baking qualities of flours in general. Three flours were tested, a high patent hard spring wheat flour, a low grade clear hard spring wheat flour, and a high patent soft winter wheat. The experiments showed that, while the bromate was effective for all the flours, the higher the grade of the flour used the greater was its effect. A loaf of finer texture and color followed the use of bromate, but such a result obviously is one of the main purposes of leavening bread. Ammonium chlorid gave similar results;

that is, the effect of that salt was less when low grade flours (containing a relatively high ash) were used than when the flour was a high patent, indicating that the ash ingredients of the lower grade flours provided sufficient mineral food for the yeast, and that the use of Arkady with a flour of this class was not advantageous.

The experiments quoted above also showed that the fineness of texture and the color of the crumb depended to a considerable extent on the amount of yeast used. While the bread made with Arcady was better in texture, color and general appearance than one made with the same amount of yeast but without Arkady, it was not of as good appearance or of as great volume as one where double the amount of yeast was used without Arkady. In other words the yeast itself appeared to have what might be considered a decided bleaching effect.

The quality of the breads obtained from the different doughs is clearly shown in Table VII. It has been claimed that Arkady increases the water-holding power of the dough and that a more moist bread results, in other words that its use permits the baker to market excess water as bread. Our tests show the contrary to be the case. Omitting test 8 for reasons already given, in only two of the ten tests did the Arkady bread contain more moisture than the other. The average moisture content of the Non-Arkady breads was slightly higher, 0.39 per cent., than in those where Arkady was used. Not only did the Arkady breads contain less water, but they also contained slightly more of each of the food nutrients. Moreover, unpublished experiments of Winslow and Falk of the Yale Medical School show that this slightly increased food value was not secured at the sacrifice of digestibility. Quoting these authorities: "If the results of this experiment, taken as a whole, indicate any effect of Arkady salts upon the digestibility of bread, the effect is a favorable rather than an inhibitory one. * * * We may safely conclude that the digestibility of Arkady bread is not effected by the yeast food used in its manufacture."

It is apparent, therefore, that the use of Arkady does not increase the moisture content of the bread, that it slightly increases its food value, and that it in no way decreases the bread's digestibility.

The Role of the Mineral Salts in Arkady.

There are, however, two other important points to be considered, namely, what is the fate of the mineral salts in the bread, and what effect, if any, do they have on its wholesomeness.

The Arkady process was developed from observations that breads made at different bakeries by the same process and using the same formulas and baking ingredients showed marked variations in flavor, texture and quality. Extensive investigations pointed to the different waters used as the source of the difference and that the varying amounts of inorganic salts contained in the different waters were the determining factor. The effect of the composition of the waters used has long been known in the brewing industry, the superiority of the waters of the Trent having given Burton ales a recognized high place among such products. Likewise it is an established fact that yeast needs certain mineral salts for its proper development and growth. While carbohydrates and nitrogenous matters are of course needed for the yeast's growth, the mineral salts are perhaps even more necessary. Experiments by Kohman and Hoffman* (**Jour. Ind. Eng. Chem.* 1916, 8, 781–789; *do.* 1917 9, 148–159), who developed the Arkady process, have shown that small amounts of calcium sulphate, ammonium chlorid and a trace of potassium bromate gave the most satisfactory results, and that a combination of these salts in the proper proportions worked better than any one of the salts by itself. The experiments of these authorities seem to establish that the calcium sulphate stimulates fermentation and increases the gas production, that the ammonium chlorid is used directly as a food by the yeast and that practically none is found as such in the baked bread, and that the potassium bromate has a marked effect in maturing the gluten, thereby conserving flour and sugar and effecting a considerable saving in the amount of yeast required. Experiments of Winslow and Falk show that the potassium bromate, in the dilutions in which this salt is introduced into bread by the Arkady process, has a pronounced effect in accelerating proteolytic ferments, an action similar to that observed in the dough.

Calcium Sulphate.

Lime and sulphates were determined in all the samples of bread. As was to be expected, in every instance, the Arkady breads contained slightly more of these two mineral ingredients. The Non-Arkady bread contained on the average 0.020 and the Arkady 0.046 per cent. lime (CaO), with 0.059 and 0.085 per cent. of sulphate (as SO_3), respectively. (Direct treatment of the bread without ashing gave much lower percentages of sulphate in all the breads.) In other words, the Non-Arkady breads contained on the average 0.079 and the Arkady 0.135 per cent. of calcium sulphate. The amount of lime even in the Arkady breads is still only about one-tenth of the amount recognized as necessary in our daily diet. Many of our common foods are deficient in lime, and while the slightly increased content of lime in the Arkady breads probably has little practical significance, its effect, if any, would be beneficial rather than injurious. Forbes has told us (address Washington Academy of Sciences, July, 1916) of calcium that "Physiologically it is the great mineral stabilizer. Practically, it is much more frequently lacking in the food of men and animals than in any other mineral nutrient." The claim that Arkady is used in bread for the purpose of a make-weight is obviously false and absurd.

Ammonium Chlorid.

The claim is made by the manufacturer that the ammonium chlorid introduced by Arkady is completely utilized by the yeast and that, therefore, no increased amount should appear in the bread. Our determination of this salt by distillation with magnesia as shown in Table VIII, indicate that while most of the added ammonium chlorid does not appear as such in the finished bread, still the Arkady breads contain slightly more than where Arkady was not used, the average percentage being 0.0051 as compared with 0.0014. This small increase, however, is entirely without significance and can have no possible deleterious effect on the wholesomeness of the bread. In fact, many of our well-known foods contain ammonia in far greater amounts than does Arkady bread, for instance, Allenburys' Milk Food 0.0105, Honor Dry Milk 0.0178, Mammala 0.0182, Horlick's Malted Milk 0.0185, Nestle's Food 0.0061, Eskay's Food 0.0076, Imperial Granum 0.0071, Camembert cheese 0.1239, canned lobster 0.0874, ham 0.0365, buttermilk 0.0337, Swiss cheese 0.0090 and American cheese 0.0056 per cent. (Hoffman and Kohman's results).

Potassium Bromate.

The claim is made that the potassium bromate of Arkady is broken up by the fermentative processes of the yeast, and in the baking process and that whatever bromin is left in the bread is in the form of potassium bromid. Our experiments, not entirely completed, seem to sustain this claim. The amounts of bromin found in the breads were extremely small, the average content of the Non-Arkady bread being 0.29 and of the Arkady bread 0.58 part of bromin per 100,000 parts of air-dry bread. Calculated to the basis of the original breads, these values would be about 0.10 and 0.20 part per 100,000, respectively. Such extremely small amounts of bromin as bromid would be without physiological effect. Moreover the fact has been recently brought out that bromin is much more widely distributed in nature than has usually been supposed, and that many of our common foods contain it in appreciable amounts.

We have determined bromin in a number of foods, by the same method as was used for the breads, with the following results:

Parts of Bromin per 100,000 *parts of Air-dry Substance*

Table salt	6.27	Post Tavern Special	0.35
Fresh codfish	3.00	Gluten Bread	0.30
Salted codfish	1.50	Borden's Malted Milk	0.25
Celery	0.75	Brown Rice	0.25
Parsnips	0.75	Corn Meal	0.25
Haddock	0.50	Canned Lima Beans	0.25
Cabbage	0.50	Canned Kidney Beans	0.25
White Potatoes	0.40	Beets	0.25
Gluten Biscuit	0.35		

All of the above results as well as those secured in the breads, are doubtless slightly low owing to the difficulties of the method, but the results are at least comparative.

2. The Losses of Food Nutrients in the Baking of Bread.

In bread-making the action of the yeast causes a loss of carbohydrates, due to their fermentation and the formation of alcohol and carbonic acid gas, which are largely lost in the fermentation troughs or the oven.

The claim has been made that the use of Arkady not only requires less yeast but also that because of this smaller amount of yeast and because of the nutrient salts contained in Arkady less

Table XII: Losses of Food Nutrients.

Test.	Kind of Dough.	Total Weight of Bread.	Losses of				
			Water.	Ash.	Protein (N x 5.7).	Carbohydrates.	Fat.
1	Non-Arkady..	618.75	72.40	0.79	0.55	17.71	2.11
1	Arkady.....	618.50	72.87	0.47	+1.95	12.17	3.12
2	Non-Arkady..	616.75	75.62	0.24	+0.97	14.75	2.91
2	Arkady.....	614.75	78.81	0.25	+2.22	8.30	2.29
3	Non-Arkady..	313.50	38.09	0.24	1.85	4.19	0.88
3	Arkady.....	313.00	37.87	0.36	0.24	3.16	0.68
4	Non-Arkady..	317.25	36.56	0.22	0.04	5.42	0.75
4	Arkady.....	309.50	41.65	0.44	+0.73	3.24	0.73
5	Non-Arkady..	315.50	38.08	+0.07	0.65	3.28	1.31
5	Arkady.....	312.50	40.00	0.18	+0.38	1.64	1.13
6	Non-Arkady..	322.75	31.14	+0.10	0.34	4.49	0.89
6	Arkady.....	317.50	33.44	0.21	+0.24	3.23	0.67
7	Non-Arkady..	311.75	41.59	0.27	0.16	3.70	1.79
7	Arkady.....	318.00	36.03	0.23	+0.33	+0.08	1.48
9	Non-Arkady..	309.25	44.75	0.54	0.62	5.35	0.49
9	Arkady.....	321.25	37.80	0.51	0.02	1.33	0.84
10	Non-Arkady..	72.00	5.22	0.05	0.30	0.87	0.12
10	Arkady.....	71.00	5.64	0.04	0.06	0.53	0.04
11	Non-Arkady..	303.00	30.11	0.21	1.92	16.40	0.18
11	Arkady.....	306.75	35.80	0.73	0.90	9.18	+0.04
12	Non-Arkady..	307.50	38.84	0.07	0.67	5.30	0.05
12	Arkady.....	305.50	44.82	0.38	0.24	2.36	0.02

of the carbohydrates of the flour and the added sugar are destroyed during the fermentation process. The very complete analyses we have made of these breads prepared under carefully controlled conditions affords an opportunity to test the accuracy of these claims.

We determined water, ash, protein, fat and (by difference) carbohydrates in all the ingredients used in the doughs and in the breads themselves. Knowing the formulas used we can determine the exact amounts of each of these ingredients introduced into the dough and the amounts recovered in the bread.

Table XII gives the net losses for each type of bread sustained by the doughs during the fermentation and baking periods. While some of the losses are so small that they might be accounted for by experimental error, certain facts stand out very clearly. The study of the losses of dry matter reported on an earlier page

TABLE XIII: SUMMARY OF LOSSES OF FOOD NUTRIENTS.

Test.	Kind of Dough.	Average total weight of bread.	Losses in total bake.					Losses per 100 pounds of Bread.				
			Water.	Ash.	Protein (N x 5.7).	Carbohydrates.	Fat.	Water.	Ash.	Protein (N x 5.7).	Carbohydrates.	Fat.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1–2	Non-Arkady	617.75	74.01	0.52	+0.21	16.23	2.51	11.98	0.08	+0.03	2.63	0.41
1–2	Arkady....	616.63	75.84	0.36	+2.09	10.24	2.71	12.14	0.06	+0.34	1.66	0.44
3–9, 11, 12	Non-Arkady	312.94	37.40	0.17	0.78	6.02	0.79	11.96	0.05	0.25	1.92	0.25
3–9, 11, 12	Arkady....	313.00	38.43	0.38	+0.04	3.01	0.69	12.28	0.12	+0.01	0.96	0.22
10	Non-Arkady	72.00	5.22	0.05	0.30	0.87	0.12	7.25	0.07	0.42	1.21	0.17
10	Arkady....	71.00	5.64	0.04	0.06	0.53	0.04	7.94	0.06	0.08	0.75	0.06
Ave.	Non-Arkady	.....	.....	....	.....	.....	....	10.40	0.07	0.21	1.92	0.28
Ave.	Arkady....	.....	.....	....	.....	.....	....	10.79	0.08	+0.09	1.12	0.24

showed that the losses in the Arkady breads were uniformly less than in the Non-Arkady breads. That these losses, regardless of whether or not Arkady was used, fell chiefly on the carbohydrates Table XII shows very clearly. There were slight losses of ash and fat, but the main loss was in carbohydrates. In seven of the twenty-two tests, however, there was an actual gain in protein and in only two tests was there a decided loss. That all but one of these protein gains were shown by Arkady breads and that the two decided pretein losses were shown by Non-Arkady breads is at least suggestive. Although in each Non-Arkady dough there was twice as much yeast used as in the corresponding Arkady dough, it would appear that the smaller amount of yeast in the presence of the Arkady mineral salts was actually able to construct protein from the ammonia of the ammonium chlorid in an amount more than sufficient to compensate for any losses sustained by the protein of the flour during the manufacturing process.

Table XIII shows the losses on a more comparable basis. Our doughs, based on weight of ingredients, fall into three well-defined classes, yielding either 600, 300 or 72 lbs. of bread. Calculated to the basis of losses per 100 lbs. of bread we find both kinds of dough lost about the same amounts of ash and fat, and that the Arkady dough lost 0.39 lb. more water, with 0.30 lb. less loss of protein and 0.80 lb. less loss of carbohydrates. It would appear, therefore, that in these tests the use of Arkady requires not only

half the normal amount of yeast, but that by using this smaller amount of yeast less carbohydrates were destroyed, and that the presence of the Arkady salts, more particularly ammonium chlorid, stimulated yeast production with an actual increase of protein in appreciable amounts. Moreover, as has been shown on a earlier page, this saving of food ingredients was secured without any sacrifice in the quality or nutritive value of the bread.

3. THE DETERMINATION OF FAT IN BREAD.

It has been frequently suggested that the official method used for determining fat in cattle feeds by means of ether extraction does not remove all the fat from bread or other baked products. The following method has been suggested by the Bureau of Chemistry to obviate this difficulty:

Method: Treat 5 gms. of material in a loosely stoppered 200 cc Erlenmeyer flask with a mixture of 10 cc alcohol (95%), 2 cc concentrated ammonia and 3 cc of water, heating 2 minutes at the boiling point. Cool, add three successive portions of 25 cc of ethyl ether, mixing thoroughly, and tamping the material each time with a glass rod flattened at the end, pouring off the extracts into a 200 cc beaker. The combined ether extracts are evaporated to dryness on the steam bath. The crude fat is extracted by washing out with several portions of anhydrous ether or preferably petroleum ether, collected in a tared flask, evaporating and drying for periods of 30 minutes at 100° C. until constant weight is obtained.

TABLE XIV: PERCENTAGE AMOUNT OF FAT IN BREAD.

Official method.	Modified method.	Official method.	Modified method.		Official method.	Modified method.
0.51	2.01	0.56	2.30		0.73	1.75
0.70	2.18	0.68	2.35		0.64	1.80
0.68	2.15	0.62	2.13		0.70	1.81
0.63	2.05	0.61	2.20		0.70	1.83
0.65	2.28	0.17	0.93	**Ave.**	**0.59**	**1.95**
0.69	2.34	0.21	1.03			

In sixteen of the samples of bread we determined fat both by the official method and the one outlined above. The results show conclusively the inapplicability of the official method to such products as bread, and indicate that practically all of the published analyses of bread are inaccurate as regards the amount of fat present. The average result secured by the official method was 0.59 per cent. and that by the Bureau method 1.95 per cent.

SAMPLES IN CLOSET.

	A			B			C			D		
	First.	Last.	Loss.	First.	Last.	Loss.	First.	Last.	Loss.	First.	Last.	Loss.
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.
	19.19	19.05	0.14	15.52	15.49	0.03	26.17	25.71	0.46	16.90	16.75	0.15
	19.29	19.22	0.07	16.08	16.01	0.07	25.22	25.08	0.14	16.90	16.86	0.04
	19.01	18.94	0.07	15.65	15.52	0.11	24.34	24.00	0.34	16.23	16.12	0.11
	19.19	18.98	0.21	16.05	15.87	0.18	24.06	23.70	0.36	16.12	16.05	0.07
	19.26	19.22	0.04	17.11	17.04	0.07	25.26	25.01	0.25	16.16	16.19	+0.03
	19.61	19.44	0.17	16.72	16.51	0.21	24.73	24.41	0.32	16.61	16.51	0.10
	19.51	19.40	0.11	16.51	16.40	0.11	25.33	25.01	0.32	17.14	17.00	0.14
	18.84	18.77	0.07	15.77	15.63	0.14	24.13	24.00	0.13	16.58	16.51	0.07
	19.33	19.26	0.07	15.77	15.52	0.25	24.62	24.30	0.32	16.97	16.86	0.11
Ave.	**19.25**	**19.14**	**0.11**	**16.13**	**16.00**	**0.13**	**24.87**	**24.58**	**0.29**	**16.62**	**16.54**	**0.08**

SAMPLES ON SHELF.

	20.21	20.04	0.17	16.01	15.77	0.24	24.76	24.44	0.32	16.61	16.44	0.17
	19.33	19.19	0.14	16.54	16.33	0.21	24.51	24.23	0.28	17.28	17.07	0.21
	18.94	18.77	0.17	16.26	16.12	0.14	24.41	24.09	0.32	17.00	16.86	0.14
Ave.	**19.49**	**19.33**	**0.16**	**16.27**	**16.07**	**0.20**	**24.56**	**24.25**	**0.31**	**16.96**	**16.79**	**0.17**
Ave. of all	**19.31**			**16.17**			**24.79**			**16.71**		

4. EXPERIMENTS ON WEIGHTS AND LOSSES IN WEIGHT OF BREAD.

The bakeries of S. S. Thompson and the L. L. Gilbert Baking Corporation were visited on May 28 and samples of bread taken. In all cases the bread was wrapped and was slightly warm; with the Thompson samples the time since baking was 1½ hrs. with the Gilbert samples ¾ hr. The bread was weighed at the bakery, then taken to the laboratory, nine loaves of each series were piled three by three in a glass-front closet, each pile being kept separate from the others. The other three loaves of each sample were placed on an open shelf in the laboratory, each loaf being separated from its fellows. The bread was reweighed at 9 A M. on May 29, May 30, May 31 and June 1, or at intervals of 16, 40, 64 and 88 hrs. Inasmuch as the losses in weight were very trivial, the following tabulations give only the initial weight at the bakery and the final weight.

The breads were as follows:

A. S. S. Thompson Co. Health Bread. Claimed 18 oz., price 10 cts.

B. S. S. Thompson Co. Better-Yet Bread. Claimed 9 oz. or more, price 10 cts.

C. L. L. Gilbert Baking Corp. Holsum Bread. No weight claimed, price 15 cts.

D. L. L. Gilbert Baking Corp. Butter-Krust. Claimed 14 oz., price 10 cts.

The experiment has three aspects:

1. Losses in weight before consumption.
2. Variations in weight of the loaves.
3. Ability of baker to meet reasonably any claimed weight.

1. *Losses in Weight before Consumption.*

The losses in weight after 88 hours were as follows:

In Closet.

A. 0.04 to 0.21, ave. 0.11 oz.
B. 0.03 to 0.25, ave. 0.13 "
C. 0.13 to 0.46, ave. 0.29 "
D. +0.03 to 0.15, ave. 0.08 "

On Shelf.

A. 0.14 to 0.17, ave. 0.16 oz.
B. 0.14 to 0.24, ave. 0.20 "
C. 0.28 to 0.32, ave. 0.31 "
D. 0.14 to 0.21, ave. 0.17 "

Even after a period of nearly four days the losses in weight were in general trivial, the larger loaves, C, showing somewhat larger losses. Likewise the samples kept on the open shelves lost somewhat more than those kept in the closet. There were practically no losses in the wrapped loaves up to 40 hours. The first two days of the experiment were rainy or cloudy, the last two bright and clear.

The temperature in the room in which the loaves were kept showed the following variations from day to day:

55 to 62°, 56 to 61°, 59.5 to 66°, and 64 to 70° Fahr.

2. *Variations in Weight of the Loaves.*

A. From 18.84 to 20.21, average 19.31 oz.
7 varied less than 0.25 oz. from average
11 varied less than 0.50 oz. from average
1 varied more than 0.50 oz. from average

B. From 15.52 to 17.11, average 16.17 oz.
4 varied less than 0.25 oz. from average
9 varied less than 0.50 oz. from average
3 varied more than 0.50 oz. from average

C. From 24.06 to 26.17, average 24.79 oz.
3 varied less than 0.25 oz. from average
8 varied less than 0.50 oz. from average
4 varied more than 0.50 oz. from average

D. From 16.12 to 17.28, average 16.71 oz.
6 varied less than 0.25 oz. from average
9 varied less than 0.50 oz. from average
3 varied more than 0.50 oz. from average

Summary. 20 varied less than 0.25 oz. from average
37 varied less than 0.50 oz. from average
11 varied more than 0.50 oz. from average

Judging simply from the variations in weight above or below the average the above figures show that the bakers have difficulty in scaling their loaves to a uniform weight. This fact, however, does not prevent them from making a claim for weight which they can live up to if a little more tolerance is permitted for overweight than under-weight, as the following consideration will show:

3. *Ability of Baker to Meet any Claimed Weight.*

The present tolerance allowed for bread is 0.50 oz. on what was formerly the five-cent, but is now the ten-cent loaf.

We will disregard the weights actually claimed, as for C no claim was made, and in the other cases the claim is too much below the actual weights found. Each lot consisted of twelve loaves.

A. If 19 oz. had been claimed three loaves would have varied more than 0.50 oz. (+.051, +0.61 and +1.21).

B. If 16 oz. had been claimed four would have varied more than 0.50 oz. (+1.11, +0.72, +0.51 and +0.54).

C. If 24.5 oz. had been claimed four would have varied more than 0.50 oz. (+1.67, +0.72, +0.76 and +0.83).

D. If 16.5 oz. had been claimed two would have varied more than 0.50 oz. (+0.64 and +0.78).

From the above it appears that the baker in order to meet his claim with certainty must provide a considerable overrun. It does not seem fair, therefore, to hold him as strictly accountable for excessive weight as for a deficiency. The recommendation is made, therefore, that the tolerance for bread both for the 10 cent and the 15 cent loaves should be not more than 0.50 oz. below or more than 1 oz. above the claimed weight. Applying these tolerances, of the 48 loaves only three would have exceeded the suggested claim by more than 1 oz. and none would have been deficient more than 0.50 oz.

Test of Variations in Weight of Loaves.

Certain bakers have protested against the tolerances in net weight of loaves of bread recognized by our regulations, claiming that unavoidably large variations necessarily followed the use of machines in moulding their bread. To test the accuracy of this claim we weighed a large number of loaves at two bakeries, 150 loaves in the one case, and 67 in the other. The bread was barely warm at the time of weighing, which was about three-quarters of an hour after removal from the ovens. It is unnecessary to give the detailed weighings, but the following is a summary of our results.

Bakery 1.

No. of loaves weighed	150
Lightest loaf	15.4 oz.
Heaviest loaf	17.1 oz.
Average loaf	16.3 oz.
1 loaf weighed	15.4 oz.
30 loaves weighed from	15.5—16.0 oz.
85 loaves weighed from	16.1—16.5 oz.
34 loaves weighed from	16.6—17.1 oz.

With a claim of 16 oz., only 1 loaf would have been more than 0.5 oz. below the claim, and 63 would have been more than 0.5 oz. above the claim; none would have been more than 1 oz. above the claim. The tolerances suggested on a previous page would have amply covered the unavoidable variations at this bakery.

Bakery 2.

No. of loaves weighed	67
Lightest loaf	15.7 oz.
Heaviest loaf	18.6 oz.
Average loaf	17.4 oz.
1 loaf weighed	15.7 oz.
4 loaves weighed from	16.1—16.5 oz.
9 loaves weighed from	16.6—17.0 oz.
29 loaves weighed from	17.1—17.5 oz.
24 loaves weighed from	17.6—18.6 oz.

With a claim of 16 oz., none would be more than 0.5 oz. below the claim, 62 would be more than 0.5 oz. above the claim, and 53 would be more than 1 oz. above the claim.

With a claim of 17 oz., 4 would be more than 0.5 oz. below the claim, 24 more than 0.5 oz. above the claim, and 13 more than 1 oz. above the claim.

It is apparent that the first bakery is much more accurate in its scaling than the second. No set of tolerances, which are justifiable, can be established to cover careless and wasteful methods of manufacture. The second bakery, with a claimed weight of 16 oz., apparently is giving the consumer much more bread than the latter has a right to expect from the weight guaranteed. The variations shown in this bakery are no argument against our tolerances. While overweight is no fraud against the consumer, the law requires a relatively accurate statement of net weight on the wrapper, and wide variations from this weight, even though in the consumer's favor, are not in harmony with the spirit of the net weight law. As before suggested, a tolerance of 0.50 oz. below and 1 oz. above the claimed weight seems to be ample for any baker who is willing to take ordinary precautions in scaling his loaves.

BREAKFAST FOODS.

Thirty samples were analyzed, the results of the analyses having been already published in Bulletin 197 of this Station. Below will be found a list of the brands, together with their claimed and actual net weight per package, and their cost.

Brand.	Cost per package, cts.	Net weight. Claimed. oz.	Found. oz.
Albers Wheat Flakes Mush	15	24	24.1
Bestovotes	15	..	19.7
Bran-eat Biscuits, Toasted	15	10	11.4
Bufceco Rolled Oats	10	20	21.1
Capitol Health Bran	15	28	24.1
Cerag	15	10	11.2
Cinnamon Rusks (Peterson)	18	14	12.9
Fruit Nut Cereal	15	11	11.7
Hecker's Cream Hominy	18	24	23.8
Hecker's Cream Oatmeal	10	20	19.9
Jersey Corn Flakes	10	9	10.8
Keen and Robinson's Granulated Scotch Oatmeal	40	32	32.6

Brand.	Cost per package, cts.	Net weight. Claimed. oz.	Found. oz.
Kellogg's Krumbles	10	..	11.5
Malabar Manoca (Bennett, Simpson and Co.).	20	16	16.3
McCann's Irish Oat Meal	35	32	32.9
Mother's Wheat Hearts	15	29	29.7
Pillsbury's Vitos	15	28	30.3
Post Tavern Porridge	18	28	31.9
Purina Sterilized Bran Zos	15	20	21.2
Purity Brand Rolled Oats	10	20	20.7
Quaker Brand Corn Puffs	9	6	7.3
Quaker (FS) Farina	10	14.5	14.9
Quaker Puffed Wheat	15	4	4.3
Ralston Wheat Food	22	24	24.6
Robinson's Patent Groats (in Powder)	50	16	16.3
Scott's Porage Oats	25	32	33.3
Sea Moss Farine	30	4	4.6
Sunbeam Pure Food Pearl Hominy	43	74	73.5
Washington Corn Crisps	10	10	13.7
Zim	15	9	9.2

The only two brands showing any material shortage in weight were *Capitol Health Bran* and *Peterson's Cinnamon Rusks*, which failed to satisfy their claims by 3.9 and 1.1 oz.; respectively.

BROSIA MEALS.

Brosia Meals are made by steam-cooking beans, pease or lentils, freeing them from the hulls and then grinding into meals. They are offered as substitutes for meat and from the standpoint of protein content compare favorably with that food.

Four brands of this product, sold by the Calumet Tea and Coffee Co., Chicago, were analyzed:

9464. *Lentil Brosia Meal*, Cost 25 cts. per lb.
9465. *Pease Brosia Meal*, Scotch, Cost 18 cts. per lb.
9466. *Pease Brosia Meal*, Cost 15 cts. per lb.
9467. *White Bean Brosia Meal*, Cost 18 cts. per lb.

	9464	9465	9466	9467
Water	7.86	8.16	7.16	8.91
Protein (N x 6.25)	29.75	27.00	29.13	24.56
Fat	1.32	1.84	2.63	1.78
Fiber	2.44	1.74	7.63	1.45
Ash	2.80	2.88	3.01	3.61
Nitrogen-free extract	55.83	58.38	50.44	59.69
Starch	41.23	41.85	20.08	35.66
Calories per 100 gms	354	358	342	353

The manufacturer tells us that "Diabetic patients will find lentil or pease or bean meal bread a happy change from gluten bread. Brosia breads contain but a small amount of the starch forbidden to such sufferers." It is true that these four meals contain much less starch than wheat flour and even many so-called gluten flours, but a satisfactory bread cannot be made from them alone, the manufacturer's formula suggesting a substitution of only one-fourth the usual quantity of flour. Breads made by such a formula would still be high in starch, much too high for any diabetic who did not have a very high starch tolerance.

BUTTER.

Of the 14 samples sent by the Dairy Commissioner, 11 were genuine, 2 were oleomargarine and 1 was renovated butter.

CHOCOLATE AND COCOA.

Five samples of these products were analyzed and will be reported in a forth coming Bulletin of this Station. The names of these brands are given below, together with their claimed and actual net weight, and their cost.

	Cost per package, cts.	Net Weight. Claimed.	Found.
Alkethrepta	25	8	8.5
Ghiradelli's Sweet Ground Chocolate and Cocoa	25	8	8.2
Hub Milk Chocolate Sweetened	48	16	16.2
Cocoatina, Anti-Dyspeptic Cocoa	45	8	8.1
Michaelis' Acorn-Cocoa	50	..	7.9

A sample of cocoa sent by the Dairy Commissioner contained no adulteration.

CONDENSED COFFEE.

The analysis of a sample of *Borden's Condensed Coffee Eagle Brand* will be reported shortly in a Bulletin. The net weight of the sample was 15.5 oz., and the cost 35 cents.

COFFEE SUBSTITUTES.

Six brands were tested as follows:

7977. *Drinket*, Kellogg Toasted Corn Flake Co., Battle Creek, Mich. Cost 22 cents for 4 oz.

8112. *Old Grist Mill*, a Substitute for Coffee, Potter and Wrightington, Boston, Mass. "A compound of whole wheat, vegetables, and a small amount of coffee for flavor." Cost 18 cents per 16.6 oz.

9576. *Jaffee*, Beech-Nut Packing Co., Canajoharie, N. Y.; "Made wholly of fruits and grains. Contains no coffee, caffeine or other stimulant." Cost 25 cents per 20.5 oz.

9574. *Postum Cereal*, Postum Cereal Co., Battle Creek, Mich. Cost 25 cents per 16.6 oz.

9463. *Calumet Cereal*, Calumet Tea and Coffee Co., Chicago, Ill.

9462. *Barley Coffee, Whole*, Calumet Tea and Coffee Co., Chicago, Ill.

	7977	**8112**	**9576**	**9574**	**9463**	**9462**
Water	8.04	9.64	9.91	9.11	9.11	6.20
Protein (N x 6.25)	5.69	15.13	11.00	12.38	13.06	10.81
Fat	0.03	3.87	1.66	3.30	4.44	2.73
Fiber	0.04	9.21	9.80	8.64	6.64	5.15
Ash	4.35	3.24	3.91	6.86	3.69	2.99
Nitrogen-free extract	81.85	58.91	63.72	59.71	63.06	72.12
Starch	*	30.38	16.40	19.20	37.97	42.80
Caffein	none	0.17	none	none	0.08	none

* Not determined.

These brands were free from coffee, except Nos. **8112** and **9463,** which contained 0.17 and 0.08 per cent. of caffeine respectively. These amounts, however, are practically negligible, being only one-seventh and one-fifteenth the quantities found in normal coffee.

CREAM.

A sample sent by the Dairy Commissioner contained 36 per cent. of butter fat.

Seven samples of cream were also studied as a basis for identifying homogenized creams, five being straight creams and the other two homogenized. Microscopic examination alone failed to differentiate these with accuracy. The variation in size of the fat globules in our experience did not appear to be as marked as the work of other investigators would indicate.

By allowing 10 cc of the cream, diluted to 100 cc with water, to stand 12 hours in a cylinder, the homogenized samples were

differentiated from the others very strikingly in this series of tests. How reliable the method is, however, can be judged only by further trials.

DIABETIC FOODS.

The following brands were analyzed:

9710. *Ayos, the Improved Soya Bean Flour*, Waukesha Health Products Co., Waukesha, Wis.

9483. *Lister's Diabetic Flour*, self Rising and Strictly Non-Carbohydrate, Lister Bros., New York.

9481. *Longuets de Lausanne*, Manuel Freres.

8768. *Genteel Flour* (manufacturer unknown).

9482. *Cocoa Factory Residue.*

9761. *Spinach Bread.*

	9710	9483	9481	8768	9482	9761
Water	8.75	11.62	10.78	11.41	8.46	.....
Ash	4.13	2.77	3.04	0.92	7.26	.....
Protein (N x 6.25)	41.44	67.38	14.19	17.13	14.44	.....
Fat	16.87	0.86	5.53	1.96	13.66	.....
Fiber	3.82	0.17	0.44	0.25	12.26	.....
Nitrogen-free extract	24.99	17.20	66.02	68.33	43.92	.....
Starch	0.56	none	49.16	60.52	3.57	44.41

Longuets de Lausanne contain altogether too much starch for a satisfactory diabetic food. *Genteel Flour* is a very inferior gluten flour. The other samples require no special comment.

Two other samples sent by a diabetic were also tested for starch. The first sample was rice that had been boiled three times, the supernatant water being discarded each time; the second was oatmeal porridge which had been washed well, squeezed twice and then boiled. The rice as received contained 83.78 per cent. water and 8.87 per cent. of starch; the oatmeal 82.83 and 3.40 per cent., respectively, indicating a starch reduction in the former of about 34 per cent., and in the latter of about 70 per cent.

FLAVORING EXTRACTS.

Nine samples were examined. These were all of the *Ariston Brand*, made by the Calumet Tea and Coffee Co., Chicago, Ill. The analyses indicate that the extracts are of excellent quality.

Flavor.	Spec. gr. @ 15.6° C.	Alcohol by vol.	Oil by vol.	Color.
Almond	0.8253	92.52	1.16	Normal
Celery	0.8226	92.35	0.73	Normal
Clove	0.8286	89.56	2.95	Normal
Lemon	0.8444	83.17	5.40	Normal
Orange	0.8424	87.45	4.96	Normal
Peppermint	0.8232	91.05	3.20	Normal
Wintergreen	0.8339	88.87	2.94	Normal

The sample of *ginger extract* had a spec. grav. of 0.8238, and contained 89.50 per cent. of alcohol by volume, 0.99 per cent. of solids, 0.93 per cent. of solids soluble in 95 per cent. alcohol, and 0.09 per cent. of solids soluble in cold water.

The sample of *vanilla extract* had a spec. grav. of 0.9750 and contained 39.75 per cent. of alcohol by volume, and 0.20 per cent. of vanillin; the lead number was 0.57, the color was normal and no coumarin was present.

PREPARED FLOURS.

Six samples of this class of food were examined, as follows:

9588. *D. and C. Self-Rising Flour*, The D. and C. Co., New York. "Soft winter wheat flour, grape cream of tartar, phosphate, soda and salt."

9577. *Grandma's Pancake Flour Mixture*, Hecker Cereal Co., New York. "Rice, wheat, corn and leavening materials."

9573. *Presto Self-Raising Flour*, The H-O Co., Buffalo, N. Y. "Leavening and seasoning agents are cream of tartar, bicarbonate of soda, phosphate and salt."

9589. *Reliable Self-Raising Prepared Flour*, Reliable Flour Co., Boston, Mass. "Wheat flour, grape cream of tartar, bicarbonate of soda and salt."

9572. *Swans Down Prepared Cake Flour*, Igleheart Bros., Evansville, Ind. "Not Self Rising."

9578. *Teco, Self-Rising Pancake Flour*, The Ekenberg Co., Cortland, N. Y. "A mixture of wheat and corn flour with malted buttermilk, salt, soda and acid phosphate."

	9588	9577	9573	9589	9572	9578
Water	12.60	11.56	12.50	12.02	12.66	11.37
Protein (N x 6.25)	9.06	8.50	8.13	9.00	8.50	10.38
Fat	0.91	0.91	0.90	0.68	0.82	1.73
Fiber	0.17	0.27	0.13	0.13	0.13	0.50

	9588	9577	9573	9589	9572	9578
Ash	3.77	4.56	3.56	3.53	0.49	7.21
Nitrogen-free extract	73.49	74.20	74.78	74.64	77.40	68.81
Sodium oxide	1.63	1.54	1.29	1.05	0.13	2.50
Potassium oxid	0.21	0.21	0.36	1.00	0.16	0.42
Phosphoric anhydrid	1.32	1.50	0.88	0.13	0.19	2.29
Sulphuric anhydrid	0.03	0.04	0.10	0.08	0.01	0.11
Chlorin	0.76	0.93	0.82	0.45	trace	0.68
Calcium oxid	trace	0.44	0.30	trace	trace	0.75
Tartrates	(?) none	present	(?) none	present	present	none
Weight claimed, oz.	18	18	20	24	36	16
Weight found, oz.	18.2	18.0	19.2	23.8	43.5	16.0
Cost per package, cts.	14	16	15	20	45	15
Cost per lb., cts.	12.3	14.2	12.5	13.5	16.6	15.0

The claims made for these flours seem to be substantiated by our analyses, except that we were unable to detect cream of tartar in Nos. **9588** and **9573.**

FRUIT JUICES.

Five brands of fruit juices were examined as follows:

9587. *Dole's Pure Hawaiian Pineapple Juice,* Hawaiian Pineapple Products Co., Honolulu, Haw. Cost 10 cents per 4.8 fl. oz.

9581. *Du Belle Grape Juice,* Du Belle Grape Juice Co., Rochester, N. Y. "About 2% granulated sugar." Cost 20 cents per 16 fl. oz.

9580. *Hay's Five Fruit,* H. H. Hay Sons, Portland Me. "Strawberries, raspberries, pineapples, oranges, lemons." "1/10 of 1 per cent. sodium benzoate, artificially colored." Cost 40 cents per 16.3 fl. oz.

5582. *Phez,* Pheasant Brand Loganberry Juice, with Sugar, Pheasant Fruit Juice Co., Salem, Ore.

9582. *Tim Pine,* J. Tim Co., New York. "Pineapple juice with sugar added." Cost 25 cents per 15.8 fl. oz.

	9587	9581	9580	5582	9582
Alcohol by volume	0.36	0.26	0.15	0.08	0.12
Solids	13.27	17.87	62.80	34.13	13.54
Ash	0.37	0.38	0.22	.....	0.52
Sucrose	0.16	0.08	1.62	13.48	3.32
Invert sugar	12.95	15.68	59.76	17.87	9.65
Saccharin	none	none	none	none	none

* Sodium benzoate 0.08%.

None of the samples contained saccharine or salicylic acid. **9580** contained amaranth color and 0.08 per cent. of sodium benzoate.

HAMBURG STEAK.

Thirty-four samples sent by the Dairy Commissioner were examined for preservatives. None contained boric acid, and five no sulphurous acid. Fifteen samples contained less than 25 mgms. of sulphurous acid per kilogram, while 13 contained this acid in considerable amount as follows:

No.	Sulphurous Acid mgms. per kilo.	No.	Sulphurous Acid mgms. per kilo.
11637	876.8	11704	368.0
11640	736.0	11706	1740.8
11641	806.4	11707	1875.2
11646	492.8	11710	3513.6
11647	124.8	11712	531.2
11649	2422.4	11721	1628.8
11701	761.6		

These amounts of sulphurous acid are very excessive, and indicate a widespread use of this preservative in comminuted meats that is not without danger to the public health.

No. **11713** had a decided putrid odor when received by us, and was totally unfit for human food.

CORDIALS.

Twenty-seven samples of cordials, brandies and liqueurs have been examined and the results are given in Table XV.

Products of this type have been examined in this laboratory on previous occasions, notably in 1901 and 1914, and their substance and quality need no extended discussion at this time. The solid matter in them consists almost wholly of cane sugar or its derivative, invert sugar, or mixtures of the two sugars. Five samples by their considerable plus polarization at 87° are shown to contain glucose or starch sugar. The coal-tar colors used are of the permitted group except in one case, No. 8155, which contained the unpermitted color magenta. The use of permitted colors does not, however, relieve the manufacturer of the obligation to state the fact of their presence when used. Delinquency in this respect is shown in a number of instances; but in some of these the goods

TABLE XV—ANALYSES OF CORDIALS, BRANDIES AND LIQUEURS.

Station No.	Brand	Price per bottle, cents	Volume of contents, fl. ozs.	Specific Gravity @ 15.6 °C.	Alcohol by Volume %	Total Solids %	Sucrose %	Reducing Sugar as Invert %	Polarization Direct °V	Polarization Invert °V	Temp. °C.	Color
8114	Creme de Menthe Glaciale. P. Garnier, Enghien, France	70	8.3	1.1410	29.30	41.21	40.89	.....	+41.7	—12.5	20	None
8130	American Creme de Menthe. M. R. Stern, New York	25	6.6	1.1121	18.76	31.85	31.60	.....	+31.8	—10.1	20	N.Y.S&L.G.SFY.[1]
8147	Creme de Menthe, in bulk. Johnson Co.,[2] New Haven	25	7.3	1.1110	23.86	33.41	19.00	13.48	+15.2	—10.0	20	" " " [6]
8149	Creme de Menthe, Liqueur Superfine. Edouard Riviere	10	1.9	1.1056	11.90	28.69	23.34	4.76	+23.7	—7.3	20	" " "
8151	Creme de Menthe Cordial Superior Quality	20	2.3	1.0728	20.15	29.94	Present	.....	+43.4	+13.6[8]	19	" " "
8158	Creme de Menthe, in bulk	30	7.2	1.0718	26.36	25.73	22.70	2.76	+22.3	—7.8	20	" " "
8159	Creme de Menthe. Charles Jacquien et Cie	25	7.9	1.1679	15.66	41.22	40.52	.....	+41.0	—12.8	20	" " " [6]
8145	Old Abbey Cordialized Apricot Brandy. California Fruit Prod. Co., New York	25	7.6	1.1029	28.88	32.05	14.33	17.60	+8.6	—10.3	21	Natural
8157	Apricot Cordial. Johnson Co.,[2] New Haven	25	7.3	1.0940	17.88	27.78	.....	26.98	—7.0	—7.0	21	"
8156	Wild Cherry Cordial. Johnson Co.,[2] New Haven	25	7.5	1.1088	13.60	29.44	7.36	20.00	+1.6	—8.1	21	"
8133	Gilbert's Grenadine Cordial. John Gilbert & Sons, New Haven	35	6.9	1.3082	4.76	64.16	.....	61.92	—19.8	—19.8	21	Archil
8146	Anisette Cordial Superior Quality. Hartford Distillery Co., Hartford	25	13.2	1.0385	24.32	16.65	15.33	.....	+15.2	—5.1	21	None
8131	Crême de Cèrisès. E. Cusenier, Paris	20	1.7	1.1555	25.50[4]	43.48	31.63	10.50	+28.6	—13.2	21	Natural
8132	Veritable Cherry Liqueur. E. Cusenier, Paris	20	1.5	1.0617	25.60	21.12	.....	18.00	—5.8	—6.1	21	"
8139	Meggy-Lelke Weichsel-Cherry Liquor. Schrank Béla es Ödön, Esztergom, Hungary	52	3.2	1.0994	28.60	32.64	.....	30.72	—8.6	—8.6	21	"
8134	Curacoa Sec. E. Cusenier, Paris	20	1.1	1.0971	38.70[5]	36.96	35.79	.....	+37.1	—10.2	21	Unidentified[6]
8135	Creme de Roses. E. Cusenier, Paris	20	1.6	1.1257	32.25[7]	40.65	39.30	.....	+39.4	—12.5	21	Cudbear[6]
8150	Creme de Rose, Superior Quality. French & Italian Imp. Co., New Haven	10	2.5	1.0680	26.20	24.20	Present	.....	+30.0	+7.7[8]	21	Amaranth
8153	Creme de Rose. New England Cordial and Importing Co.	20	2.4	1.0704	25.00	24.41	Present	.....	+31.8	+9.0[9]	21	Amaranth[6]
8136	Grande Liqueur Saint-Martial. P. Bardinet, Bordeaux	20	1.9	1.0935	41.00	37.07	27.39	7.56	+33.0	—3.2	21	None
8137	Kummel. John Gilbert & Son, New Haven	20	1.6	1.0823	41.20	35.36	31.47	3.25	+34.0	—7.6	21	None
8140	Bazilika Ukör, Schrank Béla es Ödön, Esztergom, Hungary	50	2.9	1.1068	35.40	36.72	0.74	35.72	—9.2	—10.8	21	Natural
8154	Creme de Coffee Cordial. New England Cordial & Importing Co.	20	2.3	1.0832	22.95	26.34	Present	.....	+34.8	+12.0[10]	21	Natural
8155	Creme de Violet. New England Cordial & Importing Co.	20	2.5	1.0694	23.95	24.71	Present	.....	+32.6	+9.6[11]	21	Magenta[6]
8138	Forbidden Fruit Liqueur. Louis Bustanoby, New York	50	1.9	1.0549	37.20	27.19	12.26	13.44	+8.2	—8.0	21	Unidentified. Coal-tar
8152	Imperial Peach Cordial. Henry H. Shufeldt & Co., Peoria, Ill	15	2.4	1.0766	16.20	22.98	1.35	20.28	—6.6	—8.4	20	Vegetable[6]
8148	Monopol Vodka. Domestic Product. Russian Monopol Co., Brooklyn, N. Y	15	3.7	0.9463	43.20	.....	.....	.....	.....	.....	..	None

[1] Napthol Yellow S and Light Green S F Yellowish, permitted coal-tar dyes. [2] Statement: Imported. [3] Polarization @ 87° = +19.2. [4] Declared alcohol 26% [5] Declared alcohol 42%. [6] Declared artificially colored. [7] Declared alcohol 34% [8] Polarization @ 87° = +13.6. [9] Polarization @ 87° = +15.2. [10] Polarization @ 87° = +14.4. [11] Polarization @ 87° = +16.0.

were not purchased in the original containers. The alcoholic distillates in all cases were examined for the presence of methyl (wood) alcohol but none was detected. Monopol Vodka is a clear, colorless liquid possessing the odor and taste of raw distilled spirit, which the partial analysis indicates it to be.

INFANT FOODS.

Two well-known brands, not previously examined by this Station, were analyzed.

5576. *Neave's Food for Infants*, J. R. Neave and Co., Fordingbridge, Eng. Wholesale price 30 cents per 16 oz.

5577. *Savory and Moore's Food for Infants and Invalids*, Savory and Moore, London, Eng. Wholesale price 27 cents per 10 oz.

	5576	5577
Water	8.81	6.28
Ash	0.60	0.75
Protein (N x 6.25)	6.94	11.75

	5576	5577
Fat	1.19	1.45
Fiber	0.21	0.12
Nitrogen-free extract	82.25	79.65
Starch	70.42	69.19

Neave's Food is essentially a baked flour, while the *Savory and Moore Food* is composed of wheat flour and malt. Both brands contain very large percentages of starch. Owing to the diastatic ferment present most of the starch in *Savory and Moore's Food*, if prepared according to directions, would be converted into soluble forms, chiefly dextrins. In *Neave's Food* such would not be the case as no ferment is present.

JELLY AND JUNKET POWDERS.

The descriptions of three new brands and their analyses follow:

9570. *Falconjel, Raspberry.* Falcon Packing Co., New York. "Composed of geletine, sugar, citric acid, artificial flavor and vagetable color." Cost 13 cts. per 6.3 oz.

9568. *Jiffy-Jell, Orange.* Waukesha Pure Food Co., Waukesha, Wis. "A mixture, vegetable color." Cost 13 cts. per 3.3 oz.

9569. *Nesnah, Lemon Flavor.* The Junket Folks, Little Falls, N. Y. "Contains U. S. certified color." Cost 10 cts. per 4.0 oz.

	9570	9568	9569
Water	2.43	3.28	0.15
Ash	0.15	0.21	0.35
Gelatin (N x 5.55)	7.66	8.05	none
Cane sugar	88.35	88.11	98.82
Undetermined	1.41	0.35	0.68
Color	*	**	***

* Lichen color, probably cudbear. ** Cochineal. *** Napthol Yellow S and Orange I.

These three samples substantially satisfy their claims, although of course it is incorrect to class cochineal as a "vegetable" color. *Nesnah* contained rennin or a rennet-like substance.

Granting the convenience of such preparations, purchasing sugar in the form of a jelly powder is rather an expensive practice.

MILK.

Three hundred and ninety samples sent by the Dairy Commissioner were analyzed. Of these 132 conformed to the legal

TABLE XVI.—WATERED MILKS.

No.	Dealer.	Solids.	Fat.	No.	Dealer.	Solids.	Fat.
	Bloomfield:				Orange:		
12302	F. Chiaramonti..	11.08	3.6	12144	E. J. Cronin.....	10.25	3.1
12199	J. Viicciaido.....	8.09	2.6	11730	S. G. Grillo.....	3.72	1.3
12300	" "	8.99	3.0	12143	Wasily Paray....	8.18	2.4
12301	" "	9.12	3.0		Shelton:		
	East Lyme:			11939	P. Imbimbo.....	11.28	4.3
11679	Koss Bros.....	11.21	3.6		Southbury:		
	Guilford:			11981	J. N. Benson....	11.62	4.1
12133	Frank Haggerty..	11.66	3.7	11975	H. B. Davis.....	6.20	2.1
12136	R. E. Scranton...	11.26	3.9	11976	" "	9.07	2.4
12138	" " ...	11.23	3.6	11978	E. Mellane.....	12.05	4.3
12139	Willard Scranton.	10.57	3.0	11979	Mrs. Nora Rogers	8.76	2.3
12140	" "	11.08	3.9	11980	" " "	11.90	4.0
	Jewett City:				So. Norwalk:		
11854	W. B. Frink, Est.	11.40	3.5	11772	J. H. Crosby....	10.87	3.2
11855	" " "	11.73	3.7	12132	J. H. Wempe.....	11.12	3.4
	Killingly:				Stonington:		
12111	Walter Chase....	11.02	3.6	12152	J. B. Crowley....	11.24	3.3
11650	(Unknown).....	8.15	2.5		Watertown:		
	Meriden:			12018	A. Brazee.....	11.30	3.5
12089	W. A. Reed.....	10.28	3.0		Westport		
12090	" "	10.59	3.1	11973	Robt. Dykman...	11.65	3.9
	Noroton:			11974	" "	11.65	3.8
12029	James H. Mead..	11.60	4.6		Willimantic:		
12030	" " "	10.20	4.0	12173	G. W. Andrews..	11.01	3.1
	No. Franklin:			11669	Reinstein Bros...	9.41	2.9
12268	J. Ries.....	12.07	4.2		Woodbury:		
	Norwich:			11946	T. Madin.....	11.43	3.6
11653	J. J. Harrington..	10.23	3.4	12000	B. F. Ricker....	10.52	3.2
11654	" "	9.95	3.0				
11655	" "	10.29	3.2				
11656	" "	10.19	3.2				
11399	(Unknown).....	10.11	2.8				

standards, 216 were below the standard in one or more respects, 44 were watered, 6 were skimmed and 2 were both skimmed and watered. Of the sub-standard samples, in which no watering or skimming was detected, 9 were deficient in fat, 3 in solids and fat, 118 in solids-not-fat, 42 in solids and solids-not-fat, and 44 in solids, fat and solids-not-fat. The large proportion of adulterated and sub-standard samples is no indication of the quality of the milk generally sold in this state, as all of these samples were taken because of some suspicion as to their purity. That there is an abundance of milk of good quality sold in the state is shown by the composition of the 132 samples which conformed to the standards. These contained from 11.75 to 14.49 per cent. of

solids and from 3.3 to 6.0 per cent. of fat, with averages of 12.61 and 4.03 per cent., respectively. In 57 per cent. of these samples the fat ranged from 3.3 to 4.0, in 30 per cent. from 4.0 to 4.5, in 7 per cent. from 4.5 to 5.9, and in 6 per cent. was over 5.0 per cent.

Table XVI shows the composition of the watered milks and the names of the dealers selling them.

The following tabulations give similar data for the skimmed and the skimmed and watered milks:

SKIMMED MILKS.

No.	Dealer.	Solids.	Fat.
12161	Mansfield Center: H. E. Avery	11.98	3.2
11691	S. J. Nacsin	10.95	2.6
12169	No. Franklin: J. Ries	11.17	2.8
11457	Southington: W. S. Crosby	10.97	2.6
12130	Sterling: Richard Fortune	11.74	2.8
11391	Willimantic: (unknown)	12.50	3.1

SKIMMED AND WATERED MILKS.

12027	Noroton: T. M. Collins	8.12	2.2
11875	Somers: E. H. Pease	9.60	2.1

SAUSAGE.

Twenty-one samples of pork sausage, sent by the Dairy Commissioner, were tested for added starch. In sixteen of these the starch ranged from 0.16 to 0.39 per cent. In the remaining five samples the percentages were much higher, indicating that starch had been added to the sausage meat. The adulterated samples were as follows:

No.	Dealer.	Starch. %
11724	Thos. Rutendo, Hartford	4.63
11731	Meriden Market, Meriden	2.75
11735	Fulton Market, Waterbury	2.55
11738	Palace Market, Waterbury	1.64
11739	Public Market, Waterbury	2.43

SPICES.

In 1916 we inspected spices sold in package form; this year the inspection has been concerned chiefly with bulk goods. Fifty-two samples, sent by the Dairy Commissioner, have been examined.

Applying the standards rigidly 1 sample of black pepper, 10 of cayenne, 4 of cloves, 2 of ginger and 1 of white pepper departed

TABLE XVII.—SPICES.

No.	Dealer.	Ash. Total.	Ash. Insol. in acid.	Starch.	Crude fiber.	Non-volatile ether extract.
	Black Pepper.					
11784	James Van Dyk Co., New York (New Haven store)	6.43	1.40	36.03	11.47	7.72
11802	Ross W. Weir & Co., New York (W. B. Eastman, New Milford)	6.17	1.11	33.96	12.69	8.19
11783	In bulk (F. H. Davis, New London)	6.35	1.35	36.62	12.26	7.90
11788	" " (Flemming & Cowan, Hartford	**7.12**	1.15	28.41	15.00	8.31
11795	" " (M. Epstein, So. Norwalk)	6.76	1.30	36.84	11.76	7.51
11798	" " (W. F. Brennan, Torrington)	5.31	0.71	39.60	11.06	7.29
11806	" " (Geo. B. Clark, Salisbury)	5.07	0.57	37.57	12.16	7.13
11829	" " (Direct Importing Co., New Haven)	5.73	0.65	41.65	9.93	6.80
11840	" " (Pure Food Market, New Haven)	6.72	1.26	32.76	13.95	8.70
11900	" " (Yale Tea & Coffee Co., Waterbury)	4.56	0.25	34.11	13.52	6.51
	Cayenne Pepper.					
11793	East India Tea Co. (So. Norwalk store)	5.57	0.20	0.62	22.12	17.83
11800	McCormick & Co., Baltimore (Jos. Gaven, Torrington)	**7.50**	**1.52**	1.43	24.08	**10.02**
11782	In bulk (W. F. Barrows, New London)	6.17	**0.57**	1.27	25.94	16.34
11790	" " (Newton, Robertson & Co., Hartford)	**6.61**	**0.65**	0.73	24.40	17.00
11797	" " (A. Davey & Co., So. Norwalk)	6.30	**0.52**	1.07	24.39	16.41
11803	" " (Geo. B. Clark, Salisbury)	**7.43**	**1.11**	0.53	25.15	10.22
11824	" " (Direct Importing Co., Mystic)	6.44	0.50	0.51	19.34	15.00
11830	" " (" " " Bridgeport)	6.37	0.48	0.96	20.65	**13.51**
11833	" " (Village Store Co., Bridgeport)	**7.81**	**0.62**	0.67	24.43	**14.87**
11835	" " (Union Pacific Tea Co., Bridgeport)	**6.97**	**1.20**	1.07	25.65	15.68
11836	" " (Mohican Co., New Haven)	6.06	0.15	0.70	21.39	19.21
11837	" " (Shartenberg & Robinson Co., New Haven)	5.35	0.15	1.17	18.82	**12.36**
11838	" " (Direct Importing Co., New Haven	6.32	0.10	1.07	14.85	**11.11**
11841	" " (Pure Food Market, New Haven)	6.42	0.40	0.87	21.91	16.61
11842	" " (F. J. Markle, New Haven)	5.60	0.38	0.81	24.76	16.82
11844	" " (Grand Union Tea Co., New Haven)	5.81	0.50	0.81	25.11	16.73
11847	" " (Yale Tea & Coffee Co., Waterbury)	**8.56**	**0.72**	1.46	27.73	**3.94**
	Cloves.					
11786	In bulk (S. Satriano, Hartford)	6.26	0.25	..	8.33	17.80
11792	" " (James Butler, Stamford)	6.55	0.32	...	9.42	14.21
11799	" " (W. F. Brennan, Torrington)	6.79	0.60	...	**13.88**	**6.40**
11826	" " (Direct Importing Co., Mystic)	6.25	0.48	...	9.08	17.34
11827	" " (Gager Crawford Co., New London)	5.96	0.27	...	**10.73**	14.81
11839	" " (John Gilbert & Son, New Haven)	7.62	**0.57**	...	8.17	19.86
11845	" " (Carlson Tea Co., New Haven)	6.42	0.39	...	9.79	15.12
11848	" " (Yale Tea & Coffee Co., Waterbury)	6.82	**0.71**	...	9.55	16.90
	Ginger.					
11787	In bulk (S. Satriano, Hartford)	5.12	0.93	49.56	...	...
11794	" " (M. Epstein So. Norwalk)	4.90	0.57	48.66	...	...
11801	" " (H. M. Hoag, Sharon)	5.11	0.70	51.36	...	...
11805	" " (Geo. B. Clark, Salisbury)	**6.51**	0.52	49.90	...	...

Figures in boldface indicate a departure from the standard.

TABLE XVII.—SPICES—*Continued.*

No.	Dealer.	Ash. Total.	Ash. Insol. in acid.	Starch.	Crude fiber.	Non-volatile ether extract.
	Ginger.					
11807	In bulk (F. S. Roberts, New Hartford)	5.17	0.90	49.05	...	...
11828	" " (Direct Importing Co., New Haven)	**6.50**	0.62	48.26	...	...
11831	" " (" " " Bridgeport)	5.57	0.66	49.44	...	...
11843	" " (Pure Food Market, New Haven)	5.95	1.00	49.05	...	...
11846	" " (Great Atl. & Pac. Tea Co., Waterbury)	4.60	0.27	51.52	...	...
11849	" " (Yale Tea & Coffee Co., Waterbury)	4.01	0.46	52.73	...	...
	White Pepper.					
11789	Chas. G. Lincoln & Co. (Brown, Thomson & Co., Hartford)	1.21	0.15	55.46	4.27	7.52
11785	In bulk (Buckley & Reardon, Hartford)	1.22	0.13	53.72	3.93	7.10
11791	" " (James Butler, Stamford)	2.03	0.50	55.23	4.38	7.96
11796	" " (Andrew Davey & Co., So. Norwalk)	1.17	0.10	55.74	4.39	7.31
11804	" " (Geo. B. Clark, Salisbury)	1.49	0.06	58.61	4.05	7.04
11825	" " (Direct Importing Co., Mystic)	**5.16**	**0.52**	47.24	**7.57**	7.49
11834	" " (Davey Bros., Bridgeport)	1.01	0.07	55.25	3.76	6.97

Figures in boldface indicate a departure from the standard.

from the standard in some respect. Many of these variations, however, are trivial, and only the following seven can be considered as seriously adulterated:

Cayenne pepper. Nos. **11800, 11803, 11837, 11838** and **11847.**

Cloves. No. **11799.**

White pepper. No. **11825.**

The spices sold in Connecticut market, both in package form and in bulk, are on the whole of satisfactory quality. The adulterations found are due chiefly either to insufficient cleaning of the crude spices, or to careless storage conditions whereby the spice value of the product is impaired.

TEMPERANCE BEVERAGES.

The quite general enactment of laws prohibiting the sale and even the use of intoxicating drinks, makes the analysis of beer substitutes a matter of some importance. Four such brands have been examined this year as follows:

8163. *Anzac Cereal Beverage*, Anzac Co., Boston, Mass. Cost 10 cts. per 12 fl. oz.

TABLE XVIII.—VINEGAR.

No.	Brand.	Acidity.	Solids.
	Cider Vinegar.		
11909	A. & P.	4.44	1.91
11926	American Grocers Society. (A. G. S.)	4.01	1.99
11922	Apple Product Co.	4.01	2.32
11923	Berkshire Products Co.	4.00	1.82
12050	" " "	3.86	1.78
12032	A. C. Blenner & Co.	4.04	1.93
11914	W. W. Cary & Son.	4.32	2.08
11919	" " "	4.20	2.09
12038	Cascade Cider Co (C. C. C.)	4.66	2.31
11910	John T. Doyle Co.(Country Club)	4.24	1.90
11935	Lewis DeGroff & Son (Health)	5.12	2.29
11920	Duffy Malt Co. (Duffy's Gold Seal)	4.04	1.98
12036	Eagle Oil & Supply Co. (Sumner)	4.00	1.74
11912	Empire Bottling Works (Empire)	4.01	1.76
11924	Empress Mfg. Co. (Howard)	4.00	1.94
11925	Glautz & Sulkind (G. & S.)	4.57	2.03
12037	Humphrey & Cornell	4.06	1.90
11933	Francis H. Leggett & Co. (Premier)	5.12	2.72
12043	D. E. Mowry Co.	4.60	1.92
12042	Pen Yan Cider Co. (Parson's)	4.80	2.60
11918	Rocco	4.32	1.91
12011	Scutonia	2.04	2.97
11917	Silver Boy Packing Co.	4.28	2.21
12061	Silver Lane Pickling Co.	4.60	2.30
11934	Standard Pickle Co.	4.16	1.83
12063	J. A. Thompson & Son (XXX)	3.84	1.93
12044	R. C. Williams & Co. (Robin Hood)	5.46	2.20
12010	E. H. Woodworth.	3.98	1.60
11944	" "	4.00	1.64
11915	Sold by W. R. Bailey, New Haven	4.72	3.26
12031	" " B. Halpert, New Haven	4.00	2.00
12034	" " Kobler Bros., New Haven	4.24	2.48
12035	" " E. Casher & Son, New Haven	3.98	1.81
12039	" " E. J. Bates, New London	4.24	1.70
12041	" " A. Wachanasky, New London	5.18	2.04
12062	" " A. Fronz, Meriden	4.04	1.88
12060	" " G. Galamandra, Meriden	3.72	1.98
12064	" " J. A. Collins, Meriden	3.28	3.27
	Distilled Vinegar.		
12040	Sold by A. Gordon, New London	4.04	0.25
	Distilled and Molasses Vinegar.		
11913	John T. Doyle Co.	3.96	0.36

8161. *Bevo*, Non-Intoxicating, Anheuser-Busch Brewing Association, St. Louis, Mo. Cost 12 cts. per 10 fl. oz.

9162. *Iron Brew*, Non-Alcoholic, The Mass and Waldstein Extract Co., Newark, N. J. "Colored with burnt sugar." Cost 5 cts. per 7.3 fl oz.

9590. *Wesco*, Temperance Beverage Co., Pelham, N. Y. "Alcohol less than ½ per cent." Cost 15 cts. per 11.5 fl. oz.

	8163	8161	8162	9590
Alcohol by volume	0.42	0.38	0.38	0.44
Solids	5.92	6.20	8.37	4.91
Ash	0.21	0.11	0.10	0.18
Direct reducing sugars	2.27	2.42	6.90	1.55
Total reducing sugars	5.41	5.79	7.72	4.15

No saccharin, benzoic or salicylic acids were found in any of the above.

VINEGAR.

Forty samples sent by the Dairy Commissioner were examined. The state standard for vinegar sets limits only for acidity and solids, 4.00 and 1.60 per cent., respectively, and only these determinations were made in this examination. Thirty-five samples satisfied the standard, and five were deficient in acidity, the percentages found ranging from 2.04 to 3.84.

MISCELLANEOUS FOODS.

EGGS. Six samples of eggs, sent by the Dairy Commissioner, and purchased for "fresh eggs," were found to be misbranded.

SUGAR. Of four samples of granulated sugar, sent by the Dairy Commissioner, three were pure, but the fourth contained about 3.5 per cent. of corn starch. A sample of brown sugar from the same source contained 86.87 per cent. of saucrose, and was not adulterated.

OVALTINE. *Ovaltine, Tonic Food Beverage.*. A. Wander, London, Eng. "A concentrated extraction from malt, milk and eggs, flavored with cocoa." "Is rich in lecithin, the assimilable organic compound of phosphorus. It is thus a valuable article of food in cases of mental and nervous exhaustion."

Water	1.03
Ash	3.52
Protein (N x 6.25)	12.75
Fat	5.58
Fiber	0.64
Nitrogen-free extract	76.48
Lecithin phosphoric acid	0.10
Reducing sugars (chiefly maltose, lactose, dextrose and dextrins)	70.01

Active amylase	present
Starch	trace
Calories per 100 gms	407

The product appears to be composed of the foods claimed. The small amount of lecithin phosphoric acid present, 0.10 per cent, hardly seems to justify the claim that the food is "rich in lecithin," or that it is "a valuable article of food in cases of mental and nervous exhaustion."

TAPIOCA. *Sunbeam Pure Food Small Pearl Tapioca, German Sago Style.* Austin, Nichols and Co., New York. Cost 12 cts. per 14 oz.

Water	13.51
Ash	0.16
Protein (N x 6.25)	0.56
Fat	0.05
Fiber	0.05
Starch	85.67
Calories per 100 gms	345

COTTEN SEED BREAD. This is a "war" bread, made according to the following recipe for one loaf:

⅔ cupful cotton seed meal
2⅓ cupfuls bread flour
1 teaspoonful salt
1 tablespoonful sugar
½ cake yeast
1 cupful lukewarm liquid (water, milk, or equal parts of each).

Its composition follows and that of baker's bread for comparison.

We are indebted for the above recipe and sample to the Bureau of Chemistry, U. S. Department of Agriculture.

WHEAT-A-LAXA BREAD. Made by the S. S. Thompson Co., New Haven. "Natural Grain, Laxative, Whole Wheat."

BISCUITS. Three samples were analyzed as follows:

8122. *Homo Whole Wheat Biscuit*, National Biscuit Co., New York, Cost 10 cts. for 66 biscuits weighing 5.9 oz.

8129. *Whole Wheat Crackers*, Loose-Wiles Biscuit Co., Boston, Mass. Cost 15 cts. for 7.4 oz.

8125. *India Biscuit* (formerly *India Digestive Biscuit*), New England Cereal Co., South Norwalk, Conn. Cost 25 cts. for 20 biscuits weighing 11 oz.

	Cotton Seed Bread.	Wheat Bread.	Wheat-A Laxa Bread.	8122	8129	8125
Water	38.02	36.44	33.60	9.56	10.23	8.67
Ash	2.09	1.43	2.17	3.47	3.18	5.02
Protein	13.51	7.65	8.60	9.13	9.13	12.81
Fat	1.63	1.98	3.75	8.10	4.33	2.24
Nitrogen-free extract	*44.75*	*52.50*	*51.90*	69.10	72.80	66.03
Fiber	...	...	...	0.64	0.33	5.23
Calories per 100 grams	248	258	276	386	367	336

NUT MARGARINE. *Nut Margarine, Coco-Nut Brand,* The Nucoa Butter Co., New York "Free from animal fats." "Contains 1-10 per cent of benzoate of soda." Cost 30 cts. per lb.

Water	7.65
Sodium benzoate	0.10
Reichert-Meissl No.	7.25
Refractive index @ 40° C.	1.4502

Phytosterol, cocoanut oil and possibly peanut oil were present, cholesteral and cotton seed oil were not present.

The product consists chiefly of cocoanut oil with possibly some peanut oil. No animal fat is present. This is a wholesome preparation and at present butter prices might well be substituted for that article. The presence of benzoate of soda is objectionable as well as unnecessary.

FLOUR. *Good Health Flour,* A. B. Klar, Canal Dover, O. "Contains muscle, brain, nerve, bone and tooth elements."

Water	12.01
Ash	1.68
Protein (N x 6.25)	15.13
Fat	3.30
Fiber	1.62
Nitrogen-free extract	66.26
Starch	53.83
Phosphoric acid	0.86
Calories per 100 gms.	355

Any good whole wheat flour justifies the above claim quite as well as this particular brand.

OYSTERO. *Oystero,* Oyster Broth Powder, J. S. Darling and Son, Hampton, Va. Carton containing three tubes weighing together about 0.5 oz., and each claimed to be "sufficient to make a pint of oyster broth," cost 25 cts.

Water	3.77
Ash	11.39
Protein (N x 6.25)	52.50
Fat	9.20
Nitrogen-free extract	23.14
Sodium chlorid	3.10
Boric acid	none

The above analysis agrees well with that of dried oyster meat and the preparation appears to be true to name.

GRISSIN. *Piemont Toreador Grissin, Salted, Italian Bread Sticks,* A. Angononoa, New York. Cost 13 cts. per 3.7 oz.

SPLIT PEAS. *Mission Garden Split Peas.* Cost 36 cts. per 32.0 oz.

	Grissin.	Split Peas.
Water	10.10	11.33
Ash	3.59	2.88
Protein (N x 6.25)	11.50	23.44
Fat	7.21	1.01
Fiber	0.21	1.06
Nitrogen-free extract	67.39	60.28
Chlorin	1.39	...
Calories per 100 grams	380	344

RYZON, The Perfect Baking Powder, General Chemical Co., New York. "Monosodium phosphate, sodium bicarbonate, starch." Cost 18 cts. per 8.6 oz. It contained moisture 4.08, phosphoric acid 22.96, carbonic acid 12.73, residual carbonic acid 0.45, available carbonic acid 12.28, sodium oxid 20.32, sulphuric anhydrid 0.22, starch 31.68 per cent., calcium oxid a trace. It is composed, therefore, of about 38.80 per cent. monosodium phosphate, 24.3 sodium bicarbonate, 31.7, starch, 0.4 sodium sulphate, 4.08 moisture and 0.74 undertermined.

8120. *Vegex,* A Vegetable Extract, J. W. Beardsley's Sons, New York, "Made entirely of vegetable products. Contains 35% protein." Cost 25 cts. per 2 oz.

8121. *Vegex Cubes;* same manufacturer as above. Cost 15 cts. per box of 12 cubes, each weighing 0.16 oz.

	8120	8121
Moisture	28.24	7.22
Protein (N x 6.25)	33.00	18.88
Ash	25.73	64.59
Chlorin	7.86	34.59

	8120	8121
=Sodium chlorid	12.96	57.02
Creatinin	none	none
Nitrates	none	none

8127. *Kremette Ice Cream Dressing*, G. F. Heublein and Bro., Hartford. "A Delicious and Palatable Adjunct to Vanilla Ice Cream. Artificially colored." "Alcohol 20%." Price 35 cts. per 6.1 fl. oz.

Spec. grav. @ 15.6° C	1.1609
Alcohol by volume	20.52
Solids	43.24
Sucrose	35.49
Invert sugar	6.40
Ash	0.02
Color	archil or cudbear

8115. *Feinste Schlag-Sahne* (*Sterilized Whipped Cream*), C. Mäden Stubben, Bremen, Germany. "Absolutely pure and free of all ingredients." (Evidently an erroneous translation.) Cost 14 cts. per 8 oz.

Water	62.22
Solids	37.78
Ash	0.56
Protein (N x 6.25)	2.52
Lactose	2.25
Fat	32.05
Borax, benzoate, and salicylate	none

THE DRYING OF VEGETABLES BY MEANS OF THE ELECTRIC FAN.

The drying of vegetables and fruits by artificial heat or by the sun's heat is an old practice, but recently in the effort to conserve food of a perishable nature, drying by means of an unheated current of air from an electric fan has been recommended.

While the method has certain advantages, for instance, a better preservation of flavor and color, doubts rose in our minds as to the keeping qualities of products thus prepared. Accordingly we have tested the method with a number of vegetables, with the following results. For comparison several samples were also dried with artificial heat and one by exposure to the sun.

The drying period which has been recommended generally is far too short. During our first tests the weather conditions were very unfavorable for successful drying, and our drying periods were longer than would have been required in less humid weather.

After drying, the vegetables were conditioned for a few days as directed, and were then placed in card-board boxes which were tightly wrapped in paraffined paper. The contents of the boxes were examined at first at two-week, later at monthly intervals for the presence of mold or insect infestation.

1. *Rhubarb*, June 1. Thoroughly washed, superficial moisture removed with a clean towel, and the stalks cut into 1–16 in. slices. Dried 15¾ hrs., probably unnecessarily long. In good condition Nov. 7.

2. *Rhubarb*, June 1. Treated as above but dried with artificial heat. dried 16⅔ hrs. In good condition Nov. 7.

3. *Asparagus tips*, June 2. Asparagus washed, surplus moisture removed, and tougher more fibrous portion cut away and dried separately. Tips cut into ½ in., fibrous part into ⅛ in. pieces. Drying very prolonged, as sample was not cut fine enough, and the air was exceedingly humid. Insect infestation noted on Oct. 2.

4. *Asparagus, fibrous part*, June 2. Prepared as above, and dried with artificial heat. In good condition Nov. 7.

5. *Asparagus tips*, June 2. Treated as in No. 4. In good condition Nov. 7.

6. *Carrots*, June 2. Sliced very thin, about 1/32 in. Dried in 3 hrs. In good condition Nov. 7.

7. *Spinach*, June 13. Thoroughly washed, and passed through a slicer, stems and all. Stems proved very hard to dry and were later removed. Dried in about 10 hrs. Slight mold shown on Oct. 2.

8. *Spinach*, June 13. Treated as No. 7, but dried with artificial heat in about 3 hrs. Slight mold shown on Oct. 2.

9. *Spinach*, June 13. Whole leaves, dried with heat. After several hours drying it was necessary to remove the leaf stems. In good condition Nov. 7.

10. *String beans*, June 18. Beans were stringed, washed and blanched in boiling water for 10 min. They were then drained and cut lengthwise for drying. Drying very prolonged. Mold developed after one month.

10*a*. *String beans*, June 18. Same as No. 10, except that beans were cut crosswise into 1 in. pieces. Drying very prolonged. Badly molded on June 30.

11. *String beans*, June 18. Treated same as No. 10, except that artificial heat was used. Drying very prolonged. In good condition Nov. 7.

12. *String beans*, June 18. Treated same as No. 10a, except that artificial heat was used. Drying very prolonged. In good condition Nov. 7.

13. *Swiss chard*, June 26. Leaves sliced fine, the chopped stems being

COMPOSITION OF DRIED VEGETABLES.

No.		Water.	Ash.	Protein. (N x 6.25).	Fiber.	Nit.-free extract.	Fat.
1	Rhubarb, fan.....	16.70	13.00	13.06	11.35	43.83	2.06
2	Rhubarb, heat.....	13.55	12.98	13.94	13.41	44.68	1.44
3	Asparagus tips, fan.....	19.69	8.13	32.06	7.74	30.54	1.84
4	Asparagus, fibrous, heat..	15.90	7.57	17.31	14.97	43.18	1.07
5	Asparagus tips, heat.....	16.51	8.32	33.31	8.32	31.04	2.50
6	Carrots, fan.....	15.41	7.54	8.63	7.92	60.10	0.40
7	Spinach, fan.....	9.96	22.00	30.88	8.74	25.55	2.87
8	Spinach, heat.....	9.34	22.22	30.50	9.22	24.99	3.73
9	Spinach, whole leaves, heat	10.54	19.65	29.63	5.81	29.51	4.86
10	String beans, long, fan....	15.57	6.91	18.38	13.99	44.37	1.78
11	String beans, long, heat...	12.86	6.32	20.19	11.72	47.06	1.85
12	String beans, short, heat..	13.60	6.36	20.00	12.01	46.36	1.67
13	Swiss chard, fan.....	13.25	20.68	24.06	8.14	30.47	3.40
14	Swiss chard, sun.....	12.74	20.71	24.63	6.44	32.01	3.47
15	Swiss chard, heat.....	12.72	14.81	28.63	6.43	32.69	4.72
16	Peas, fan.....	14.12	3.38	24.25	5.71	51.38	1.16
17	Peas, fan.....	14.01	4.00	27.50	8.58	43.34	2.57
18	Baked beans, fan, heat...	7.70	3.19	24.50	4.55	58.90	1.16

kept separate. Leaves dried in 6 hrs., stems taking longer. In good condition Nov. 7.

14. *Swiss chard*, June 26. Treated same as No. 13, but dried in greenhouse with sun's heat. Drying much slower than with fan. In good condition Nov. 7.

15. *Swiss chard*, July 8. Leaves stripped from stems and the whole leaves dried with heat. Dried in about 6 hrs. In good condition Nov. 7.

16. *Peas*, July 12. Peas shelled and passed through meat grinder. Dried in about 7 hrs. Insect infestation found on Oct. 2.

17. *Peas*, July 13. Treated as No. 16. Dried in 12 hrs., somewhat over dried. Insect infestation found on Sept. 1.

18. *Baked beans.* Beans baked, then dried with fan and current of hot air. In good condition Nov. 7.

To summarize, we find that only 3 of 9 samples dried without heat by the electric fan were in good condition after from 4 to 5 months, while 8 of 9 samples dried with artificial heat and the one sample dried with the sun's heat were free from mold and insect infestation at the end of the same period. On the whole our short experience, therefore, is unfavorable to the cold air, electric fan method of drying.

That the dried vegetables possess high nutritive value is shown by the following analyses of our products. By adding the following parts of water to one part of the dried vegetable the resultant product would have about the same moisture content as the fresh vegetable: Baked beans, 3, peas 3.5, rhubarb 14, carrots, 7 asparagus 14, spinach 11, Swiss chard 11 and string beans 8 parts.

II. DRUG PRODUCTS.

DRUGS FROM STOCK OF DISPENSING PHYSICIANS.

In the Report for 1916 the analyses of 53 such samples were reported. On the following pages will be found the results with 76 additional samples, completing our first inspection of this class of products.

The names and addresses of the firms represented are shown below:

Bristol Myers Co., Brooklyn, N. Y.
Brewer and Co., Worcester, Mass.
Buffington Pharm. Co., Worcester, Mass.
Daggett and Miller Co., Providence, R. I.
Direct Sales Co., Buffalo, N. Y.
Drug Products Co., New York.
The G. F. Harvey Co., Saratoga Springs, N. Y.
The Harvey Co., Saratoga Springs, N. Y.
Independent Pharm. Co., Worcester, Mass.
C. Killgore, New York.
Maltbie Chemical Co., Newark, N. J.
Moore and Co., Worcester, Mass.
National Drug Co., Philadelphia, Pa.
Norwich Pharmacal Co., Norwich, N. Y.
P. J. Noyes Co., Lancaster, N. H.
The E. L. Patch Co., Boston, Mass.
Polk Calder Co., Troy, N. Y.
Progressive Chemical Co., New Haven, Conn.
Surgeon and Physicians Supply Co., Boston, Mass.
Tailby-Nason Co., Boston, Mass.
The Tracy Co., New London, Conn.
John Wyeth and Bro., Philadelphia, Pa.
Yates Drug and Chemical Co., New York.

In the case of tablets at least half of the number making up the sample were weighed individually. These were then ground into a composite sample and the mixture analyzed. In certain instances only the active drug or drugs were determined, while in others a complete analysis was made.

TABLETS.

Acetasol.

11592. *Acetasol*, made by Daggett and Miller Co.; stock of Dr. F. Schavoir, Stamford. *Claimed;* Acetanilid 50%, caffein

2.5%, sodium salicylate, sodium bicarbonate, sugar of milk and oil of wintergreen q.s. to make 100. *Found;* Weights of 19 tablets ranged from 345.9 to 363.4, average, 353.2 mgms. They contained 44.06% acetanilid, 2.12 caffein, 13.36 sodium bicarbonate and 7.36 sodium salicylate; milk sugar and oil of wintergreen present.

Tablets deficient in acetanilid and caffein.

Ammonium Salicylate Comp.

11588. *Ammonium Salicylate Comp.*, made by Daggett and Miller Co.; stock of Dr. J. G. Stanton, New London. *Claimed per tablet;* Ammonium salicylate 2 grs., caffein 1 gr., camphor ½ gr., acetanilid 1⅓ grs., and Dover's powder 1½ grs. *Found;* Weights of 20 tablets ranged from 405.2 to 454.8, average 425.5 mgms. They contained 27.12% ammonium salicylate, 13.42 caffein and 19.27 acetanilid; camphor present and opium and ipecac (indicating Dover's powder).

Tablets contained in part

	Ammonium Salicylate. grs.	Caffein. grs.	Acetanilid. grs.
Heaviest	1.90	0.94	1.35
Lightest	1.70	0.84	1.21
Average	1.78	0.88	1.26

Tablets deficient in ammonium salicylate and caffein.

Antiseptic Tablets.

11577. *Antiseptic Tablets No. 2*, made by Daggett and Miller Co.; stock of Dr. J. W. Callahan, Norwich. *Claimed per tablet;* Corrosive sublimate 7 grs., citric acid 3.48 grs. *Found;* Weights of 12 tablets ranged from 569.8 to 666.2, average, 603.4 mgms. They contained 56.24% corrosive sublimate, or from 4.94 to 5.78, average, 5.24 grs.

Tablets very variable in weight, all short weight, and deficient in corrosive sublimate.

11619. *Antiseptic Tablets No. 1*, made by Direct Sales Co., stock of Dr. T. F. O'Loughlin, Rockville. *Claimed per tablet;* Corrosive sublimate 7.3 grs., ammonium chlorid 7.7 grs. *Found;* Weights of 12 tablets ranged from 970.8 to 1016.8, average, 983.9 mgms. They contained 47.23% corrosive sublimate, or from 7.08 to 7.41, average 7.17 grs.

Tablets satisfactory.

11558. *Antiseptic Tablets No. 1*, made by the Tracy Co.; stock of Dr. T. J. Connors, West Haven. *Claimed per tablet;* Corrosive sublimate 7.3 grs., ammonium chlorid 7.7 grs. *Found;* Weights of 12 tablets ranged from 1061.9 to 1083.9, average, 1073.3 mgms. They contained 46.57% corrosive sublimate, or from 7.63 to 7.79, average, 7.72 grs.

Tablets satisfactory.

11625. *Alkaline and Antiseptic Tablets (Dr. Seiler's Formula)*, made by National Drug Co.; stock of Dr. E. J. Thompson, Hartford. *Claimed per tablet;* Sodium bicarbonate, sodium biborate, sodium benzoate, sodium salicylate, sodium chlorid, eucalyptol, thymol, menthol, oil of sweet birch. *Found;* Weights of 13 tablets ranged from 834.2 to 883.1, average, 863.2, mgms. No specific amounts being claimed only qualitative tests were made. Sodium borate, carbonate, chlorid, salicylate, benzoate and thymol and menthol were found.

Tablets satisfactory in respect to ingredients.

11447. *Antiseptic Germicide*, made by the Maltbie Chemical Co.; stock of Dr. J. L Gilday, Bridgeport. *Claimed per tablet;* Mercuric iodid ⅜ grs., potassium iodid ⅜ gr., sodium bicarbonate 6 grs. *Found;* Weights of 12 tablets ranged from 1040.8 to 1152.6, average 1096.1, mgms. They contained 2.03 mercuric iodid, 2.88 potassium iodid and 94.25 per cent. sodium bicarbonate; so that one tablet contained

	Mercuric iodid. grs.	Potassium iodid. grs.	Sodium bicarbonate. grs.
Heaviest	0.361	0.512	16.88
Lightest	0.326	0.463	15.14
Average	0.343	0.487	15.94

Tablets satisfactory except for large excess of sodium bicarbonate. It is possible, however, that the sampling agent erroneously copied 6 for 16 grs.

Arsenious Iodid Compound.

11445. *Arsenious Iodid Compound*, made by Drug Products Co.; stock of Dr. C. L. Dichter, Stamford. *Claimed per tablet;* Corrosive sublimate 1-64 gr., potassium iodid 2 grs., syr. iron iodid 5 min., sol. arsenic and mercury iodid 2 min., tinct. nux vomica 2 min. *Found;* Weights of 24 tablets ranged from 497.2 to 559.5, average, 534.6, mgms. They contained 5.21 potassium

and 17.10 per cent. iodin; mercury, arsenic and iron present; sample too small for identification of nux vomica. Based on the potassium content, tablets contained 22.12 per cent. potassium iodid, so that heaviest tablet contained 1.91 grs., lightest, 1.70, average, 1.82.

Tablets slightly deficient in potassium iodid.

Aspirin Tablets.

11587. *Aspirin Tablets,* made by Daggett and Miller Co.; stock of Dr. J. S. Stanton, New London. *Claimed per tablet*; 5 grs. *Found;* Weights of 12 tablets ranged from 422.5 to 447.0, average, 434.1, mgms. They contained 53.65% aspirin, or from 3.50 to 3.70, average, 3.59 grs.

Tablets deficient in aspirin.

11567. *Aspirin Tablets,* made by National Drug Co.; stock of Dr. S. H. Holmes, Jewett City. *Claimed per tablet;* 5 grs. *Found;* Weights of 12 tablets ranged from 339.0 to 356.0, average 347.1, mgms. They contained 84.90% aspirin, or from 4.44 to 4.66, average, 4.55 grs.

Tablets passed.

11563. *Aspirin Compound,* made by the P. F. Noyes Co.; stock of Dr. F. M. Dunn, New London. *Claimed per tablet;* Aspirin 1¼ grs., strontium salicylate 2 grs., acetphenetidin 1 gr., caffein ¼ gr., colchicin 1-200 gr., oil of wintergreen, q.s. *Found;* Weights of 20 tablets ranged from 368.5 to 400.5, average, 385.0, mgms. They contained 18.54 aspirin, 30.78 strontium salicylate, 14.10 acetphenetidin and 3.80 per cent. caffein; oil of wintergreen present and an alkaloid but insufficient for identification as colchicin.

One tablet contained in part

	Aspirin. grs.	Strontium salicylate. grs.	Acetphenetidin. gr.	Caffein. gr.
Heaviest	1.15	1.90	0.87	0.235
Lightest	1.05	1.75	0.80	0.216
Average	1.10	1.83	0.84	0.226

Tablets slightly deficient in aspirin, strontium salicylate and acetphenetidin.

Blaud's Compound.

11572. *Blaud Pills Compound No.* 6, made by Independent Pharmaceutical Co.; stock of Dr. E. P. Douglass, Groton. *Claimed per pill;* Arsenious acid 1/60 gr., strychnin sulphate 1/60 gr., corrosive sublimate 1/60 gr., powdered capsicum 1/64 gr. extr. gentian 1/16 gr., Blaud's mass 5 grs. *Found;* Weights of 24 pills ranged from 577.8 to 646.2, average, 613.3, mgms. They contained 15.45 ferrous carbonate and 0.16 per cent. arsenious acid; capsicum and strychnin sulphate (impure residue=0.19%) present; mercury present but material insufficient for determination.

One pill contained in part

	Ferrous carbonate. grs.	Arsenious acid. gr.	Strychnin sulphate (impure). gr.
Heaviest	1.54	0.0160	0.0189
Lightest	1.38	0.0143	0.0169
Average	1.46	0.0151	0.0180

Tablets passed.

11593. *Blaud's Compound Tablets No.* 7, made by National Drug Co.; stock of Dr. F. Schavoir, Stamford. *Claimed per tablet;* Extr. nux vomica 1/10 gr., Blaud's mass 5 grs., arsenious acid 1/60 gr., extr. cascara sagrada 1 gr., manganese binoxid 1 gr. *Found;* Weights of 24 tablets ranged from 680.1 to 725.5, average, 703.5, mgms. They contained 8.30 ferrous carbonate, 0.15 arsenious acid, and 8.73 per cent. manganese binoxid; cascara and strychnin present (impure alkaloidal residue=0.20%).

One tablet contained in part

	Ferrous carbonate. gr.	Arsenious acid. gr.	Maganese binoxid. gr.
Heaviest	0.93	0.0168	0.98
Lightest	0.87	0.0157	0.92
Average	0.90	0.0163	0.95

Tablets satisfactory.

Bronchitis Tablets.

11585. *Bronchitis No.* 6, made by C. Killgore; stock of Dr. F. E. Wilcox, Willimantic. *Claimed per tablet;* Creosote 1 min., strychnin sulphate 1/60 gr., terpen hydrate 2 grs., eucalyptol ½ gr. *Found;* Weights of 20 tablets ranged from 461.2 to 535.4, average, 499.6 mgms. They contained 0.23 strychnin sulphate and approximately 22.60 per cent. terphen hydrate; creosote and possibly eucalyptol present.

One tablet contained in part:

	Strychnin Sulphate. gr.	Terpen hydrate (approx.) grs.
Heaviest	0.0190	1.87
Lightest	0.0164	1.61
Average	0.0177	1.74

Tablets probably slightly deficient in terpen hydrate.

Calcreose.

11552. *Calcreose No. 2*, made by the Maltbie Chemical Co.; stock of Dr. C. K. Heady, Milford. *Claimed per tablet;* Calcreose (a powder containing approximately 5% of beechwood creosote in chemical combination with calcium) 4 grs., reduced iron ½ gr., arsenic trioxid 1/150 gr., strychnin 1/150 gr. *Found;* Weights of 20 tablets ranged from 570.0 to 621.4, average, 590.9 mgms. They contained calcium oxid 8.92, reduced iron 6.33, arsenic trioxid 0.038, ash 29.91, talc 3.14, strychnin not over 0.035 and creosote approximately 15.38 per cent.

The amounts of arsenic and strychnin are much higher than claimed.

Calomel Tablets.

11575. *Calomel Tablet Triturates*, made by Buffington Pharmacy Co.; stock of Dr. R. E. Black, New London. *Claimed per tablet;* Calomel 1/10 gr., flavored with wintergreen. *Found;* Weights of 26 tablets ranged from 70.7 to 86.2, average, 77.1, mgms. They contained 8.10 per cent. of calomel, or from 0.089 to 0.109, average 0.097 gr.

Tablets satisfactory.

11573. *Calomel Tablets*, made by Drug Products Co.; stock of Dr. W. A. Hillard, Pawcatuck. *Claimed per tablet;* Calomel 1/10 gr., flavored with spearmint. *Found;* Weights of 25 tablets ranged from 72.7 to 89.4, average, 76.7 mgms. They contained 8.42 per cent. of calomel, or from 0.094 to 0.116, average, 0.099 gr.

Tablets satisfactory.

11627. *Calomel Tablet Triturates*, made by the Harvey Co.; stock of Dr. G. F. Lewis, Stratford. *Claimed per tablet;* Calomel 1 gr. *Found;* Weights of 25 tablets ranged from 111.5 to 126.8, average, 119.9 mgms. They contained 49.37 per cent. of calomel, or from 0.85 to 0.97, average, 0.91 gr.

Tablets passed.

11611. *Calomel Tablets* (*Calomets*), made by Moore and Co.; stock of Dr. E. M. Hamblin, Bristol. *Claimed per tablet;* Calomel 1/10 gr. *Found;* Weights of 25 tablets ranged from 28.2 to 38.4, average, 36.2 mgms. They contained 16.85 per cent. of calomel, or from 0.068 (a single light tablet) to 0.109, average, 0.094 gr.

Tablets satisfactory.

11568. *Calomel Tablet Triturates*, made by National Drug Co.; stock of Dr. S. H. Holmes, Jewett City. *Claimed per tablet;* Calomel 1/10 gr. *Found;* Weights of 25 tablets ranged from 73.6 to 87.2, average, 79.3 mgms. They contained 7.94 per cent. of calomel, or from 0.091 to 0.107, average, 0.097 gr.

Tablets satisfactory.

11559. *Calomel Tablet Triturates*, made by E. L. Patch Co.; stock of Dr. H. Stendel, Ansonia. *Claimed per tablet;* Calomel, 1 gr. *Found;* Weights of 25 tablets ranged from 134.2 to 148.8, average, 141.2 mgms. They contained 45.28 per cent. of calomel, or from 0.94 to 1.04, average, 0.99 gr.

Tablets satisfactory.

11609. *Calomel Tablets*, made by Tailby-Nason Co.; stock of Dr. W. R. Hanrahan, Bristol. *Claimed per tablet;* Calomel 2 grs. *Found;* Weights of 18 tablets ranged from 153.2 to 169.5, average, 161.7 mgms. Tablets contained 69.34 per cent. of calomel, or from 1.64 to 1.82, average, 1.73 grs.

Tablets deficient in calomel.

11586. *Calomel Tablets*, stock of Dr. T. R. Parker, Willimantic; **11603**, stock of Dr. C. A. Hamilton, Waterbury; **11557**, stock of Dr. T. J. Connors, West Haven; all made by Yates Drug and Chemical Co. *Claimed per tablet;* Calomel 1/10 gr. *Found;* In **11586** weights of 25 tablets ranged from 84.5 to 98.5, average, 94.9 mgms. They contained 6.62 per cent. of calomel, or from 0.086 to 0.101, average, 0.097 gr. In **11603** weights of 25 tablets ranged from 90.1 to 110.9, average, 106.3 mgms. They contained 6.30 per cent. of calomel, or from 0.088 to 0.108, average, 0.103 gr. In **11557** weights of 25 tablets ranged from 90.0 to 99.6, average, 95.8 mgms. They contained 7.04 per cent. of calomel, or from 0.098 to 0.108, average, 0.104 gr.

Tablets in the three samples satisfactory.

11595. *Calomel Tablets*, stock of Dr. W. Burke, Greenwich; **11614**, stock of Dr. N. A. Burr, Manchester; both made by Yates Drug and Chemical Co. *Claimed per tablet;* Calomel 1/4 gr.

Found; In **11595** weights of 25 tablets ranged from 90.1 to 100.9, average, 96.8 mgms. They contained 16.23 per cent. of calomel or from 0.226 to 0.253, average, 0.242 gr. In **11614** weights of 25 tablets ranged from 86.2 to 95.5, average, 91.1 mgms. They contained 17.16 per cent. of calomel, or from 0.228 to 0.252, average, 0.242 gr.

Tablets in both samples satisfactory.

Calomel and Soda Tablets.

11571. *Calomel and Soda Tablet Triturates No.* 3, made by Independent Pharmaceutical Co.; stock of Dr. E. P. Douglass, Groton. *Claimed per tablet;* Calomel 1/4 gr., sodium bicarbonate 1 gr. *Found;* Weights of 25 tablets ranged from 116.5 to 130.2, average, 124.3 mgms. They contained 12.52 calomel and 57.46 per cent. sodium bicarbonate, so that one tablet contained:

	Calomel. gr.	Sodium bicarbonate. grs.
Heaviest	0.252	1.15
Lightest	0.225	1.03
Average	0.240	1.10

Tablets are satisfactory.

11570. *Calomel Compound Tablet Triurates No.* 6, made by E. L. Patch Co.; stock of Dr. J. H. McLoughlin, Jewett City. *Claimed per tablet;* Calomel 1/2 gr., sodium bicarbonate 1/2 gr. *Found;* Weights of 25 tablets ranged from 150.0 to 166.9, average, 160.3 mgms. They contained 19.74 calomel and 74.93 per cent. sodium bicarbonate, so that one tablet contained:

	Calomel gr.	Sodium bicarbonate. grs.
Heaviest	0.509	1.93
Lightest	0.456	1.73
Average	0.488	1.85

Tablets satisfactory, the claim for sodium bicarbonate probably having been copied incorrectly.

11606. *Calomel and Soda Tablets*, made by Yates Drug and Chemical Co.; stock of Dr. J. Gaucher, Waterbury. *Claimed per tablet;* Calomel 1/10 gr., sodium bicarbonate 1 gr. *Found;* Weights of 25 tablets ranged from 121.9 to 129.6, average, 126.5 mgms. They contained 5.34 calomel and 51.14 per cent. sodium bicarbonate, so that one tablet contained:

	Calomel. gr.	Sodium bicarbonate. grs.
Heaviest	0.107	1.02
Lightest	0.100	0.96
Average	0.104	1.00

Tablets satisfactory.

Cascara Compound.

11607. *Cascara Compound No.* 3, made by E. L. Patch Co.; stock of Dr. R. J. Lawton, Terryville. *Claimed per tablet;* Cascarin 1/4 gr., aloin 1/4 gr., podophyllin 1/6 gr. extr. belladonna 1/8 gr., strychnin sulphate 1/60 gr., gingerine 1/8 gr. *Found;* Weights of 25 tablets ranged from 165.9 to 199.6, average, 181.5 mgms. They contained aloin, ginger, resins (probably podophyllin) and probably cascara; no tests were made for belladonna alkaloids; no calomel present; 0.56 per cent. of total alkaloids chiefly strychnin. Heaviest tablet contained 0.0172, lightest 0.0143, average 0.0157 gr. of strychnin.

Tablets satisfactory.

Cathartic Compound.

11578. *Cathartic Compound*, made by Daggett and Miller Co.; stock of Dr. J. N. Callahan, Norwich. *Claimed per tablet;* Extr. colocynth Co. 1 1/4 grs., calomel 1 gr., jalap resin 1/3 gr., powdered gamboge 1/4 gr. *Found;* Weights of 17 tablets ranged from 410.2 to 443.9, average, 430.3 mgms. They contained 14.60 per cent. of calomel, a large amount of resinous material, aloes and a bitter principle (colocynth), the aloes indicating the presence of Extr. colocynth Co. The tablets contained from 0.92 to 1.00, average, 0.97 gr. of calomel.

Tablets satisfactory.

11452. *Cathartic Compound*, made by National Drug Co.; stock of Dr. T. Martino, Hartford. *Claimed per tablet;* Extr. colocynth Co., 1 1/4 grs., calomel 1 gr., jalap resin 1/8 gr., powdered gamboge 1/4 gr. *Found;* Weights of 20 tablets ranged from 320.0 to 346.1, average, 332.0 mgms. They contained 14.60 per cent. of calomel, a large amount of resinous material, aloes and a bitter principle (colocynth), the aloes indicating the presence of Extr. colocynth Co. The tablets contained from 0.72 to 0.78, average, 0.75 gr. of calomel.

Tablets deficient in calomel.

Cold Tablets.

11576. *Cold Tablets*, made by Buffington Pharmacy Co.; stock of Dr. R. E. Black, New London. *Claimed per tablet;* Acetanilid 1½ grs., powdered opium 3/20 grs., camphor monobrom 1/3 gr., caffein citrated ½ gr., cascara sagrada ½ gr. *Found;* Weights of 20 tablets ranged from 252.8 to 269.6, average, 263.1 mgms. They contained 33.40 acetanilid and 12.16 per cent. of caffein citrated U. S. P.; powdered opium, camphor monobrom and cascara present. One tablet contained in part:

	Acetanilid. grs.	Caffein citrated, U. S. P. gr.
Heaviest	1.39	0.51
Lightest	1.30	0.47
Average	1.36	0.49

Tablets deficient in acetanilid.

11618. *Cold Tablets No. 2 (Dr. Gage)* made by Moore and Co.; stock of Dr. T. E. O'Loughlin, Rockville. *Claimed per tablet;* Powdered capsicum ¼ gr., tinct. aconite 1 min., quinin sulphate 2 grs. and Dover's powder 2 grs. *Found;* Weights of 20 tablets ranged from 415.4 to 462.2, average, 446.4 mgms. They contained 28.77 per cent. quinin sulphate; capsicum, Dover's powder (opium and ipecac) present; no test made for aconitin. They contained from 1.84 to 2.05, average, 1.98 grs. quinin sulphate.

Tablets satisfactory so far as tested.

Hammond's Tonic.

11560. *Triturate Tablets Tonic (Dr. Hammond)*, made by E. L. Patch Co.; stock of Dr. H. Stendel, Ansonia. *Claimed per tablet;* Iron pyrophosphate ½ gr., quinin sulphate ½ gr., strychnin sulphate 1/120 gr. *Found;* Weights of 20 tablets ranged from 95.8 to 100.8, average, 98.9 mgms. They contained 23.90 total alkaloids, 6.12 iron and 11.24 per cent. phosphoric acid; quinin and strychnin present as sulphates; material insufficient for quantitative separation of the small amount of strychnin. Iron pyrophosphate is an indefinite salt, but judging from the relation between the iron and phosphoric acid found the tablets contained from 19 to 20 per cent. of anhydrous iron pyrophosphate.

Tablets passed as probably satisfactory.

Headache Tablets.

11608. *Acetanilid Comp. Tablets*, made by Brewer and Co.; stock of Dr. W. R. Hanrahan, Bristol. *Claimed per tablet;* Acetanilid 3.5 grs., caffeine 0.5 grs., sodium bicarbonate 1 gr. *Found;* Weights of 15 tablets ranged from 452.7 to 477.8, average, 462.3 mgms. They contained 47.52 acetanilid, 6.80 caffeine and 13.94 per cent. sodium bicarbonate, so that one tablet contained:

	Acetanilid. grs.	Caffein. gr.	Sodium bicarbonate. grs.
Heaviest	3.50	0.50	1.03
Lightest	3.32	0.48	0.97
Average	3.39	0.49	0.99

Tablets satisfactory

11626. *Acetanilid Comp. Tablets, No. 4*, made by National Drug Co.; stock of Dr. E. J. Thompson, Hartford. *Claimed per tablet;* Acetanilid 3½ grs., sodium bicarbonate 8/10 gr., sodium bromid 1/10 gr., caffeine citrated ½ gr. *Found;* Weights of 15 tablets ranged from 375.9 to 403.9, average, 389.2 mgms. They contained 57.93 acetanilid, 15.46 sodium bicarbonate, 1.46 sodium bromid and 8.24 per cent. citrated caffeine U. S. P., so that one tablet contained:

	Acetanilid. grs.	Sodium bicarbonate. gr.	Sodium bromid. gr.	Caffein citrated, U. S. P. gr.
Heaviest	3.61	0.96	0.091	0.51
Lightest	3.36	0.90	0.085	0.48
Average	3.48	0.93	0.088	0.50

Tablets passed, although slightly deficient in sodium bromid.

11444. *Acetanilid Comp. Tablets No. 17*, made by National Drug Co.; stock of Dr. C. L. Dichter, Stamford. *Claimed per tablet;* Acetanilid 3 grs., sodium bicarbonate 2 grs., caffeine citrated ½ gr., camphor monobrom ½ gr., acid tartaric 1/8 gr., fl. ex. gelsemium 1 min., oil of cinnamon q. s. *Found;* Weights of 12 tablets ranged from 438.5 to 459.8, average, 446.1 mgms. They contained 43.16 acetanilid, 7.20 citrated caffein U. S. P., and 28.45 per cent. sodium bicarbonate; camphor monobrom, tartaric acid, oil of cinnamon and gelsemium present, so that one tablet contained in part:

	Acetanilid. grs.	Citrated caffein, U. S. P. gr.	Sodium bicarbonate. grs.
Heaviest	3.06	0.51	2.02
Lightest	2.92	0.49	1.93
Average	2.97	0.50	1.96

Tablets satisfactory.

11622. *Migrain Tablets No. 2*, made by E. L. Patch Co.; stock of Dr. T. F. Rockwell, Rockville. *Claimed per tablet;* Acetanilid 2 grs., caffein citrated 0.5 gr. camphor monobrom 0.5 gr. *Found;* Weights of 20 tablets ranged from 227.2 to 254.4, average, 240.3 mgms. They contained 54.26 acetanilid and 13.32 per cent. citrated caffein U. S. P. camphor monobron present; so that one tablet contained:

	Acetanilid. grs.	Citrated caffein, U. S. P. gr.
Heaviest	2.13	0.52
Lightest	1.90	0.47
Average	2.01	0.49

Tablets satisfactory.

11620. *Migrain Tablets No. 3*, made by Surgeons and Physicians Supply Co.; stock of Dr. T. F. O'Loughlin, Rockville. *Claimed per tablet;* Acetanilid 2 grs., caffein citrated 0.5 gr., camphor monobrom 0.5 gr. *Found;* Weights of 15 tablets ranged from 298.7 to 349.8, average, 328.8 mgms. They contained 36.20 acetanilid and 8.92 per cent. citrated caffein, U. S. P.; camphor monobrom present; so that one tablet contained:

	Acetanilid. grs.	Citrated caffein, U. S. P. gr.
Heaviest	1.95	0.48
Lightest	1.77	0.41
Average	1.84	0.45

Tablets passed.

11583. *Migrain Tablets*, made by Tailby-Nason Co.; stock of Dr. T. Soltz, New London. *Claimed per tablet;* Acetanilid 2 grs., caffein citrated 0.5 gr., camphor monobrom 0.5 gr. *Found;* Weights of 20 tablets ranged from 198.4 to 233.4, average, 223.0 mgms. They contained 58.03 acetanilid and 14.36 per cent. citrated caffein, U. S. P.; camphor monobrom present; so that one tablet contained:

	Acetanilid. grs.	Citrated caffein, U. S. P. gr.
Heaviest	2.09	0.52
Lightest	1.78	0.44
Average	2.00	0.50

Tablets satisfactory.

11601. *Migrain Tablets*, made by Tailby-Nason Co.; stock of Dr. C. Rowling, New Haven. *Claimed per tablet;* Acetanilid 2 grs., caffein 0.25 gr., camphor monobrom 0.5 gr. *Found;* Weights of 20 tablets ranged from 202.6 to 230.6, average, 221.2 mgms. They contained 57.94 acetanilid and 7.18 per cent. caffein; camphor monobrom present; so that one tablet contained:

	Acetanilid. grs.	Caffein. gr.
Heaviest	2.06	0.26
Lightest	1.81	0.22
Average	1.98	0.24

Tablets satisfactory.

11605. *Headache Tablets* (Dr. F. J. Hawley), made by Yates Drug and Chemical Co.; stock of Dr. J. Caucher, Waterbury. *Claimed per tablet;* Acetanilid 2.5 grs., aromatic powder 0.5 gr., sodium bicarbonate 1 gr., caffein 0.5 gr., camphor 0.1 gr., oil quassia q. s. *Found;* Weights of 15 tablets ranged from 341.6 to 362.7, average, 330.6 mgms. They contained 46.61 acetanilid, 8.90 caffein and 19.16 per cent. sodium bicarbonate; volatile oil, aromatics and camphor present; so that one tablet contained:

	Acetanilid. grs.	Caffein. gr.	Sodium bicarbonate. grs.
Heaviest	2.61	0.50	1.07
Lightest	2.46	0.47	1.01
Average	2.52	0.48	1.04

Tablets satisfactory.

Hexamethylene Tetramine Tablets.

11598. *Hex-uro-gen*, made by Daggett and Miller Co.; stock of Dr. H. L. F. Locke, Hartford. *Claimed per tablet;* Hexamethylenamine 5 grs., acid sodium phosphate 5 grs. *Found;* Weights of 12 tablets ranged from 676.9 to 706.7, average, 694.7 mgms. They contained 51.80 hexamethylene tetramine and 42.16 per cent. of acid sodium phosphate, so that one tablet contained:

	Hexamethylene tetramine. grs.	Acid sodium phosphate. grs.
Heaviest	5.65	4.60
Lightest	5.41	4.41
Average	5.55	4.52

Tablets satisfactory.

11612. *Hexaform Tablets*, made by Yates Drug and Chemical Co.; stock of Dr. A. S. Brackett, Bristol. *Claimed per tablet;* Hexaform 5 grs. *Found;* Weights of 12 tablets ranged from 311.8

to 338.2, average, 323.6 mgms. They contained 99.75 per cent. hexamethylene tetramine, or from 4.80 to 5.21, average, 4.98 grs. per tablet.

Tablets satisfactory.

Hypophosphites Compound.

11599. *Tabs. Hypophosphites Compound Improved*, made by Daggett and Miller Co.; stock of Dr. H. L. F. Locke, Hartford. *Claimed per tablet;* Iron hypophosphite 3/8 gr., manganese hypophosphite ¼ gr., quinin hypophosphite 1/6 gr., calcium hypophosphite ¼ gr., potassium hypophosphite 3/8 gr., strychnin hypophosphite 1/64 gr., arsenious acid 1/50 gr., cascarin 1/8 gr. *Found;* Weights of 25 tablets ranged from 150.2 to 177.9, average, 161.4 mgms. They contained 2.05 iron, 2.42 manganese, 1.04 calcium, 3.57 potassium, 10.82 phosphorus and 0.51 per cent. arsenious acid; quinin, strychnin and hypophosphites present. The claimed amounts of the various hypophosphites require 3.31 per cent. iron, 2.95 manganese, 2.34 calcium and 5.59 potassium, with 17.37 total phosphorus. Our analysis shows only about 62 per cent. of the required phosphorus and deficiencies in iron, manganese, calcium and potassium.

Tablets below strength claimed.

Iodized Calcium.

11449. *Calcium Iodized*, made by Daggett and Miller Co.; stock of Dr. S. M. Garlick, Bridgeport. *Claimed per tablet;* Calcium iodized 1 gr. *Found;* Weights of 25 tablets ranged from 91.5 to 111.0, average, 101.7 mgms. They contained 3.09 per cent. total iodin, 0.26 available iodin, 14.20 total calcium oxid and 3.28 calcium iodid (calculated from the non-available iodin). The tablets, therefore, contained from 1/227 to 1/270, average, 1/244 gr. available iodin and from 1/18 to 1/22, average, 1/20 gr. calcium iodid.

No standard for comparison.

La Grippe Saratoga Tablets.

11624. *La Grippe Saratoga Tablets*, made by the Harvey Co.; stock of Dr. J. B. Waters, Hartford. *Claimed per tablet;* Acetanilid 1¾ grs., caffein citrated ½ gr., ipecac, 1/20 gr., quinin salicylate ½ gr., capsicum 1/10 gr., podophyllin 1/40 gr., aloin 1/40 gr. *Found;* Weights of 15 tablets ranged from 350.2 to 405.9, average, 380.4 mgms. They contained 31.11 acetanilid, 8.96 citrated caffein U. S. P., 6.32 total alkaloids and 2.45 per cent. salicylic acid (probably as quinin salt); capsicum, quinin salicylate, aloin, podophyllin and ipecac powder present; so that one tablet contained in part:

	Acetanilid. grs.	Citrated Caffein, U. S. P. gr.
Heaviest	1.95	0.56
Lightest	1.68	0.48
Average	1.83	0.53

Tablets quite variable in weight, but satisfactory as regards average composition.

Mercury Protoiodid Tablets.

11602. *Mercury Protoiodid Tablets*, made by Polk Calder Co.; stock of Dr. M. D. Slattery, New Haven. *Claimed per tablet;* Mercury protoiodid ¼ gr., charcoal 1/10 gr., aromatics q.s. *Found;* Weights of 25 tablets ranged from 97.0 to 102.5, average, 99.1, mgms. They contained 15.22 per cent. of mercury protoiodid, or from 0.228 to 0.240, average, 0.233 gr. per tablet.

Tablets satisfactory.

Mixed Treatment.

11453. *Mixed Treatment (Dr. Sherwell)*, made by National Drug Co.; stock of Dr. T. Martino, Hartford. *Claimed per tablet;* Corrosive sublimate 1/64 gr., potassium iodid 2 grs. syr. iron iodid 5 min., liq. arsenic and mercury iodid 2 min., tinct. nux vomica 3 min. *Found;* Weights of 20 tablets ranged from 497.4 to 532.4, average, 514.6, mgms. They contained 5.75 potassium and 20.06 per cent. iodin; mercury, arsenic and iron present; insufficient sample to confirm presence of nux vomica. Based on the potassium percentage tablets contained 24.41 per cent. potassium iodid, so that heaviest contained 2.01, lightest 1.87, average, 1.94 grs.

Tablets passed.

Myalgie (Dr. Harvey).

11566. *Myalgie (Dr. Harvey)*, made by Daggett and Miller Co.; stock of Dr. G. E. Bradford, New London. *Claimed per tablet;* Sodium salicylate 2 grs., acetanilid 2 grs., cerium oxalate ½ gr., caffein citrated ½ gr. *Found;* Weights of 20 tablets ranged from 382.2 to 419.4, average, 406.6, mgms. They contained

21.26 sodium salicylate, 25.30 acetanilid, 4.92 citrated caffein U. S. P., and 7.10 per cent. cerium oxalate; so that one tablet contained

	Sodium Salicylate. grs.	Acetanilid. grs.	Citrated caffein, U. S. P. gr.	Cerium Oxalate. gr.
Heaviest	1.38	1.64	0.32	0.46
Lightest	1.26	1.50	0.29	0.42
Average	1.33	1.59	0.31	0.45

Tablets deficient in sodium salicylate, acetanilid and citrated caffein.

Neuralgie No. 5.

11610. *Neuralgie No. 5*, made by Yates Drug and Chemical Co.; stock of Dr. E. M. Hamblin Bristol. *Claimed per tablet;* Acetanilid 2 grs., aconitin 1/100 gr., strychnin muriate 1/120 gr., quinin muriate 1 gr. *Found;* Weights of 15 tablets ranged from 309.5 to 324.2, average, 317.9, mgms. They contained 39.60 acetanilid and 17.50 per cent. total alkaloids; quinin, strychnin and chlorids present; no test made for aconitin.

One tablet contained in part

	Acetanilid. grs.	Total Alkaloids. gr.
Heaviest	1.98	0.875
Lightest	1.89	0.837
Average	1.94	0.659

Tablets passed.

Phenolphthalein Tablets.

11581. *Phenolphthalein Tablets*, stock of Dr. N. B. Lewis, Norwich; **11589,** stock of Dr. G. A. Shelton, Shelton; both made by the G. F. Harvey Co. *Claimed per tablet;* Phenolphthalein 2 grs. *Found;* In **11581** weights of 24 tablets ranged from 276.9 to 303.9, average, 287.2, mgms. They contained 48.46 per cent. phenolphthalein, or from 2.07 to 2.27, average, 2.15, grs. per tablet. In **11589** weights of 20 tablets ranged from 288.7 to 305.2, average, 297.3 mgms. They contained 43.13 per cent. phenolphthalein, or from 1.92 to 2.03, average, 1.98 grs. per tablet.

Tablets in both samples satisfactory.

Phenolphthalein and Calomel Tablets.

11621. *Phenolphthalein and Calomel Tablets*, made by Tailby-Nason Co.; stock of Dr. T. F. Rockwell, Rockville. *Claimed per tablet;* Phenolphthalein 1/10 gr., calomel 1/10 gr. *Found;* Weights of 25 tablets ranged from 90.9 to 109.2, average, 102.5, mgms. They contained 6.94 per cent. phenolphthalein and 6.56 calomel, so that one tablet contained

	Phenol-phthalein. gr.	Calomel. gr.
Heaviest	0.117	0.111
Lightest	0.097	0.092
Average	0.110	0.104

Tablets satisfactory.

Quinin Sulphate Tablets.

11615. *Quinin Sulphate Tablets*, made by Tailby-Nason Co.; stock of Dr. W. S. Gillam, South Manchester. *Claimed per tablet;* Quinin sulphate 2 grs. *Found;* Weights of 15 tablets ranged from 312.0 to 336.9, average, 322.6 mgms. They contained 38.41 per cent. quinin sulphate, or from 1.85 to 2.00, average, 1.91, grs. per tablet.

Tablets satisfactory.

11623. *Quinin Sulphate Tablets*, made by John Wyeth and Bro.; stock of Dr. J. B. Waters, Hartford. *Claimed per tablet;* Quinin sulphate 2 grs. *Found;* Weights of 20 tablets ranged from 256.6 to 280.0, average, 266.3, mgms. They contained 44.06 per cent. quinin sulphate, or from 1.74 to 1.90, average, 1.81 grs. per tablet.

Tablets deficient in quinin sulphate.

11590. *Quinin Sulphate Tablets*, made by Yates Drug and Chemical Co.; stock of Dr. G. A. Shelton, Shelton. *Claimed per tablet;* Quinin sulphate 2 grs. *Found;* Weights of 20 tablets ranged from 210.0 to 234.5, average 225.3 mgms. They contained 62.18 per cent. quinin sulphate, or from 2.01 to 2.25, average, 2.16 grs. per tablet.

Tablets satisfactory.

Quinin and Nux Vomica Tablets.

11600. *Quinin and Nux Vomica Tablets*, made by Tailby-Nason Co.; stock of Dr. C. Rawling, New Haven. *Claimed per tablet;* Quinin sulphate 1 gr., extr. nux vomica 1/10 gr. *Found;* Weights of 20 tablets ranged from 175.9 to 195.3, average, 186.1 mgms. They contained 32.79 per cent. quinin sulphate; nux vomica

alkaloids present but not determined. Tablets contained in part from 0.89 to 0.99, average, 0.94 gr. quinin sulphate per tablet.

Tablets satisfactory.

Sodium Bromid Tablets.

11574. *Sodium Bromid Tablets*, made by Buffington Pharmacy Co.; stock of Dr. E. A. Hillard, Pawcatuck. *Claimed per tablet;* Sodium bromid 5 grs. *Found;* Weights of 25 tablets ranged from 317.0 to 328.2, average, 324.2 mgms. They consisted wholly of sodium bromid and contained from 4.89 to 5.06, average, 5.00 grs. per tablet.

Tablets satisfactory.

Sodium Salicylate Tablets.

11450. *Sodium Salicylate Tablets*, made by Drug Products Co.; stock of Dr. C. P. Townsend, Bridgeport. *Claimed per tablet;* Sodium salicylate 5 grs. *Found;* Weights of 12 tablets ranged from 376.5 to 465.0, average, 412.6, mgms. They contained 71.55 per cent. sodium salicylate, or from 4.16 to 5.14, average, 4.56 grs. per tablet.

Tablets deficient in sodium salicylate, 5 of the 12 showing a deficiency greater than 10 per cent. and only one containing the full amount claimed; very variable in weight.

11569. *Sodium Salicylate Tablets*, made by the Maltbie Chemical Co.; stock of Dr. J. H. McLoughlin, Jewett City. *Claimed per tablet;* Sodium salicylate 5 grs. *Found;* Weights of 20 tablets ranged from 428.5 to 464.5, average, 451.0 mgms. They contained 70.71 per cent. sodium salicylate, or from 4.67 to 5.07, average, 4.92 grs. per tablet.

Tablets satisfactory.

11613. *Sodium Salicylate Tablets*, made by Yates Drug and Chemical Co.; stock of Dr. A. S. Brackett, Bristol. *Claimed per tablet;* Sodium salicylate 5 grs. *Found;* Weights of 21 tablets ranged from 425.0 to 450.5, average, 440.9, mgms. They contained 69.74 per cent. sodium salicylate, or from 4.57 to 4.85, average, 4.74 grs. per tablet.

Tablets passed.

Strontium Salicylate Tablets.

11580. *Strontium Salicylate Tablets*, made by Drug Products Co.; stock of Dr. N. B. Lewis, Norwich. *Claimed per tablet;*

Strontium salicylate, 5 grs. *Found;* Weights of 24 tablets ranged from 363.0 to 407.5, average, 386.5 mgms. They contained salicylic acid equivalent to 76.23 per cent. strontium salicylate (strontium present, but only 93.8 per cent. of theoretical amount), or from 4.27 to 4.80, average, 4.54 grs. per tablet.

Tablets deficient in strontium salicylate, 7 of the 24 showing a deficiency greater than 10 per cent., and no tablet containing the full amount claimed.

Strychnin Sulphate Tablets.

11564. *Strychnin Sulphate Tablets*, made by Bristol Myers Co.; stock of Dr. F. M. Dunn, New London. *Claimed per tablet;* Strychnin sulphate 1/60 gr. *Found;* Weights of 53 tablets ranged from 66.0 to 86.2, average, 75.2 mgms. They contained 1.31 per cent. strychnin sulphate, or from 0.0134 to 0.0174, average, 0.0152 gr. per tablet.

Tablets satisfactory.

11440. *Strychnin Sulphate Tablets*, made by Independent Pharmaceutical Co.; stock of Dr. C. K. Isham, Hartford. *Claimed per tablet;* Strychnin sulphate 1/60 gr. *Found;* Weights of 50 tablets ranged from 87.8 to 114.0, average, 96.0 mgms. They contained 1.09 per cent. strychnin sulphate, or from 0.0147 to 0.0192, average, 0.0161 gr. per tablet.

Tablets satisfactory.

11597. *Strychnin Sulphate Tablets*, made by Progressive Chemical Co., New Haven; stock of Dr. A. E. Abrams, Hartford. *Claimed per tablet;* Strychnin sulphate 1/50 gr. *Found;* Weights of 50 tablets ranged from 48.5 to 77.8, average, 67.6 mgms. They contained 0.79 per cent. strychnin sulphate, or from 0.0059 to 0.0095, average, 0.0082, gr. per tablet.

Tablets deficient in strychnin sulphate and very variable in weight.

11582. *Strychnin Sulphate Tablets*, made by the Tracy Co., New London; stock of Dr. T. Soltz, New London. *Claimed per tablet;* Strychnin sulphate 1/60 gr. *Found;* Weights of 48 tablets ranged from 96.1 to 123.2, average, 109.3 mgms. They contained 0.91 per cent. strychnin sulphate, or from 0.0135 to 0.0173, average, 0.0154 gr. per tablet.

Tablets satisfactory.

11594. *Strychnin Sulphate Tablets*, stock of Dr. W. Burke, Greenwich; **11604,** stock of Dr. C. A. Hamilton, Waterbury; both made by Yates Drug and Chemical Co. *Claimed per tablet;* Strychnin sulphate 1/60 gr. *Found;* In **11594** weights of 50 tablets ranged from 90.9 to 106.0, average, 99.0 mgms. They contained 1.03 per cent. strychnin sulphate, or from 0.0144 to 0.0169, average, 0.0158 gr. per tablet.

In **11604** weights of 51 tablets ranged from 94.0 to 101.0, average, 96.3 mgms. They contained 1.03 per cent. strychnin sulphate, or from 0.0149 to 0.0161, average, 0.0153 gr. per tablet.

Tablets in both samples satisfactory.

Solutions.

Elixir of Iron, Quinin and Strychnin.

11596. *Elixir of Iron, Quinin and Strychnin Phosphate*, made by Brewer and Co.; stock of Dr. A. E. Abrams, Hartford. *Claimed;* Each fl. dram contains tinct. iron citrochlorid 7½ min., quinin hydrochlorid ½ gr., strychnin phosphate 1/64 gr. *Found;* The elixir contained 16.68 per cent. alcohol by volume, 0.52 iron, 0.672 quinin (approximately) and 0.028 strychnin (approximately). It contained therefore, 8.8 min. tinct. iron citrochlorid, approximately 0.49 gr. quinin hydrochlorid and approximately 1/41 gr. strychnin phosphate.

Elixir satisfactory.

11616. *Elixir Iron, Quinin and Strychnin No. 2*, made by Yates Drug and Chemical Co.; stock of Dr. W. R. Tinker, South Manchester. *Claimed;* Each fl. oz. contains strychnin sulphate 2/15 gr., quinin sulphate 4 grs., tinct. iron citrochlorid 60 min., sodium citrate q.s., alcohol 19 per cent. *Found;* The elixir contained 17.55 per cent. alcohol by volume, 0.52 iron, 0.577 quinin (approximately), and 0.020 strychnin (approximately). It therefore contained per fl. oz. 70.9 min. tinct. iron citrochlorid, approximately 3.85 grs., quinin sulphate and approximately 2/15 gr. strychnin sulphate.

Elixir satisfactory.

Elixir Lactated Pepsin.

11617. *Elixir Lactated Pepsin Stronger*, made by the Harvey Co. stock of Dr. W. R. Tinker, South Manchester *Claimed;* Each fl. dram contains pepsin (1/3000) 1 gr., maltase ¼ gr., diastase 1/16 gr., lactic acid 5/32 min., hydrochloric acid ⅛ min., alcohol 17 per cent. *Found;* Spec. grav. @ 15.6° C. 1.1228, alcohol by volume 16.35 per cent.; pepsin and pancreatin present; diastatic action faint, if any. The pepsin present showed about 15.5 per cent. of the activity the claimed amount of U. S. P. pepsin should exhibit, the pancreatin from 8 to 10 per cent. of the claimed activity.

Elixir below the strength claimed.

Solution Iodin and Potassium Iodid.

11591. *Sol. Iodin and Potassium Iodid*, made by Yates Drug and Chemical Co.; stock of Dr. J. E. Black, Shelton. *Claimed;* Alcohol 91.5; tinct. iodin 1 part, alcohol 2 parts. *Found;* It contained 91.70 per cent. alcohol by volume, and 1.69 gms. potassium iodid and 2.83 gms. iodin per 100 cc. A solution of one part of tincture iodin U. S. P. and two parts of alcohol should contain from 1.50 to 1.83 gms. potassium iodid and from 2.16 to 2.50 gms. iodin per 100 cc.

Solution satisfactory.

Spt. Ammonia Aromatic.

11561. *Spt. Ammonia Aromatic*, made by Yates Drug and Chemical Co.; stock of Dr. C. W. Gaylord, Branford. *Claimed;* Spirit of Ammonia Aromatic, alcohol 67 per cent. *Found;* Sample contained 62.00 per cent. alcohol by volume, and 1.6167 gms. of ammonia per 100 cc. with aromatic oils.

Solution passed.

Syrup Hydriodic Acid.

11562. *Syrup Hydroidic Acid*, made by Norwich Pharmacal Co.; stock of Dr. C. W. Gaylord, Branford. *Claimed;* Syr. hydriodic acid, U. S. P. *Found;* Spec. grav. @ 25° C. 1.2155 1.32 gms. hydriodic acid per 100 cc.

Solution passed.

TABLE XIX.—VARIATIONS IN THE WEIGHTS OF MEDICINAL TABLETS.

Station No.	Name of Tablet.	Weight per tablet. Maximum. mgms.	Minimum. mgms.	Average. mgms.	Maximum variation. Above average. Per cent.	Below average. Per cent.	Total. Per cent.
	Acetasol.						
11592	Daggett & Miller Co.	363.4	345.9	353.2	2.9	2.1	5.0
	Ammon. Salicylate Compound.						
11588	Daggett & Miller Co.	454.8	405.2	425.5	6.9	4.8	11.7
	Antiseptic (Corrosive Sublimate).						
11577	Daggett & Miller Co. (7 grs.)	666.2	569.8	603.4	10.4	5.6	16.0
11619	Direct Sales Co. (7.3 grs.)	1016.8	970.8	983.9	3.3	1.3	4.6
11558	The Tracy Co. (7.3 grs.)	1083.9	1061.9	1076.3	1.0	1.1	2.1
	Alkaline Antiseptic.						
11625	National Drug Co.	883.1	834.2	863.2	2.3	3.4	5.7
	Antiseptic Germicide.						
11447	Maltbie Chem. Co.	1152.6	1040.8	1096.1	5.2	5.0	10.2
	Arsenious Iodid Comp.						
11445	Drug Products Co.	559.5	497.2	534.6	4.5	7.0	11.5
	Aspirin.						
11587	Daggett & Miller Co. (5 grs.)	447.0	422.5	434.1	3.0	2.7	5.7
11567	National Drug Co. (5 grs.)	356.0	339.0	347.1	2.6	2.3	4.9
	Aspirin Compound.						
11563	P. J. Noyes Co.	400.5	368.5	385.0	3.0	4.3	7.3
	Blaud's Compound.						
11572	Independent Pharm. Co.	646.2	577.8	613.3	5.4	5.8	11.2
11593	National Drug Co.	725.5	680.1	703.5	3.1	3.3	6.4
	Bronchitis No. 6.						
11585	C. Killgore	535.4	461.2	499.6	7.2	7.7	14.9
	Calcrease.						
11552	Maltbie Chem. Co.	621.4	570.0	590.9	5.2	3.5	8.7
	Calomel.						
11575	Buffington Pharm. Co. (1/10 gr.)	86.2	70.7	77.1	11.8	8.3	20.1
11573	Drug Products Co. (1/10 gr.)	89.4	72.7	76.7	16.6	5.2	21.8
11627	Harvey Co. (1 gr.)	126.8	111.5	119.9	5.8	7.0	12.8
11611	Moore & Co. (1/10 gr.)	38.4	28.2	36.2	6.1	22.1	28.2
11568	National Drug Co. (1/10 gr.)	87.2	73.6	79.3	10.0	7.2	17.2
11559	E. L. Patch Co. (1 gr.)	148.8	134.2	141.2	5.4	5.0	10.8
11609	Tailby-Nason Co. (2 grs.)	169.5	153.2	161.7	4.8	5.3	10.1
11586	Yates Drug & Chem. Co. (1/10 gr.)	98.5	84.5	94.9	3.8	11.0	14.8
11603	" " " " (1/10 gr.)	110.9	90.1	106.3	4.3	15.2	19.5
11557	" " " " (1/10 gr.)	99.6	90.0	95.8	4.0	6.1	10.1
11595	" " " " (¼ gr.)	100.9	90.1	96.8	4.2	6.9	11.1
11614	" " " " (¼ gr.)	95.5	86.2	91.1	4.8	5.4	10.2
	Calomel & Soda.						
11571	Independent Pharm. Co. (¼ gr.)	130.2	116.5	124.3	4.7	6.3	11.0
11570	E. L. Patch Co. (½ gr.)	166.9	150.0	160.3	4.1	6.4	10.5
11606	Yates Drug & Chem. Co. (1/10 gr.)	129.6	121.9	126.5	2.5	3.6	6.1
	Cascara Compound.						
11607	E. L. Patch Co.	199.6	165.9	181.5	10.0	8.6	18.6
	Cathartic Compound.						
11578	Daggett & Miller Co.	443.9	410.2	430.3	3.2	4.7	7.9
11452	National Drug Co.	346.1	320.0	332.0	4.2	3.6	7.8

TABLE XIX.—VARIATIONS IN THE WEIGHTS OF MEDICINAL TABLETS—*Continued.*

Station No.	Name of Tablet.	Weight per tablet. Maximum. mgms.	Minimum. mgms.	Average. mgms.	Maximum variation. Above average. Per cent.	Below average. Per cent.	Total. Per cent.
	Cold Tablets.						
11576	Buffington Pharm. Co.	269.6	252.8	263.1	2.5	3.9	6.4
11618	Moore & Co.	462.2	415.4	446.4	3.5	7.0	10.5
	Hammond's Tonic.						
11560	E. L. Patch Co.	100.8	95.8	98.9	1.9	3.1	5.0
	Headache Tablets (Acetanilid).						
11608	Brewer & Co. (3.5 grs.)	477.8	452.7	462.3	3.4	2.1	5.5
11626	National Drug Co. (3.5 grs.)	403.9	375.9	389.2	3.9	3.4	7.3
11444	" " " (3 grs.)	459.8	438.5	446.1	3.4	1.7	4.8
11622	E. L. Patch Co. (2 grs.)	254.4	227.2	240.3	5.9	5.5	11.4
11620	Surg. & Phys. Supply Co. (2 grs.)	349.8	298.7	328.8	6.4	9.2	15.6
11583	Tailby-Nason Co. (2 grs.)	233.4	198.4	223.0	4.7	11.0	15.7
11601	" " " (2 grs.)	230.6	202.6	221.2	4.2	8.4	12.6
11605	Yates Drug & Chem. Co. (2.5 grs.)	362.7	341.6	350.6	3.2	2.6	5.8
	Hexamethylene tetramine.						
11598	Daggett & Miller Co. (5 grs.)	706.7	676.9	694.7	1.7	2.6	4.3
11612	Yates Drug & Chem. Co. (5 grs.)	338.2	311.8	323.6	4.5	3.6	8.1
	Hypophosphites Compound.						
11599	Daggett & Miller Co.	177.9	150.2	161.4	10.2	6.9	17.1
	Iodized Calcium.						
11449	Daggett & Miller Co. (1 gr.)	111.0	91.5	101.7	9.1	10.0	19.1
	LaGrippe Tablets.						
11624	Harvey Co.	405.9	350.2	380.4	6.7	7.9	14.6
	Mercury Protoiodid.						
11602	Polk Calder Co. (¼ gr.)	102.5	97.0	99.1	3.4	2.1	5.5
	Myalgie.						
11566	Daggett & Miller Co.	419.4	383.2	406.6	3.1	5.8	8.9
	Neuralgie.						
11610	Yates Drug & Chem. Co.	324.2	309.5	317.9	2.0	2.6	4.6
	Phenolphthalein.						
11581	G. F. Harvey Co. (2 grs.)	303.9	276.9	287.2	5.8	3.6	9.4
11589	" " " (2 grs.)	305.2	288.7	297.3	2.7	2.9	5.6
	Phenolphthalein & Calomel.						
11621	Tailby-Nason Co. (1/10 gr.)	109.2	90.9	102.5	6.5	11.3	17.8
	Quinin sulphate.						
11615	Tailby-Nason Co. (2 grs.)	336.9	312.0	322.6	4.4	3.3	7.7
11623	John Wyeth & Bro. (2 grs.)	280.0	256.5	266.3	5.1	3.7	8.8
11590	Yates Drug & Chem. Co. (grs. 2)	234.5	210.0	225.3	4.1	6.8	10.9
	Quinin & Nux vomica.						
11600	Tailby-Nason Co.	195.3	175.9	186.1	4.9	5.5	10.4
	Sodium bromid.						
11574	Buffington Pharm. Co. (5 grs.)	328.2	317.0	324.2	1.2	2.2	3.4
	Sodium salicylate.						
11450	Drug Products Co. (5 grs.)	465.0	376.5	412.6	12.7	8.7	21.4
11569	Maltbie Chem. Co. (5 grs.)	464.5	428.5	451.0	3.0	5.0	8.0
11613	Yates Chem. & Drug Co. (5 grs.)	450.5	425.0	440.9	2.2	3.6	5.8
	Strontium salicylate.						
11580	Drug Products Co. (5 grs.)	407.5	363.0	386.5	5.4	6.1	11.5

TABLE XIX.—VARIATIONS IN THE WEIGHTS OF MEDICINAL TABLETS—*Concluded.*

Station No.	Name of Tablet.	Weight per tablet.			Maximum variation.		
		Maximum. mgms.	Minimum. mgms.	Average. mgms.	Above average. Per cent.	Below average. Per cent.	Total. Per cent.
	Strychnin sulphate.						
11564	Bristol Myers Co. (1/60 gr.).....	86.2	66.0	75.2	14.6	12.2	26.
11440	Independent Pharm. Co. (1/60 gr.)..	114.0	87.8	96.0	18.8	8.5	27.
11597	Progerssive Chem. Co. (1/50 gr.)...	77.8	48.5	67.6	15.1	28.3	43.
11582	The Tracy Co. (1/60 gr.).....	123.2	96.1	109.3	12.7	12.1	24.
11594	Yates Drug & Chem. Co. (1/60 gr.)	106.0	90.9	99.0	7.1	8.2	15.
11604	" " " " (1/60 gr.)	101.0	94.0	96.3	4.9	2.4	7.

Summary.

Fifteen of the 76 samples did not contain the amounts of drugs claimed, allowing a tolerance of 10 per cent. The names of these with their manufacturers were as follows:

Buffington Pharm. Co.
  Cold Tablets.
Daggett and Miller Co.
  Acetasol.
  Ammonium Salicylate Comp.
  Antiseptic Tablets No. 2.
  Aspirin Tablets.
  Tabs. Hypophosphites Comp.
  Myalgie (Dr. Harvey).
Drug Products Co.
  Sodium Salicylate.
  Strontium Salicylate.
The Harvey Co.
  Elixir Lactated Pepsin.
National Drug Co.
  Cathartic Compound.
B. F. Noyes Co.
  Aspirin Compound.
Progessive Chemical Co.
  Strychnin Sulphate.
Tailby-Nason Co.
  Calomel Tablets.
John Wyeth and Bro.
  Quinin Sulphate.

Or to summarize the whole inspection, of 111 samples of tablets 22 were deficient, and of 18 samples of solutions 8 were unsatisfactory.

Variations in the Weights of Tablets.

This subject having been discussed at some length in our Report for 1916, only a summary of the results will be discussed here. We now have data on the variations in weight of 111 samples of tablets. While in some cases these are remarkably uniform in weight, in others the variations are so great as to indicate very careless manufacture. Table XIX gives the detailed results on this year's samples.

TABLE XX.—VARIATIONS IN MEDICAMENT IN TABLETS.

Station No.	Name of Tablet.	Amount declared. grs.	Amount found.			Maximum Variation from Claim.	
			Maximum. grs.	Minimum. grs.	Average. grs.	Above.	Below.
						%	%
11588	Ammonium Salicylate Comp.						
	Ammonium salicylate.....	2	1.90	1.70	1.78	0	15.0
	Caffein.....	1	0.94	0.84	0.88	0	16.0
	Acetanilid.....	1⅓	1.35	1.21	1.26	1.5	9.0
11577	Antiseptic Tablets No. 2.						
	Corrosive sublimate.....	7	5.78	4.94	5.24	0	29.4
11619	Antiseptic Tablets No. 1.						
	Corrosive sublimate.....	7.3	7.41	7.08	7.17	1.1	3.0
11558	Antiseptic Tablets No. 1.						
	Corrosive sublimate.....	7.3	7.79	7.63	7.72	6.7	4.1
11447	Antiseptic Germicide.						
	Mercuric iodid.....	⅜	0.361	0.326	0.343	0	13.1
	Potassium iodid.....	⅜	0.512	0.463	0.487	36.5	0
	Sodium bicarbonate.....	6	16.88	15.14	15.94		
11445	Arsenious Iodid Compound.						
	Potassium iodid.....	2	1.91	1.70	1.82	0	15.0
11587	Aspirin.						
	Aspirin.....	5	3.70	3.50	3.59	0	30.0
11567	Aspirin.						
	Aspirin.....	5	4.66	4.44	4.55	0	11.2
11563	Aspirin Compound.						
	Aspirin.....	1¼	1.15	1.05	1.10	0	16.0
	Strontium salicylate.....	2	1.90	1.75	1.83	0	12.5
	Acetphenetidin.....	1	0.87	0.80	0.84	0	20.0
	Caffein.....	¼	0.235	0.216	0.226	0	13.6
11572	Blaud's Compound.						
	Ferrous carbonate.....	1	1.54	1.38	1.46	54.0	0
	Arsenious acid.....	1/60	0.0160	0.0143	0.0151	0	14.4
	Strychnin sulphate.....	1/60	0.0189*	0.0169*	0.0180*	13.2*	0*
11593	Blaud's Compound.						
	Ferrous carbonate.....	1	0.93	0.87	0.90	0	13.0
	Arsenious acid.....	1/60	0.0168	0.0157	0.0163	0.6	6.0
	Manganese binoxid.....	1	0.98	0.92	0.95	0	8.0
11585	Bronchitis No. 6.						
	Strychnin sulphate.....	1/60	0.0190	0.0164	0.0177	13.8	1.8
	Terpen hydrate.....	2	1.87*	1.61*	1.74*	0*	19.5*
11575	Calomel Tablet Triturates.						
	Calomel.....	1/10	0.109	0.089	0.097	9.0	11.0
11573	Calomel Tablets.						
	Calomel.....	1/10	0.116	0.094	0.099	16.0	6.0
11627	Calomel Tablet Triturates.						
	Calomel.....	1	0.97	0.85	0.91	0	15.0
11611	Calomel Tablets.						
	Calomel.....	1/10	0.109	0.068	0.094	9.0	32.0
11568	Calomel Tablet Triturates.						
	Calomel.....	1/10	0.107	0.091	0.097	7.0	9.0

* Approximate.

TABLE XX.—VARIATIONS IN MEDICAMENT IN TABLETS—*Continued.*

Station No.	Name of Tablet.	Amount declared. grs.	Amount found. Maximum. grs.	Amount found. Minimum. grs.	Amount found. Average. grs.	Maximum Variation from Claim. Above.	Maximum Variation from Claim. Below.
						%	%
11559	Calomel Tablet Triturates. Calomel	1	1.04	0.94	0.99	4.0	6.0
11609	Calomel Tablets. Calomel	2	1.82	1.64	1.73	0	18.0
11586	Calomel Tablets. Calomel	1/10	0.101	0.086	0.097	1.0	14.0
11603	Calomel Tablets. Calomel	1/10	0.108	0.088	0.103	8.0	12.0
11557	Calomel Tablets. Calomel	1/10	0.108	0.098	0.104	8.0	2.0
11595	Calomel Tablets. Calomel	¼	0.253	0.226	0.242	1.2	9.6
11614	Calomel Tablets. Calomel	¼	0.252	0.228	0.242	0.8	8.8
11571	Calomel and Soda Tablets No. 3. Calomel	¼	0.252	0.225	0.240	0.8	10.0
	Sodium bicarbonate	1	1.15	1.03	1.10	15.0	0
11570	Calomel Compound, Tablets No. 6. Calomel	½	0.509	0.456	0.488	1.8	8.8
	Sodium bicarbonate	½(?)	1.93	1.73	1.85	(?)	(?)
11606	Calomel and Soda Tablets. Calomel	1/10	0.107	0.100	0.104	7.0	0
	Sodium bicarbonate	1	1.02	0.96	1.00	2.0	4.0
11578	Cathartic Compound. Calomel	1	1.00	0.92	0.97	0	8.0
11452	Cathartic Compound. Calomel	1	0.78	0.72	0.75	0	28.0
11576	Cold Tablets. Acetanilid	1½	1.39	1.30	1.36	0	13.3
	Caffein citrated	½	0.51	0.47	0.49	2.0	6.0
11618	Cold Tablets No. 2. Quinin sulphate	2	2.05	1.84	1.98	2.5	8.0
11608	Acetanilid Compound Tablets Acetanilid	3½	3.50	3.32	3.39	0	5.1
	Caffein	½	0.50	0.48	0.49	0	4.0
	Sodium bicarbonate	1	1.03	0.97	0.99	3.0	3.0
11626	Acetanilid Compound Tablets No. 4. Acetanilid	3½	3.61	3.36	3.48	3.1	4.0
	Sodium bicarbonate	8/10	0.96	0.90	0.93	20.0	0
	Sodium bromid	1/10	0.091	0.085	0.088	0	15.0
	Caffein citrated	½	0.51	0.48	0.50	2.0	4.0
11444	Acetanilid Compound Tablets No. 17. Acetanilid	3	3.06	2.92	2.97	2.0	2.7
	Caffein citrated	½	0.51	0.49	0.50	2.0	2.0
	Sodium bicarbonate	2	2.02	1.93	1.96	1.0	3.5

TABLE XX.—VARIATIONS IN MEDICAMENT IN TABLETS—*Continued.*

Station No.	Name of Tablet.	Amount declared. grs.	Amount found. Maximum. grs.	Amount found. Minimum. grs.	Amount found. Average. grs.	Maximum Variation from Claim. Above.	Maximum Variation from Claim. Below.
						%	%
11622	Migrain Tablets No. 2. Acetanilid	2	2.13	1.90	2.01	6.5	5.0
	Caffein citrated	½	0.52	0.47	0.49	4.0	6.0
11620	Migrain Tablets No. 3. Acetanilid	2	1.95	1.77	1.84	0	11.5
	Caffein citrated	½	0.48	0.41	0.45	0	18.0
11583	Migrain Tablets. Acetanilid	2	2.09	1.78	2.00	4.5	11.0
	Caffein citrated	½	0.52	0.44	0.50	4.0	12.0
11601	Migrain Tablets. Acetanilid	2	2.06	1.81	1.98	3.0	9.5
	Caffein	¼	0.26	0.22	0.24	4.0	12.0
11605	Headache Tablets (Hawley). Acetanilid	2½	2.61	2.46	2.52	4.4	1.6
	Caffein	½	0.50	0.47	0.48	0	6.0
	Sodium bicarbonate	1	1.07	1.01	1.04	7.0	0
11598	Hex-uro-gen. Hexamethylene tetramin	5	5.65	5.41	5.55	13.0	0
	Acid sodium phosphate	5	4.60	4.41	4.52	0	11.8
11612	Hexaform Tablets. Hexamethylene tetramine	5	5.21	4.80	4.98	4.2	4.0
11624	La Grippe Tablets. Acetanilid	1¾	1.95	1.68	1.83	11.4	4.0
	Caffein citrated	½	0.56	0.48	0.53	12.0	4.0
11602	Mercury Protoiodid Tablets. Mercury protoiodid	¼	0.240	0.228	0.233	0	8.8
11566	Myalgie (Dr. Harvey). Sodium salicylate	2	1.38	1.26	1.33	0	37.0
	Acetanilid	2	1.64	1.50	1.59	0	25.0
	Caffein citrated	½	0.32	0.29	0.31	0	42.0
	Cerium oxalate	½	0.46	0.42	0.45	0	16.0
11610	Neuralgie Tablets No. 5. Acetanilid	2	1.98	1.89	1.94	0	5.5
11581	Phenolphthalein Tablets. Phenolphthalein	2	2.27	2.07	2.15	13.5	0
11589	Phenolphthalein Tablets. Phenolphthalein	2	2.03	1.92	1.98	1.5	4.0
11621	Phenolphthalein and Calomel Tablets. Phenolphthalein	1/10	0.117	0.097	0.110	17.0	3.0
	Calomel	1/10	0.111	0.092	0.104	11.0	8.0
11615	Quinin Sulphate Tablets. Quinin sulphate	2	2.00	1.85	1.91	0	7.5
11623	Quinin Sulphate Tablets. Quinin sulphate	2	1.90	1.74	1.81	0	13.0
11590	Quinin Sulphate Tablets. Quinin sulphate	2	2.25	2.01	2.16	12.5	0
11600	Quinin and Nux Vomica. Quinin	1	0.99	0.89	0.94	0	11.0

TABLE XX.—VARIATIONS IN MEDICAMENT IN TABLETS—*Concluded.*

Station No.	Name of Tablet.	Amount declared. grs.	Amount found. Maximum. grs.	Minimum. grs.	Average. grs.	Maximum Variation from Claim. Above.	Below.
						%	%
11574	Sodium Bromid Tablets. Sodium bromid.....	5	5.06	4.89	5.00	1.2	2.2
11450	Sodium Salicylate Tablets. Sodium salicylate.....	5	5.14	4.16	4.56	2.8	16.8
11569	Sodium Salicylate Tablets. Sodium salicylate.....	5	5.07	4.67	4.92	1.4	6.6
11613	Sodium Salicylate Tablets. Sodium salicylate.....	5	4.85	4.57	4.74	0	8.6
11580	Strontium Salicylate Tablets. Strontium salicylate.....	5	4.80	4.27	4.54	0	14.6
11564	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0174	0.0134	0.0152	4.2	19.8
11440	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0192	0.0147	0.0161	15.0	12.0
11597	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/50	0.0095	0.0059	0.0082	0	70.5
11582	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0173	0.0135	0.0154	3.6	19.2
11594	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0169	0.0144	0.0158	1.2	13.8
11604	Strychnin Sulphate Tablets. Strychnin sulphate.....	1/60	0.0161	0.0149	0.0153	0	10.8

Below is shown a comparison of between Kebler's results in 1914 with 231 lots and our own with 111 samples.

	Kebler. Per cent.	Connecticut. Per cent.
Showing variation less than 10%...	43	44
" " more " 10%...	57	56
" " " " 12%...	44	35
" " " " 15%...	28	26
" " " " 20%...	9	10

The results of the two inspections are strikingly similar.

Twelve of our samples show total variations in weight of 20 per cent. or over. The fact that eight of these contained such potent drugs as corrosive sublimate, acetphenetidin, nitroglycerin and strychnin sulphate, makes the discrepancy a matter of considerable gravity.

Variations in Amount of Medicament in Tablets.

It is of even greater importance, however, to ascertain how closely the composition of the tablets conforms with that claimed

for them on the label. In securing these data it has been necessary to assume that the tablets are of uniform composition, and that the manufacturer has carefully prepared his mix before passing it through the machines. The small quantity of medicament in certain tablets makes the analysis of individual tablets of such drugs almost an impossibility. In the table which follows, therefore, it has been assumed that all the tablets in any one sample were chemically the same and the amounts of medicament recorded for the heaviest and lightest tablets have been calculated from the analysis of a composite of 10, 25 or more tablets. Table XX gives the detailed results in this respect on this year's samples.

Considering the variations both above and below the claimed amounts, we find a wide range, from 54.0 per cent. above to 70.5 per cent. below. The following is a summary of these variations in both directions in the 111 samples:

	Number.	Per cent. of total determinations.
Variations less than 5%.....	169	55
" from 5.00–9.99%.....	56	18
" " 10.00–14.99%...	40	13
" " 15.00–19.99%...	22	7
" " 20.00–29.99%...	10	3
" " 30.00–50.00%...	8	3
" over 50%.....	4	1

That is, 27 per cent. of all the drugs determined varied from the claimed amount by more than 10 per cent. and 14 per cent. by more than 15 per cent.

In the smaller tablets a slight variation causes a relatively large percentage variation, and possibly a comparison based on grains of active drug present is more illuminating. On this basis the following variations from claim are shown:

	Claimed. grs.	Found. Max. grs.	Found. Min. grs.	Maximum Variation. from Claim. grs.	Maximum Variation. from Claim. Per cent.
Acetanilid.....	1.33	1.35	1.21	—0.12	— 9.0
"	1.50	1.30	1.30	—0.20	—13.3
"	1.75	1.95	1.68	+0.20	+11.4
"	2.00	2.13	1.50	—0.50	—25.0
"	2.50	2.61	2.46	+0.11	+4.4
"	3.00	3.06	2.92	—0.08	— 2.7
"	3.50	3.61	3.32	—0.18	— 5.1
Acetphenetidin.....	1.00	0.87	0.80	—0.20	—20.0
Ammonium salicylate...	2.00	1.90	1.70	—0.30	—15.0

	Claimed.	Pound. Max.	Pound. Min.	Maximum Variation from Claim.	
	grs.	grs.	grs.	grs.	Per cent
Arsenious oxid	0.0167	0.0168	0.0143	—0.0024	—14.4
Aspirin	1.25	1.15	1.05	—0.20	—16.0
"	5.00	4.66	3.50	—1.50	—30.0
Caffein	0.25	0.260	0.216	—0.034	—13.6
"	0.50	0.50	0.47	—0.03	— 6.0
"	1.00	0.94	0.84	—0.16	—16.0
Caffein citrated	0.50	0.56	0.29	—0.21	—42.0
Calomel	0.10	0.116	0.068	—0.032	—32.0
"	0.25	0.253	0.225	—0.025	—10.0
"	0.50	0.509	0.456	—0.044	— 8.8
"	1.00	1.04	0.72	—0.28	—28.0
"	2.00	1.82	1.64	—0.36	—18.0
Cerium oxalate	0.50	0.46	0.42	—0.08	—16.0
Corrosive sublimate	7.00	5.78	4.94	—2.06	—29.4
" "	7.30	7.79	7.08	+0.49	+6.7
Ferrous carbonate	1.00	1.54	0.87	+0.54	+54.0
Hexamethylene tetramine	5.00	5.65	4.80	+0.65	+13.0
Manganese binoxid	1.00	0.98	0.92	—0.08	— 8.0
Mercury iodid	0.375	0.361	0.326	—0.049	—13.1
Mercury protoiodid	0.25	0.240	0.228	—0.022	— 8.8
Phenolphthalein	0.10	0.117	0.097	+0.017	+17.0
"	2.00	2.27	1.92	+0.27	+13.5
Potassium iodid	2.00	1.91	1.70	—0.30	—15.0
Quinin sulphate	1.00	0.99	0.89	—0.11	—11.0
" "	2.00	2.25	1.74	—0.26	—13.0
Sodium bicarbonate	0.80	0.96	0.90	+0.16	+20.0
" "	1.00	1.15	0.96	+0.15	+15.0
" "	2.00	2.02	1.93	—0.07	— 3.5
Sodium bromid	0.10	0.091	0.084	—0.015	—15.0
" "	5.00	5.06	4.89	—0.11	— 2.2
Sodium phosphate, acid	5.00	4.60	4.41	—0.59	—11.8
Sodium salicylate	2.00	1.38	1.26	—0.74	—37.0
" "	5.00	5.14	4.16	—0.84	—16.8
Strontium salicylate	2.00	1.90	1.75	—0.25	—12.5
" "	5.00	4.80	4.27	—0.73	—14.6
Strychnin sulphate	0.0167	0.0192	0.0134	—0.0033	—19.8
" "	0.0200	0.0095	0.0059	—0.0141	—70.5
Terpen hydrate	2.00	1.87	1.61	—0.39	—19.5

While the composition of the tablets agrees as a rule very satisfactorily with that claimed, the above table shows that the individual variations are far too wide. Moreover, the maximum variation is more often below than above the amount claimed, only 9 of the 47 drugs determined showing a maximum above the claim.

These variations for the whole 111 samples of tablets may be summarized as follows:

	Number.	Per cent.
Variation less than 5%	11	13
" " " 10%	30	37
" " " 15%	47	57
" " " 20%	62	75
" " " 30%	73	89
" " " 50%	78	95
" more " 50%	4	5

In other words, in more than one-third of the determinations the variation from the claim amounts to over 10 per cent. in more than one-half to over 15 per cent., in one-fourth to over 25 per cent., while in 4 drugs the maximum variation amounts to from 54 to 70.5 per cent.

Judging by examinations made by Kebler and by ourselves in past years, tablets taken from the stocks of druggists show quite as great variations as these. It is the tablets themselves we criticize, not the persons who happen to sell or dispense them.

TOILET PREPARATIONS.

At the last session of the Legislature an act was passed forbidding the use of wood alcohol in any preparation intended for internal or external use; and if used in products intended for technical purposes a poison label on the container is required.

To test the observance of this law the Dairy Commissioner submitted 25 samples of toilet preparations taken from the stock of dealers in barbers' supplies. The results of our examination of these are given in Table XXI.

Twelve of the 25 samples contained wood alcohol in amounts ranging from about 11 per cent to 84.80 per cent. Not only was this use of wood alcohol illegal, but in no instance was its presence in these samples stated on the label. Sample **12216,** although claiming 90 per cent. methyl alcohol, contained only 39.20 per cent. alcohol all in the form of ethyl. Sample **12209** claimed " menthol " alcohol, whatever that is, and contained 39.56 per cent. methyl alcohol. Five samples claimed to be bay rum, which if of standard quality should contain about 58 per cent. of grain alcohol; they actually contained 30.64 per cent. alcohol (28 per cent. of which was methyl), 15.00 per cent. grain alcohol (30 per cent. claimed),

TABLE XXI.—TOILET PREPARATIONS.

Sample No.	Dealer.	Brand.	Specific gravity @ 15.6° C.	Total alcohol by vol.	Per cent. of total alcohol in form of methyl
12205	A. Amico, Seymour	Imported Bay Rum (C. A. Johnson, New Haven)	0.9536	39.64	28.83
12206	" " "	Bayryber Toilet Water (F. J. Mangini, Waterbury)	0.9496	40.60	100.00
12214	T. Baker, Danbury	Unexcelled Herb Rub (Rich. Lenroth, Jersey City)	0.9778	21.96	0
12215	Frank Dieli, Bridgeport	Bouquet de Fleurs	0.9974	3.00	0
12216	" " "	Circassian Hair Dressing	0.9610	39.20[1]	0
12217	" " "	Domestic Bay Rum	0.9811	15.00[2]	0
12223	Jos. Fanighetti, Waterbury	Extr. Witch Hazel (C. A. Johnson, New Haven)	0.9877	8.90	0
12207	C. A. Johnson, New Haven	Imported Bay Rum	0.9536	40.32	27.80
12208	" " " " "	Letonneaux Eau de Quinine	0.9193	59.60[3]	0
12209	" " " " "	Bouquet Toilet Water	0.9530	39.56[4]	100.00
12219	G. Lupo, New Haven	Bay Toilet Water	0.9656	27.52	100.00
12220	" " " "	Superior Hair Tonic	0.9562	36.92	100.00
12224	F. J. Mangini, Waterbury	Hoffmann's Hair Tonic	0.9477	43.12	0
12210	A. Palmer, Bridgeport	Quinine Tonic Comp. (Rich. Lenroth, Jersey City)	0.9599	37.56	0
12211	" " "	Glacier Scalp Rub (Rich. Lenroth, Jersey City)	0.9367	48.24	0
12200	N. Seidman, Hartford	Eau de Quinine	0.9678	29.64[5]	47.67
12201	" " "	Sage Head Rub	0.9611	34.20[6]	0
12202	" " "	Floral Bouquet Toilet Water	0.9555	37.92[7]	0
12218	E. F. Stefhan, New Haven	Violet Toilet Water	0.9674	28.36	0
12222	R. F. Surinek, Bridgeport	Remo Bay Rum (Remo Co., Bridgeport)	0.8730	84.80	100.00
12221	" " " "	Remo Quinine Hair Tonic (Remo Co., Bridgeport)	0.9101	70.60	100.00
12212	J. Tavano, Bridgeport	Carnation Hair Dressing (Barber Supplies Co., Bridgeport)	0.9631	29.00	100.00
12213	" " "	Comtesse Aime Bay Rum (Perfumerie Comtesse Aime Paris)	0.9726	23.24[8]	0
12203	E. Warshaw & Co., Bridgeport	Carnation Hair Tonic	0.9636	30.00	100.00
12204	" " " " "	Eau de Quinine Hair Tonic	0.9375	51.32	100.00

[1] Claimed 90% ethyl alcohol.
[2] Claimed 30% grain alcohol.
[3] Claimed 62% alcohol.
[4] Claimed 50% menthol alcohol.
[5] Claimed 50% grain alcohol.
[6] Claimed 45% grain alcohol.
[7] Claimed 40% grain alcohol.
[8] Claimed 25% grain alcohol.

40.32 per cent. (all methyl), 84.80 per cent. ethyl, and 23.24 per cent. ethyl (25 per cent. claimed). Similarly the one sample of extract of witch hazel, which should contain at least 14.25 per cent. of grain alcohol, contained only 8.90 per cent.

The following is a summary of the examination:

Containing wood alcohol:

12205 Johnson's Imported Bay Rum.
12207 " " "
12209 " Bouquet Toilet Water.
12206 Mangini's Bayryber Toilet Water.
12219 Lupo's Bay Toilet Water.
12220 " Superior Hair Tonic.
12200 Seidman's Eau de Quinine.
12222 Remo Bay Rum.
12221 " Quinine Hair Tonic.
12212 Carnation Hair Dressing.
12203 Carnation Hair Tonic.
12294 Warshaw's Eau de Quinine Hair Tonic.

Containing less grain alcohol than standard:

12223 Johnson's Extr. Witch Hazel.

Containing less alcohol than claimed:

12216 Dieli's Circassian Hair Dressing.
12217 " Domestic Bay Rum.
12208 Johnson's Letonneaux Eau de Quinine.
12209 " Bouquet Toilet Water.
12200 Seidman's Eau de Quinine.
12201 " Sage Head Rub.
12202 " Floral Bouquet Toilet Water.
12213 Comtesse Aime Bay Rum.

MISCELLANEOUS DRUGS.

11324. *Watkins Cough Medicine*, The J. R. Watkins Medicine Co., Winona, Minn. "Alcohol 11 per cent., chloroform 4 min. per oz."

Spec. grav. @15.6° C.	1.2352
Alcohol by volume	12.73
Solids	59.08
Ash	0.30
Chloroform	0.67
Sugar	present
Alkaloids	present
Gelsemium	indicated
Saccharin	present
Morphin, opium, cocain	absent

This is a sugar syrup containing alcohol, chloroform, saccaharin and gelsemium.

11325. *Watkins Catarrh Relief*, The J. R. Watkins Medicine Co., Winona, Minn. "2.5 grs. chloterone per av. oz."

Loss — 100°C.	3.43
Chloretone	0.45
Volatile oils, menthol	present
Alkaloids	absent

The above medicine was tested chiefly for the chloretone. The base was a mixture of a non-saponifiable hydrocarbon and a fat.

12225. *Hanford's Balsam of Myrrh*, G. C. Hanford Mfg. Co. "Wood alcohol 84%." This was tested only for methyl (wood) alcohol, of which it contained 88.96 per cent. by volume. Its sale is illegal in this state.

12226. *Elastic Soluble Gelatine Capsules No. 49 Santal Oil, 10 minims*, American Druggists Syndicate, Long Island City, N. Y. Cost $3.25 per 100 capsules. The capsules contained on the average 8.65 minims of santal oil. The oil showed a specific gravity @ 25° C. of 0.9726, an optical rotation of —15.7 @ 20° C. in a 100 mm tube, and contained 95.90 per cent. of total alcohols calculated as santalol.

5583. *Koch's Celebrated Hair Dye.* Sample consisted of two bottles. Bottle 1 contained a clear, yellow liquid which darkened on exposure to the air; it consisted of a solution of pyrogallol in water (2.858 gms. per 100 cc.). Bottle 2 contained a clear liquid with an ammoniacal odor. It consisted of an ammoniacal solution of silver nitrate (0.771 gm. of silver nitrate and 5.75 gms. of ammonia per 100 cc.).

12150. *Silicate of Soda*, dist. by The Talcott Co., Hartford. It contained 28.44 per cent. silicic oxid and 0.04 per cent. suspended matter; sodium was present, and a very slight amount of iron and alumina. **11744.** *Turpentine*, General Naval Stores Co., New York. It had a specific gravity @ 15.6° of 0.8605 and a refractive index @ 20° C. of 1.4685; it had an initial distillation temperature of about 150° and about 93 per cent. distilled under 170°; unpolymerized residue 3.2 per cent. Sample passed.

MISCELLANEOUS SAMPLES SENT BY PRIVATE INDIVIDUALS.

Anzac. A sample of this temperance beer contained 0.25 per cent of alcohol by volume.

Butter. Thirteen samples were tested, of which 8 were genuine, 2 were oleomargarine, 2 were renovated butter, and one contained the excessive moisture of 38.3 per cent.

Butter Color. The sample examined was annatto in oil solution.

Coffee. The single sample tested showed no adulteration.

Coffee Wax. A substance obtained during the refining process for caffein contained water 6.27, ash 2.10, protein (N x 6.25) 19.00, ether extract 71.31, and nitrogen-free extract 1.32 per cent.

Coffee Residue. A residue from the manufacture of Kaffee Hag. The coffee is dry charred before treatment with the solvent, and the solution containing the caffein is filtered this residue being left. It contained

Water	8.57	Nitrogen-free extract	52.11
Ash	10.79	Total nitrogen	1.90
Protein (N x 6.25)	11.88	Total phosphoric acid	0.24
Ether extract	0.25	Potash, water-soluble	4.10
Fiber	16.40		

Confectionery. A sample of *Lolly Pops* suspected of having cuased sickness was examined. No heavy metals or alkaloids were found; the color was a mixture of caramel and a small amount of Orange I.

Cottage Cheese. Old Fashioned Cottage Cheese, made by Benvenuto Farm, West Bloomfield. It contained.

Water	26.28	Ash	1.57
Solids	23.72	Lactic acid	0.76
Protein	17.61	Lactose, etc.	1.38
Fat	2.40		

Cream Nine samples were tested containing from 17 to 39 per cent. of butter fat; two of these contained sucrate of lime.

Fish. Two samples were tested for preservatives with negative results.

Flour. The sample tested was not adulterated.

Grape Juice. A sample suspected of containing poison was found normal in all respects.

Ice Cream. The three samples tested contained from 10.27 to 11.92 per cent. of butter fat.

Maple Syrup. The sample tested contained 66.70 per cent. solids, 0.69 ash and had a Winton lead number of 1.36 (2.04 on dry basis).

Milk. Twenty-four samples were tested, of which 10 were genuine, 12 were below standard, 1 was watered and 1 was both skimmed and watered.

Olive Oil. The sample examined was very largely, if not entirely, peanut oil.

Peanut Butter. A sample sold by the Great Atlantic and Pacific Tea Co. contained the following:

Water	1.93	Fat	45.97
Ash	2.99	Fiber	1.59
Protein (N x 6.25)	28.13	Nitrogen-free extract	19.19

Salt Pork. A sample of the brine and one of the meat itself, each contained boric acid and nitrates.

Semolina. Sample of two cars sold by L. A. Viviano, New York, were analyzed with the following results:

	1st car.	2nd car.
Water	12.53	13.23
Ash	0.70	0.65
Protein (N x 6.25)	13.13	12.63
Fiber	0.27	0.24
Fat	1.14	1.07
Nitrogen-free extract	72.23	72.18

Sludge from Gas Co. The sample contained water 65.00, ash 29.04, organic and volatile matter 5.96, lime 15.94, magnesia 0.91, total sulphuric anhydrid 0.47, water-soluble sulphuric anhydrid 0.35 per cent.

Sugar. Three samples were tested, two of which were not adulterated. The third sample contained 0.86 per cent. of sulphuric acid, probably an accidental contamination acquired during transportation.

Tobacco Dust. The sample tested contained 1.22 per cent. of nicotin.

Vanilla Extract. A sample of *Thompson's Extract of Vanilla,* made by C. S. Lettell and Co., New York, contained 0.185 per cent. of vanillin with no coumarin.

Vinegar. Forty-four samples were tested, of which 31 conformed to the state standard. Three were below standard in acidity, 5 in solids and 4 in both acidity and solids. One sample contained 0.131 gm. of zinc per 100 cc.

Water. The sample tested showed 8.9 parts per million of chlorin, 414.0 parts of sulphuric anhydrid and less than 0.1 part of iron.

Whisky. Two samples were tested which contained no adulteration.

Wine. The single sample tested contained 11.90 per cent. of alcohol by volume.

Alcohol. The sample tested contained 89.7 per cent. of ethyl alcohol by volume.

B-K Bacili-Kil, made by General Laboratories, Madison, Wis. The material was an aqueous solution of alkaline earth and alkali hypochlorites; it contained approximately 3.41 gms. of available chlorin per 100 cc.; calcium, magnesium, sodium, potassium, and hypochlorites present; no heavy metals.

Police Cases. Three suspicious samples of drugs were sent to us by the local police. One was heroin hydrochlorid, one morphin sulphate, while the third was an abortion medicine consisting chiefly of ferrous iron and aloes. No ergot, savin, pennyroyal or alkaloids were detected.

Prescriptions. A sample of 3 gr. phenacetin in powders suspected of substitution was examined; the prescription was genuine. Another prescription supposed to consist of two parts bismuth subcarbonate and one part magnesium peroxid, was tested quantitatively and bismuth, magnesium, carbonates and peroxids were found.

Samples suspected of containing poisons. Twelve samples of this kind were examined. A milk suspected of containing carbolic acid was found to contain that drug. Another suspected milk was found normal in all respects. A sample of suspected raspberry jam contained no alkaloids or heavy metals. A sample of bird pie contained much free yellow phosphorus. A sample of wheat bran was tested with negative results. The contents of a cow's stomach were found to contain zinc; two samples of paint to which it was suspected the cow might have had access contained no zinc, one being a lead pigment and the other a mixture of lead chromate and Prussian blue. A sample of *Baby Buster Scratch Feed* alleged to have caused the death of 45 young chickens, was fed to two chickens for four days with no bad effects. A hen and a rooster, which were suspected of having been poisoned, were examined; no metallic poison was detected; the crops were gorged

with food and greatly distended, the lungs congested; the birds appeared to have died of suffocation rather than of poison. The contents of a dog's stomach were examined and a large quantity of mercury, probably derived from corrosive sublimate, was found. A red powder found scattered in a pig pen was tested for alkaloids and metallic poisons with negative results; iron, lime and sulphates were present in abundance.

Summary of Examinations.

Sampled by Station:

Canned Beans	62	Prepared Flours	6
Bread (weights only)	265	Fruit Juices	5
Bread Materials	56	Infant Foods	2
Breakfast Foods	30	Jelly Powders	3
Brosia Meals	4	Malt Extracts	3
Chocolate and Cocoa	5	Malt Flours	4
Condensed Coffee	1	Temperance Beverages	4
Coffee Substitutes	6	Miscellaneous Foods	17
Cordials	27	Dried Vegetables	18
Diabetic Foods	8	Drug	1
Flavoring Extracts	9		
		Total	536

Sampled by Dairy Commissioner:

	Total.	Adulterated.		Total.	Adulterated.
Butter	14	3	Spices	52	7
Cocoa	1	0	Sugar	5	1
Cream	8	0	Vinegar	40	5
Eggs	6	6	Physician's Drugs	76	15
Hamburg Steak	34	14	Toilet Preparations	25	19
Milk	390	258*	Miscellaneous Drugs	6	1
Sausage	21	5			
			Total	678	334*
Sent by Private Individuals				140	44
Total samples examined				1354	

* Including 118 samples of milk deficient only in solids—not—fat.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

BULLETIN 201 JANUARY, 1918

ECONOMY IN FEEDING THE FAMILY

III

Food Oils and Fats

By E. M. BAILEY

CONTENTS

The Bulletins of this Station are mailed free to citizens of Connecticut who apply for them, and to others as far as the editions permit.

Food Oils and Fats

Chemically all fats resemble one another in that they are combinations of fatty acids with glycerin. Physically they differ in that some are liquid while others are solid. The term "fixed" or "fatty oil" is generally applied to those fats which, at the ordinary temperatures, remain in the liquid condition, but chemical industry has eliminated this natural distinction by the introduction of the "hydrogenating" or "hardening" process which converts liquid oils into the solid state.

As food stuffs fats belong to the same category as sugars, i. e., they are chiefly energy producers, in contrast with protein foods which are, in addition, tissue builders. When taken with other food in the diet, fats (and sugars) have the property of reducing the protein requirements of the body and this is what is meant by their so-called protein-sparing action. The calorific (energy-producing) value of fat is about 2.25 times as great as that of either protein or sugar, and it is practically the same regardless of the particular source of the fat or oil, or whether it be of animal or vegetable origin. By accurate measurement it has been found that one ounce of fat yields 264 calories to the body. On the basis of calorific values, substitutions among fatty foods in the diet may be made with considerable freedom, but personal tolerance, preference, or prejudice, will influence the choice in this as in other types of foods.

Although so nearly alike in energy-producing capacity, the fats show differences in other nutritional aspects. We refer especially to the growth-promoting properties possessed by some fats and lacking in others. It has been shown[1] that butter possesses this peculiar efficiency to a marked degree and that the efficiency resides in the butter fat itself. This shows us an additional and important reason for the effectiveness of milk as a food for children. Other fats show this property, among them beef fat, and, as

[1] Osborne and Mendel Jour. Biol. Chem. **16.** 423–37 1913; ibid **20,** 379–90, 1915.

might be expected from their ingredients, the oleomargarines made of the so-called oleo-oil from beef fat. Lard and olive oil lack this peculiar property, as do those margarines also which are made from the commonly used vegetable fats and hydrogenated oils; as has been shown by Halliburton and Drummond.[1] The particular substances or properties responsible for this phenomenon are obscure, and as yet unidentified components of the fats. They have been detected in other types of food, and for lack of better definition have been called "vitamines" or "accessory diet factors."

Fatty foods not possessing the virtue just mentioned should not, however, be discriminated against on this account when used in the ordinary liberal diet, but it would appear to be inadvisable to eliminate butter entirely from the menu, particularly that of children.

We have referred already to the process of "hydrogenation," by which the physical and chemical characters of fats are modified, the conspicuous physical change being that liquid fats are hardened and converted into solids. The question of the wholesomeness and digestibility of fats so treated at once presented itself. The considerable amount of work which has been done on this subject has not resulted in anything to prejudice us against the use of products so treated. Upon this point Ellis[2] says: "It seems to be generally accepted by those who have investigated the matter, that the hydrogenated oils have as desirable a degree of digestibility as the oils from which they are derived." The debate as to their suitability for food has centered chiefly upon the presence of certain metals, more particularly nickel, which are used in the process of their manufacture. The amounts of nickel retained in the finished product, in the case of some hardened cottonseed oils, has been determined and quantities ranging from .020 to .075 milligrams per kilo (1,000 grams) found. The significance of such figures is better understood by comparing them with the quantities of nickel acquired by various foods prepared in nickel-lined cooking utensils which have been in common use for some years. Spinach contained from 25 to 27 milligrams per kilo; peas, 12 to 16; plums, 35; fruit cooked in 2% acetic acid (about one half the acid strength of ordinary vinegar), 65 to 67; cabbage, 83; sour-kraut, 127; potato, 80. No injurious effects have been attributed

[1] Jour. of Physiol., LI., p 250.

[2] Hydrogenation of Oils, Van Nostrand & Co., 1914, p. 144.

to the use of foods so prepared, yet it is seen that they contain amounts of nickel one thousand or more times greater than has been found in the hardened oils examined. However, it is perfectly obvious that this phase in the production of hydrogenated products should be carefully controlled.

The inspection of foodstuffs such as, of necessity, more and more engrosses the attention of this laboratory, involves tests for purity and tests to determine truthfulness of label or guaranty. When such inspections result in the detection of substances positively poisonous or deleterious to digestion and health, their value from the standpoint of public health is obvious to all. But instances of flagrant and vicious adulteration are largely passing out of the experience of the food control chemist of to-day, so that frequently the results of his labors lie within the realm of public health in its broader sense, which includes public economy. The substitution of one edible oil wholly or in part for another, and the sale of such substitute does not constitute a sin against the consumer's digestion, but it does defraud him of the difference in commercial values between the product he actually gets and that which he thinks he is buying. And now more than ever before he is anxious to protect himself in this direction. It is intended that our analyses should guide the consumer to intelligent purchasing; aid him to a better appreciation of comparative food values, and foster alertness to the deceptions of flashy labels and cunning advertising literature. Particularly at this time we desire to help him to co-operate in the program of economy that is being urged upon us.

These general considerations seem justified, in view of recent inquiries which have come to us on this subject. In addition we shall indicate briefly the source, preparation and composition of the principal fatty foods and summarize our accumulated experience with them. We shall include also some analyses not heretofore published, and some data, not our own, which may be of interest from a culinary standpoint.

Any classification of edible fats on the basis of their domestic uses will necessarily include the same fat in two or more classes, but for convenience we shall group them as follows: (1) Salad Oils. (2) Cooking fats and (3) Butter and its substitutes.

SALAD OILS.

Olive Oil. The oil supplied by the fruit of the olive tree has been used as a food by man since the earliest times. Grown originally in oriental countries, its cultivation and use have extended through Mediterranean countries to South America, and it is now grown to a considerable extent in the United States, notably in California and Arizona.

About 50% of the fleshy part of the olive fruit is oil. The best grades of oil are prepared from fruit picked by hand just before maturity. These are crushed and the oil removed by gentle pressure, the first run being called "Virgin" oil or Sublime. This is generally characterized by a distinct greenish tinge of color due to the chlorophyll which is associated with the oil in the plant cells. Genuine oil may, however, lack this characteristic and may be pale or even deep yellow. Admixtures of peanut, sesame, poppy seed, corn and cottonseed oils with olive oil are much less common than formerly, although blending of inferior grades; i. e., oil obtained from repressings of the olive pulp, with higher grades is practiced to some extent in Europe.

Cottonseed Oil. A keen competitor of olive oil for table use is the refined oil of the cottonseed. Although produced in countries of Europe, Asia and South America, it is essentially an industry of the United States, where methods of refining lead those of other countries. The oil is unfit for use until it has been refined, which process includes deodorizing, decolorizing and "chilling," the latter step removing the high-melting fatty constituent (stearin), which would cause the oil to "cloud" in cold climates.

Corn Oil. In the process of making starch and glucose from maize or Indian corn the germ of the seed is removed. This germ contains about 15% of oil and yields the corn oil now appearing in our market. It is golden yellow in color and has a pleasant odor and taste.

A sample of corn oil examined in this laboratory[1] was found to be mixed with other oils, chiefly cottonseed oil. Thus early has this product been dignified and commercially flattered by adulteration.

Peanut Oil. Next in importance is peanut oil, of which there is an increasing production in the United States. Like cottonseed oil it must be refined before it is marketable as a food oil. The refined oil has a distinct nutty flavor which commends itself to some tastes.

[1] Connecticut Food & Drug Report, 1905, p. 121.

Other Oils. Oils of the poppy-seed, rape, sesame and sunflower are not used alone to any extent in this country, but some of them may occur in admixture with the oils described above, either as adulterants or in legally marked compounds.

The commercial value of the oils described is in about the following order: olive, peanut, corn, cottonseed, the values of the others being intermediate between peanut and corn oils.[1]

Summary of the Results of Our Inspections of These Products.

Between 500 and 600 samples of olive oil have been examined in this laboratory since 1897, chiefly represented by six inspections. The percentage of total adulteration decreased from a maximum of 40% found in 1900, to 13.7% in 1909. It has been found that this product, put up in sealed containers, is freer from adulteration than that purchased in bulk from druggists, although the quality of druggists' goods has shown improvement. The general improvement is due in part to more truthful labeling practiced since 1905.

The following tabulation[2], representing 448 samples, illustrates this point. No figures are given subsequent to 1909, because no representative number of samples has been examined in any one year.

Table I.—Summary of Inspections of Olive Oil.

From	Year	Not found adulterated	Adulterated	Per cent. Adulterated
Grocers	1897	37	23	38.3
	1900	45	28	38.4
	1905	19	0	0.0
	1906	25	0	0.0
	1907	7	0	0.0
	1909	44	0	0.0
Druggists	1897	13	5	27.8
	1900	17	13	43.3
	1905	21	9	30.0
	1906	55	11	16.7
	1907	65	11	14.5

[1] Leach, Food Inspection and Analysis, p. 516.
[2] Conn. Food & Drug Report, 1909–10, p. 214.

The adulterations found in these inspections were cottonseed, sesame and peanut oils. Such admixtures, as we have noted above, do not constitute a menace to health, and, if properly labelled, would not constitute an infringement of law.

Products sold under the name of "Salad Oil" our examinations have shown to consist wholly or in part of cottonseed oil. Such products are legally labelled; they do not purport to be any single oil and are sold under a distinctive name. Our experience has been, however, that they are often sold upon request for olive oil.

No oil other than olive should be sold as "sweet oil."[1]

COOKING FATS.

The fats chiefly used by our grandmothers for culinary purposes were the rendered fats of hogs or beef, known respectively as lard or beef suet. To-day the housewife has a large array of shortening compounds at her disposal. These nearly always appear under trade names but may contain both the animal fats mentioned combined with a vegetable oil, such as cottonseed oil, or they may be entirely of vegetable origin. Other oils mentioned in the preceding section also occur in these compounds; any of them are adaptable to such use.

Our examination of some of the products in this group indicates their essential constituents to be as follows: Cotosuet[2], cottonseed oil and beef fat; Cottolene[3], cottonseed oil and beef fat; Korno[4], corn oil, cottonseed oil and a harder fat like stearin; Waverly shortening[5], beef stearin and cottonseed oil; Crisco, hardened vegetable oil, probably cottonseed; Vegetole, vegetable product containing cottonseed oil; Kuxit, vegetable product having the character of cocoanut fat; Wesson oil, cottonseed oil; Mazola, corn oil. A sample of Lard oil[6], said to have been used for deep frying, was found to contain about half its weight of mineral oil. This mixture is unique for food purposes but common as a lubricant.

Recent analyses of some of these fats are given in Table II.

[1] U. S. Food Inspection Decision No. 139; Conn. Rules & Regulations No. 43.

[2] Connecticut Food Report 1896, p. 23.

[3] Connecticut Food Report 1896, p. 23, 1900, p. 145.

[4] Connecticut Food Report 1906, p. 122.

[5] Connecticut Food Report 1909, p. 278.

[6] Connecticut Food Report 1900, p. 148.

TABLE II—ANALYSES OF COOKING FATS.

No.	Brand.	Moisture.	Protein (N x 6. 25)	Ash.	Fat.	Free fatty acids as Oleic.	Refractometer reading at 40°C.	Reichert-Meissel No.	Halphen test.	Nitric Acid test.
		%	%	%	%	%				
8164	Wesson Oil	0.06	....	....	99.94	0.06	59.5	1.04	Red	Br. yellow
8165	Mazola....	0.00	....	....	100.00	0.17	62.5	0.86	Yellow	Red brown
8166	Vegetole...	0.02	0.38	0.02	99.58	0.15	59.5	0.45	Deep Red	Red brown
8167	Cottolene..	0.02	0.31	0.08	99.59	0.10	56.0	0.48	Deep Red	Red brown
8183	Crisco.....	0.20	0.19	0.05	99.56	0.18	54.7	0.50	Br. yellow	Br. yellow
8184	Kuxit.....	0.31	0.13	0.03	99.53	0.15	37.0	5.03	Yellow	Yellow

The analyses show that the samples contain only traces of moisture and are practically all fat. The percentage of free fatty acid is very low. These are the substances prominently concerned in the changes which result in rancidity. A rancid fat or oil is one in which a part of the fat has been decomposed, by enzyme action it is believed, into free fatty acids and glycerine. The action of light and air upon these fatty acids produces the substances of disagreeable taste and odor associated with rancidity. An excess of free fatty acids does not necessarily indicate rancidity, but the conditions are favorable for rancidity to occur.

Edible fats and oils should be kept in securely closed containers protected from sunlight. Oils are more likely to become rancid than are solid fats. It is claimed as one of the advantages of hydrogenation that fats so treated remain wholesome for long periods.

Particular attention, with respect to the presence of animal fats, has been given to those products claiming to be of purely vegetable origin. In none of them have we found evidence of cholesterol, a characteristic constituent of animal fats. The following appear to be pure vegetable products, as claimed: Wesson oil; Mazola; Vegetole; Crisco; Kuxit.

There are few precise physical or chemical data by which to decide the desirability of one fat over another for culinary use. The housewife learns and decides by her experience which to use, judging by the results obtained. One thing she avoids, however, is the use of "smoky" fats for deep frying. The reason for this is that such a fat or oil "smokes" and gives off disagreeable vapors,

which will be absorbed by the food, before the desired cooking temperature is obtained. A desirable fat for deep frying, then, should have a sufficiently high burning point or smoke test. Blunt and Feeney[1] have determined this for a number of common cooking fats and their results are given here as of interest. The temperatures given indicate the degree of heat acquired by the fat or oil at the time it begins to give off visible fumes or vapors. The degrees have been converted to the ordinary Fahrenheit scale.

TABLE III.

Cottonseed oil (Wesson)	451°
Snowdrift	450°
Crisco	448°
Leaf lard	430°
Butter fat	406°
Leaf lard heated 5 hrs	405°
Bulk lard	381°
Olive oil	347°
Peanut oil (1)	323°
Peanut oil (2)	300°
Cocoanut oil	277°

The recognized temperature for deep frying is 350°—400° F. It is apparent, then, that those fats decomposing below that temperature are not well suited to this particular purpose.

BUTTER AND ITS SUBSTITUTES.

Butter. A typical butter contains about 15% of water and 85% of solids, of which 82.5% is milk fat and 2.5% other milk constituents and salt.

Renovated Butter. Renovated butter is made by melting genuine butter and separating the curd and water-soluble constituents of the original product. The fat so obtained is rechurned with milk or cream, or both, and no other substances added except salt. Like butter, it must contain 82.5% of milk fat. The object of this treatment is to save butter which has become rancid or fallen off from prime quality.

Oleomargarine is a product which varies as to proportionality of ingredients and, to some extent, as to character of ingredients, but generally it consists of oleo oil, neutral lard, butter, milk, cream and salt. Vegetable oils, such as cottonseed oil, may be used in the mixture.

[1] Jour. of Home Economics, 7, p. 535, 1915.

Rigid rules are in force to govern the sale of both renovated butter and oleomargarine, in order to protect the butter industry. The controversy which has existed for many years concerning oleomargarine and butter is unfortunate, as each might well have its proper place in the trade. The tax placed upon oleomargarine has increased the price to the consumer for this perfectly wholesome and nutritious product.

Nut Margarine. There have quite recently appeared upon the market a number of brands of nut margarines. These products consist chiefly of cocoanut fat, with admixtures of cottonseed or other vegetable oils. The fats are churned with milk* and salted, as in the preparation of butter. Color capsules accompany the package for the use of the consumer if he desires to color the product. It is not colored by the manufacturer as he is required to conform to regulations similar to those governing the sale of oleomargarine. The coloring we have found to be the vegetable color annatto, which is largely used for butter coloring.

Our analyses of some of these products are given in Table IV.

The analyses show some variation in water content but none contains excessive amount. All contain over 82.5% of fat. The ash varies considerably, due, in all cases, to the salt added. The free fatty acids are within normal limits for these products. Other tests must be interpreted with the knowledge that hydrogenation modifies them very materially. Nos. 8169 and 8170 are declared to contain 0.1% of benzoate of soda; they did not contain amounts in excess of this figure. No. 8168 made no statement as regards preservative; no preservative was found.

The diagnosis of mixtures of this kind is more difficult for the reason that hydrogenation changes the chemical as well as the physical properties of fats, so that their response to the usual tests is either modified or destroyed.

As we have stated elsewhere in this paper, nut margarines are supposedly composed of vegetable fats only, while in oleomargarine animal fats are used, with or without fats of vegetable origin. As in the case of cooking fats, we have looked particularly for evi-

* The flavor of butter is due to the action of lactic acid-forming bacteria in the milk from which it is churned. Nut margarine fats are ripened with milk to which a culture of such bacteria has been added to impart the flavor of butter. [Pickard. The Am. Food Jour., Jan. 1918.]

TABLE IV—ANALYSES OF BUTTER SUBSTITUTES.

Number	Brand	Moisture.	Protein (N x 6. 25.)	Ash.	Fat.	Free fatty acids as Oleic.	Refractometer reading at 40° C.	Reichert-Meissel No.	Halphen test.	Nitric Acid test.
		%	%	%	%	%				
	Nut Margarine.									
8168	A 1 Brand, Downey Farrell Co., Chicago...	10.84	1.25	4.51	83.40	0.45	40.0	7.00	Deep pink	Brown
8169	Cocoanut Brand, Nucoa Butter Co., Soho Park, N. J.	6.53	0.69	1.58	91.20	0.39	37.2	7.50	Yellow	Brown
8170	Providence Churning Co., Prov., R. I.	11.28	0.75	1.14	86.83	0.47	39.0	6.15	Yellow	Yellow
	Oleomargarine									
8171	Lily, Swift & Co..	1.67	0.56	0.41	97.36	0.74	52.0	1.50	Deep red	Red brown
8172	Premium, Swift & Co.....	2.54	0.63	0.60	96.23	0.63	49.2	0.99	Red	Red brown
8173	Gilt Edge, John F. Jelke Co.	8.52	1.25	1.62	88.61	0.74	49.2	....	Pink	Red brown
9994	Good Luck, John F. Jelke Co.	9.20	1.00	3.08	86.72	0.50	49.3	....	Red	Red brown
8175	Silver Churn, Armour.....	4.90	0.56	1.44	93.10	0.80	51.0	1.30	Deep red	Red brown

dence of animal fats in the nut margarines but with negative results. There is nothing shown by our analyses inconsistent with the claim that they are vegetable products. They are very palatable preparations and may well be substituted for a part of the family butter supply, thereby conserving animal fats.

MILK-BUTTER MIXTURE.

The present is a fruitful time for invention and device designed to appeal to public economy. Such a device is one advertised of late, for which it is claimed that two pounds of butter or table butter can be made from one pound of butter and one pint of milk. While the fine distinction is made that you start with butter and milk and produce "table" butter, no distinction is made between the commercial values of the two substances. Both the expressed and implied thought is that from one pound of butter at (say) 55 cents per pound and one pint (pound) of milk at 7 cents per pint, two pounds of butter or "table" butter are produced, valued at $1.10.

The true story of this economic idea may be simply told by the following table:

Substance.	Composition.	Food Value Calories.	Commerical Value.
1 lb. Butter	85 parts solids, 15 parts water, 82.5 parts fat.	3478	$0.55
1 lb. Milk[1]	12 parts solids, 88 parts water, 4.0 parts fat.	305[2]	0.07
2 lbs. Milk-Butter mixture	97 parts solids, 103 parts water, 86.5 parts fat.	3783	1.10
or per lb. mixture	48.5 parts solids, 51.5 parts water, 43.3 parts fat.	1892	0.55

[1] One pint of milk may be called one pound.
[2] Basis of 4.5% sugar and 2.8% protein.

Whatever the finished product is called, it is watered butter, as a comparison of the composition and food value of the finished product with the original shows. As to the commercial value of the product, if it is worth the combined value of the ingredients, 62 cents, then the cost to the consumer per 100 calories is practically the same as in the original butter, 1.6 cents; if it is worth $1.10, then the consumer pays nearly twice as much; viz., 2.9 cents per 100 calories. The two pounds of mixture will "go as far" as two pounds of butter in the same sense that a pint of milk diluted with a pint of water will go as far as a quart of milk. The same economy will be effected by drinking the pint of milk and serving half portions of butter. This device may be looked upon as an ingenious method for serving half portions.

Connecticut Agricultural Experiment Station

NEW HAVEN, CONN.

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ECONOMY IN FEEDING THE FAMILY

IV

An Experience in Keeping Poultry in the City.

NOTE BY THE DIRECTOR

The following pages give the experience of one of the Station staff in keeping a small number of fowls for more than a year near the center of New Haven.

In connection with the movement now undertaken to encourage families living in cities and large towns to keep very small flocks for their own supply of eggs and poultry, I believe the results of such an experience where the expense and income have been carefully recorded will be of value to many, however different their particular surroundings may be.

This paper is published in the hope that it may aid in this movement for increased food production.

E. H. JENKINS, *Director.*

Poultry Keeping in the City.

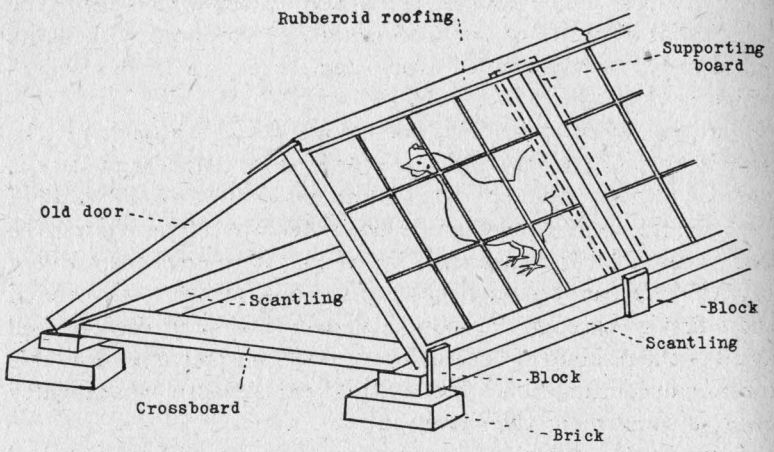
Persons living in cities and large towns have been urged to devote their gardens to the production of food and many have responded to this call by cultivating their backyards. More or less success has attended these efforts, but in many cases the outcome has been distinctly disappointing because sufficient sunshine is rarely available. Under such circumstances no amount of skill or care will avail, because, the sun being the source of all the energy which food supplies, seeds and tubers which form the substantial elements of our food cannot be produced without its aid. In all partly shaded places the crops are largely leaves which have but little food value.

Gardens where sunshine does not prevail throughout the greater part of the day will yield far better returns if poultry is raised and hens kept for eggs, and in this time when all waste of food should be avoided there is no better way of recovering the last scrap of table refuse than by feeding it to chickens. Every particle of meat left on bones from chops, steaks, etc., even if these first go through the soup kettle can thus be utilized, as well as all of the residues of vegetables of all kinds which are unsuitable for human consumption. Food of this kind is exactly what poultry need to supplement their grain rations.

I live in the center of New Haven and last year tried the dual experiment of keeping hens for eggs and raising young chicks, and in order to learn what the return from this form of backyard agriculture might be I kept an accurate account of expenses and returns. Although I had had no experience with poultry I found it distinctly profitable, for not only did I get a good supply of absolutely fresh eggs, but also fowls, roasters and broilers which in quality were equal to the very best that could be bought.

To make such an undertaking pay the first thing to be considered is overhead charges. A few birds cannot meet heavy expenses of this kind. The high board fences on two sides of my garden and a building on a third side made it necessary to buy only enough wire netting to fence in the fourth side. In this way a yard about forty feet square was provided. The building on one side of this

was an old brick barn in one corner of which was a box stall about ten feet square. By cutting a hole through the barn wall on the east side an exit to the hen yard was provided. This opened into a covered runway. For the north side of this runway three old doors that happened to be on hand were used. These were tilted over against a row of old window sash that met them tent-fashion and admitted all the south sun to the runway, the sash being nearly at right angles to the sun's rays. As support for the doors and sashes, pieces of scantling were laid on bricks resting on the ground, the scantling being kept in place by narrow cross boards nailed from one to the other. To make this intelligible the following sketch must be referred to:



Before putting the sashes in place the doors were supported at the proper angle by boards about six inches wide which were nailed to the scantling at the lower end and to the door at the upper end. These boards were so placed that the ends of adjacent sashes rested on them when in place and in this way rain was prevented from running into the cracks between the sashes.

To keep water out at the peak where the sashes rest against the doors, a strip of heavy roofing material was nailed to the doors but not to the sashes. In this way a perfectly tight runway was made at small expense with the sashes unfastened so that they can easily be removed in warm weather. By filling in with earth over the cross boards the ground level inside was raised above that outside and thus kept dry all winter. Owing to the small

space inside this runway a great deal of heat is accumulated in sunny days even in very cold weather, the thermometer on sunny days reaching 80°—100° when the temperature outside is much below freezing. As the earth inside never freezes to any noticeable extent and is always dry the hens dust themselves there all winter. I built this runway or sun parlor in one afternoon. It is about 20 feet long and gives plenty of room for over 30 hens. Of course such a sun parlor can be made of other materials, but probably old doors are as cheap as anything else, for they are tight and require no labor in fitting if all are of the same width. In winter the end of the sun parlor away from the hen house serves as the entrance and thereby draughts in the house are reduced to a minimum. In my old barn I found doors and sashes, as well as all necessary boards and scantling and as the box stall was ready at hand, quarters for my hens cost me only $2.50 which I had to pay for the 40 feet of poultry netting and $1.90 which I paid for the heavy roofing paper and some tar paper which was used to cover the floor of the house.

Not everyone would find so much of the needed materials about his place but with ingenuity similar quarters could probably be provided at small expense. One must be sure to remember that the cost of quarters must be kept small, for it takes a good many eggs even at the present high prices to pay for new boards and skilled carpenters. A large part of the return from the backyard agriculture comes from the chance it gives to a busy man to occupy his mind and leisure moments and to apply his ingenuity and business skill in a field wholly different from his daily routine. I can recommend it to anyone who has a taste for farm life and no other opportunity to gratify it. The labor involved is small but has the disadvantage of being constant. I solved this problem by giving one-quarter of the produce to a young man who lives nearby and seems satisfied with the arrangement and much interested in the experiment.

Just a year ago this venture was initiated by the purchase of twelve Rhode Island Red pullets on December 4th.* These proved to be what the seller represented them to be for they at once began to lay, and on December 7th twelve more were bought from

* Roosters should never be kept in town for they are noisy and have no effect on egg production; furthermore, infertile eggs keep better than fertile ones.

the same party. Being a novice in the business and not having time to spend in an attempt to buy at the lowest price, these cost me $48. Laying well through the winter and spring these hens gradually became broody. After setting three of them with poor success and trying to break up others, it seemed more profitable to kill and eat them as young fowls. Four were kept through the fall to see what they would return in the way of eggs, but up to the present time have laid only sixteen eggs. Under backyard conditions it seems decidedly more profitable to eat the hens as soon as they cease laying; otherwise they "eat their heads off" and, besides, the longer they are kept the greater the loss by death which, under backyard conditions, has been my greatest cause of loss of profit. Poultry should be either growing or laying eggs all of the time, otherwise they will not earn their living. Probably on the farm it pays to keep hens through the second and third year, but under city conditions this is evidently not the case. Owing to the diminishing size of the flock the egg production fell off during the summer, but at this season fresh eggs are relatively cheap. In August 24 White Leghorn pullets, hatched in February and raised at Storrs, were added to the flock in the hope that these might lay during the fall and winter.

The egg production was as follows:

	Number of hens at the end of each month.		Number of eggs.	Value.
1916, December	24		134	$8.30
1917, January	24		106	5.85
February	24		188	9.40
March	23		289	10.80
April	22		312	11.70
May	16		201	9.18
June	12		217	9.90
July	4		159	7.32
August	4 Rhode Island Reds	42	82	3.25*
	24 White Leghorns	40		
September	4 Rhode Island Reds	7	170	8.00*
	24 White Leghorns	163		
October	4 Rhode Island Reds	3	129	9.00
	23 White Leghorns	126		
November	4 Rhode Island Reds	0	136	9.62
	22 White Leghorns	136		
December	4 Rhode Island Reds	6	190	12.67
	20 White Leghorns	184		
			2,313	$114.99

* Part of these pullets' eggs were too small to be marketable, and allowance was made therefor in estimating their value.

A financial statement of this experience in poultry keeping follows:

STATEMENT OF RECEIPTS AND EXPENSES.

Receipts:			
* Eggs (2,313).....	$114.99		
Meat:			
14 fowls...	$24.50		
6 broilers..	7.12		
2 roasters..	4.00		
	35.62		
			$150.61
Expenses (excluding Labor):			
Equipment:			
Tar paper.....	$1.15		
Roofing paper...	.75		
Poultry netting..	7.41		
	$9.31		
Birds bought.....	84.00		
*Feed bought.....	57.40		
			150.71
On hand:			
Birds:			
20 White Leghorn pullets	@ $1.75..	$35.00	
6 R. I. Red pullets	@ 1.50..	9.00	
4 R. I. Red hens	@ 1.50..	6.00	
2 Plymouth Rock pullets	@ 1.50..	3.00	
1 Plymouth Rock cockerel	@ 2.00..	2.00	
		$55.00	
Feed.....		4.50	
			59.50
Gain.....			59.40
			$210.11 $210.11

* Per lists.

The value set on these eggs will seem high to a farmer, but this was estimated on the basis of the cost of strictly fresh eggs delivered at my house and is what it would have cost me to buy them.

Up to this time six of the Rhode Island Reds have died and three have been very sick from canker. These last were cured by vigorous treatment with tincture of iodine. Of the White Leghorns four died. The causes of death were not ascertained with certainty, but two of the Leghorns apparently were "egg-bound."

This is a high death rate, but in a city is probably to be expected, as the sparrows and starlings that abound in towns may easily transfer infection from one place to another. I have succeeded in securing some return from these pests by trapping and feeding them to the chickens. Both sparrows and starlings were eaten with avidity. If back yard poultry raising is to become profitable, every bird that shows any sign of illness should be either quarantined or killed. I have a small quarantine coop and yard for this purpose and very lately by immediately isolating five pullets I prevented what appeared to be roup from spreading and saved all my infected birds.

During the late spring three hens were set on Rhode Island Red eggs, but the hatchings were poor as only eighteen chicks were obtained. All of these lived and grew vigorously. They were kept separate from the laying hens by fencing off a part of the lawn with poultry netting kept in place by dahlia stakes driven into the ground. A gate was hinged to a tree on one side and to a post firmly set on the other. In this way no injury was done to the lawn and the poultry netting and gate were later removed in a few minutes. A great many people living in cities have ideal places of this kind for raising young chicks, for trees and shrubs afford the shade they need and where there is not enough sunshine for a successful garden there is plenty of sun for chicks. Of the eighteen chicks thus raised nine were cockerels. Of these latter six were killed for broilers when three months old. As they had grown at the maximum rate they weighed nearly three pounds each when dressed and although large for broiling they were excellent when thus cooked, far superior to the ordinary under-fed farm chicken usually sold in the markets. Two of the remaining cockerels were killed when about five months old and weighed almost six pounds each, dressed. These made as fine roasting chickens as were ever eaten. The secret of success in raising such birds for the table is to give them plenty of food, both dry mash and scratch feed, as well as all the waste soup meat and similar refuse from the kitchen. They should also have plenty of lawn to range over for chickens need much grass and other fibrous vegetable food if they are to remain healthy and grow fast. The faster they grow the cheaper and better their meat. As grass usually grows fast in summer, a lawn furnishes a large amount of this kind of food without suffering damage. For the table only the large

varieties of chickens should be raised, such as Rhode Island Reds, Plymouth Rocks, White Wyandottes, etc. The hens of all these breeds are good layers and the pullets should be kept for this purpose.

Now as to the costs excluding labor:

Dec.	7, 1916,	100 lbs. corn	$2.35
		10 lbs. oyster shells	.10
		grit	.60
Feb.	1, 1917.	100 lbs. corn	2.35
		25 lbs. oyster shells	.25
March	31,	100 lbs. corn	2.55
April	20,	3 sittings eggs	1.50
May	11,	50 lbs. chick food	2.10
	20,	100 lbs. corn	3.00
June	10,	200 lbs. corn	6.00
	13,	grit	.15
		oyster shells	.10
	18,	50 lbs. chick food	2.15
July	1,	50 lbs. chick food	2.20
	20,	50 lbs. chick food	2.00
		50 lbs. scratch feed	2.00
		insect powder	.15
Aug.	15,	100 lbs. scratch feed	4.40
Oct.	10,	50 lbs. scratch feed	2.30
Nov.	1,	25 lbs. scratch feed	1.20
	8,	100 lbs. scratch feed	4.30
		100 lbs. mash	3.60
		25 lbs. meat scrap	1.25
Dec.	8,	100 lbs. scratch feed	4.30
		100 lbs. wheat	4.50
		1 bale oat straw	2.00
			$57.40

As no charge has been made for labor and as the equipment cost less than $10, because so much old material was used, the financial results of this experiment are not very inviting to one who views the problem of backyard poultry farming from a purely financial standpoint. Viewed from the point of food production, however, the results of these efforts are in my opinion far greater than from backyard vegetable gardening, for I have also tried

that with much greater success than most of my friends have had, largely owing to exceptional conditions.

This is the experience of a greenhorn and doubtless some other greenhorn might have better luck, but however that may be I produced a good deal of real food at a considerable profit per hen. In an undertaking of this sort one must count his reward for the labor involved as consisting in a pleasant out-door occupation and the satisfaction that his pleasure has resulted in an increase in the food supply instead of a decrease, as results from most other forms of amusement.

The experience gained in this experiment has convinced me that by raising young chicks in backyards by those who have grounds with sufficiently extensive lawns a relatively large amount of food can be produced and that this is the most productive use that can be made of such places. Many people have lawns shaded with trees and shrubbery which they do not wish to destroy by converting them into vegetable gardens. Furthermore, such places are usually so shaded that seed, fertilizer and labor are wasted and no useful purpose is served by planting. These back lawns are ideal places for young chicks and the younger members of the family can find no more useful occupation than in caring for them. It surprised me to find how chickens throve on my back lawn and how well the lawn appeared after they were removed in the fall. Next summer I shall try to raise at least 100 chicks on my lawn.

I would buy good vigorous incubator chicks instead of raising them under a hen, if I did not fear that cats and rats would destroy them unless watched and protected by a mother hen. In any event I shall give each hen as many chicks as she can cover and if necessary I shall buy some hens with broods early in the season and reinforce these broods with incubator chicks.

Where the premises are restricted in area and do not include lawns of considerable size it would be inadvisable to undertake the rearing of chicks. Under such conditions efforts should be limited to egg production.