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Department of Dairy Husbandry

The Part of Milk Contests in Im- proving the Milk Supply of Portland, Oregon

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CORVALLIS, OREGON

THE PART OF MILK CONTESTS IN IMPROVING THE MILK SUPPLY OF PORTLAND, OREGON

The growth of urban population is responsible for the development of a complex milk problem for which municipalities are constantly seeking a satisfactory solution. The milk-contest plan, a method of procedure evolved in some western cities, has been highly satisfactory in improving the milk supply. The results secured from the plan applied in Portland, Oregon, are typical. It is in answer to numerous inquiries concerning milk contests and results obtained through them that this bulletin is prepared.

THE MILK SUPPLY OF PORTLAND

The growth of the market milk business in Portland has not been in proportion to the growth in population. It is estimated that the population has grown from 207,214 in 1910 to 331,933 in 1918, an increase of 7.5 percent yearly. The daily milk supply increased from 14,230 gallons in 1910 to 20,000 gallons in 1916 and then decreased to 17,600 gallons in 1917. The relation of growth of population to milk consumption is given in detail in Table I. The population estimates are from the United States Bureau of Census Estimates, while the figures representing the amount of milk consumed are from the records of the Portland Bureau of Health, Milk and Dairy Inspection Division.

Table I. Showing by Years the Relation of Population to Amount of Milk Consumed in Portland

Year.	Population.	Gallons Milk consumed.	Increase in	Increase in	Per capita consumption
			population,	milk supply,	
			%	%	Pints
1910	207,214	14,230			0.55
1911	222,400	15,400	7.3	8.2	0.55
1912	234,500	16,400	5.8	6.5	0.56
1913	246,500	18,000	4.7	9.8	0.58
1914	260,601	18,000	6.2	0	0.55
1915	272,800	18,000	4.7	0	0.52
1916	295,400	20,000	8.3	11.0	0.54
1917	313,100	17,600	6.0	*12.0	0.45
1918	331,900	19,600	6.0	**11.3	0.40

* Decrease.

** Increase.

The decrease in total consumption and greater decrease in per capita consumption in 1917 and 1918 as compared to previous years was coincident with an unavoidable increase in the price of milk. In 1918 there is a slight increase over 1917, about proportional to the increase in population. In the fall of 1917 and the spring of 1918 it is estimated that Portland's shipyards increased the population of the city by at least 30,000, or approximately ten percent. Shipyard employees consumed several hundred gallons of milk at the noon lunch hour. It is estimated that the under consumption in the home in 1918 was greater even than in 1917. In 1918 in one Portland school only 30 percent of the children had milk to drink at home.

AREAS DRAWN FROM

Figure I shows a map of Portland's milk supply in June, 1918. It will be noted that the greater part of the milk is produced within twenty miles, and about 98 percent of it within twenty-five miles of the city. This is an exceptional condition. The location of producer-distributors is indicated by crosses and the shippers by dots. Many of the dairies located on lowlands along the rivers and on the islands are compelled to move off in May and June about one year in two, due to high water. This is of course a disturbing element affecting the quality as well as the quantity of the milk during these months.

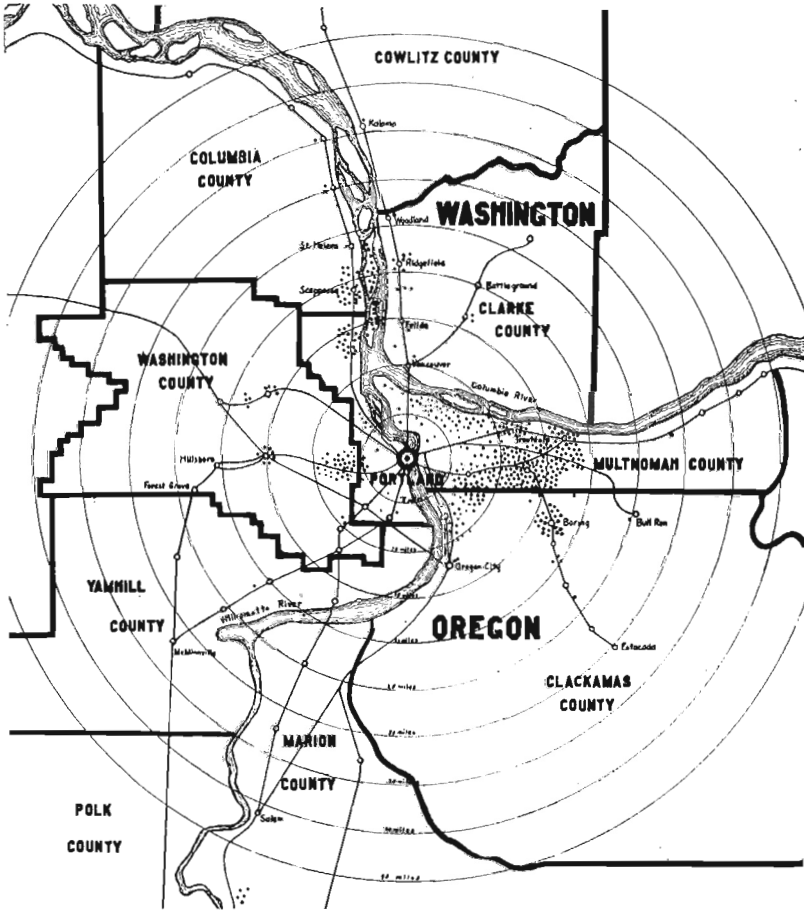


Fig. 1. The map shows the area from which in June, 1918, Portland's milk supply was drawn. Each concentric circle represents a radius of five miles from Portland. The location of producer-distributors is indicated by crosses and the shippers by dots.

The dairymen on lands adjacent to Portland depend for feed upon such crops as oats and vetch, kale, wild hay, and clover. On the low lands there is abundant pasture for from two to six months, depending upon the season and high-water conditions. Little alfalfa is grown in this section, and there is only a limited use of silos.

TRANSPORTATION

Of the milk consumed daily in the city during July, 1918, 9835 gallons were delivered directly to the consumer by the producer; 9855 gallons were shipped by train and boat to the distributors. This represents on the average the prevailing method of transporting milk to the city.

METHODS OF SELLING

There are three distributing systems in Portland: the producer distributors, of which there are two classes,—the bona fide dairyman who produces and delivers by wagon the product of five or more cows and the urban milkman, who milks and peddles the product of from one to five cows; the milk dealer who pasteurizes and distributes, securing his supply from farmers usually living farther from the city than the producer-distributor; the store, including such retailers as groceries, confectionaries, delicatessen, cafeterias, butcher shops, cigar stores, bakeries, restaurants, and apartment houses. These places have only bottled goods obtained either from city dealers or producer-distributors.

DEVELOPMENT OF THE MILK PROBLEM IN PORTLAND

The milk problem of any city is a complex one of economics as well as of sanitation. Any satisfactory solution must take into consideration these two phases of the problem. In attempting to improve the milk supply of any city there is always the tendency to approach the question from only the sanitary viewpoint. This has made failures of many otherwise meritorious plans for milk improvement.

The back lot dairy is responsible for a most difficult phase of the milk problem. As is true with other rapidly growing western cities, Portland covers a wide area in proportion to its population. Many suburban families keep from one to five cows and sell the surplus milk to neighbors. In most cases children handle and distribute the product. They use little or no equipment such as the modern dairyman finds necessary. While it seems to be recognized that the city is not the proper place for a dairy, yet these small milkmen enjoy both the patronage and protection of the suburban population. The rules and regulations enforced on the bona fide dairyman in Portland do not apply to these men. At the present time because of these conditions, the plan of milk improvement described in this bulletin does not apply to the small urban dairyman. Ten percent of Portland's milk supply comes from such small dairies.

The most alarming thing perhaps to the milk consumer is the danger of contracting disease from milk. Because it affords sensational reading, this danger has been featured in the press until it is actually beginning to reduce the per capita consumption of milk. While any

plan of procedure must take full cognizance of this danger, recent experiments show that there is probably a more serious danger in underconsumption, which must be guarded against.

Science recognizes three ways by which milk may transmit disease. Cows having such diseases as tuberculosis and actinomycosis, may transmit them through their milk direct. Again milk may be infected by disease germs of human origin and thus the disease be transmitted from one person to another. Milk produced under insanitary conditions may be contaminated with animal excreta and other filth. Through the multiplication of these introduced flora a culture may be produced that will cause intestinal disorders in infants and children. These diseases are usually classified under the head of diarrhea and enteritis. An adequate inspection service must therefore take into consideration the health of both animals and persons handling milk.

Consumers are very exacting in their demands for an improved product. In some cases milk ordinances make unreasonable and even impossible demands. All ordinances and regulations should be practicable and workable. Furthermore, when a dairyman has complied with the demands of the market, surely he is entitled to the patronage of that market. It is plainly evident that it is unreasonable for consumers to demand that any dairyman or class of dairyman should make investments in equipment and incur added expenses of production, and at the same time extend patronage to other dairymen who do not meet these requirements.



Fig. 2. Interior of barn in which a high-grade milk is produced.

The solution of the milk problem begins on the dairy farm. There are at least two ways of securing the observance of city milk regulations. The dairy farms may be policed and all violations punished by immediate prosecutions, or the dairymen may be approached in a cooperative spirit and individuals prosecuted only in cases of dishonesty, extreme slovenliness, or willful violation of ordinance requirements. The dairy inspector must therefore be thoroughly trained to assist the farmer. While it is necessary in extreme cases to exercise police functions, the well-trained inspector, can with tact usually accomplish the desired results without using his authority. For immediate and permanent results, the latter, without doubt, is preferable.

No plan for milk improvement can be satisfactorily applied unless the officials in charge are permitted to proceed without the interference of politicians or those whose business might be disturbed by the application of that plan. The success of the work described in this bulletin is in part due to the fact that trained men were permitted to discharge their duties without interference on the part of those selfishly interested.

MILK IMPROVEMENT METHODS IN PORTLAND

The city of Portland adopted a milk ordinance and began a limited inspection service in 1909. Previous to that time the only inspection afforded was that of the office of the State Dairy and Food Commissioner. The dairy business at that time was a flourishing industry from an economic standpoint, but modern equipment such as sterilizers, bottling machines, small-top milk pails, and the like, were not used by any person handling milk for the Portland market.

Recognizing the need for a more rigid and thorough inspection, a group of people inaugurated what is sometimes designated the Milk Campaign. A dairy inspector was appointed and shortly afterwards a laboratory established with a chemist in charge. The findings of the laboratory during the first year unmasked a deplorable condition. About seventy-five percent of the city's milk supply was shown to be either watered or skimmed, or both, not to mention added coloring and preservatives or contamination by filth. During the years 1910, 1911, and 1912 the inspection division directed its attention toward the detection of adulterated milk and the eradication of tuberculosis from dairy herds. Milk adulterators were promptly prosecuted under the provisions of the city ordinance.

Dairy inspection, purposing to secure a more sanitary milk supply through educational and cooperative rather than mandatory methods, was begun in 1911. The force at this time included a chemist-bacteriologist: assistant chemist, who also collected samples; a dairy inspector, whose duty was partly to instruct the farmers in up-to-date methods; and a veterinarian, who tested herds for tuberculosis. The dairies, especially of the producer-distributors were regularly inspected and scored. The force was inadequate to give as thorough inspection to shippers. The ordinance was amended so that milk plants could be scored and the scores published. While this procedure was rather drastic, it had the effect of eliminating several hopelessly insanitary basement plants.

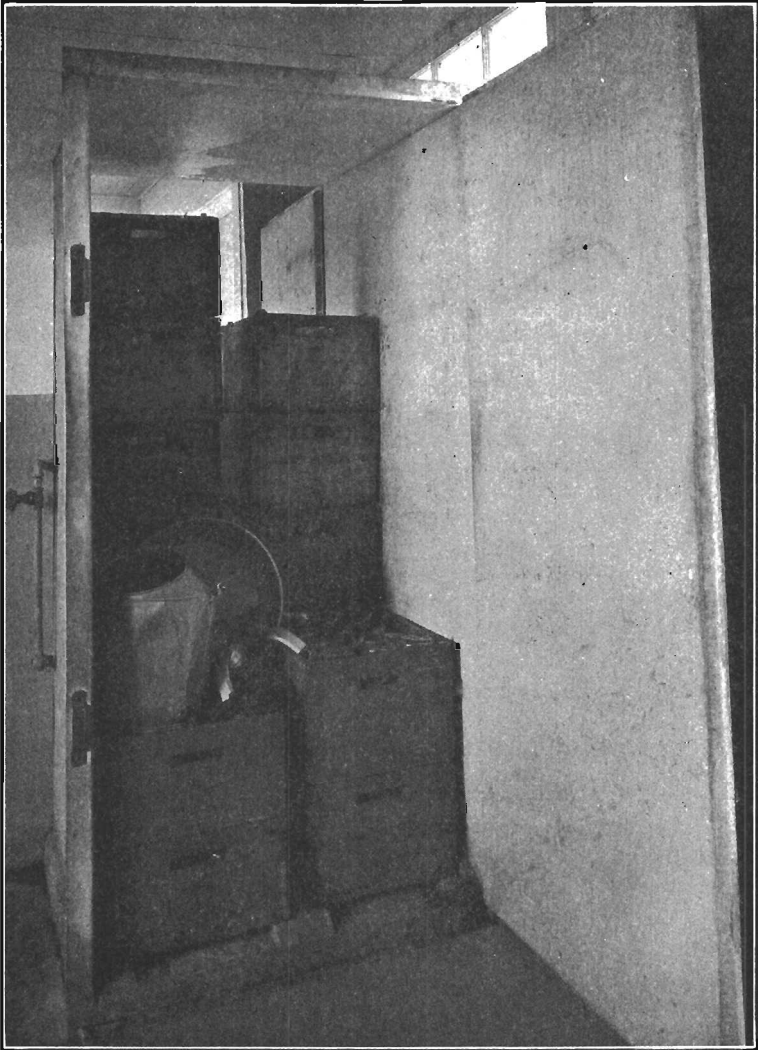


Fig. 3. The sterilizing of milk utensils is a most important factor in the production of milk of a low bacterial count. Exposure to live steam for a period of thirty minutes is sufficient.

Samples from both dealers and producers were regularly collected, analyzed for fat and solids-not-fat, and bacterial counts made.

In 1913 the force in the City Milk Inspection Division was doubled, making a per capita expense of five cents for milk inspection, or an expense of two mills per gallon of milk distributed. It might be noted in passing that this force was not adequate to cope with the situation, though perhaps the largest in proportion to population of any large city. The force at this time included a chief, two veterinarians, two dairy inspectors, two milk inspectors, one chemist, and one assistant bacteriologist.

It was recognized that the score of the milk plant, including equipment and methods, was not necessarily indicative of the quality of the product. In an effort to obviate this difficulty dairies and milk-plants were rated 50 percent on the analysis of the milk, covering the fat, solids-not-fat, and bacterial count, and 50 percent on the score of the dairy or milk plant. These ratings were printed in the daily newspapers and the Bureau of Health Bulletin. Ratings above 90 were designated as excellent; 80 to 90, very good; 70 to 80, good; 60 to 70, fair; 50 to 60, passable; and below 50, too dirty to continue business. Two dairies (certified dairies) were rated as excellent; ten dairies, very good; forty dairies, good; sixteen, fair; and six, passable. Four milk plants were rated excellent; three, very good; five were rated good; seven, fair; and seven were rated passable. At first, dealers and dairymen did not take kindly to this means of advertising their business. There was strenuous objection to the designations "excellent", "good", "fair", etc. It was contended that the score of the plant might not have any appreciable bearing upon the quality of the milk. This seemed to be true. At this stage in the development of the problem the Milk Contest method of rating dairies was instituted.

A milk score card for scoring milk shows had been adopted by the Dairy Division of the United States Department of Agriculture in 1906. It was first used at the National Dairy Show in Chicago and subsequently at other shows including some city contests. In all of these contests the samples were prepared and presented by the exhibitor. Now, the plan was to use this score card to arrive at the quality of samples of milk collected from the wagons of the distributors. In this manner a representative sample of the **average** milk delivered to the consumer would be secured, and the rating given would indicate the quality of milk delivered by any dealer or dairyman as compared with that of any competitor.

The following is the score card of the Bureau of Animal Industry of the United States Department of Agriculture as used in these contests:

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
DAIRY DIVISION.

SCORE CARD FOR MILK.

Place

Class Exhibit No.

ITEM.	PERFECT SCORE.	SCORE ALLOWED.	REMARKS.
Bacteria	35		Bacteria found per } cubic centimeter }
Flavor and odor	25		Cow, Bitter, Feed, } Flat, Strong, }
Visible dirt	10		
Fat	10		Per cent found.....
Solids not fat	10		Per cent found.....
Acidity	5		Per cent found.....
Bottle and cap	5		{ Cap Bottle
TOTAL.....	100		

Exhibitor,

Address,

(Signed) Judge.

Date,, 191

DIRECTIONS FOR SCORING.

BACTERIA PER CUBIC CENTIMETER—PERFECT SCORE, 35.

	POINTS.		POINTS.
Under 500	35	25,001—30,000	29.0
500—1,000	34.9	30,001—35,000	28.0
1,001—1,500	34.8	35,001—40,000	27.0
1,501—2,000	34.7	40,001—45,000	26.0
2,001—2,500	34.6	45,001—50,000	25.0
2,501—3,000	34.5	50,001—55,000	24.0
3,001—3,500	34.4	55,001—60,000	23.0
3,501—4,000	34.3	60,001—65,000	22.0
4,001—5,000	34.0	65,001—70,000	21.0
5,001—6,000	33.8	70,001—75,000	20.0
6,001—7,000	33.6	75,001—80,000	19.0
7,001—8,000	33.4	80,001—85,000	18.0
8,001—9,000	33.2	85,001—90,000	17.0
9,001—10,000	33.0	90,001—95,000	16.0
10,001—11,000	32.8	95,001—100,000	15.0
11,001—12,000	32.6	100,001—120,000	12.5
12,001—13,000	32.4	120,001—140,000	10.0
13,001—14,000	32.2	140,001—160,000	7.5
14,001—15,000	32.0	160,001—180,000	5.0
15,001—20,000	31.0	180,001—200,000	2.5
20,001—25,000	30.0	Above 200,000	0.0

NOTE.—When the number of bacteria per cubic centimeter exceeds the local legal limit the score shall be 0.

FLAVOR AND ODOR—PERFECT SCORE, 25.

Deductions for disagreeable or foreign odor or flavor should be made according to conditions found. When possible to recognize the cause of the difficulty it should be described under Remarks.

VISIBLE DIRT—PERFECT SCORE, 10.

Examination for visible dirt should be made only after the milk has stood for some time undisturbed in any way. Raise the bottle carefully in its natural, upright position, without tipping, until higher than the head. Observe the bottom of the milk with the naked eye or by the aid of a reading glass. The presence of the slightest movable speck makes a perfect score impossible. Further deductions should be made according to the amount of dirt found. When possible the nature of the dirt should be described under Remarks.

FAT IN MILK—PERFECT SCORE, 10.

	POINTS.		POINTS.
4.0 per cent and over	10	3.2 per cent	6
3.9 per cent	9.8	3.1 per cent	5
3.8 per cent	9.6	3.0 per cent	4
3.7 per cent	9.4	2.9 per cent	3
3.6 per cent	9.2	2.8 per cent	2
3.5 per cent	9	2.7 per cent	1
3.4 per cent	8	Less than 2.7 per cent	0
3.3 per cent	7		

NOTE.—When the per cent of fat is less than the local legal limit the score shall be 0.

SOLIDS NOT FAT—PERFECT SCORE, 10.

	POINTS.		POINTS.
8.7 per cent and over	10	3.1 per cent	4
8.6 per cent	9	3.0 per cent	3
8.5 per cent	8	2.9 per cent	2
8.4 per cent	7	2.8 per cent	1
8.3 per cent	6	Less than 2.8 per cent	0
8.2 per cent	5		

NOTE.—When the per cent of solids not fat is less than the local legal limit the score shall be 0.

ACIDITY—PERFECT SCORE, 5.

	POINTS.		POINTS.
0.2 per cent and less	5	0.23 per cent	2
0.21 per cent	4	0.24 per cent	1
0.22 per cent	3	Over 0.24 per cent	0

BOTTLE AND CAP—PERFECT SCORE, 5.

Bottles should be made of clear glass and free from attached metal parts. Caps should be sealed in their place with hot paraffin, or both cap and top of bottle covered with parchment paper or other protection against water and dirt. Deduct for tinted glass, attached metal parts, unprotected or leaky caps, partially filled bottles, or other conditions permitting contamination of milk or detracting from the appearance of the package.

8—1817

Fig. 5. Directions for the use of the Bureau of Animal Industry milk score card.

METHOD OF CONDUCTING CONTESTS

At the date set for the contest, two bottles of milk are taken from each dealer or dairyman. The samples are brought to the laboratory, a record is made of the source from which taken, and each sample is labeled with a number which identifies it throughout the contest. From one bottle the bacterial count, the percent of butter fat, solids-not-fat, and acidity are determined. The other is scored by the judges for appearance of package, visible dirt, and flavor and odor. Three judges score the contest samples. In practically all the contests the judges consisted of an expert from the Dairy Division of the United States Department of Agriculture, one from the office of the Oregon Dairy and Food Commissioner, and one from the Department of Dairy Husbandry of the Oregon State Agricultural College. The samples are scored and plated the same day on which they are taken. A period of six days is required for the completion of the contest; three days for the taking, scoring, and plating of samples; and three days for making counts and preparing the score cards.

Samples of milk are collected at irregular intervals throughout the year from wagons, without previously informing the dairyman. These are plated for bacteria and the counts become a part of the permanent records of the Bureau of Health. They are used by the Milk and Dairy Inspection Division in its regular inspection work and are also averaged with the counts secured at a contest.

Bacteria. Each sample is plated in agar by the usual method and incubated at 37° C. for two days, after which the count is made and recorded. In computing the rating for bacteria the contest count is averaged with those made since the date of the previous contest as discussed above. The average is determined by means of (1) Dr. North's curve for computing bacterial averages.

Flavor and Odor. In order to facilitate the detection of foreign flavors and odors the milk is warmed to 80° F. The milk is thoroughly shaken to secure uniform distribution of fat and a small portion taken in a glass for tasting. Odor is then taken from the half-filled bottle. Deductions for feed flavors are not made as heavily as for foul, barn, or cowy flavors. Feed flavors due to faulty feeding practices, such as the feeding of kale or turnips just before milking, are cut much more heavily than feed flavors such as ensilage, clover, and alfalfa.

Visible Dirt. Before scoring for visible dirt the bottle is allowed to stand twelve hours. The bottle is examined carefully, care being taken not to disturb the dirt found on the bottom. Only movable specks are counted. The amount of deduction is largely a matter of judgment and experience. Where the dirt particles are few enough to be counted a cut is made of .1 of a point for each two specks.

Fat and Solids-not-fat. The rating for fat and solids-not-fat is obtained by averaging the contest sample with all samples taken since the last contest.

(1) Public Health and Marine Hospital Service Reprint of Report No. 73, p. 26.

Acidity. The acidity is determined immediately after the samples are taken by titrating 25 cc. of milk against tenth-normal sodium hydroxide (N/10 Na OH), using phenolphthalin as indicator. In the contests practically all of the milk has been found to score perfect in acidity.

Bottle and Cap. Small deductions are made for chipped and defective bottles as well as partly filled bottles, but more severe cuts are made for defective capping. Four points are allowed for a perfect package capped with an ordinary cap and five points for a perfect package capped and sealed as certified milk is usually prepared.

In compiling the ratings, all samples taken after the date of the previous contest are averaged in. No rating is made on less than five samples including the contest samples. The number of samples collected from each distributor during the month is determined by the amount of milk distributed. For a dairyman with fifty cows, or a milk dealer distributing two hundred gallons of milk a day, from two to five samples are collected each month and their rating usually represents about fifteen samples.

The results of each contest are recorded in a permanent contest book and each dairyman and dealer receives a score card giving in detail the score of his product. After the first few contests the exact rating was not printed. It was found that milk patrons would change dairymen for .2 of a point difference in score. In view of this fact the ratings were later printed by classes listing in alphabetical order those from 95 to 100; 90 to 95; 80 to 85; 70 to 80; and 60 to 70.

Table II. Showing the Percentage of Dairies in Each Class by Years.

	95-100		90-95		80-90		70-80		60-70		Below 60		Tot.No. Dairies
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
March 1914	..	..	9	8.7	51	49.0	20	19.2	6	5.8	18	17.3	104
June 1914	..	..	33	33.6	53	54.1	7	7.2	4	4.1	1	1.0	98
December 1914	..	..	32	31.4	64	62.7	4	3.9	1	1.0	1	1.0	102
March 1915	29	30.2	28	29.2	39	40.6	..	..	..	..	..	..	96
August 1915	30	23.6	68	53.5	24	19.0	3	2.3	2	1.6	..	..	127
January 1916	16	12.0	93	71.4	18	13.6	1	0.7	3	2.3	..	..	133
May 1916	22	17.0	94	72.3	13	10.0	1	0.7	..	..	..	..	130
December 1916	16	11.3	91	64.6	31	22.0	3	2.1	..	..	..	..	141
May 1917	17	12.0	95	66.9	23	16.2	4	2.8	3	2.1	..	..	142
March 1918	21	21.0	61	61.0	14	14.0	4	4.0	..	..	..	..	100

Table III. Showing the Percentage of Milk Plants in Each Class by Years.

	95-100		90-95		80-90		70-80		60-70		Below 60		Tot.No. Plants
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
March 1914	..	..	..	..	4	18.8	8	36.3	2	9.1	8	36.3	22
June 1914	..	..	3	15.8	10	52.6	4	21.1	2	10.5	..	..	19
December 1914	3	12.5	2	8.3	17	70.9	2	8.3	..	..	..	..	24
March 1915	4	18.2	6	27.3	10	45.4	2	9.1	..	..	..	..	22
August 1915	7	25.0	11	39.3	3	10.7	4	14.3	2	7.1	1	3.6	28
January 1916	4	17.4	12	51.7	5	21.7	1	4.3	..	..	1	4.3	23
May 1916	4	14.9	17	63.0	5	18.5	1	3.6	..	..	..	..	27
December 1916	6	24.0	9	36.0	7	28.0	3	12.0	..	..	..	..	25
May 1917	4	15.4	15	57.7	5	19.3	1	3.8	1	3.8	..	..	26
March 1918	3	14.3	9	42.8	7	33.3	..	..	2	9.5	..	..	21

Table II indicates the improvement made during the four years contest by the producer-distributors. The table shows that up to May

1916 there was a constantly increasing number of dairies producing milk that rated 90 points or above. It also indicates that this high standard was maintained through the years 1916 and 1917.

That improvement was made during the first year of the contest is shown by the phenomenal percentage of increase of dairies rating 90 to 95. But to secure a product rating above 95 requires more than a year of education and improvement of equipment on dairy farms. For instance dairymen had to be convinced that it is a good investment to install a boiler and sterilizer large enough for steam sterilization of bottles, cases, milk pails, bottling machine, and even the cloths, brushes, and milk stools. While there is a fluctuation in the percentage of dairymen attaining the score of 95 from 1915 on, this is to be expected, because a few are unable to maintain from month to month this high degree of efficiency. While the table does not show exactly what took place, the facts are, that part of the dairies scoring 60 or under went out of business on account of lack of patronage while the remainder improved their rating.

It will be noted that there is a 30 percent reduction of the number of producer-distributors doing business in 1918 as compared to 1917. This was due almost entirely to the inability of the dairymen successfully to meet the economic difficulties brought about by the war. Competition between producer-distributors was keen. The increase in cost of labor and feed greatly increased the cost of production. Many dairymen failed to secure a price for their product that their rating justified. The price of milk was increased from 9 to 12½ cents late in 1917, by recommendation of a City Milk Commission appointed to investigate the cost of milk production. Several dairymen who rated 95 or above, and a few of those rating 90 to 95 had raised their price several months previous to the recommendation of the Commission, but the 30 percent retiring from business and a large percentage of the others failed to raise their price because they feared the destructive competition practiced at the time and the increasing competition of the 1- to 5-cow suburban milkmen.

During 1914 and 1915 and part of 1916, dairymen No.'s 1, 5, 13, 17, 18, 22, and 23, in Table IV were able to command a price of 10 cents a quart for their milk while the prevailing price of their competitors was 7½ cents to 9 cents. During this period these dairymen increased their business very materially without advertising or employing solicitors, but by referring the consumer to the rating of their product. None of these dairymen suffered any appreciable loss of business when their price was advanced. Necessarily the entire public is not sufficiently educated as yet to be willing to buy milk on the same basis as other foods, for when all dairymen and dealers increased their price there was a decrease in the total consumption of milk. There seems to be a class of people who are interested only in whether or not milk can be obtained at a low price. Since they are ignorant of its food value, when its price increases, it is the first food they sacrifice. There is a reason to expect, however, that by continuing the Contest Plan, the number of these people will be constantly reduced.

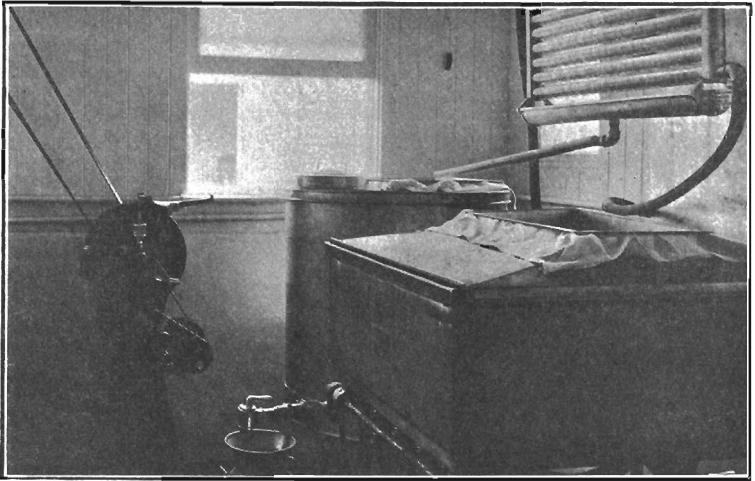


Fig. 6. A well-equipped, well-arranged milk room. The owner of this has always secured a permit for his product.

Table III shows an improvement in the scores of pasteurized milk from milk plants about parallel with the improvement of milk from dairies. The irregularities in the percentages are due to the sporadic milk depots. These usually begin operation in the spring when there is an oversupply of milk; and for various reasons, chief among which are incompetency and lack of capital, they fail after a few months of operation.

The table further shows that it is possible to secure more rapid improvements in milk plants than it is with dairies. The improvement in milk plants was along three lines; namely, the improvement of the quality of the milk shipped in from the country; greater efficiency in the process of pasteurization; and in the sterilization of bottles and utensils. It is an interesting fact that plants using the in-bottle method of pasteurization find it easy to make a rating above 95. Of the others none rate above 95 except those equipped with the most modern machinery for the holding process of pasteurization. Increased cost of distribution has resulted in the consolidation of some of the plants and consequent lessening of the number in operation.

Table IV illustrates the improvement occasioned by the contest plan in one year. Twenty-five dairymen were selected as representative of 90 percent or more of the producer-distributors. These particular dairymen were selected because they operated continuously during the years 1914, 1915, 1916, and 1917 on the same dairy farms, and there were apparently no other factors influencing their improvement except the milk contests. The average increase in quality of milk produced at these dairies from about 1000 cows was from 83.17 to 94.63 or 12 percent improvement in a year.

Table IV. Showing Improvement of Milk from 25 Representative Dairies
in the First Four Contests

Dairy No.	March 1914	June 1914	Dec. 1914	March 1915	Number Cows
1	91.00	94.37	94.00	95.25	40
2	79.65	92.50	88.90	94.10	14
3	84.75	89.12	87.50	92.50	50
4	78.40	80.80	90.75	94.96	125
5	88.50	93.50	91.85	95.40	30
6	85.10	87.87	82.50	93.50	75
7	81.65	86.15	89.00	94.50	53
8	88.80	91.30	92.55	94.90	40
9	87.50	88.87	91.25	94.80	53
10	82.75	87.50	88.75	94.20	78
11	76.00	91.90	87.80	94.35	21
12	82.15	91.00	91.80	94.90	18
13	86.80	89.10	92.25	93.70	10
14	84.85	91.75	91.75	92.50	60
15	85.80	60.85	84.75	91.50	19
16	84.45	.....	86.50	94.25	19
17	90.25	91.25	92.00	96.40	55
18	92.00	94.12	93.85	97.50	90
19	70.95	91.75	91.95	95.50	23
20	84.69	92.50	91.25	95.73	30
21	58.50	68.00	83.40	.....	9
22	88.10	90.80	92.00	95.55	64
23	79.55	93.25	93.65	95.45	30
24	86.25	90.95	91.00	95.55	35
25	80.85	87.37	88.75	94.15	35
Average	83.17	88.18	89.99	94.63	43

Table V. Showing Average Milk Rating of 25 Representative Dairyman
During Years 1914, '15, '16, '17

Dairy Number	1914	1915	1916	1917
1	93.12	94.60	95.60	93.70
2	87.01	94.02	91.80	94.12
3	87.12	93.37	93.11	93.80
4	83.31	95.30	94.90	92.90
5	91.25	95.82	95.40	95.17
6	85.15	93.45	89.93	91.57
7	85.60	94.27	94.21	92.72
8	90.88	94.20	92.56	95.50
9	89.20	94.85	92.86	90.80
10	86.33	94.85	94.08	92.57
11	85.23	94.85	92.35	93.35
12	88.31	94.32	94.98	92.82
13	89.38	94.57	94.76	95.07
14	85.53	92.12	93.31	87.85
15	73.80	93.42	92.50	93.40
16	85.47	94.25	93.76	92.97
17	91.16	95.26	95.70	94.42
18	93.32	97.42	97.03	94.35
19	84.81	95.30	90.56	92.82
20	89.48	95.10	93.88	92.45
21	69.96	81.40	88.75	84.42
22	90.30	95.67	94.96	94.00
23	88.81	95.75	93.63	95.25
24	89.40	93.90	95.11	94.65
25	85.65	94.55	92.63	93.60
Average	86.78	94.10	93.55	92.97

Table V tabulates the average milk ratings of dairies number 1 to 25, for four years. A detailed inspection of the table will reveal the fact that some men had little improvement to make. Others made a rapid

improvement in the first year, and then, probably because their enthusiasm lagged, were unable to maintain such a high standard.

Table VI. Showing Average Bacterial Count of 25 Representative Dairies During Years 1914, '15, '16, '17

Dairy Number	1914	1915	1916	1917
1	2,900	4,050	3,600	7,200
2	23,200	7,200	11,400	5,400
3	21,200	12,900	12,200	12,000
4	35,300	6,100	8,700	8,600
5	6,300	3,800	1,300	3,800
6	32,600	14,700	21,400	15,100
7	27,100	10,200	7,600	10,500
8	6,700	8,300	10,400	5,600
9	11,000	6,200	13,000	13,100
10	21,900	8,000	8,000	8,500
11	30,400	6,900	10,900	12,700
12	8,100	8,100	3,000	3,600
13	12,500	8,800	3,900	6,800
14	26,000	17,300	9,900	30,200
15	75,100	14,500	18,000	12,200
16	15,500	9,100	9,300	8,900
17	8,000	3,000	1,900	3,500
18	6,800	2,300	2,500	9,800
19	36,700	5,100	8,400	4,500
20	10,700	7,700	12,000	19,000
21	139,000	52,000	34,600	55,400
22	10,000	5,500	5,800	5,200
23	21,600	2,800	12,700	2,500
24	8,800	13,600	5,400	9,400
25	21,000	10,600	15,600	11,500
Average	24,700	9,900	10,060	11,400

Table VI gives the average bacterial counts of dairies number 1 to 25 for the four years. Each count is an average of from 12 to 40 samples taken at irregular intervals during the year. All of the counts are low, but the improvement in the total scores (Table No. V) is reflected in the bacterial counts.

Table VII. Showing the Average Milk Ratings and Bacterial Counts for Four Years of Ten Dairies—Representative of the 10 Percent or Less of Dairymen That Do Not Improve

Dairy No.	Ratings.				Bacterial Counts.			
	1914	1915	1916	1917	1914	1915	1916	1917
26	85.97	90.57	87.36	86.55	22,500	56,200	41,500	44,000
27	90.70	96.50	94.95	88.57	12,700	2,000	2,800	39,100
28	89.40	93.87	90.07	83.55	8,800	12,600	23,200	53,400
29	73.65	88.97	76.38	71.60	223,000	9,500	109,800	118,000
30	87.45	89.52	90.53	89.50	19,400	24,800	16,800	16,050
31	89.00	93.75	90.71	87.67	10,300	11,700	22,800	27,200
32	79.38	93.90	90.81	87.00	39,060	10,000	21,400	41,300
33	86.63	95.35	90.92	88.60	9,600	3,800	19,200	20,600
34	81.95	92.27	90.98	86.86	114,000	35,900	23,600	30,400
35	84.72	92.65	90.73	88.72	30,000	13,300	17,300	24,400
Average	84.88	92.73	89.34	85.86	40,430	17,980	30,340	41,440

Table VII gives the average ratings and bacterial counts of ten dairies which failed to respond to the influences of the milk contest. They do not permanently improve, but the contest plan helps to eliminate them by reducing their patronage. For example, dairyman No. 29 had

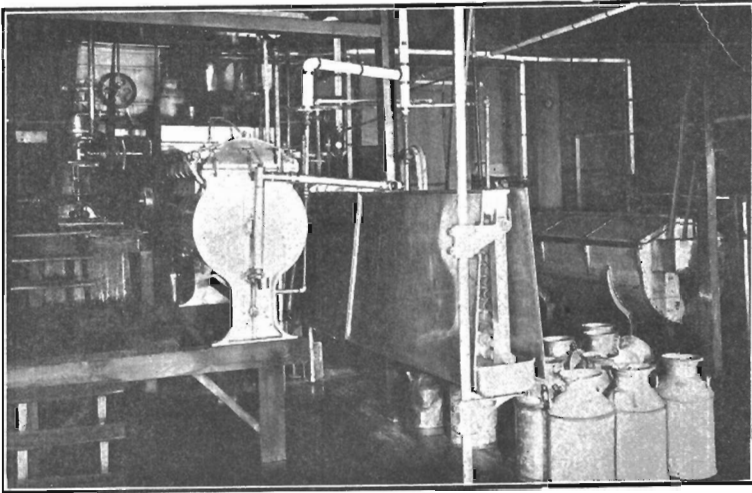


Fig. 7. A majority of Portland's plants make use of the retarding system of pasteurization. The milk is pasteurized in bulk by being held at 142° F. for thirty minutes.

65 cows in 1914. In 1917 he had 12 cows and received only 7½ cents a quart for his milk. Even these dairies, however, showed a marked improvement during the first year of milk contests. In 1914 this average was 84.83 while in 1915 it was 92.73.

Table VIII. Showing the Improvement in the Ratings of Pasteurized Milk During the First Four Contests

Plant No.	March 1914	June 1914	Dec. 1914	March 1915
1	77.53	87.99	88.62	94.19
2	87.44	93.84	96.05	96.70
3	83.94	.....	96.85	97.00
4	84.45	93.59	92.80	96.05
5	76.08	82.99	84.90	94.86
6	79.52	77.40	89.18	94.58
7	67.00	85.85	84.10	89.61
8	77.75	83.30	87.50	88.20
9	.....	.....	96.33	95.53
10	53.70	79.10	73.50	86.15
11	80.35	.....	83.50	72.68
12	58.05	64.87	84.25	89.49
13	59.85	85.45	87.30	93.35
14	75.75	89.00	87.00	94.80
15	73.50	84.30	88.05	92.33
Average	73.92	83.93	88.00	91.70

Table VIII shows that improvement in the ratings of pasteurized milk was due mainly to greater efficiency in pasteurization, and in sterilization of utensils. As in the case of dairies, the greatest improvement was made in 1914.

Table IX. Showing Average Ratings and Bacterial Counts of 15 Pasteurizing Plants During the Four Years

Plant No.	Ratings.				Bacterial Counts.			
	1914	1915	1916	1917	1914	1915	1916	1917
1	84.71	94.18	93.24	92.65	14,460	6,300	12,400	8,200
2	92.44	97.01	96.13	95.40	2,400	1,900	2,100	5,000
3	90.39	96.95	96.53	95.31	5,400	200	800	1,050
4	90.28	96.02	93.91	93.20	9,900	5,300	6,700	15,800
5	81.32	93.08	91.25	91.67	22,200	12,800	16,700	19,100
6	82.03	94.64	94.00	92.65	21,900	7,400	10,030	8,200
7	79.18	92.60	92.38	92.67	36,600	18,200	10,300	11,500
8	82.85	90.23	88.76	90.85	17,700	27,000	28,200	19,200
9	96.33	94.10	95.37	95.22	1,700	11,050	6,100	5,500
10	68.76	78.40	82.96	90.32	92,000	87,200	163,500	17,400
11	81.92	66.09	85.78	89.05	153,500	153,500	40,500	28,000
12	68.89	86.58	84.62	88.52	85,800	69,700	55,900	35,900
13	77.53	96.07	80.40	86.20	68,400	43,000	63,700	39,300
14	83.91	92.92	91.10	91.45	38,300	13,700	19,800	12,500
15	81.95	92.64	88.22	92.45	59,600	11,000	31,300	10,400
Average	82.83	90.77	90.34	91.84	42,000	31,200	31,500	15,800

Table IX gives the average ratings and bacterial counts of the milk from pasteurizing plants, numbers 1 to 15. The table illustrates the immediate improvement and sustained quality in pasteurized milk.

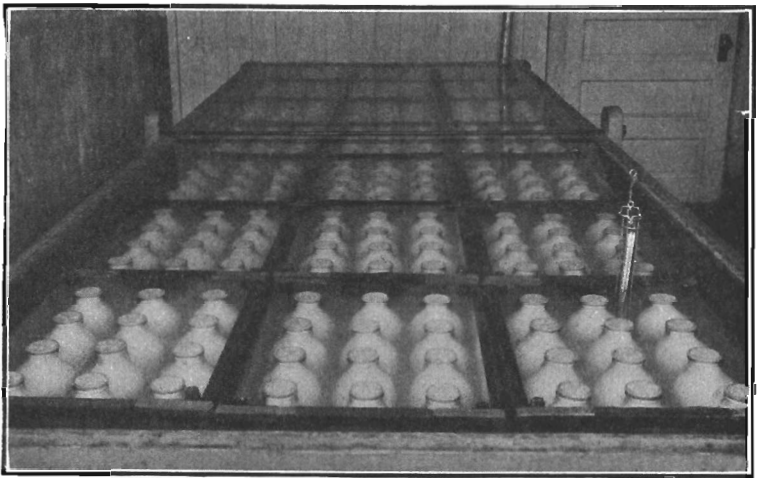


Fig. 8. Milk pasteurized in the bottle by the immersion process has invariably scored well, due to the germ-killing efficiency of this system. When properly carried out, the milk is held in a tank of water thirty minutes at a temperature of 142° F. The hot water is then replaced by cold, the final cooling being made by ice water.

Table X. Showing the Relation of the Milk Score to the Sanitary Score of the Dairy in the Case of 25 Representative Dairies

Dairy No.		1914	1915	1916	1917
1	Milk Score	93.12	94.60	95.60	93.70
	Dairy "	82.50	83.00	87.00	91.00
2	Milk Score	87.01	94.02	91.80	94.12
	Dairy "	80.10	80.50	81.10	83.80
3	Milk Score	87.12	93.37	93.81	93.80
	Dairy "	75.90	75.90	83.40	85.60
4	Milk Score	93.31	95.30	94.90	92.70
	Dairy "	79.60	80.60	83.40	80.40
5	Milk Score	91.25	95.82	95.40	95.17
	Dairy "	37.10	89.00	92.00	97.00
6	Milk Score	35.15	93.45	89.93	91.57
	Dairy "	86.20	86.80	88.50	89.00
7	Milk Score	85.60	94.27	94.21	92.72
	Dairy "	82.00	82.80	85.10	90.90
8	Milk Score	90.88	94.20	92.56	95.50
	Dairy "	83.50	90.20	90.20	91.70
9	Milk Score	89.20	94.35	92.86	90.80
	Dairy "	72.10	75.60	79.40	92.10
10	Milk Score	86.33	94.85	94.08	92.57
	Dairy "	75.30	80.60	86.60	86.70
11	Milk Score	85.23	94.85	92.85	93.35
	Dairy "	76.00	76.10	79.20	88.70
12	Milk Score	88.31	94.32	94.98	92.82
	Dairy "	67.70	80.10	86.60	88.80
13	Milk Score	89.38	94.57	94.76	95.07
	Dairy "	80.70	81.00	82.50	84.40
14	Milk Score	73.80	93.42	92.50	93.40
	Dairy "	78.80	80.20	83.50	86.30
16	Milk Score	85.47	94.25	93.76	92.97
	Dairy "	62.40	65.80	70.00	80.20
17	Milk Score	91.16	95.76	95.70	94.12
	Dairy "	93.70	95.80	95.50	95.60
18	Milk Score	93.32	97.42	97.03	94.35
	Dairy "	94.10	94.10	95.20	96.50
19	Milk Score	84.81	95.30	90.56	92.80
	Dairy "	80.30	80.30	77.00	83.90
20	Milk Score	89.48	95.10	93.88	92.45
	Dairy "	75.30	75.90	78.30	85.20
21	Milk Score	69.96	81.40	88.75	84.42
	Dairy "	55.10	60.40	70.80	78.90
22	Milk Score	90.30	95.67	94.96	94.00
	Dairy "	91.00	91.20	91.20	88.90
23	Milk Score	83.81	95.75	93.63	95.25
	Dairy "	79.75	79.60	82.00	85.30
24	Milk Score	89.40	93.90	95.11	94.65
	Dairy "	87.80	88.40	86.30	90.70
25	Milk Score	85.65	94.55	92.63	93.60
	Dairy "	88.00	88.00	91.40	91.10
36	Milk Score	94.15	96.45	95.86	95.30
	Dairy "	96.10	95.40	96.90	.....

Table X shows the relation between the score of the milk and the sanitary score of the dairy as made by the inspectors of the Milk and Dairy Inspection Division, Bureau of Health, City of Portland. Recent experiments show that the score of the dairy cannot be expected to determine the quality of the milk. An inspection of Table X shows this to be the case in Portland. It is certain technique in handling milk and the human equation rather than the equipment used that have most to do with determining the quality of milk.

DEFECTS IN THE SYSTEM OF SCORING

On first thought it would seem that barn scores have not been used as intelligently as they might be. The score card on dairy farm equip-

ment and methods is used at the present time by the inspector merely as a basis for recommendations to the farmer. Recent experiments at the New York Agricultural Experiment Station (Geneva) show that certain barn practices formerly thought to be an important factor in the production of low-count milk are really insignificant. Dairy farm practices as reflected in the quality of the milk, moreover, are indirectly but positively considered in the milk score card. Good milk is produced through the intelligent application of proper methods by the dairyman rather than by mechanical compliance with score-card rules.

A study of the results of these contests indicates that certain points allowed the different items on the score card are not properly balanced, and some points are not included which should be. This is especially true with reference to the health of the dairy herd. Changes should be made in the score card, but only by an official body in which all phases of the industry are represented.

There are necessarily a few dairymen and dealers who are not influenced by this system of milk improvement. Efforts to assist them are without results, and their rating is not improved. They attempt to balance the loss of customers by soliciting others. While the system fails in this respect, the failure is not peculiar to the contest plan, but applies as well to all other known plans. Ultimately these men quit business, but others take their places.

The plan, as operated in Portland, reaches the shipper indirectly through the desire of the dealer to obtain milk with a low bacterial count. So far, it has not resulted in Portland dealers' paying for milk on a basis of quality, with the exception of a bonus for butter-fat. Climatic conditions make it relatively easy to produce milk with a low-count near Portland. Were it not for the fact that Portland enjoys a large supply of milk of high quality, milk-dealers would be forced to pay on a basis of quality in order to secure a high rating on their product. That is, they would be forced to pay at least a bonus for a low bacterial count.

THE EFFECT OF THE CONTESTS ON THE CONSUMER

If the consumer's attitude is any index, the publishing of milk ratings must continue. In the latter part of 1917, on account of the unsettled condition of the industry, no contest was held. Through clubs and other civic organizations the demand was made of the City Milk and Dairy Inspection Division that a contest be held and the ratings published as usual. The interest in the ratings has been so keen that the newspaper securing first publication of the list considers it a privilege. Many consumers are in the habit of calling by telephone for the ratings of all dairymen delivering in their neighborhood. This is a condition which has been encouraged by the inspection division. Dairymen starting in business state that it is difficult to solicit patrons without a rating on their product. Quite generally the consumer has come to understand the points covered by the rating. Many patrons even go further in ascertaining whether the herd has been tested and found free from tubercular reactors. Physicians make use of the ratings in recommending to their patients dairymen whom it is safe to patronize. Perhaps

the best effect on the consumer is the fact that he is now ready to accept, as an indication of the quality of milk, the rating based on laboratory findings, rather than the old cream line.

EFFECT OF MILK IMPROVEMENT ON INFANT DEATH RATE

When milk inspection started in Portland the infant death rate was about the same as in average American cities. About one baby in ten failed to reach the age of one year.

The following table gives by years the number of deaths under one year of age for every thousand children born during the given year:

Table XI. Showing the Death Rate of Children Under One Year of Age for Each 1000 Children Born (in Portland, Oregon)

1909	94.0	1914	65.7
1910	95.4	1915	57.7
1911	88.2	1916	55.1
1912	74.6	1917	62.8
1913	69.3		

Table XII. Showing the Reduction in the Actual Number of Deaths from Diarrhea and Enteritis of Children Under Two Years of Age.

1909	100	1914	15
1910	73	1915	14
1911	57	1916	12
1912	38	1917	33
1913	29		

It is a significant fact that the total mortality and the death rate from intestinal diseases were gradually and surely reduced in about the same ratio as the improvement in the milk supply. In 1917, as previously mentioned, labor conditions on dairy farms, and other discouraging factors, reduced the quality of the milk produced. That the infant death rate in Portland seems to be so nearly parallel to the quality of its milk supply is probably due to the fact that almost all other factors are ideal for the health of babies. The summers are mild, the water supply is pure, there are practically no tenement districts, and there is but a small percentage of poor people. It would seem, therefore, that the facts given above furnish an admirable example of the fact that pure milk saves babies. In 1916, Portland had the lowest infant death rate of any large city.

EFFECTS OF THE CONTESTS ON THE DEALER

The proposition of printing the ratings was opposed at first by the milk dealers. The plant managers, being business men, were accustomed to advertise their own product and resented what they considered arbitrary action on the part of the Bureau of Health. Now, however, the dealers are almost unanimously in favor of the printed ratings. The justice of the system is recognized. It protects the honest dealer from the competition of the unscrupulous competitor. It releases money for plant improvement that might otherwise be spent for advertising. The paid milk solicitor has been banished from Portland by this system.

At the beginning of the contests only about 25 percent of the milk plants had modern equipment. In order to establish a rating, all of the plants except one have been equipped with some type of machine to pasteurize milk by the holding process. Competition between dealers has become one of wholesomeness of product rather than advertising claims that in some cases cannot be established.

EFFECT OF CONTESTS ON PRODUCER

The producer-distributor displays a keen interest in the milk contests. All those who have been in business two or three years understand perfectly how to obtain a low bacterial count and a product comparatively

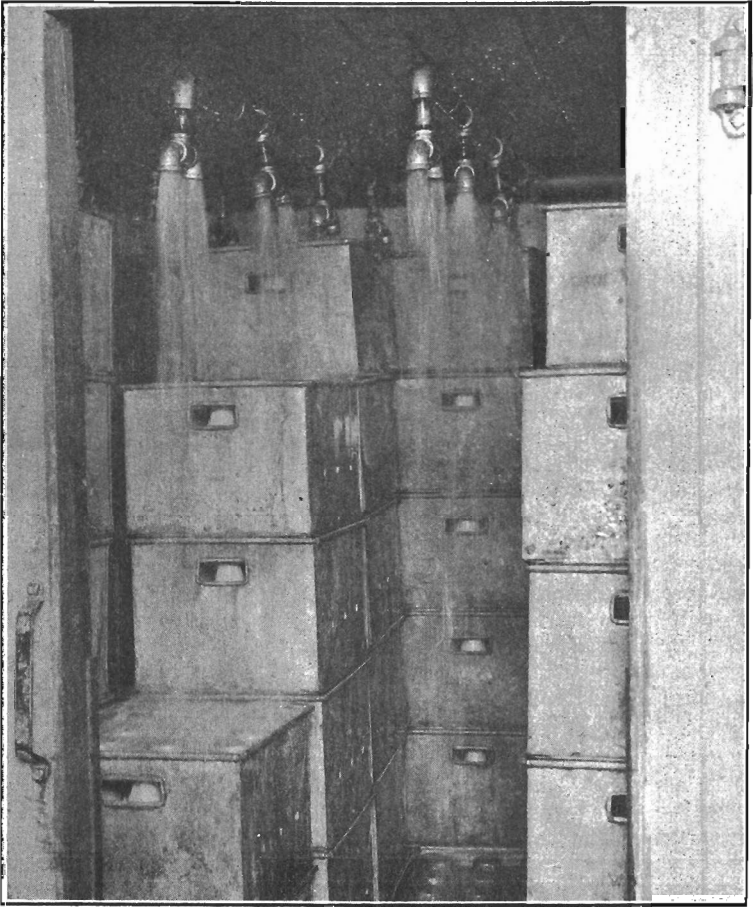


Fig. 9. Some of the city's plants pasteurize in the bottle by the regenerating process. Hot water is pumped over the bottles and distributed by means of pans fitting in the tops of the crates. The system conserves water and energy.

free from dirt and obnoxious flavors. The dairymen understand that each sample taken from their wagon is counted in their rating. They keep informed as to the analyses of their milk and thus are constantly striving to improve their rating. Since samples are also taken irregularly between contests any tendency of the dairymen to become lax immediately after a contest, is eliminated. The installation of such equipment as boilers, sterilizers, bottling machines, bottle cappers, and refrigerating plants, and the extra labor necessary in producing high-grade milk necessarily increases the cost of production. The majority of those dairymen rating above 95 usually keep their price a cent or more per quart above that of the dairyman whose product rates less. For example, in July, 1918, the City Milk Commission recommended a price of 13½ cents per quart as being a fair price for retail milk. Dairymen numbers 1, 5, 13, 15, 17, 18, 22, and 23 of Table II raised their price to 15 cents per quart, lost some trade, but secured enough new trade so that the average loss of trade was less than 5 percent. Dairymen numbers 3, 7, 10, 11, 12, 19, 20, 24, and 25 raised their price to 14 cents with no greater loss. This displays an understanding and an appreciation on the part of consumers that seem to result from the operation of the contest plan. This increased price as well as an increased demand justifies the extra labor and equipment necessary. This difference of price, however, does not hold with equal force in the case of those dairies rating between 80 to 90, and 90 to 95. A score below 70 has invariably resulted in a decreased demand for the product, even at a reduced price, while a rating below 60 has operated to eliminate the man from business entirely unless improvement was made. The printing of the ratings has gradually resulted in grading the price on a basis of quality, with no other influence assisting except that of competition. In 1916 again the price ranged from 7½ cents to 10 cents per quart. Practically all of those selling for 7½ cents rated below 70 and all of the 10-cent milk rated above 95. Some dairymen obtained a better price than their rating warranted while others failed to command a meritorious price, but these were exceptions to the rule. The recent recommendation of a uniform price by the City Milk Commission has tended to upset this automatic grading. Under normal conditions there is every reason to believe that price and demand would have continued to be governed by quality.

CONCLUSIONS

1. The Milk Contest Plan of improving a city's milk supply furnishes accurate information to the consumer and an incentive to the producer and distributor.
2. It is superior to printing bacterial counts, and lists of fat and solids in that it furnishes a comparative rating, the terms of which the consumer can understand.
3. If honestly and intelligently applied, it will rapidly improve the milk supply of a city.
4. It secures the cooperation of most of the parties concerned,—the producer, the distributor, and the consumer.
5. It encourages at least 90 percent of the dairymen to produce better milk.

6. By the operation of the plan consumers in a constantly increasing number are educated to the value of quality of milk.

ACKNOWLEDGMENT

The milk scoring contests in Portland, Oregon, described in this bulletin were inaugurated, developed, and conducted under the supervision of Dr. D. W. Mack, Chief Dairy and Milk Inspector of that city, whose assistance and advice in compiling this bulletin are hereby acknowledged. All figures were taken from the records of his office. In compiling the data the authors were ably assisted by Mr. A. Stayner, Statistician for the Milk and Dairy Inspection Division of the Portland Bureau of Health.