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A Picture of the Dairy Industry

BY C. W. LARSON



MARKETING DAIRY PRODUCTS LESSON 1

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THE MAN WHO CONDUCTS THIS LESSON



Carl W. Larson

Now Chief of the Dairy Division, Bureau of Animal Husbandry, U. S. Department of Agriculture, Professor Larson is in a position, as perhaps no other man is, to give a clear picture of the dairy industry. This is because he has reached his present position through a rather extensive series of positions, all bearing on the same subject.

Beginning with the degree of Bachelor of Science of Agriculture at the Iowa State College in 1906, he received the degree of Master of Science at the Pennsylvania State College in 1913, and the degree of Doctor of Philosophy at Columbia University in 1916.

His teaching experience includes work as an instructor in dairying at the Pennsylvania State College from 1907 to 1909. In 1909 he was made Assistant Professor, and in 1913, was made Professor in Charge of the Department.

At Columbia University he held a position as Assistant Professor of Agriculture and Agricultural Economics.

In 1917, he joined the U. S. Department of Agriculture as Assistant Chief of the Dairy Division, Bureau of Animal Industry, and in 1921 he was made Chief of the Division.

Dr. Larson's work takes him to all parts of the country into those sections where dairying is the principal type of farming. His work also keeps him in touch with dairy manufacture, which is such a large part of the dairy industry.

You have a right to look forward to the study of this lesson with a great deal of pleasant anticipation, because Dr. Larson is both ideally prepared in his experience and naturally gifted as a writer. you will find his lesson both interesting and clear.

SUMMARY OF DR. LARSON'S TRAINING AND EXPERIENCE

EXPERIENCE: Chief, Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture, 1921-

Assistant Chief, Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture (on leave from Columbia) 1917-21

Assistant Professor of Agriculture and Agricultural Economics, Columbia University, 1916-18

Professor in Charge, Department of Dairy Husbandry, Pennsylvania State College, 1913-16

Assistant Professor of Dairying, Pennsylvania State College, 1909-13

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Secretary, Official Dairy Instructors Association

Secretary, Pennsylvania Dairy Union

Delegate to Dairy Congress, Stockholm, 1911

Studied Dairy Conditions in Europe, 1911

AUTHOR: (with Putney) "Dairy Cattle Feeding and Management", 1917; "Milk Production, Cost Accounts, Principles, and Methods", 1916; and several chapters in books and articles in reviews on dairying and economic subjects.

EDUCATION: B. S. A. Iowa State College, 1906; M. S. Pennsylvania State College, 1913; Ph. D. Columbia, 1916

HOW TO STUDY THIS LESSON

Perhaps it has not occurred to you that butter produced in Denmark has anything to do with the price of butter produced in Fond du Lac, Wisconsin. If you have not thought that dairy products are of world importance so far as marketing is concerned, you will be surprised to learn some of the facts contained in Part I.

Spend One Study Period on Part I

Spend plenty of time on Part I. Remember, you must have a broad view of marketing if you are going to accomplish the most. Even though you may be a farmer with only 25 cows, a broad view of marketing will accomplish a great deal more than if your vision does not go beyond the local buyer. It will be worth your while to spend a whole study period on Part I.

Spend Another Study Period on Part II

Part II is very important because such a large percentage of the milk produced in the United States is manufactured into various products before it finally reaches the consumer. While it is true that later lessons are devoted entirely to the subject of manufacturing dairy products, still you must not depend upon those lessons by themselves. You must have the broad picture of dairy manufacture that Part II gives you. Spend at least one whole study period on this particular lesson.

Study Parts III and IV Together

Parts III and IV may be used as the basis for one study period. As a matter of fact, they have a very definite connection with each other because it is the consumption of dairy products on which the future must be based, and if consumption is increasing, it is likely there will be an increasing demand for dairy products.

Perhaps the most important thing to know about the increase in production is that new uses have been found for dairy products. This is an indication that there is a possibility of still more uses to be found.

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A PICTURE OF THE DAIRY INDUSTRY

By C. W. Larson

PART I.

WHY DAIRYING IS SO IMPORTANT IN AMERICA

There is no other agricultural enterprise so important in America as dairying, when you consider the extent and value of the products.

More than 80% of the five million farmers of the United States have dairy cows and are interested in the product they produce. All consumers are interested in the product because it is so important from the standpoint of health and nourishment, and because the cost of dairy products to the consumers amounts to more than three billion dollars annually.

An idea of the extent of the industry may be gained by some comparisons with other lines of agriculture. The farm value of dairy products in 1921 was three times the farm value of the enormous wheat crop of that year.

It would take the farm value, on January 1, 1922, of all of the steers, twice the total sheep, and twice the total hogs, to be equivalent to the farm value of dairy products for the year 1921.

This does not include the beef and veal furnished by the dairy industry which constitutes one-third of the beef and veal supply of the United States. The combined farm value of the wheat crop, the cotton crop, the potato crop, and the oat crop of 1921 does not equal the farm value of dairy products produced that same year.

The handling and manufacture are important parts of this industry. Every city has its milk and ice

cream plants for the preparing and delivery of milk and its products to the consumers. And in addition, there are in the United States 3,761 creameries, 3,748 cheese factories, and 553 condensed-milk plants operated to manufacture the products of milk.

Many Products Made from Milk

Besides the chief products, whole milk, cream, butter, cheese, condensed milk, and ice cream, there are many other products which, though they have not as yet developed to the same extent, are important.

There are being made in this country more than 30 varieties of cheese, many of foreign origin. Sterilized milk and cream are being marketed, also fermented milks of various kinds and varieties; milk powder, cream powder, skim milk powder, buttermilk powder, malted milk, milk sugar, and various casein and albumen products.

A great amount of milk is used in the manufacture of milk chocolate. Semi-solid and dried buttermilk and skim milk products are being manufactured for feeding chickens and hogs. Casein, which is used for sizing paper, the making of glue, and various other products, is also made from milk.

Why Milk Is a Universal Food

It is generally recognized by physicians and nutrition experts that milk is essential for children if they are to develop strong, normal bodies. In prescribing diets for children, one quart per child per day is recommended, and it is commonly stated that no less than a pint of milk should be furnished to each child.

Investigations have shown that milk contains the necessary elements for the building of strong healthy bodies because it is wholesome and readily digested, and because it contains, in addition to the general nutritive materials, recently discovered constituents known as vitamins.

Milk contains protein in large quantities, which is used for the formation of muscle and other tissues in the body. It also contains relatively large amounts of lime which, with the protein, are very important to both muscle and bone building. To furnish heat and power and also to aid in building the fatty tissues of the body, the milk fat and milk sugar are necessary.

RANK OF THE NATIONS OF THE WORLD IN DAIRYING

The United States leads the world in the production of dairy products. But in world commerce, she does not hold so important a place. In the exports of butter, for example, Denmark, Russia, the

Table I. PRODUCTION OF BUTTER (1909-13)

<u>Country</u>	<u>: Millions of Pounds</u>
<u>1. United States</u>	<u>: 1,648</u>
<u>2. Germany</u>	<u>: 881</u>
<u>3. Russia</u>	<u>: 326</u>
<u>4. France</u>	<u>: 286</u>
<u>5. United Kingdom</u>	<u>: 282</u>
<u>6. Denmark</u>	<u>: 257</u>
<u>7. Canada</u>	<u>: 201</u>
<u>8. Australia</u>	<u>: 182</u>
<u>9. The Netherlands</u>	<u>: 147</u>

Netherlands, Australia, France, New Zealand, and Sweden excel our exports in the order named.

There are about 15 countries that have developed dairying on an important scale and which export some butter. The production of the nine most important dairy countries (from the standpoint of production only) is shown in Table I. The countries are arranged in the order of greatest production of butter.

This table is important; familiarize yourself thoroughly with it.

Which Nations Export Most

Denmark leads all nations in the export of butter, although she is sixth in the total production of butter. Russia came second before the war. The figures on her production now are very doubtful, but it is certain that she is not producing very much.

The Netherlands, although ninth in total production of butter, exports the third largest amount. Australia follows as fourth in rank of exports. It is important to note also that New Zealand, a comparatively small island near Australia,

Table II. EXPORTS OF BUTTER (1909-13)

<u>Country</u>	<u>: Millions of Pounds</u>
1. Denmark	210
2. Russia	172*
3. The Netherlands	86
4. Australia	64
5. France	44
6. New Zealand	40
7. Sweden	28
8. United States	15
9. Italy	9

*Before-the-war figures. Russia exports little now (1922).

has exports of butter greater than those of the United States. New Zealand is sixth in the rank of nations, while the United States is eighth. (See Table II.)

This is one of the most important tables in the course. Be sure you are thoroughly familiar with this rank of nations before leaving the table.

Where Our Imported Cheese Comes From

While the United States manufactures a large amount of cheese and exports some, still we are a big importing nation, getting a large part of our imports from France, Greece, Italy, and Switzerland. For example, in 1921 we imported over 9 million pounds of

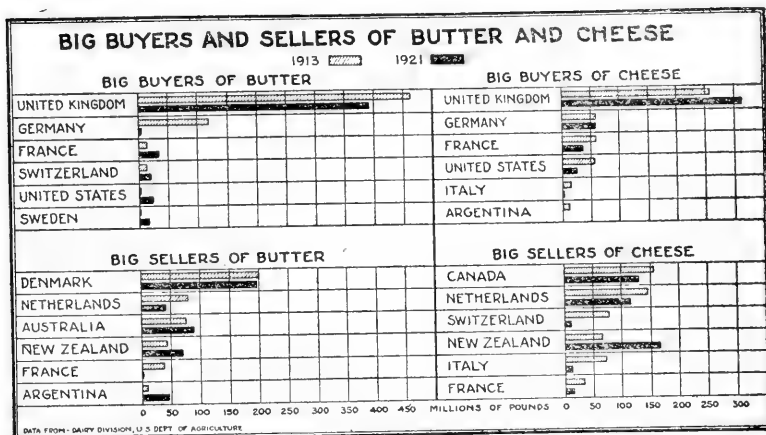


FIGURE 1. THE WORLD'S TRADE IN BUTTER AND CHEESE
The rank of countries varies with different years. This indicates the wide fluctuation in exports. Don't be confused because Table II shows a different rank. It is based on a different period

cheese from Italy, 8 million pounds from Argentina, over 2 million pounds from Switzerland, two million pounds from France, one million pounds from the Netherlands, and 419,000 pounds from Greece.

We Export More Dairy Products Than We Import

Taking dairy products as a whole, the United States is far ahead in the balance of trade. That is, she exports a great deal more than she imports. Considering butter, cheese, and condensed and evaporated milk all together, in 1919 we exported 2 billion 600 million pounds more than we imported.

Who Buys Our Dairy Exports

We have some very good customers close at hand in the so-called Pan-American countries. These countries buy butter, cheese, and condensed milk from us. The principal Pan-American buyers are the following nations (largely in South America): Bolivia, Brazil, British Guiana, Chile, Colombia, Costa Rica, Cuba, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Santo Domingo, Salvador, Uruguay, Venezuela.

The largest percentage of our export butter, 29.8%, was taken by Belgium in 1920. The second largest amount, 22.3%, was purchased by the United

Table III. CONSUMPTION OF BUTTER PER PERSON PER YEAR

<u>Country</u>	<u>:</u>	<u>Pounds Per Year</u>
Canada	:	27.7
Australia	:	25.6
New Zealand	:	21.7
Denmark	:	19
United States	:	17.5
United Kingdom	:	17
The Netherlands	:	16.8
Sweden	:	16.5
Germany	:	14.7
Norway	:	14
Switzerland	:	12.1
Italy	:	2.5
Argentina	:	1.8

Kingdom. The West Indies and Bermudas bought 16.5% of our exports, Canada, 4.9%, Central American States and British Honduras, 4.9%, Mexico, 4.6%, and Venezuela, .1%.

Why Some Countries Have Little Dairying

The reason that dairying is not developed in some countries as much as in others, is because the habits of the people in some countries do not include the use of butter as much as in others. This is illustrated in an interesting way by the figures in Table III showing the amount of butter consumed per person in the following countries:

Notice the wide variation between 1.8 pounds per person and 27.7 pounds.

The consumption of milk varies in somewhat the same way. For example, in Hawaii the population consumes an average of only one gallon of milk per year. Whereas, in Sweden, the average consumption is 69.7 gallons, and in the United States, 43 gallons.

PART II

HOW DAIRY MANUFACTURE HAS DEVELOPED

Besides the importance of milk for children, its products form a large and important part of the diet of the entire population, and the average American family devotes from 15% to 20% of its allowance for food to dairy products.

Dairying is one of the most highly developed forms of agriculture in this country, and practically all of the progress has come during the last century.

The industry has developed from a system of production whereby a large percentage of people derived their dairy products from their own small herds, to the present time when all the benefits of invention and modern science are used in the production of enormous quantities of milk products.

Great expansion has taken place. The qualities of dairy cattle have been wonderfully improved and much better and more uniform products made.

Early Development in Dairying

During the early years of the nineteenth century, the handling of milk and milk products was largely a household duty of farmers' wives. The methods used were simple and the equipment crude.

Very little winter dairying was practiced, and it was the custom to make sufficient quantities of butter and cheese to carry through the winter. Butter was accumulated and put away in the cellars in crocks to

be used during the winter. Without the knowledge of uniform manufacture, and without facilities for proper storing, the butter was very inferior when consumed.

Milk was placed in pans or crocks in cellars, pantries, or kitchens, and the cream was skimmed with a dipper. The cream thus obtained was allowed to accumulate until a sufficient amount for churning was on hand. Each lot of butter was different. This product sold in local markets for from five to eight cents a pound!

Some cheese was made on the farm with the same crude guess-work system, and it was not until after 1850 that rapid progress in the development of the industry began.

What Developed in the Dairy Industry After 1850

In the year 1838, the first milk was hauled into a city by a railroad. Prior to this time, all the cities received their milk supplies from farmers who hauled the milk directly to the consumers. This period, therefore, marks the beginning of the development of our market milk business.

The markets for butter were increasing, and some counties developed a good reputation for their butter.

The production of farm cheese was increasing, but it was not made extensively in factories until the year 1851, when the first cheese factory was established.

During the Civil War, there was little development in dairying and the prices for products were low.

Immediately following the war, however, prices began to advance. Cheese increased from 10 cents a pound in 1860 to 20 cents or more by 1865. Butter had made similar increases.

The demand for cheese in Europe at about that time also stimulated production, and the exports from

this country jumped from 50 million pounds in 1865 to over 100 million pounds 10 years later.

First Creamery Established in 1861

The first creamery was established in 1861, and the manufacture of butter soon increased because a more uniform product was made. The increased price for the products turned the attention of the dairymen to their dairy cattle, and efforts were made to improve their cows and to feed them better. Soon after this, importations of cattle from Europe increased rapidly.

Change from Farm Production to Factory Production

Twenty years after the first cheese factory was started, almost the entire production of cheese had gone from the farm to the factory system. Butter, on the other hand, continued to be made in increasing quantities on the farms, and it was not until 1885 that 100 million pounds of factory butter were produced in a year, while in that year 900 million pounds of farm butter were made.

The peak of farm-butter production was reached in 1900, when more than a billion pounds were made.

Since that time, it has decreased and the factory butter has rapidly increased until now 1 billion 54 million pounds of factory butter are made yearly, in comparison with 600 million pounds of farm butter.

The Invention of Condensed Milk

For several years during the last half of the 19th century, Mr. Gail Borden was experimenting to find a way of preserving milk so that it could be transported long distances without spoiling in warm climates. In 1856 he obtained a patent on his process of condensing milk, and five years later he put upon the market both the sweetened and the unsweetened product. In the early stages of production, the product was shipped in open cans, and it was not until later that the sealed cans were used.

The Influence of the Hand Separator

Up to the time of the introduction of the hand separator, about 1895, the two systems of handling milk for butter making were either to use the shallow pan or gravity system on the farm, or to send the milk to creameries where large centrifugal separators which had been introduced some years previous, were used.

The gravity system required that the milk be kept in several vessels for a long time. Fresh skim milk was not available for calves, and some of the butterfat was lost in the skim milk.

There was also some opposition to hauling the whole milk to the central plants, and then hauling all of the skim milk back, for the plants had no use for the skim milk. This was unnecessary hauling. Furthermore, the skim milk brought back was not always the same skim milk taken from the farm, and often it was not in good condition when returned.

The hand separator for use on the farms was, therefore, a great stimulus to dairy production. It took away much of the drudgery of cleaning and caring for so many pans, furnished fresh milk to the calves, increased the amount of butterfat available, and required that only the cream be hauled to the plants.

This especially encouraged the general farmers of the country to market their surplus cream, and it is largely through the invention of this convenient machine that the system of factories known as "centralizers" developed throughout the middle western part of this country. These factories now produce a large percentage of the creamery butter.

"Centralizer creameries" are large institutions in central locations that buy cream from a wide surrounding territory, sometimes from several states.

The Beginning of Centralizer Creameries

In certain sections, where cream could be assembled from a large territory, plants were established

and cream was shipped from long distances. In many parts of the country, there is not a sufficient quantity of milk produced to furnish a supply for an economical plant, and through a combination of the hand separator and the large factories operated in different railroad centers, the total production of butter in this country has been greatly increased.

There are two systems used by the centralizer creameries. In one, farmers ship direct. And in the other, the cream is assembled in small towns and shipped in larger units from those stations. Because of the distance cream is shipped and the lack of facilities for cooling, some of the product of these plants has been inferior. Grading of cream and improved methods are helping this situation.

Cooperation Now Popular

Cooperation in both the production and sale of dairy products has, perhaps, been practised to a larger extent than with any other agricultural product.

Many of the early cheese factories were run on a cooperative basis. Creameries owned cooperatively by dairymen may be found in all parts of the country. Later, producers cooperated in purchase and use of bulls and in the employment of cow testers to study the costs and efficiency in the management and feeding of herds.

At the present time, there is a tendency for farmers to assemble manufactured products and in some cases, to distribute the milk to consumers.

How the Babcock Tester Put Dairying on a Business Basis

Butterfat in the milk was early accepted as the measure of value of milk for the various products, but up to 1890 there was no simple and accurate way for the determination of the amount of butterfat in milk or cream.

It was in that year that Dr. S. M. Babcock of the Wisconsin Experiment Station patented and gave to the industry his invention which is known as the Babcock Tester, for determining the amount of butterfat in milk products. The method of operation is simple and the results accurate. It was possible with this machine to put dairying on a business basis whereby milk could be paid for on a basis of its butterfat.

Development of Dairy Herds

No breed of dairy cattle was originated in the United States. The cattle sometimes called Native Cattle and those of the western ranges originally came from other countries. Our pure bred cattle have been bred pure in other countries. They have been improved here, and have been used to improve the grade and scrub cattle.

The Beginning of Pure Bred Importations

Among the first cattle to be brought into this country for milking purposes were Short Horns. Much of the blood of this breed is still to be found in dairy herds, though there has been a tendency to increase what is known as "special dairy breeds."

When the last census was taken there were 916,724 pure bred dairy cattle of the various special dairy breeds. Of these, 56.6% were Holstein-Friesians, 25.2% Jerseys, 8.6% Guernseys, 3.3% Ayrshires; 0.9% Brown Swiss, and 5.4% of all other breeds.

Pure Bred Bulls Improve Native Stock

Besides the improvement in our production due to the pure bred cattle, the influence of this pure blood is having an effect upon the entire dairy cattle population, although pure breeds constitute less than 3% of all dairy cattle.

Pure bred bulls are being mated with grade animals, and progress is being made in the increased production of our dairy cattle.

On account of the foot and mouth disease and some other diseases on the continent of Europe, pure bred cattle have been prohibited from coming from there for the last several years. However, some importations have continued from the Channel Islands, Canada, and England.

It is through the specialized dairy herds, made up of cows that have a relatively high production, that the city milk business and specialized dairies for large condenseries and similar plants, are made possible.

The development of better cattle and the devising of better systems of feeding and caring for dairies has materially increased the production and decreased the cost. This is having a favorable influence on the development of the industry.

The Development in Dairy Sanitation

As the cities grew, and milk was transported longer distances, the age of the milk when it reached the consumer was extended until there was difficulty in delivering a satisfactory product.

This, together with the development of the knowledge of bacteriology and the relation of bacteria to health, led to a consideration of the sanitary methods of producing and handling milk.

In the early development of the industry, little attention was given to matters of sanitation, as they are known today. Little was known of the necessity for sterilizing utensils, and for the cleaning of the cows, and for the keeping down of dust, and other forms of contamination.

The First Certified Milk

In 1893 the first certified milk was produced under the supervision of a medical milk commission. The care and supervision required in the production of this milk was too great for general production, but it had a large influence on the changing of practices in dairies generally, and the adoption of practical methods that would insure a better and safer product.

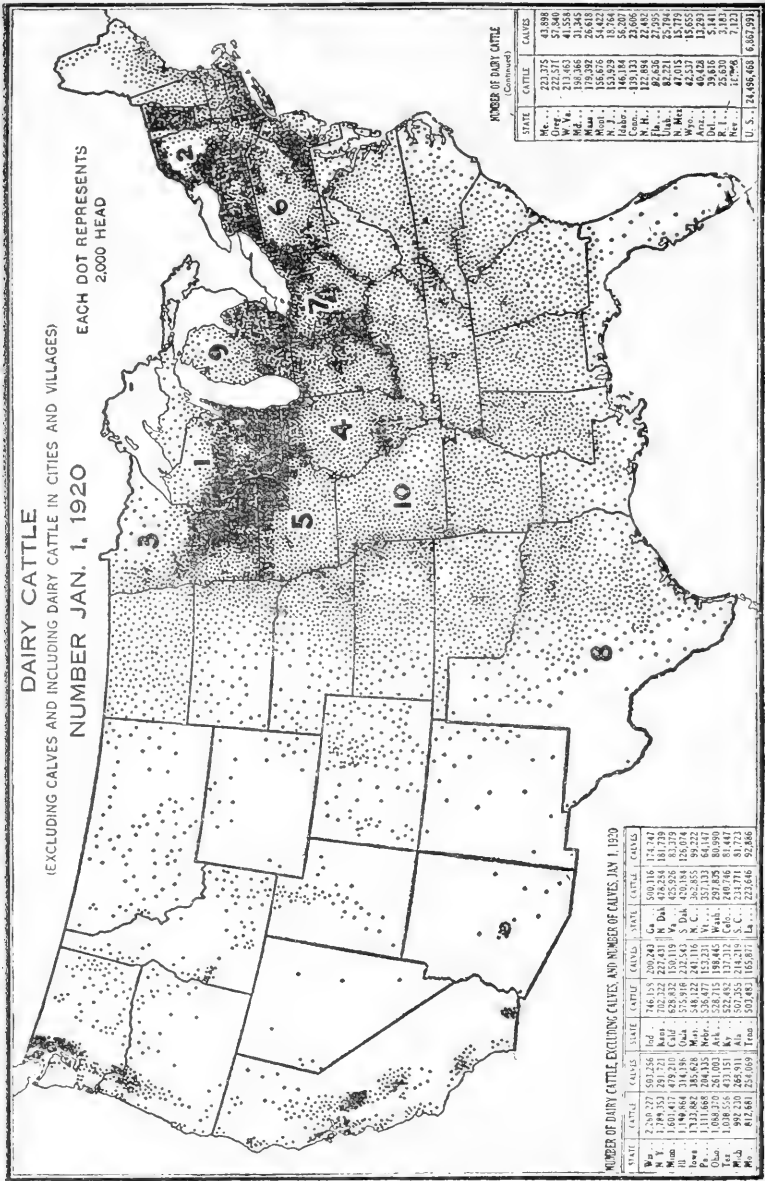


FIGURE 2. WHERE DAIRY CATTLE ARE LOCATED

The dots indicate the location of dairy cattle. The numbers indicate the rank of states in numbers of dairy cattle. Compare this with Figure 3, which shows the value of products sold

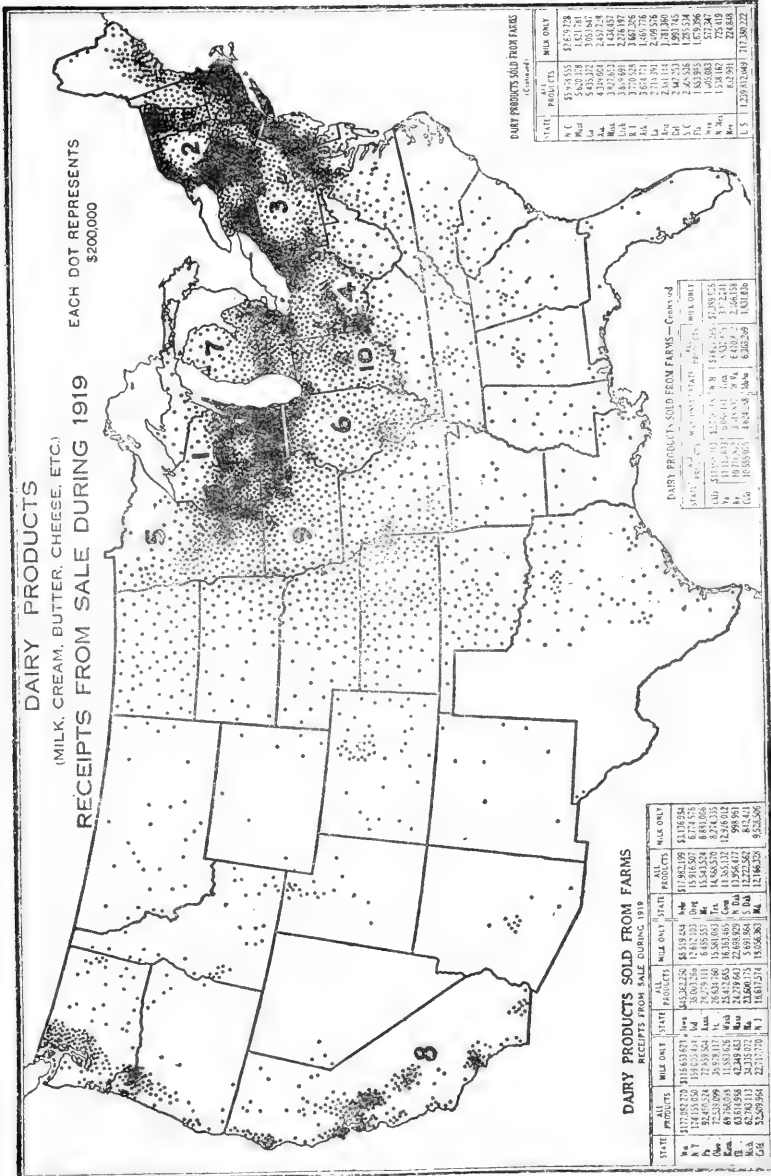


FIGURE 3. VALUE OF DAIRY PRODUCTS BY STATES

Notice how the order of rank is changed from Figure. 2. Evidently the farmers of Pennsylvania and Ohio make more per cow than the farmers of Minnesota and Iowa

Practices which are simple and effective have been put into general use in the important dairy centers. With the milk so produced, it is now possible to assemble milk from a wide territory and still deliver a product of high quality to the consumer.

Dairy Production Grows With Population

The dairy industry of this country has grown and developed as rapidly as has the population and general development of the country. The dairy cows and their products have kept up with our very rapid increase in population, and have extended as our population and industries have gone into new territory, and, altogether, have been adjusted according to the changes and developments of our nation.

Population Grows Faster Than Number of Dairy Cows

However, the demand of the increasing population for dairy products could not have been met in this country by the more or less specialized dairy animals. It was necessary to depend for much of the increase

Table IV. NUMBER OF MILCH COWS IN THE UNITED STATES PER 1,000 PERSONS

1840	.....	287
1850	.....	278
1860	.....	276
1870	.....	234
1880	.....	251
1890	.....	264
1900	.....	237
1910	.....	220
1920	.....	223
1921	.....	218

upon the cattle kept originally and primarily for beef production.

Cows of the special dairy breeds have hardly increased in the same proportion as the population has increased. As will be seen in Table IV, the number of milch cows in the United States per thousand persons decreased from 287 in 1840 to 218 in 1921.

During this time, however, there have been increases in the yield per cow, which would probably make up for the loss in numbers so that it may be assumed that the production of milk has kept up with the increase in population.

Table V. NUMBER OF MILCH COWS ON FARMS FROM 1840 to 1922

Year	Milch Cows on Farms	Year	Milch Cows on Farms
1840	4,837,000	1913	20,497,000
1850	6,385,000	1914	20,737,000
1860	8,586,000	1915	21,262,000
1870	8,935,000	1916	22,108,000
1880	12,443,000	1917	22,894,000
1890	16,512,000	1918	23,310,000
1900	17,136,000	1919	23,455,000
1910	20,125,000	1920	23,722,000
1911	20,823,000	1921	23,594,000
1912	20,699,000	1922	24,028,000

HOW MILK IS UTILIZED

The total annual production of milk in the United States has reached almost 100 billion pounds, and is constantly increasing. The uses of this product are undergoing noticeable changes.

Greater and greater proportions are needed for household consumption because of the rapidly increasing population. Now, more than 45% of the total milk produced is used for direct consumption or for household purposes. A little more than this percentage, or about 47%, is used in the manufacture of the various products of milk.

Four Products Use About 46% of the Milk

The product using the largest amount of milk is butter. Cream from 35% of all the milk produced, is used for butter, and this is divided with 22% for creamery butter and 13% for farm butter. The three other products coming next in importance are: condensed milk, cheese, and ice cream, each using a little less than 4%.

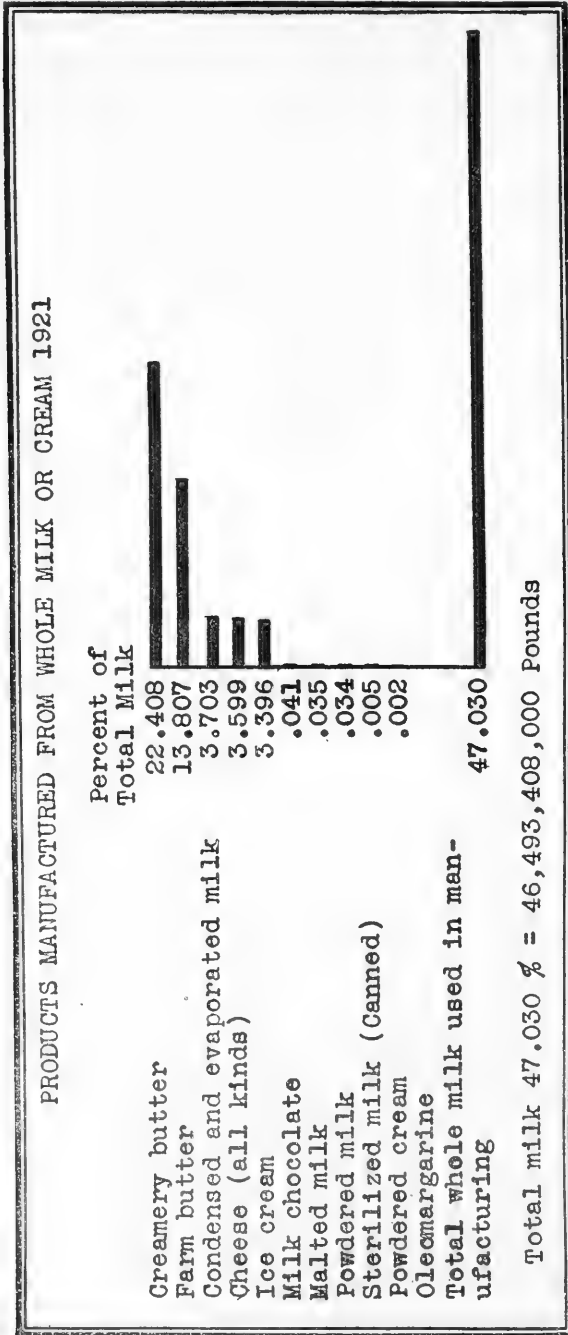


FIGURE 4. THE IMPORTANT MANUFACTURED PRODUCTS

You will see from this chart that most of the milk used in manufacturing is made into only five products—creamery butter, farm butter, condensed and evaporated milk, cheese, and ice cream. The other uses are still comparatively insignificant

Each year, new products are being added, each one affecting somewhat the production of the other products. Although there are no rapid changes from year to year in the relative amounts of milk used for

Table VI. USES OF MILK IN THE UNITED STATES

Use	: Pounds of Whole : Milk Used	: Percent : Of Total
For household purposes	: 45,143,000,000	: 45.660
For manufacturing	: 46,493,408,000	: 47.030
Fed to calves	: 4,260,000,000	: 4.310
Waste, loss, and un-	:	:
specified uses	: 2,965,868,000	: 3.000
Grand Total	: 98,862,276,000	: 100.000

these various purposes, nevertheless there is more variation from year to year depending upon the relative market prices of the various products.

There is a tendency over a period of months for adjustments to take place, so that the advantage of one product over another is largely lost. There are

Table VII. PRODUCTS MANUFACTURED FROM WHOLE MILK OR CREAM, 1921

Product	: Whole milk : used	: Per cent : of total	: Quantity of : product manu- : factured	: Milk : used per : unit of : product
	: Pounds	: Per Cent	: Pounds	: Pounds
Creamery butter	22,153,698,000	22.408	1,054,938,000	21
Farm butter	13,650,000,000	13.807	650,000,000	21
Condensed and evaporated milk	3,660,408,000	3.703	1,464,163,000	2.5
Cheese (all kinds)	3,558,380,000	3.599	355,838,000	10
Ice cream	3,355,000,000	3.396	*244,000,000	13.75
Milk chocolate	40,000,000	.041	:	:
Malted milk	34,434,000	.035	15,652,000	2.2
Powdered milk	33,944,000	.034	4,243,000	8
Sterilized milk (canned)	5,074,000	.005	5,074,000	1
Powdered cream	2,470,000	.002	130,000	19
Oleomargarine	:	:	211,867,000	.065
Total whole milk used in manufac- turing	46,493,408,000	47.030	*Gallons	:

times, however, when one product is out of line, and the production of it is thereby stimulated.

Tables VI and VII show the way in which our milk supply is utilized.

The skim milk and buttermilk, by-products from the manufacture of butter, are not included in this table.

Growth in the Production of Dairy Products

Butter and cheese were the only two manufactured dairy products that were prominent in the dairy business until a comparatively recent time.

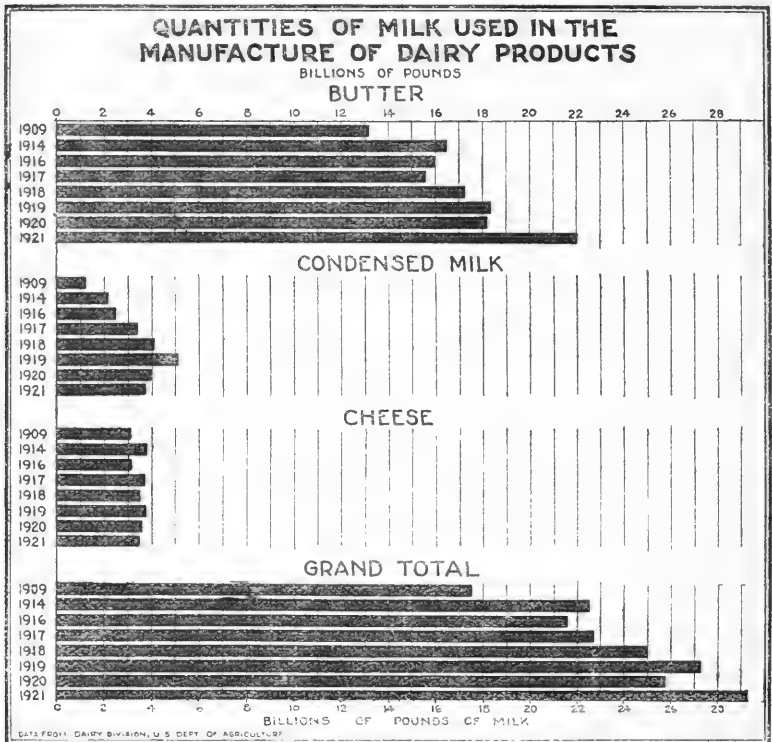


FIGURE 5. FLUCTUATIONS IN MANUFACTURE

This chart indicates a trend toward increased production, but the production from year to year fluctuates rather violently. This is due largely to changes in demand. Some of these violent fluctuations were due to the World War conditions

Both of these products started as farm enterprises, and as recently as 1870, 33% of all the cheese made in the United States was produced on the farm, while at the present time only about 2% is made on farms.

Practically all of our butter was made on the farms up to about 1880, when the factory production

began to increase at about the same rate as farm production.

In 1900, the peak of farm butter production was reached. In that same year, factory butter had gone to about 600 million pounds. During the last 20 years, farm butter has been gradually decreasing, and factory butter increasing.

The manufacture of what is known as sweet cream butter is increasing because of its superior keeping quality and because it can be made more uniform in flavor.

TABLE VIII. TOTAL PRODUCTION OF FARM AND FACTORY BUTTER IN UNITED STATES

Year :	Creamery butter :	Farm-made butter :	Total Butter
1849 :	..... :	313,345,000 :	313,345,000
1859 :	..... :	459,681,000 :	459,681,000
1869 :	..... :	514,093,000 :	514,093,000
1879 :	29,422,000 :	777,250,000 :	806,672,000
1889 :	181,285,000 :	1,024,224,000 :	1,205,508,000
1899 :	420,954,000 :	1,071,745,000 :	1,492,699,000
1904 :	531,478,000 :	..... :	.....
1909 :	627,146,000 :	994,651,000 :	1,621,797,000
1914 :	786,003,000 :	..... :	.....
*1916 :	760,031,000 :	..... :	.....
*1917 :	743,895,000 :	..... :	.....
*1918 :	822,719,000 :	..... :	.....
*1919 :	873,907,000 :	..... :	.....
1919 :	938,505,000 :	707,667,000 :	1,646,172,000
*1920 :	866,662,978 :	..... :	.....
*1921 :	1,057,114,000 :	650,000,000 :	1,707,114,000

*Estimates of Bureau of Markets

Tables VIII, IX, and X give the production of creamery and farm butter, condensed and evaporated milk, and factory and farm cheese.

Increased Use of Milk Powder

The three other products of greatest importance are ice cream, condensed milk, and milk powder. Milk powder production slowly increased up to 1919, when there was a very rapid increase. Since that time, production has dropped back considerably, on account of the decrease in the foreign demand.

Table IX. PRODUCTION OF CONDENSED AND EVAPORATED MILK IN THE UNITED STATES FOR THE YEAR 1919, BY MONTHS

Month:	Sweetened condensed milk	Unsweetened condensed milk	Evaporated whole milk	Sterilized whole milk
1919	Pounds	Pounds	Pounds	Pounds
Jan.	3,838,000	4,875,000	25,898,000	79,440,000
Feb.	4,594,000	3,583,000	39,801,000	86,538,000
Mar.	6,861,000	3,987,000	55,610,000	101,817,000
April	8,197,000	5,479,000	68,104,000	108,471,000
May	11,029,000	6,937,000	70,403,000	132,669,000
June	7,751,000	9,139,000	64,019,000	153,673,000
July	4,845,000	8,878,000	56,399,000	124,538,000
Aug.	4,109,000	7,171,000	46,329,000	105,401,000
Sept.	3,964,000	5,454,000	49,026,000	92,619,000
Oct.	3,879,000	5,251,000	50,689,000	89,632,000
Nov.	4,285,000	4,371,000	41,731,000	77,491,000
Dec.	5,678,000	3,968,000	37,154,000	81,914,000
Total	69,030,000	69,071,000	605,161,000	1,234,203,000

(Bureau of Markets and Crop Estimates)

*Modified with foreign fats

Ice Cream Business Has Grown Enormously

Ice cream production has made phenomenal growth, and has gone up rapidly to the present time, though there was a slight decline in 1921.

Table X. TOTAL PRODUCTION OF FARM AND FACTORY CHEESE IN UNITED STATES

Year	Factory Cheese	Farm Cheese	Total Cheese
	Pounds	Pounds	Pounds
1849	.....	105,536,000	105,536,000
1859	.....	103,664,000	103,664,000
1869	109,435,000	53,492,000	162,927,000
1879	215,885,000	27,272,000	243,158,000
1889	238,035,000	18,727,000	256,762,000
1899	282,634,000	16,372,000	299,007,000
1904	317,145,000	.....	.....
1909	311,176,000	9,406,000	320,582,000
1914	377,513,000	.....	.....
*1916	314,717,000	.....	.....
*1917	372,540,000	.....	.....
*1918	352,622,000	.....	.....
*1919	379,320,000	.....	.....
1919	475,331,000	6,600,000	481,931,000
*1920	362,431,000	.....	.....
*1921	355,838,000	*6,000,000	361,838,000

*Estimates of Bureau of Markets.

Table XI. PRODUCTION OF MILK POWDER, BY YEARS

Year	Whole Milk powder Pounds	Skim Milk powder Pounds	Total Pounds
1914	.....	.....	20,988,000
1916	2,123,000	16,463,000	18,587,000
1917	3,139,000	22,624,000	25,763,000
1918	4,154,000	25,432,000	30,251,000
1919	8,661,000	33,076,000	42,328,000
1920	10,334,000	41,893,000	52,227,000
1921	4,242,000	38,546,000	42,788,000

Table XII gives an estimate of the quantities of ice cream produced in the United States each year since 1909.

Table XII. ESTIMATED QUANTITY OF ICE CREAM PRODUCED IN UNITED STATES

Year	Gallons production	Year	Gallons production
1909	80,000,000	1916	208,320,000
1910	95,450,000	1917	219,385,000
1911	138,000,000	1918	231,053,000
1912	160,000,000	1919	248,382,000
1913	172,380,000	1920	251,820,000
1914	163,761,000	1921	216,569,000
1915	175,224,000		

Growth by Geographical Divisions

There has been a very great change in the last 50 years in the relative importance of dairying in the different geographical divisions of the United States. The changes in the population and in the amount of improved land in the different divisions of the country have had an influence to change the extent of dairying and the kind of dairying practised.

The population of the New England and Middle Atlantic states has more than doubled in the last 50 years, while the number of dairy cattle has remained about the same. During this same time, the North Central states and the Mississippi River states have made large increases in their population, yet the

number of dairy cows and the products have increased faster than the population.

Reference to Table XIII, showing the increases in dairy cows by geographic divisions during recent years, indicates the trend of the sectional growth in the dairy cow population.

Table XIII. SECTIONAL GROWTH OF DAIRYING, 1915-21

	: Increase	: Decrease
10 Middle Western and Rocky	:	:
Mountain states	: 19.3%	:
13 Southern states	: 16.8%	:
6 New England states	: 2.5%	:
6 Middle Atlantic states	: No Change:	:
8 North Central states	: 7.4%	:
3 Pacific states	:	: .1%

Not only are the centers of cow population changing, but also the type of dairying and the uses to which the product is put. The growth of cities and the increase in population per acre of tillable land help determine the kind of product made in the different localities. First the butter factories moved west. Then the cheese factories moved west. And now there is a tendency for the condenseries and similar plants to move westward, as the increased population in the East requires more of the milk for direct consumption.

The result is that in the last 50 years the center of production of these products has moved from New England and the East North Central states to the Middle West.

Although milk is sometimes shipped as far as 500 or more miles, yet there is an economic limit as to the distance which milk can be shipped to advantage because of the transportation cost, as well as the time required for transportation.

Butter, cheese, condensed milk, and similar products occupy less space and are not so perishable and can, therefore, be shipped long distances. On this account, the territories surrounding the thickly

populated centers are going into the production of milk for direct consumption, and the manufactured products are being shipped from the more distant and less populated sections.

PART III

THE CONSUMPTION OF DAIRY PRODUCTS

Scientific discoveries in the food value of milk and milk products, and actual dietary tests made during the last few years have, together with the educational campaigns that have been conducted throughout the country, had a tendency to greatly increase the consumption of dairy products.

There were times before 1880 when the exportation of dairy products was a material factor in our production, but since that time, there has been a gradual decrease in the foreign trade as the demand in this country increased due to the increased population, until now we consume just about all the milk and milk products that we produce.

The Consumption of Milk

Whole milk for direct consumption constitutes the most important part of the product of the dairy industry. The American people, although not quite as large consumers of milk as some others, do use large quantities. It is estimated that the average per capita consumption is about 49 gallons per year. Surveys made in some of the cities indicate a somewhat smaller consumption than in the country, although this does not hold true of all cities. In general, consumption is apparently less in small towns than in large cities.

There is not the same fluctuation in the consumption of milk as in some other products. Consumers may take a little extra milk when the times are good, but in general it is the practice of a family to have a certain standing order, and when increases or

decreases are made to the order they are more or less permanent. Fluctuations in price are not so influential on the demand as with some of the other products of milk.

The Consumption of Butter

Of the manufactured products, butter is the most important from the standpoint of consumption. Although the United States is exceeded by some other countries in the amount of butter consumed per capita, still the United States consumes a larger total of butter than any other large country with large population.

In spite of the relatively high consumption of butter, as compared with other countries, there appears to be a tendency for the consumption to increase. During 1921 the increase was 10% over 1920.

For a statistical comparison of consumption of butter in the United States with that in other countries, see Table III.

The Consumption of Cheese

The American people are not large cheese consumers. Some of the countries of Europe consume four or five times as much per capita as is consumed by the people of this country.

Cheese is one of the dairy products which the consumers of this country are taking from other countries. In the year 1914, more than 60 million pounds were imported to this country, but since then the imports have decreased owing to World War conditions. In 1920, the imports did not total 16 million pounds.

This importation is equivalent to almost one-fifth of our production, and indicates that there is a large demand for other varieties than the regular American cheese which constitutes the chief product made in this country.

The inability during the war to secure many of the foreign varieties of cheese, induced manufacturers of this country to undertake the production of cheeses of foreign varieties, and the manufacture of

Table XIV. AVERAGE PER CAPITA CONSUMPTION OF CHEESE PER YEAR IN VARIOUS COUNTRIES--(Numerous authorities)

Country	Year	Cheese consumed	Country	Year	Cheese consumed
		: Pounds			: Pounds
Switzerland...	1914	26.4	Italy.....	1913	4.8
Netherlands...	1912	13.3	Australia.....	1913	4.8
Denmark.....	1914	12.3	United States*	1919	a 4.2
United Kingdom:	1905	11.2	Do*.....	1909	3.8
Germany.....	1912	9.5	Canada.....	1911	3.0
France.....	1892	8.1	New Zealand...	1914	3.0
Norway.....	1910	7.1	Argentina--b..	1913	2.9

* Census a. Including cottage cheese. b. Factory cheese only

these products is increasing. The total cheese consumption per capita, however, is now less than four pounds.

The Consumption of Ice Cream

Ice cream is distinctly an American product, and the people of this country consume many times as much ice cream as all the other countries combined. It has increased until now this product uses nearly as much milk in its manufacture as the whole cheese industry or the condensed-milk industry.

Because, however, of the nature of the product and the service required in its distribution, the ice cream industry is greater in value of finished product than either the cheese or the condensed-milk business.

The consumption of ice cream has increased gradually and more or less steadily up to four or five years ago, when there was a rather stimulated consumption, and during the past five years consumption has doubled in some sections of the country. There is now consumed annually in the United States more than 2 1/4 gallons of ice cream per capita.

The Consumption of Other Products

The production of canned milk, including both condensed and evaporated, increased enormously until 1919. The increase was largely brought about by the demand for army use during the World War. Since 1919, the production has decreased very materially, due to the decreased demand for foreign use. Consumption in this country, however, has remained fairly constant with slight increases until at the present time a little more than 10 pounds is consumed per person.

The same statement may be made of milk powder as of evaporated milk, although the uses for milk powder have increased during the past years, and there is some tendency for its consumption to be increased. Production of milk powder has gone from 20 million pounds in 1914 to more than 50 million pounds in 1920.

PART IV

THE TREND OF THE DAIRY INDUSTRY

The trend of the dairy industry at the present time is toward specialization. Although much of the butter is produced as a side line to general agriculture, nevertheless there is a general tendency to increase specialization.

This is especially noticeable in the eastern part of the United States. Farmers are selecting their cattle and improving their facilities for production and handling, and are increasing the size of the herds.

The eastern part of the United States is gradually going out of the manufacture of dairy products; larger amounts of milk are used for direct consumption, and less for products that can be shipped long distances.

Improved Sanitation Has Widened the Market

Systems of handling and caring for milk are being improved, and the manufacture is becoming standardized. These circumstances are having the effect of improving the product and increasing its desirability. The sanitary methods being adopted and the safeguards, which include pasteurization, are having their effects upon consumers, and these have widened the possibilities for enlarged markets.

From the standpoint of production, the largest opportunity is in increasing the efficiency of the herds. Although the best individuals of every breed are in the United States, yet the average production

Table XV. AVERAGE YIELD OF MILK PER YEAR OF DAIRY COWS IN VARIOUS COUNTRIES

Country	: :Year: :	:Average: :yield : :of milk:	Country	: :Year: :	:Average: :yield :of milk
Netherlands	:1902:	7,585	Norway	:1910:	3,680
Switzerland	:1914:	6,950	Sweden	:1911:	3,600
United Kingdom	:1914:	5,934	Japan	:1918:	3,339
Denmark	:1914:	5,666	Hungary	:1914:	2,932
Germany	:1912:	4,350	Australia	:1916:	2,719
Canada	:1911:	3,779	Italy	:1914:	2,279
United States	:1917:	3,716	Chile	:1916:	1,520
Do	:1920:	3,627	Siberia	:1916:	1,192

of our cattle is low, and since the quantity of production is the chief factor in economy, the trend is to increase the production per cow as the demand increases, rather than to increase the number of dairy cattle.

Production Per Cow May Be Increased

Table XV, giving the average production of dairy cows of some of the other countries, indicates the possibilities for increasing the efficiency of production in this country.

Larger Manufacturing Plants for the Future

In manufacture, the trend is for larger plants, and greater science and skill in operating them. In

the manufacture of butter and cheese, there are large quantities of skim milk, buttermilk, and whey that are by-products. These contain enormous quantities of important constituents of milk, and these should be utilized. The trend is to make more of these products available for food or other purposes.

It is not economical to feed them to live stock, from the standpoint of food production and utilization. Because of the enormous amount of these products, however, they cannot all find a place in our markets at the present time, but demands and new uses for the various products as they are discovered, and the various constituents separated, indicate that these by-products will find a larger place as the industry develops.

HOW DOES MANUFACTURING INFLUENCE MILK PRICES?

In this lesson you have learned something of the importance of the manufacturing part of the dairy industry. You have a good idea now as to the importance of manufacturing dairy products. And this has prepared you for the next lesson, which is devoted exclusively to a discussion of the manufacturing situation as it now exists.

Are dairy manufacturing plants properly distributed throughout the United States?

Why is condensed milk made in large quantities in some dairy states, whereas in others very little is made?

Does manufacturing stabilize prices, or does it keep the price of milk down?

These, and dozens of other vital questions that may already have come to your mind will be answered in the next lesson. It contains some of the most important facts about dairying. Not only is it important in your study of this course, but you will find it a very interesting lesson.

GLOSSARY OF MARKETING TERMS USED IN DAIRY LESSON 1

balance of trade. The excess in the value of exports over imports. When the United States exports a million dollars worth of goods more than she imports, it is said that her balance of trade amounts to one million dollars.

buttermilk powder. The product resulting from drying and powdering wholesome buttermilk.

canned milk. A vulgarism used to mean condensed or evaporated milk sold in metal cans.

casein, n. A proteid compound found in milk, which forms the principal ingredient in cheese.

centralizer, adj. A word commonly used to describe a large creamery located in some central railroad center where farm separated cream can be assembled from a large territory for manufacturing butter.

condensed milk. A product made by evaporating a large part of the water contained in fresh, sweet milk, to which cane sugar has been added.

condensery, n. A factory equipped for making condensed milk.

cream powder. Evaporated or dried cream reduced to powdered form.

evaporated milk. Unsweetened, sterilized, condensed milk; when sweetened it is known as "condensed milk".

malted milk. A product in powdered form made by combining malt extract with milk and then reducing the mixture to a powder.

milk, n. The normal secretion of the mammary glands of animals which suckle their young; commonly used to mean cow's milk; when milk from another animal is meant, the name of the animal is used as, "goat's milk."

milk plant. A building equipped for handling milk. "Handling" in this case includes one or more of the following: cooling, bottling, canning, pasteurizing, sterilizing, and some other processes.

milk powder. Evaporated or dried milk reduced to a powder.

milk sugar, The sugar contained in milk; technically known as lactose.

per capita consumption, This phrase is used to indicate the average amount of any product used by each man, woman, and child of any given territory; usually refers to annual consumption.

pure bred, adj. A term that describes an animal that is eligible to be recorded in an official herd book. A pure bred animal may have a recorded pedigree, and at least both sire and dam are pure bred. Most pure bred animals have a long list of pure bred ancestors. Animals not having both parents pure bred can never be the ancestors of pure bred animals unless a new breed is started. In other words, pure bred animals cannot be made by a "grading up" process.

scrub cow, A cow, neither of whose parents is pure bred.

semi-solid buttermilk, A product produced by the removing of part of the water from buttermilk. The resulting product is a paste shipped in barrels and used for feeding live stock.

separator, n. A device for separating cream from milk by mechanical means. Separators operate on the centrifugal principle and are commonly known as centrifugal separators or cream separators. The same device with modifications may be used for separating other liquids, especially liquids containing oily substances that are to be removed.

standardized milk, Milk that has been mixed with cream, skim milk, or with other milk to procure a product with a uniform percentage of butter fat. It may be made uniformly richer or less rich.

sterilized milk, Milk in which all living organisms have been destroyed by heat or other means. The product is often prepared by hermetically sealing fresh, whole milk in cans. The milk is then boiled under pressure.

whey, n. A clear, straw-colored liquid consisting of protein, mineral matter, water, and milk sugar that remains after casein and other ingredients in milk are removed in the production of cheese.

whole milk, n. Milk as it is drawn from the cow; as differentiated from skimmed milk, buttermilk, etc.

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