BULLETIN No. 24. (B. A. I. 134—Dairy No. 28.)

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF ANIMAL INDUSTRY.

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NOTES UPON DAIRYING IN CALIFORNIA

AND

THE EXPORT OF CALIFORNIA BUTTER TO THE ORIENT.

BY

R. A. PEARSON, M. S.,
ASSISTANT CHIEF OF DAIRY DIVISION.

Prepared under the direction of
DR. D. E. SALMON,
Chief of the Bureau of Animal Industry.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1900.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., October 31, 1899.

SIR: I have the honor to transmit herewith a manuscript entitled "Notes upon dairying in California and the export of California butter to the Orient," prepared by Mr. R. A. Pearson, assistant chief of the Dairy Division.

Mr. Pearson recently visited California under your orders, and this report of his visit is prepared in accordance with your direction. The California State Fair and the annual convention of the State Dairymen's Association were attended with a view to meeting representative men and inquiring as to the present condition of the dairy industry in that State and the possibilities of supplying dairy products suitable for export from the Pacific coast.

This paper contains numerous suggestions which may be of special interest to California dairymen at this time, and I recommend its publication as a bulletin.

Respectfully, D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON, *Secretary.*

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NOTES UPON DAIRYING IN CALIFORNIA AND THE EXPORT OF CALIFORNIA BUTTER TO THE ORIENT.

THE STATE FAIR.

The California State fair at Sacramento, September 4 to 16, 1899, was said to be the most successful ever held by the State board of agriculture. The number of exhibits was larger than in previous years and the number of visitors had never been equaled. Although the dairy features of the fair were overshadowed by the exhibits of fruits and vegetables, which were shown in great number and variety, and by the usual displays of agricultural products and implements, a very creditable showing was made of dairy stock, implements, and products.

DAIRY LIVE STOCK.

In the live-stock department were representatives of the leading milk breeds of the State—Jerseys, Holsteins, and Shorthorns—and not a few of the animals showed high merit, capable of taking prizes in many Eastern fairs. The exhibit demonstrated that at least some of the breeders of the State are well to the front in their work. There were fewer animals shown than would have been expected from so large a State. One reason for this was the small number of registered herds in California as compared with other dairy States, and another was the lack of sufficient interest on the part of owners of well-bred stock. There are numerous herds of blooded dairy cattle throughout the State; but it appears that the benefits of showing at the fair are not considered equal to the drawbacks, one of the greatest of which is the long and expensive haul to and from the fair. Without strong inducement, a breeder of fine cattle will not subject his animals to the excitement of travel and noisy crowds.

DAIRY MACHINERY.

The displays of creamery and dairy machinery and utensils were quite similar to what would be seen at a large Eastern fair; in fact, much of this apparatus is furnished to California supply houses from Eastern factories. On an elevated platform the operations of a working creamery were carried on daily. This instructive feature is commendable and worthy of imitation. The time and place of such an

exhibition should be thoroughly advertised, so that all who might want to see it would know about it.

BUTTER.

About thirty samples of butter—in squares, rolls, tubs, and small export packages—were entered for prizes. It was in three classes—fresh, June storage, and packed for export. Six prizes—$30, $25, $20, $15, $10, and $5—were offered in each of the first two classes, and three prizes—$25, $20, and $15—were offered for export butter. Although these prizes did not attract an exceptionally large number of entries, the competing samples were representative of all sections of the State and they were uniformly of high quality. The butter was judged by Mr. W. D. McArthur, of San Francisco, a temporary special agent of this division, and the writer. The following table gives the names of exhibitors, their addresses, and scores. In order to show the districts where the exhibited samples were produced, the State is divided into five parts of about equal size, by imaginary east-and-west lines; these are designated from north to south by the letters A, B, C, D, and E, respectively, and the letters are shown in the first column of the table:

Scores on butter at the California State fair, September 13, 1899.

Exhibitors.	Section.	Flavor (50).	Grain (25).	Color (10).	Salt (10).	Appearance (5).	Total (100).
FRESH.							
Alton Creamery Co., Alton	A	47¾	23¾	10	10	5	96½
Eel River Creamery Co., Ferndale	A	47¾	23½	10	10	5	96¼
Geo. E. Peoples, Bakersfield	D	47½	23½	10	10	5	96
O. J. Vine, Lakeport	B	47¾	23	10	10	5	95¾
G. G. Knox, Grafton	B	47¾	23	9¾	10	5	95½
Allen Quain, Stockton	C	47½	23	10	10	5	95¼
Joseph Sheppard, Point Arena	B	47½	22¾	10	10	5	95
O. E. Jones, Newman	C	47½	22¾	10	10	5	95
Lockeford Creamery Co., Lockeford	C	47	22½	10	10	5	94½
J. N. Keiser, Hollister	C	46½	22¾	9¾	10	5	93¾
J. A. Howie, Compton	E	46	22½	10	10	5	93½
Warren Myers, Woodland	B	45	23	10	10	5	93
C. A. Starkweather, Oakdale	C	46½	22	10	9¾	5	93¼
W. T. Mitchell, Susanville	A	46½	22¾	9	10	5	93¼
Geo. E. Newman, Lompoc	E	45	22¾	10	9¾	5	92½
JUNE STORAGE.							
W. M. Twiner, Sierra Valley	B	45	23	10	10	5	93
E. H. Zimmerman, Watsonville	C	44¾	22½	10	10	5	92¼
J. H. Keiser, Hollister	C	44	23	10	10	5	92
D. Brough, Newman	C	44	22¾	9½	10	5	91¼
A. J. Bloom, Petaluma	B	44	22	10	10	5	91
Bailey Bros., Crescent City	A	43	22½	10	10	5	90½
W. T. Mitchell, Susanville	A	42½	22½	10	10	5	90
O. J. Vine, Lakeport	B	42	23	10	10	5	90
O. E. Jones, Newman	C	42½	22½	9¾	10	5	89¾
C. A. Starkweather, Oakdale	C	42	23	10	10	4½	89½

Butter in small cans for export.

[Cans scored equally; judged on quality of butter.]

Dairymen's Union of California, San Francisco, first premium for butter in paraffined paper can; Hilmer, Bredhof & Schulz, San Francisco, second premium for butter in lithographed tin can; Sussman, Wormser & Co., San Francisco, third premium for butter in lithographed tin can.

Both first and second prizes on fresh-made butter went to creameries in Humboldt County, a large county near the northern boundary of the State, bordering on the ocean, and possessing exceptional advantages for dairying. Some well-informed dairymen claim that this county is the best natural dairy district in the world. The third prize on fresh-made butter was taken by a creamery in the southern part of the State. The fourth and fifth prizes went to the district just north of an east-and-west line through San Francisco, and the sixth prize to the district just south of the same line. All of the entries of storage butter were from the central and northern parts of the State.

It happened that the Humboldt County creameries had a distinct advantage over most of the others in the State at the time the fresh butter was made for the fair, as many factories elsewhere were then receiving milk from patrons whose pastures were suffering on account of the dry season, and undesirable flavors could not be avoided, while the pastures in Humboldt were in good condition. The aroma and flavor of the Humboldt County butter were excellent. It was also exceptionally well made and well packed, as was shown by the fact that it stood the three days' journey by boat and rail from the creameries to Sacramento without unusual protection. It was in the regular California squares, described on page 25. Other entries were in small tubs.

Butter in hermetically sealed pound packages for export was exhibited in small quantity. The judges deemed it best not to attempt to decide the merits of the different packages, as the experimental shipments of butter from the Pacific coast to trans-Pacific ports, now being made by the United States Department of Agriculture, are partly for the purpose of testing the several packages available for shipments without refrigeration to tropical points. Therefore in this class prizes were awarded on the basis of the quality of the butter in the cans; and in this respect there was considerable variation, some of the samples being decidedly rancid. These small cans had been exposed for several days to high temperatures. Possibly they were thus put through more unfavorable conditions than would be encountered on a voyage to the Tropics, but this was probably not the case. They again showed that hermetically sealed cans will not, under all circumstances, preserve the good qualities of butter, as some people seem to think they are capable of doing.

THE DAIRYMEN'S ASSOCIATION.

The sixth annual meeting of the California State Dairymen's Association was held during the State fair at the capitol building. It was attended by leading dairymen, creamery men, and cheese factory men from all parts of the State. Representatives were present from commission houses in San Francisco and Sacramento. The State Univer-

sity was well represented, and the sessions were visited by prominent citizens. The press of the State gave liberally of its space in reporting the proceedings. A regular programme had not been prepared, as it was thought best to occupy the time with informal discussions on the special subject which the secretary had announced in advance, namely, "The export of dairy products from the Pacific coast." The topic was opportune, and its various phases were taken up and discussed in a logical way. A brief résumé of the facts brought out in the discussion follows.

THE INCREASE OF BUTTER PRODUCTION.

First, it was pointed out that dairying in the older States is being promoted and encouraged by various agencies, such as well-equipped dairy schools, live dairy associations, and efficient State dairy commissioners. And it is now being extensively developed as a new industry in certain large sections of the United States where only a few years ago cows were seldom seen. As examples of this recent dairy growth the activities in Georgia and the Dakotas were referred to. All this shows that our home markets will continually be more and more plentifully supplied, and in many cases competition will be keen.

It was stated that the production of dairy products in California is increasing and in some sections very rapidly. This is not surprising when one considers how the industry is favored by many natural conditions, of which too much could hardly be said. The mild climate, splendid natural grazing, and the tremendous crops of alfalfa which can be raised at small cost almost make it seem that California has been favored above all other States. Many of the great wheat ranches are gradually adopting dairying as a secondary interest, and some of them have gone into it farther than they had originally planned. Large herds of dairy cows (Pl. I, fig. 1) are becoming common, and the owners of less than one hundred cows refer to their "small herds" very much as an Eastern dairyman would speak of his fifteen or twenty cows. New creameries are in operation at many points. Besides the advantages named, the markets for dairy products have been good. It has been possible for the California dairyman to produce cheaply and sell well. It is therefore not unlikely that the growth of dairying will continue, and within a few years more butter and cheese will be made than the home market will require. California dairymen will then face conditions similar to those already met in the Eastern markets.

FOREIGN MARKETS FOR SURPLUS.

In the second place, the possibilities of finding markets for surplus in countries bordering on the Pacific Ocean were discussed. Although some of those lands fairly swarm with people, only small quantities of dairy products are sent to them, and these supplies are chiefly for the few foreigners who are there—Americans, English, Germans, and

French. As a rule the natives have not yet learned to use butter and cheese, but extracts from consular reports were read which showed that in some cases they are commencing to eat dairy products and a gradual increase in their demands may be expected. With improvement of domestic and commercial conditions, new tastes are developed and new wants are manifested. This is shown in the upward growth of every nation. Just at this time the changes which are taking place in some Asiatic countries are attracting the attention of the world. Every commercial nation is looking for new trade in articles not before called for, and in this respect California merchants propose to take an important place. American flour is a product which has successfully established a market for itself within the past few years. Large quantities are now shipped to places where it was once prophesied flour would never be commonly used. Other illustrations could be given of American products which have found favor. Judging by the success along other lines and by the small beginning already made by our butter and cheese, the Western dairymen have good reason to feel encouraged in their hopes of finding large markets across the Pacific. And it may be profitable to have such an abundant surplus that regular and frequent shipments can be made, at least during the season of greatest production, at which time there will be but little competition from dairy countries south of the equator.

Furthermore, attention was called to the fact that most of the small amount of butter going to the points referred to is now supplied by Denmark, France, and Australia, and, as a rule, the products from these countries are sold at prices in excess of what is paid for "States goods." In other words, the present limited demand for dairy products in the far East is being supplied chiefly by our competitors, and they frequently receive as high as 50 cents per pound for their butter. The California dairymen should, and many of them do, appreciate that the best way to assure themselves of enjoying a large share of the future trade with the Pacific countries is to secure and hold a large share of the present trade with those countries.

PREPARATION OF BUTTER FOR WARM CLIMATES.

It having been shown that there may soon be a surplus of dairy products available for export, that in the near future large markets for these products may be developed at trans-Pacific points, and especially that the United States does not share in the present trade to the extent that she should, the next question considered was how butter should be prepared for shipment to warm climates. There was an interesting discussion on the various phases of this question, participated in by dairymen, creamery men, and scientists, and numerous ideas of practical value were advanced. The want of refrigerated compartments for ocean transportation makes the problem quite different from what it is in the East.

As to the kind of butter wanted, all agreed that for export without refrigeration it should be of particularly hard body and high melting point. More stress was laid on this than on the necessity of its having a high flavor. A clean, mild flavor is wanted, and an article of close texture, with a dry, solid body and capable of resisting the effect of heat as much as may be. At the same time producers were warned not to make such butter except for foreign trade, as it would not sell as well as the regular creamery in home markets.

Causes affecting hardness of butter.—It is believed that the body, or hardness, of butter is largely within control of the feeder and butter maker. It is thought by some that butter made from milk containing large fat globules has a lower melting point than that made from milk containing small fat globules. According to this theory, butter from Channel Island stock would be softer than that from the so-called "cheese" breeds, a proposition that was opposed by not a few. It was stated, also, that butter made from milk taken during the latter part of the period of lactation is harder than that from milk taken soon after calving. That the body of butter can be easily affected by variations in manufacture is well known.

An important cause of difference in hardness is supposed to be difference in the relative proportions of the component parts of the butter fat caused by various kinds of feed. An increase in the stearin and palmatin, which are solids at ordinary temperatures, and a corresponding decrease in olein, which is an oil at ordinary temperatures, would cause butter to be harder, while changes of an opposite nature would make it softer. Practical experience and a few experiments show that the hardness of butter can be affected to a certain extent by the feeds given the cows. It was generally agreed that butter is made hard by the addition to the ration of a small amount of potatoes; cotton-seed meal has a similar effect, but too much of it will taint the butter. One person said oat hay and green corn fodder also have somewhat the same effect. On the other hand, linseed meal causes soft butter, and alfalfa hay when used alone does the same. An instance was given of a herd which had been fed on alfalfa and Bermuda grass and was changed to a pasture of young barley that had dried up before it was fully grown. The butter immediately became very hard. A commission merchant reported that the butter from one of his shippers suddenly became hard and would not melt as readily as usual. Upon investigation it was found that the herd had recently been turned onto a stubble field. Sugar beet pulp and tops were not discussed, but some facts about them are given below.

Method of making.—No special points were brought out regarding the manufacture of butter for the new trade. The ordinary methods are followed, but the necessity of using great care in every step of the work, so as to produce the highest grade article, was emphasized. The butter maker should discard all dirty milk. He can not afford to

introduce into the butter millions of bacteria of many species, which may cause bad flavors, when they can easily be excluded. It was recommended both to wash and to work the butter a little more than usual, to get out as much as possible of the casein, albumen, and sugar, which are excellent materials for bacteria to feed upon. Even when all possible precautions have been taken there will still be many bacteria in the finished product. Coloring and salting need not be different from the home requirements, unless to comply with special orders. It is the practice to do the canning in the butter cellars at San Francisco, using any butter sent to that market that appears to be satisfactory. The butter can be cut from large packages in lumps of proper size for the cans, so that reworking it is not necessary. Probably this method will obtain until a regular export trade is developed which will make it more economical to install canning appliances in the creameries.

The packages should be as nearly sterile as practicable at the time they are filled. They may be easily sterilized by exposure to steam in a tight chest of wood or galvanized iron. In packing, care should be taken to exclude the air as much as possible by having the butter completely fill the can. This is for the double purpose of keeping out bacteria which might be floating on dust particles in the air and to avoid furnishing one of the essentials for growth to those bacteria in the butter which can not develop without air. After the can is sealed some change takes place, unless it is held in cold storage, and this does not seem strange when it is remembered that, in spite of all the care which may be taken, some air will be in the cans and the butter is very likely to contain some bacteria which can thrive even in the absence of air. Thus it is seen that although hermetically sealed packages have many advantages they are not a panacea. The problem is not yet satisfactorily solved.

Preservatives.—There is a disposition on the part of some to use preservatives to hold bacteria in check, and various compounds of this class are on the market and are very strongly indorsed by those interested in their sale. Many misleading statements have been made in their favor. It has not been scientifically demonstrated whether preservatives in butter are harmful to consumers or not, but dairy scientists and leading dairymen strongly object to them on general grounds and the laws of some States forbid their use. It is interesting to note that Danish butter, which holds the first place wherever it is sold, is free from preservatives, and it is almost unnecessary to add that no preservatives are or have been used in butter sent abroad by the United States Department of Agriculture. It is to be hoped that the California dairymen will not adopt them until an unquestioned authority has plainly shown that their advantages exceed their disadvantages. Their general use at this time might cause great injury to the fair reputation the State is seeking for its dairy products. A

resolution condemning their use was adopted by the Dairymen's Association.

It is argued that in some respects the process of digestion is similar to fermentation, and that any substance which stops the usual changes in a food product will also affect its digestibility. Furthermore, some and perhaps all of the active chemical substances in preservatives have distinct influence on the functions of certain organs of the body. No one cares to take a dose of medicine without need of it, much less regular and frequent doses of an unknown substance, even though they are small, and many persons would prefer to go without a certain food than to run such a risk. Still another objection to preservatives is the fact that they make it impossible for the butter maker to control the cream ripening and the development of desired flavors. As a matter of fact the effect of preservatives could be made unnecessary in most cases where they are used. A few milk producers and butter makers have unfortunately learned that these substances are, so far as appearances go, a fair substitute for cleanliness. By improving their methods they could do away with the use of the questionable compounds and enjoy a clear conscience in delivering to their customers goods known beyond a doubt to be pure. Preservatives do not wholly stop bacteria from growing and multiplying, and it is safe to say that by observing scrupulous cleanliness pure butter could be made which would keep as well as or better than the ordinary kind preserved. The pasteurization of milk for making butter for export is practicable, and it may be that this, in connection with cleanliness, will be the true solution of the problem.

Packages.—A round tin can holding 1 pound is the favorite package. Until quite recently all the joints of the can have been closed with solder, but now a special machine is used for fastening the top without solder, thus doing away with the necessity of applying heat to the can after it is filled. It is important to have the cans made of a good quality of standard tin (tin weighing about 100 pounds to the box has given satisfaction), and special care should be used to have them smoothly finished. The inside of the can is usually paraffined or lined with parchment paper; sometimes both paraffin and parchment paper are used.

The sale of butter always depends to a varying extent upon the appearance of the packages, and among the oriental people appearance has a decided influence. They like neatness and decoration, and therefore it pays to finish the cans in a way that will please them. Seals, trade-marks, fancy figures, and lettering are recommended. Paper labels soon become soiled, rubbed, and torn, and cans thus marked will be passed by for prettily lacquered ones. Some buyers attach more importance to the appearance of the packages than to the quality of their contents. There is no doubt that an official seal or stamp

showing inspection by an authorized person would often serve as a guaranty and aid in sales. Cans opened by removing with a "key" a narrow strip of tin from the side near the top have an advantage over the old-fashioned style and are much preferred in some markets.

SOME PURPOSES OF THE DEPARTMENT'S EXPORTS.

During the discussions on the general subject of exports an account of the efforts of the Department of Agriculture to find and develop new markets for our dairy products was given. A letter from Maj. H. E. Alvord, Chief of the Dairy Division of the Bureau of Animal Industry, Department of Agriculture, was read and received with applause. It told of the experiments already made in exporting high-grade butter to the English market, and explained the purpose of the Department to conduct similar experiments from the Pacific coast, by sending small lots of selected butter and cheese to a half dozen of the largest seaport cities of Japan and China, to show that the best grades of dairy products can be procured in this country, and to obtain information as to the best ways of shipment. It was pointed out that while a temporary overproduction of butter or cheese can be easily cared for and kept off the market by our excellent storage facilities, a continued production of goods of high grade in excess of the home demand would result seriously to the dairy interests by causing a fall of prices, unless a profitable outlet could be found for the surplus. This fact commends to all dairymen any efforts to extend markets for milk products. Whether they are personally interested in exporting or not, their welfare may largely depend upon the success of those who are engaged in foreign trade.

It is most important for our butter and cheese to bear a good reputation in all foreign markets, so that they will be received at their true value at any time they are offered for sale, and this thought was plainly brought out by several speakers. Such a desirable condition does not now exist, owing partly to the fact that a large proportion of the dairy products sent out from this country is inferior in quality. This is well known to be the case with shipments from New York; it is also true of shipments from San Francisco. Some of the Western merchants argue that, as the butter will be somewhat off flavor anyway when it reaches its destination, it will make little difference if it is just a bit inferior when it starts! This mistake is largely responsible for the fact that our butter in cans sells in many places at prices 25 to 50 per cent lower than the goods from other countries.

Much interest was shown in the efforts of this Department to improve present conditions and there were many liberal offers of assistance. Especially was this generous spirit shown by some creameries that were willing practically to place themselves at our disposal for the preparation of goods for export. The possible needs of the

Department were fully discussed with the officers of one well-equipped plant and they will hold themselves ready to fill any requirements on short notice.

THE PRESENT EXPORT TRADE.

A short time was spent in San Francisco arranging details in connection with our experimental exports. Although the three steamship lines to Hawaii, Japan, and China have more than they can do and are now refusing freight, their officials showed an interest in the work of the Department and agreed to assist in the experimental exports by carrying our consignments whenever offered. They do not have much call for service in refrigerated compartments and nothing of this kind is provided.[1]

By referring to the table below it will be seen that present shipments of dairy products would not justify transportation companies to go to very great expense for their exclusive accommodation. Nor is it now possible for this Department to guarantee to the steamship lines payment for freight on the full capacity of their refrigerators if not filled, as the Canadian government has practically done in some instances, to the great benefit of her dairy interests. The three principal trans-Pacific countries to which butter and cheese are sent from the United States are Japan, China, and Hongkong, and the amounts these countries and the Hawaiian Islands have received in recent years are shown in the following table. Of course, most of the shipments to these countries from the United States are from the Western ports.

Exports of butter and cheese from the United States to Japan, China, Hongkong, and Hawaiian Islands, 1893–1899.

[From Commerce and Navigation of the United States, Treasury Department.]

Year ended June 30—	Japan.		China.		Hongkong.		Hawaiian Islands.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
BUTTER.	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*
1893	56,664	11,402	5,789	1,303	7,491	1,793	114,355	23,253
1894	58,189	11,534	5,768	1,312	5,000	1,048	72,578	15,992
1895	77,001	14,007	5,528	1,097	1,165	245	122,855	23,068
1896	101,751	18,103	20,277	3,709	3,536	708	128,847	23,243
1897	87,180	15,654	25,336	4,621	3,850	725	127,037	22,808
1898	115,203	23,097	21,555	4,688	13,315	2,779	152,367	34,561
1899	92,495	18,592	22,337	5,159	.....	.....	.....	.....
CHEESE.								
1893	10,480	1,355	31,009	4,122	15,348	1,989	77,158	9,944
1894	14,153	1,884	29,104	3,777	9,973	1,323	80,787	10,290
1895	13,051	1,553	28,787	3,507	17,367	2,052	87,615	10,113
1896	31,960	3,603	35,290	3,779	16,681	1,922	93,795	10,761
1897	40,965	4,433	41,690	4,589	81,380	9,168	100,585	11,073
1898	35,594	3,867	44,264	4,817	93,205	10,106	138,975	14,975
1899	52,580	5,965	101,950	11,161	.....	.....	.....	.....

[1] It is reported that a refrigerator plant has just been installed on a sailing vessel between San Francisco and the Hawaiian Islands and refrigerated compartments will be open for perishable articles.

In this connection it is interesting to note that thus far the total shipments from the Pacific coast have not been large. The following table shows the exports of butter and cheese in recent years from the two principal exporting districts—San Francisco and Puget Sound. By comparing the two tables it will be seen that only a small part of the total exports are sent across the ocean. As a rule, less than 25 per cent of the butter leaving the Pacific coast goes to China, Japan, and Hongkong. A large proportion of the exported butter is packed with brine in firkins.

Exports of butter and cheese from San Francisco and Puget Sound, 1893–1898.

[From Commerce and Navigation of the United States, Treasury Department.]

Year ended June 30—	San Francisco.		Puget Sound.	
	Quantity.	Value.	Quantity.	Value.
BUTTER.	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*
1893	409,428	84,242	6,116	1,589
1894	444,740	92,538	25,695	5,569
1895	333,596	60,621	35,367	7,279
1896	386,422	69,144	49,118	9,497
1897	421,191	74,268	113,676	21,915
1898	525,490	113,743	93,740	20,446
CHEESE.				
1893	227,491	29,712	11,301	1,252
1894	239,580	31,176	2,628	386
1895	218,805	26,374	6,502	696
1896	246,773	28,107	5,957	720
1897	352,202	39,225	19,664	2,499
1898	382,850	41,463	12,623	1,707

UNNATURAL CONDITIONS OF HOME MARKETS.

Although as much butter is probably made in California as is used in the State, the production is so uneven that at certain seasons of the year it is found necessary to import from the East. Large quantities of cheese are also sent from New York and Wisconsin to supplement the output of the home factories. Frequently the goods shipped in are not the best. They usually sell well, however, as they meet little competition with superior grades. This peculiar condition will not last when the Coast production has further increased.

DAIRY MANAGEMENT.

The various grain feeds commonly used by dairymen in the East are seldom used in California. The feeding stuffs principally depended upon are natural pasturage, alfalfa, roots, and hay. The climate is so mild that the pasture season is unusually long; in fact, in some districts it has no end. In Humboldt County grain is not fed; cows are pastured the entire year. The pasture is principally red clover and Italian rye grass, and it is supplemented in fall and winter with green peas, carrots, beets, corn fodder, and hay. That the cattle do well with this care is shown by the fact that some herds of grade stock average over 300 pounds of butter per year, and the cows, as a rule, are in good condition.

In the alfalfa districts one hears almost incredible reports concerning the productiveness of the soil. Enormous crops are common, and five or six cuttings a year are not unusual. Irrigation is practiced to a considerable extent. Here, too, grain is seldom used. When cows are grazing they are usually given a small amount of hay at night, and a little bran is occasionally fed. One dairyman, who paid $175 an acre for his 40-acre ranch, reports that he receives about $100 per month from the creamery for the milk of his 30 cows. He uses no grain, pastures eight months, and feeds hay four months each year. His herd consists of ordinary grades and fairly represents many others which have been built up within a short time from stock which is better for beef production than for the dairy.

It is stated on good authority that a dairyman in Yolo County fed 90 milch cows in a corral from March 10 to July 18, 1897, on alfalfa cut from 32 acres. No other feed was used. The cows gave satisfactory results in milk yield and were in better condition at the close of the period than at the beginning. The custom of keeping cattle out of doors is made possible by the prevailing mild climate. On many ranches the animals never go under a roof to be milked or for any other purpose.

These facts make it evident that the California dairymen have good cause to boast of their ability to produce milk cheaply. As might be expected, they have much room for improvement. They admit that in many ways their methods are extravagant and not a few of them are leading in movements toward economy. The more careful selection of cows for the dairy and especially the selection of good stock for breeding is a line of improvement which would show splendid results. This general subject was fully discussed in an early bulletin of the Dairy Division of this Bureau (Dairying in California), and need not be further referred to here.

BEET-SUGAR BY-PRODUCTS.

But something should be said of the use as feed of sugar-beet pulp and tops, which, though comparatively recent, is very common in some localities. Sugar beets are extensively raised in the vicinity of beet-sugar mills, of which there are several in the State. Three such districts were visited, namely, Alvarado, Watsonville, and Salinas. As a matter of general interest, it may be stated that a good crop of beets runs about 15 tons to the acre, and the price for the year 1899, as agreed upon in advance by the sugar companies and the farmers, is $4.50 per ton. During the harvesting season there is on some days an almost continuous procession of two, three, four, and six horse beet wagons on every important road leading to the factories. The roots are loaded onto strong nets in high wagon racks and are quickly

FIG. 1.—A CALIFORNIA DAIRY HERD.

FIG. 2.—COMBINED DAIRY AND SUGAR-BEET RANCH.

tumbled into the bins by raising one side of the net with the aid of a steam engine and tackle.

Sugar-beet pulp.—Sugar-beet pulp,[1] which is the principal by-product in the manufacture of beet sugar, is usually sold for 25 to 30 cents a ton at the factory. Last year the price was as high as 50 cents. As it can be held a long time in silo and is fed to best advantage when old, it is available the entire year. The use of fresh pulp is said to reduce the milk flow. It is supposed to be good when a few weeks old and better at six months, and will keep two or three years.

When fresh the pulp is piled or placed in a silo (Pl. II, fig. 1) where it remains undisturbed until needed for use. The material is so soft and moist that if a large pile is dumped in the corner of an inclosed space it will gradually settle until the surface is almost level. Of course the top part decays, and after a time the entire mass is covered with a protecting layer from 3 to 6 inches in thickness. Within a few months the individual pieces of beet which were originally 2 or 3 inches long and quite slender are broken down, and the appearance of the material reminds one of cold mush, grayish brown in color. Three tons of fresh pulp make about 1 ton cured.

Pulp has a tendency to fatten and it is given to beef cattle without the addition of any other food, but for milch cows its effect is found to be best when used with a little grain or hay. Without these latter it is supposed to produce a thin and watery milk. One feeder uses corn with pulp, another feeds about 3 pounds of bran daily. When pulp is fed in considerable quantity the animals do not care for water and may go for months without a drink. A feeder who has been using this by-product several years complains that when his cows have been fed for a long time on pulp their calves are likely to come weak and be troubled with scours. Another dairyman of less experience who feeds the pulp fresh states that in his observation it has no bad effect on the calves.

A herd of 200 milch cows kept near a beet-sugar factory about 40 miles south of San Francisco is given a daily ration of 60 pounds of pulp, 5 pounds of mixed ground grain, and a little hay. The cows were seen in the pasture and appeared to be in good health and flesh. The milking cows averaged almost 2 gallons each per day. Their

[1] The average analysis of diffusion pulps is given by Mr. G. L. Spencer in the 1898 Yearbook, as follows:

Moisture	89.09
Nitrogenous matter	.92
Digestible carbohydrates	6.52
Indigestible carbohydrates	1.98
Fat	.09
Mineral matter	1.40
Total	100.00

milk is shipped to a dealer in San Francisco, who pays 12½ cents per gallon for it the year through and 1⅙ cents per gallon for railroad freight. The production is greatest from February to May. Butter made from milk of this herd, for experimental export, was found to have exceedingly good body, a satisfactory flavor, and an apparently first-class keeping quality.

On a ranch near Watsonville, which supplies milk to a creamery, pulp has been used a few months each year for the past eight years. About 100 pounds a day are given to each animal.

It is the general opinion that pulp causes the butter to be hard.

Sugar-beet tops.—By "beet tops" is meant the leaves and the extreme top parts or crowns of the beets cut off when the beets are being piled ready for hauling. They are available during the harvesting of the crop, which lasts about three months. (See Pl. II, fig. 2.) This portion of the crop has some fertilizing value, and it is often plowed under on that account. Indeed, some beet-sugar companies which own large tracts of land forbid the removal of the tops. But considerable quantities of beet tops are fed and good results are claimed. The market value of this feed depends almost entirely on the prices of other feeding stuffs. When feeds are high, tops sell for $3.50 to $4 per acre on the ground; this year (1899) the price is about $2.50. It is best to allow the tops to wilt two or three days before being gathered and fed. They are then easily handled and not as liable to physic the cows as when used fresh. If they become crisp, a few green leaves are mixed with them before feeding. Unlike the pulp, they cause the animals to desire a large amount of water. Many farmers feed the tops alone, but it is claimed to be better to use a little bran with them. Evidently they are satisfactory to the cows, as little else is eaten when the cows are turned out to pasture. Some people claim that beet tops give a peculiar flavor to the butter, but only a few made this criticism.

One dairyman brought his entire herd of 90 grade Durham and Holstein cows from his own ranch to a beet farm where he had bought the privilege of using the tops. After the crop has been gathered he will move back to the home place. At the date of the visit of the writer the cows had been fed on beet tops five days and were running on wheat stubble. The owner stated that their milk yield had doubled in that short time, the average being almost 2 gallons a day. Before the removal, hay was the principal feed. This man makes the butter himself and sells it in the local market at highest San Francisco prices. It is always hard when he is feeding beet tops. A dairyman who feeds beet tops two or three months each year states that one September he sent a barrel of butter made from beet-top milk to a mining camp. It was packed in rolls and covered with brine, and it lasted so long, remained hard, and kept so well under unfavorable conditions that it attracted much attention, and orders were received for more of the same kind.

FIG. 1.—SUGAR-BEET-PULP SILO.

FIG. 2.—WILTED BEET TOPS FROM THE FIELD READY FOR FEEDING.

CALIFORNIA CREAMERIES.

There are about 300 creameries in California, and, judging by the few visited and what was reported of many others, they are well equipped and capable of doing good work. It appears that they are, as a rule, profitable investments. The charge for making butter is commonly as high as 3½ cents per pound, and until quite recently creameries charged 4½ cents. One establishment, now receiving daily 10,000 pounds of milk from 70 patrons and averaging about 7 tons of butter per month, has been in operation four years, and during that time almost $5,000 from the regular earnings have been invested in permanent improvements, besides paying good dividends. Inasmuch as it took some time to grow from a small beginning, this is a good record.

As a rule, the creameries run every day of the year. The output of the one just referred to, which is in an alfalfa district, is largest in May, being 8½ tons last May; in April 8 tons were made; in November 6½ tons; and in December 5½ tons, the smallest monthly output.

In equipment the creameries are quite similar to those in the East. Box and combined churns, separators, vats, in fact, practically all of the apparatus, is from the East. One plant, receiving in September, 14,000 pounds of milk a day and the cream of as much more from its two skimming stations, uses an ice-making machine capable of producing 3 tons of ice in a day; the direct expansion system is used. A large tank of brine is suspended near the top of the butter room, and when it is desired to shut-down the ice machine the brine is thoroughly cooled and it keeps the temperature in the workroom low until the machinery is again started. This creamery had the honor of making and packing in 3-pound cans 3 tons of butter for the U. S. S. *Oregon* for her famous trip around the Horn. The butter was made in the usual way, except a little drier. It was reported to have been good to the last.

PAYMENT FOR MILK.

The method of payment for milk, as explained at two cooperative creameries, is as follows: Composite samples of each patron's milk are tested by the Babcock test once or twice every month, and a statement of the amount of milk delivered by each person and the average tests is handed to the secretary early in the following month. The total amount of butter made and any deliveries to patrons are also reported at the same time. The secretary computes the amount of fat brought by each patron and the total. The overrun is then determined (and it is usually found to be about 16 per cent). The fat delivered by the different patrons is increased in the proper proportion and each is credited with the delivery of a certain number of pounds of butter. The receipts from sales of butter made during the month are reduced by the creamery charge for making (3 or 3½ cents per pound), and the net

average rate to be paid to the patrons is determined by dividing the amount of money remaining after this reduction by the number of pounds of butter delivered. The amount due each patron is then found by multiplying the number of pounds of butter credited to him by the average rate. Any charges for butter are deducted, and checks for the balance are delivered about the middle of the month.

The method may be illustrated as follows: Suppose a creamery receives in June 30,000 pounds of milk testing 3 per cent fat from A; 40,000 pounds of 3.4 per cent milk from B; 50,000 pounds of 3.7 per cent milk from C; 60,000 pounds of 4 per cent milk from D, and the total amount of butter made is 7,550 pounds. The operator reports these figures to the secretary, who fills them in the first two columns of a blank form, as shown below; the remaining numbers are then calculated from them and the data received from the sales agent. The work is sometimes done with great accuracy by carrying the decimals out several points, so that each patron always receives the exact number of cents due him. Frequently the secretary of the creamery slightly increases or decreases the amount to be distributed by changing the rate of payment a few hundredths of a cent per pound so as to enable him to use round numbers in his calculations instead of awkward figures. The difference is adjusted the following month. This system of borrowing from or loaning to the next month is very sensible. It greatly simplifies the secretary's work and, at the most, makes a difference of only a few cents in the returns to the various patrons, and these small amounts are not taken from them or given to them, but simply borrowed or loaned for a month.

Smithville creamery.—Statement for June, 1899.

Patron.	Milk delivered.	Average test.	Fat delivered.	Equivalent in butter.	Amount due.	Charges.	Checks.
	Pounds.		*Pounds.*	*Pounds.*			
A	30,000	3	900	1,044	$229.68	$2.00	$227.68
B	40,000	3.4	1,360	1,577.6	347.07	.....	347.07
C	50,000	3.7	1,850	2,146	472.12	1.50	470.62
D	60,000	4	2,400	2,784	612.48	5.50	606.98
Total	180,000	.....	*a* 6,510	*b* 7,551.6	*b* 1,661.35	9.00	1,652.35

a Overrun 16 per cent. *b* At 22 cents.

Fat delivered		6,510
Butter made		7,551.6
Overrun, 16 per cent.		
Sales	3,000 pounds, at 25.5 cents	$765.00
	2,000 pounds, at 25 cents	500.00
	2,000 pounds, at 24.5 cents	490.00
	551.6 pounds, at 24.1 cents	132.93
	7,551.6	1,887.93
7,551.6 pounds, at 25 cents		1,887.90
Charge for making, 3 cents per pound		226.55
Amount due patrons, 7,551.6 pounds at 22 cents		1,661.35

When there are many patrons it is seen that the number of calculations is very large. This laborious work could easily be lessened.

FIG. 1.—CREAMERY AT WATSONVILLE.

FIG. 2.—BUTTER CHESTS AWAITING TO BE PACKED.

FIG. 1.—CUTTING SQUARES OF BUTTER.

FIG. 2.—WRAPPING SQUARES OF BUTTER.

The column headed "Equivalent in butter" might well be omitted, thus saving one series of multiplications. Payments could be based on the amount of fat delivered, the average price per pound being found by dividing the sum to be distributed by the pounds of fat delivered, or, in the above case, $1,661.35 by 6,510, which gives 25.52 cents as the value of each pound of pure fat. This rate, with the numbers in the column headed "Fat delivered," shows the same amounts due the patrons as obtained by the longer method illustrated above.

HANDLING ALFALFA MILK.

Butter made from milk of alfalfa-fed cows is liable to have a peculiar flavor unless special care is taken in the handling of the cream. It is customary to separate a very heavy cream and to hasten the ripening in order to exclude or cover undesirable flavors. The cream tests about 40 per cent fat, and the use of homemade or commercial starters is not uncommon. In one creamery the cream is stirred continually for five hours after it is put into the vat. No doubt this serves to aerate it and partially removes undesirable flavors. The cream is churned when from twenty to twenty-four hours old and the butter is immediately prepared for market.

CALIFORNIA SQUARES.

Practically all the best creamery butter sold on the Pacific coast is in squares of about 2 pounds each. The squares are blocks with square ends and rectangular sides. The butter is packed on a table (Pl. IV, fig. 1) fitted with sideboards as high as the squares stand when on end. The top surface is carefully leveled even with the table sides, and the squares, a number at a time, are cut by wires. They are wrapped in parchment paper (Pl. IV, fig. 2), and packed on end in heavy wooden chests (fig. 1). This method of handling butter is excellent in some respects, but it is subject to criticism on two important features: First, there is now no uniformity in the weights of the squares. One creamery sends cases of sixty 1¾-pound squares, or 105 pounds, to Sacramento, and to the same market another creamery sends cases holding sixty squares, aggregating 101 pounds. This latter creamery also sends to San Francisco cases holding sixty squares of 93 pounds. It must be both confusing and annoying to handle squares of such varying weights, and no really good reason for the practice was found. Doubtless many people who purchase butter do not notice the difference in weights, but consider all squares alike, and the seller who can shave off the most without being suspected is the gainer. Such competition is not only discreditable but dishonest. The second criticism of the method of marketing butter relates to the packages. Eastern dealers have learned that it

is more economical and satisfactory in many ways to use cheap but neat boxes for shipping, which do not have to be returned, than to use the heavy and expensive trunks or chests that were so common only a few years ago. These latter are continually being lost and broken, cause annoyance at both ends of the line, and require much labor for proper cleaning (and this is too often neglected), while the cheaper packages have not these objections.

CHEESE MAKING.

California dairymen and commission men are willing to admit that their State does not produce much cheese suitable for export. As a rule it is soft, open, and moist, and must be used soon after it is made.

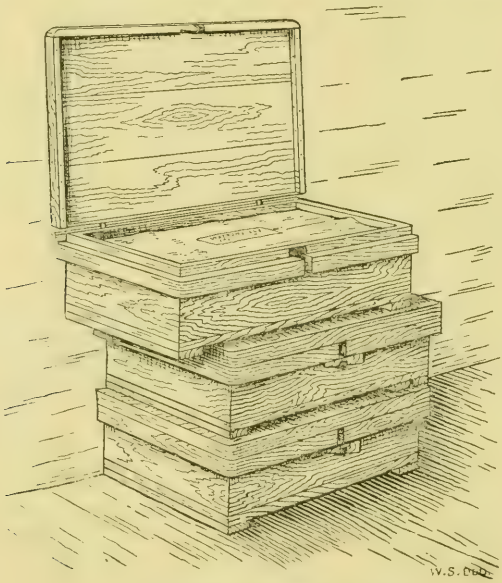

FIG. 1.—Butter packed ready for shipment.

The trouble, in all probability, is due to improper methods of manufacture, and the surest method of remedying the matter is to teach the science of cheese making and the systems successfully followed elsewhere. If such instruction were offered there is no doubt but that those interested would avail themselves of it.

Only one cheese factory was visited—a private concern on a ranch of 4,000 acres. Here the milk from 130 cows, mostly grade Durhams, is manufactured into "Flats" and "Young Americas." The factory is a neat little one-story, square, brick structure, containing a curing room on the main floor and another below the level of the ground for use in hot weather. It is well equipped for making a fine article of cheese.

CITY MILK SUPPLY.

As in many other parts of the country, the business of supplying milk to California cities is in an unsettled state. There is a lack of cooperation between milk producers, health officers, and milk consumers, which is detrimental alike to the interests of those who have good milk for sale and those who wish to purchase it. Methods adopted by public officials for improving the milk supply sometimes result in more harm than good.

Unclean dairies have been so widely advertised in official reports and newspaper articles that many citizens think well-conducted dairies do not exist, or, if they do, no way is known by which one can be assured of getting their milk. And many persons will go without milk whenever possible rather than run the risk of getting the dangerously impure article which they are convinced is very common. Thus the scare articles have the effect of reducing the production and use of impure milk; but they have the same effect also on the use of pure milk. It is unfortunate that the excellent features of the best dairies are not given as much prominence as are the defective features of the worst, so as to show those interested that good milk is on the market as well as bad. A practicable plan by which this could be accomplished could easily be followed, greatly to the benefit of all concerned.

Although only a few dairies were visited, it was readily seen that at least a part of the milk going into Sacramento and San Francisco is produced with great care and can be relied upon as a safe and wholesome food. As already suggested, if these first-class dairies and others like them could be brought to the attention of the public as forcibly as the worst types, a decided step would be taken toward the improvement of the general city supply.

DAIRY EDUCATION.

In striking contrast with California's characteristic energy in advancing the interests of many of her industries in every possible way, the one method of promoting dairying, which in other States is considered of the greatest importance, has thus far been neglected. The State is doing nothing in the line of special dairy instruction, and her dairy interests are suffering in consequence. The reason may be that this branch of agriculture has not until recently become one of the important industries of the State, and those having power to assist in its promotion have not yet realized its great possibilities. Efforts to establish a State dairy school have been made, but without success. It was a subject of discussion at the dairymen's convention, and its friends will continue to agitate it, hoping that a school will be opened in the near future.

The necessity for such a school is readily seen. In the past few

years there have been many improvements and changes in dairy operations, and the improvements and changes still continue. Butter and cheese makers who now follow comparatively recent but really out-of-date methods are working at a great disadvantage. New forms of machinery are constantly being introduced, methods of manufacture are being perfected, market requirements are becoming more strict, and competition is growing more keen. In order to keep up with competitors at home and abroad it has been necessary to provide for giving instruction in the latest dairy methods, and special schools have been established in all the leading dairy States to meet this urgent need. It has been found best to connect them with State agricultural colleges, making use, so far as possible, of the latter's equipment.

In a few States splendid buildings have been erected for the exclusive use of the dairy schools. In other dairy States, where there is less call for instruction, there is less pretentious equipment, but the training offered is none the less complete. At Cornell University, New York, there is a building, erected and equipped at a cost of $50,000, devoted exclusively to dairy instruction, and every year about seventy-five men are given a three months' course of lectures in breeding and feeding of dairy cattle and the manufacture of butter and cheese and practical work in a model creamery and cheese factory. At the State experiment station of the same State a $40,000 building has recently been erected to be used chiefly as a laboratory for studying dairy problems for the benefit of the dairy interests of the State. At Madison, Wis., there is another dairy school building, which cost about $40,000 and where more than a hundred dairy students are trained every winter. The wonderful growth of dairying in that State is attributed largely to the influence of the dairy school, graduates of which can be found in charge of successful cheese factories and creameries in almost every county. The dairy school at Ames, Iowa, is conducted in connection with a large creamery. Students are in attendance at all times of the year. Special sixteen-weeks' courses are given to beginners and a four-weeks' winter course is conducted each winter for experienced butter makers. Over 100 students are instructed every year. The cost of maintaining the school is less than $3,000 per year, and a part of this is earned by the creamery. This school and others have furnished experienced butter and cheese makers to California. The other leading dairy States are also well equipped for giving instruction. Quite recently the legislature of Kansas appropriated $34,000 for building and equipping a dairy school in that State.

Special instruction in dairying is offered at more or less well-equipped schools in thirty-one States. California is the only one in which the industry is at all prominent that is not on the list. The need of a dairy school in California is very apparent. The annual reports of the

State board of trade show the importance of the dairy industry as compared to others. The value of California dairy products is equal to two-thirds the value of her gold output, and far exceeds the value of any other mineral product. The dairy products are worth almost half as much as the wheat crop and about half as much as the combined crops of all kinds of fruit. The receipts from sales of butter, cheese, cream, and milk amount to nearly double the annual expenditures for the support of the public schools. According to the last census California ranks in dairying with other States as follows: Seventeenth in total number of cows; seventeenth in total butter product; ninth in total cheese product. Yet thirty-one States are ahead of her in encouraging and promoting dairying by offering special dairy instruction. It is seen that the dairy interests of many of them are smaller than those of California, both in toto and in comparison with other industries.

It is said to be a difficult matter to find capable operators of butter and cheese factories; and the same is true of helpers, even though these latter receive higher wages than farm laborers. As stated above, some well-trained factory operators have gone to California from other States. In addition to these there are some, of course, who have been successful in picking up their business at home and a few who have gone East for their dairy training and then returned to the State. But the majority of the butter and cheese makers of any large State will not be as well trained in their professions as they should be for the good of their work until a dairy school is maintained in that State and they shall have availed themselves of its advantages. This applies with special force to California, because it is so far from other leading dairy States and the expensive journey to their schools will prevent many from going away for dairy training who might do so if the distances were shorter.

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